ANNUAL REPORT

OF THE

BOARD OF REGENTS

OF THE

SMITHSONIAN INSTITUTION,

SHOWING

THE OPERATIONS, EXPENDITURES, AND CONDITION
OF THE INSTITUTION

FOR THE

YEAR ENDING JUNE 30, 1893.

REPORT

OF THE

U. S. NATIONAL MUSEUM.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1895.

FIFTY-THIRD CONGRESS, SECOND SESSION.

Resolved by the Senate (the House of Representatives concurring), That there be printed of the report of the Smithsonian Institution and the National Museum for the year ending June 30, 1893, in two octavo volumes, 10,000 copies, of which 1,000 copies shall be for the use of the Senate, 2,000 copies for the use of the House of Representatives, 5,000 copies for the use of the Smithsonian Institution, and 2,000 copies for the use of the National Museum.

REPORT

OF THE

U. S. NATIONAL MUSEUM,

UNDER THE DIRECTION OF

THE SMITHSONIAN INSTITUTION,

FOR THE

YEAR ENDING JUNE 30, 1893.

REPORT OF THE U. S. NATIONAL MUSEUM FOR THE YEAR ENDING JUNE 30, 1893.

SUBJECTS.

I. Report of the Assistant Secretary of the Smithsonian Institution, in charge of the National Museum, with Appendices.

II. Papers describing and illustrating collections in the U. S. National Museum.

UNITED STATES NATIONAL MUSEUM,
UNDER DIRECTION OF THE SMITHSONIAN INSTITUTION,
Washington, December 1, 1893.

SIR: I have the honor to submit herewith a report upon the present condition of the U. S. National Museum, and upon the work accomplished in its various departments during the fiscal year ending June 30, 1893.

Very respectfully,

G. BROWN GOODE,
Assistant Secretary, in charge of U. S. National Museum.

MR. S. P. LANGLEY,
Secretary, Smithsonian Institution.

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PART I.

REPORT

UPON THE

CONDITION AND PROGRESS OF THE U. S. NATIONAL MUSEUM DURING THE YEAR ENDING JUNE 30, 1893.

BY

G. BROWN GOODE,

ASSISTANT SECRETARY OF THE SMITHSONIAN INSTITUTION, IN CHARGE OF U. S. NATIONAL MUSEUM.

REPORT

UPON

THE CONDITION AND PROGRESS OF THE U. S. NATIONAL MUSEUM DURING THE YEAR ENDING JUNE 30, 1893.

BY

G. BROWN GOODE,

Assistant Secretary, Smithsonian Institution, in charge of U. S. National Museum.

I.—GENERAL CONSIDERATIONS.

The work of the past year in the Museum, though in many respects unlike that of previous years, has nevertheless been the direct outgrowth of the activities of more than half a century, and it seems but proper, before describing current operations, to speak briefly of the origin and history of the Museum, of its aims and methods, and of its relations to other national institutions, especially the Smithsonian Institution, under whose control it was placed at the time of its formal organization.

A.—THE DEVELOPMENT OF THE MUSEUM.

The history of origin and development has been discussed in previous reports, and in a paper entitled "The Genesis of the National Museum."* It will therefore be sufficient for our present purpose to repeat a few of the most essential facts.

The idea of a national museum in the city of Washington was first suggested by the Hon. Joel R. Poinsett, of South Carolina, Secretary of War under President Van Buren, who in 1840 organized, for the purpose of establishing such a museum, a society called "The National Institution," afterwards "The National Institute," which was for four years exceedingly prosperous and active. By this society the nucleus for a national museum was gathered in the Patent Office building in Washington, and public opinion was educated to consider the establishment of such an institution worthy of the attention of the Government of the United States. In 1846, having failed in securing the public recognition at which it is aimed, the society became torpid, and eventually, in 1861, passed out of existence.

*The Genesis of the U. S. National Museum. Report of Smithsonian Institution, Part II, National Museum, 1891, pp. 273–330.

In January, 1847, the first Board of Regents, after many weeks of consultation and deliberation over the plans for the organization of the Smithsonian Institution, unanimously voted the following resolution:

Resolved, That it is the intention of the act of Congress, and in accordance with the design of Mr. Smithson, as expressed in his will, that one of the principal modes of executing the act and the trust is the accumulation of collections of specimens and objects of natural history and of elegant art, and the gradual formation of a library of valuable works pertaining to all departments of human knowledge, to the end that a copious storehouse of materials of science, literature, and art may be provided, which shall excite and diffuse the love of learning among men, and shall assist the original investigations and efforts of those who may devote themselves to the pursuit of any branch of knowledge.*

From 1844 until 1858, when the so-called "National Cabinet of Curiosities" passed into the charge of the Smithsonian Institution, the term "National Museum" was not in use. From that time onward, however, it was used, unofficially, to designate the collections in the Smithsonian building. After the "National Cabinet" was delivered to the Regents, appropriations were made by Congress for its maintenance. During the twenty-three years which followed, the collections were greatly increased and were made the subjects of numerous important memoirs upon the natural history and ethnology of America. The public halls, with their arrangements for the exhibition of a portion of the collection, also received a due share of attention, and a certain amount of instruction and pleasure was afforded to visitors. The appropriations, however, were meagre, the space limited, and the staff was so inadequate that little could be done except to keep the collections in good preservation.

The broad plan upon which the operations of the National Museum are now conducted was, however, anticipated as far back as 1853, when Prof. Henry wrote:

There can be little doubt that in due time ample provision will be made for a library and museum at the capital of this Union worthy of a Government whose perpetuity depends upon the virtue and intelligence of the people.†

The difficulties attending the formation of such a museum were appreciated by Prof. Henry, who already in his report for 1849, had spoken with much emphasis of the caution required in assuming under the direction of the Institution the care of the national collections.

Prof. Henry, in the report of the Institution for 1870,‡ again carefully expressed his opinion as to the character which should be given to the National Museum.

There is [he wrote] scarcely any subject connected with science and education to which more attention is given at the present day than that of collections of objects of nature and art, known under the general denomination of museums. This arises from their growing importance as aids to scientific investigation and instruction.

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* Report of Committee on Organization, p. 20.

† Report, Smithsonian Institution, 1852, p. 245.

‡ Report, Smithsonian Institution, 1870, p. 31.

In the report for 1873 allusion is made to the enormous increase in the national collections, "requiring the utmost exertions of the limited force connected with the National Museum for its proper treatment."*

Although the appropriations for the Museum have of late years been more liberal, it is certain that, on account of the immense annual increase in the quantity of material received, quite as much care and caution is still needed.

The Smithsonian Institution from its foundation fostered explorations, and its Museum was enriched by the numerous ethnological and natural history objects brought home by the explorers. Many gifts were received from private sources, and valuable objects were deposited in its Museum for safe-keeping. The nucleus of its collections was a small but valuable cabinet of minerals formed by the Founder, James Smithson, who was himself a chemist and mineralogist of good repute, and a Fellow of the Royal Society of London.

At the time of the establishment of the Institution several naval expeditions and surveys of the public domain were being organized by the Government, and during their progress large collections of ethnological and natural history objects were made. Important foreign material was obtained by the Pacific Exploring Expedition, Perry's Expedition to Japan, and the other naval expeditions, while the naturalists attached to the Pacific Railroad Survey, the Mexican Boundary Survey, and the surveys under the Army Engineer Corps, brought together great collections illustrating the natural resources and ethnology of North America.

A new source of growth, subsequent to 1871, was the exploration of the waters of North America, by the U. S. Fish Commission, whose connection with the Institution has always been intimate.

At the close of the Centennial Exhibition of 1876 the exhibits of the United States Government, and those of numerous foreign governments and of private exhibitors, came to the National Museum.

A new period now began. The storage rooms and exhibition halls of the Smithsonian building were already overflowing with the accumulations of thirty years, and the small number of persons employed in caring for them were overburdened and unable to do the necessary work. The scope of the collections had become wider and a new and broader classification was found to be necessary. The growth of the country in wealth and culture was leading to the establishment of many local museums, and the educational influences flowing from these and from the Centennial Exhibition caused a demand for more efficient methods of musuem administration.

The exhibition of 1876 had been indeed an event of great educational importance to the people of the United States; and not the least of its

* Report, Smithsonian Institution, 1873, p. 48.

good works was the lesson it taught as to the possibilities for good in public museums.

The objects which at the close of the Centennial were given to the United States for its National Museum were of large intrinsic value, and were also very important from the fact that the necessity of caring for them led to the erection of a large building for the expansion of the Museum itself.

In 1881, after the new building had been completed, the Museum was entirely reorganized.

In the early years Prof. S. F. Baird, then Assistant Secretary, with two or three assistants, was able to give all necessary attention to the care of the collections, and the Museum was not formally divided into departments.

When the reorganization was made in 1881, under the immediate care of the present Assistant Secretary, the diversity of the collections made it necessary to establish a number of departments, each of which was placed in charge of a curator, and the staff has since been constantly increasing. This is at present composed of the officer in charge and thirty-two curators and acting curators, twenty-two of whom receive no salary from the Museum. There are also eleven administrative offices, each under its own chief, while in connection with the general work of administration there is in the Museum a library, a chemical laboratory, a photographic laboratory, and various workshops for taxidermy, modeling, and for the preparation of skeletons for exhibition.

THE DEVELOPMENT OF THE MUSEUM IDEA.

The history of the National Museum may, then, be divided into three periods :—

First, that from the foundation of the Smithsonian Institution to 1857, during which time specimens were collected purely and solely to serve as materials for research, no special efforts being made to exhibit them to the public or to utilize them except as a foundation for scientific description and theory.

Second, the period from 1857, when the institution assumed the custody of the "National Cabinet of Curiosities," to 1876. During this period the Museum became a place of deposit for scientific material which had already been studied, this material, so far as convenient, being exhibited to the public and, so far as practicable, made to serve an educational purpose.

Third, the present period, beginning in the year 1876, within which the Museum has entered more fully into the work of gathering collections and exhibiting them on account of their value from an educational standpoint.

In the first period the main object of the Museum was scientific research; in the second, the establishment became a museum of record as well as of research, while in the third period is growing up the idea of public education.

In closing this general statement it may be well to mention what seem to be the things definitely accomplished since the time of reorganization in 1881.

The definite steps of progress may be summarized as follows:

(1) An organization of the Museum staff has been effected, efficient for present purposes and capable of expansion and extension as occasion may require, and many capable museum-experts have been trained for work in other institutions.

(2) Through the agency of this staff the materials in the Museum, the accumulations of nearly half a century, have been examined, classified, and brought under control and arranged in such manner as to insure their safely and make them available for study.

(3) The collections have been increased to more than fifteen-fold their former extent.

(4) A considerable beginning has been made toward the development of a well labeled and effectively installed exhibition series, available for the instruction of the public.

(5) A thorough study of the organization and systems of classification in other museums throughout the world has been made, the results of which are beginning to appear in the work of the Museum staff and which will be made available for other institutions through a report upon the principles and methods of museum administration, now in preparation.

(6) Many new methods of installation have been developed by experiment in the Museum, and the best and most available employed elsewhere have been adopted. Our new methods are being adopted in many similar establishments at home and abroad.

(7) The art of taxidermy and the making of museum models have been advanced and dignified by the policy adopted in the treatment of the experts in the employ of the Museum.

(8) Science has been forwarded by the publication of some thousands of papers describing the materials in the Museum, while the work of specialists in the production of these papers has greatly enhanced the value of the national collections.

(9) Popular educational work of unquestionable value has been accomplished by participation in great expositions in Philadelphia, Berlin, London, New Orleans, Cincinnati, Louisville, Madrid, and Chicago.

(10) Hundreds of thousands of named specimens have been distributed to other museums and to colleges and schools.

THE POSSIBILITIES FOR THE FUTURE.

It is evident that a National Museum worthy of the dignity of the nation must always be maintained in the city of Washington.

Every country has a museum or group of museums in its capital city—centers of scientific and educational activity—the treasure-house of the people, filled with memorials of national triumphs in the fields of science, art, and industrial progress.*

These are legitimate objects of national pride, for upon the character of its museum and libraries intelligent persons visiting any country very properly base their judgment as to the nature and degree of the civilization of the people.

Washington may without question be made the seat of one of the greatest museums in the world. It may perhaps be neither practicable nor desirable to gather together in this city extensive collections of early works of art, but a representative series of such objects will undoubtedly grow up which will tend to educate the public taste, and promote the study of the elements of art and the history of civilization, and forward the arts of design. Attention must, however, be directed mainly toward the exposition of the geology and natural history of America and its natural resources, to the preservation of memorials of its aboriginal inhabitants, and the encouragement of the arts and industries of our own people.

It is evident that the National Museum of the United States will of necessity have features peculiar to itself developed in response to the peculiar needs of the people of this continent. It should be remembered that the national collections of every principal European nation are divided into several groups, each under separate administration, though often within the general control of some central authority. In France, for instance, most of the museums are under the ministry of public instruction, and in England, to a less extent, under the department of science and art.

In the great capitals of Europe the public collections are scattered through various parts of the same city, in museums with distinctive names and independent in their organizations. Much of the work which should properly be done by such museums is omitted, because no one of them has seen fit to undertake it; while, on the other hand, much labor is duplicated, which is perhaps equally unfortunate, collections of similar scope and purpose being maintained in different parts of the same city. One of the chief objections to such division of effort is that much of the value of large collections in any department is lost by failure to concentrate them where they may be studied and compared side by side. In Washington the national collections are all without exception, concentrated in one group of buildings. The Army Medical Museum now occupies a building side by side with those under the control of the Smithsonian Institution, and this proximity, in connection with the long-established policy of cooperation between the two organizations, renders them, for all practical purposes, united in interest.

* Most of the older nations have museums devoted to their military achievements and triumphs, but our country has no need or desire to enter into this field of work.

Although the appropriations from the public treasury for the maintenance of the National Museum are small, compared with those in several European countries, the value of objects given by private individuals is proportionately larger. The actual value of such contributions for ten years past, has not, it is estimated, fallen short of $20,000 a year, and in some years has been greater.

Among important gifts may be mentioned such as the George Catlin Indian gallery, of inestimable value to the American historian and ethnologist; the Baird collection of North American vertebrates; the collection bequeathed in 1887 by the late Isaac Lea, of Philadelphia, containing, besides minerals and other objects, about 20,000 conchological specimens, and appraised by the State at $10,000; the Bendire and Ralph collections of American birds' eggs given to the Smithsonian Institution; the Lacoe collection of fossil plants, and the collection of the American Institute of Mining Engineers, for the transfer of which from Philadelphia to Washington a special appropriation was made by Congress.

Some exceedingly valuable collections in this country and in Europe have been bequeathed to the Smithsonian Institution which have not yet come into its possession. It is estimated that within the past fifteen years individuals to the number of at least 2,000 have made gifts to the Museum to the value of $100 or more.

Almost every day strangers, pleased with the work of the Museum, voluntarily send in contributions more or less important.

The National Museum now contains over three millions of objects.

The late Prof. Baird was once asked whether the value of the collections in the National Museum was equal to the amount which had been expended in its maintenance. He replied unhesitatingly that, although it would be by no means a fair criterion of their value, he did not doubt that by a judicious and careful system of sale the entire sum could be recovered. What was said ten years ago by Prof. Baird is more than true to-day.

One of the most striking features in the affairs of the Museum is the manner in which its collections are increasing. In 1893 the number of specimens is more than fifteen times as great as ten years before.

In the last fiscal year 1,200 new lots or groups of specimens were entered upon the Museum catalogues.

This increase, as has been shown, is, in large degree, spontaneous, only a small amount of money having ever been available for the purchase of new material.

As might be supposed, a considerable proportion of the objects given are duplicates of material already on hand, and although these contributions can, with the utmost advantage, be used for distribution to museums and schools, they do not materially increase the value of the collections for study by specialists and for general educational purposes. The need of a larger fund for the purchase of specimens is yearly more manifest. Exceedingly important material is constantly offered at prices very much below what it would cost to obtain it by collecting, and in many instances, when refused, it is eagerly taken by the museums and institutions of Europe.

The Museum in its present condition may be compared to a book from which pages here and there have been omitted, so that the narrative is disjointed and incomplete.

In certain museums of Europe more money is expended annually in purchases than is represented by the entire appropriations for the National Museum. There are instances even in this country in which more money is expended for the improvement of private museums. The officers of the Museum have repeatedly suffered the chagrin of being compelled to refuse the offer of specimens necessary to complete the collections, and to see them pass into the hands of private institutions in this country or the government museums in Europe. For the purchase of specimens for the South Kensington Museum, from 1853 to 1887, $1,586,634 was expended, or a yearly average of nearly $47,000.

England is equally liberal toward her other museums. Exact statistics are not at hand, but it is quite within bounds to assert that her average expenditures for the purchase of new objects for museums in London is not less than $500,000 a year.

The museums of Europe are rich with the accumulations of centuries. The National Museum of the United States is young, and has enormous deficiencies in every department. It needs, more than any museum in Europe, the opportunity to increase its resources through purchase. The total amount expended for the purchase of specimens for the National Museum since its foundation has not exceeded $20,000, and never in one year more than $8,500.

Our treasures are the result of the activities of an enlightened Government. Through a thousand channels materials for the formation of a museum come into the possession of the Government, and out of such materials our Museum has been built. A museum formed in this manner, however, suffers sooner or later from immense accumulations of objects of certain kinds and from the absence of others. This is true of the National Museum. At the outset no additions were unwelcome, and the expectation that all important deficiencies would be supplied might properly be indulged in. As the years have passed, however, it has become more and more apparent that many of these deficiences can only be supplied by purchase.

More striking present results might certainly have been attained by limiting the development of the Museum to special fields. We have, however, had in view the future as well as the present, and no object has been refused a place in the Museum which is likely to be needed even in the remote future, in the development of whatever grand museum plans the nation may ultimately be willing to promote.

B.—ORGANIZATION AND SCOPE.

The National Museum is under the charge of the Smithsonian Institution, and its operations are supervised by the Board of Regents of the Institution.

The Secretary of the Smithsonian Institution is by law the "keeper of the Smithsonian Museum," and the Assistant Secretary, by the usage of nearly fifty years, its executive head.

In the act of Congress passed in 1846 to establish the Smithsonian Institution are contained the following provisions concerning the scope of the museum to be placed under its charge:

> 1. The act above referred to provides that "all objects of art and of foreign and curious research, and all objects of natural history, plants, and geological and mineralogical specimens belonging, or hereafter to belong, to the United States, which may be in the city of Washington," shall be delivered to the Regents of the Smithsonian Institution, and together with new specimens obtained by exchange, donation, or otherwise, shall be so arranged and classified as best to facilitate examination and study.
>
> 2. It provides that, in proportion as suitable arrangements can be made for their reception, these objects shall be delivered to such persons as may be authorized by the Board of Regents to receive them.
>
> 3. It provides that they shall be arranged in such order and so classified as best to facilitate their examination and study.
>
> 4. It provides that they shall thus be arranged in the building to be inclosed for the Institution.
>
> 5. It authorizes the Regents to obtain new specimens, by exchange of duplicate specimens, and by gift, and directs also that they shall be appropriately classed and arranged.

The National Museum thus became the authorized place of deposit for all objects of art, archæology, ethnology, natural history, mineralogy, geology, etc., belonging to the United States or collected by any agency whatsoever for the Government of the United States, when no longer needed for investigations in progress.

The collections in the Museum are intended to exhibit the natural and industrial resources, primarily of the United States and secondarily of other parts of the world, for purposes of comparison.

The activities of the Museum are exerted especially in three directions:

1. The permanent preservation of the collections already in its possession, which depends chiefly upon the vigilance of the curators and the skill of the preparators.

2. The increase of the collections which are acquired—

> (1) From the various Government surveys and expeditions, in accordance with law;
>
> (2) By gift from individuals, from other institutions, and from foreign governments;
>
> (3) By exchange for its duplicate specimens or publications;
>
> (4) By the efforts of officers of the Museum, who make collections

in connection with their regular duties, or are detailed for special service of this nature:

(5) By purchase when appropriations are made by Congress for that purpose.

3. The utilization of the collections, which is effected by exhibiting them to the public, and by encouraging investigations on the part of the officers of the Museum and other suitable persons, and facilitating the publication of the results; also by the distribution to other museums and educational institutions of duplicate specimens, which have formed the basis of scientific investigation, these being identified and labeled by the best authorities.

The Museum by these means fulfills a threefold function:

1. It becomes *a museum of record*, in which are preserved the material foundations of a very great number of memoirs—the types of numerous past investigations. This is especially the case with those materials which have served as a foundation for the numerous Governmental reports upon the resources of the United States. Types of investigations made outside of the Museum are also incorporated.

2. It becomes *a museum of research*, by reason of the policy which aims to make its contents serve as fully as possible as a stimulus to and a foundation for the studies of scientific investigators. Research is a necessary part of the work, in order that the collections may be properly identified and arranged. Its officers are selected for their capacity as investigators as well as for their ability as custodians, and its treasuries are open to the use of any trustworthy student.

3. It becomes *an educational museum*, by reason of its policy of illustrating specimens of every group of natural objects and, so far as it may prove practicable, such other collections as may be found useful for the instruction of the public, which are explained by displaying descriptive labels adapted to the popular mind, and by its policy of distributing its publications and its series of duplicates named, classified, and labeled.

The collections of the National Museum are made up to a very large extent of the following materials:

1. The natural history and anthropological collections accumulated since 1850 by the efforts of the officers and correspondents of the Smithsonian Institution.

2. Collections which have resulted from explorations carried on more or less directly under the auspices of the Smithsonian Institution or resulting from explorations carried on by the Smithsonian Institution in connection with educational institutions or commercial establishments.

3. Collections which have been obtained through the courtesy of the Department of State and the cooperation of United States ministers and consuls.

4. The collection of the Wilkes exploring expedition, the Perry expedition to Japan, and other naval expeditions.

5. Collections made by the scientific officers of Government surveys, such as the Pacific Railroad survey, the Mexican boundary survey, and the surveys carried on by the Engineer Corps of the

U. S. Army, and by officers of the Signal Corps of the U. S. Army stationed in remote regions.

6. Collections obtained by the U. S. Geological Survey, the U. S. Fish Commission, and those resulting from the activities of the U. S. Department of Agriculture and other Departments of the U. S. Government.

7. The remnant of the collections of the old "National Institute."

8. The collections made by the United States to illustrate the animal and mineral resources, the fisheries, and the enthnology of the native races of the country on the occasion of the International Exhibition at Philadelphia in 1876; the fishery collections displayed by the United States at the International Fisheries Exhibition at Berlin in 1880 and at London in 1883, and the collections obtained from various local expositions, as, for instance, the New Orleans Cotton Centennial Exposition in 1884 and in 1885, and the Cincinnati Exposition in 1887.

9. The collections given by the governments of the several foreign nations, thirty in number, which participated in the exhibition at Philadelphia in 1876.

10. The industrial collections given by numerous manufacturing and commercial houses of Europe and America at the time of the Philadelphia exhibition and subsequently.

11. The materials received, in exchange for duplicate specimens, from museums in Europe and America.

12. Collections received as gifts, deposits, or in exchange, from individuals, numbering usually from 1,000 to 1,500 each year.

In connection with the general work of administration there is in the Museum a library, a chemical laboratory, a photographic establishment, and various workshops for taxidermy, modeling, and for the preparation of skeletons for exhibition. In connection with the department of art and industry two preparators are constantly employed.

The publications of the Museum consist of—

1. The Annual Report;
2. The Proceedings of the U. S. National Museum;
3. The Bulletin of the U. S. National Museum;
4. The series of Circulars.

The Proceedings and Bulletins, have in part, been reprinted in the volumes of the Smithsonian Miscellaneous Collections.

Papers prepared by the Museum staff, or based upon the collections, have been printed in every scientific periodical in the United States and in many of those of Europe.

THE RELATIONS OF THE MUSEUM TO THE SMITHSONIAN INSTITUTION.

The Smithsonian Institution, though it bears the name of a private citizen and a foreigner, has been for nearly half a century one of the principal rallying points of the scientific workers of America. It has also been intimately connected with very many of the most important scientific undertakings of the Government.

Many wise and enlightened scholars have given to its service the best years of their lives, and some of the most eminent scientific men our country has given birth to have passed their entire lifetime in work for its success. Its publications, 970 in number, which when combined make up over 200 dignified volumes, are to be found in every important library in the world, and some of them, it is safe to say, on the working table of every scientific investigator in the world.

Through these books, through the reputation of the men who have worked for it and through it, and through the good accomplished by its system of international exchange, by means of which within the past forty-two years 1,380,075 packages of books and other scientific and literary materials have been distributed to every region of the earth, it has acquired a reputation at least as far reaching as that of any other institution of learning in the world.

It is therefore representative of what is deemed in other lands the chief glory of this nation, for whatever may be thought in other countries of American art, of American literature, or American institutions generally, the science of America is accepted without question as equal to the best.

In the scientific journals of Great Britain and other European countries the reader finds most appreciative reviews of the scientific publications of the Smithsonian, the Museum, the Bureau of Ethnology, the Geological Survey, the Department of Agriculture, and the Fish Commission, and they are constantly holding up the Government of the United States as an example of what governments should do for the support of their scientific institutions.

It is surely a legitimate source of pride to Americans that their work in science should be so thoroughly appreciated by other nations, and it is important that the reputation should be maintained. Nothing can be more in consonance with the spirit of our Government, nor more in accord with the injunction of Washington in his Farewell Address, admiringly quoted by Sir Lyon Playfair in his address as president of the British Association for the Advancement of Science:

Promote, then, as an object of primary importance, institutions for the general diffusion of knowledge.

In proportion as the structure of a government gives force to public opinion it should be enlightened.

No one has been able to show why Smithson selected the United States as the seat of his foundation. He had no acquaintances in America, nor does he appear to have had any books relating to America except two. Rhees quotes from one of these (Travels through North America, by Isaac Weld, secretary of the Royal Society), a paragraph concerning Washington, then a small town of 5,000 inhabitants, in which it is predicted that "the Federal city, as soon as navigation is perfected, will increase most rapidly, and that at a future day, if the affairs of the United States go on as rapidly as they have done, it will become the grand emporium of the West and rival in magnitude and splendor the cities of the whole world."

Inspired by a belief in the future greatness of the new nation, realizing that while the needs of England were well met by existing organizations such as would not be likely to spring up for many years in a new, poor, and growing country, he founded in the new England an institution of learning, the civilizing power of which has been of incalculable value. Who can attempt to say what the condition of the United States would have been to-day without this bequest?

In the words of John Quincy Adams:

Of all the foundations of establishments for pious or charitable uses which ever signalized the spirit of the age or the comprehensive beneficence of the founder, none can be named more deserving the approbation of mankind.

The most important service, by far, which the Smithsonian Institution has rendered to the nation has been from year to year since 1846—intangible but none the less appreciable—by its constant cooperation with the Government, public institutions, and individuals in every enterprise, scientific or educational, which needed its advice, support, or aid from its resources.

There have been, however, material results of its activities, the extent of which can not fail to impress anyone who will look at them. The most important of these are the library and the Museum, which have grown up under its fostering care.

The library has been accumulated without aid from the Treasury of the United States. It has, in fact, been the result of an extensive system of exchanges, the publications of the Institution having been used to obtain similar publications from institutions of learning in all parts of the world.

In return for its own publications the Institution has received the books which form its library.

This library, consisting of more than a quarter of a million volumes and parts of volumes, has for over twenty years been deposited at the Capitol as a portion of the Congressional Library and is constantly being increased. In the last fiscal year 37,982 titles were thus added to the national collection of books.

Chiefly through its exchange system the Smithsonian had in 1865 accumulated about 40,000 volumes, largely publications of learned societies, containing the record of the actual progress of the world in all that pertains to the mental and physical development of the human family, and affording the means of tracing the history of at least every branch of positive science since the days of revival of letters until the present time.

These books, in many instances gifts from old European libraries, and not to be obtained by purchase, formed even then one of the best collections of the kind in the world.

The warning given by the fire of that year, and the fact that the greater portion of these volumes, being unbound and crowded into insufficient space, could not be readily consulted, while the expense to be incurred for their binding, enlarged room, and other purposes connected with their use, threatened to grow beyond the means of the Institution, appear to have been the moving causes which determined the Regents to accept an arrangement by which Congress was to place the Smithsonian Library with its own in the Capitol, subject to the right of the Regents to withdraw the books on paying the charges of binding, etc. Owing to the same causes (which have affected the library of Congress itself) these principal conditions, except as regards their custody in a fire-proof building, have never been fulfilled.

The books are still deposited chiefly in the Capitol, but though they have now increased from 40,000 to fully 250,000 volumes and parts of volumes, and form one of the most valuable collections of the kind in existence, they not only remain unbound, but in a far more crowded and inaccessible condition than they were before the transfer.

This condition of affairs will happily soon be remedied.

The purchasing power of the publications of the Institution, when offered in exchange, is far greater than that of money, and its benefit is exerted chiefly in behalf of the National Library, and also to a considerable extent in behalf of the National Museum.

The amount expended during the past forty years from the private fund of the Institution in the publication of books for gratuitous distribution has been fully half as much as the original Smithson bequest.

These publications have had their influence for good in many ways, but, in addition to this, a library much more than equal in value to the outlay has, through their buying power, come into the possession of the nation.

In addition to all this, a large amount of material has been acquired for the Museum by direct expenditure from the private fund of the Smithsonian Institution. The value of the collections thus acquired is estimated to be more than equal to the whole amount of the Smithson bequest.

The early history of the Museum was much like that of the library. It was not until 1858 that it became the authorized depository of the scientific collections of the Government, and it was not until after 1876 that it was officially recognized as the National Museum of the United States.

But for the provident forethought of the Smithsonian Institution, the United States would probably still be without a reputable nucleus for a national museum.

The relations of the Museum to the system of popular lectures, for many years established in Washington, which replaces the old Smithsonian courses, once so influential, and the assistance which it affords each year to students of science, is referred to elsewhere in this report.

The Institution publishes many circulars giving information on scientific subjects, which are distributed gratuitously to those who write to make inquiries, and this system is being continually extended. In addition to this, a large correspondence is carried on with people in search of information on scientific topics. Probably 6,000 letters a year go out to people who write seeking to know the name of some object or other scientific fact. Inquiries of this kind are always answered promptly and fully; and frequently, to intelligent inquirers, books are sent which will enable them to find out such names for themselves in future. This work has not only an educational value, but often a great economic importance as well; as, for instance, when some common mineral has been mistaken for one of value, some useless plant has been wrongly identified and supposed to be of service in medicine, or some harmless animal feared as noxious.

The publications of the Institution and its dependencies reach every State and almost every county in the United States. A careful study of the subject, recently made by the president of one of the scientific societies in Washington, seems to indicate that there are several States which are reached by no scientific publications, whatever, except those distributed gratuitously by the Government.

Speaking of the Smithsonian Institution proper, and not of the Museum or any other trust which it administers, it may be stated that nothing could be so desirable for the Institution as that Congress should examine for itself whether, on the whole, in the execution of the trust of Smithson, more has been given to the Government than has been received; for if, in attempting to increase and diffuse knowledge among mankind, the machinery of the Institution's action has been such that it has incidentally paid over to the Government the equivalent of much more than the whole original fund, these facts should surely be known to those who have to ask themselves in what spirit as well as for what purpose the Institution expends money placed in its charge.

Mr. Langley has pointed out that "although by the judicious administration of the Smithson fund nearly $1,500,000—the fruits of its investment—have been applied during the past forty years to the advancement of science and education in America (in addition to the principal, $911,000, larger now than ever before), it should be remembered that the unrestricted income of the Institution is less than $50,000 a year, a sum much smaller in its power to effect results than ever in previous years."

Can the United States fail to recognize its obligation to supplement liberally this private contribution for public good, especially if it be borne in mind that, as Mr. Langley has recently shown, the Institution has left in perpetual charge of the nation, in the Museum alone, property acquired out of its private fund (and to which it has apparently the same title) which is probably now more than equal in value to the whole amount of the Smithsonian bequest.

Every museum has its special characteristics growing out of its form of organization, its location, scope, and financial and other resources.

The character of the National Museum is fundamentally affected by its connection with the Smithsonian Institution, its dependence upon Congress for appropriations annually, and the necessity, under existing laws, of its caring for all collections belonging to the Government.

Of the connection of the Museum with the Smithsonian Institution, it should be said that it is in the highest degree advantageous. It should be borne in mind that it is essentially a Smithsonian museum, since, especially in its earlier history, the Institution expended large sums of money in aiding explorations, with the distinct purpose of increasing the collections in certain directions, while of late years it has deposited all the valuable gifts and bequests of specimens it has received. It has had in addition, for nearly half a century, the use of the larger portion of the Smithsonian building, and what is of paramount importance, the guidance and influence of the officers of the Institution, and the very valuable assistance of its numerous correspondents.

C.—THE WORK OF THE MUSEUM IN PUBLIC EDUCATION.

The work of the Museum, if it only performed the functions of an institution for scientific investigation, would be of sufficient value to justify its maintenance and extension. The Museum, however, not only performs these functions, but also does a very great deal to render the resources of science available to the public at large.

Prof. Huxley's definition of a museum is that it is "a consultative library of objects."

The National Museum is a consultative library for the scientific man, and it is something more. It aims to be an agency for the instruction of the people of the whole country, and to keep especially in mind the needs of those whose lives are not occupied in the study of science.

In a recent address before the American Historical Association, I attempted to explain the idea of our work as follows:

(1) That public institutions of learning are not intended for the few, but for the enlightenment and education of the masses.

(2) That the public has a right to full participation in the results of the work of the scientific establishments which they are helping to maintain.

(3) That one of the chief duties of the officers of these institutions is to provide means by which such results may be presented in an attractive as well as an intelligible form.

No scientific institution is more thoroughly committed to the work of the diffusion of knowledge than is the Smithsonian Institution, and no department of its activity has greater possibilities in this respect than is the National Museum.

The benefits of the Museum are extended not only to the specialists in its laboratories and to the hundreds of thousands of visitors from all parts of the United States who pass its doors each year, but to local institutions and their visitors throughout the country, through the distribution of the duplicate specimens in the Museum, which are made up into sets, accurately named, and distributed to schools and museums.

In the next annual report it will be shown how many hundred thousands of objects have been thus distributed during the past twenty years. Every museum in the United States has profited in this way, and by its system of exchange the Museum has, while enriching itself, contributed largely to the stores of every important scientific museum in the world.

Not only are specimens thus sent out, but aid is rendered in other ways. Within the last year not less than forty local museums in the United States were supplied with working plans of cases in use in the Museum, and similar sets of plans have been supplied within the past few years to national museums in other countries.

Not only do the people of the country at large profit by the work of the Smithsonian, as made available to local institutions, but also to a very considerable extent directly and personally.

The curator of each department in the Museum is expected to be an authority in his own line of work, and the knowledge of the whole staff of experts is thus placed without cost at the service of every citizen.

It is much to be regretted that many specialists, intent chiefly upon the study of certain scientific problems in which they individually are absorbed, are disposed to neglect the claims of the educated public to the enjoyment and instruction which museums afford. They do not hesitate to say that scientific museums should be administered for the benefit solely of persons engaged in research. Such men would find no welcome among us.

At a recent meeting of professional naturalists an eminent investigator in natural science publicly expressed his opposition to exhibiting certain scientific collections to "the gaping clowns who form the majority of the visitors to our museums." Such a spirit defeats its own purposes and such a remark deserves rebuke. The experience of Europe with its magnificent educational museums and the history of the several expositions in the United States should be quite sufficient to satisfy any one who has studied the matter, that the museum is an educational power of no slight potency.

The venerable director of the South Kensington Museum, the late Sir Philip Cunliffe Owen, speaking from an experience of thirty-five years, not only in his own establishment, but in the work of building up the score of sister museums now under its wing, located in the various provincial towns of Great Britain, remarked to the writer:

> We educate our working people in the public schools, and give them a love for refined and beautiful objects, and a desire for information. They leave school, enter town life, see only dirty streets and monotonous rows of buildings, and have no way to gratify the tastes which they have been forced to acquire. It is as much the duty of the Government to provide them with museums and libraries for their higher education as it is to establish schools for their primary instruction.

In the same conversation, Sir Philip insisted very strongly that a museum not actually engaged in educational work of some kind could not long survive, and as an example of one such field of activity pointed to the great system of lectures and examinations connected with the Science and Art Department of the Council of Education, of which the South Kensington Museum is one of the chief agencies.

II.—RECENT ADVANCES IN MUSEUM METHOD.

The importance of the Museum as an agency for the education of the young and for the culture and enlightenment of the public in general is each year becoming better understood.

The control of all museums is passing out of the hands of mere caretakers, or showmen, and is being assumed by men of intelligence and enterprise, whose purpose it is to elevate this agency of public culture to a plane of higher usefulness.

Museum-practice has become to such an extent an art that some years of training and experience in a well-organized general museum are almost essential. Intelligence, a liberal education, administrative ability, enthusiasm, and that special endowment which may be called "the museum sense" are simply prerequisite qualifications.

Any museum which employs an untrained curator must expect to pay the cost of his education in delays, experimental failures, and waste of material.

A museum without intelligent, progressive, and well-trained curators is as ineffective as a school without teachers, a library without a librarian, or a learned society without a working membership of learned men.

Such facts as these are gradually becoming impressed upon the public mind, and although the community within which a given museum is located may not for a time concern itself actively about its shortcomings, all the good work which it does is at once appreciated, and if advances are in progress, their results are eagerly awaited.

The "Museums Association," recently organized in England, is doing excellent work in that country. Such an organization is perhaps not yet necessary in the United States, where local museums are so few, but in time one will doubtless be organized. In the meantime the American Society of Naturalists is so situated that it can perform a part of the work proper to such an organization.

Sir W. H. Flower, the superintendent of the British Museum of Natural History, in his address at the last meeting of the "Museums Association" remarked:

> Of the museums of the United States of America much may be expected. They are starting up in all directions, untramelled by the restrictions and traditions which envelope so many of our old institutions at home, and many admirable essays on museum work have reached us from the other side of the Atlantic, from which it appears that the new idea has taken firm root there.*

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*Report of the Museums Association, fourth general meeting, 1893, p. 12.

It is gratifying to know that even in the smaller towns of Europe the ideals which we hold before us in our work are appreciated and quoted. The "Brighton Herald" of August 18, 1894, contained the following editorial comment:

All those remarkably constituted persons who maintain that we do not want a museum in Brighton would do well to read a well-written little brochure by Dr. Charles A. White, of the U. S. National Museum, entitled "The relations of biology to geological investigations." It is a philosophical subject, philosophically treated, demonstrating the important relation that museums hold to science and to civilization as centers of learning and conservatories of the evidence concerning acquired knowledge. Museums [he concludes] should not only be made safe treasure-houses of science, but they should be what their name implies, temples of study perpetually open to all investigators.

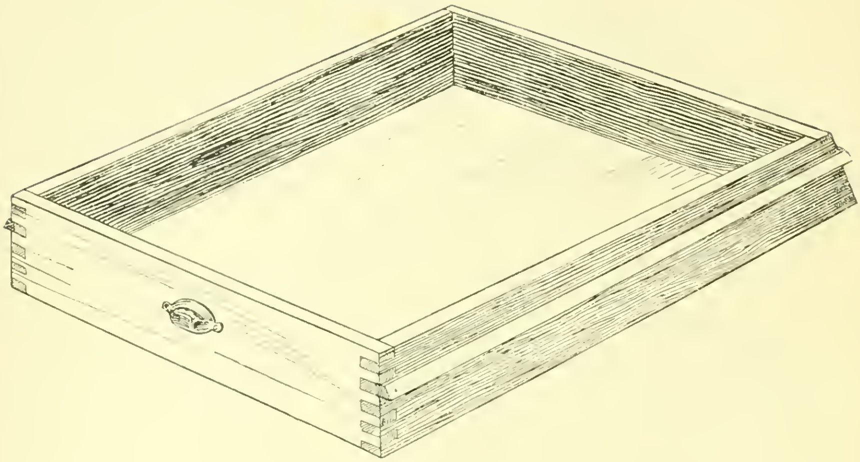
In our own country the spirit of museum extension is spreading, as is shown by such articles as that by Prof. Morse in the "Atlantic Monthly," entitled "If Public Libraries why not Public Museums," which is reprinted in a subsequent part of this report. It is the highest ambition of the National Museum to be associated actively in the work of museum reform, and to feel that we are standing shoulder to shoulder in this respect with the older institutions of Europe, and that this fact is recognized by them.

As we have worked along from year to year, always striving to do the best thing possible under the circumstances, we have always taken first into consideration the plans in use in other museums, and have either cast them aside as unavailable, modified them for our own needs, or frankly adopted them.

So it has come to pass that we have a large number of forms of cases and devices for installation, fitted to meet almost every need of museum or exposition administrators. These are always placed freely at the disposal of those who need them. Working drawings and photographs of cases, and samples of fixtures of every kind are freely lent. When the museum has had made, for its own use, expensive tools, such as molds for specimen jars or pedestal tiles, or dies for corrugating metal for the sliding-racks of storage cases, these are placed without charge at the service of public institutions, and the use of blocks for illustrating reports is always accorded.

In this way the entire resources and experience of the National Museum are placed at the disposal of even the smallest country museums, and this policy has, we hope, been very beneficial.

In pursuance of this policy some of the most instructive of our recent experiments are described in this report, in advance of a fuller discussion in a comprehensive work on the principles and methods of museum administration, which has been in preparation for some years. This is done with less hesitation because of the example set by Dr. A. B. Meyer, whose papers on the methods of the Royal Zoological and Anthropological-Ethnographic Museum in Dresden have proved so interesting to all museum workers, and who, rightly thinking that museums are doing too much in the way of experiment and too little in utilizing the



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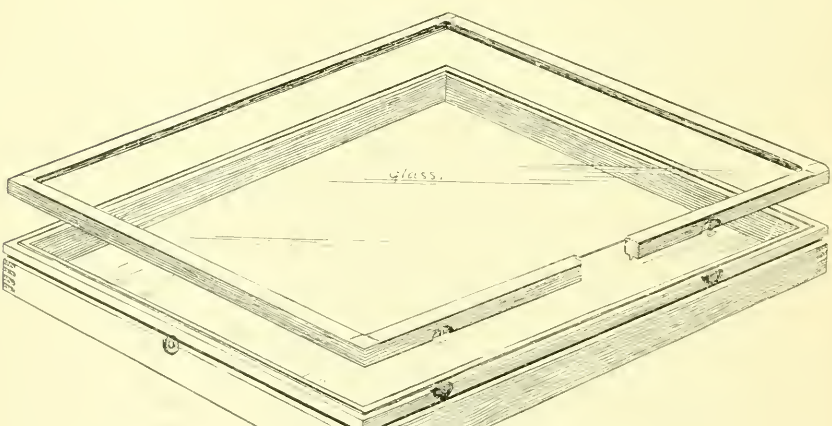

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UNIT DRAWERS.

Fig. 1. Storage drawer.
Fig. 2. Exhibition drawer with glass front; 24 by 30 inches.

experience of others, publishes his own experiences for the good of other workers in the same field.*

MUSEUM CASES.

Of all the practical questions which confront the museum administrator those relating to the form and construction of cases and the methods of interior fitting are among the most perplexing and, so far as the relationships of the museum to the public are concerned, the most important. Each well-arranged case with its display of specimens and labels is a perpetual lecturer, and the thousands of such constantly on duty in every large museum have their effect upon a much larger number of minds than the individual efforts of the scientific staff, no matter how industrious with their pens or in the lecture room.

Ever since the occupation of our new building very special attention has been given to improving the cases, and a system, peculiar in the beginning to the National Museum, though since adopted by others, has grown up—a system based upon a fixed and interchangeable unit of construction; so that, to a very large degree, it is possible to transfer cases from one department to another. This fixed unit is the storage drawer or "unit drawer," 24 by 30 inches in dimensions (Pl. 1, fig. 1). Modifications and extensions of this unit are very generally in use in many forms of cases, both for exhibition and storage. (Pl. 1, fig. 2.)

Exhibition cases.—The various kinds of cases now in use are indicated in a general way in the two accompanying plates. (Pls. 2 and 3.) Fuller descriptions of the cases and their manner of construction will be reserved for a future report. It may be said, however, that the tendency has been toward the use of the very best of glass in the largest possible sizes, the woodwork being, as a rule, restricted to bases, corner pieces, and cornices. The top of the case—no matter what its size—is of glass. When possible, where two panes of glass are used in a single case front, a narrow metal connecting strip is used instead of a wooden bar.

The theory which has led to the development of this form of case is that collections should be so arranged that each surface of glass, or each panel of a long case, stands by itself, its contents being grouped with reference to a general descriptive label, either placed in their midst or in the middle of the case-frame above. It is not considered legitimate to arrange series of specimens on long shelves extending from one end to the other in cases whose fronts are broken by panels or doors; but, as has been said before, each panel or door stands for itself, like the page of a book, the arrangement being without exception from left to right, as in a book.

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* MEYER, A. B. Zweiter Bericht über einige neue Einrichtigungen des königlichen zoologischen und anthropologisch-ethnographischen Museums in Dresden. *Abhandl. und Berichte K. Zool. Anth.-Ethnog. Museums Dresden*, 1892–'93; Dresden, 1894. No. 1, pp. 1–28, Pls. I–XX.

The breaking of the view of a specimen or an exhibit by a horizontal bar is also avoided, and when horizontal sash-bars are necessary (as in a cheap case where small panes of glass are used) the situation is relieved as much as possible by placing a shelf behind this horizontal bar, so that it is in effect a part of the shelf.

The form of case with which we are at present best satisfied is shown in the illustrations of some of the groups of Indians. (Pls. 51 and 52.) Where smaller objects are shown, a large proportion of the height of the case is occupied by the base in which "unit drawers" are fitted.

We have also introduced an inexpensive and practical adjustment of the doors of the larger cases, by means of which these may be raised instead of swinging upon hinges, thus doing away with the exceedingly objectionable swinging doors, so undesirable in narrow aisles and so inconvenient to curators. With the new system the cost of the mechanical appliances for swinging the sash is almost compensated for by the saving in hinges, wrench-locks, clamping-bars, and special contrivances for dust-proofing. The general appearance of these cases is shown in the accompanying plate. (Pl. 4.)

So perfect is this adjustment that a glass door weighing more than one hundred pounds may be lifted with one finger. The complicated arrangement of cranks and levers used in many old-fashioned cases is entirely unnecessary.

The advantages of iron and steel exhibition-cases have been urged with so much enthusiasm of late that it seems proper to say that the question of the use of iron has been constantly under consideration here since 1879. All the different forms of iron cases have been studied, including the Dresden cases constructed by Prof. Meyer which were inspected by the writer in 1880, and the wooden-sheathed iron cases in the American Museum of Natural History in New York. This was before the system of wooden cases, which we now use, had been adopted. When the new Museum building was finished, in 1881, the use of iron cases was practically decided upon, and sample cases were made, in general accordance with the Meyer plans. They were found, however, to be much more expensive than wooden cases, heavier, and less easy to adapt to special uses. They offered no material advantage, except, possibly, a greater durability. The limitations of iron in the matter of design are manifest, and the impossibility of securing the polished surfaces of wood, which add so much to the attractiveness of a museum case, was another reason against iron construction.

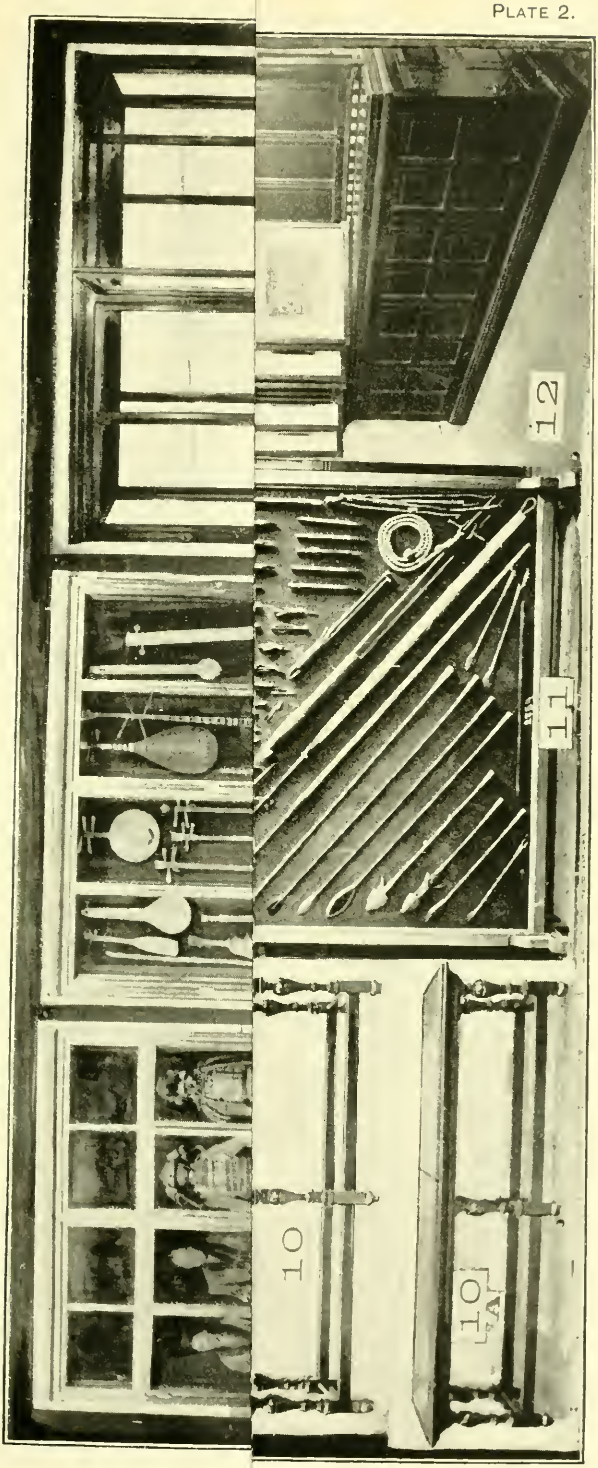
Looking back fourteen years to the time when iron was rejected, no reason appears for regretting the decision then made.

The use of Mexican or Frontier mahogany which is well known as softer and straighter grained than the West India variety so popular for furniture, has been continued, and no other is so thoroughly suitable, so far as color is concerned, though the oaks when used have, in other respects, given great satisfaction. When black cases are required, cherry wood is employed and an ebony finish added.

EXPLANATION OF PLATES 2 AND 3.

Standard forms of cases used in the U. S. National Museum.

Fig. 1. Pier Case.
Fig. 2. Alcove Case.
Fig. 3. Table Case (upright).
Fig. 3A. Table Case (upright), half size.
Fig. 4. Table Case (sloping).
Fig. 4A. Table Case (sloping), half size.
Fig. 5. Table Case (flat).
Fig. 6. Table Case (Gray pattern), storage base.
Fig. 7. Table Case (Gray pattern), glazed base.
Fig. 8. Kensington Case (Gray pattern).
Fig. 9. Unit Table.
Fig. 9A. Unit Table (half size).
Fig. 9B. Unit Table (quarter size).
Fig. 10. Base Tables.
Fig. 10A. Base Tables (dwarf size).
Fig. 11. Floor Screen.
Fig. 11A. Arch Screen.
Fig. 12. Table Screen.
Fig. 13. Slide Screen Case.
Fig. 13A. Slide Screen Case (half size).
Fig. 14. Door Screen Case.
Fig. 15. Case Top Screen.
Fig. 16. Half Column (for wing-frames).
Fig. 17. Glass Screen (sloping).
Fig. 18. Glass Screen (upright).
Fig. 19. Standard Bookcase.
Fig. 20. Standard Shelf-stack.
Fig. 21. Standard Pigeon-hole Stack.
Fig. 22. Standard Card-catalogue Drawer.
Fig. 23. Unit Drawers, 2″ to 12″ deep, 24″ wide.
Fig. 24. Unit Boxes (glazed), standard.
Fig. 25. Wing Frames (standard).



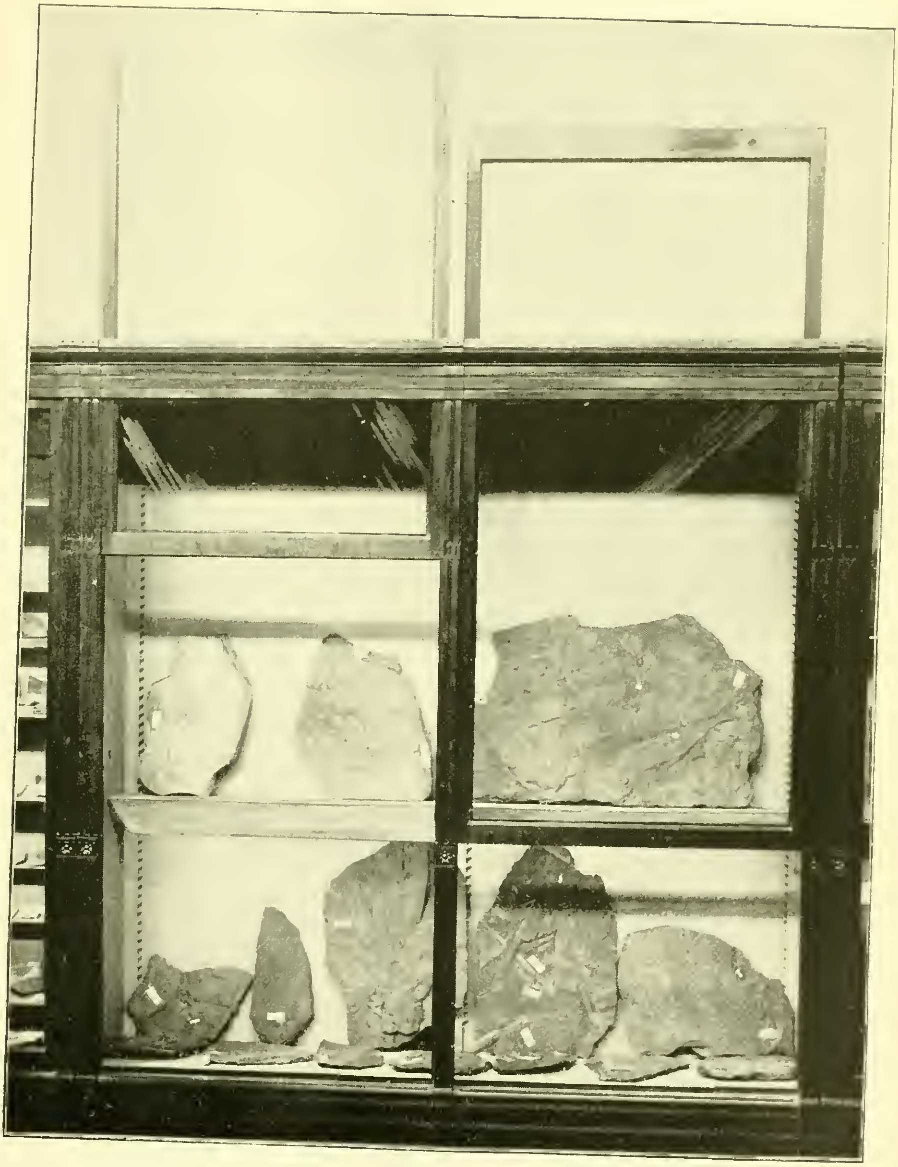
STANDARD FORMS OF CASES USED IN U. S. NATIONAL MUSEUM.

STANDARD FORMS OF CASES USED IN U. S. NATIONAL MUSEUM.

PLATE 3.

STANDARD FORMS OF CASES USED IN U. S. NATIONAL MUSEUM.

STANDARD FORMS OF CASES USED IN U. S. NATIONAL MUSEUM.

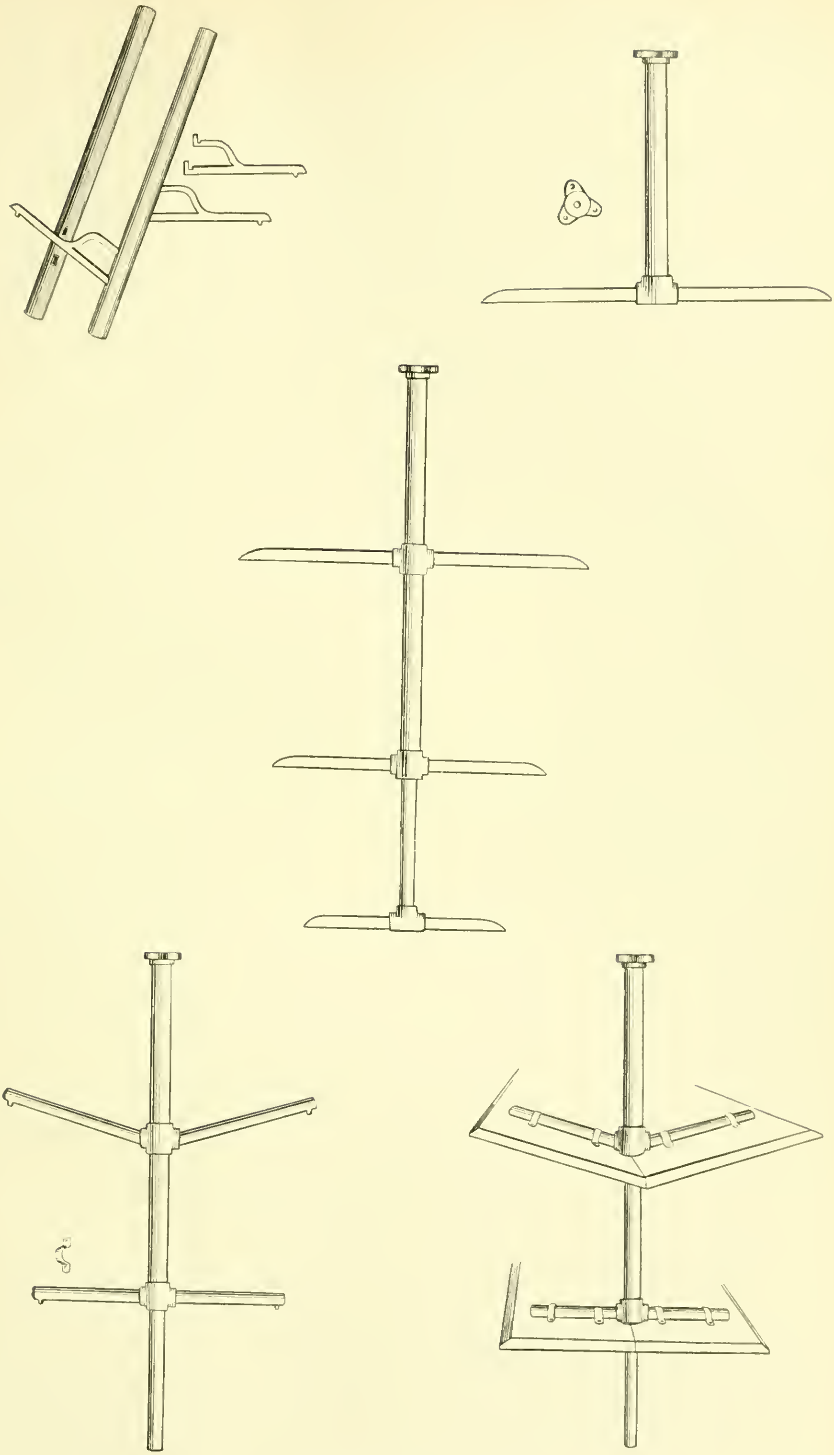


CASE FOR PALEONTOLOGICAL SPECIMENS, WITH SUSPENDED DOOR.

Size of glass in door, 43½ by 87½ inches.

CASE OF PLATE GLASS WITH MOLDINGS REDUCED TO MINIMUM OF POSSIBILITY.

Size of glass, 17 by 44 inches



BRACKET SUPPORTS.

(See p. 25.)

Some cases have been made in which corner pieces of wood or metal have been entirely dispensed with, as in that containing the reproduction of the Bryant Memorial Vase (Pl. 5). This ingenious method requires mechanical skill of the highest quality, and the expense is so great that it is only justifiable in the case of very precious objects which require to be hermetically sealed. The cost of this special receptacle was $395. It is the most expensive case, for its size, in this museum, and is an exceedingly beautiful piece of work.

In fitting cases with shelves the so-called "Gavit bracket," invented by Prof. Edward S. Morse, of the Peabody Museum, in Salem, which is supported upon racks secured to the side, of upright bars, in the back of the cases, has always been thoroughly satisfactory. In some instances where heavy objects, like minerals, are to be shelved and the question of protection against insects is not involved the "Jenks bracket," which fits with a triangular knob into an aperture of similar shape in a metal plate secured to the back of the case, has been substituted.

Another kind of bracket support which seems to have great possibilities is the invention of Mr. Henry Horan. It is constructed of iron pipe and is exceedingly light and strong. The essential features of this contrivance are shown in Plate 6.

The use of clear, strong colors for backgrounds is continued, the only changes having been in the direction of better and purer pigments. Many experiments have been made and the number of colors used have been reduced to two—a maroon corresponding to that customarily seen on the walls of art galleries, for large cases in brilliantly lighted halls where the installation is not crowded, and a light, warm buff, somewhat resembling in tint the Solenhofen lithographic stone, but somewhat warmer, in cases and halls where specimens are crowded or where much light is for any reason desirable. This luminous buff is also used very largely upon ceilings and the upper parts of walls, while the maroon is used on walls up to the level of the tops of the cases, harmonizing admirably with the mahogany furniture. Glass shelves are used when possible, even in cases for natural history objects.

The influence of the National Museum system of case construction and labeling was manifest everywhere throughout the American exhibits at the World's Fair, particularly in the Government building, the Liberal Arts building, the Fisheries building (where Norway also had in part adopted our style), the Woman's building, some of the State buildings, and particularly in the exhibit of the Pennsylvania Railroad, where our cases and labels were adopted under the direction of one of our curators.

Storage cases.—A modification of the English form of sliding mechanism, by means of which drawers of different depths are used interchangeably throughout a long series of storage cases, has been in use in the Museum since 1882. At least 30,000 of the standard drawers, 24 by 30 inches, are in use for the reception of minerals, fossils, and zoological specimens of all kinds, as well as in the departments of ethnology and archæology.

Besides these there are over 10,000 unit boxes fitted with glass fronts, which also, when necessary, are worked into the same system.

The storage case, from which the idea was originally taken, was, I believe, first invented by Prof. Strickland, of Cambridge, England, and afterwards modified by Mr. Osbert Salvin. As at first constructed in the National Museum, the sliding strips in the storage cases were triangular pieces of hard wood, 1 inch in width and one-half inch wide at the top, sloping to one-eighth inch at the bottom. (Pl. 7, fig. 3.) These were nailed horizontally close together upon each side of the case, while in the grooves thus formed were received the corresponding strips nailed upon the two sides of each drawer—strips originally of the same size but trimmed slightly in order that they might run smoothly.

The top, or thin edge, of the slide-strip was always placed 1 inch below the top of the unit drawer, or 2 inches below the top of the glass-covered unit box, and since the depth of these unit drawers and unit boxes was always an even number of inches, a drawer of any depth could be used, from 2 to 14 inches, and a corresponding drawer of any depth could be placed above or below it. Any compartment could thus be filled with unit drawers of any desired depth.

The first improvement in this mechanism grew out of the desire to secure still greater tightness. The interior of the compartment was lined with zinc, and the strips were nailed on the inside of the zinc. This proved objectionable on account of the nail-holes.

The next step was to make the slide-strips at the sides also of metal, and to accomplish this many experiments were tried, and finally arrangements were made with a firm in Philadelphia engaged in manufacturing corrugated iron. It was necessary for the Museum to have especially constructed a set of dies and rolls for rolling the metal into the desired shape (Pl. 7, fig. 1), and also to import Florence tin of extraordinary thickness, the kind ordinarily used in the United States not being sufficiently strong. This experiment proved satisfactory, and 150 cases of this type have been for four years in use in the Museum, and have stood the test of wear. The only objections arise from the slight roughness where the sheets of tin are joined together, which is not serious, and the fact that the outer ends of the metal ridges, which were of course hollow, had a tendency to bend when the drawers were drawn so far as to make a strong leverage upon the points. This, however, has been satisfactorily remedied by the use of triangular plugs of hard wood, technically called "dutchmen," which are driven into the openings.

Out of these experiments still another form of storage case resulted, in which the metal was placed outside of the woodwork instead of inside, being soldered upon the outside of a substantial framework of wood, while the strips upon the inside were of wood arranged in a new way.

SLIDING STRIPS TO SUPPORT UNIT DRAWERS IN UNIT TABLE-CASES.

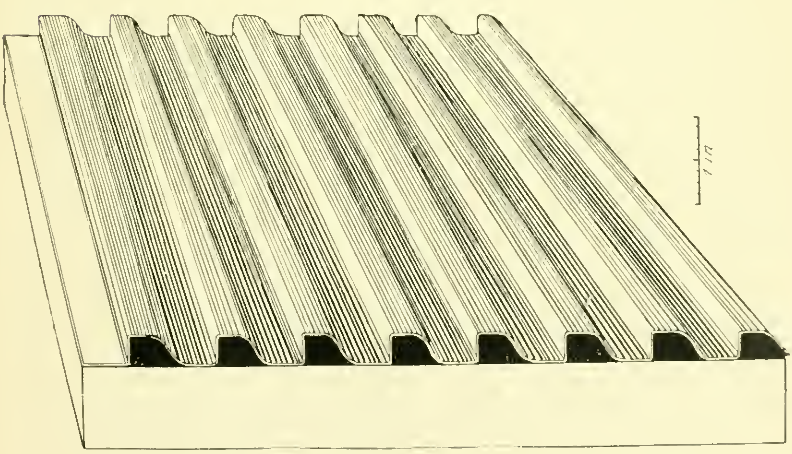


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Fig. 1. Metal runners.

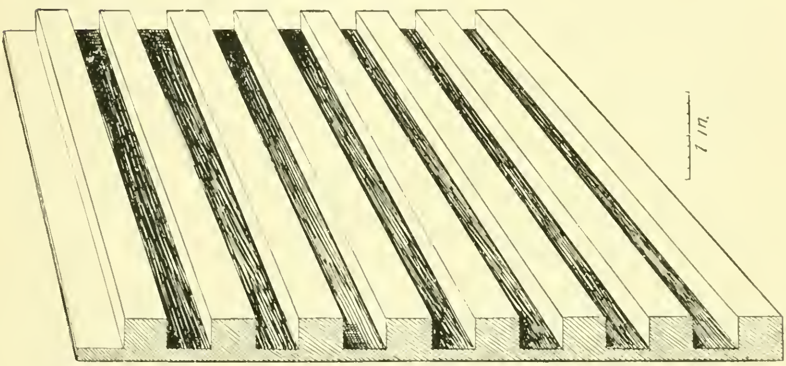

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Fig. 2. Grooved strips.

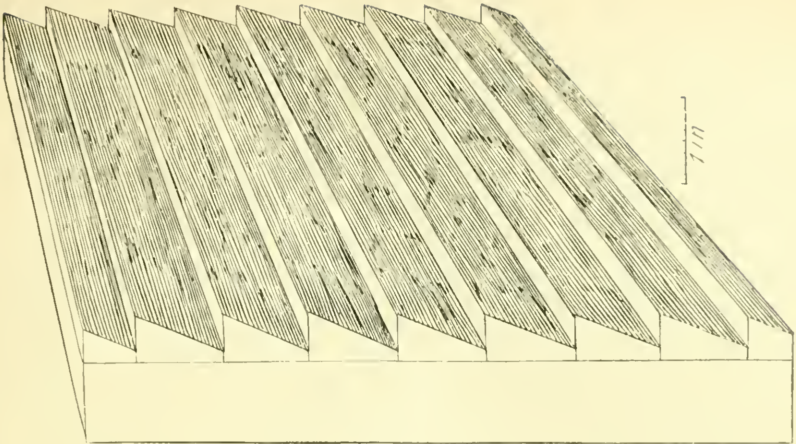

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Fig. 3. Triangular strips.

Instead of separate triangular strips, 8-inch boards of oak or ash, one-half inch in thickness, are glued and nailed close together upon the sides of these strips. In these boards are worked at intervals of every half inch grooves one-half inch in width and about one-half inch in depth. (Pl. 7, fig. 2.) The sides of the case are thus provided with a series of parallel, horizontal grooves separated by half-inch bars, which represent the triangular strips formerly described. To correspond to these grooves a new device is employed for the support of the trays. Instead of the strip which was formerly nailed at the side, the lower edge of the tray projects with a triangular section beyond the plane of the sides, as shown in the diagram. (Pl. 8, fig. 1.) This device is applicable to light drawers not over 4 inches in depth. The drawer of the old type, however, works advantageously in the same groove.

In both the metal-lined and metal-covered cases, as just described, a very effective means of closing the front is secured by the use of rubber tubing fastened in a groove in the zinc-covered front edges of the opening, against which a solid wooden door is firmly pressed by means of a special form of combined bolt and lock, as shown in the accompanying sketch.* (Fig. 1.)

Many improvements have been made in the past ten years, not only in the sliding mechanism, but also in the methods of making the cases moth and dust-proof.

One moth-proof case is a modification of the form originally devised by Mr. William Brewster, of Cambridge, Mass.

The most perfect example of the moth-proof case which has been produced, is one especially modified from designs by Mr. J. S. Goldsmith, for the reception of the type specimens in the mammal collection. This case contains 8 drawers, 3 by 4 feet. Most of the drawers are 2 inches deep, but others of any required depth can be used. The drawers are of pine and have a solid wooden bottom, although one of three-ply veneer would doubtless be an improvement. The system of construction is that already described, with grooved wooden boards inside of a zinc cover. The drawers are provided with the ordinary triangular slide-strips. The frame of the case which supports the slide-racks inside is covered with zinc outside, and is of pine 3 inches wide and seven-eighths of an inch thick. The frame is covered with sheet-zinc, weighing 16 ounces to the square yard. The zinc-covered case, which is 38 inches long, 51 inches wide, 31¾ inches high, is then placed in a case of hard wood, whose dimensions in the clear inside are 2 inches longer and 2 inches higher than the case, which, when pushed into place, fits against the back of the wooden case—the front edge of which projects about 3½ inches beyond the outer edge of the zinc case—but is separated by seven-eighths of an inch from its sides, bottom, and top. This space is filled by pine strips, 3 inches in width and seven-eighths of an inch in thick-

*The text figures have been grouped into plates, following Plate 57.

ness, which are necessary for use in connection with the device for dust-proofing.

The device for dust-proofing is dependent upon a double door and a double system of rubber tubing. The system by which the double doors are made is shown in the accompanying sketch (Fig. 2). These doors are separated by an air space of 2 inches. The inner one is of soft wood, paneled, and lined with zinc. The outer one is of hard wood, paneled. The pressure against the rubber tubing, which is necessary for absolute tightness, is secured by three sets of stubs and plates, at the bottom (Fig. 3), and by two bolts, one in each corner above. These are so shaped that, when pressed, they have the effect of wedges (Fig. 4).

The outer door has the same system of stubs and plates, and a rod lock of the ordinary type, fitted with a Yale key for the greater security of the precious contents.

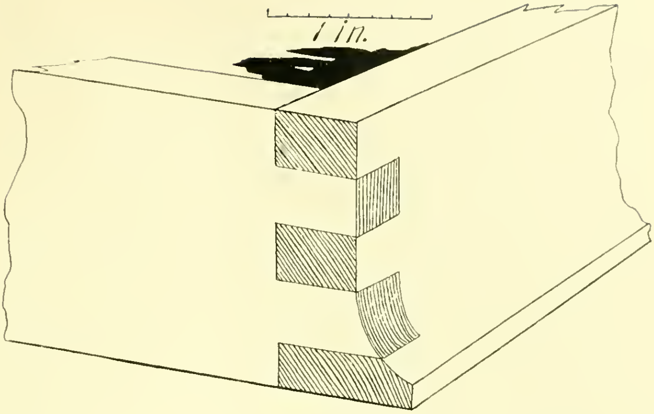
This case has been used for some months and has proved thoroughly satisfactory, being practically air-tight, while its construction is such that it will doubtless be as good fifty years hence as it is now.

Improvements have also been effected in the construction of the unit drawers. At first these were joined at the corners by dovetailing. This proved unsatisfactory, and the device of "fingering" was substituted. (Pl. 8, fig. 2.) The fingered corners have been secured in two ways, one by wooden dowels, the other by the ordinary process of gluing. The doweled trays were exceedingly strong and satisfactory, but it has been more convenient to use the other method and this is now exclusively employed.

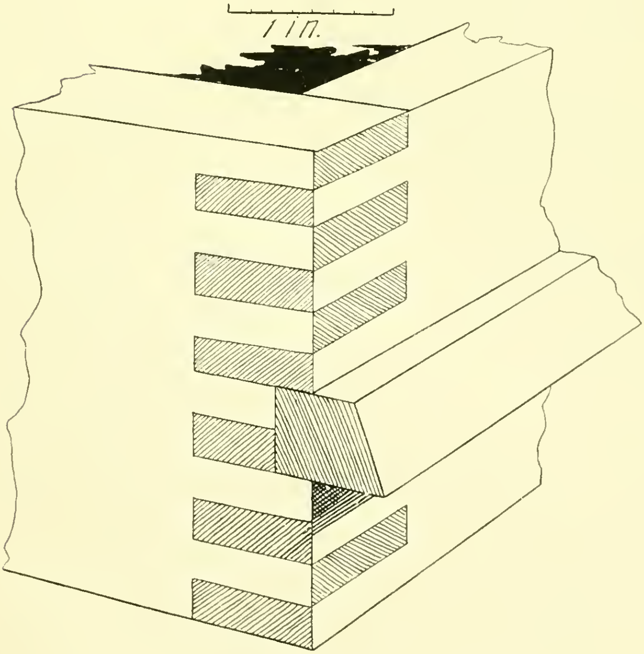
The bottoms, which are inserted in grooves about a quarter of an inch from the bottom of the tray, are of three kinds:

(1) Of pine or of poplar, seven-eighths of an inch in thickness, for the minerals and heavy specimens and three-eighths of an inch for light specimens.

(2) Of "three-ply veneer," such as is used for the seats of chairs and for the lining of cars and in other kinds of cabinetwork. These are made of three layers of very thin, straight-grained wood glued together, the central layer being of pine, the outer layers of ash, maple, or other hard wood. These layers are so adjusted that the grain of the center layer runs at right angles with that of the two outer layers. They are solidly glued together under heavy pressure, the thickness of the whole not exceeding a quarter of an inch. Although somewhat more expensive than the plain wooden bottoms, they are stronger and very much lighter and have the positive advantage of never cracking or shrinking. The plain bottoms, it has been found, often shrink away from their attachments to the sides of the drawer, even when thoroughly kiln-dried lumber is used. Many thousands of "three-ply" bottoms are in use, and they have satisfactorily stood the test of hard use for ten years or more.



1



2

DETAILS OF CONSTRUCTION OF UNIT DRAWER.

Fig. 1. Triangular section of unit drawer.
Fig. 2. Corner section of fingered drawer, showing triangular strip on side.

(3) Of paper. This form of bottom grew out of the desire for a lighter and cheaper form of tray.* In the early storage cases deep drawers were used, chiefly for reasons of economy, and small pasteboard-bottomed trays, four of which covered the bottom of a unit drawer, were used to contain birdskins and other small objects, these being piled one above another in several layers. This was inconvenient and detrimental to the specimens, and the real desideratum proved to be a light shallow drawer of moderate cost, in which specimens could be stored in a single layer. It should be said that the old system of deep drawers was also in part the outgrowth of the necessity for making the drawers themselves dust and moth proof. This was in the days before air-tight cases had been developed, and skins of birds and mammals were kept in glass-covered boxes, similar to the unit box. The development of the light paper-bottom tray was simultaneous with that of the moth-proof case.

In the search for a light and durable drawer of this kind many experiments were made. The first stage was that of binders' board, then followed tin, then light three-ply veneering, then wire-gauze covered with paper, then cotton cloth painted, then cotton cloth covered with paper, and finally the bottom made of paper alone. These bottoms are made only in the Museum workshops, it never having been found possible to get a contractor sufficiently careful to furnish satisfactory drawers. The materials used and the process employed are as follows:

Materials.—(1) Brown manila paper, 150 pounds to the ream. The size of each sheet (from which two bottoms are made) is 40 by 48 inches; (2) common flour paste; (3) brown shellac of commerce, dissolved in alcohol.

Tools.—The tools are a bookbinder's knife, a broad, flat paste brush, a stout wooden stretcher, 27 by 33 inches, which is the size of the bottom before it is trimmed. This stretcher is of pine, at least 1¼ inches in thickness, in order to resist the strain of the shrinkage of the paper when drying. There should be, of course, a considerable number of these stretchers (Pl. 9, fig. 1).

The process.—A sheet of paper is pasted to the large wooden stretcher,

* The size and estimated cost of the trays with paper bottoms now in use in the Museum and of the stretchers used in making the trays are here indicated:

Department in which used.	Size.	Estimated cost.
	Inches.	*Cents.*
Mammals	24 by 30	25
Do	24 by 36	30
Ornithology	22 by 28	25
Do	28 by 44½	30

Sizes of stretchers for making trays with paper bottoms: 27 by 33 inches, 29 by 40 inches, 27 by 33 inches, and 31 by 46½ inches.

extreme care being taken to avoid wrinkling, and is then set aside to dry for a half hour or more. It is then taken up again, and another sheet is pasted to it, after which it is again set aside to dry. This is repeated until four or five thicknesses of paper have been joined together, five thicknesses being necessary for the heaviest drawers. Each sheet, before being pasted on, is thoroughly soaked in water. The combined sheets thus forming the bottom of the drawer are then allowed to dry for twelve to twenty-four hours, according to the moisture of the atmosphere. The inside of the bottom of the drawer is then thoroughly coated with shellac. Then, without removing the sheets of paper from the stretcher, they are tacked to the bottom of the frame of the drawer with 6-ounce Swedish tacks, placed about a quarter of an inch apart (Pl. 9, fig. 2). Then another sheet of paper is pasted over, thus covering the heads of the tacks. This not only improves the appearance of the bottom, but prevents the tacks from drawing out. Then the bottom is also thoroughly shellacked, and the edges of the paper trimmed close to the edge of the drawer, which is then complete. The weight of the lightest 24 by 30-inch drawers for small bird skins, 2 inches in depth, is about $31\frac{1}{2}$ ounces, and the cost is about 25 cents.

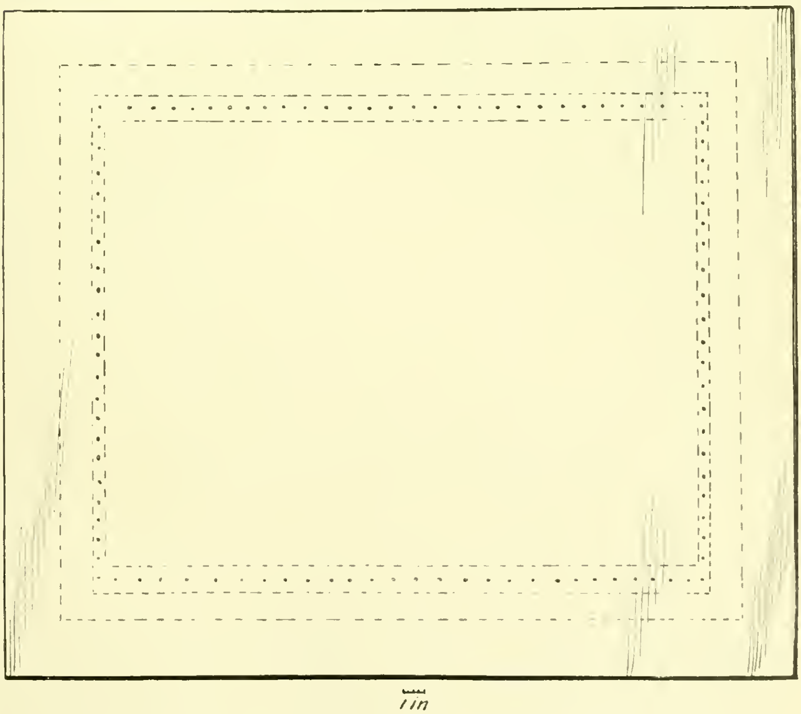
The ordinary pine storage drawer, 3 inches in depth, costs on the average about 50 cents; a 4-inch drawer, 55 cents; a 5-inch drawer, 60 cents, and so on in proportion. This, of course, refers to prices where a large number of them are made by machinery at the same time.

Another feature in our cases, peculiar to this Museum, it is believed, is that every case, no matter how large, is placed upon rollers, or can be lifted from the floor on adjustable rollers of various forms. Even the long wall cases, 9 feet in height, which have been recently constructed, are made in sections, so that they can be moved without the assistance of carpenters.

The largest case in the Museum—that containing the group of buffaloes—is undoubtedly the largest movable show case in the world. It is 16 feet 6 inches by 12 feet $5\frac{3}{8}$ inches by 11 feet $1\frac{7}{8}$ inches in dimensions, and the weight of the case, with its contents, is about 9,300 pounds. This is supported on 10 rollers, which are of the kind used on the heaviest rolling platforms in warehouses, and are made of iron, the wheels being $4\frac{1}{2}$ inches in diameter, with rims about 2 inches wide. They are of a pattern called the "anti-friction" castors, the bearing of the axle being upon an arrangement of several wheels. This case can be readily moved from one end of the Museum to the other by eight men.

There are other cases almost as large, and still others—in the mineral hall—much heavier in proportion to their size. The mineral storage case, 8 feet 6 inches long, 4 feet 4 inches wide, and 3 feet 3 inches high, filled with unit drawers, loaded with minerals, has an estimated weight of 2,000 pounds. Such cases as these are supported on 4 or 6 anti-friction castors of the pattern and size just described, one at each corner, and can be moved by four men.

1



2

DETAILS OF CONSTRUCTION OF UNIT DRAWER WITH PAPER BOTTOM.

Fig. 1. Pine stretcher and drawer (front view).
Fig. 2. Pine stretcher, showing paper tacked to drawer (back view).

The ordinary lighter type of exhibition case is not provided with independent rollers, but can be raised by wooden trucks with rubber tires about 4½ inches in diameter, and movable in every direction, like furniture castors. There is an attachment of levers so accurately adjusted that a case full of bottles can be moved from one end of the building to the other without disturbing labels or specimens.

This system of trucks has been found of the greatest service in the exposition work, in which the Museum is often called upon to take part, since the cases can be arranged in cold or bad weather in sheltered, warm rooms, and carried to their places on the floor.

Another form of case especially advantageous for exhibition work is what is called the "knockdown" case, in which the parts are fastened together by pins and escutcheons. These cases have all the permanence and strength of fixed cases, and can be put together and taken apart with great celerity.

MOUNTINGS FOR INDIVIDUAL SPECIMENS.

One of the most convenient and ingenious devices is that invented by Prof. Merrill for placing geological specimens, jars, and other similar objects upon sloping shelves, in such a manner that both specimen and label shall be easily seen, while at the same time resting on a level surface; the objects are not in danger of sliding forward. This system is shown in the accompanying illustration. (Fig. 5.)

In the plate referred to (Pl. 10) the appearance of a number of specimens thus arranged upon the shelves is shown, though not well. The arrangement of this case is in many respects one of the most satisfactory pieces of installation which has ever been effected in the National Museum.

Each block or tablet has tacked to its front a small strip of tin, so bent as to receive and hold the label and to allow its ready removal when desired. This is painted the same color as the block, and is thereby rendered quite inconspicuous. To prevent the sliding of the specimens of the front row, which, in order to bring them below the level of those in the back row, are without blocks, a continuous strip of tin is tacked along the front edge of the shelf, bent as shown in the cut. The full width of the strip is the average width of the labels. In this series it is about one inch. The elevation of the back edge, which is to check the sliding of the specimens, is from one-eighth to one-fourth inch, while the front edge is folded over just sufficient to hold the label in place, as before.

Among the other devices which have recently been adopted in the department of geology two may be mentioned:

The first is the curator's plan for showing the appearance of a cave by setting up in its natural position a miniature grotto, with diminutive stalactites and stalagmites, which he was so fortunate as to secure from the Marengo Cave, in Indiana (Pl. 11), placing at the sides of the case mirrors by whose reflections the general effect of an extended miniature cave is produced. This is a very effective way of mounting exhibits. and the use of the mirrors seems to be an aid to the imagination of visitors, especially to young people who have never seen a cavern.

Another is for storing the great series of microscope slides of thin sections of rocks which belongs to this department. It is thus described by Prof. Merrill:

As it happened, we had in stock a number of pasteboard boxes, some 93 mm. wide, 143 mm. long, and 48 mm. deep, all inside measurements. The dimensions of our standard slide are 48 by 28 mm. By means of two wooden partitions some 3 mm. thick, running lengthwise, each box was divided into three equal compartments, the partitions being held in place by glue reinforced by two small tacks at each end. Heavy manila wrapping paper, such as we also had in stock, was then cut into strips 25 mm. wide and as long as the sheet of paper would allow, in this case about 7 feet. These strips were then bent into a series of folds, as shown in the accompanying illustration, the apices being rounded, not pinched flat. If carefully done, the folds when crowded gently together act as a spring. Two of these folded strips were then placed lengthwise in each compartment, and the slides introduced, standing on end, between the folds at the top. A box as thus prepared readily holds 3 rows of 50 slides in a row, or 150 altogether.

Each slide is separated from its neighbor in the same row by a double thickness of manila paper, which, owing to its manner of folding, acts as a spring, and avoids all possible danger of breakage. When all the compartments are filled, the space between the tops of the slides in any row is but about 2 mm., but there is, nevertheless, no difficulty in removing a slide or in getting at it to read the label without removal, since, owing to the yielding nature of the paper, the top may be readily drawn apart. In this respect the box offers a great advantage over those with rigid compartments, such as are commonly in use. The first box was made merely as an experiment. It proved so satisfactory that, for the time being at least, it is the form adopted for storing the several thousand slides forming the museum collections.

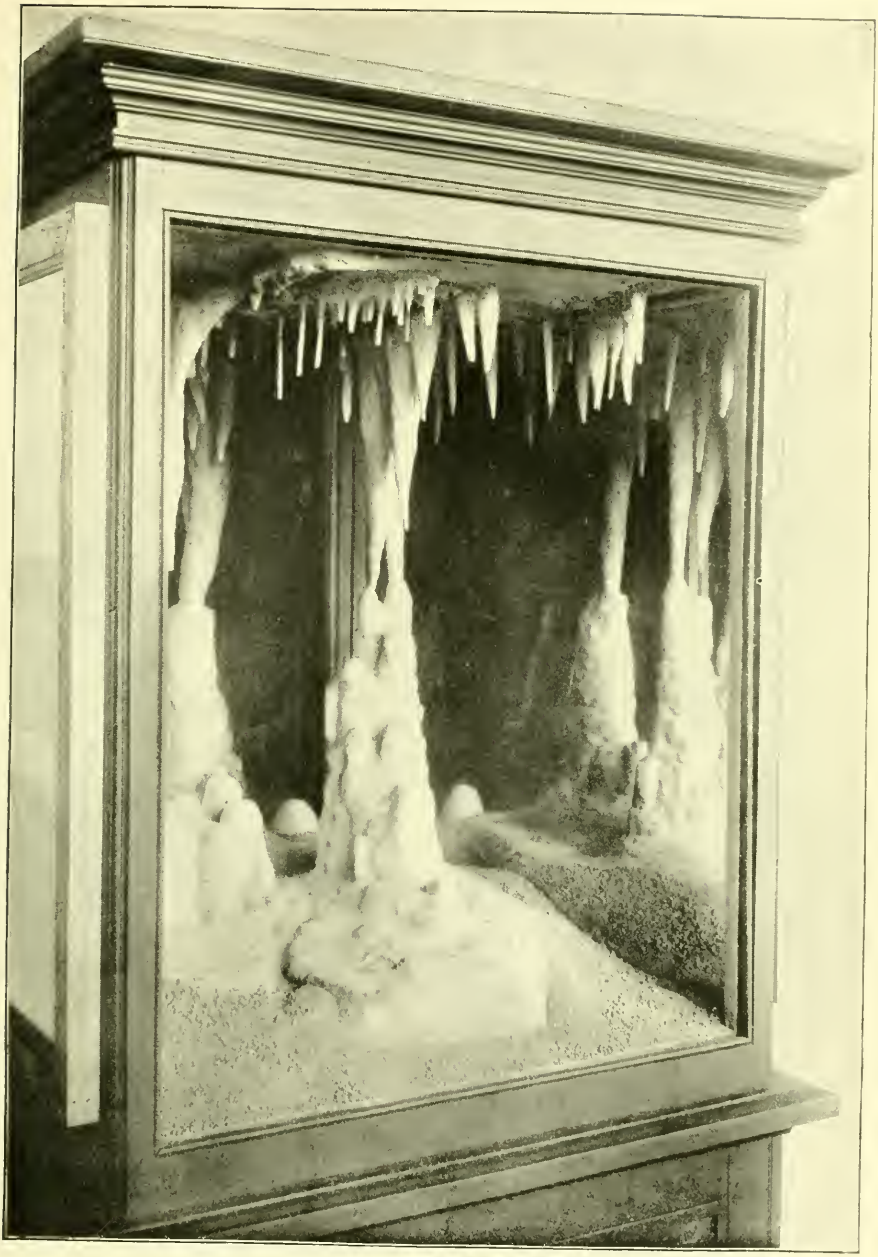
I have attempted to show the arrangement as above described in the accompanying drawing (Fig. 6). In reality the slides are held much more firmly than indicated, since the paper bulges and comes against both the front and back of the slides the full length of the fold, instead of merely at the bottom. It will very likely strike the reader that a better material than paper might be found. I can only state that after considerable experimenting the paper was, all things considered, found most satisfactory.*

The adoption of unglazed tiles, instead of wooden or paper blocks, to support minerals, shells, and other small objects, is being considered, and experiments, the result of which will be announced later, are being made by Mr. Charles Schuchert, of the Paleontological Department. These tiles are rectangular, and of a soft buff color, corresponding closely to one of the standard shades used in the interior of our cases.

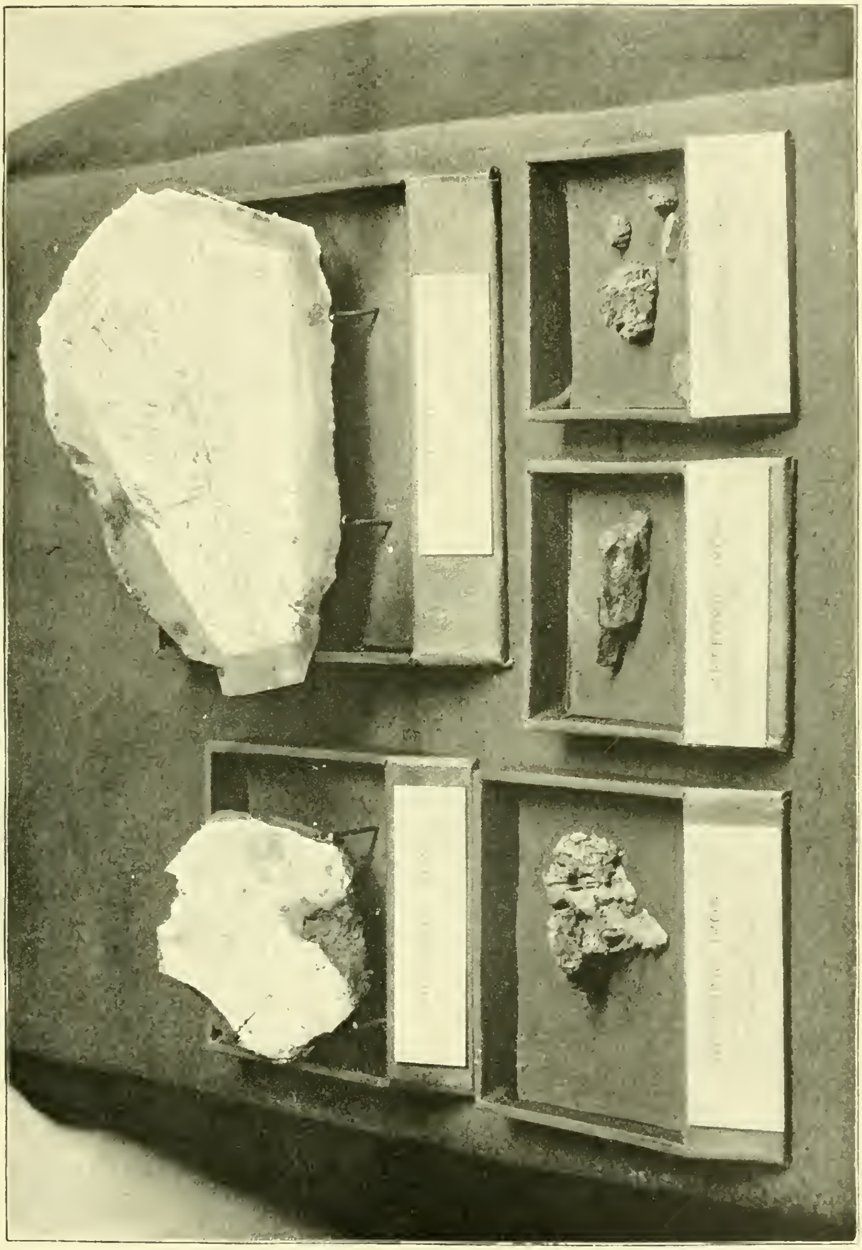
A form of exhibition tray which has been in use for a number of years is provided with a bevel front of peculiar construction, as shown in the accompanying plate (Pl. 12). These trays are covered with black binder's-board, and a piece of colored paper or fabric is placed on the bottom. This form of tray may replace the very objectionable

* This notice was printed in "Science," November 25, 1892.

ARRANGEMENT OF GEOLOGICAL SPECIMENS ON SLOPING SHELVES.



CASE OF STALACTITES, INSTALLED WITH MIRROR AT BACK.



BLACK PASTEBOARD TRAYS WITH LABEL-BEVELS.

and unsightly pasteboard tray, usually white, which is so often seen in collections of shells, minerals, and fossils. It is particularly well suited for coins and other single objects which it is desired to dignify by placing on a special mount with a pleasing back-ground.

The tray of sheet iron used in the Dresden Museum is much stronger than the pasteboard tray customarily used in other museums, and for large study collections is undoubtedly preferable, although less desirable for exhibition purposes.

For very precious objects, such as small bronzes, ivory carvings, and small examples of metal-work, which lie flat upon the shelves, or at the bottom of table case, our curators occasionally use cushions of maroon or dark blue plush, bound with silk cord; this, however, is a refinement in installation which is not recommended for use except in very special cases, as when it is desired to install a loan or gift collection very elaborately, or when the objects exhibited are of the greatest intrinsic worth. Such cushions may be used to excellent advantage on glass shelves.

EXHIBITION JARS.

The necessity for rectangular jars for the exhibition of alcoholic preparations has long been felt, and for many years our people have been in conference with the glass-blowers concerning them; but the difficulties in the way of securing satisfactory results seem almost insuperable.

The most desirable form of rectangular jar—one with a wide aperture of the "salt mouth" pattern—seems to be unobtainable. This is to be regretted, since a jar which can be closed with a circular ground-glass stopper is the most convenient for museum purposes. The plan of a round opening closed by a stopper was proposed, and experiments were made for improving the ordinary type of anatomical receptacle, long in use in this country as well as in Europe, in which the large opening at the top is closed by a flat plate. Such receptacles as this have been used for a number of years in the Museum of Comparative Zoology and in the Army Medical Museum, and they have also long been in use in Europe, both for round and rectangular vessels.

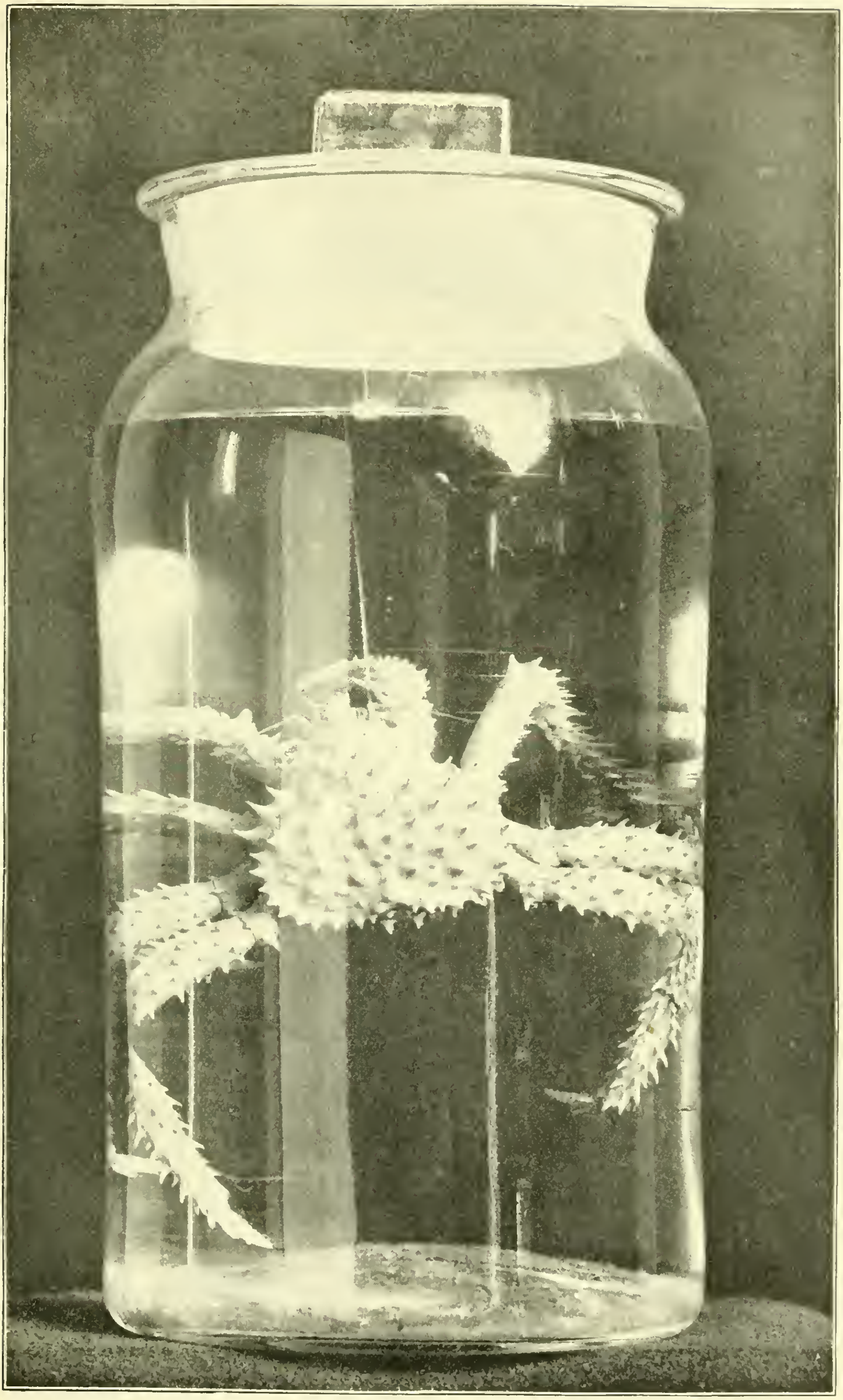
A modification of this device, by Mr. James E. Benedict, is described as follows:

The lip is ground to a perfect plane, and the opening, closed by a sheet of glass annointed with vaseline, is held in place by a cover which just completes the rectangular shape of the jar, its edges filling the shoulder, which is blown on the outer margin of the top of the jar, as shown in the accompanying diagram (Fig. 7). This cap is sufficiently heavy to hold the cover plate in place, and it takes the place of the unsightly mechanical clamps of the jar customarily used in museums for anatomical preparations. The arrangement is thoroughly satisfactory for exhibition purposes, and the cover being made of common window glass, which is somewhat irregular in its surfaces, enough small openings occur around the edges for the escape of gases, so that the somewhat unsightly vent-hole, usually made in hermetically sealed jars to allow the escape of gas and the introduction of alcohol without removing the luting, is dispensed with.

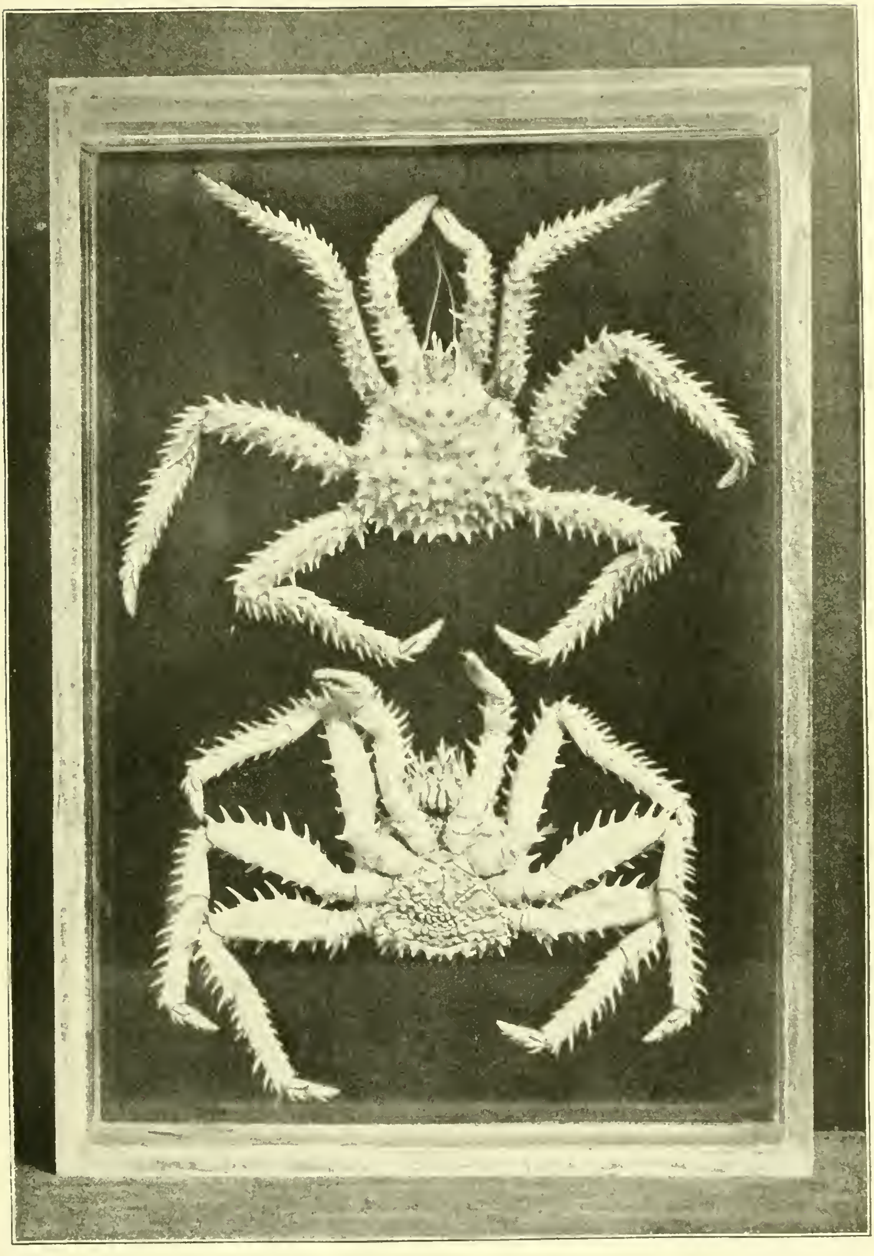
The most serious difficulty, however, has not been in regard to the cover, but rather in securing at the front of the jar a face sufficiently smooth and well polished to display the specimens clearly and without distortion. Some of the samples made for us by the glass manufacturers had this surface polished on the buffing wheel; but the grinding was not sufficient to remove the inequalities in the glass, and the corners, furthermore, are not rectangular, but rounded to such a degree as to cause some distortion of the specimens. Besides this, these are irregular and unsightly, and even to secure this imperfect result the glass is so thick that its transparency is somewhat impaired. This method of polishing the front surface of the receptacle has been used also in Europe. It is an alleviation but not a remedy for the evil, and, furthermore, is exceedingly expensive and beyond the reach of a museum which has to provide for a large number of wet preparations. Jars of this type, made in Edinburgh, are used in the Army Medical Museum in Washington. The cost of these jars, 9 by 12 inches, at the factory was about $105 a dozen. A firm in this country tried to produce jars somewhat similar, but was unable to make them at this price.

Every important factory in the United States which would undertake work of this class has been consulted, and Mr. Benedict was sent on a special mission to visit them and study in person the possibilities. He soon became satisfied that in the present state of the glass-blowing industry nothing more can be done with blown jars, and began investigations in another direction.

Experiments have been made by Mr. Benedict with a view to the possibility of building receptacles out of plate glass. Something of this kind had already been tried in Germany, with receptacles in metal frames, and constructed on the principle of an aquarium tank. The plan adopted here has been to dispense with entirely metal, and to use silicate cements which are insoluble in preservative fluids, and which unite so closely with the glass as to become, practically, a part of it. The recipes for these cements used are, unfortunately, the property of private individuals. In the process of manufacture the receptacles are exposed to a heat of 350° F. for several hours. It is impossible at the time of writing to say with certainty that these experiments have been successful, although one large jar has been filled with alcohol and specimens for eleven months and twelve others for six months. In jars of this particular form the top is made of two pieces of plate glass, the lower one being smaller, and so attached to the other as to form a shoulder all around; and the cover thus formed is luted to the opening



CYLINDRICAL JAR FOR PREPARATIONS IN SPIRITS, SHOWING DISTORTION DUE TO FORM OF JAR.



SQUARE JAR FOR WET PREPARATIONS, SHOWING ABSENCE OF DISTORTION.

with vaseline. The junction thus formed is so perfect that it is necessary to have a vent-hole in the top, though much smaller than is customary, it being only one-sixteenth of an inch in diameter. Jars made in this way, of the size already alluded to as costing more than $100 a dozen, can certainly be had for a little more than half the price and, if they prove permanent, will be in every respect better.

Photographs have been made from jars filled with alcohol and specimens, and the peculiarities of the two systems are shown without distortion or exaggeration in the accompanying plates (Pls. 13 and 14).

A small built-up jar, made in Germany, has been in use in the Army Medical Museum and elsewhere as an accessory to the microscope. These jars will hold all liquids and acids used in microscopic work, and careful examination shows that the cement used is subjected to a vitrifying heat. The use of hot water in the jars breaks them in the corners, which make natural lines of cleavage. Just how large a jar can be made in this way we have no information, but some of the experiments tried by us demonstrate that they are not as reliable as those made with cemented corners.

A convenient way of mounting specimens for the rectangular jars is shown in fig. 8. The fish or other object to be mounted is fastened to a pane of common window glass by means of threads passed through the object, ordinarily by the use of a surgeon's needle. These are drawn through holes bored in the glass at the proper places, and fastened by breaking off a soft wooden peg in the hole, biting and fastening the thread in place. The holes are readily bored by aid of a solution of turpentine and camphor used as a lubricant, and a small file as a drill, held in a small drilling machine. Any jeweler's supply store can furnish the requisite material.

THE PREPARATION OF LABELS.

The preparation of labels is one of the most difficult tasks of the museum man. The selection of the descriptive matter to be printed requires the best of judgment and the widest and most accurate information; while to determine the form and size of the different labels in a series, and to secure the best typographic effect, is equally difficult, and requires abilities of quite a different order.

A label may contain a vast amount of exact and valuable information, and yet, by reason of faulty literary and typographic arrangement, have as little significance and value as a piece of blank paper.

Before a specialist is prepared to label a collection he must be a complete master of the subject which the collection is intended to illustrate. After he has written the series of labels, if the collection is complete, he will have the material under control which would enable him to write a very complete book of reference upon the subject.

No task is more exacting than label writing. Not only is it impossible to conceal any lack of precise knowledge, but the information must be conveyed in a terse, concise, and definite phraseology, such as is not demanded in any other class of writing, unless it may be the preparation of definitions for a dictionary. He who writes definitions for a dictionary, however, has usually the advantage of having before him numerous other definitions of the same term, which he needs only to collate and rearrange. A good descriptive label, furthermore, should do something more than impart information. It should be so phrased as to excite the interest of the person who is examining the specimen to which it is attached; to call his attention to the points which it is most important that he should observe; to give him the information which he most needs while looking at the specimen, and to refer him to the books by means of which he can, if so disposed, learn all that is known upon the subject illustrated.

The labels describing the specimens in a collection are intended to take the place of the curator of the collection when it is impossible for him to personally exhibit the objects and explain their meaning. When collections were small and visitors were few, the curator or owner of a cabinet was accustomed, in person, to conduct visitors among the cases, to take the specimens in his hand, to tell their names and where they came from, to indicate features of special interest, and to answer questions.

This was in some respects an ideal way, when the curator was a man of wide knowledge and so much of an enthusiast that he took pleasure in talking without limit. The method was not without defects, however, since the lecturer (for such he was, in fact) selected for exhibition a limited number of objects which interested him, or which he supposed might interest the visitors, and gave the latter no chance for selection. Furthermore, the arrangement could not be such as to convey a sequence of ideas, such as a selected and well-labeled series of specimens can do, and the spoken descriptions, being as a rule full of unfamiliar words, were not remembered. The printed label of to-day may be read over again and again, and is often copied into the visitor's notebook. Again, under the old system, examining a collection was looked upon rather in the light of amusement than of study, and what might have been possible in the way of instruction was rarely attempted.

In these days, when the curator attempts verbal instruction, it is by means of a lecture delivered in the Museum lecture hall, or, if a floor-lecture, among the cases, surrounded by scores or hundreds of auditors, who may either take notes or find the substance of the lecture in some syllabus or printed text-book.

While one visitor might listen to the Museum lectures, tens of thousands pass through the halls without a guide. They must depend entirely upon the labels for information; for guidebooks, if such have been printed, are rarely bought, still more rarely used in the presence of the specimens, and, though often taken home with the intention of studying them, are only in the rarest instances ever opened after their purchaser has left the Museum.

The function of the label, then, is a most important one, since it is practically only through the aid of the labels that visitors derive any benefit whatever from a visit to a museum.

What has already been said indicates in a general way the office of the descriptive label, and may be expressed more concisely as follows:

The label must—

(1) Tell the name of the object: its exact and technical name always, and if there be one, its common name.

(2) It must call attention to the features which it is important for the visitor to notice.

(3) It must explain its meaning and its relations to the other objects in the series. If it accompanies a natural history specimen, it should explain its geographical distribution, which, if possible, should be plotted on a small map, forming part of the label, and mentioning peculiarities of structure or habit.*

If an ethnological object, then its uses and construction should be explained, its materials named if they are not obvious, and supplementary information given by means of pictures; and, where pictures are better than words, these may be substituted.

(4) The exact locality, date of collection, and source of the specimen exibited should be mentioned.

(5) For the convenience of visitors it is well, in many cases, to give the dimensions or weight of the specimen.

The art of label writing is in its infancy, and there are doubtless possibilities of educational results through the agency of labels and specimens which are not as yet at all understood. It is clear, however, that the advice of the negro cook in regard to making soup applies equally well to a good label; to wit, that much more depends on what you leave out than on what you put in. The value of this method of instruction is perhaps better understood by the most advanced writers of school text-books and dictionaries than even by the average museum worker.

In Dr. Edward Eggleston's new "School History of the United States," engravings are plentifully interspersed through the text, as well as in the margins,—portraits, pictures of historical localities, buildings, costumes, and archaeological objects:—and each of these has a label of the museum type, surrounded by rules, and separated from the text with which it has usually only incidental relationship. The originals which are thus illustrated, if brought together would make an admirable

* We have used in the National Museum, in years gone by, labels of different colors to indicate geographical sources, and have also used for the same purpose labels with printed borders of different colors. This, however, has long since been abandoned as cumbersome and impracticable. In most cases a word upon the label is sufficient to convey this idea. But when it is desired to convey fuller information, a map has great possibilities, for even the exact range of each species may be shown in this way without materially increasing the size of the labels.

museum of American history, and the book itself could hardly be improved upon as a handbook to such a collection.

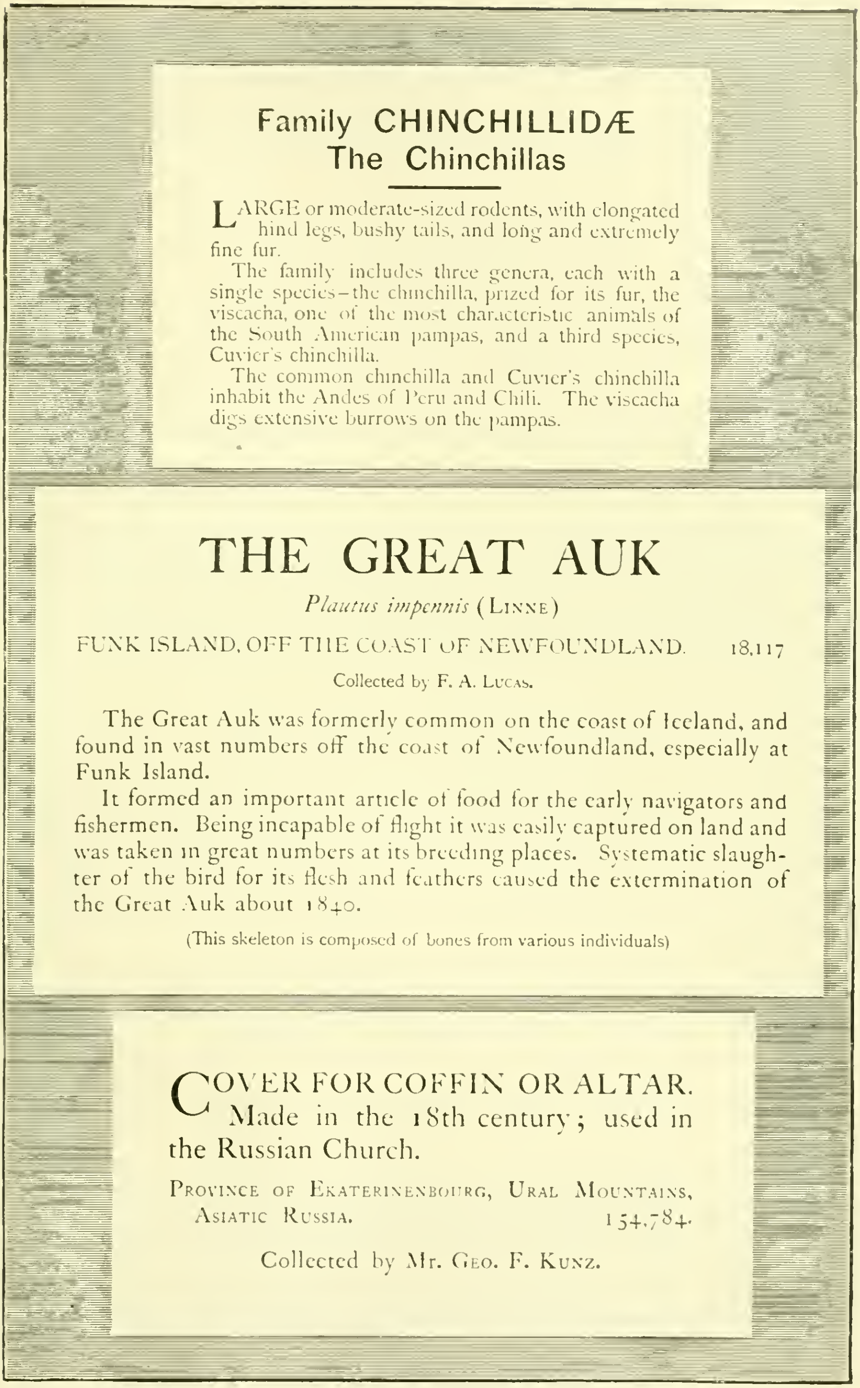
The modern illustrated dictionary owes much of its success to the adoption of museum methods, due, perhaps, to the fact that so many men, trained in museum work, have been engaged upon the preparation of the latest American publications of this kind, the Century Dictionary and the more recently published Standard Dictionary. These works impart instruction by methods very similar to those in use in museums, except that they are placed much at a disadvantage by reason of their alphabetical arrangement.

There is, of course, one respect in which the museum exhibition-case has the advantage over the lecturer, who can only present one subject at a time, or over the writer of books, who is prevented by the size of his pages from bringing a large number of ideas into view at once. This difficulty has been in part overcome by the editor of the Standard Dictionary, in the large plates, where are shown, in one case all the principal varieties of precious stones; in another plate, all the races of the domesticated dog, and in another, the badges of orders of chivalry. Even this, however, is far from reaching the possibility possessed by the Museum (with its broad expanses of exhibition cases) of showing a large number of objects so arranged as to exhibit their mutual relationship, and so labeled as to explain the method of their arrangement.

As has already been said, the size and typography of the label are of the greatest importance. The best written label may be ruined by the printer. Not only must the letters be large enough to be legible from the customary point of view, but the type must be pleasing in form, and so arranged as to lead the eye of the reader with pleasure from one line to another, and so broken into paragraphs as to separate from each other the topics discussed.

Furthermore, a system of subordinate sizes of type is essential, so that the most important facts will first meet the eye. In many of the labels shown in the accompanying illustrations type of four or five different sizes is used, the largest giving the name of the object, the next size the name of locality and donor, the next its distribution, and so on, much in the order of importance of the topics already proposed, while the least essential illustrative matter at the bottom of the label is placed in the smallest type. The theory is that the largest type should give the information desired by the greatest number of visitors—by every one; the next size, that needed by those who are studying the collection in a more leisurely way, and so on.

Too much can not be said of the necessity of breaking the descriptive matter into short paragraphs, which should never be more than half a square in length. Where a label of great width is printed, it is our experience that it is better to arrange the matter in two columns, as is shown in one of the accompanying plates, rather than to weary the eye by requiring it to follow back and fro across the card.



Family CHINCHILLIDÆ
The Chinchillas

LARGE or moderate-sized rodents, with elongated hind legs, bushy tails, and long and extremely fine fur.

The family includes three genera, each with a single species—the chinchilla, prized for its fur, the viscacha, one of the most characteristic animals of the South American pampas, and a third species, Cuvier's chinchilla.

The common chinchilla and Cuvier's chinchilla inhabit the Andes of Peru and Chili. The viscacha digs extensive burrows on the pampas.

THE GREAT AUK

Plautus impennis (LINNE)

FUNK ISLAND, OFF THE COAST OF NEWFOUNDLAND. 18,117

Collected by F. A. LUCAS.

The Great Auk was formerly common on the coast of Iceland, and found in vast numbers off the coast of Newfoundland, especially at Funk Island.

It formed an important article of food for the early navigators and fishermen. Being incapable of flight it was easily captured on land and was taken in great numbers at its breeding places. Systematic slaughter of the bird for its flesh and feathers caused the extermination of the Great Auk about 1840.

(This skeleton is composed of bones from various individuals)

COVER FOR COFFIN OR ALTAR. Made in the 18th century; used in the Russian Church.

PROVINCE OF EKATERINENBOURG, URAL MOUNTAINS, ASIATIC RUSSIA. 154,784.

Collected by MR. GEO. F. KUNZ.

SPECIMEN FORMS OF LABELS.

FOX TRAP (MODEL).---Wood, with cord of vegetable fiber or sinew.

Length, 11 ins. Breadth, 4 ins. Height, 5½ ins.

BRISTOL BAY, ALASKA, 1882. 55,879.

Collected by CHAS. L. MCKAY.

Used by Tinneh Indians. Consists of a stake-pen closed at one end by a net, in which the fox, becoming entangled and caught, is killed by the hunter who watches from "blind."

TOBACCO POUCH.---Made of small, various colored glass beads closely woven in a regular geometric pattern, fringe of similar beads strung on variegated worsteds. Suspended from neck by a cord.

Length, including fringe, 5½ ins. Width, 5 ins.

KHUILCHAN INDIANS, ALASKA, 1881. 72,841.

Gift of IVAN PETROFF.

This pouch came from the Khuilchan (*Athabaskan*) tribe of the interior of Alaska; this tribe has no connection with the sea save through the Atwah, or Copper River, natives, from one of whom it was procured in 1881, at Huchek, Prince William Sound.

SPECIMEN FORMS OF LABELS.

GROUP OF

ORANG UTANS OR MIAS.

SIMIA SATYRUS, LINNÉ.

DISTRIBUTION: BORNEO AND EASTERN SUMATRA

This group represents a scene among the trees of a Bornean forest, at a height of about thirty feet from the ground.

The group consists of the following individuals:

Two adult male Orangs (13,962-63), represented as fighting in their characteristic manner.

An adult female (13,965) escaping from her nest, with a nursing babe (13,921) about eight months old, clinging to her body in the position usually adopted when the mother is traveling.

A young male of two years (13,964), represented as aroused from sleep and looking down from his nest.

These specimens were obtained on the Sadong River, Sarawak Territory, Borneo, in September and October, 1878, by the naturalists of an expedition sent to the East Indies by Professor Henry A. Ward.

MOUNTED BY WILLIAM T. HORNADAY.

SUN BEAR.

HELARCTOS EURYSPILOS, HORSF.

Malay Peninsula, Java, Borneo, Sumatra

14.332.

Gift of BARNUM, BAILEY AND HUTCHINSON.

SPECIMEN FORMS OF LABELS.

CORNELIUS VANDERBILT.

Copies in bronze of the gold medal awarded by act of Congress January 28, 1864, to Cornelius Vanderbilt "for his unique manifestation of a fervid and large-souled patriotism in presenting as a free gift to the Government" his new steamship "Vanderbilt."

Received from BUREAU OF THE MINT, 1884. 75,302

POET, SCOTCH.

WILLIAM DRUMMOND, OF HAWTHORNDEN.

Born at "Hawthornden," near Edinburgh, Dec. 13, 1585; d. Dec. 14, 1649, and buried at Lasswade, two miles from his birth-place.

Descended from an ancient Scotch family of noble blood. Educated at the University of Edinburgh (M. A., 1605), and in Law at Paris and Bruges; a man of wealth and a Royalist, resident at Hawthornden, except from 1625–30, when travelling on the Continent.

A Scotch poet of the Spenserian school,—author, among other works, of *Teares on the Death of Mœliades*, 1613; *Poems*, 1616; *Faith Feasting*, 1617; *Flowers of Sion* and *The Cypresse Grove*, 1623; and some forgotten historical and political writings.

"DRUMMOND was essentially a follower of Spenser, delighting in the description of outer nature, but, amid all his sensuousness, and even in those lines most conspicuously laden with lustrous beauty, there is a dash of melancholy thoughtfulness—a tendency deepened by the death of his first love. He was so successful as a writer of sonnets that he was called 'the Scottish Petrarch,' and his sonnets are still ranked immediately after Shakespeare's, Milton's and Wordsworth's. His poems are distinguished by pensive beauty, sweetness of versification and nicely-worded descriptions, but lack vigour and originality. *The Cypresse Grove*, one of the noblest prose poems in literature, exhibits great wealth of illustration, much fine thinking and an extraordinary command of musical English."

THOMAS GILRAY.

See *Drummond of Hawthornden*, by David Masson, 1873.

Feast of Tabernacles (Photograph).—Showing the offering of grace before the meal (known as *Kiddush*, or sanctification) in a tent. The feast of tabernacles takes place on the 15th of Tishri (September-October), and continues according to Leviticus xxiii, 39–43, seven days; most of the modern Jews observe eight days. The important feature of the celebration was the command to dwell in booths, a practice still kept up. In ancient times this feast which was coincident with the harvest time, was the most important of the three pilgrimage festivals. 154,472.

Photographed from the original drawing by permission of the CENTURY CO., New York.

SPECIMEN FORMS OF LABELS.

KORAN STAND Inlaid with mother-of-pearl. Inscribed with the usual Mohammedan invocation before any religious act: "In the Name of God," and the date A. H. 1210.

CONSTANTINOPLE, TURKEY. 154,757.

The Koran, the sacred book of Islam, is treated by the Mohammedans with great external veneration and reverence. They generally take care never to hold it, and they deposit it upon a high and clean place, and never put another book, or anything else on top of it. When read it is placed on a stand. The reading of the Koran should commence with legal ablution and prayer. The usual prayer is: "I seek protection with God against Satan the accursed," followed by the invocation: "In the name of God the Merciful, the Compassionate." In the services of the mosque it is chanted by the *imam*, or the leader in prayer.

VOTIVE RELIEF DEDICATED TO CYBELE

(Cast)

FOUND IN ATTICA, GREECE.

Representing the goddess seated on a throne holding in one hand a bowl, in the other the flattened drum or cymbal, with a lion at her feet. Before her stands a woman holding a bundle of twigs, and part of another figure holding an amphora.

ORIGINAL OF MARBLE IN THE ROYAL MUSEUM OF BERLIN. 154,656.

Cybele or Rhea was called the "Great Mother of the Gods." The original home of her worship was in Phrygia, (Asia Minor), in the district afterwards known as Galatia. Her priests were called Corybantes, and her festivals were celebrated with wild dances, and orgiastic excesses amid the resounding music of drums and cymbals. From Asia her worship came to Greece, and at Athens she had a temple called the Metroun, the temple of the great mother.

In Rome her worship was introduced during the second Punic war in 204 B. C. A yearly festival was instituted in her honor (April 2-4) called the *Megalesia*, and under the empire another in March which was celebrated with the observance of mourning followed by the most extravagant joy In the second century A D. the festivals *Taurobolia* and *Criobolia* were added.

Among the ceremonies observed in these festivals was a kind of baptism with the blood of bulls and rams killed in sacrifice, with the object of cleansing and bringing about a new birth The oak and the pine, as also the lion were sacred to her She was supposed to traverse the mountains riding on a lion, or in a chariot drawn by lions. She is usually represented enthroned between lions, with a diadem on her head, and a small drum or cymbal, the instrument used in her rites, in her hand.

SPECIMEN FORMS OF LABELS.

FIRE-DRILL.—Used to make sacred fire. Lower piece of agave stalk, a soft, pithy wood, with harder longitudinal fibers, rendering it a good medium for the purpose of making fire. Spindle, a smaller piece of the same material.

Length of lower piece, 19½ inches; length of spindle, 18 inches.

ZUNI INDIANS (Zunian Stock), New Mexico. 127,708.

Collected by JAMES STEVENSON.

With this set sand was used by the Zuni in the fire-cavity to increase the friction. The fire is preserved in a piece of decayed wood. It is the custom of the priests to moisten the sticks before beginning to drill out fire. This renders the success much more difficult and therefore more meritorious in the sight of their gods.

PRINTING BLOCK (Ban-jul-pan).—Wooden block; ends wedge-shaped for fitting into a holder. Engraved.

Length, 17¾ inches: width, 8 inches.

SEOUL, KOREA, 1885. 77,018.

Collected by Ensign J. B BERNADOU, U. S Navy.

Blocks and movable type are both used in Korea. This is a common block for printing the alphabet sheet from which children learn the ŏn-moun, or native Korean character. The characters are arranged in vertical columns, and above each is a rough pictorial representation of something containing the initial consonant sound of the characters in the column. The writing on the left is astrological.

Satow says, "There are some Korean books dating back to 1317 and 1324, printed with movable type."

HOATZIN.

OPISTHOCOMUS CRISTATUS GMELIN.

BERBICE, DEMERARA. 18,518.

Gift of DEMERARA MUSEUM.

The most striking feature of the skeleton, and one peculiar to the Hoatzin, is the shape of the breast-bone. the keel being cut away in front where it is usually deepest.

The food of the Hoatzin consists mainly of leaves of the arum, and as large quantities of leaves are eaten, a large crop is required for their reception, and this crop completely fills the space below the sternum where the keel is lacking.

The lower end of the furcula (wish-bone) is united with the sternum, and its upper ends with the coracoids—the bones to which the wings are articulated.

The Hoatzin is the sole member of the order *Opisthocomi*, and is probably the representative of a once more numerous group of birds of generalized structure.

SPECIMEN FORMS OF LABELS.

SELENITE CRYSTALS.—From cave in what is locally known as the South Wash, in Wayne County, Utah. 60,881.

Received from J. E. TALMAGE, 1893.

The crystals occur in a cave which is inclosed by a thick shell forming a mound which stands in relief on a hillside as shown in the photograph. The crystals vary greatly in size and weight, some being over four feet long. Owing to the vandalism of visitors, it has been found necessary to remove the finest specimens to the Deseret Museum, at Salt Lake City, to prevent their complete destruction. (See Science, Feb. 17, 1893.)

CORRODED STALACTITE.—The specimen is partially dissolved by the corroding action of water from the roof. It illustrates one of the latest stages in the life history of a cave. The lime in the overlying roof has been so far removed that the water percolating though it is still acid and attacks the material of the stalactites as it drips over them.

ROBERTSON'S CAVE, Springfield, Missouri. 68,186.

Collected by GEORGE P. MERRILL, 1892.

VOLCANIC DUST.

VOLCANO OF KRAKATOA, Straits of Sunda. 36,974.

Gift of F. W. HOUGHTON, 1889.

This ash was showered for three days in September, and at the rate of one inch per hour, on board ship Beaconsfield while in latitude 0° 14′ S., longitude 92° E., and at a distance of 855 miles from the source of eruption.

ORTHORHOMBIC SYSTEM.

DISTINCTIVE CRYSTALS ON MATRIX.

A combination of the Basal Plane (001, O) and a Brachyprism (120, i-2̆) with a Brachydome (041, 4-ĭ) and two Pyramids (223, ⅔, and 111, 1), slightly modified by the Unit Prism (110, I)

TOPAZ

with Albite, Muscovite and Smoky Quartz.

ALABASCHKA, Ural Mountains, Siberia

LEIDY COLLECTION

SPECIMEN FORMS OF LABELS.

COLLECTIONS OF THE BUREAU OF ETHNOLOGY.

STORAGE BASKET (DJELO).—Warp of osiers; weft of the sides of split pine root, weft of the bottom of osiers, both in twined weaving. The weft strands are overlaid with bright straws to form the pattern. Margin strengthened on the inside by a hoop of hard wood.

Height, 3 feet; diameter, 28 inches.

HUPA INDIANS, CALIFORNIA, 1889. 111,433.

Collected by JEREMIAH CURTIN.

After these baskets are made they are filled with hot wet sand to give them a good form. They are set around the wall of the semi-subterranean houses of the Hupas upon a banquette of earth and filled with acorns for winter food. As many as twelve may be seen in one house.

FISHING CANOE (MODEL).—Wood, dug out; sloping sides, slightly flared at top; flat bottom; sharp ends; long overhanging bow. terminating in a point; straight stern.

Length, 22½ inches. Beam, 5¼ inches. Height, including figures, 6 inches

NEAH BAY, WASHINGTON TERRITORY, 1883. 72,907.

Collected by JAMES G. SWAN, Port Townsend, W. T.

Made by MAKAH INDIANS, of Cape Flattery. Perfect in all its appointments, with figures of two Indians seated face to face, the position always taken. Contains two paddles; two fishing-lines complete; two baskets for spare hooks and lines, two clubs for killing fish, five halibut hooks; one bailer, two halibut. None of the objects are made to a scale to compare with the canoe or with each other, the purpose of the Indians being simply to show the various articles without regard to relative size.

SPECIMEN FORMS OF LABELS.

HOMOLOGIES OF THE PRINCIPAL BONES

The series of which this specimen forms a part is intended to show the corresponding bones in the different classes of vertebrates. The spaced skeleton should be compared with the mounted skeleton.

SKULL OF SHARK, *Carcharias* sp., an example of the simplest type of cranium. It consists entirely of calcified cartilage, is immovably connected with the backbone, and does not completely inclose the brain. Neither cartilage bones nor membrane bones are developed.

26,164

THE DOMESTIC FOWL

THE ANATOMY OF THE DOMESTIC FOWL as shown on a large scale by the Turkey, *Meleagris gallopavo*, one of the largest of the Gallinaceous Birds.

Model, natural size, by AUZOUX, Paris.

MODEL

Showing structure of

PRECIOUS CORAL, *Corallium rubrum.*

GREATLY ENLARGED.

1. Axial skeleton.
2. Friable crust or Cænosarc, in which lie the tubes connecting the body cavities of the individual polyps.
3. Individual polyps.

SPECIMEN FORMS OF LABELS.

ECCLESIASTICAL HISTORY AND ART

COSTUME OF THE MISERICORDIA OF TUSCANY

THIS COSTUME consists of a simple hooded cassock of black, worn over ordinary citizen's dress, and a broad brimmed felt hat, used in outdoor service.

SIENA, 1892. 153,893.

Collected by G. BROWN GOODE.

The FRATERNITY OF THE MISERICORDIA (*Pia Arciconfraternita de Santa Maria della Misericordia*) is a great society, with branches in Siena, Florence, Pisa, and the other cities and towns of Tuscany, which has for its sole object the alleviation of suffering and the furtherance of all works of benevolence. Its most striking characteristic is that its active work is carried on by its members in person, and not by paid deputies. On its rolls are found the names of a large proportion of the adult males of the community, without regard to rank or wealth. A certain number of these are assigned to duty for each day in the year, and are expected to respond at once to any call from the officer of the day, and while on duty are under strict discipline.

The personal relationship of the wealthy and the powerful to the charitable work of the community is productive of much good. All distinctions of rank are ignored in the organization, and to this end a costume of the cheapest material is used, to disguise figure and face, and members while on duty neither speak nor are spoken to, except as a matter of necessity. The money needed for the work is obtained by the mute appeals of the members in public places and at the doors of churches, and from the fees of membership. Each local society has its chapel for funeral services, and all funerals with but few exceptions, are conducted by this organization, the coffin being borne by its members in their peculiar dress.

One of the oldest of these societies, that to which the costume exhibited belongs, is that of Siena. This was founded at the end of the fourteenth century by Bernardino Albizzeschi (San Bernardino) as a society to perform works of mercy and to aid prisoners. In 1564 a statute prescribed the manner in which their charitable offices might be exercised It was suppressed in the time of Leopold I, and resuscitated by royal permission in 1794 In 1829 it was reorganized upon the model of those in Pisa and Florence, and in 1862 by popular subscription an endowment of 155,000 lira ($31,000) was secured, which has since been increased by other donations. Its membership is very large, including in a city of fifty thousand inhabitants, about three thousand active members.

Its scope includes everything which comes within the term charity—the relief of those stricken by misfortune of any kind at any time or place. Owing to the precipitous character of many of the streets, horses are comparatively few in Siena, and sick people, as well as coffins, must be carried upon men's shoulders. Invalids are taken by them to the Royal Hospital, three miles from the city, and they have control of an extensive cemetery, in which nearly all interments are made. A group of members is organized under the name of visitors to the sick (*Consultatori Infermieri*). They render aid to the ill at home, supplying them with beds, underclothing, bandages, broths, easy chairs, trusses, and watchers or nurses at night. In summer the Society dispenses mineral water for use in baths, and when necessary, keeps open a room for vaccination and dispenses the vaccine matter throughout the city and the surrounding country In the case of an accident of any kind, a squad of members is upon the spot to render service, in other communities expected from the police and board of health.

The administration is in the hands of a brother called the *Provveditore*, who presides at the meetings of the board of management, the *Magistrato*, composed of twelve brothers called *Conservatori*, and also those of the council, composed of eighty councillors (*Consiglieri*). A full financial report is printed each year. The Society has its house, in which is not only a chapel, but a vast warehouse for the accessories of their work—litters and surgical appliances,—and a great room, surrounded by cupboards, in which the cassocks of the members are kept ready to be put on when they are hastily summoned to duty from their places of business.

The officers of the Society are an inspector (*Ispettore*), who controls the public and private services, a brother deputy (*Deputato*), in charge of the Convalescent's Home, a secretary (*Cancelliere-Segretario*), who supervises the business, archives and correspondence, a treasurer (*Camarlingo*), and a steward (*Massaio*), who has charge of all linen, furniture, and other property in the warehouse. There are fifty-two officers of the guard, who in turn, day by day throughout the year, supervise the public services, and sometimes as many as three hundred of the members are in active duty in a single day, under the charge of one of these officers. All officers serve gratuitously except the secretary, a physician, two priests, two servants and a letter-carrier.

SPECIMEN FORM OF LABEL.

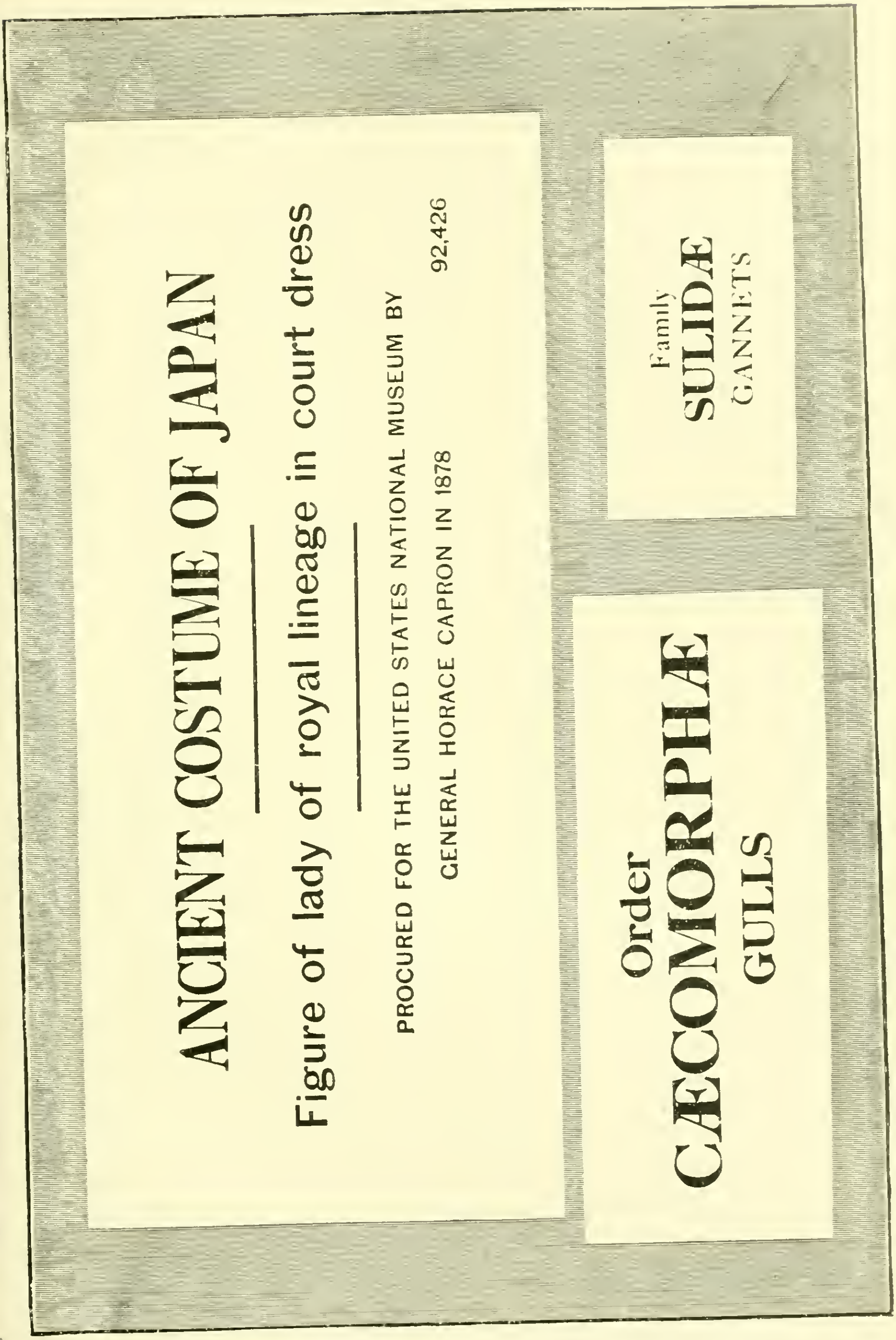
COSTUMES OF CHINA.

NINGPO BRIDE.--.-Crimson robe embroidered with the dragon.

Gift of CHINESE CENTENNIAL COMMISSION, 1876. 127,561.

When the Imperial family of the Sung Dynasty were fleeing before the Kin Tartars, who carried away the Chinese Emperor Hwaitsung (A. D. 1125) and established a Tartar Dynasty at the mouth of the river Laugtz, the heir apparent, then quite a lad, was for a year or so kept concealed in a private family about a mile and a half from the city of Ningpo. The house is still known as the house of the "yellow gateway." Here he formed an attachment to a daughter of the family, of the same age as himself. The troubles of the times drove him from this asylum but some years afterwards, peace having been made between the Tartar and Chinese Dynasties and the lad having succeeded to the Imperial seat, he sought to find his youthful love, but she and her family had disappeared and he was never able to find any trace of them. In honor of the memory of his lost love the Emperor ennobled her country women in the department of Ningpo, by authorizing them to wear at their marriage a red robe embroidered with the Imperial dragon. The bride is carried to the house of her husband in a gorgeous sedan chair, with four bearers, preceded, when the family can afford it, by musicians, and men bearing the insignia of office which have belonged to any of her ancestors, and followed by two female servants and by porters carrying hand-barrows with bedding, furniture and other articles. The highest official, when meeting such a bridal procession, will yield the way

SPECIMEN FORM OF LABEL.



SPECIMEN FORMS OF LABELS.

Labels, as a rule, seem to be most satisfactory when nearly square, or with the height less than the width.

The relationship of the objects in a series to each other may usually be indicated by the size of the labels, which should be uniform for objects of the same general character in the same case. When a deviation from this rule is necessary, if the size of the type remains the same, more space may be obtained either by slight widening or slight lengthening; but in the same series we must always lengthen or always widen. Classification labels, which are placed, unattached, among the specimens, increase in size with the importance of their grade in the plan of classification, as is shown in the family labels illustrated.

There are limits to the possibilities of making labels speak by their size. An object on the top of a case, or on a pedestal, or in a case by itself, is always regarded as "out of classification," and its label arranged solely with reference to its appearance or utility in the place where it is to stand. It is also necessary to vary the size somewhat in the same series, when, as in a long case of mammals, a small species and a large one are placed side by side. Here, for æsthetic reasons, the rule of uniformity is usually set aside.

Much attention has been given to the selection of type and color for labels, it having been found that labels printed on white cardboard become dirty or turn yellow, besides being dazzling and hard to read. Many tints of cardboard which would otherwise be available may not be used, because of their tendency to fade—objectionable in itself, and doubly objectionable when it becomes necessary to put a fresh, bright label by the side of one which has become faded in use. Almost every sample of colored board which has been tried in the National Museum has faded after a time. The most satisfactory has been one of greenish gray. This is temporarily in use in the geological and mineralogical collections, where a light gray color for the interior of the cases and shelves seems preferable, and also in the collection of birds, which is installed by preference in a somewhat dark apartment.

The standard label-board, however, is a rough-faced manila. The color, being that natural to the fiber, is quite unchangeable. There is no fading, little tendency to become dirty, and its soft, rich, brownish-yellow tone sets off admirably the heavy black lines of the antique-faced type which is used, and harmonizes well with the buffs and maroons which are our favorite colors for case interiors. The material at first used was a somewhat soft though thick paper, made specially for genus-covers in the herbarium. This did not prove thoroughly satisfactory, since the labels, unless very small, had to be glued or tacked to some solid support to prevent their bending and winding, and even then the corners frequently rolled.

We now have a special cardboard of the material just mentioned, heavily pressed, very stiff, and durable, which, though its surface lacks somewhat the desirable softness, proves very satisfactory.*

*Samples of this board will be sent to any museum worker who may request it.

It may be added that cartridge paper, such as is ordinarily used for wall decoration, in any tint of gray or light brown, is an admirable material for labels, especially large ones. It must, however, be glued to a tablet. If this is made of dark wood with a bevel retreating from the edge of the label, forming a dark border, the effect is very pleasing. Labels thus prepared, and mounted upon metal rods, are used by us for general classification labels in the interior of cases.

It is the plan in the National Museum to have a large label, glazed and framed, at the top of each case, or in front of each panel. These are printed on black or maroon paper in gold or silver letters.*

The labels in gold on black are printed from large wooden type, and are used to indicate the general system of classification of the cases upon the floor. When it is desired to use outside labels, glazed and framed, which are not in this general-classification series, we print with heavy-faced type in black upon manila or cartridge paper, such as have been already referred to, since the black upon yellow is more legible with comparatively small type than the gold upon black.

The National Museum owes many most important lessons in the matter of labeling and the interior fitting of cases to the Art Museum at South Kensington. Their system was studied with the greatest care by the writer in 1880 and during a residence of seven months at South Kensington in 1883, and, as will be evident to anyone who knows their system, its influence has been very great upon that in use in Washington.

In the accompanying illustrations (Pls. 15–26) are shown a number of the forms of labels adopted in the National Museum. Others are being developed from day to day; but it is thought advisable to place these upon record as an indication of what has already been accepted as measurably good.

ADVANCES IN GENERAL INSTALLATION.

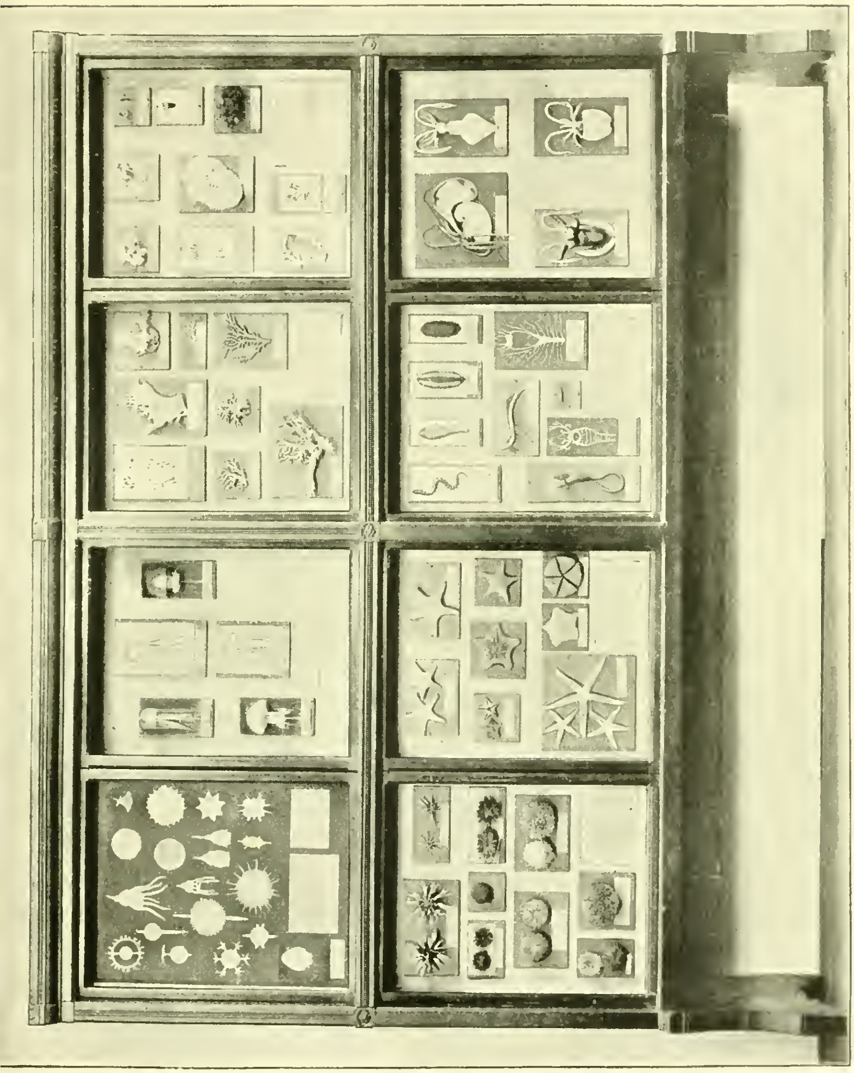
The map devised by Mr. Merrill to show the extent and location of the great ice sheet in North America during the glacial period is described further on in this report.

The synoptical collection of invertebrates prepared by Mr. Lucas also marks a positive advance in methods of mounting and labeling, to say nothing of the success attained in showing the structure of certain representative forms. This work will be described in the report for 1894, and a mere mention must now suffice.

The accompanying illustrations (Pls. 27, 28, 29), however, tell the story better than words can do.

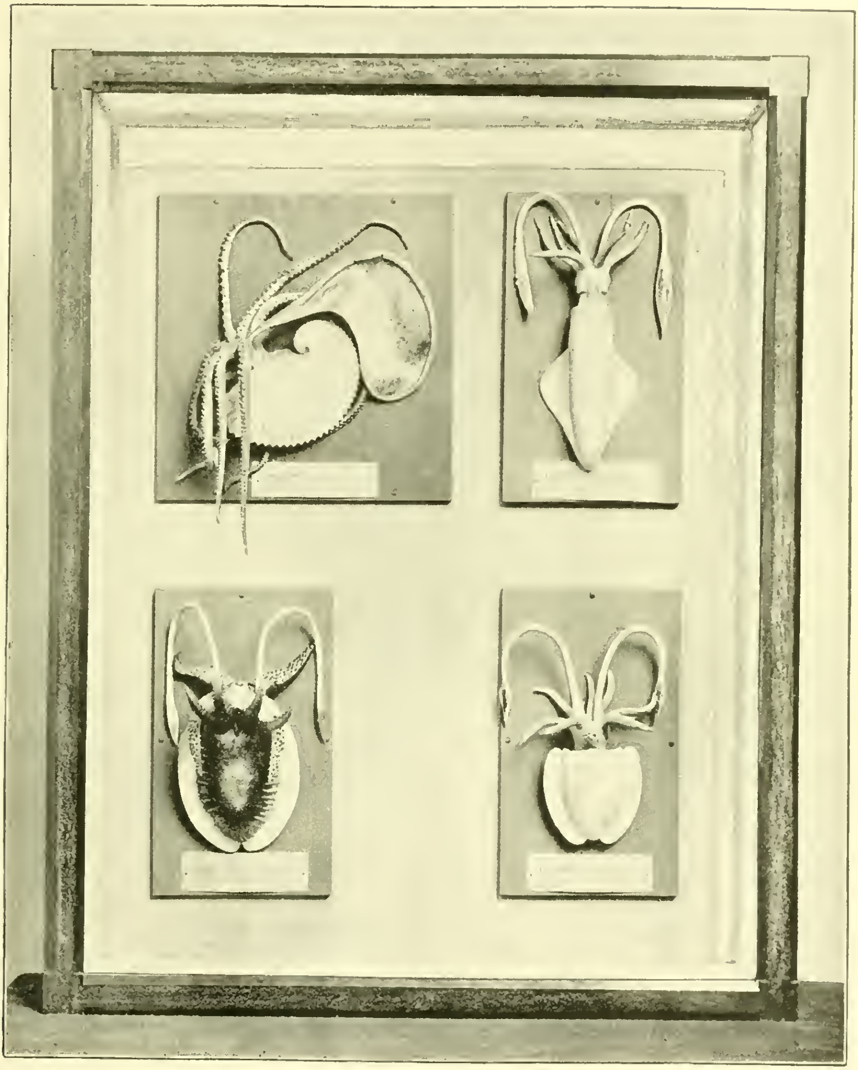
We have adopted two ideas already well carried out in the British Museum of Natural History, and original with its director, Sir William Flower, to whom we are indebted for other ideas equally good, soon to

* To produce silver letters, size is used instead of printer's ink, and nickel powder is applied before the size is dry. The nickel is unchangeable and very effective.



UNIT SLIDE SCREEN HAVING EIGHT GLASS-COVERED UNIT BOXES, CONTAINING SPECIMENS FROM THE SYNOPTIC SERIES OF INVERTEBRATES.

The boxes are 24 by 30 inches, outside measurement.



GLASS-COVERED UNIT BOX CONTAINING MODELS OF CEPHALOPODS.
Size of box, 24 by 30 inches, outside measurement.

GLASS-COVERED UNIT BOX, CONTAINING MODELS OF MARINE WORMS.
Size of box, 24 by 30 inches, outside measurement.

be materialized in Washington. One is the exhibit of skeletons of man and horse (Pl. 30), shown side by side, with the homologies of the bones indicated by a parallel system of labeling, the other the mounting of the races of domestic pigeons in one case upon a stand in the form of a dovecote, the specimens being so arranged as to show their relationship to each other and to the parent form, the rock dove. A similar project is being worked out for the domestic fowl, but is not yet in final shape.

Another advance is that effected by Mr. Lucas in showing, side by side, all the principal variations of the vertebrate skull, the homologies of the bones being indicated by a system of coloration modified from that already in use in the Natural History Museum in Milan, Italy.

A minor feature which seems to add materially to the comfort and convenience of many visitors is the reading table, a sketch of which is here given as a substitute for a detailed description (Fig 9). There are some thirty of these tables, one for each department, and about 500 books are thus placed at the service of visitors. The books on the tables are text books, bibliographies, dictionaries, and standard works of reference, and each table is devoted to the subject illustrated by the special collection in the midst of which it stands. In the rotunda is a bookcase containing cyclopedias, and visitors who desire fuller information are at liberty to go to the Museum library, and thence, if need be, to the sectional libraries in the curators' laboratories.

It is pleasant to be able to say that although over a thousand volumes are thus exposed without surveillance in the public halls, not a single volume has been stolen, though many of them have been "read to death."

TAXIDERMY IN THE MUSEUM.

Allusion has been made from time to time in the reports to the work of the Museum preparators in preparing objects for exhibition or study, and the time seems now to have come for a consideration of what has been accomplished and how this has been done.

As early as 1875, when, by means of the appropriations for the exhibit of the Museum at the Centennial Exhibition at Philadelphia, it became for the first time possible to employ competent taxidermists, an effort was made to secure the very best men available, and to have prepared better specimens than were at that time to be found in any American museum. Mr. Joseph Palmer and Mr. Julius Stoerzer, excellent workmen of the old school, were the chief agents in the preparation of the exhibit of mounted animals and casts shown in Philadelphia, and the results, though, so far as accessories are concerned, far below the present standards, were in many instances quite equal to what has since been done, as is indicated by the accompanying plate of the group of fur seals (Pl. 31). Their work was greatly admired, and the influence of the movement then just beginning soon spread to other institutions.

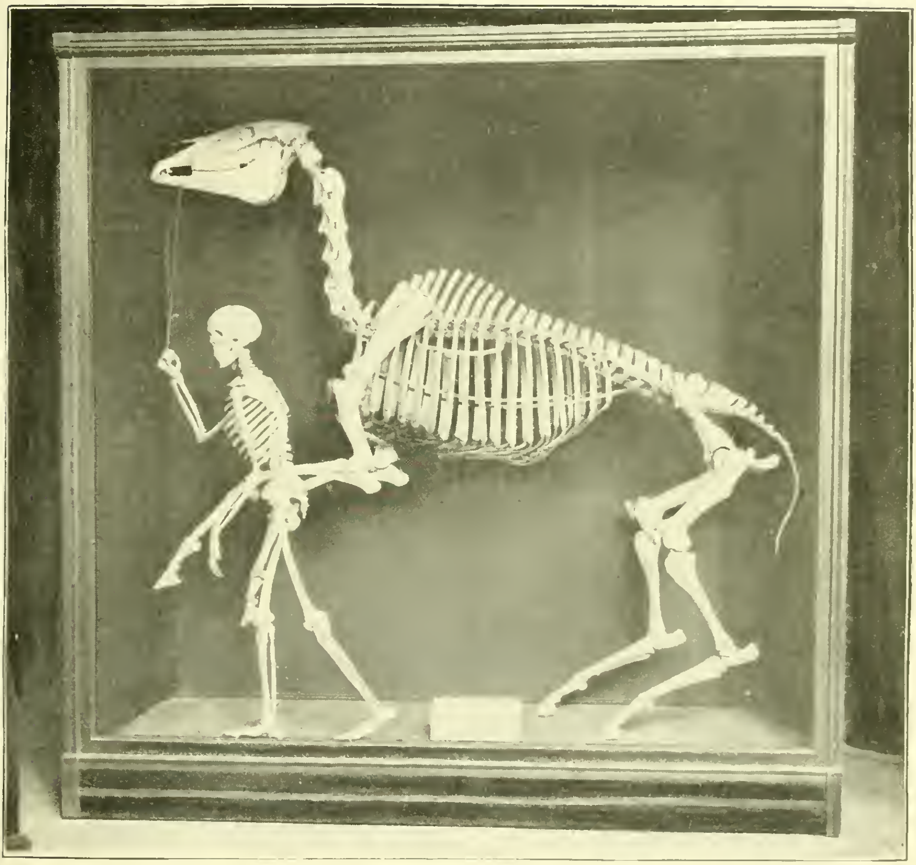
The ideals in the National Museum were as high then as at the present time, and Professor Baird, himself a very skillful taxidermist, was not only the best of critics, but enthusiastic in the extreme upon the whole subject. The time of preparation for the Philadelphia exhibition was so short and the appropriations so limited, however, that it was not possible at that time to accomplish the results desired.

In this same connection should be mentioned the very important influence of Prof. Henry A. Ward, who, in the conduct of his natural history establishment at Rochester, was always evidently actuated quite as much by a love for natural history and the ambition to supply good material to museums, as by the hope of profit, which was always by him subordinated to higher ideals in a manner not very usual in commercial establishments.

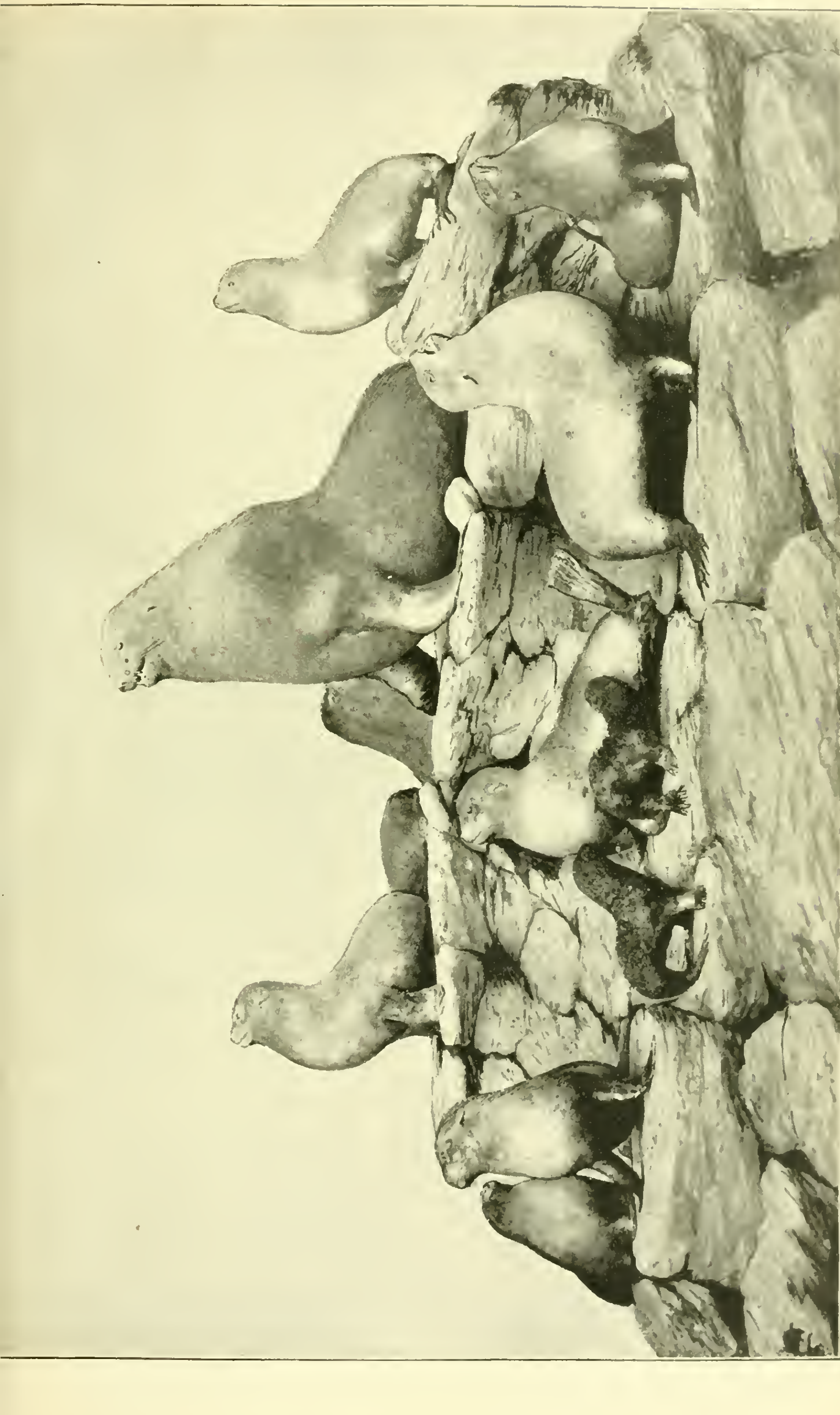
While the work from 1875 on was constantly advancing in Washington, and the antiquated and badly prepared specimens in the old collection were being replaced as fast as possible by others as good as could at that time be prepared, similar agencies were in activity in Rochester, and under the influence of Prof. Ward a number of enthusiastic young men were brought together and employed in the various branches of the work connected with the establishment. It was here that, through the stimulus of association and in connection with the immense work in preparing natural history specimens which was then in progress, mental forces of another kind came into being; and here, in 1879, and the years following, some very remarkable pieces of work were accomplished, which for originality and strength far surpassed anything hitherto attempted in America. Among these may be mentioned Hornaday's groups of orangs, one of which is now in the museum in New York, and another here in Washington. These, though lacking in the artistic repose which characterizes some of the later productions of himself and his pupils, were extremely spirited and had all the qualities of good workmanship and permanence which could be desired.

A series of animals of the Rocky Mountains, mounted by Mr. F. S. Webster to serve as models for the artist Bierstadt, and since destroyed by fire, should also be mentioned in this connection. Work of this kind demonstrated the triviality and false ideals of such ambitious figure groups as those of Verreaux, of which certain examples had reached this country and were up to that time greatly admired, and of the work of the European school of mammal taxidermists in general, well typified in the celebrated Wurtemburg collection and in many of the groups in the Liverpool Museum. It is not intended, however, to disparage the very excellent work of Verreaux upon single specimens*

* A lion which, since 1870, has been displayed in the American Museum in New York City, is perhaps the best in this country. The National Museum has a hyena mounted by him which, though not one of his greatest works, is full of spirit.



A GROUP OF SKELETONS INTRODUCTORY TO THE SERIES SHOWING THE HOMOLOGIES OF THE BONES.



GROUP OF FUR SEALS, CALLORHINUS URSINUS.

Mounted by Julius Stoerzer in 1875 and exhibited at the Philadelphia Exhibition.

mounted in attitudes of repose for case installation, nor is it intended to ignore the wonderful work done under Paolo Savi for the University of Pisa—work quite in the modern spirit, which the test of nearly a century has shown to have all the qualities of good workmanship.* But for the fact that these are buried in the midst of a poorly installed collection in an inaccessible gallery in a small Italian city, possibly the spirit of modern artistic taxidermy would not have remained so long latent. The museum at Turin has also had excellent taxidermists in its employ.

At Leyden also much good work was done, and the animals were mounted in varied positions. The birds at Leyden afforded a striking contrast to those in the Natural History Museum at Bremen. These were mounted in fixed conventional attitudes, and since the museum possessed an immense collection of birds, they were crowded together side by side, heads toward the wall and tails projecting over the edges of the shelves toward the spectator, so that they looked like horses in a stable, viewed from the rear. This museum, as I saw it in 1880, was an eloquent teacher of methods to be avoided. It is to be hoped that, before now, most of these skins have been unmounted and placed in drawers in a study series, and a reasonable exhibition series substituted.

Mr. John Hancock, of London, many years ago did excellent work, combining artistic feeling with scientific accuracy, and Mr. E. T. Booth somewhat later developed a marvelous collection of British birds in his "Dyke Road Museum" at Brighton. These were mounted in life-like attitudes in the midst of natural accessories, and were satisfactory alike to artists and to naturalists. Following in the same course the admirably mounted collection in the Town Museum at Leicester was developed by Mr. Montagu Brown, and that in the British Museum of Natural History under Dr. Günther, beginning as early as 1880. On this side of the Atlantic, as early as 1870, most excellent work of this kind was done by Mr. Andrew Downes in his private cabinet in Halifax, Nova Scotia.

The Society of American Taxidermists was organized March 24, 1880, by Messrs. Hornaday, Lucas, Webster, Critchley, Jules Bailly (a pupil of Verreaux), Martens, and Fraine, all of Rochester, and a number of other taxidermists scattered through the country joined in the movement. This society was the direct outgrowth of the aspirations of the enthusiastic founders of the new American school, and had for its object not only the improvement of taxidermy from the technical standpoint, but the elevation and ennobling of the profession of taxidermy and the establishment of loftier ideals for the work.

The intention was to hold annual exhibitions, to secure the award of

* A group of starlings around the skull of a sheep rivals the best bird group since made, and a boar attacked by hounds shows wonderful skill in mammal work.

prizes for the most meritorious advances, and to publish an annual volume of Proceedings, devoted to the discussion of the principles and methods of the art.

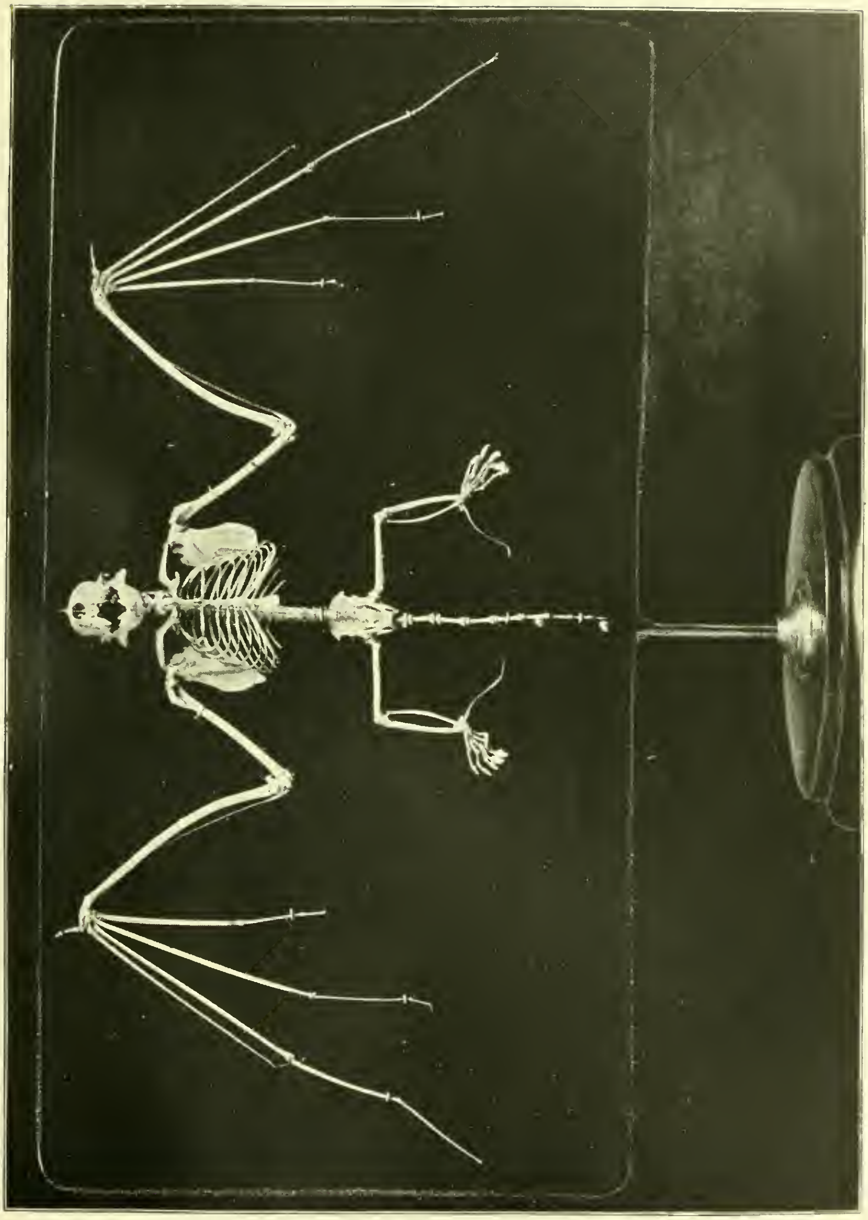
The ideals of the organization before very long developed to such a degree that they could not be worked out to the best advantage in a commercial establishment, and several members of the new school, having found that their objects were thoroughly appreciated and their efforts meeting with hearty support from the authorities of the U. S. National Museum, began to look to Washington as a wider and more promising field for their activities. In the National Museum, in the meantime, constant progress had been made, especially in the work of preparing casts and models in plaster. Some of the work prepared for the International Fisheries Exhibitions in Berlin in 1880 and London in 1883, would be regarded as admirable if done at the present time.

Soon after the reorganization of the National Museum in 1881 Mr. W. T. Hornaday was appointed chief taxidermist, and he was soon followed to Washington by Mr. F. A. Lucas, who, though an accomplished taxidermist, had given especial attention to the mounting of skeletons and anatomical preparations. Somewhat later came Mr. F. S. Webster, and others of the Rochester group would also have been added to the Museum staff but for our feeling of unwillingness to interfere with the important establishment at Rochester by taking away so many of its most competent men.

In the meantime the Society of American Taxidermists had been steadily at work. It held three annual exhibitions (in Rochester, in Boston, and in New York), and in 1884 another exhibition was held in connection with the Cotton Centennial Exposition at New Orleans and under the auspices of the National Museum. Three numbers of the reports were published. Since 1884, however, the society has been dormant. Perhaps its work had been accomplished. At all events, its influence was strongly felt, not only among taxidermists but through the larger and smaller museums of the country, and during the five years of its existence a decided change in public opinion had been effected.

The necessity for the development of a great mounted collection of mammals in the National Museum, and above all the execution of the plan for preparing monumental groups of the animals which are approaching extinction, mounted in natural attitudes and surrounded by proper accessories, has given a very wide field for work in higher taxidermy, and a number of young men from various parts of the country sought admission to the Museum workshops, where they received or completed their training. Among the most prominent of these may be mentioned the late Jenness Richardson, who was for three years in the Museum, and went in 1886 to become the chief taxidermist of the Museum of Natural History in New York City, where he accom-

SKELETON OF MEGAPODE,—TALEGALLUS LATHAMI, SHOWING METHODS OF MOUNTING.



SKELETON OF BAT,—MOLOSSUS RUFUS, SHOWING METHODS OF MOUNTING.

plished some very noteworthy pieces of work, especially in the mounting of birds.

Mr. L. L. Dyche, now professor in the University of Kansas, also passed several months here, and learned the methods which have resulted in his excellent work upon large mammals shown in the Kansas State building at the World's Fair of 1893.

Mr. William Palmer, now chief taxidermist of the Museum, also received his first training during these years, and began a career which has resulted in the production of such remarkable work as the groups of Caribou, prepared especially for Chicago, which, in the judgment of the writer, have not been surpassed anywhere, marking as they do the highest attainment in the imitation of nature, with that combination of life with perfect repose which is the supreme test of merit in taxidermy. Many other men have profited by work in our laboratories, and are now scattered through the country, either attached to museums or in private business as taxidermists.

The taxidermists previously attached to the Museum have produced work in its way equal to that of their associates. The casts of reptiles, fishes, and cetaceans made by Joseph Palmer are by universal admission unrivaled, and this perfection was reached under Prof. Baird's encouragement before the Society of Taxidermists began its work and as early as 1876.

The bird work of Henry Marshall, though for the most part limited to preparation of specimens for shelf installation, has not been surpassed. Mr. N. R. Wood, who came from Rochester in 1888, has produced noteworthy work in groups of birds, and is especially skillful in the mounting of the various breeds of domestic fowl, which he has done with such painstaking accuracy that they may well serve as fixed standards in the development of the races of poultry. His work in restoring hair to skins which have become bare, is worthy of the most painstaking Oriental.

In the mounting of skeletons and anatomical preparations the highest standard of excellence has been aimed at, and it is believed that there is no collection of mounted skeletons in the world which can show more perfect pieces of work or a higher average grade of excellence. Mr. Lucas, under whose direction this collection has grown up, and who with his own hands prepared many of the most remarkable specimens (Pls. 32 and 33), has become curator of the department of comparative anatomy, but has transmitted the technical merits of his methods to Mr. J. W. Scollick, whose work upon minute osteological preparations is little short of marvelous.

It might be said that these words of commendation would be in better taste coming from outside and written by one who has not been, in the matter of sympathy, so closely associated with the development of the ideals of the higher taxidermy and the furthering of their accomplishment. This was in my mind when, a year ago, I requested Dr. R. W.

Shufeldt, U. S. Army, who had recently published some articles on taxidermy in "The Great Divide," and who was also a judge of awards in the department of taxidermy at the Columbian Exposition, to prepare an article upon the modern museum taxidermy. It was the idea that Dr. Shufeldt, not being attached to any museum, would be able to examine critically and discuss the subject without prejudice, taking into consideration all that has been done elsewhere as well as in Washington, and this he endeavored to do. The predominance of illustrations taken from specimens in our Museum, as finally published, was not intentional, but was due to the difficulty of obtaining satisfactory photographs from other establishments. An effort was made to obtain illustrations from the New York Museum and from the British Museum.* The illustrations obtained from these sources by no means did justice to the specimens illustrated, and the efforts to secure photographs of the Savi groups in Pisa, and of the rhinoceros mounted for the Medici collection in Florence three hundred years ago, were unsuccessful.

Dr. Shufeldt's essay, which was published in the Museum report for 1892, has attracted much attention, especially abroad, and the American taxidermic work, the excellences of which are suggested rather than fully depicted in the illustrations, has received much praise from those who are not familiar with it, and, if one may predict, the paper will be useful in still further raising the standard of museum taxidermy.

A special illustrated supplement to Natural Science was published in England on the occasion of the meeting of the British Association for the Advancement of Science. This was entitled "Taxidermy as a Fine Art," and was devoted not so much to a review of the Shufeldt article as to critical comments upon the illustrations, of which a selection of nine were reproduced. In closing his remarks the editor says:

> In selecting the plates for this article we have paid but small attention to the many beautiful illustrations of birds. In respect to bird groups our home museums do not require much teaching, though even they have yet to learn that a bird can be mounted in the most natural manner on an ordinary museum perch or stand. It

* Dr. R. Bowdler Sharpe's paper on "Ornithology at South Kensington," in the "English Illustrated Magazine," December, 1887, pp. 166–175, gives an excellent idea of the British Museum groups, though the illustrations, not being photographic, do not afford the opportunity for judging the degree to which the accessories simulate natural effects.

> We frankly admit that in the matter of environmental groups of birds, Great Britain still surpasses the United States. So far as taxidermy is concerned, American workmen can hold their own, but the art of making and grouping accessories we have yet to acquire. The only successful accessory work done in this country is that by the Mogridges, who were trained at South Kensington, and who are represented extensively in the New York Museum and by one piece in Washington.
>
> Many of the groups of this kind, even when made by the Mogridges, err in making the accessories more prominent than the birds and filling the cases with artificial flowers and leaves to such a degree that the birds are entirely subordinate. An excellent illustration of effective and legitimate use of accessories is to be seen in the admirable group of king-rails in the New York Museum.

HEAD OF TIGER,—FELIS TIGRIS.

Mounted by W. T. Hornaday; illustrating modeling in clay under the skin. Ears with metallic substitutes for cartilages, and tongue skinned and built up within with clay.

BURCHELL'S ZEBRA, EQUUS BURCHELLI.

Mounted by W. T. Hornaday. Showing method of modeling of lips and eyes.

is in preparing the other classes of Vertebrata and the Invertebrata that American taxidermists take the lead, and it is their excellence in this direction that we have endeavored to set forth as an example.

But for the general approval of the American work, as shown in the comments upon this paper, I should perhaps not venture to express so frankly my own opinion as to what the American taxidermists have done, and, as it is, this is done chiefly for the purpose of explaining the causes which have led to its development.

The editor of Natural Science is quite right in questioning Dr. Shufeldt's statement* that the development of taxidermy in the United States is due to the stimulating influence of the World's Columbian Exposition. As a matter of fact, the taxidermy at the Columbian Exposition, with the exception of that in the Government building and that of Prof. Dyche in the Kansas building, was decidedly poor. Certain mammal heads mounted by Mr. Stainsky were of high merit. Beside these, there was scarcely a specimen of remarkable merit in the general taxidermic display; and many of the groups, so-called, illustrating the fauna of special States, belonged to the grotesque and unworkmanlike period of twenty years ago.

Very important advances had been made before the Chicago Exposition was organized, and there was scarely a group among those shown by the National Museum which had not been planned and partially executed before preparation for the Exposition began. The Caribou groups already referred to are possibly exceptions, but these were simply advances along established lines.

To emphasize the fact that work of the very highest type was done in the Museum as early as 1884, representations are given here of a tiger (Pl. 34) and a zebra (Pl. 35) mounted by Mr. Hornaday and his assistants at that time. These have all been engraved before, but so unsatisfactorily that for the purpose of making a record in this place new plates have been prepared.

The true explanation of our advance in taxidermy lies in the happy relationship which was established in 1882 between the authorities of the Museum and the representatives of the Society of Taxidermists. These were based upon a recognition of the dignity of personal labor, and a recognition of the fact that work of this kind could not be done by men who counted their pay as the only remuneration for their exertions. The taxidermist was recognized either as an artist or as an expert artisan, as his individual capacities might merit, and he was encouraged to do every part of the work with his own hands, trusting nothing to laborers or ordinary mechanics. He was furthermore told that one specimen well mounted would be more highly appreciated than twenty "stuffed in the old way," and that no expenditure of thought,

*Dr. Shufeldt assures me that his statement has been misapprehended, and that he quite agrees with the critic in his views as to the cause of the development of the higher taxidermy.—G. B. G.

time, or material, was too great, if needful to secure the very best possible results which his abilities would enable him to produce. When he had accomplished a really creditable and conscientious piece of work, his name was placed upon the label as its maker. In this way a good piece of taxidermy is placed in the same standing, in its way, as a book printed by Mr. William Morris or one bound by Mr. Cobden-Sanderson.

One of the former members of the Museum staff of taxidermists, now engaged in other pursuits, writes:

> The fact that the National Museum gives the author of a really good group credit for it on the label has had a great influence for good. The American Museum is the only other that I have ever known to do this; but if the museum officers generally could only know the tremendous stimulus this is to even the humblest taxidermist all would take advantage of it. And it costs nothing. If your plan in this respect were universally adopted it would be a constant and powerful stimulus to the production of the finest kind of work.*

No taxidermist or modeler was placed in a responsible position who was not himself a naturalist and whose own instincts did not lead him to study a living model or the best attainable pictures or sculptures of similar subjects before beginning his work, and whose painstaking habits of research did not have an influence upon his method of work to such an extent that he would work out every muscle and bone with reference to casts or skeletons before him in his workshop.

The workshops soon became filled with photographs and casts, and among these would be seen models and sometimes originals from the hand of Barye and other sculptors, whose art the taxidermist attempted to adopt as far as possible into his own. These men were members of the scientific societies, and some ot them have since become specialists in science, although they have never lost their relationships to their previous work. Prof. W. B. Scott, of Princeton University, and Prof. F. H. Knowlton, of Columbian University, did excellent work in taxidermy before leaving it for research-work, and Mr. L. L. Dyche, although professor of zoology in the State University of Kansas, mounted with his own hands most of the specimens in the great groups shown in the Kansas State building at Chicago.

Incidentally it may be mentioned that many American naturalists are amateur taxidermists, and that some of the most successful groups of mammals and birds in the Museum have been done by workmen not possessed of artistic skill though excellent in technique, whose work has been designed and directed by the curators of the several departments.

In connection with these discussions of American work it seems desirable to refer to the extensive collection of South African mammals and birds, exhibited at the Dr. Emil Holub's South African Exposition in Prague in 1891.† The mammals were mounted in groups in

* A label of the kind here referred to is illustrated in one of the plates.

† Dr. Holub's South African Exposition was held in the building erected for the National Jubilee in Bohemia in 1891. Here were exhibited the material results of

GROUP OF TWO SPECIES OF AFRICAN KUDUS, STREPSICEROS CAPENSIS AND S. ZAMBESIENSIS.

Collected by Dr. Emil Holub and mounted under his direction for the South African Exhibition, Prague. 1892.

A "NESTING COLONY" OF MEROPS RUBICOIDES, ON THE LOWER BANK OF THE TSHOBE RIVER, NEAR ITS JUNCTION WITH THE ZAMBESI. (MO-RUTSE KINGDOM.)

Mounted under the direction of Dr. Emil Holub for the South African Exhibition, Prague, 1892

GROUP OF OCTOPUS—OCTOPUS VULGARIS.

Mounted in a glass case to produce the effect of life under water

varied attitudes, and some of these groups were admirable. One of them is here illustrated, as well as one group of birds (Pls. 36, 37).

Environmental groups of marine animals.—It has long been a favorite idea of the writer that the appearance and habits of fishes and other aquatic animals might be best shown by mounting some of our colored casts among natural surroundings in a case resembling an aquarium tank, and admitting most of the light from above through glass so tinted that the appearance of being under water would be given. All attempts in this direction failed, however, and it has remained for Mr. Lucas, in his group of Octopus (Pl. 38), to show that it is possible. It is intended to carry this still further, and especially to attempt to show the life of the coral reefs.

Some groups of reptiles, colored casts in the midst of natural surroundings, have also been completed, and these, though not realizing our highest ideals, show that there are good possibilities in this direction. The stuffing of skins of fishes has been carried to high perfection in Europe, owing to the desire of anglers to preserve trophies of their successful excursions in their own homes. Simple accessories, such as suffice to represent the shores of a stream or lake, are used with them with a very good degree of effect. A wonderful display of these angling trophies was shown at the International Fisheries Exhibition in London in 1883. It is our experience, however, that it is scarcely advisable to stuff a scaly fish or reptile. Sharks may be stuffed, but fishes are neither satisfactory nor lasting. If casts can not be had, it is best to be content with preparations in spirits.

The mounting of the Pacific walrus.—In the discussion of the recent taxidermic work in the Museum which has appeared from time to time during the past year in the scientific journals, the Pacific walrus, which was exhibited at the World's Fair, has been severely criticised, and it has been said that it is inartistic and false to nature.

The preservation of a worthy memorial to the North Pacific walrus is especially desirable, since this is one of the species threatened with extinction. Numbered by tens of thousands and flocking together in immense droves when the American whaling fleet first entered the Arctic in 1854, they have now been reduced to a mere handful in American waters, and the old males are now entirely extinct in the Western Pacific, and it is doubtful whether this particular phase of the species is to be found anywhere. The specimen shown at the World's Fair (Pl. 39) is an admirable example of the old male, and since it was

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Dr. Holub's second exploring trip to South and Central Africa in 1883–1887, which were first exhibited in 1891 in Vienna. The exposition at Prague was the most complete, 13,000 objects being exhibited in addition to the groups of mammals which were mounted in accordance with measurements made by Dr. Holub in Africa. There were a number of groups of natives exhibited in connection with their actual dwellings and the implements of their arts and industries. A large album of views of this exposition and of the groups was presented to the Institution by Dr. Holub.

acquired only after long and continued effort it seems but proper that its truth to nature, as now mounted, should be vindicated.

The skin in question was mounted by a most skillful and conscientious member of the staff, the chief taxidermist, Mr. William Palmer, who spent some months on the Pribilof Islands making preliminary studies in order to fit himself for this particular undertaking.

Capt. E. P. Herendeen, formerly of the U. S. Coast Survey, who was familiar with the Arctic Ocean for fifteen years, and who has seen tens of thousands of walruses in the times when they were abundant, in 1854 and in subsequent years, and who has seen thousands of them at one time upon the shore at Sandy Point, says of the specimen in the Museum:

> I am satisfied that the mounted walrus is true to nature and in every respect an admirable piece of work. The only criticism which I would make upon it is that an animal in the attitude of extreme attention and activity in which this is represented would be slightly smaller about the neck. The arrangement of the wrinkles in the skin and the tuberculated appearance of its surface are perfect, and the attitude of the limbs can not be criticised.

The following statement of the material upon which the treatment of the skin was founded is supplied by Mr. Palmer:

> (1) *Personal observations.*—On August 7 we landed from the U. S. revenue-cutter *Rush* on Walrus Island, having previously seen the remnant of a walrus herd, consisting of eight individuals, on the island. We landed on the southern end of the island and made our way over the rocky interior toward the walrus, but unfortunately the vessel remained within sight of the animals, and the sailors from the boat in which we had landed instead of keeping on the other side of the island persisted in getting into view of the walrus, with the result that before we got within shooting distance they made preparations to leave the rocks. Before us was a wide crevice in the rocks full of water, so that it was impossible to get over it, and there not being time to get around the head of it before the walrus took to the water, I sat down on the rocks at the edge of the crevice and examined the animals at leisure. Before they had reached the water I had succeeded in fixing in my mind the most important features of their physiognomy. The walrus nearest to me was the one that I examined most thoroughly, and I convinced myself of the fact that the general positions of the walrus, as delineated in Mr. Elliott's pictures, was true, and in mounting this specimen I followed as closely as possible the picture which remained in my mind of this particular walrus. I had a fine view of the animal, which was distant not more than 20 rods and within easy gunshot. No attempt was made to kill the animal, however, since it was so near the water that if it had been struck it would have fallen and been lost. Then, too, I hoped that there might be another opportunity of capturing a specimen.
>
> (2) *Measurement from the fresh specimen.*—The skin which was mounted was obtained by the *Rush* ten days afterwards. This was after I left the island, however, and I was unable to study the animal in the flesh. Dr. White, the surgeon of the cutter, however, made careful measurements in accordance with specifications which I left in his hands, and I am satisfied that these measurements are accurate. They met all the necessities of taxidermy, and are practically those which I would have taken had I been present. The only thing lacking which I could have supplied would have been casts and photographs of certain portions. I had, however, the advantage of the head already in the Museum, which was received from Alaska in pickle and practically in the flesh, and was mounted in that condition after careful study by Mr. Hornaday. I also had a photograph of the great head of an Atlantic walrus.

PACIFIC WALRUS.—ODOBOENUS OBESUS.

Mounted under the direction of William Palmer for the U. S. National Museum.

MOUNTING THE PACIFIC WALRUS.

(3) *Pictures.*—I had devoted some years to making a collection of tracings of all the illustrations of the walrus in books of travel and natural history, and think I had assembled some twenty of these, and am satisfied that I had, if not all, at least all of the most important of those which made any claim to have been made by observers. These were all quite unlike Mr. Elliott's drawings, but, as I have said, personal observation satisfied me that these drawings were true to nature and the others not. I showed Mr. Elliott's pictures to many of the natives and others on the islands, who all expressed themselves as perfectly satisfied with them.

(4) *Anatomical indications.*—In mounting the specimen the large wrinkled folds on the skin around the limbs and body were followed as closely as possible, and these, as every anatomist knows, indicate in no uncertain way the customary attitudes of thick-skinned animals such as the walrus, the rhinoceros, the elephant, and the armadillo. The shape and position of the warts on the neck, which look so grotesque and unnatural in the Elliott pictures, were clearly shown in the skin and could not possibly have been very different from those which Mr. Elliott delineated. Even the inflamed surface as shown in the drawings, giving such a ghastly and disagreeable appearance to the animal, were manifestly true to nature, which is also supported by the testimony of people on the island and by Capt. Herendeen.

The deep wrinkles at the base of the flipper, have been criticised as unnatural, but my own observations on many specimens of fur seal, sea lions, and walruses, and which are confirmed by many competent observers whom I have consulted (in fact, they can be readily found on any pickled skin), satisfied me that I was correct.

The thinness and smoothness of the skin in the center of these wrinkles, their position and general direction, even as illustrated in the palm of one's own hand, will convince anyone who sees them that there must necessarily be wrinkles at those points when by the position of the animal the skin and blubber is entirely released of all tension and even crowded on itself; indeed, the most conspicuous feature of the surface of an animal of this division of the pinnipeds as he moves about, is the rapid change in the position and form of these wrinkles on many parts of the body.

The accompanying illustration (Pl. 40) shows the manner in which the folds appeared in the fresh skin, the process of making them permanent, and the manner of preserving them as the mounting progresses.

Criticisms have been made also upon the shape of the nostrils. In regard to this I can only say that my guide was the appearance of the nostrils in the skin before it was fleshed, and when it was comparatively fresh. This I considered myself justified in doing, since I am not aware that anybody has made careful observations upon the appearance of the nostrils close at hand, except Mr. Elliott, whose drawings correspond with my interpretation, and Capt. Herendeen says that the walrus never opens its nostrils wide, and that it is only when breathing or excited that they are open to any considerable degree.

It has been also said that the neck is possibly a little too large, but the dimensions of the specimen as mounted are smaller in this part than is indicated by the measurements made by Dr. White. In mounting it I took into consideration the probability that the animal in life, standing with head erect and muscles rigid, would measure somewhat less.

It should be clearly stated that the preparation under discussion was intended to show the appearance in life of the animal to which this skin belonged, namely, an old male such as are rarely seen, and that none but old males assume the grotesque attitudes of which this is one. A young male would never present the same appearance even in the same attitude, because they are comparatively smooth, with thinner skins, more hair, and fewer tubercular growths upon the surface.

It should be said also that this represents the animal upon land and in action, just as it would appear after being aroused from sleep and just before making its way to the water. The customary attitude in which walruses are mounted, with the flippers stretched out behind as in the hair seals, is not itself untrue to nature, but is only assumed by them when in repose or asleep, while with the hair seal it is constant.

It has been questioned whether it would be wise to mount a young Pacific walrus in the same attitude as that of the old male under discussion, but Capt. Herendeen states, from his experience, that all walruses, young and old, assume these positions when in action.

REPRESENTATIONS OF THE HUMAN FIGURE.

For fifteen years the Museum has been constructing models of the human figure for use in the exhibition series, and has been striving by various means to secure the best results in this direction.

These figures are required for three purposes: (1) To show the characteristics of the different races, (2) to display costumes, and (3) to illustrate the methods of use of weapons, instruments, and processes of various arts and handicrafts.

For the first purpose it is manifest that the greatest accuracy and fidelity to nature is necessary, or the result will be useless. For the others the same degree of accuracy is, perhaps, not essential, if the labels clearly indicate that the faces are not portraits, but so far as possible the figures intended chiefly to show costume and action should attain the highest possible anatomical perfection.

The use of well-constructed figures in scientific museums is of quite recent origin, though manikins of conventional type have long been employed in collections of costumes and armor; and many very creditable efforts in this direction have been made in connection with expositions.

Before beginning our experiments we were familiar with the altogether admirable gallery of historical figures in Castan's "Panopticum" in Berlin, and with those of Madam Tussaud in London, not so very good in execution, but nevertheless of high interest to the masses. We knew the representation of races of mankind at Sydenham and the Swedish peasant figures which had been so popular at the Philadelphia Centennial. We have since become familiar with the separate groups showing the history of primitive man, made for the Paris Exposition in 1888-'89, and the figures of race types in the Trocadero Museum in Paris. Indeed, we owe to the courtesy of Dr. Hamy the privilege of having had made copies of several of the latter, one of which is here illustrated (Pl. 41), and at the same time obtaining a replica of the Roman warrior in armor, modeled for the Museum of Artillery in Paris, by the sculptor Bartholdi.

It is scarcely worth while to mention the ghastly wax figures of Kane, the arctic explorer, and his companions, in costumes of fur, which were displayed in the old Smithsonian Museum as early as 1870. These, and the equally crude manikins of Eskimo Joe and his wife Hannah, made in 1873, have long since been discarded and have no place in the history of recent efforts.

FIGURE OF MASAI WARRIOR, UPPER KONGO.

From specimen in the U. S. National Museum: a replica of the figure in the Musée du Trocadéro, Paris.

JAPANESE MAN AND WOMAN OF THE LABORING CLASS.
Manikins constructed in Japan for the U. S. National Museum.

FIGURE OF JAPANESE MAN OF THE LABORING CLASS, UNDRAPED.
Manikin made in Japan for the U. S. National Museum.

KAN-KU-WASH-TE-WIN (THE GOOD ROAD WOMAN), YANKTON SIOUX.

Plaster cast, with hair, eyes, and costume in plaster. Modeled for the U. S. National Museum by M. Achile Colin, and painted by A. Zeno Shindler.

CHE-TA-WAU-KOU-VA-MA-NI (THE HAWK THAT HUNTS WALKING), MEDAWANKATON SIOUX.

Plaster cast, with hair, eyes, and costume in plaster. Modeled for the U. S. National Museum by M. Achile Colin, and painted by A. Zeno Shindler.

(Cat. No. 76858, U. S. N. M.)

CHOCTAW SQUAW (ROSA WHITE THUNDER).

With artificial hair; sculptor's eye in plaster; actual costume. Modeled by U. S. J. Dunbar for the U. S. National Museum.

The first advances were made in 1875, when four costumed figures were imported from Japan. These were exceedingly spirited and effective, and when examined in detail showed such conscientious workmanship and such thorough fidelity to nature that they have served as an inspiration and a model for our workmen up to this day. Two of these figures, representing an actor and an actress in the costume of Japanese nobility, were carved in wood, and seem to show the extreme limits of this material in the construction of the human model. The other two, a laborer and his wife (Pl. 42), are in papier-maché and are satisfactory in the highest degree. The material is brought to an extreme of hardness, strength, and delicacy of line which no American workman has been able to rival. Indeed, we have not yet progressed beyond the use of the much heavier and clumsier plaster of Paris. The modeling is almost perfect, as may be judged from the fact that the figures, with or without clothing, stand poised upon their feet without any attachment to the bottom of the case. The hair is attached directly to the figures and has none of the wig-like appearance which is almost universal in figures of this kind. The eyes, though glass is used for the outer film, are not glass eyes. Even the nails are cunningly fashioned of horn and inserted; and the coloring, of which more will be said hereafter, is as yet the despair of our workmen. The figures as a whole exhibit such conscientious and painstaking accuracy, and such fidelity to nature in the smallest details, that too much can not be said in their praise. (See Pl. 43.)

In 1881 some figures were made for us by M. Achille Colin, a French sculptor living in Washington, on a new plan. These were executed in accordance with the rules of sculpture, the hair and the clothing to be of the same material as the head and body, and the sculptor's eye to be used instead of the customary one of glass. They were then painted by a portrait painter whose life had been spent in delineating Indians. The result was thoroughly satisfactory, and nothing better has since been done. (Pls. 44 and 45.) It is probable that this method will be used more and more in the future, since many of the races whose lineaments and costumes it is most desirable to perpetuate can only be shown in this way. Their costumes no longer exist, and must be supplied by the modeler and painter from such portraits as those of which we have a large number in the Catlin gallery. When actual garments are not used, there is no reason for the unsightly wig or the staring glass eye.

A modification of the same method was employed by Mr. U. S. J. Dunbar, a Washington sculptor, in modeling the face of a Sioux girl, Rosa White Thunder, for a full-length figure to be clad in a modern Sioux costume of blue cloth ornamented with elk ivory, obtained from the original, at that time a pupil in the Indian school at Carlisle. In this figure, although the sculptured eye is used, the hair is represented by a wig. The result is only partly satisfactory, but the experiment is an interesting one. (Pl. 46.)

More recently other methods have been employed. Mr. J. W. Hendley, a man of great ingenuity and mechanical skill employed in making models of fruit, produced a cast from life of a negro boy, which in its way is something entirely unique. Although no portion of the figure was touched by the modeler or sculptor, it has the merit of absolute accuracy, and yet is surprisingly spirited and life-like—a Samoan youth (Pl. 47), modeled from photographs under the direction of Lieut. W. E. Safford, U. S. Navy, who is very familiar with these people; a Dyak warrior (Pl. 48), produced in the same way under the supervision of Mr. Hornaday, and an Indian in feather costume (Pl. 49), from a painting by an Indian artist of Chile, are thoroughly satisfactory, as is also a Bantu negro boy, modeled by Mr. Theodore Mills from life, by the aid of casts. (Pl. 50.)

A number of figures of the same general character were prepared for the World's Fair. None of these were so carefully made as those already described, owing to the confusion and haste which always attend the preparation for a great exhibition. A new feature of the greatest interest was, however, introduced among the figures prepared for this occasion, and a set of groups, unique and full of interest, was the result. These, as shown in the cases, surrounded by proper environmental accessories and engaged in the occupations peculiar to the tribes which they represented, were no longer pieces of sculpture but pictures from life. The success of these groups is due to the supervision exercised by Prof. W. H. Holmes, artist as well as ethnologist, who gave life and pictorial expression to the figures already accurately modeled and costumed by the Museum preparators, who himself designed a spirited group of Powhatan Indians quarrying material for the manufacture of stone implements, which was modeled by Mr. U. S. J. Dunbar. To Mr. Frank Hamilton Cushing, whose long residence among the Indians of the southwest has given him perfect familiarity with their customs, and in whom mechanical skill supplements an artistic temperament, is due the perfection of other groups showing the life of these people. These are:

1. The Zuñi ritual of creation.
2. The Zuñi bread-makers and millers. (Pl. 51.)
3. The Zuñi potter.
4. The Zuñi basket-maker.
5. The Zuñi belt-maker.
6. Navajo women, spinning and weaving.
7. Indian women of the plains dressing hides. (Pl. 52.)

The first group of the new style made was the group of Kiowa children at play, equally good in its way, designed some years ago by Mr. James Mooney, of the Bureau of Ethnology, who also planned the group of Navajo silversmiths. Dr. W. J. Hoffman's "The Primitive Scribe," a Chippewa shaman in his lodge writing an incantation on prepared birchbark, and another of a Crow Indian painting a blanket, are worthy of notice.

SAMOAN YOUTH.

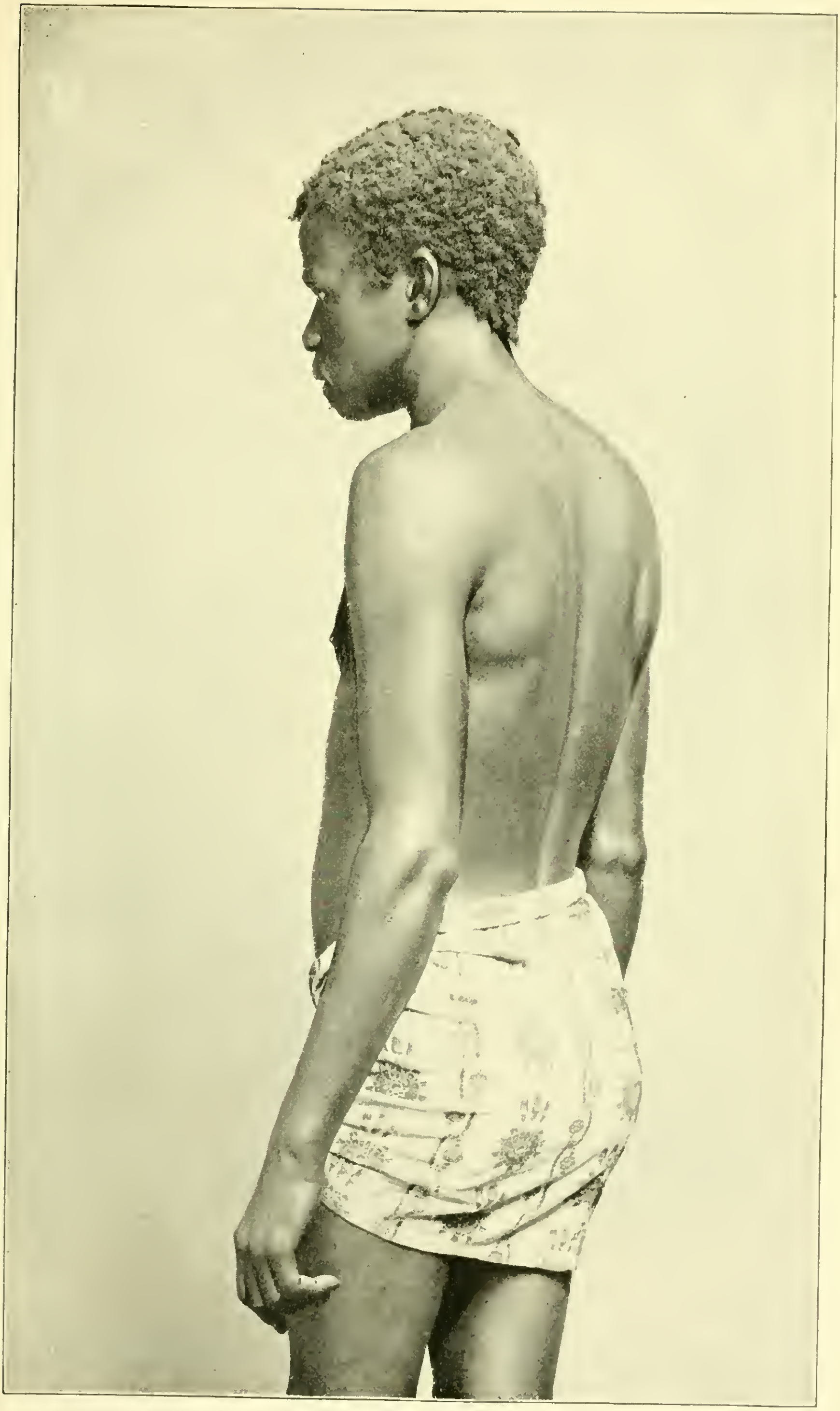
Modeled for the U. S. National Museum by Theodore Mills.

DYAK WARRIOR.

Modeled for the U. S. National Museum by Theodore Mills.

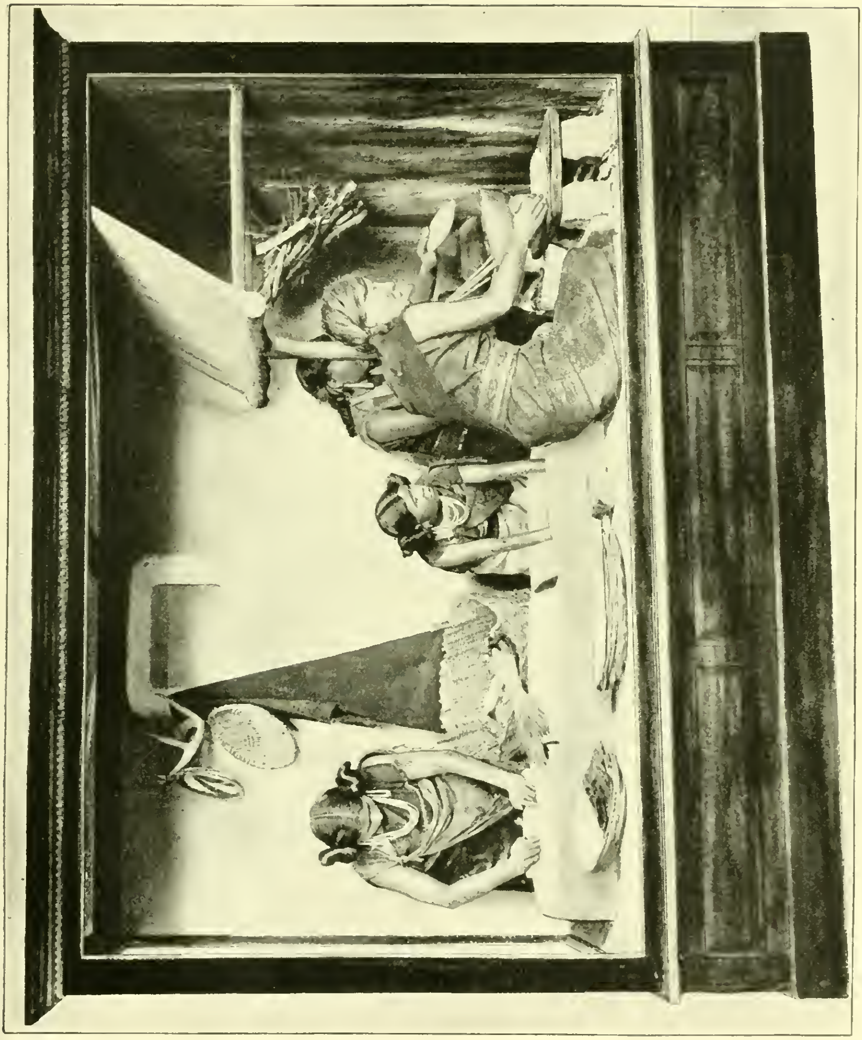
XIVARO INDIAN IN FEATHER COSTUME.

Modeled for the U. S. National Museum by Theodore Mills.

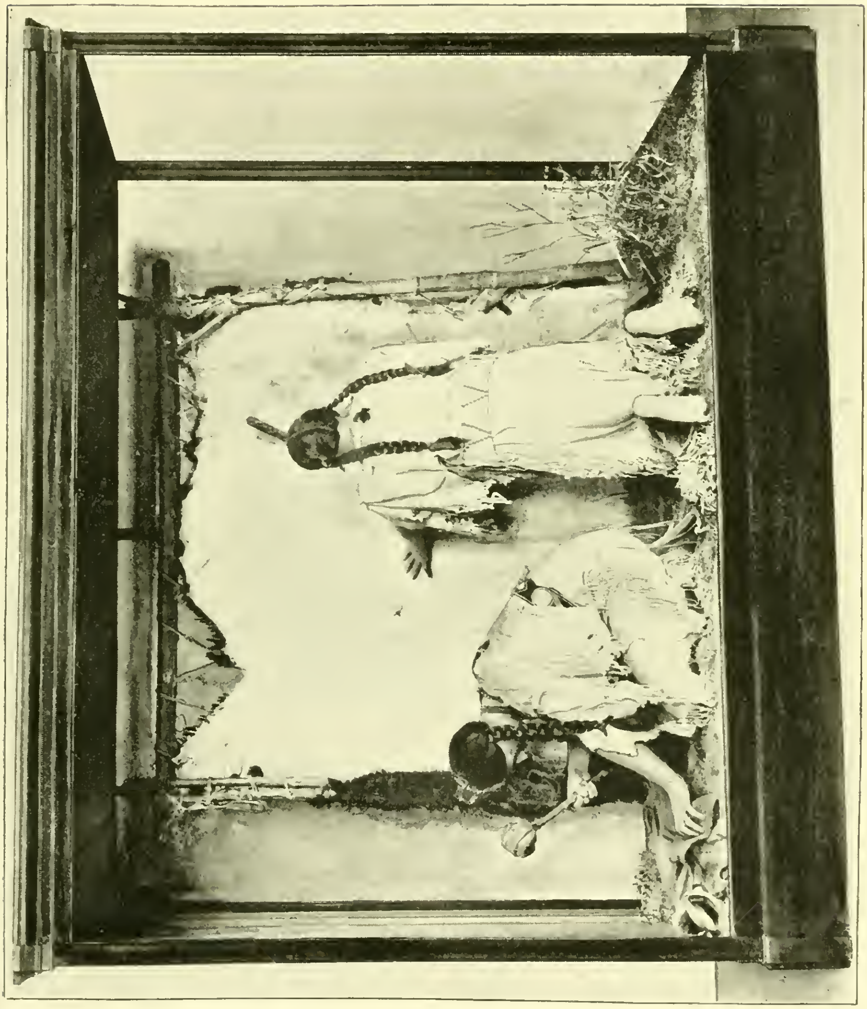


BANTU NEGRO BOY.

Modeled for the U. S. National Museum by Theodore Mills.



ZUÑI BREAD-MAKERS.
Prepared under the direction of Mr. Frank H. Cushing.



INDIAN WOMEN DRESSING HIDES.

Prepared under the direction of Mr. William H. Holmes.

The groups of Loucheux and Hupa Indians, arranged by Prof. Holmes, were also effective artistically, though lacking the advantages which a personal acquaintance with the tribe would have given the designs.

The relative values of costumes and implements displayed upon manikins, and those shelved in cases with tickets explaining their uses, need no discussion. A caution should be written to museum men, however, which is that it is very dangerous to try to make such groups except under the eye of an ethnologist who has been among the people to be represented. The object of a reference to these groups is simply to call attention to the fact that something has been done which was never before attempted for the American Indian, and that the result seems to more than justify the effort.

Experiments are still in progress, and it is believed that figures still more truthful and life-like than any that have yet been produced will be the result. The most serious difficulty to be overcome is in the treatment of the surface of the figures and their coloring. We use only plaster of Paris. Wax, which has been so often employed for faces and hands, has been discarded as being too delicate, and not so well suited for life-like effects as plaster. Papier-maché, as has been stated, our workmen can not manipulate so as to produce sufficient hardness of surface and delicacy of line. The gelatine which has been used for natural history preparations offers no absolute permanence. Plaster of Paris has only one objection, which is the roughness of its surface. It is now believed that the smoothness and texture of the flesh can be produced by the use of some of the mineral waxes.

The question of coloring is a more difficult one. Our Japanese figures, on close examination, do not present a uniform hue, but have a solid body color, enlivened by innumerable dots of a much darker tone. These are produced by some spatter-work process, either by spraying from a stiff brush, or by blowing the pigment in a fine spray from the mouth. When viewed at a short distance, the effect is precisely that of living flesh. Experiments are now being made with the air brush, which will doubtless produce the same effect.

The representation of human hair, especially of the beard, also presents great difficulties; but it is believed that in time the use of plaster and paint will supplant the products of the wig factory.

It will be observed that the steps of progress in modeling man have been very similar to those in the mounting of the lower animals, and the influence of the skilful American taxidermist has been felt everywhere in this work also.

Allusion has already been made to the taxidermy at the Holub exhibition in Prague. The mounting of anthropological groups was even more ambitious and successful, and is illustrated here by three plates, showing a group in action, a group in repose, and a single figure to show details of modeling. [Plates, 53, 54, 55.] In the anthropological as well as the zoological groups, the generous space of the exposition afforded opportunities which are not often available in museums. Indeed the permanence of museum work seems to demand not only greater compactness, but more reserve, repose, and dignity than is necessary in installation for a temporary exhibition.

ENVIRONMENTAL GROUPS.

It is not expected that in the ethnographical museum of the future the lay figure will supplant the show case as a means for displaying ethnographic collections; but just as naturalists may feel it legitimate to use a considerable number of cases of animals mounted in the midst of natural surroundings to illustrate their habits or to make impressive memorials of species which are rarely seen or likely to become extinct, so will the anthropologist employ figures, not only for the education of the public, but as a more sure means of preserving certain of the most precious memorials of the primitive races of mankind.

It will soon be time to consider the question to what extent museums are justified in the use of environmental groups. It is evident that this may be carried too far and be made tiresome instead of agreeable to visitors, while at the same time producing an effect quite opposite to that of dignified and systematic order, which should be characteristic of every museum. Furthermore, specimens thus mounted, unless the workmanship is of the very best and the cases practically perfect and impervious to air, are certain to deteriorate, since it is very difficult to get at them in order to cleanse them and protect them from vermin. The writer has seen neglected cases of this kind in some of the largest government museums of the Old World, which were serious warnings against departure from the practice of individual mounts in cases free from the incumbrance of accessories.

In the National Museum a definite limit has been fixed. Environmental groups will only be made in the case of the larger mammals and birds which are rarely seen and are on the verge of extinction, or for the purpose of illustrating some very remarkable habit.

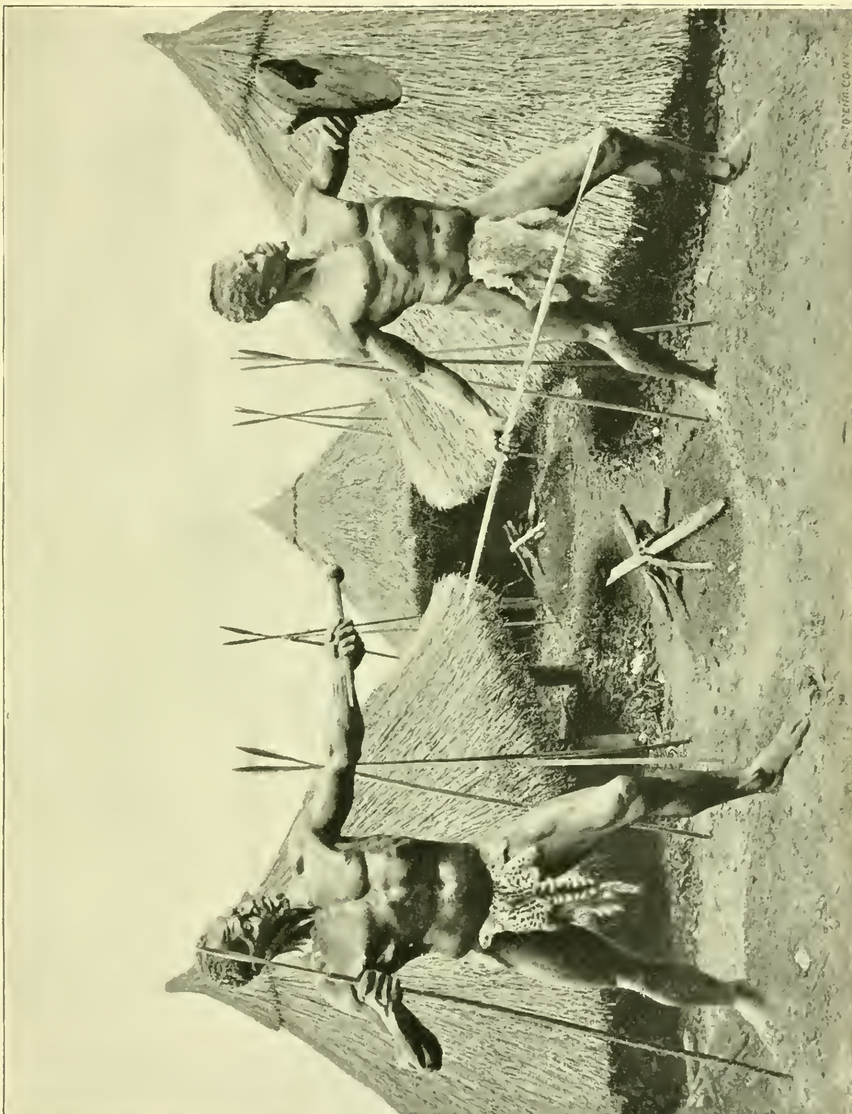
It has been found in the installation of our department of birds that the series of Audubon's plates, showing the habits of birds, framed and hung near the exhibition cases, are almost as effective as the groups mounted to illustrate the same phases in their habits.

CONCERNING COLLECTIONS AND SPECIMENS.

The following principles in regard to collections and specimens represent in a general way the ideas which underlie all our recent work:

Collections in general.—Any object which has a name may be used in museum work. It does not follow, however, that any one museum should attempt to include all such objects, nor that there are not many which, in the present stage of museum practice, might not be entirely neglected.

A Bushman in the act of engraving figures with a stone hammer on a diorite rock.
Mounted under the direction of Dr. Emil Holub for the South African Exhibition, Prague, 1892.



MATABELE WARRIORS IN THEIR ENCAMPMENT; THE LATTER BUILT UP FROM THE ROOFS OF HUTS OF A MO-TOKO TOWN.
SOUTH ZAMBESI TRIBE; ZULU NATION.

Mounted under the direction of Dr. Emil Holub for the South African Exhibition, Prague, 1892.

ZULUS OF NEW SHESHEKE, ON THE CENTRAL ZAMBEZI, AT SUPPER.

[The food is tasted by the attendants before it is passed to the king, who is seated in the center of the picture.]

Mounted under the direction of Dr. Emil Holub for the South African Exhibition, Prague, 1892.

Specimens in a museum are like the types in a printing office. They may be sorted in the cases in conventional order so as to be accessible when needed, or they may be used to make intelligible almost any train of thought or series of ideas, each being available in hundreds of different relationships.

Single or unrelated specimens, though valuable or interesting, are in themselves of little moment in comparison with series of much less precious objects which unite to teach some lesson to student or visitor.

Cumbersome and superfluous materials in collections.—One of the greatest perils to a museum is the possession of vast collections.

Collections which are encumbered with conditions as to manner of disposition and installation are usually causes of serious embarrassment.

Not the least important duty of the curator is to prevent the accession of undesirable material.

Material not germane to the plan of a museum should be exchanged or given to other museums which have use for it. What is expensive and unprofitable to one may be of the greatest use to another.

Advances in any museum are effected not only by accession and enlargement, but by the constant substitution of better specimens, by advance in methods of display, labeling, and handbooks.

The principal uses of specimens.—A museum is rarely justified in exhibiting all its materials. An exhibition series, when properly installed, is more effective when limited than when extensive.

Specimens not needed in the exhibition series are much more useful when placed in a reserve or study series, either to be used by students; to be exchanged or given to other museums, or to be employed when occasion may offer in forming new exhibition series.

The exhibition series.—The effectiveness of a museum for popular culture depends chiefly upon:

(1) A careful selection and effective arrangement of the specimens exhibited (which implies the exclusion of many objects in themselves attractive and interesting).

(2) A thorough system of labels in simple language, supplemented by pictures, diagrams, maps, and books of reference.

(3) Specimens for exhibition should be selected solely with reference to the lesson they can teach, singly or in combination.

(4) To complete a series, any specimen is better than none.

(5) A copy, model, or picture of a good thing is often more useful than an actual specimen of a poor one.

(6) A picture or model may often be shown to advantage in place of a minute or unintelligible object.

(7) Books, manuscripts, pictures, maps, etc., become specimens when treated in the museum method.

The study series:

(1) Specimens in the study series should be acquired in series suffi-

ciently large to meet the needs of students who are known to exist. While nothing of value should be lost, it is questionable whether material should be sought in large quantity, when there is no indication that it will soon be needed.

(2) Study specimens should be stored as compactly and economically as is consistent with their safety and convenient use, and should be accessible to every student.

(3) The study series is the storehouse from which the exhibition series may be replaced or extended and from which the needs of other museums may be supplied.

Records.—The most important fact concerning any object is the locality where it was found; next most important, the person from whom it was received. Every specimen should have its catalogue number indelibly engraved or marked upon it, and, when possible, the locality and source. Specimens can be named at any time, but the locality once lost, the object becomes comparatively valueless. The record of donors should be accurate and complete, so that the specimens from any given source can be traced at once to their location.

III.—SPECIAL TOPICS OF THE YEAR.

THE UNUSUAL CHARACTER OF THE YEAR'S WORK.

The activities of the entire staff have been in a large degree diverted to exposition work, as they were last year and are likely to be for a year to come. Many of the Museum halls have been closed, being needed for the work of mounting and packing the collections. Many of our employees have been transferred to the exhibition staff, and at the time of this report are absent in Chicago, while a considerable number of others have been detailed for special service at the fair, or have been given special leaves of absence to attend the congresses or to act as judges of awards.

A large number of specimens and cases have been withdrawn from the exhibition halls and sent to the expositions in Madrid and Chicago, and it has required the utmost ingenuity to fill the gaps thus caused, so that the collections may be presentable in the eyes of the visitors, who are quite as numerous this year, and among whom are many from foreign lands.

Indeed, the occasion is really a revolution in museum affairs, and it will require fully a year after the return of the collections next winter to readjust the collections and to reestablish customary routine.

All of this is accepted without complaint, because, though the Museum undoubtedly loses much more than it gains on such occasions, the opportunity for popular education is too important to be neglected, and the anniversary is one for which no outlay of labor and expense can be too great.

The effect of this upheaval, extending as it has and will over a period of nearly four years, must, however, of necessity be manifest in this report, and it should be read with the facts just mentioned in mind.

The responsibility of the Assistant Secretary in preparing for the two expositions, and the completion of the report on the deep-sea fishes of the *Albatross* and *Blake* expeditions, and his long absence from the city on official duty, have rendered it impossible for him to attend, as usual, to the details of museum administration, except in connection with the present report. Mr. Frederick W. True, as curator in charge, has very faithfully and successfully directed the work of this unusually trying year.

CHANGES IN THE FORM OF THE ANNUAL REPORTS.

Each report upon the Museum is intended to convey to every one interested in its work, and especially to Congress, an exact idea of what has been done during the year, the relation of the work done to that of previous years, and to the plans for the future. So far as it is deemed likely to be of public interest, reasons are always given for the course pursued, especially when there are changes in method and policy.

It is also intended to show fully what new museum materials have come into the possession of the Government during the year and how it has been assigned, what is being done to preserve and utilize the old collections, and when, in accordance with law, material has been distributed to other institutions, to show what has been done with it.

The report then must of necessity discuss hundreds of thousands of small details, and it is exceedingly difficult to handle them so systematically that the reference to anyone of these details can be at once found.

With the growth of the Museum the system has been becoming yearly more complicated, and the body of the report constantly more and more filled up with tables and statistical summaries.

In the attempt to avoid what is becoming a burden, many of the statements heretofore included in the main report have this year been placed in appendixes. The discussions of the gifts and other accessions have, so far as possible, been assembled in a special appendix under the control of indexes, which show not only the source but the disposition of each object by museum departments, and also group the objects by geographical origin.

Still further concentration has been made by doing away with the special reports of the curators upon their respective departments and incorporating their substance in the general report upon the progress of the Museum. This is an experiment, and it is not impossible that hereafter the old system may, at least in part, be resumed.

THE MUSEUM STAFF.

There are at the present time thirty-two organized departments and sections in the Museum under the care of curators and assistant curators, and eight administrative divisions.*

The following changes in the personnel of the scientific departments have occurred during the year:

Dr. William S. Dixon, honorary curator of the section of materia medica, was detached by the Secretary of the Navy on January 5, 1893, for duty in the office of the Surgeon-General, and was succeeded by Dr. C. H. White, U. S. Navy.

Mr. W. S. Yeates, who has for many years filled the position of assistant curator of the Department of Minerals in the National Museum, resigned on June 14, 1893, to accept the post of State Geologist of Georgia.

Dr. George Vasey, honorary curator of the Department of Botany in the National Museum, died March 4, 1893, and Mr. Frederick V. Coville,

*A list of the scientific and administrative officers is printed in Appendix I.

who succeeded him as botanist in the Department of Agriculture, has been placed in charge of the Department of Botany in the Museum. A fuller reference to Dr. Vasey will be found in a subsequent page.

Mr. J. E. Watkins, curator of the section of transportation and engineering in the National Museum, was granted leave of absence October 1, 1892, to take charge of the exhibit of the Pennsylvania Railroad Company at the World's Fair, and the work of collecting and organizing the historical collections shown by that railroad in Chicago has since occupied his time.

APPROPRIATIONS FOR 1893-'94.

The sum total of the appropriations is $166,000, which is $5,000 less than for the previous fiscal year, and $47,500 less than for 1891-'92. The items are as follows:

MUSEUM APPROPRIATIONS FOR 1893-'94.

Preservation of collections	$132,500
Furniture and fixtures	10,000
Printing	12,000
Heating and lighting	11,000
Postage	500
	166,000

It is a source of serious embarrassment that the appropriations have been reduced, and but for the fact that this reduction is part of a general system of economy growing out of the necessities of the Government, and affects all branches of the Government alike, it would be very discouraging. As it is, the situation has been accepted loyally and cheerfully; and though the growth of the Museum and its efficiency are of necessity greatly interfered with, the effort has been made to accomplish the best results with the means available, while waiting for a time of greater prosperity. One of the most serious inconveniences has been the necessity of discharging a number of men, who have been trained for the special work of the Museum, whose services are essential to its efficiency, and whom it will be difficult to replace in the future.

INCREASE IN THE COLLECTIONS.

At the close of 1881 a census of the collections was taken, resulting in the preparation of a table, published in subsequent reports, which gave 193,362 as the approximate total number of specimens of all kinds at that time entered in the catalogue books of the several departments of the Museum. The census for the year ending June 30, 1893, places the total number of specimens of all kinds at 3,306,020. It must, however, be stated that a large proportion of the material catalogued in 1884 and in later years had been in the custody of the Smithsonian Institution for several years, but had remained in storage on account of there being no opportunity to have it classified and entered in the catalogue books.

There still remains in the basement of the Smithsonian building and in the old Armory building much material, consisting largely of gifts from foreign governments and contributions from expositions, which has not yet been brought under control, owing to lack of space and other necessary facilities.

The number of accessions received in 1892-'93 was 1,266 (Acc. Nos. 25885 to 27150, inclusive), embracing, in all, 82,148 specimens, distributed among the several departments as follows:

Departments.	Number of specimens.
Arts and industries:	
Materia medica	27
Domestic animals (for mounting)	31
Historical collections, coins, medals, paper money, etc	1,000
Musical instruments	263
Transportation and engineering	37
Modern pottery, porcelain, bronzes, etc	312
Physical apparatus	18
Graphic arts	260
Forestry	725
Ethnology	5,094
American aboriginal pottery	889
Oriental antiquities and religious ceremonial	458
Prehistoric anthropology	3,095
Mammals (skins and alcoholics)	728
Birds	2,255
Birds' eggs and nests	2,869
Reptiles and batrachians	2,301
Fishes	1,010
Vertebrate fossils	13
Mollusks (including Cenozoic fossils)	5,600
Insects	7,000
Marine invertebrates	2,690
Comparative anatomy:	
Mammals	630
Birds	
Reptiles and batrachians	
Fishes	
Invertebrate fossils:	
Paleozoic	1,200
Mesozoic	6,440
Fossil plants	2,000
Recent plants	33,110
Minerals	793
Geology	1,300
Total	82,148

The following table shows the number of accessions to the Museum, annually, since 1881:

Year.	Accession numbers (inclusive).	Number of accessions during the year.
1881		
1882	9890–11000	1,111
1883	11001–12500	1,500
1884	12501–13900	1,400
1885 (January to June)	13901–15550	1,650
1886	15551–16208	658
1887	16209–17704	1,496
1888	17705–19350	1,646
1889	19351–20831	1,481
1890	20832–22178	1,347
1891	22179–22340	1,162
1892	22341–24527	1,187
1893	24528–25884	1,357
	25885–27150	1,266

A list of the accessions during the year, arranged alphabetically by names of contributors, and including indexes by locality and by departments, is printed as Appendix VI.

Special reference to the particularly valuable material obtained by foreign exchanges seems desirable.

Ethnology.—Mr. Henry Balfour, of the Ethnographic Museum of Oxford University, England, has sent a miscellaneous collection of ethnological objects.

Mr. William T. Brigham, curator of the Bernice Pauahi Bishop Museum, Honolulu, Hawaiian Islands, sent a collection of about 500 specimen samples of Hawaiian kapas, or tapa cloth, especially interesting as illustrating the great variety of patterns.

Mr. Edward Lovett, Croydon, England, sent ethnological objects.

From Prof. Henry H. Giglioli has been received a valuable and interesting collection of ethnological and other objects from the Andaman Islands. A collection of American ethnological objects has been sent in return.

Prehistoric anthropology.—Mr. Edward Lovett, Croydon, England, has sent a collection of stone implements, flints, human leg and arm bones, and fragments of crania obtained in England, Ireland, Germany, and Belgium, for which an equivalent has been sent.

From the Royal Zoological Museum, Florence, Italy (through Prof. Henry H. Giglioli, director), have been received fragments of pottery, shells, fragments of bone, and a piece of quartz from a kitchen-midden, near Port Blair, South Andaman, for which archæological objects and publications have been transmitted.

Birds.—Dr. Robert Collett, director of the Zoological Museum, Christiania, Norway, sent specimens of fishes.

Mr. H. E. Dresser, London, England, sent 4 specimens of birds' skins, representing 3 species, principally from Japan, in return for specimens already sent by the National Museum.

Birds' skins have been sent to Mr. Louis Molnar, Molna Szecsöd Post, Egyháros, Hollós, Hungary, in return for similar material received from him.

From the Rev. H. B. Tristram, The College, Durham, England, have been received 3 specimens of birds' skins, representing 3 species from New Guinea, in continuation of an exchange.

Fishes.—From the Indian Museum, Calcutta, India (through Mr. A. Alcock, curator), have been received in exchange specimens of deep-sea fishes, collected by H. M. S. *Investigator*, types of his own recent papers.

Mollusks.—Mr. M. Cossmann, of Paris, sent fossils from the Paris basin, in return for Claiborne shell marl already transmitted by the National Museum.

From Mr. Hugh Fulton, of Chelsea, England, have been received shells representing 25 species, for which an equivalent has been sent.

Insects.—Mr. E. Brunetti, London, England, sent specimens of European diptera, representing 90 species, for which an equivalent has been returned.

Mr. H. du Buysson, Chateau du Vernet, per Brout Vernet (Allier), France, transmitted specimens of European diptera, hymenoptera, and coleoptera, representing 71 species, for which 69 specimens of *Elateridæ* have been sent in return.

From the Imperial Austrian Museum, Vienna, Austria (through Dr. Brauer, curator), have been received type specimens representing 98 species of European *Muscidæ*, illustrating Brauer and Bergenstamm's classification, in return for 230 specimens of American *Muscidæ* already transmitted.

Marine invertebrates.—From the Canterbury Museum, Christchurch, New Zealand (through F. W. Hutton, curator), have been received Ophiurans, representing 3 species, also 7 species of starfishes.

Invertebrate fossils.—From the Australian Museum, Sydney (through Dr. Edward P. Ramsay, curator), have been received Australian graptolites, in return for specimens of a similar character already transmitted by the National Museum. A specimen each of *Polyodon* and *Amia calva* have also been sent to the Australian Museum, in continuation of an exchange.

Invertebrate fossils.—Prof. A. Pavlow, Moscow University, Moscow, Russia, has sent a collection of Mesozoic fossils.

Fossil plants.—From the University of Upsala, Sweden (through Dr. Theo. Fries), has been received a large collection of herbarium specimens, chiefly from Brazil, for which an equivalent has already been sent.

Botany.—From Prof. S. E. Lassimonne, à Yseure (Allier), France, have been received dried plants from the interior of France, for which a return has been sent.

Minerals.—From the Munich Academy, Munich, Bavaria (through Prof. P. Groth), have been received minerals in return for specimens already transmitted.

The K. K. Hofmuseum, Vienna, Austria (through Dr. A. Brezina, custodian), transmitted minerals from various localities as an equivalent for specimens already transmitted.

Geology.—From the Munich Academy, Munich, Bavaria (through Prof. P. Groth), have been received rocks, in return for material already transmitted, and Mr. H. J. Johnston-Lavis has forwarded in exchange volcanic materials from Naples.

The following table shows the annual growth of the collections since 1882:

Table showing annual increase in the collections since 1882.

Name of department	1882.	1883.	1884.	[1]1885–'86.	1886–'87.	1887–'88.	1888–'89.	[2]1889–'90.	1890–'91.	1891–'92.	1892–'93.
Arts and industries:											
Materia medica		4,000	4,442	4,850	5,516	5,762	5,942	[3]5,915	6,083	6,290	6,317
Foods		1,244	1,589	822	877	877	911	1,111	1,111	1,111	1,111
Textiles			2,000	3,063	3,144	3,144	3,222	3,288	3,288	3,288	3,288
Fisheries			5,000	9,870	10,078	10,078	10,078	10,080	10,080	10,080	10,080
Animal products			1,000	2,792	2,822	2,822	2,948	2,949	2,994	2,994	2,994
Graphic arts								600	974	1,174	1,434
Forestry											[4]725
Transportation and engineering								1,250	1,472	1,737	1,774
Naval architecture			600				600	600	600	600	[5]600
Historical relics				1,002	13,634	14,640	14,990	20,899	23,890	28,390	29,390
Coins, medals, paper money, etc				1,005							
Musical instruments				400	417	427	427	447	542	636	899
Modern pottery, porcelain, bronzes, etc				2,278	2,238	3,011	3,011	3,132	3,144	3,232	3,514
Paints and dyes				77	100	100	109	197	197	197	197
"The Catlin Gallery"				500	500	500	500	([6])			
Physical apparatus				250	251	251	251	263	273	273	291
Oils and gums				197	198	198	213	1,112	1,112	1,112	1,112
Chemical products				659	661	661	688				
Domestic animals								66	97	103	134
Ethnology			200,000	500,000	503,764	505,464	506,324	508,830	510,630	512,871	517,965
American aboriginal pottery			12,000	25,000	26,022	27,122	28,222	29,269	30,488	32,305	33,194
Oriental antiquities and religious ceremonial							850	3,485	3,487	3,487	3,945
Prehistoric anthropology	35,512	40,491	45,252	65,314	101,659	108,631	116,472	123,677	127,761	137,087	140,182
Mammals (skins and alcoholics)	4,660	4,920	5,694	7,151	7,811	8,058	8,275	8,836	9,301	[7]10,387	11,046
Birds	44,351	47,246	50,350	55,945	54,987	56,484	57,974	60,219	[8]62,601	68,416	70,671
Birds' eggs and nests			40,072	44,163	48,173	50,055	50,173	51,241	52,166	55,260	58,129
Reptiles and batrachians			23,495	25,344	27,542	27,664	28,405	29,050	29,935	30,939	33,240
Fishes	50,000	65,000	68,000	75,000	100,000	101,350	107,350	122,575	127,312	129,218	130,228
Vertebrate fossils								[9]512	521	1,582	1,595

Mollusks	33,375	....	400,000	460,000	425,000	455,000	468,000	471,500	476,500	482,725	488,325
Insects	1,000	....	151,000	500,000	585,000	595,000	603,000	618,000	630,000	646,500	653,500
Marine invertebrates	11,781	14,825	200,000	350,000	450,000	515,000	515,300	520,000	526,750	533,870	536,560
Comparative anatomy:											
Osteology	3,535	3,640	4,214								
Anatomy	70	103	3,000	10,210	11,022	11,558	11,753	12,326	12,981	[10] 12,555	13,185
Paleozoic fossils	....	20,000	73,000	80,482	84,491	84,649	91,126	92,355	92,970	93,839	95,039
Mesozoic fossils	....	....	100,000	69,742	70,775	70,925	71,236	71,305	79,754	82,853	89,293
Cenozoic fossils	(Included with mollusks.)										
Fossil plants	....	4,624	7,291	7,429	8,462	10,000	10,178	10,507	10,685	110,685	112,685
Recent plants	....	....	....	30,000	32,000	38,000	38,459	39,654	[11] 80,617	134,001	167,111
Minerals	....	14,550	16,610	18,401	18,601	21,896	27,690	37,101	44,236	48,357	[12] 49,150
Lithology and physical geology	9,075	12,500	18,000	20,647	21,500	22,500	27,000				
Metallurgy and economic geology	....	30,000	40,000	48,000	49,000	51,412	52,076	[13] 32,762	[14] 64,162	35,787	37,087
Living animals	....	....	....	....	....	220	491	(15)	....	....	....
Total	193,362	263,143	1,472,600	2,420,944	2,666,335	2,803,459	2,864,244	2,895,104	3,028,714	3,223,941	3,306,020

[1] No census of the collection taken for the six months ending June 30, 1885.

[2] The actual increase in the collections during the year 1889-'90 was much greater than appears from a comparison of the totals for 1889 and 1890. This is explained by the apparent absence of any increase in the departments of lithology and metallurgy, the total for 1890 in both of these departments combined showing a decrease of 46,314 specimens, owing to the rejection of worthless material.

[3] Although about 200 specimens have been received during the year, the total number of specimens in the collection is now less than that estimated for 1889, owing to the rejection of worthless material.

[4] Only a small portion of these specimens were received during the year 1892-'93.

[5] No estimate of increase has been made since 1889.

[6] Included in the historical collection.

[7] This is slightly in excess of the actual number of specimens on hand June 30, 1892.

[8] The total number of specimens in the department of birds in 1890-'91 was 62,806 instead of 62,601.

[9] Only a small portion of the collection represented by this number was received during the year 1889-'90.

[10] The decrease in this department for the year 1891-'92 was occasioned by the transfer of a large number of skeletons to the department of vertebrate fossils.

[11] Up to 1890 the numbers have reference only to specimens received through the Museum, and do not include specimens received for the National Herbarium through the Department of Agriculture. The figures given for 1890-'91 include, for the first time, the number of specimens received both at the National Museum and at the Department of Agriculture for the National Herbarium.

[12] During the year the curator and assistant curator have been unable to do any collecting by reason of other pressing work. This accounts for the fact that the increase in the collection is much less than during preceding years.

[13] Collections combined in October, 1889, under the department of geology. The apparent decrease of more than 50 per cent of the estimated total for 1889 is accounted for (1) by the rejection of several thousands of specimens from the collection, and (2) by the fact that no estimate of the specimens in the reserve and duplicate series is included.

[14] This number is, in reality, far in excess of the actual number of specimens available for exhibition and study, several thousand specimens having been discarded.

[15] Transferred to the National Zoölogical Park.

NOTE 1.—In compiling the annual statement of increase, allowance has not been made for the decrease in some of the collections, caused by distribution of duplicates or elimination of worthless material. It thus happens that the total number of specimens as given by the curators in their annual reports does not agree in all cases with the totals printed in this table.

NOTE 2.—The fact that the figures for two successive years relating to the same collection are unchanged, does not necessarily imply that there has been no increase in the collection, but that for some special reason it has not been possible to obtain the figures showing the increase.

CATALOGUE ENTRIES.

The entries made in the catalogue of the departments during the year have numbered 19,768. This is less than one-half of the number for 1892, but the decrease in this direction is readily accounted for by the fact that most of the curators were busily occupied during the entire year with the preparation of exhibits for the World's Columbian Exposition, and that all collections received have not yet been catalogued.

The following table shows the number of entries made in each department of the Museum:

Departments.	Number of entries.
Arts and industries:	
Materia medica	26
Domestic animals (for mounting)	31
Musical instruments	251
Transportation and engineering	31
Modern pottery, porcelain, bronzes, etc	304
Graphic arts	254
Forestry	33
Ethnology	3,161
American aboriginal pottery	249
Prehistoric anthropology	465
Mammals (skins and alcoholics)	1,344
Birds	491
Birds' eggs and nests	765
Reptiles and batrachians	2,301
Fishes	418
Vertebrate fossils	13
Mollusks (including Cenozoic fossils)	4,578
Insects	219
Marine invertebrates	962
Comparative anatomy:	
Mammals	
Birds	630
Reptiles and batrachians	
Fishes	
Paleozoic fossils	159
Mesozoic fossils	790
Fossil plants	29
Recent plants	567
Minerals	348
Geology	1,349
	19,768

COOPERATION OF THE EXECUTIVE DEPARTMENTS OF THE GOVERNMENT.

The growth of the Museum has always depended to a considerable degree upon the friendly cooperation of the various Executive Departments, and the encouragement which they have given to their officers to assist in the increase of the collections and to some extent in their administration.

With the exception of the special Museum of Hygiene maintained by the Navy Department and the Army Medical Museum, the nucleus of which are the surgical and pathological collections developed in the course of the preparation of the medical and surgical histories of the war, no departmental museums have been formed, and the collections which have incidentally resulted from their activities have been promptly transferred to the custody of the Smithsonian Institution.

The association of the Museum with the scientific bureaus whose work requires the use of Museum material, has always been intimate and friendly.

The collections of the Geological Survey are deposited in the Museum and incorporated with the general collection, while the interests of both establishments are advanced through the detail of certain of the scientific investigators connected with the Survey, to act as curators or custodians of the combined collections. In this way, Prof. Marsh, Mr. Walcott, Dr. White, Prof. Ward, and Prof. Clarke are attached to the scientific staff of the Museum.

Between the Fish Commission and the Museum a similar and even more intimate relationship exists, since the Museum undertakes to publish all the results of work upon the Fish Commission collections, except those which relate to economic fishes, or, have in some way a positive economic value. Dr. Rathbun and Dr. Bean, officers of the Fish Commission, have been for many years in charge of departments in the Museum.

With the Department of Agriculture the same kind of alliance has always existed. The National Herbarium, the depository of all the plants belonging to the Smithsonian Institution, as well as those which have been obtained by the Department of Agriculture, is under the charge of Mr. Coville, botanist of the Department and also an honorary curator in the Museum, and this collection is deposited in the Department of Agriculture. The insects, on the other hand, with relation to which Prof. Riley, the entomologist of the Department, holds a similar relationship, are in the Museum. The collections of the division of Economic Ornithology and Mammalogy are also deposited in the Museum, and are under the general control of Dr. C. Hart Merriam, chief of the division, who is practically, though not nominally, a member of the Museum staff. The chief of the Forestry Division of the Department, Dr. Fernow, is in charge of the somewhat chaotic mass of material illustrating the methods of forestry and the woodworking industries, which has as yet no definite place in either establishment.

The Department has a temporary museum in a wooden building upon its own reservation, in which are placed on view a large number of objects of interest to agriculturists, and which is the source of the material which the Department is often called upon to exhibit at expositions. A considerable mass of technological material is also kept in the National Museum, chiefly in storage, awaiting the time when it shall be found practicable to build up a technological collection in connection with the museum system of Washington.

Until within a few years, a military museum was maintained in one of the buildings belonging to the War Department. When this was abandoned in 1888, its contents were distributed among the armories and arsenals throughout the country, in each of which some sort of museum is maintained, but a considerable remainder, of a purely historical character, was transferred to the National Museum.

The old "National Cabinet of Curiosities" was long in charge of the Interior Department, this arrangement dating from the days when the old National Institute occupied a room in the so-called Patent Office building. This was transferred in 1858 to the Smithsonian Institution, but a thread of administrative connection still attached the Museum to the Department of the Interior until 1888, when, as narrated in the Report of the Museum for that year, the Secretary of the Interior, having investigated the law, decided that he had no official responsibility in connection with the Museum, and that the entire control should be left to the Smithsonian Institution.

These facts are mentioned simply to show that, by general consent, the museum interests of the Capital are becoming yearly more concentrated, in accordance with the manifest intent of Congress in the act establishing the Smithsonian Institution.

It seems proper in each Annual Report to make special acknowledgment of the kindly cooperation of the Executive Departments in the general work of the Museum.

The Department of State has, as always in the past, encouraged its consular officers to make collections, and has transmitted with favorable recommendations every request in behalf of the Museum, and these officers have almost without exception responded enthusiastically to the requests made of them. From such cooperation as this the Museum has everything to hope in the future, and were it possible to expend a few thousands of dollars through the consular service each year, additions of wonderful value might be obtained from every quarter of the globe.

Among those who have rendered special service during the past year should be mentioned Mr. Henry Andrews, U. S. Consul, Hankow, China; Mr. R. M. Bartleman, U. S. Legation, Carácas, Venezuela; Hon. Truxton Beale, U. S. Consul-General, Teheran, Persia; Mr. Erhard Bissinger, U. S. Consul, Beirut, Syria; Hon. S. H. M. Byers, U. S. Consul-General, St. Gall, Switzerland; Mr. J. Lyall, acting U. S. Consul, Singapore, Straits Settlements; Mr. Lewis Dexter, U. S. Consul, Fayal, Azores; Mr. Louis B. Grant, acting U. S. Consul-General, Cairo, Egypt; Mr. Augustine Heard, U. S. Consul-General, Seoul, Korea; Mr. Frank von Phul, Vice-Consul, San Juan del Norte, Nicaragua, and Mr. Alexander Webb, U. S. Consul, Manila, Philippine Islands. The character of their contributions is described under their respective names in the list of accessions in Appendix VI, as is the case also of those of the other persons mentioned in this same connection.

The Treasury Department has rendered most important service by facilitating the entry of material from foreign countries through the custom-house. In this connection special acknowledgments are due to Mr. John Quackenbush, by whom the packages received through the New York custom-house have been forwarded, in connection with his voluntary services as New York agent of the Smithsonian Institution. The following officers of the Treasury have been especially efficient in their efforts to increase the collections of the Museum: Dr. S. J. Call, U. S. Revenue Marine Service; Mr. J. A. Clampitt, U. S. Life-Saving Service; Mr. J. Q. Larner, Bureau of Engraving and Printing, and Mr. J. Henry Turner, U. S. Coast and Geodetic Survey.

Under the War Department the Quartermaster-General of the Army has greatly aided the Museum by furnishing transportation for bulky and cumbersome collections from the Western States, which without this assistance it would have been almost impossible for the Museum to have acquired. To Capt. John F. Rogers, U. S. Army, of the Quartermaster's Department, is due especial acknowledgment for his supervision of the transportation of the Museum World's Fair material from Washington to Chicago. The following-named officers of the Army have made valuable contributions: Dr. Timothy E. Wilcox, major and surgeon; Dr. J. C. Merrill, captain and assistant surgeon; Dr. Edgar A. Mearns, captain and assistant surgeon; Capt. John G. Bourke, Capt. Charles E. Bendire, Capt. Henry Romeyn, Capt. Sawyer, Lieut. H. C. Benson, Lieut. Wirt Robinson, and Dr. R. W. Shufeldt.

To the Navy Department acknowledgment is due for the detail of a medical officer to act as curator of the section of materia medica, while the following-named officers have contributed to the collections: Lieut. G. T. Emmons, Lieut. C. F. Pond, Ensign W. E. Safford, Dr. C. H. White, Messrs. J. S. Carpenter, A. S. Greene, and W. S. Moore.

Under the Department of the Interior, with the exception of the specimens contributed by Dr. Z. T. Daniel and Mr. Charles H. Thompson, officials of the Indian Office, the chief assistance has been from the U. S. Geological Survey. The extent of the accessions from this source is fully shown in the list of accessions, and special acknowledgments are also due the following officers of the Survey for their hearty cooperation: Maj. J. W. Powell, director; Mr. C. D. Walcott, Mr. Frank Burns, Prof. F. W. Clarke, Mr. Whitman Cross, Dr. J. S. Diller, Mr. B. K. Emerson, Mr. S. F. Emmons, Dr. W. F. Hillebrand, Dr. W. P. Jenney, Mr. L. C. Johnson, Dr. W. H. Melville, Dr. A. C. Peale, Prof. S. L. Penfield, Prof. I. C. Russell, and Dr. R. E. C. Stearns.

Several large and interesting collections have been received from the Department of Agriculture, its officers, and persons officially connected with it. A full report of the transmissions will be found in the list of accessions. The names of the contributors of collections are given in the following list: Dr. C. Hart Merriam, Prof. C. V. Riley, Mr. F. L. J. Boettcher, Dr. A. K. Fisher, Mr. Albert Hassall, Mr. Frank H. Hitchcock, Mr. Theodore Holm, Mr. J. F. James, Dr. George Marx, Dr. E. Palmer, Mr. E. A. Preble, and Mr. H. E. Van Deman.

The U. S. Fish Commission is so closely associated in its work with the Museum, and each year contributes so extensively to its collections, that it seems almost impossible to make special acknowledgments apart from those in the list of accessions. Reference must however be made to the assistance rendered by the following officers of the Commission: Col. Marshall McDonald, U. S. Commissioner of Fisheries; Dr. Richard Rathbun, Dr. T. H. Bean (both honorary curators), Mr. Vinal N. Edwards, Prof. B. W. Evermann, Dr. R. R. Gurley, Dr. Hugh M. Smith, Mr. C. H. Townsend, and Mr. S. G. Worth.

Since the Bureau of American Ethnology is, like the National Museum, a branch of the Smithsonian Institution, it is scarcely perhaps proper to refer to it under this head, except to say that its entire staff is constantly in cooperation with that of the Museum. During the past year special contributions have been received from the following persons connected with the Bureau: Maj. J. W. Powell, director; Mr. F. H. Cushing, Dr. A. S. Gatschet, Mr. H. W. Henshaw, Mr. F. Webb Hodge, Dr. W. J. Hoffman, Mr. James Mooney, and Mr. James C. Pilling.

SPECIAL EXPLORATIONS.

During the year special collections from various parts of the world have been made by explorers who have offered their services to the Smithsonian Institution, and many of whom have been supplied with instruments and materials for collecting.

Among the most interesting groups of objects sent in from abroad are those collected by Dr. W. L. Abbott in Kashmir and other parts of India; from the Seychelles, from Aden, and from Aldabra, Glorioso, and the adjacent islands. Dr. Abbott is a man of private means, whose interest in exploration and in field sports is happily supplemented by great enthusiasm for natural history work. His collections cover every branch of natural history, as well as ethnology, and are sent to the Museum with the understanding that they shall be promptly studied and described and the results published. A number of papers descriptive of his collections have already appeared, and others are in preparation. Dr. Abbott has previously sent much important material from Kilima-Njaro and other important localities in Africa.

Equally important have been the explorations of a similar character made by Mr. William Astor Chanler, of New York City, who has already sent in extensive ethnological, zoological, and botanical collections from Mashonaland, the Tana River, and other localities in East Africa.

Mr. H. C. Moore, while making explorations in South Africa, obtained a valuable collection of skins, skulls, and horns of antelopes and other large animals.

The Hon. William Woodville Rockhill, Third Assistant Secretary of State, brought with him from Tibet, as the result of his explorations under the auspices of the Smithsonian Institution, a most valuable collection of ethnological objects, which were acquired by the Museum, and a special catalogue of which is published in this volume.

Mr. P. L. Jouy, of the National Museum, was sent to Mexico to make special natural history collections.

Among the explorers within the limits of the United States, Dr. Edgar A. Mearns, U. S. Army, who is attached to the Mexican Boundary Commission, deserves special mention. Dr. Mearns has been furnished with every appliance for natural history work in the field, and at the request of the Museum has received special facilities for scientific work, and the material sent in by him, as shown in the list of accessions and the curators' reports, is of great value to science.

Prof. George P. Merrill, Mr. Barton A. Bean, and Mr. William Palmer, of the Museum staff, have also made collections in the field.

No allusion is made at this time to the important collections obtained especially for the exhibit of the Bureau of Ethnology and the Museum at the World's Fair. These will be referred to in the report of next year.

Offers to collect specimens are frequently received from persons contemplating a visit to some remote portion of the United States or to foreign countries. In the event that the locality is one from which material is desired, the National Museum has always been glad to supply collecting outfits, consisting of ammunition, traps, tanks, alcohol, etc. In this way a considerable amount of valuable material has been added to the collections, and the thanks of the Museum are due to its many friends who have thus exerted themselves in its behalf.

During the past year collecting outfits and materials of various kinds have been sent to the following persons: Mr. Harlan I. Smith, Madisonville, Hamilton County, Ohio; Dr. Edgar A. Mearns, U. S. Army, International Boundary Commisson, Bisbee, Ariz.; Mr. R. M. Bartleman, U. S. legation, Carácas, Venezuela; Mr. C. W. Richmond, Greytown, Nicaragua; Mr. J. H. Camp, Leopoldville, Congo District, Africa; Mr. Henry D. Woolfe, Valparaiso, Chile; Mrs. F. E. B. Latham, Micco, Brevard County, Fla.; Mr. Mark B. Kerr, Tumaco, Colombia; Dr. Einar Lönnberg, Orlando, Fla.; Prof. S. E. Meek, Fayetteville, Ark.; Mr. Frank X. Holzner, Nogales, Sonora; Mr. H. C. Ganter, Mammoth Cave, Kentucky; Dr. R. P. Bigelow, Kingston, Jamaica; and Dr. Leonhard Stejneger, of the National Museum.

DEVELOPMENT AND ARRANGEMENT OF THE EXHIBITION SERIES.

The overcrowded condition of the exhibition halls, which has been referred to in the annual reports for the past few years, continues to exist, and although it has been impossible to undertake any radical improvements looking toward the extension and rearrangement of the collections on exhibition, many minor alterations have been made.

The collections of oriental antiquities and religious ceremonial were temporarily removed to the east hall, next to the rotunda. The work of labeling the specimens on exhibition in the section of graphic arts has been continued and is now nearly finished. Additions have been made to the collection, but no new series have been begun. It was found necessary, owing to the crowded condition of the north hall, to place in temporary storage the entire collection of medals and coins. The collection of historical objects now on exhibition includes autograph papers and personal relics of many of the Presidents of the United States, and of soldiers, statesmen, and other eminent Americans, as well as memorials of important events in the history of the country. A number of specimens were withdrawn from the exhibition series in the section of transportation and engineering for exhibition at the World's Columbian Exposition, among them the locomotive "John Bull" and the valuable collection of early typewriting machines. In the section of materia medica some new material has been placed upon exhibition during the year, and the condition of the collection is very satisfactory.

The installation in the mammal hall of a collection of mounted heads of African antelopes, deposited by Mr. William Astor Chanler, has been commenced, and a few specimens have been purchased to fill gaps in the exhibition series.

In the department of birds a number of new specimens have been placed on exhibition. The work of mounting and labeling the collection of vertebrate fossils has been carried on during the year. The preparation of a series of restorations of extinct animals of North America is in progress, a number of specimens having already been completed. It is proposed to utilize the wall space above the cases for their exhibition. The work of arranging the material in the department of mollusks has been finished, and the collection now presents a very satisfactory appearance. A large portion of the exhibit series was sent to the World's Fair, requiring the preparation of fifty-six boxes of native and exotic species, from the duplicates, to take their place. A new series of North American insects, comprising 181 species, was placed on exhibition in the early part of the fiscal year. The collection of the department of marine invertebrates was overhauled after the completion of the repairs in the west hall of the Smithsonian building. Considerable time has been devoted to filling up gaps in the exhibition series in the department of comparative anatomy, and the collection of mammal skeletons is now nearly complete. The preparation of some new series for the exhibition hall is under consideration.

A large quantity of material was temporarily withdrawn from the exhibition series in the department of minerals for the World's Columbian Exposition. At the close of the exposition these specimens will be restored to their old places and new material will be added, involving a general rearrangement of and a considerable increase in the exhibition series. The material sent by the department of geology to the World's Columbian Exposition was prepared with a view to making it fill a definite place in the collection when returned. A large proportion of the time of the curator has been devoted to the exhibition series, and important improvements have been made in the manner of displaying specimens in the table cases.

LABELS.

During the fiscal year ending June 30, 1893, there were printed, 10,814 descriptive labels (aggregating nearly 250,000 copies), or more than double the number usually printed in the course of a year. The large increase was caused chiefly by the necessary preparation of labels for the exhibit of the Museum at the World's Columbian Exposition at Chicago. All the departments of the Museum were represented in the series.

LIBRARY.

The Museum maintains a working library, covering the fields of zoology, botany, paleontology, geology, geography, anthropology, archaeology, and the arts. This library is kept in the Museum buildings, and is quite distinct from the general library of the Smithsonian Institution, which is deposited in the Library of Congress, which it to a certain extent duplicates. A large proportion of the books in the Museum library are lent by the Institution. During the past year the number of publications added to the library was 501 volumes of more than 100 pages, 1,457 pamphlets, besides parts of serials, of which 272 volumes, 821 pamphlets, and 6,981 parts of serials were those temporarily retained for the use of the Museum from the accessions of the Smithsonian Institution. The remainder were obtained by gift, exchange, or purchase.

In connection with the central library of reference, nearly every department has its own "sectional" or working library. The largest of these are the sectional library of geology with 1,400 titles, of entomology with 1,200, of ornithology with 880, of oriental antiquities with 862, and of mineralogy with 650.

CONTRIBUTIONS OF THE YEAR TO SCIENTIFIC LITERATURE.

A large number of papers upon scientific subjects have been published by officials of the Museum and other specialists. These are, for the most part, based on collections in the Museum, and are referred to by title in the bibliography, Appendix VII. The authors of these papers are ninety-two in number, thirty-seven of whom are connected with the Smithsonian Institution or the National Museum. The papers referred to in the bibliography number 341, and relate to the following subjects:

Subjects.	By Museum officers.	By other investigators.
Administration	1	
American aboriginal pottery	1	
Archaeology	12	
Biography	3	1
Birds	20	23
Chemistry	1	
Comparative anatomy	1	
Ethnology	10	7
Fishes	16	13
Fossils	33	6
Geology	14	2
Graphic arts	6	
Historical collections	1	
Insects	40	11
Mammals	3	4
Marine invertebrates	3	3
Materia medica	1	
Mineralogy	3	
Mollusks	15	3
Oology	1	
Oriental antiquities and religious ceremonial	6	
Plants	12	20
Reptiles and batrachians	6	8
Transportation and engineering	3	
Miscellaneous	21	7
Total	233	108

PUBLICATIONS OF THE MUSEUM.

The publications are issued in four series, as follows:

Annual report.—This report constitutes the second part of the report of the Smithsonian Institution to Congress, and, commencing with the year 1884, has been printed as a separate volume. The reports for 1881, 1882, and 1883 were printed in the reports of the Smithsonian Institution for those years, and were reprinted in pamphlet form. The series of Annual Reports of the Museum now consists of nine volumes (1884–'92, inclusive).

It is customary to send a copy of the report to each person who has sent specimens to the Museum during the year.

In the appendix to each volume are printed papers, usually illustrated, and based upon, or explanatory of, collections in the National Museum. A limited edition of each paper is printed in separate form for special distribution, and is found especially useful in the encouragement of gifts and in exchange for publications.

The edition of the report, which was in 1890 10,000, and in 1891 19,000, was in 1892 reduced to 10,000, thereby greatly diminishing its usefulness. Of the 10,000 now printed, 7,000 copies are for the use of the Institution and the Museum, the remaining 3,000 copies being reserved for distribution by Senators and Representatives. The report is sent to about 4,000 libraries at home and abroad, to contributors to the collections, and to the correspondents of the Museum who are interested in its welfare.

Proceedings.—The series of "Proceedings of the U. S. National Museum" was begun in 1878, and was established for the purpose of securing prompt publication of discoveries in the Museum, and is printed in octavo. Vols. I and II were reprinted in Vol. XIX of the "Miscellaneous Collections of the Smithsonian Institution," and Vols. III and IV were reprinted in Vol. XXII of that series. This method of reprinting was, however, not carried beyond the fourth volume. Each article in the series has its special number, and the total number published up to August 1, 1894, was 1,000.

Since the beginning of Vol. XII, commencing with No. 761, the papers in this series have been printed separately, in advance of the publication of the bound volume, and have been distributed among specialists interested in the topics discussed.

The complete volumes are reserved for public institutions and libraries.

List of volumes of Proceedings.

Volume.	Year.	Pages.	Plates.	Text figures.	Papers.
I	1878	iv, 520	8	5	1-61
II	1879	iv, 499	7	....	62-101
III	1880	v, 589	2	....	102-184
IV	1881	v, 676	1	13	185-256
V	1882	xi, 703	12	52	257-342
VI	1883	vii, 530	14	10	343-396
VII	1884	viii, 661	2	....	397-469
VIII	1885	viii, 729	25	12	470-548
IX	1886	viii, 714	25	5	549-598
X	1887	viii, 771	39	11	599-675
XI	1888	xi, 703	60	145	676-760
XII	1889	viii, 686	23	14	761-789
XIII	1890	viii, 665	38	11	790-841
XIV	1891	vi, 750	34	3	842-886
XV	1892	vi, 508	84	5	887-918
XVI	1893	x, 808	84	13	919-975

Vol. XVII, for 1894, was in progress of publication when the manuscript of this report was sent in, and is now in press. Papers 976-1000, which form parts of this volume, had already been published separately.

The Bulletin.—The publication of the "Bulletins of the U. S. National Museum" was commenced in 1875 for the purpose of illustrating the collections of natural history and ethnology belonging to the United States. Forty-six numbers have been printed, all in octavo.

The first 16 numbers of the Bulletin were reprinted in Vols. XIII (Nos. 1-10), XXIII (Nos. 11-15), and XXIV (No. 16) of "Miscellaneous Collections of the Smithsonian Institution," and were distributed in this form to institutions and libraries, but this method of reprinting and distribution has been discontinued.

The Special Bulletins.—The "Special Bulletin of the U. S. National Museum," a series in quarto, corresponding to the "memoirs" of many similar establishments, was established in 1892 for the publication of elaborate, illustrated monographs.

LIST OF SPECIAL BULLETINS.

No. 1. Life Histories of North American Birds, with special reference to their breeding habits and eggs. By Maj. Charles Bendire, U. S. Army., pp. i–viii, 1–446. Plates i–xii. 1892. This work treats of the game birds, pigeons, and birds of prey, the arrangement adopted being that of the American Ornithologists' Union.

No. 2. Oceanic Ichthyology. By G. Brown Goode and Tarleton H. Bean. (In press.) An exhaustive monograph of the deep-sea fishes of the world. The volume will contain upward of 600 pages and will be accompanied by an atlas of 123 plates, with more than 400 figures of deep-sea fishes.

At the time of sending the present volume of the annual report to press the papers published in the Proceedings (including those belonging to the sixteenth and seventeenth volumes, which have been issued in separate form or are in type) have reached the number of 1,000, and it is intended in a later report to print a list of all papers, with annotations and indexes, based upon Museum material, which have been published by the Museum, as well as by other departments and bureaus of the Government.

TYPE SPECIMENS.

Those specimens which have been actually in the hands of investigators engaged in original research, and especially those which have been described in the establishment of new species and genera, and have furnished the material for illustration, are recognized by all museums as the most precious among their possessions. They form a part of the archives of science; they are the vouchers for the accuracy of the investigator who has studied the material, and are invaluable to subsequent students as a means for testing the accuracy of his conclusions. They are, therefore, the foundation stones of the fabric of natural science, and it is impossible to be too careful in preserving them.

The value of types is at present differently estimated in the several branches of natural history, but with the adoption of the stricter methods of modern work, and of more strenuous rules in regard to priority in nomenclature, the value of types will constantly be more highly appreciated. Unique specimens are, by common consent, priceless. It often happens that investigators in other cities need to refer to types, and applications are often made for their loan from our collection. The Museum has always endeavored to aid its collaborators in their researches by placing collections at their disposal for study, and it seems ungracious to refuse such requests, especially when they come from those who have lent types to us and are willing to do so in the future. Still, the subject is a serious one, and it seems time that a strong position should be taken, not only for the security of the treasures in our own custody, but also to encourage other institutions to care better for their own. It should also be said that a knowledge of the fact that a given museum surrounds its types with the strongest safeguards will lead investigators not connected with public museums to place their types in its custody, and that the concentration of all types in a few large museums will be extremely advantageous to science.

With these considerations it has been determined to establish certain provisional regulations governing the preservation and loan of type specimens belonging to the National Museum. The collaborators of the Museum will not be restricted in their study of type specimens further than may be necessary to insure their proper care. These regulations are as follows:

(1) Each curator is responsible for the type specimens in his custody.

(2) No types will be lent, or allowed to be taken out of the building, exceptions being made only in the case of a limited number of museums with which arrangements have been made for the interchange of type specimens.

(3) Every type specimen in the National Museum should be distinguished by a peculiar label.*

(4) A special book should be kept by each curator in which all the types under his custody should be entered under their catalogue numbers, with full data, including a reference to the place of description.

(5) In the annual report of each department a statement should be made concerning the condition of the types in its custody.

(6) When, in the judgment of a curator, it is necessary for the safety of the types in his custody that they be kept in a separate case, arrangements will be made to enable him to do this, and curators are requested to call attention to such necessity whenever it arises. They will be held responsible for injury to type specimens resulting from a failure to take precautionary measures of this kind

(7) The collection of types in the National Museum will be open to inspection and study by any investigator. Curators may, however, impose such restrictions as they deem necessary to protect themselves from losses for which they are by these regulations held responsible, provided that the free use of the material, under the provisions already laid down, is in no way impeded thereby.

In future discussions of this subject it may be said that *a type* in the strictest sense of the word is one which has been used by the author of a systematic paper as the basis for detailed study, and as the foundation of a specific name. In cases where a considerable number of specimens have been used, it is desirable to separate one or more as being the *primary* types, while the other specimens which may have been used in the same study for the purpose of comparison, may be regarded as *collateral* types. It will not always be necessary to apply the same rules to the use of the collateral types as to the primary types. The importance of a type is, of course, greatly increased when it has been used by a succession of authorities, and it is important that the data regarding such use should be carefully recorded.

*NOTE.—In the department of mammals and of birds a red label is used, and it is suggested that, as far as possible, a similar label should be used in the other departments.

MATERIAL LENT FOR INVESTIGATION.

It has always been one of the aims of the National Museum to aid, as far as possible, persons who are engaged in scientific investigation. A few of the more important transactions of this character are here mentioned.

A number of specimens of insects of the genus *Trypoxelon* and family Pemphredonidæ were sent to Mr. William Fox, of the Academy of Natural Sciences, Philadelphia, to be used in the preparation of a review, which was afterwards published in the Transactions of the American Entomological Society. The African Myriapods, collected by Dr. Abbott, were sent to Mr. O. F. Cook, Huntington, N. Y., for study and special report. Forty-two specimens of birds of the genera *Myrmeciza*, *Synallaxis*, *Empidochanes*, *Myiarchus*, *Thryothorus*, and *Basileuterus* were sent to Mr. Frank M. Chapman, of the American Museum of Natural History, New York City, to be used in the preparation of a paper on the birds of the island of Trinidad.

A number of specimens of Scorpænoid fishes were lent to Prof. C. H. Eigenmann, Bloomington, Ind. There were forwarded to Lieut. Wirt Robinson, Atlanta, Ga., specimens of birds forming part of a collection made by him in Curaçao and on the coast of Colombia. This material was desired for use in the preparation of an illustrated work on the ornithology of the region indicated. Skins and skulls of field, meadow, and harvest mice were lent to Dr. J. A. Allen, of the American Museum of Natural History, New York City; also specimens of the Thamnophiline genus *Dysithamnus*, for comparison. Twenty-one specimens, representing 17 species of birds, were sent to Mr. Osbert Salvin, London, England, for examination in connection with the preparation of Vols. XVI and XXI of the Catalogue of Birds of the British Museum. They are mentioned specifically in the latter volume. One hundred and four specimens of birds were lent for examination to Mr. Witmer Stone, of Philadelphia, Pa. These were to be used in the preparation of a paper on the Birds of British Columbia, based on a collection made by Mr. S. N. Rhoads. Skulls of bats were sent to Dr. Harrison Allen, of Philadelphia, who is engaged in the preparation of a monograph on the North American species.

Dr. A. S. Packard, of Providence, R. I., who has been engaged in the study of the North American Bombycid moths, was allowed free access to the Museum collections, and such species as required a more detailed study were forwarded to him. Extended anatomical researches have been made by Prof. E. D. Cope, in connection with his new ophiological system. Prof. F. W. Goding, of Rutland, Ill., has been aided in his study of Fitch's types of insects. The collection of fossil plants from the Trinity rocks, near Glen Rose, Tex., were studied by Prof. William M. Fontaine, of the University of Virginia, who made an elaborate report on the same. Dr. Samuel H. Scudder, of Cambridge, Mass., has been engaged in an investigation of the Orthoptera of the Galapagos Islands. The work of Dr. O. P. Hay on the Indiana reptiles was completed during the present year. The skulls of bears and fur seals in the Museum collection were studied by Dr. C. Hart Merriam, U. S. Fur-seal Commissioner, in connection with the Bering Sea controversy.

The Museum collection of plants in alcohol was temporarily transferred to the Department of Agriculture for the use of Mr. Theodor Holm in connection with his studies on the life histories and growth of North American plants. The sponges belonging to the Museum collection of the family Hexactinellidæ, collected in the Pacific Ocean by the steamer *Albatross*, have been sent to Prof. F. E. Schulz, of Berlin, who is preparing a revision of the group. He will submit a paper, based on an examination of these specimens, for publication in the Proceedings of the Museum. Arrangements have also been made with Dr. Axel Göes, of Sweden, to study the Foraminifera collected in the Gulf of Mexico, the Caribbean Sea, and the Pacific Ocean, and with Mr. John Murray, of Edinburgh, to study certain deep-sea deposits obtained by the Fish Commission steamers.

THE USE OF THE GOVERNMENT SCIENTIFIC COLLECTIONS BY STUDENTS.

Congress, by a joint resolution approved April 12, 1892, has formally thrown open all the literary and scientific collections in Washington for the use of students, with the definitely avowed purpose of encouraging the establishment and endowment of institutions of learning at the National Capital.

This most important and liberal action is in accord with the tendency toward the establishment in Washington of a great national university, or of a group of institutions practically national in their scope, for the advancement of higher learning.

The new law does not in any respect modify the attitude of the Smithsonian Institution and National Museum, for from the very beginning students and investigators have been welcomed and given every facility for their work, and within the past fifty years thousands have availed themselves of these privileges.

The action is significant, however, and especially welcome, because it shows that the legislative branch of the Government is disposed to encourage in every way the use of the collections in Washington, already vast in extent, for the one purpose for which, above all others, they are adapted.

The resolution is printed below in full:

Whereas large collections illustrative of the various arts and sciences and facilitating literary and scientific research have been accumulated by the action of Congress through a series of years at the National Capital; and

Whereas it was the original purpose of the Government thereby to promote research and the diffusion of knowledge, and is now the settled policy and present practice of those charged with the care of these collections specially to encourage students who devote their time to the investigation and study of any branch of knowledge by allowing to them all proper use thereof; and

Whereas it is represented that the enumeration of these facilities and the formal statement of this policy will encourage the establishment and endowment of institutions of learning at the seat of Government, and promote the work of education by attracting students to avail themselves of the advantages aforesaid under the direction of competent instructors: Therefore,

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the facilities for research and illustration in the following and any other Governmental collections now existing or hereafter to be established in the city of Washington for the promotion of knowledge shall be accessible, under such rules and restrictions as the officers in charge of each collection may prescribe, subject to such authority as is now or may hereafter be permitted by law, to the scientific investigators and to students of any institution of higher education now incorporated or hereafter to be incorporated under the laws of Congress or of the District of Columbia, to wit:

One. Of the Library of Congress.
Two. Of the National Museum.
Three. Of the Patent Office.
Four. Of the Bureau of Education.
Five. Of the Bureau of Ethnology.
Six. Of the Army Medical Museum.
Seven. Of the Department of Agriculture.
Eight. Of the Fish Commission.
Nine. Of the Botanic Gardens.
Ten. Of the Coast and Geodetic Survey.
Eleven. Of the Geological Survey.
Twelve. Of the Naval Observatory.

Approved, April 12, 1892.

VISITORS.

The number of visitors to the Museum building during the year ending June 30, 1893, was 319,930, an increase of 50,105 over the preceding year; and to the Smithsonian building, 174,188, an increase of 59,371 over the preceding year.

The monthly register of visitors during the fiscal year ending June 30, 1893, is as follows:

Year and month.	National Museum building.	Smithsonian building.
1892		
July	21,846	10,132
August	18,776	8,704
September	122,484	75,392
October	28,434	9,194
November	12,139	5,229
December	14,992	7,284
1893.		
January	10,819	5,291
February	12,656	5,869
March	36,760	25,544
April	12,778	7,415
May	16,662	7,976
June	11,584	6,094
Total	319,930	174,188
Approximate daily average on a basis of 313 days in the year	1,022	556

Number of visitors to the Museum and Smithsonian buildings since the opening of the former in 1881.

Year.	Museum building.	Smithsonian building.	Total number of visitors to both buildings.
1881	150,000	....	150,000
1882	167,455	152,744	320,199
1883	202,188	104,823	307,011
1884	195,322	91,130	286,452
1885 (January–June)	107,365	60,428	167,793
1885–'86	174,225	88,960	263,185
1886–'87	216,562	98,552	315,114
1887–'88	249,665	102,863	352,528
1888–'89	374,843	149,618	524,461
1889–'90	274,324	120,894	395,218
1890–'91	286,426	111,669	398,095
1891–'92	269,825	114,817	384,642
1892–'93	319,930	174,188	494,118
Total	2,988,130	1,370,686	4,358,816

QUESTIONS OF CORRESPONDENTS AND REQUESTS FOR IDENTIFICATION.

In an editorial in the London "Athenæum" not long ago, it was said that there is not a department of the British Government to which a citizen has a right to apply for information upon a scientific question. This seems hard to believe, for I can not think of any scientific subject regarding which a letter, if addressed to the scientific bureaus in Washington, would not receive a full and practical reply. It is estimated that not less than 20,000 such letters are received each year. The Smithsonian Institution and National Museum alone receive about 6,000, and the proportion of these from the new States and Territories, which have not yet developed institutions of learning of their own, is the largest. An intelligent question from a farmer on the frontier receives as much attention as a communication from a royal academy of sciences, and often takes more time for the preparation of the reply.

A large number of specimens are sent to the Museum each year by correspondents in different parts of the country for examination and report. Although very little benefit to the Museum is derived from the labor thus performed, it has always been the policy of the Museum to assist its correspondents in this direction as far as practicable. By far the larger portion of the material received is geological. Quantitative analyses, however, can not be undertaken, owing to lack of facilities for such work. A record is kept of each package received for examination, and should the specimens prove to be of sufficient interest or value, they are added to the collections of the Museum and given an accession number.

There were received for examination during the present year 516 lots of specimens, embracing Nos. 1775 to 2290, inclusive. A detailed list of the material so received, arranged alphabetically by name of sender, is given in Appendix v.

MEETINGS OF ASSOCIATIONS IN WASHINGTON DURING THE YEAR.

Washington has during recent years been selected as the place for holding meetings of a large number of national and international societies of all kinds. Each year has seen an increase in this respect, and the matter has now become of such importance (not so much, however, on account of the number as of the character of the societies) that it seems proper to make mention of it in a report which is intended to contain in a general way a reference to all efforts to develop and encourage research, both from a scientific, economic, and a literary point of view. There is probably no place in the country better suited for such meetings. The seat of government and center of political activity has become accustomed to receiving and entertaining organizations.

Of late years numerous learned bodies have met in various halls in this city. The many attractions of the capital, the opportunity of easy access to public record offices and the Congressional Library, the general interest of the Government buildings, combine to make Washington a favored city for such purpose. During the last year these conventions were fewer than usual owing to the concentration of so many interests in Chicago during the World's Fair.

The meeting of the American Ornithologists' Union continued in session for three days (from November 15 to 17), and during that time a large number of interesting papers were presented.*

As in previous years, the annual meeting of the National Academy of Sciences was held in the lecture hall of the Museum, the session lasting four days, from April 18 to 21.†

The course of Saturday Lectures, which was discontinued two or three years ago, was resumed in March, 1893, under the auspices of the Anthropological Society of Washington. The course consisted of a series of lectures, somewhat popular in their character, on various subjects relating to ethnology. The lecturers were all men well known in their chosen fields of investigation.‡

* In Appendix VIII the titles of these papers are given.

† A list of the papers read before the Academy appears in Appendix VIII.

‡ A list of the lectures comprising this course will be found in Appendix VIII.

The following table indicates the number and dates of Saturday lectures since 1882:

Year.	Date of first and last lecture.	No. of lectures.
1882	March 11, April 29	8
1883	January 13, March 31	12
1884	January 5, April 26	17
1885	February 7, May 2	12
1886	March 6, May 8	10
1887	March 12, May 7	12
1888	February 18, May 5	12
1889	March 9, May 11	10
1890	February 1, April 3	10
1891		
1892		
1893	March 25, May 13	8
Total		111

NECROLOGY.

Dr. George Vasey, botanist of the Department of Agriculture and honorary curator of the Department of Botany in the U. S. National Museum, died on March 4, 1893. Dr. Vasey was born on February 28, 1822, at Scarborough, Yorkshire, England. He graduated from Berkshire Medical College, at Pittsfield, Mass., in 1848; was appointed botanist of the Department of Agriculture in April, 1872. He also held the position of honorary curator of botany in the U. S. National Museum. His principal work has been upon grasses, and among other papers he published a Descriptive Catalogue of Native Forest Trees of the United States, 1876; Grasses of the United States: a Synopsis of the Tribes with Descriptions of the Genera, 1883; Agricultural Grasses of the United States, 1884; Descriptive Catalogue of the Grasses of the United States, 1885; Report of Investigations of Grasses of the Arid Regions, two parts, 1886–'87; Grasses of the South, 1887; Agricultural Grasses and Forage Plants of the United States, a revised edition, with 114 plates of agricultural grasses, 1889; Illustrations of North American Grasses: Vol. I, Grasses of the Southwest, 100 plates with descriptions, 1891; Vol. II, Part I of the same, Grasses of the Pacific Slope and Alaska, 1892; Monograph of the Grasses of the United States and British America (Vol. III, No. 1, Contributions from U. S. National Herbarium), 1892. Dr. Vasey was a member of the Biological and Geographical Societies of Washington, and a Fellow of the American Association for the Advancement of Science. He was appointed delegate from the Department of Agriculture and the Smithsonian Institution to the Botanical Congress in Genoa in September, 1893.

At a meeting of the officers of the U. S. National Museum held on March 6, 1893, the following minute and resolution were adopted:

In the death of Dr. George Vasey the National Museum has lost a faithful and efficient officer and the science of botany an able and indefatigable worker. As botanist of the Department of Agriculture and curator of the National Herbarium for twenty-one years, Dr. Vasey's name has become known to all botanists throughout the world, and his contributions to science form an indispensable part of the working library of every botanist. His familiarity with the flora of all parts of the United States, especially with the plants of the great West, was unrivaled, and caused his opinion to be sought and respected upon all critical questions relating thereto. He was the recognized authority on this side of the Atlantic in the important department of grasses, and his publications relating to these have great economic as well as scientific value.

Dr. Vasey was uniformly gentle and kind, manifesting a warm interest in the progress of younger botanists and beginners, always ready to give his valuable time and counsels to those who went to him for assistance, and many who are now well known in the science owe their success in large part to the encouragement and stimulation received from him. In this way the circle of his influence was much wider than would be naturally inferred from his quiet life and long confinement to a single post of duty.

To the world at large Dr. Vasey was distinguished for his modest and unobtrusive character, his kindly disposition, and his genial manners. A model husband and father, an estimable neighbor, and a good citizen, his loss will be deeply felt by all who knew him: Therefore,

Resolved, That the sympathies of the officers of the National Museum and Smithsonian Institution be extended to the widow and family of the deceased, and that a copy of this minute and resolution be transmitted to them.

Capt. John Melmoth Dow, who for many years, as agent of the Pacific Mail Steamship Company at Panama, was a warm and valued friend of the National Museum, died in New York City on November 4, 1892. Capt. Dow was an Honorary Fellow of the Zoological Society of London, a member of the New York Geographical Society, of the Academy of Natural Sciences of Philadelphia, of the Society of California Pioneers, and of the Société Humanitaire et Scientifique du Sud-Ouest de la France.

Lieut. T. Dix Bolles, U. S. Navy, who for many years has cooperated with the National Museum, particularly in matters relating to ethnology, and from whom valuable contributions to the collections have been received, died during the year.

COLUMBIAN HISTORICAL EXPOSITION IN MADRID.

In accordance with an act of Congress approved May 13, 1892,* the President appointed a commission to represent the United States at the Commemoration of the Fourth Centenary of the Discovery of America, which took place in Spain in the latter part of 1893.

This commission consisted of Rear-Admiral S. B. Luce, U. S. Navy; James C. Welling, LL.D., chairman of the executive committee of the Smithsonian Institution, and the Assistant Secretary of the Institution.

The Spanish Government had, in pursuance of the royal decree of January 9, 1891, provided for a series of international celebrations, most prominent among which were two historical expositions to be held in

*See Appendix X.

Madrid simultaneously and in adjacent buildings—one the Exposicion Historico-Americana, the other the Exposicion Historico-Europea.* This idea of two expositions, held simultaneously in the same building, and each illustrative of the other, was a novel one, and proved in the end a success. The plan is discussed in the report of his excellency Don Antonio Cánovas del Castillo to the Queen Regent, and the classification of the two expositions indicates fully the intention of the exposition authorities.*

The Historic American Exposition was intended to illustrate the civilization of the New Continent in the Pre-Columbian, Columbian, and Post-Columbian periods, while in the Historic-European Exposition were shown the civilization of Europe, and particularly of the Iberian Peninsula, at the time when the New World was discovered and colonized. It was intended that, by the aid of these exhibitions, students and visitors might be enabled to understand the state of artistic and industrial civilization in Europe and America in this important epoch, and to realize the influence which the one may have exercised upon the other.

The period which the authorities in charge of the Historic-European Exposition desired especially to illustrate was that during which American history was most closely identified with that of Europe. This extends from 1492, when the Spanish caravels first reached the Antilles, to 1620, when the *Mayflower*, setting forth from a Dutch seaport, brought the English Puritans to New England.

"The Columbian epoch," extending from the end of the fifteenth century through the first third of the seventeenth, includes most of the principal initial efforts for the exploration and colonization of the new continent by Europeans. By bringing together, in a retrospective exhibition, what remains to illustrate the arts and industries of Europe at this time, it was the desire of the Spanish authorities "to teach the people of to-day what were the elements of civilization with which, on the side of the arts, Europe was then equipped for the task of educating a daughter, courageous and untamed, but beautiful and vigorous, who had risen from the bosom of the seas, and who, in the course of a very few centuries, was to be transformed from a daughter into a sister—a sister proud in aspiration and mighty in power."

The exhibits in this Historic-American Exposition were divided into three great series: One to include American prehistoric remains, the first indication of the existence of man in caves, neolithic monuments, lacustrine dwellings, and the arms and utensils of this primitive age; the second to illustrate the characteristics of the American aborigines just prior to the discovery, and the third, the period of discovery, of conquest, and of European influence, up to the middle of the seventeenth century.

It was arranged to have also a special group of objects illustrating

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* See Appendix x.

the voyages of Columbus and his companions, as well as previous efforts for the discovery of a new continent.

The expositions were held in the new building erected for the national library and museums in the Paseo de Recoletos, and in the adjacent grounds and buildings of the Parque de Madrid.

There were other celebrations in connection with the expositions, beginning with a congress at Huelva, on the 2d of August, in commemoration of the four hundredth anniversary of the departure of the vessels of Columbus from the port of Palos, followed by a session of the Congress of Orientalists, which took place in the Alcazar in Seville, continuing from the 1st to the 6th of October; and the Ninth Congress of Americanists, in the Convent of La Rábida, at Huelva, from the 7th to the 11th of October. On the 11th of October was unveiled at La Rábida a monument to commemorate the discovery of America. There were other festivals and naval demonstrations at Huelva at various times from the 3d of August to the 3d of November.

The management of the commemoration was vested in a royal commission, the president of which is the prime minister of Spain, his excellency Don Antonio Cánovas del Castillo. Commissions were organized in all of the Spanish-American republics, by which very extensive exhibits were secured, and special commissions were also appointed by the governors of the Spanish provinces and the governors-general of the Antilles and the Phillippine Islands.

Our commissioners, by a circular issued June 1, 1892, invited the cooperation of persons having objects of any kind suitable for exhibition on this occasion, requesting them to be sent to the Smithsonian Institution for transmission to Madrid. Objects intended for the World's Columbian Exposition in Chicago were, by a special arrangement, to be forwarded direct from Madrid to Chicago in ample time for installation.

It was especially urged that authors and publishers of books relating to the periods of discovery and conquest, and the colonial history of the several European settlements in America, should exhibit them.

The executive work was, by agreement between the three commissioners, divided as follows: The commissioner-general to reside in Madrid through the exhibition, and in addition to his ceremonial functions to direct the return of the exhibits; Dr. Welling was to prepare a general report upon the exhibition, and the writer to have charge of the preparation of the exhibits, their transportation to Madrid, and their installation in the exposition building.

In connection with this work, representatives of the two anthropological departments of the Museum were detailed to accompany the exhibits of the Museum to Madrid, and to assist in the installation and maintenance of the display. These were Dr. Thomas Wilson, curator of prehistoric anthropology, and Dr. Walter Hough, assistant curator of ethnology, who was sent to represent Prof. Mason, the curator, the latter, on account of the preparations in progress for the Chicago Exposition, in which his department was so extensively concerned, being unable to leave Washington.

The Department of State and the Bureau of American Republics sent the extensive collection of portraits of Columbus, and of monuments and historic localities connected with the discovery of America, which had been prepared by Mr. William Eleroy Curtis, Chief of the Bureau; and Mr. Curtis, in person, superintended the installation of this exhibit while serving as special envoy of the Government to invite the attendance of a representative of the royal family and the Duke of Veragua, Columbus' lineal descendant and representative, to attend the World's Columbian Exposition.

Mr. Stewart Culin, curator of the museum of archaeology and paleontology of the University of Pennsylvania, was detailed by the university to represent the institution upon that occasion, and to install a large collection of archaeological objects from its museum.

Mr. J. Walter Fewkes, director of the Hemenway Expedition, by which an extensive display of ethnological objects from the Southwest was exhibited, also accompanied the commissioner to Madrid and remained during the entire period, in company with his assistant, Mr. J. S. Owen.

Mr. Stewart Culin was appointed secretary of the commission; Lieut. J. C. Colwell, U. S. Navy, was detailed by the Navy Department as disbursing officer, and Mr. Henry Horan, of the National Museum, was sent to attend to the unpacking and the mechanical work of mounting the exhibits in Madrid.

The writer sailed for Southampton August 4, accompanied by Dr. Hough and Mr. Culin, and arrived in Madrid August 19, remaining until the exhibits had arrived and the work of installation well begun. In the meantime, the opening of the exhibition having been deferred until October 30 and his share of the work having been practically accomplished, except what could be done even more satisfactorily by other officers of the Museum already in Madrid, he left Madrid for Washington September 17. Dr. Wilson was recalled, by reason of family troubles, November 3. Dr. Hough remained until the close of the exhibition, February 4, and superintended the packing and return of the exhibits, the last of which reached Washington in April, in time, as had been anticipated, for use in Chicago.

It should be said that a large part of the exhibits sent from the National Museum to Madrid were selected from those already mounted for display at the World's Fair, and that cases were sent from Washington for the accommodation of all the exhibits sent from the United States, which occupied a floor space of 16,000 square feet. It was found, however, that the Spanish Government had provided a certain number of cases admirably suited for exhibition—an entirely unprecedented act of forethought and liberality in exhibition management—and it was consequently found unnecessary to unpack all the cases which had been provided.

Dr. Welling, who had proceeded as far as London, was called home by business connected with his university and was unable to return. He therefore resigned, and Prof. D. G. Brinton, of the University of Pennsylvania, was appointed to serve in his stead. Dr. Brinton, accompanied by his assistant, Mr. H. C. Mercer, arrived in Madrid December 1 and spent several weeks in studying the collections in both expositions and writing his report.

Mrs. Zelia Nuttall, well known for her remarkable studies in Mexican archæology, was present for a considerable time at the exhibition, and made an exhibit in the section of the United States.

The exhibit of the United States was received with great favor, and the friendly action of our Government in sending so extensive and impressive an exhibit was greatly appreciated. Among the results to which it led were the acceptance of the invitations of the Government to the royal family and to the Duke of Veragua, the liberal response of the Spanish Government to the invitation to participate as an exhibitor in the World's Fair, and, incidentally, the increased interest on the part of the Latin-American Republics, many of which confessedly did far more at Chicago, inspired by the example of the Government of Spain, than they would otherwise have done; and, incidentally, may it be also noted, the speedy completion of an important commercial treaty between the United States and Spain, which had long been pending, and which, until the action of Congress in connection with the Madrid Exposition was known, seemed scarcely likely to be agreed to by Spain.

The exposition was undoubtedly a most successful one, and in many respects one of the most noteworthy international expositions ever held, although from its very nature it appealed more to the scholar than to the general public, and consequently, so far as popular attendance and financial outcome were concerned, was not noteworthy. The various governments which participated were represented by men of character and high scholarship, and the catalogues published by Spain and by the several governments were important contributions to history and archæology, and several valuable reports have already been printed by governments and specialists. Others are in preparation, and the effects of the comparative display made will appear in historical and archæological literature for a long time to come. A most noteworthy indirect result was the publication of a considerable number of important historical monographs and collections of documents hitherto unpublished, which appeared in Madrid during the period of the exposition.

The Ninth Congress of Americanists, held at Huelva, was one of the most successful which has been held, and American scholars participated prominently in the discussions. The report of this congress, when published will contain much that is of importance to archæology.

The customary system of medals and diplomas prevailed at the exposition. A grand diploma of honor was given to the Government of the United States. Twelve gold medals with diplomas, eighteen silver medals with diplomas, thirteen bronze medals with diplomas, were awarded, while thirty-six exhibitors received honorable mention. A list of the medals and diplomas is given in the Appendix,* which contains also a list of exhibitors.

It should be said in this connection that with the exception of the exhibits sent by the Bureau of American Republics, the University of Pennsylvania, and the Hemenway expedition these mentioned in this list were all sent at the request of the Smithsonian Institution, and were mounted, labeled, and exhibited as a part of its display. Indeed, as was recognized by the Government, but for the enthusiastic cooperation afforded by the Smithsonian Institution it would have been impossible in the short time between the passage of the appropriation and the opening of the exposition, to have prepared and forwarded an exhibit which would have been at all creditable to the United States.

Incidentally may be mentioned the award by the Queen Regent of the grand cross of naval merit to Admiral Luce, and that of commander in the Royal Order of Ysabel la Católica to Mr. W. E. Curtis, Dr. Thomas Wilson, and the writer; and that of knight in the same order to Messrs. Hough, Fewkes, and Culin, while the latter was also honored by election to membership in the Royal Academy of History.

At the close of the exposition Admiral Luce, who remains in Europe, dissolved his official connection with the commission, and the closing up of the business of the commission is left in the hands of the writer as Acting Commissioner-General, with the assistance of Dr. Hough as executive officer, while the other commissioner, Dr. Brinton, is engaged upon the preparation of the general report, which will be published during the coming year, supplemented by a catalogue of the objects displayed by the Museum, by Messrs. Wilson and Hough, and papers by Mrs. Zelia Nuttall, upon "Ancient Mexican Feather Work;" by Dr. Hough, on "Ancient American Pottery as shown at the Exposition," and Mr. H. C. Mercer, on the "Chipped Stone Implements shown at the Exposition."

In view of the great interest in this exposition, and of the fact that the publication of the official report may be somewhat delayed, I include here a discussion of the exposition in its general aspects from the pen of Dr. Walter Hough.†

The display which was brought together in Madrid was the greatest collection of Americana ever under one roof, and brought into contrast, side by side the art of the Old World at the time of the discovery and that of the New World, roughly on either side of the discovery.

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*Appendix, No. x.

† A description of the Exposition in some of its features was printed by Dr. Thomas Wilson in the "American Naturalist" for September and October, 1893.

Joined with its admirable historical and scientific motive, there was great taste displayed in the presentation of the valuable material. No doubt a similar opportunity to compare the ethnological and archæological products from so many American sources will be far in the future.

The American exhibits dealt mainly with the archæologic aspect, except that of the United States, which was a comprehensive collection, setting forth in plain terms the interdependence of archæology and ethnology. The twenty-four States and countries in large proportion displayed ethnological specimens only for decoration or in an unsystematic way. There were about 250,000 pieces on view, of which the United States, Mexico, and Spain showed the larger number. The floor-space measured 5,000 square meters; of this space the United States and Mexico occupied about one-third.

The United States section occupied six rooms, embracing a long list of exhibitors, both institutions and private persons. The National Museum furnished a portion of the large ethnological and archæological collections destined for Chicago, selected by Profs. Mason and Wilson. It furnished also specimens of the animals encountered by the early explorers, maps, pictures, photographs, transparencies, illustrations from books on American ethnology, publications of the Smithsonian Institution, enlargements, maps, paper money, medals, etc. There was also a library of historical works, and a collection of writings on American archæology and ethnology presented by the authors.

The Bureau of Ethnology contributed models of Indian pueblos, the great linguistic maps, pottery, photographs, pictures, and four cases containing a fine series from seven pre-Columbian mines and quarries explored by Mr. W. H. Holmes. These especially attracted a great deal of attention, as did the splendid series of relief maps exhibited by Mr. E. E. Howell.

Philadelphia was well represented in the exhibition. The University of Pennsylvania displayed publications and monographic archeological collections from Pennsylvania, Ohio, North Carolina, and Florida. The enterprise of the Numismatic and Antiquarian Society and the Academy of Natural Sciences, of Philadelphia, is very commendable. The former showed a large collection of medals, paper money, and publications. The Academy of Natural Sciences exhibited 44 crania from the Morton collection, representing 35 tribes and 14 American stocks. The Philadelphia collections were in the efficient charge of Mr. Stewart Culin.

The Bureau of Latin American Republics showed a magnificent gallery of Iconographia Columbiana, supplemented by Mr. Curtis's own collection. These pictures formed a well-arranged and attractive feature of the exhibition.

One large hall was devoted to the Tusayan pueblos and was filled with the collections made by Dr. Fewkes, under the munificent patronage of Mrs. Hemenway, and presented especially the religion and symbolism of the Hopi. Sand pictures and altars were shown for the first time. The ancient pottery was exceptionally fine, and there was a large series of religious paraphernalia. Photographs, water-color drawings, maps, and publications completed an exhibit for which Dr. Fewkes is to be highly congratulated.

Mexico brought a magnificent collection of antiquities, chiefly pottery and stone filling over 50 cases. There were casts of famous antiquities, copies of the codices, pictures, models, and photographs of the ancient ruins, and notably a grand model of the Temple Mayor of Cempoala (Vera Cruz), measuring 12 by 18 feet in area. A fine central case held the gems of the collection, such as obsidian masks, vases, labrets, mirrors, tiles, a carved notched femur (which is probably part of a musical instrument like those used in New Mexico and Arizona), copper rings, jade objects, etc. The series of obsidian rings of hour-glass shape, with wide, flat rims, worked down to a thickness of one-sixteenth of an inch and highly polished, are very remarkable specimens of lapidary work. They would tax Mr. McGuire's skill and ingenuity in stone-working. Many such problems confront one at every step in this vast and practically unworked material. One room with 11 cases is devoted to the Zapotecs. In the whole collection the relics of 23 ancient civilizations were shown. Mr. Troncoso, director of the National Museum of Mexico, is a host in himself and has an efficient staff of collaborators.

There were a number of small collections from Cuba, San Domingo, the latter consisting of human remains, weapons, idols, pottery, etc., of the aborigines, and historical relics of the age of the discovery, and from Bolivia, Argentine Republic, Brazil, Chile, Honduras, Salvador, and Paraguay.

The bulk of the numbers from Guatemala were of pottery. There were many finely carved stone images, an oval dish of polished quartz of bluish tint, and an exquisitely carved bead of jade. There was also a curious globular pottery whistle or flute, somewhat like an ocarina, with four holes, giving five tones, running from C to F sharp, and a pottery trumpet, with four pipes blown from one mouthpiece. I do not know who is to be held responsible for the exhibition of an Egyptian scarab and a bronze *shubti* as American relics. This collection contains three rare and beautiful vases ornamented with Quiche Maya hieroglyphics. Dr. Brinton believes that these are the only Quiche Maya inscriptions yet discovered.

Nicaragua displayed a small collection of pottery in red outlined with black, stone implements, rude and polished, and a few pieces of jade and gold work.

Costa Rica occupied two halls with a fine collection, mostly of pottery and stone carvings, contained in 40 cases. The walls were covered with paintings of the excavations, maps, and photographs. This collection was shown at Chicago. The interesting gold objects exhibited by Mr. Alfaro in Washington in 1891 were displayed in one case, and two other cases held jade carvings. The pottery resembles that of Nicaragua, and consists of burial jars, cups, vases, spoons, cooking pots, etc. The stone carvings are particularly good ; they are principally of friable, volcanic rock. The ornamented metates, skillfully worked stools with their seats upheld by human figures ; the magnificent sacrificial stone, 6 feet long and 25 inches wide, finely sculptured at the head and along the margins and edges, are especially noteworthy, while the series of stone masks, standing and sitting figures, animal and human heads, give an enlarged idea of the progress of the sculptor's art in ancient Costa Rica.

Seventy-two pounds of wrought-gold objects, 452 in number, and 383 objects of copper, invested Colombia's room with a peculiar interest. These consisted of bowls, canteens with full-length human figures, necklaces, animal and human forms, etc. There also was much pottery of a superior order from the Quimbayas, Chibchis, Chiriquis, the Department of Tolma and Antigua ; a fine series of photographs was also displayed. There was a small ethnological collection from the Cunas and Guahibos. This collection was well installed and catalogued by Mr. Ernest Restrepo, and was a great credit to the Republic of Colombia.

Of the 11 cases from Ecuador 10 were of the lustrous, dark, and usually indurated pottery, which is very interesting from its curious forms, among which occur long, narrow, amphora-like jars with lugs, tazzas sitting on a high, perforated foot, exactly counterfeiting Korean mortuary pottery, and square jars of Chinese form, giving this collection a strange phase. There was one case of copper axes, bored stone axes, star club heads, labrets, and charms of worked stone. It is rather remarkable if articles which are evidently separators for pottery are found in ancient excavations in Ecuador.

Peru exhibited a large number of pottery bottles of red and black ware in human and animal forms from the huacas of the Yuncas. Four of these are in the form of human heads, in which the nose is represented as having been eaten away, evidently by some disease which a Spanish physician diagnoses as lupus. Dr. Brinton expresses the opinion that the disease characterized is syphilis. The Yunca pottery also shows trace of Spanish influence. There were some good specimens of gold working, textiles and wood carving.

Uruguay sent a small but well-displayed collection of stone implements, comprising bolas, club heads, arrowheads, scrapers, hammer stones, mortars, stone and pottery vessels, bone awls, pitted stones, and many polishers and grinders. There were a number of probable club heads, square to oblong in shape, roughly broken from schistose rock, which slightly resemble the obsidian heads from Easter Island in the Thomson collection at the National Museum. The greater part of these remarkably rude objects have four cusps, and are constricted midway apparently for purposes of hafting. Some of the pebbles with one smooth central pit are apparently head pieces of a drill. A good series of photographs of stone implements accompany this collection. These specimens are interesting, since they are from a new field.

Spain showed the treasures of the Archeological Museum and the Museum of Natural Sciences, which are especially rich in Peruvian and Mexican archeology. From the former country there were numerous mummies, hafted stone implements, and other objects taken from graves, cult apparatus, stone and metal work, splendid textiles and feather work, musical instruments, and an immense series of pottery, in which are many groups of pieces evidently from the same mold. The exquisite Peruvian coat from the Royal Museum was a marvel, which for fineness of fabric, color, ornamentation, and finish it is difficult to believe has ever been surpassed. There were also many other examples of fine Peruvian textiles.

The famous Troano and Cortesian codices were displayed, and also a great deal of stone and metal work, pottery, etc., from Mexico. One case of pottery and some stone idols, labeled "frauds," were very suggestive. There were also small groups of specimens from South and Central America, and ethnologica from various states. The Alaskan and other Indian specimens were in few cases localized, the objects having been collected before such information was deemed necessary. The museums labor under this difficulty, and there is a good field for comparative work. The Northwest coast masks, hats, adzes, carvings, armor, etc., were collected more than one hundred years ago by the Malespina expedition and range from British Columbia to Sitka. A collection of arrowheads, sent by Dr. W. J. Hoffman, occupied a prominent place. The museum of Natural Sciences had on exhibition a large collec-lection of minerals and botanical specimens brought back from America by Spanish explorers. The museums have been benefited by the infusion of new blood; Mr. Narciso Sentenach and José Ramón Mélida are young men, who promise to do excellent work.

The Portuguese exhibit contained a few American specimens used for decoration, with other objects from different quarters of the globe, forming what was apparently a fisheries exhibit. There were splendid paintings and metal work of the fourteenth and fifteenth centuries, which should have been installed in the European exposition upstairs. Two rare Sandwich Island feather cloaks and some helmets were shown. The locality of few specimens was known.

Austria contributed an excellent exhibit of mound pottery and other objects from the United States. This collection was under the care of Dr. Wilhelm Hein, of Vienna, who is an enthusiastic worker in the field of ethnology.

Germany sent casts of the sculptures of Santa Lucia Cozumahualpa, in Guatemala, consisting of large bas-reliefs, monkeys' heads, human figures, and a large brazier in the Ethnographical Museum of Berlin. Two antique Mexican feather shields from Stuttgart, and a great number of illustrations and photographs were displayed. The gold objects from Colombia in this collection were in an elegant burglar and fire-proof case, so fitted that the tablets upon which the specimens were mounted could be lowered into a steel vault and secured for the night. Dr. Edward Seler, of the Royal Ethnographical Museum of Berlin, was in charge, and most of the specimens were collected by him.

Sweden showed the fine collection of early maps, globes, and manuscripts of Baron Nordenskjöld, the collections from the Chukchis and the Eskimo of Port Clarence, procured on the voyage of the *Vega*, the photographs, models, and specimens resulting from the explorations of Gustav Nordenskjöld in Colorado two years ago, and the objects brought from Nicaragua and Costa Rica by Dr. Carlos Bovallius. These gentlemen were in charge and arranged a very creditable display.

Norway exhibited a full-sized model of a viking boat. The original was taken from a tumulus on the east coast of Norway in 1880.

The display of Denmark was composed of two parts, viz, one illustrating the life of the Eskimo of Greenland, the other the grade of civilization of Iceland in the middle ages. The collection was well presented, and showed in a small way the Eskimo man and woman, their houses and utensils, methods of transportation, and some of their arts. The wood carvings, textiles, and model of the house of the Icelanders were very interesting.

The documents under the efficient charge of Dr. Zaragoza were of the highest interest, and included priceless letters of Columbus and other discoverers and conquerors, with manuscripts of the early explorers and priests.

The exposition was visited by many of the Americanists after the meeting at Huelva, among whom may be mentioned Dr. Hamy, Baron de Baye, M. Adam, Charles Read, and others. The orator, Castelar, was a close student of the collections, and the intelligent interest displayed by many scientific men at the Spanish capital was very gratifying.

On the whole, the exhibition was not well attended, as its patronage was largely drawn from Madrid and the immediate vicinity, there being also little advertising and no excursion rates offered by the railroads. This, however, does not detract from the commendation which should be given to the Spanish Government for the enlightened idea and the consummate ability with which this idea was carried out by the delegate general, Señor Don Juan Navarro Reverter, Rev. Padre Fita, and their colleagues.

When it comes to describe the sister exhibition, setting forth the state of European culture at the era of the discovery, there is a great difficulty in merely indicating the priceless rarities displayed. No one imagined that after the many spoliations which the Iberian Peninsula has suffered, so many art works survived.

When inquiry was made for the relics demonstrating the splendor of Old Spain, the church alone could respond with the evidences of her traditional fostering and conservation of art.

Thus it happens that the exhibit largely comprised ecclesiastical objects from the more important churches of Spain. Without doubt not above one-fifth of the precious relics existing among the churches and religious institutions were represented in Madrid, due to the poor communications in Spain and no general antiquarian interest among the people.

There is a saying that "tapestries are like weeds in Spain." Mr. Charles H. Read, of the British Museum, from whose admirable description of the exposition I shall more than once quote, says:*

"The most striking feature of this part of the exhibition, and that which distinguishes it from any other, is the extraordinary display of Flemish and Spanish tapestries and carpets and Persian and Arab textiles with which the walls of every room on the upper floor are lined. Most of the Flemish tapestries from the Escorial and the other royal palaces are already well known, both from their being generally shown to visitors and from the excellent photographs published by M. Laurent, of Madrid. But in addition to these, many from private collections and from religious establishments, some of them fully as important as those of the royal collections, have come to light and are now seen for the first time. The most striking case of this kind is probably that of the Cathedral of Zamora. The authorities

*Read, C. H., Report to the British Museum on the Historical Exhibition at Madrid. London, 1893.

at Zamora were asked to contribute to the exhibition some of their works of art, and sent among other things several beautiful tapestries of the fifteenth century, of great size, of fine design, and in a good state of preservation. With this consignment came a statement that if more tapestries were required for the decoration of the walls, the chapter possessed fifty others. It seems impossible that so wonderful a series of precious tapestries could have lain entirely unknown for centuries, and doubtless unseen except by such as attended the services at the cathedral on certain special festivals. Such a case, and it seems to be by no means an isolated one, illustrates in a forcible manner the unknown riches of the religious establishments of Spain, unknown even to the comparatively few persons in the country who are specially interested in such matters."

The display of church vestments was very large, but the majority were overloaded with embroidery in gold and silver and belong to the sixteenth and seventeenth centuries. The older vestments are invariably of higher quality. One of these is described by Mr. Read:

"First of these comes a cope of opus anglicanum of the end of the thirteenth century, belonging to the Cathedral of Toledo, and stated to have been the property of Cardinal Gil de Albornoz (1367). It is of the usual semicircular shape, embroidered in many colors with sacred subjects and figures of saints under canopies. Along the straight side are six figures of bishops, a king and queen, and the rest of the surface is entirely covered with a radiating design, the central subjects being the Coronation and Assumption of the Virgin, the Nativity, the Annunciation, and the Virgin and Child, and on either side of the outer edge figures of the following saints: John the Evangelist, Edward the Confessor, Laurence, Mary Magdalen, Ethelbert, Dunstan, Margaret, Catherine, Thomas of Canterbury, Olave, Stephen, Helen, Dionysius, Edmund the King, John the Baptist, and a bishop without name. The inner circle is composed of eight figures of apostles: Saints Paul, Simon, Philip, James, Andrew, Thomas, Bartholomew, and Peter. The names are inscribed upon scrolls in Lombardic capitals. In the spandrels are placed birds, executed in brilliant colors. It will be seen that certain of the saints are especially English, and thus help to confirm the cardinal's description of his own cope, as well as the internal evidence of the design and method of work, both of which point to the conclusion that the cope is of English work. In addition to this, however, I am able to add by the kind offices of Senor Canovas del Castillo, through Don G. J. de Osma, the following extract from the will of the original owner: 'Item lego eidem ecclesiæ Conchensi caput argenteum cum reliquiis beati Blasii ponderis quadraginti octo marchorum. Item pluviale meum pretiosum de opere anglicano. Volo tamen quod dicti decanus et capitulum nunquam possint illa alienare, vendere, seu impignorare, etc.'" *

The Cathedral of Mondoñedo sent the sandals of Don Pelayo II, of Cedeira (1199-1218). The shoes or sandals reach to the ankles, made of stuff originally purple, with bands of gold thread across the instep and down the middle of the foot to the toe. The soles are nearly 2 inches thick, somewhat like a Chinese shoe, and the edges are ornamented with stiff interlacing floral scrolls of the style usually found in works of art at this period.

In reference to the large display of church plate, Mr. Read says:

"There can be no doubt that so rich a collection of material for the study of Spanish gold and silversmiths' work has never been before brought together. A great proportion of the objects exhibited is naturally of the late sixteenth and early seventeenth centuries, but many fine pieces of earlier and more interesting periods are to be found. The silver chalice and paten of late thirteenth or early fourteenth century from Toledo Cathedral are remarkable among these, both for the beauty of the work and for the unusually large size of both objects. The chalice is more than a foot in diameter at the base and 17 inches in height, while the paten is 16 inches

* Genesius de Sepulveda. Opera. Madrid. 1780.

in diameter. The latter is sunk in the center, the depression having twelve foliations around the edge, and within it is engraved the crucifixion with the Virgin and St. John, the whole inclosed within a stiff floral border. The chalice has a plain bowl, widening rapidly upward (and in this it differs conspicuously from Spanish chalices of later date), the knob is ornamented with the evangelistic symbols in repousse, and the stem is quite plain except for two bands of quarterfoil tracery. The base is in design much like that of the Dolgelly chalice, viz, it has three concentric bands of flat lobes or scallops in slight relief, upon which are engraved figures of angels, and the edge is molded in twelve foliations supported upon a slight tracery of quarterfoils, and in each foliation is a figure of an apostle. This chalice is as early in date as any in the exhibition, and its large size renders it the most remarkable. It is stated in the catalogue that it was probably used on Holy Thursday, when two hosts are consecrated, one being reserved till Good Friday, when it is consumed by the priest. This second host is usually kept in a chalice of large size and ancient work.

"Another chalice and paten of much the same date is sent from the Cathedral of Santiago, and possesses additional interest from the decoration of the knop being in niello. The paten is of similar design to that from Toledo, but the central subject represents Our Lord seated within an engraved quaterfoil, the engraved design being all within a depression of eight foliations. The bowl of the chalice is again of the shallow form, and the stem is slender and somewhat longer than is found in English and other northern chalices. The knop has circular medallions with nielloed scrolls, but without any sacred emblems. The base is plain, with the exception of a narrow engraved border of stiff scroll work, and on one side is engraved a group of the Virgin and Child seated, with a female figure kneeling in adoration at the side. The presence of this group is the only instance in the exhibition of the practice so common in English chalices, of placing a cross or other sacred symbol upon the side of the chalice to be held next the priest during the celebration of mass. The catalogue attributes this chalice and paten to the twelfth century, but it should, I think, be placed somewhat later, i. e., in the early thirteenth century.

"Of later chalices there are a great number, dating from the early sixteenth century to the middle of the seventeenth, a period which would include by far the greatest proportion of all the church plate exhibited. It will be sufficient to notice three of the sixteenth century as being fine examples of their kind, and at the same time characteristic of the style peculiar to the period.

"The first, from the Cathedral of Seville (No. 49), is remarkable in having a cover which fits closely into the bowl and has a central socket, into which the foot of some object has been placed, perhaps a short cross. The bowl is deep and has round the base outside a row of pear-shaped settings containing knot-work medallions of cloisonne enamel, the patterns being an inheritance from the Moorish artists, and their prototypes are seen in perfection upon the sword of Boabdil, belonging to the Marques de Viane. The stem, knop, and foot are Gothic in design, the tracery being fairly pure in style; but the foot is ornamented with embossed designs of the rich, floriated style, common in Spanish and Portugese objects of the Renaissance. This mixture of Gothic and Renaissance motives is, in fact, the remarkable characteristic of the church plate of the peninsula in the sixteenth century, and the exhibition furnishes numberless examples of it. This chalice has upon the foot the arms of an archbishop in enamel.

"The second chalice, of about the same date, from the Cathedral of Valencia (No. 50) is of a somewhat different design, and in many details recalls the drawings of cups by Holbein, though here again the border at the foot is of Gothic tracery. But for an unfortunate heaviness of the base this vessel would be of very graceful design. It is singularly secular in its details, which are chiefly composed of festoons of flowers, and fruit, and cherubs, and upon the knop tiny cupids riding dolphins. The only indications of its sacred character, apart from its shape, are six circular medallions let into the foot, which are engraved with the Crucifixion and other designs of the same character. These have once been enameled, but the enamel has now entirely disappeared, owing to the vessel having been passed through the fire to freshen the metal, a practice which seems to have been common in Spain, as a large proportion of the enameled details on church ornaments of all kinds are now bare metal, owing to this somewhat barbarous practice. The third chalice, from the church of Osuna, has, perhaps, a more peculiar feature than either of the others, in having the bowl and knop surrounded with small bells, ten on the former and six on the latter. It is usually rich in detail, with the customary mixture of Gothic elements with florid Renaissance foliage. The knop is composed of rich canopy work beneath, or rather inside, which are seated figures of apostles, and upon the foot are highly-embossed scenes from the Passion. The inscription on the paten is a curious instance of the misspelling of Latin, *pax domini sit senpir bobiscem.*

"Among the paxes are several deserving of mention. The Cathedral of Valencia sends the most beautiful of these. It is of fine gold, elaborately chased and enameled in brilliant colors. The front is in the form of a chair, in which is seated the infant Saviour, the whole of the figure being enameled; the back of the chair is covered with elaborate scroll work of beautiful design and filled with enamel; the lower part of the chair beneath the seat is hollow, and has two small doors which open and display a group modeled in the round, and representing the Nativity. The pediment above the back of the chair is edged with two elegant scrolls in openwork, and at the base of the pediment on each side is a figure of a warrior standing. The back is minutely engraved and enameled with sacred subjects, the Adoration of the Magi, Christ among the Doctors, etc. This specimen is by far the most remarkable of all the paxes exhibited, and its attribution to the hand of Cellini is much more reasonable than is generally the case with works assigned to the artist. A certain delicacy and refinement in the designs points rather to Italy than to Spain as the country of its origin, though whether it is really by Cellini is a far more difficult point to decide. This appears in the will (A. D. 1566) of Don Martin de Ayala, archbishop of Valencia, who bequeathed it to the cathedral.

"A pax of perhaps greater interest, and of nearly equal beauty, is that from the Cathedral of Ciudad Real. The interesting feature about this specimen is that it has for its central subject a carving in black stone of Byzantine period, representing the Descent into Hell, with the legend above, *H. Anactacic*, i. e., Resurrection, and behind the figure of Our Lord stand the emperor and empress, crowned and with halos round their heads. The frame is in the best style of the Spanish Renaissance, of silver gilt and enameled, and it bears the date 1565. On either side are square projecting stages supported on well-designed caryatid figures, and containing four figures of saints, and at the top is a frieze in relief representing a combat between horsemen and men on foot; the pediment represents the Assumption of the Virgin, with figures of Virtues at the sides, and the apex is surmounted by an enameled figure of Our Lord holding the orb. The back, though by no means so richly decorated as the front, is of great beauty. The handle is formed of a female caryatid figure with wings, surmounted by Cross of Santiago, and toward the bottom the terminal base of the figure divides into two serpent scrolls, which curve toward the edges of the pax. For beauty of line this charming figure compares favorably with any work of the period, and it would be difficult to speak in terms too high of the masterly character of the design.

"Another pax possessing unusual features is that from the Cathedral of Parazona. The central portion, if not the whole pax, is certainly of north Italian work. It is of silver gilt, and has in relief the subject of the Flagellation, a group of well-modeled figures of late fifteenth century style. The peculiarity of the work is that the flat background is painted in enamel with a mountainous landscape, in the style common in north Italy at this period, and of which there are several good examples in the British Museum collection. The inscription at the bottom of the central subject, '*Borgia Car. Mon. Regal.*' would seem to indicate that it was the property of Cardinal Borgia, archbishop of Monreale, in Sicily, who died in 1503. The frame is of uncommon design, and may be of the same work as the center, but it is possible that it was added in Spain. Two pilasters which form the sides are somewhat poor in execution, and the cresting round the curved top of the pax is curiously classical in feeling, and consists of groups of two winged lion monsters, looped together at the neck and tails, the junctions of the latter being surmounted by palmettes. There is a certain clumsiness about the design which is scarcely Italian.

"The only other pax worthy of special note is that from the Cathedral of Madrid-Alcala, an excellent example of Spanish Gothic metal work of the late fifteenth or early sixteenth century, without any trace of later style. The subject is the Descent from the Cross, modeled in high relief and enameled; this is surmounted by an elaborate canopy filled with rich tracery, and on each side are pinnacles with buttressed bases, surrounded with figures of saints. The back is good in design, the handle being a plain semicircle pierced to represent a dragon, while the edges are bordered with bold tracery in relief. The work of the whole is excellent, and little is wanting to make it a beautiful object, but a certain squatness and want of elegance of form in the design suffice to make it fall short of true beauty.

"One of the best specimens of Spanish Gothic, and a remarkable object for its great size, is the monstrance from the Cathedral of Jativa, which, without the modern silver base upon which it is now placed, stands 5 feet high. The occasion of its construction was in itself notable. Pope Alexander VI was a native of Jativa, and had this gigantic monstrance made for the Cathedral from the first consignment of silver received from America. The shape is very graceful and consists of a stem rising from a many-sided base and supporting a shaped oblong platform, the edges of which are bordered by a light arcade. Upon this platform rest four pillars which sustain the roof, and from this rise three slender towers pierced with tracery, with rich canopy work at their bases. The actual monstrance, or receptacle for the Host, is a circular disk of a size proportionate to the rest, with an elaborate openwork border of what in England would be called late Tudor style, and it is held up by two angels kneeling on opposite sides. The effect of this beautiful object is much destroyed by the whole having been regilt, and by the enamels in the foot having been renewed; but in spite of this drawback it remains one of the most beautiful, and it is the most conspicuous, objects of ecclesiastical art in the exhibition.

"The processional crosses, of which a very large number are shown, form a very interesting and instructive series, possessing many features differing from similar objects in other countries. The Marques de Cubas exhibits a good collection, which is supposed to represent all the types from the eleventh century to the seventeenth. Whether the series begins so early is perhaps doubtful, but some of the examples may well be of the twelfth, or more probably, thirteenth century. These earlier crosses are flat plates of copper, gilt, and decorated with champlevé enamels in the style of Limoges, but neither so well drawn nor so perfect in execution as the French examples, though it is by no means improbable that the Spanish enamel of this kind is an imitation of that of Limoges. The most noticeable peculiarity in design in the Spanish crosses of this period is the presence of four oval plates upon the four limbs of the cross, projecting beyond the edges of the limbs, and in each plate is a subject in enamel, but those upon the horizontal arms seem always to be the Penitent and Impenitent Thieves. The form of the cross remains practically the same up to the sixteenth century, and the four oval plates are frequently found at that date, though these two are then no longer reserved for the two thieves, but are sometimes devoted to figures of saints, the Evangelists, etc.

"A very large cross from the Diocese of Vich merits special notice. It is of silver, nearly 5 feet in total height, the surface quite plain, except for a circular disk upon each arm, in the center of which is a sixfoil with a subject in translucent enamel. This cross differs so much from all the others that it might be thought to be of foreign make, but the probability is that it was made in Catalonia, and perhaps near Vich itself, where the influence of French designs would be more felt than in the more southern parts of Spain. It is attributed, and, I think, rightly, to the fifteenth century.

The Spanish crosses of the sixteenth and late fifteenth centuries have a character fully as peculiar and national as those of earlier date. Those of the sixteenth century are characterized by a richness of detail that makes them look at a little distance like filigree work, but a closer examination shows that this rich effect is produced by a multiplicity of canopies, edgings, and pendants, symmetrically designed in a semi-Gothic style. The richest, and at the same time the best, in general design, of this kind is that from the Cathedral of Osuna (Seville), though many others, from Salamanca, Astorga, and other cathedrals are very good. Nearly all, however, have suffered, and their enameled details are destroyed by having been passed through the fire to render them bright."

Another class of objects are the caskets used as reliquaries. Some of them are of pure Moorish work, with Saracenic designs and inscriptions. Mr. Read describes the earliest and most important of these, a large casket of carved ivory with mounts of champlevé enamel, from the Provincial council of Valencia.

"The whole surface is carved in relief with scrolls of conventional leaves of the style common in the ornamentation of the Alhambra, the stems being interlaced. On the sides are hunting scenes; on the body of the casket are broad borders formed of pairs of birds and deer, alternating, each pair facing, and above them a series of triple arches. The cover is in the same style, but that the borders are much simpler, and in one panel a piece from another casket has been inserted. The enameled mounts are an interesting feature and form an important landmark in the history of enameling in Spain. The patterns of these are the simplest geometrical designs, and the colors blue and white; but there is every appearance of these being the original mounts, and if this be the case they must be of the middle of the eleventh century; for the great historical value of this object consists in its bearing the date of its manufacture, A. H. 441 (A. D. 1049-'50), the name of its maker, Abd-er Rahman ibn Zeyyan, who made it at Cuenca for Hosam-ud-Daulat Abu Mohammad.

"Another casket, of nearly equal importance, comes from the Cathedral of Gerona, where it is usually placed upon the High Altar. This, though equally of Arab work, is very different in style as well as material. It is entirely covered with plates of silver gilt, embossed with open scrolls inclosing symmetrical flowers, the details of which are inlaid with niello. Around the edge of the lid, as in the previous example, is a Cufic inscription stating that it was made in Cordova by the order of Al-Hakam II, the Caliph of Spain, more celebrated for his studious habits than for warlike achievements, who died in A. D. 976. The inscription states that Al-Hakam ordered it for his son, and gives the name of the maker (Riano, p. 12). But for this inscription the style of the ornament would probably have led to the casket being assigned to a later date.

"These two caskets are without any mixture of Western motives in their decoration, and are of special interest in the history of art industries from the precision of their date and country of manufacture.

"Among the altar caskets one of the most beautiful is a cylindrical ivory box from the Cathedral of Saragossa. It is of Oriental work, the sides pierced with delicate tracery, and with bands of Arabic inscription in relief round the edge. These boxes, though by no means common, are well known, and two in the British Museum have always been thought to be of Persian origin, and it is possible that the example now in question may be also of Persian work. It has, however, an enrichment of bands of delicate filigree work, passing over and around it, which are certainly Moorish and of the late fifteenth century. This is decided by their similarity in style and work to the mounts of the sword of Boabdil belonging to the Marques de Viane. In both specimens there are Arabic inscriptions, outlined in thin wire, running over the surface, a peculiar method that seems to have been employed only by the Moors, and about this period. At the Cathedral of Saragossa this is used to contain a cylindrical pyx, which is also exhibited. The pyx is quite plain, of silver gilt, and upon the flat cover is engraved and enameled a coat of arms surrounded by an inscription.

"A painted ivory casket, of the style usually called in England Sicilian, is shown by the Royal Academy of History. This bears upon it, many times repeated, the arms of Aragon-Sicily, and is said to have belonged to the King Don Martin, of Aragon, who died A. D. 1410. The ornamental scrolls between the shields are of unusual beauty and freedom, and a band of carved Cufic letters of an ornate character gives it an oriental aspect, which is but faintly seen in the other designs. Though the painting is not in the best state of preservation, this box is a charming specimen of the Moorish art of Sicily.

"The mudejar style, that is, the combination of Moorish or Saracenic and Christian art, is perhaps even better shown in a pair of wooden doors with gilt bronze fittings from the Cathedral of Seville. The paneling of these might be from a Cairene mosque, so purely Saracenic are their design, while their borders are composed of Biblical texts in well-carved black letter, and the bronze fittings are in accord with the ornament. The purity of the two styles is the remarkable feature of these doors, each keeping unmixed its own peculiar characteristics, and yet remaining in perfect harmony.

"The very early and interesting 'Arquilla de los Reyes,' the reliquary of King Alfonso III (*el Magno*), and his Queen, Ximena,* should properly have been mentioned earlier, but that its style and work are quite foreign to the Moorish taste. Alfonso the Great reigned as King of the Asturias and Leon from 866 to 910 A. D., and the shrine is therefore interesting as an authentic monument of a period of which few remains exist, though it can scarcely be said to have high claims as a work of art. It is of the usual oblong form with pyramidal lid and nearly covered with silver plates embossed and otherwise ornamented. Upon the lid is the inscription '*Aldefonsvs Rex Scemena Regina*,' with a figure of the Agnus Dei between the two names. Upon the sloping sides are embossed the symbols of the Evangelists, Lucas and Iohann being upon the front slope (the eagle very like a dove), and the angel of St. Matthew on the left, with the word Angelvs in place of the name of the Evangelist. On the slope at the back is a cartouche or frame of the last century, with the names of the Saints Diodoras and Deodatus, whose relics were doubtless contained in the shrine. The front is in two stages, each consisting of six round-headed arches formed of cloisons, some of which still contain the triangular or pear-shaped slabs of glass and stone, with which originally all were embellished. Within the arches are, upon the upper ranges, embossed trees or plants more or less symmetrical, and in the lower, figures of angels facing the middle, three in direction. The execution is throughout of the rudest character, the figures of the angels being reduced to the most elemental representations of the human figure and their wings more like leaves than any feathered limb. The presence of the cloisonné work, as a survival of Visigothic methods, gives the object a peculiar interest, though it should at the same time be pointed out that it is not cloisonné enamel. There can be no doubt that the stones or glass were cut and placed in position without the application of heat, and do not therefore constitute enamel."

The description of other interesting altar ornaments is found in Mr. Read's paper:

"The Cathedral of Astorga sends a very beautiful globular vessel of rock crystal, engraved in the East with elegant scrolls in relief. This is attributed, and probably with justice, to the eleventh century; its beauty is, however, much lessened by a seventeenth century gilt mount, which has transformed it into a tall 2-handled

* This would serve equally well for Alfonzo IV, whose Queen also bore the name of Ximena. This King abdicated in 927, and his Queen died in the previous year.

vase. An equally beautiful object, but by far different character, is the crystal Navecilla, a crystal ship on wheels, with elaborate Gothic mounts of silver gilt from the Cathedral of Toledo. It is about 15 inches in length, the body of the vessel made of rock crystal, above which is a considerable superstructure of silver gilt in which the ribs of the ship are indicated. At the prow and stern the bulwarks are formed of a band of elegant tracery surmounted by a cresting of leaves. The figure-head is a wyvern in full relief, and the keel is formed of a band of boldly modeled leaf-work. All the lines of the construction are very graceful, and the composition is pleasing as well as unusual. It is said to have been the property of Dona Juana la Loca, and probably became the property of the Cathedral as a votive offering. Another ship, of which the body is formed of a large turbo shell, is shown from Saragossa, but this, though very quaint, and of perhaps a somewhat earlier date, can not be compared for beauty with the crystal ship of Toledo."

The painted enamels can not be better described than by the pen of Mr. Read:

"It is somewhat surprising to find among the ecclesiastical objects from the various cathedrals so few painted enamels that are worthy of note. A good triptych belonging to the Cathedral of Saragossa would seem to be from the hand of Nardon Penicaud or of his school. The central subject is of the Adoration of the Magi, painted in the usual manner, the faces somewhat round, and here and there the small raised jewels or rosettes backed with foil. The Conde de Valencia has also a triptych by the same artist, who seems to have been popular in Spain, to judge by the comparative frequency of his works. Three other enamels in the collection shown by the Conde de Valencia de Don Juan are, however, of far greater interest and beauty. The first of these is of North Italian work of the fifteenth century, a circular pectorial medallion, with a hinged front displaying both inside and out scenes from the Passion painted in the exquisite style characteristic of this period and country, and of which we have a few good examples in the British Museum. The back of this charming pendant is formed of a plate of pearl shell engraved with the Crucifixion, and every part seems in perfect preservation. The two other enamels are of Limoges, the more important being a brilliant triptych, unsigned, but doubtless by Leonard Limousin, the second an equally brilliant but small plaque painted by Pierre Reymond in 1537, with the Good Shepherd giving crooks to the shepherds, and the exhortation to the shepherds is inscribed in two panels at the top. The triptych represents the Last Supper, and has the arms of Lorraine beneath quarterly and an inescutcheon of pretence of Lorraine, while on the wings are the arms of Lorraine (on a bend three alerions) and those of France, as well as a motto, which would point to the piece having been made for a personage of distinction. The Conde de Valencia also exhibits a large and interesting series of the small champleve enamel plaques from horse trappings, most of which have devices of an armorial character, both Moorish and Christian. These little ornaments were used in all European countries in mediaeval times, and a large number, such as are to be found here, could scarcely fail to produce some interesting results, if time were given to their study

"The absence of any large number of Limoges or Italian enamels is not so surprising as the entire want of Flemish plate of the period of Charles V or earlier. There are no doubt some pieces which, on examination, would prove to be of Flemish manufacture, but there is certainly nothing like a display of such objects, and it seems scarcely credible that great quantities of church plate and objects of domestic use were not brought from Flanders, a country where art of this kind had attained to such perfection."

Mr. Read also describes two famous historical Arab standards, which I will give in his words:

"The Monastery of Las Huelgas at Burgos has sent one of its greatest treasures in the standard of the Almohade Sultan, captured by Alfonso VIII at the famous battle of Las Navas in 1212, a wonderful specimen of Arab silk weaving, still preserving in many parts the original colors. Though much restored it still possesses the most important of its original features. It is covered with verses of the Koran, the Mohammedan formula and other Arabic inscriptions. This precious relic is traditionally stated to have been given by the victorious King to the monastery which still possesses it, and it is only used in the procession of Corpus Christi. Señor Riano thinks it probable that 'Alfonso VIII' should be 'Alfonso XI' (1312–1350), as he considers the banner to be of the fourteenth century work. An appropriate pendant to this comes from the Cathedral of Burgos, the standard of Alfonso VIII carried at the same battle, or, to speak more accurately, all that now remains of it, representing the Crucifixion, the Virgin, and St. John.

"An Arab standard of similar work to the first belongs the Cathedral of Toledo. This is the Bandera del Salado, made in Fez in the year 1312 A. D. The central design is very original, and the combinations of colors singularly beautiful. It is formed of sixteen crescents of gold, arranged in four lines, each having within it, in white on a green ground, the Mohammedan formula repeated eight times, each crescent containing one-half of the fomula; and around is a broad border formed by chapters of the Koran, written in intertwined Cufic letters. The effect of the alternating tints of gold, green, red, and white, which appear to be little affected by time, is very rich and harmonious."

The rich armor was very striking. Among the collection was noted a complete Gothic armor of the fifteenth century. Another suit of the same century had a helmet with a human mask. The jousting harnesses of Charles V and Philip II, elaborately chiseled and plated with gold, were displayed on manikins of horse and rider. There were also a number of figures showing the equipment of the foot soldiers of the fourteenth to the sixteenth centuries. On the walls were helmets, trophies of swords, daggers, arbalests, coats of màil, helmets, etc., displaying a remarkable richness in form and ornamentations.

Señor Don José Estrech, of Barcelona, sent a fine series intended to show the history of arms and armor from the eighth century down to the present time.

Among other pistols, muskets, and firearms, chiseled, incrusted, and damaskeened, was the pistol of Charles V, made by the famous Peter Pech.

The sword of Pizarro and of Cortes, with weapons and armor stated to be those of the conquerors of Peru, formed an interesting group.

Several swords of Boabdil, the last Moorish King of Granada, shown are of remarkable artistic value as well as of romantic interest. They are thus described by Mr. C. H. Read:

"One of them has been already mentioned as coming from the Royal Armoury but it is plain in make, and its principal interest is its history. It is far otherwise with the beautiful swords belonging to the Marques de Viane and the Marques Campotejar, and another sword belonging to the Archaeological Museum of Madrid, though somewhat older, belongs to the same class. This last is made entirely of metal, the hilt and guard being of bronze with gilt details, the blade of steel, the total length 40 inches. The pommel is globular, flattened on the two faces, on each of which is a circular medallion engraved with ornamental Cufic characters; the grip is fusiform, engraved with circles joined together by a single twist, and containing also Cufic letters. The guard is of the peculiar form characteristic of the Moorish swords of the late fifteenth century, viz, rounded shoulders ending on either side of the blade in a narrow limb running parallel with it, the outer edge of the limb curving inward to the end, where it suddenly turns outward in a hook, the hollow formed by this curving of the limb being filled up in this case with a plate of metal pierced with circular holes. The faces of the guard are quite flat, and engraved with conjoined circles, like those on the grip, the spaces between them being filled with engraved floral designs. The bands forming the circles are in all cases gilt. The blade is straight and two-edged and has upon one face the stamp of the armorer, a circle containing badly written characters which have not yet been read, but they are conjectured to be Hebrew, from the fact of the Jews in Spain devoting themselves to the manufacture of arms. This sword came from the Church of San Marcelo, the warrior saint, at Leon, and was there long connected with him. It is believed that it may have been a gift by the King Ferdinand the Catholic on the translation of the body of the martyr from Africa. The Boabdil sword of the Marques Campotejar is of the same general type, but is infinitely more sumptuous in execution, and, in addition, it retains its scabbard complete. The mounts, both of the sword and scabbard, are of silver gilt, embossed and richly chased with formal floral designs of the same style as those of the ivory casket of the Cathedral of Palencia (*supra*, p. 24), though, of course, the sword is of a much later date. The mounts are further enriched with bands and medallions of translucent cloisonné enamel, a feature which this sword has in common with that of the Marques de Viane. An interesting, and to some extent peculiar, circumstance connected with this sword is that, notwithstanding the pure Moorish character of its ornament, yet it would seem to have been the work of a Christian artificer, working for the Moors at Granada. The bonds of amity which existed between Boabdil and Ferdinand, for some years before the final stand made by the Moors for the possession of Granada, would account for the presence in the Court of Boabdil of Christian workmen, who doubtless succeeded in serving two masters in different capacities. Upon the plain backs of one of the two tabs to which the sword belt was attached is stamped, in characters of the period, the name *Ivan Abad*, with the pomegranate of Granada, as well as another stamp not easy to interpret. This Christian stamp illustrates a remark of Señor Riano (in his introduction to the Catalogue of Spanish Works of Art in the South Kensington Museum): 'The continued contact of the Christian and Mohammedan races, notwithstanding the barbarism of the time and the difference of creed, did not oblige them to live perpetually as enemies. This contact could not fail to influence works of art and industry, and for this reason many archæological objects of the Spanish Middle Ages possess a peculiar character.'

"The third sword of this type and, like the last, once the property of Boabdil, is that belonging to the Marques de Viane, who exhibits also the velvet jacket, another sword, and a dagger, stated to have been taken from the Moorish King at his defeat (in 1492) and given by Ferdinand the Catholic to one of the ancestors of the present owner. One of these is the most perfect example in the exhibition of the refinement and richness of effect of which Arab art is capable. It combines the highest efforts of the enameler, the carver, and the goldsmith, and doubtless the blade is of corresponding quality, and in every part it is well preserved. The actual grip is of ivory, the rest of the hilt is of gold, entirely covered with granular work and filigree, in which are set at intervals eight pointed and cruciform panels of translucent cloisonné enamel. The ivory grip is deeply carved with geometrical designs forming panels of various shapes, filled with Arabic inscriptions alluding to the weapon, and ornamental leaves and other devices, and where the ivory joins the metal are two broad bands of cloisonné enamel (the cloisons being here, as upon other parts of the mounting, of gold) composed of scroll work of the greatest beauty, interrupted by shaped panels containing Arabic inscriptions, among which might be expected the name of the artist, but this nowhere appears. The pommel is spherical, but at the upper end is prolonged as a straight point, and is entirely covered with the granular work and enameled panels mentioned above. This granular goldsmith's work is of the same style as that of the bands of the Persian casket from the Cathedral of Saragossa and might in fact be the work of the same artist. The ground is filled with minute pellets of gold, through which run lines of Arabic inscriptions, outlined in flat gold wire, thus leaving the interior of each letter empty. The enameled crosses upon the pommel are changed into a different form by the exigencies of the shape of the pommel, the artist finding it necessary to reduce the four limbs of the cross to three, and the corresponding outlines of the eight pointed panels are ingeniously altered and adapted to the same end. The surface of the guard is ornamented with similar work, and it is only necessary to mention that the two ends running parallel with the blade terminate in the heads of monsters, from each of which springs an elegant openwork border of spiral scrolls, enameled in white and other colors. The blade is straight, and has the stamp of the armorer upon one side. The sheath is of red leather, though very little of this foundation is visible, as one-half of its length is hidden by mounts matching those of the sword itself, and these fit into each other so closely that when the sword is in the scabbard it is impossible to distinguish where the guard ends and the scabbard mounts begin. This sword is described, and the inscriptions are given, by Señor Riano, p. 81.

"The enameled details upon this sword are of peculiar interest, not only for their intrinsic merits, which are very great, but also as serving to decide the origin of the beautiful stirrups in the Forman collection. These stirrups were exhibited before the Society of Antiquities of London, and are described in their proceedings (Vol. XIV, 169). It is sufficient here to say that they are of Moorish form, of iron, plated with silver, which is engraved with Oriental designs, while upon the sides are semicircular plates of silver with nielloed designs somewhat in the style of the arabesques of Aldegrever. Around these are borders of cloisonné enamel on gold, in style and execution so like the sword just described that there can be little question as to their common origin, though it is probable that the sword is earlier in date by perhaps a quarter of a century. The niello plates of the stirrups also could very well be of a Spanish make, as the use of the niello is not uncommon, both in Moorish and Christian work of medieval and later times. An example of this is near at hand, in the second sword shown by the Marques de Viane. This is more a weapon for use than for parade, and is a simple form, by no means beautiful, though the details are planned and carried out with the greatest skill. Like the other, it has a straight blade, apparently also of Christian make, or at least not Moorish; the handle is entirely of ivory, the grip cylindrical, with a thicker cylinder above and below, and forming the pommel, being slightly curved inward at the sides. The whole handle is engraved with beautiful scroll work, brought into relief by an inlay of black substance, probably akin to niello, and upon the sides of the pommel is the shield of arms of the kings of Granada, as seen upon the azulejos of the Alhambra. The scabbard is in keeping with the modesty of the sword, being a plain leather sheath, tooled like a bookbinding with a scale pattern, and having a silver mount and chape, the former engraved and nielloed with Arabic inscriptions and the shield of Granada, and the chape engraved in a similar manner. The contrast between this simple and useful weapon and the gorgeous blade shown beside it is most remarkable and instructive, and the fortunate owners of them both may be congratulated on the possession of hereditary treasures of a kind and quality but seldom seen.

"There now remains to notice the collections of pottery, which are confined almost entirely to the lustered wares so well known and so highly appreciated all over the world for their decorative qualities. Before describing these, however, it is desirable to allude to an altogether unexpected, though by no means unimportant, exhibit of mosque lamps of pottery and glass sent by the Imperial Ottoman Museum at Constantinople. Of the pottery lamps the most curious, though the least ornamental, is one with two rows of handles, covered with oil gilding, and decorated only with two narrow bands of inscription in blue, the rest of the surface being plain white; probably a product of the potteries either at Cairo or Damascus. Far more beautiful, and of unusually large size, are two richly-colored lamps of Rhodian ware, with bosses round the lower part filled with elegant arabesque designs, the rest of the surface covered with inscriptions and ornament. The red and turquoise colors are of unusual brilliancy, and the execution of the ornament, as well as the outlines of the lamps themselves, leave nothing to be desired. Four small lamps, painted entirely in pale blue, though neither so unusual nor so immediately attractive, are fine specimens of their kind. Their principal decoration consists of bands of ornamental Cufic, the spaces between being filled with delicately penciled devices that recall the illuminated Persian manuscripts of the fifteenth century. The glass lamps seem to be of Venetian manufacture, and probably of the fifteenth or early sixteenth century. They are all of lace glass of various patterns, somewhat coarse in make, and they preserve the usual form of the mosque lamp. In addition to these there are two trumpet-shaped lamps of the same kind of glass, which have been used either as the oil receptacle of a pottery lamp or perhaps independently, as they would be too large for any but the largest size of lamp. Some of these Venetian lamps have been thought by their Mussulman owners to be too simple in style, and accordingly they have been painted with flowing scrolls in gold, which gives them rather a tawdry appearance.

"Of Spanish wares the only collections of any note are those of the Conde de Valencia de Don Juan, Señor Don Guillermo de Osma, and of the Archæological Museum of Madrid. Unfortunately the latter collection must be dismissed with but little notice, for the objects were arranged in panels upon the walls of the room, reaching to the ceiling, and it was therefore barely possible to see them, and quite out of the question to examine any of them closely. One of the plates is said to have an Arabic word upon it, a most unusual thing, but as it was at least 12 feet from the floor it was not possible to verify this statement, which has already been doubted. Among the objects nearer at hand was, however, one of the famous Alhambra vases, a fine specimen standing more than 4 feet high, but unfortunately wanting one of its handles. It is decorated in yellow or pale blue, with a profusion of arabesque designs and inscriptions, one of the latter referring to its use as a water jar. This vase came from the parish church of Hernos (Jaen), where it was used as a holy-water vessel. A similar story is told of an equally fine vase, now in the museum at Palermo. Another jar of Toledan make is interesting as bearing the name of the maker. It is an oviform vessel of common clay, nearly 3 feet in height, unglazed, and with two projecting ears or handles on the shoulders. The ornament consists of impressions from oblong stamps, with animals, monsters, etc. Near the neck are impressed three stamps inscribed in black letter en toled me feci dj perez. This dates probably from the sixteenth century.

"The collections of the Conde de Valencia and Señor de Osma areshown together, and comprise a superb series of the lustered wares of the various Spanish factories, a number of tiles, interesting for their devices as well as for the technical processes of their manufacture, and a large and unique series of a curious ware believed to have been made in Andalusia in the fifteenth and sixteenth centuries, but of which the history is at present somewhat uncertain. Among the lustered wares the most remarkable pieces are two dishes painted in blue and luster, with figures in fantastic costumes of the fifteenth century, one of the dishes representing a fishing scene, carried around the dish in a quaint fashion. Two covered bowls are also worthy of remark, both from their rarity and the originality of their design, the covers being of the same shape as the bowls, but somewhat larger in the mouth, and when placed together the form is that of a barrel with narrow ends. Many other pieces of this beautiful series deserve mention, if space permitted. The Andalusian ware, however, is less known, and therefore deserves more particular notice. Though it can scarcely be said to possess so great a charm as the lustered wares, yet it has an originality and vigor which is rarely found in any but the earliest productions of Valencia and Malaga. It recalls in appearance the Italian sgraffiato wares, though the process of manufacture is of quite a different character. The method employed is, however, not quite clear, but seems to have been to draw the outlines of the design in some substance which was thrown off in the furnace, leaving little or no trace of its presence, but which, before the firing, possessed an antipathy to the colored glaze used to fill up the design, so that these glazes could be applied close up to the edge of the outlines without in any instance impinging upon them. In no case is the clearness of the outline interfered with, though it is rare to find an instance of the glaze being otherwise than close to its edge. The glazes are thick and heavy, probably with a base of tin, and the colors used are rich and full—amber, green, slaty blue, yellow, and manganese. The collection comprises five large dishes, twenty-four small, an oviform vase, two large panels with the arms of Castile-Leon and Aragon-Sicily, as well as tiles. The designs of the dishes are vigorously, if somewhat coarsely drawn, and include a head of a young man in the costume of the late fifteenth century, a deer and other animals, heraldic lions, and motives derived from plants and trees. Some of the tiles have inscriptions in black letter, and the oviform vase bears the legend, *Mjel rosado coud* (Honey of roses). It may be of interest to mention that this ware is being imitated in Spain at the present time, and a good many examples of these imitations are to be found in the shops in Madrid; and though the character of the work lends itself easily to imitation, there are essential differences between the old and the new."

There were few musical instruments. Two organs of Charles V, shown for their artistic cases; a Moorish rebeck of four strings, and a clavichord may be mentioned. The latter is one of the most curious musical instruments belonging to the history of music in the seventeenth century. The instrument exhibited is said to have been made in 1625 by Fraz Raymundo Truchado. I heard several performances upon this instrument and found the music not unpleasing.

Of music books there was a great number, the ponderous illuminated missals of the Escorial and other cathedrals forming an attractive exhibit. . A MSS. of the thirteenth century, entitled "Himnos Religiosos," is interesting as showing early part music. The MSS. is preserved in the National Library. Another folio in vellum from the Cathedral of Tuy contains the psalms of St. Augustine, with the first page of ancient music without the pentagram *(Sin pentagrama)*.

There were in the exposition numerous documents relating to the history of the discovery of America, consisting of letters, charts, books, etc. The Papal exhibit contained two famous charts on vellum of the Old and New Worlds, made in the third decade of the sixteenth century. The better preserved map measures 85 centimeters in height and 2.09 meters in width. It bears the inscription: "*Carta Universal en que se contiene todo lo que del mundo se ha descubierto fasta agora, hizola Diego Ribera, cosmógrapho de Su Majestad, año de 1529, en Sevilla. La qual se devide en dos partes conforme la capitulacion que hicieron los Catholicos Reyes de España e el Rey Juan de Portogual en Tordesillas, año de 1494.*" On either side of the line showing the division of the New World between Spain and Portugal are the banners of these countries. In Peru the conquest had extended to Sierra Morena, on whose southern border is written in red ink the name of the last people then known, Chincax Cibad—that is, the city of Chincha, founded by Almagro.

The other chart is perhaps older. It bears the famous line of Alexander VI. It shows the plan of the City of Mexico and the illuminated portraits of Montezuma, Atahualpa, and Prester John, of the Indias.

The National Library exhibited 150 manuscripts comprising Greek, Persian, Hebrew, and Arab codices, bibles, liturgical, and devotional works; works on science, art, history, geography, literature, and the theater, autographs and codices notable for the importance of the text, binding, ornamentation, etc.

Among the Hebrew manuscripts is an interesting Book of Esther, which the Jews read on feast days. It is a roll of parchment 3.50 meters long and 29 centimeters wide, dating from the beginning of the fourteenth century, written in 24 columns of 22 lines each.

Among the numerous Arabic manuscripts was the book of Alfarabi, entitled "Music," which explains the beginning of music, voices, tones, and instruments. It contains drawings of instruments and figures of music. This remarkable codex of the fourteenth century is the best of the three existing in Europe, one being in the Ambrosiana at Milan and the other in Leiden.

The first edition of the polyglot bible of Cardinal Cisneros dated 1514-1517 and the only copy of the first edition of Don Quijote were shown.

A few Jewish relics of interest were displayed. One of these was a precious fragment of a roll of the Thorah or Hebrew Pentateuch of the fourteenth century, which no doubt belonged to an ancient Spanish synagogue. The fragment contains the last chapters of the Book of Leviticus and the first chapters of Numbers. Another book from the Cathedral of Toledo, written in rabbinical characters, had "*73 hojas de arbol llamado Parra van ensartadas en una cuerda.*"

There was an astrolabe of burnished bronze made by Philip II in the sixteenth century, as the inscription shows.

There was a beautiful mosque lamp from the Alhambra, composed of four parts, the upper formed by four apples in delicate openwork combining the motto of the Al-Ahmares; the second below a kind of pyramidal chimney, each face of fine, engraved fretwork; the third section is a large screen composed of four wings fretted and engraved with the Al-Ahmares motto in African characters; the fourth section is funnel-shaped, having attached eight fretwork arms. This lamp was ordered by the Sultan Mohammed III of Granada in the year 705 of the Hegira, 1305 A. D.

From the same city is an oil holder covered with very delicate work with enamel inscriptions in gold of the purest Grenadine handicraft. It dates from the fourteenth century. The pieces just described belong to the National Archæological Museum of Spain.

From Leon were shown two torch holders of four lights. They are formed of a disk of plate iron with fretted ogival ornamentation. In the center of the disk the sockets to remove the links are grouped. These date from the fifteenth to the sixteenth centuries.

The Escorial sent a very beautiful lamp of bronze and coral of the seventeenth century.

Mention may be made of the unique series of royal, ecclesiastical, and municipal seals of wax and lead, the jewelry and miniatures and the large collection of artistic ironwork for which Spain is so famous.

The naval and military museums made an important chronological exhibit of their respective subjects.

THE WORLD'S COLUMBIAN EXPOSITION.

At the beginning of the fiscal year, preparations for the World's Fair had been in active progress for fifteen months, and many of the exhibits had been completed, mounted, provided with labels, and were being packed. Much progress had also been made in the construction of cases, and the taxidermists had finished a number of the most important groups of animals.

Uncertainty as to the amount of money which would ultimately be appropriated by Congress for our exhibit, and similar uncertainty as to the amount of space which would finally be available in the Government building, the dimensions of which had already been much contracted from those proposed in the original plan, owing to the costliness of building in Chicago, made it impossible as yet to decide exactly what would be sent. Indeed, the indefinite manner in which the appropriations were made was a cause of great embarrassment, since no positive plans could be made, and work, which otherwise could have been done deliberately and at moderate expense, was delayed until the last moment, to be finished in haste and at greater cost.

After the adjournment of Congress in August, the character of the exhibit was finally decided upon, and as soon as the Government building had been completed and the space allotted, the plans for installation were made. It was not until December, however, that the building was so far completed that the space could be studied with reference to the final arrangement of the collections.

The work of shipping began in February, and continued until late in April, when the last cars were loaded. Twenty-five carloads in all were sent, among the last being the collections returned from the exhibition at Madrid. The total number of boxes was 1,305, aggregating 145 tons, or more than a quarter of a million pounds.

The amount of space finally occupied by the Institution was 21,250 square feet, of which 5,875 feet were set apart for main isles or thoroughfares. This was much less than had originally been planned for, and necessitated the omission of many objects and the too great crowding of others. The work of installation was begun in March, at which time Mr. Earll, the special agent in charge of the exhibit, went to Chicago to remain through the Exposition. Sixteen expert mechanics and preparators went from the Museum in March, and about twenty additional mechanics and laborers were constantly employed in Chicago from that time until the installation was completed. Early in April a number of the curators went on to superintend the arrangement of their respective exhibits.

Notwithstanding the delays of the railroads, many of our cars having been three weeks on the way, the exceedingly inclement weather, which caused much sickness in the force, and the unfinished state of the building, and the showers of rain and snow which found their way through the roof upon the specimens as they were being unpacked and upon the polished wood and glass of the cases, the installation was practically ended before the opening of the Exposition, and at the time when the doors were thrown open there was every appearance of completion, although, owing to the causes already mentioned, a considerable amount of work had to be done in May.

At the end of the fiscal year the Exposition had run only one-third of its course, but the throngs of visitors* and the appreciative comments of those qualified to judge of the merits of the exhibition indicate that notwithstanding the many difficulties which it has been necessary to face the participation of the Institution in the Exposition is a successful one.

The character of the collections sent is discussed very fully in the review of the work of the scientific departments of the Museum. The description of the exhibit as a whole will be deferred until after the close of the Exposition.

* "The popularity of the Smithsonian exhibit may be ganged by the difficulty that a visitor experiences in forcing his way through the almost immovable crowd." F. A. BATHER, in *Natural Science*, London. 1893.

The exhibits of the Smithsonian Institution were designedly selected so as to supplement and be supplemented by those displayed elsewhere in Jackson Park. It was our purpose to avoid all rivalry, and, so far as could be done without disobeying the implied requirement of the law, that the exhibits should illustrate all the functions of Government institutions, to show nothing which would be shown well by others.

In consequence, our exhibits can not well be considered except in connection with the others of a similar character. This has been well done by Mr. William H. Dall, in a series of three letters on "Science at the Fair," published by the New York Nation, as being the result of a careful review by an unbiased observer and the only really careful report of the kind which has been made.*

The accompanying diagram of the floor space of the Government building shows in a general way the assignment of our space and its relation to that occupied by the other Departments of the Government. (Pl. 56).

The exhibit of the Government was made under the direction of a board of control and management, appointed by the President in accordance with an "Act providing for the celebration of the four hundredth anniversary of the discovery of America by Christopher Columbus," etc., approved April 25, 1890.† This board was composed of one member representing each Department. At the beginning of the Exposition the board was composed of the original appointees, as follows: Sevellon A. Brown, chief clerk, Department of State; A. B. Nettleton, Assistant Secretary, Treasury Department; Maj. Clifton Comly, U. S. A., War Department; Commodore R. W. Meade, U. S. N., Navy Department; A. D. Hazen, Third Assistant Postmaster-General, Post-Office Department; H. A. Taylor, Commissioner of Railroads, Department of the Interior; E. C. Foster, General Agent, Department of Justice; Edwin Willits, Assistant Secretary, Department o fAgriculture; J. W. Collins, Assistant, U. S. Fish Commission, and G. Brown Goode, Assistant Secretary, Smithsonian Institution; but shortly after the opening of the Exposition Mr. W. E. Curtis became the representative of the Department of State, Mr. F. A. Stocks of the Treasury, Prof. F. W. Clarke of the Interior, and Dr. Tarleton H. Bean of the Fish Commission.

The functions and responsibilities of this board were very different from those of the boards previously charged by Congress with the preparation of Government exhibits, and it remains to be seen whether the change is altogether advantageous, either in the matter of efficiency or economy. In previous exhibitions the representative of each Department has been looked upon as the representative of its official head, and the Government exhibit has been an assemblage of indi-

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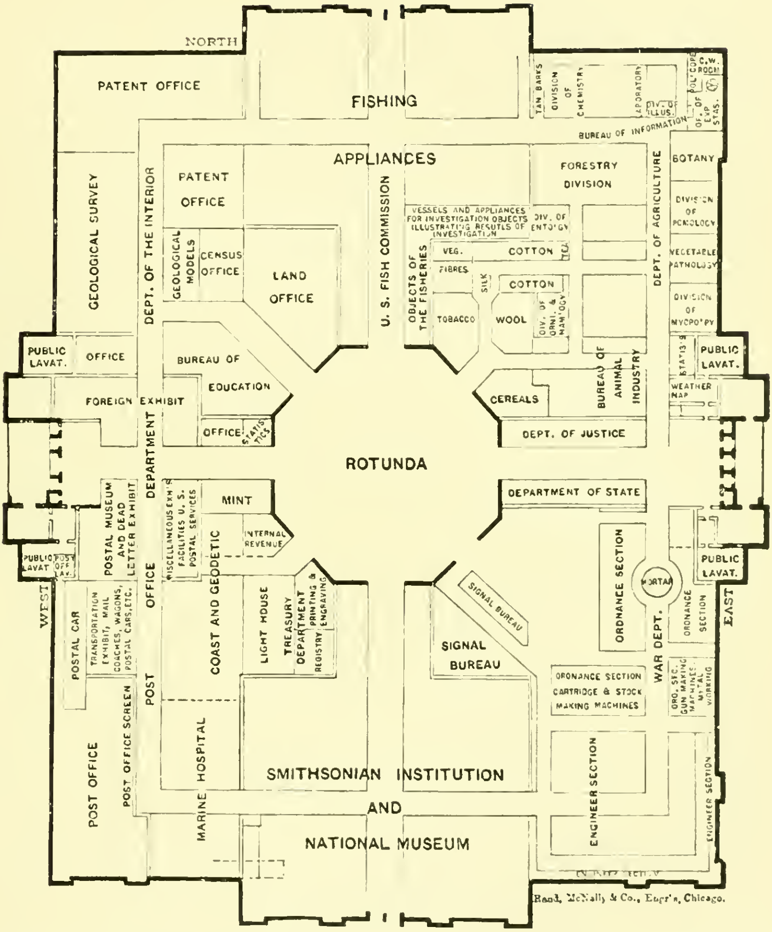
*DALL, W. H. The Columbus Exposition.—Science. *The Nation*, Sept. 14, 21, 28, 1893.—(Nos. VII–IX of *The Nation* series of letters.)

† See Appendix IX.



Ground Plan of the United States Government Buildings at the World's Columbian Exposition, 1893.

vidual exhibits, each illustrating, under the control of the Department itself, its functions and administrative methods.

The Chicago board, apparently rather through the decisions of the Treasury Department than by reason of the intent of the law, has been forced into quite another position. Under the provision of section 18, which subjects the "itemized accounts and vouchers" to the approval of the Secretary of the Treasury, jurisdiction in detail over the affairs of the board was assumed by officials of that Department, and their rulings have formed, of necessity, the dominant standard of judgment. By virtue of an early ruling based upon the provision of section 16, which empowers the heads of the Executive Departments and the directors of the Smithsonian Institution and National Museum, and of the U. S. Fish Commission, to designate the articles which should compose the contributions of their respective branches, the initiative in respect to each article exhibited was vested in the heads of the branches. The power of final approval was retained in the Treasury, the board of management serving as an intermediary between the two authorities.

It is held by the Treasury that the board as a whole is responsible for the exhibit as a whole, and that the relation of the heads of the Executive Departments to the board and to their own individual representatives is advisory rather than supervisory. The tendency of this is to place the members of the board at times in embarrassing positions, and in at least one instance has resulted in a complete alienation of the Exposition work of a department from the Department itself, and an open hostility between the head of the Department and his representative. Nothing could be more unfortunate, and nothing could more thoroughly prevent the preparation of an exhibit which would be thoroughly representative.

In connection with this policy has grown up also a disposition on the part of certain elements of the board organization to criticise the conduct of the representatives of the Departments, and to attempt to control their action under the plea of "securing harmony and preventing duplication." The outcome has been far from satisfactory, when contrasted with the direct, business-like, and less complicated methods followed by previous boards of management.

The appropriation of an aggregate sum by Congress, instead of a special appropriation to each Department, has also been a cause of embarrassment. It is quite impossible for ten men, representing ten distinct interests, to divide such a sum among themselves equitably and to the satisfaction of all. Still more perplexing, especially in the early days of the preparation for the Exposition, were the joint claims upon the same appropriation of the Government board of management and of the National Commission. This was fortunately settled by Congress in 1891, but the uncertainty as to the amount of money available during the first year of preparation was not the least serious of the many obstacles to effective work at the most important period of exhibition work—the beginning.

It should also be said that the establishment of a board with independent functions and a separate legal status seems likely to prove a source of expense for general purposes, far greater in proportion than has been found necessary in other exhibitions.

In addition to the $400,000 appropriated for the building, the aggregate of the allotments for the use of the Government board was $949,000, of which amount 5 per cent, or $47,450, were set apart for the general expenses of the board of management, the remainder being allotted among the several Departments. The amount available for the use of the Smithsonian exhibit, after deducting the 5 per cent contributed toward the expenses of the board, was $133,807.50.

By the provisions of a joint resolution approved March 3, 1893,* the secretary of the Smithsonian Institution was authorized to prepare and send for exhibition in the Woman's building any articles from the Museum illustrative of the life and development of the industries of women. In accordance with this authorization, a special exhibit was prepared and installed in the Woman's building under the direction of Prof. Mason. The character of this exhibit is described in the discussion of his department.

The original model of the colossal statue of Leif Erikson (the property of the city of Boston), which had been presented to the National Museum by the sculptor, Miss Anne Whitney, was also installed in the Woman's building at the request of the Board of Lady Managers, as well as a collection illustrating the history of lacemaking, prepared by Dr. Thomas Wilson.

Very many requests were made by the authorities of the Exposition and by exhibitors for the loan of objects from the Museum, to be exhibited elsewhere than in the Government building, but these were without exception refused, on the ground that the Government had already provided for the exhibition of such objects as could be sent from Washington in a special building which was more nearly fireproof than any other on the grounds, and that there was no legal authority for allowing the Museum material belonging to the Government to pass out of the custody of its officials. This limitation did not, of course, apply to the Government building. Specimens were lent to almost every department of the Government, especially to the Fish Commission, the Patent Office, the Geological Survey, the War Department, the Department of Agriculture, and the Treasury Department. Certain historical objects were also placed in the Convent of La Rabida, which was recognized as a Government building, forming part of the exhibit of the Department of State.

It was perhaps regarded as a hardship by the officials in charge of the Anthropological building that material should not have been sent from the Government collections to swell the very interesting miscella-

*See Appendix IX.

neous display of ethnological objects which were gathered there, but setting aside the question of lack of legal authority, this building was especially open to the objection of not being fireproof. Everything possible was done, however, to avoid interference with this department, by refraining from exhibiting in the Government building objects of a kind similar to those which we were informed would be shown by the Exposition authorities.

The ethnological and archaeological collections in the Smithsonian space were the joint exhibit of the Museum and the Bureau of Ethnology, and too much can not be said of the enthusiastic work of Maj. Powell and the officers of the bureau in the development of this portion of the display, and especially in the preparation of the group of costumed figures of the aborigines of North America.

In addition to the exhibits sent from the Museum and the Bureau of Ethnology, a special alcove was devoted to the exhibit of the Smithsonian Institution and its methods of work. Here were shown photographs of the Smithsonian and Museum buildings; portraits of the three secretaries—Joseph Henry (1846–1878), Spencer Fullerton Baird (1878–1887), and Samuel Pierpont Langley; the publications of the Smithsonian Institution, including the Annual Reports, the Smithsonian Contributions to Knowledge, the Miscellaneous Collections, the Reports of the National Museum, together with the Proceedings and Bulletins; publications of the Bureau of Ethnology; the publications of the National Academy of Sciences; the Reports of the American Historical Association (affiliated with the Institution), and the reports of the various scientific expeditions which have been conducted under the direction of the Institution. There was also a screen of photographs illustrating the discoveries of Prof. Henry, including those which led to the invention of the electric telegraph.

It had been intended to publish a series of popular handbooks explaining the various collections exhibited, and also illustrated pamphlets in regard to the Smithsonian Institution and the Museum, but the regulations issued by the local directory governing the distribution of books and catalogues were found to be so oppressive that this was abandoned, although much work had been done in the preparation of this feature of the exhibition.

By the action of the Local Directory of the Exposition the whole matter of catalogues and illustrative literature was placed in the hands of a single firm of printers, who were unwilling to print anything without a guaranty that their sales should considerably exceed the cost of printing, and who refused to allow other publishers to enter the field. This illiberal policy undoubtedly reduced very largely the extent of the literature which usually grows out of such expositions, and is not only its chief educational agency, but one of its most important permanent results, and it is to be hoped that no future exhibition will be led into a similar error.

Acknowledgment should be made for assistance rendered by a number of friends of the Institution, who by their advice and cooperation, or by the loan of objects for exhibition, contributed materially to the success of the occasion.

Mr. George F. Kunz assisted by his advice in the forming of the collection of gems and animal products, and lent from his private collection a number of Russian eikons, shown in the collection of religious ceremonial objects.

Tiffany & Co., of New York, lent an extensive collection of leathers, prepared from the skins of animals not ordinarily used in the arts, which was displayed among the animal products, and, as has always been our experience on occasions of exhibits, exhibited a spirit of genuine interest in the work

Dr. Marcus Benjamin, of New York, lent his collection of portraits and autographs of the members of the National Academy of Sciences, and Mr. Albert Rosenthal assisted in the formation of the collection of American historical portraits.

Walter H. Harris, esq., ex-sheriff of London, and one of the Royal Commissioners from Great Britain, lent his unique collection of British war models.

Mr. Hieromich Shugio lent a number of Japanese porcelains and arranged the synoptical collection showing the history of the ceramic art in Japan.

Mr. Fritz Kaldenberg, of New York, lent his collection of carved and tinted ivories, and in other ways helped to build up the collection of animal products. Mr. Sulzberger, of Philadelphia, and Mr. Hadji Ephraim Benguiat, of Boston, aided materially by loans from his private collection to the collection of religious ceremonials.

Acknowledgment is also due to the officials of the exposition in general, and especially to Mr. George R. Davis, Director General; to Mr. Lyman J. Gage and Mr. William T. Baker, during their terms of presidency of the Board of Directors; to Mr. J. W. Ellsworth, a member of the board; Mr. Benjamin Butterworth, the first secretary of the board, and to his successor, Mr. H. O. Edmunds; to Mr. Frank D. Millet, director of decorations, and to Mr. W. H. Holcombe, general manager of transportation, for numerous courtesies.

To the members of the Government board the staff of the Institution were indebted for many acts of courtesies.

Mr. William E. Curtis, as chief of the Bureau of American Republics, and subsequently as a member of the board, was especially helpful.

IV.—REVIEW OF THE WORK OF THE SCIENTIFIC DEPARTMENTS, INCLUDING THEIR PARTICIPATION IN THE WORLD'S COLUMBIAN EXHIBITION.

DEPARTMENT OF ARTS AND INDUSTRIES.

The Department of Arts and Industries was the immediate and necessary outgrowth of the erection in 1881 of the new building intended to receive the collections presented by foreign governments to the United States at the Centennial Exposition. Most of these collections could not with propriety be merged with any already in the custody of the Institution, since they were neither geological, biological, nor in a strict sense anthropological.

This new department was therefore formed, which was intended to include all the collections illustrating the utilization of the earth and its products by man, and the history and method of arts and industries within historic times. At first all the anthropological collections except those classed as prehistoric were administered by this department, but experience taught that there are large classes of objects which can be best exhibited and studied when arranged ethnically, and so in 1884 the Department of Ethnology was established.

The distinction between these two departments is not easy to define, and is really not very strictly observed, and will perhaps in time disappear. There are, however, certain classes of objects which either for effective installation or for convenience it has been found better to arrange with reference to form rather than race. These are as a rule those in which the arts of civilized man are predominant, and which possess some special interest when arranged in progressive, or, as they are sometimes in questionable propriety called, "evolutionary" series. Among these are such collections as those of musical instruments, land transportation, the models of boats and vessels, and the fishery appliances.

Closely allied to some of these is another group of collections, properly technological, in which the idea of materials, and tools and processes of manufacture, together with the products of the processes, are the most prominent.

It was at one time intended to develop this part of the Museum to such an extent that every product of the earth useful to man—mineral, vegetal, and animal—should be shown, in its natural condition and in the various stages through which it may pass, in preparation by man for his own use, together with the tools employed and illustrations of processes. This project has not yet been fully realized, chiefly through lack of room, though also because of practical difficulties of arrangement and installation. It has not been abandoned, however, and the Museum possesses the materials for an extensive technological display.

In the meantime the specimens of this class derived from the mineral kingdom are incorporated with the geological collections, those from the vegetable kingdom with the textile, materia medica, and food and forestry collections, besides a great mass now in storage, while those from the animal kingdom, with the exception of what are arranged with the textiles, medicines, foods, and fishery collections, are brought together in the animal products collection.

It is still an open question whether technological material is not more useful and instructive, distributed among the scientific departments, than set aside in a special series. At the present time, this is the only practicable plan. If it were possible to employ a special staff of technological curators, trained to appreciate and to keep abreast of the mechanical and chemical processes of modern industrial arts and manufactures, and the arts of design connected with their development, the case would be different.

When the need shall be felt for a technological museum in Washington, one of the best in the world can be erected upon existing foundations, with comparatively slight expense and in a very short time.

In addition to those mentioned, there are certain other collections which are still assigned to the Department of Arts and Industries, which it would be difficult to place elsewhere—those composed of objects made by civilized man, in which the idea of beauty predominates over that of utility. Here belong porcelains, pottery, bronzes, enamels, lacquer, laces and tapestries, musical instruments; in part, costumes and their accessories, and the collections illustrating the graphic arts.

Such objects are often arranged in art museums, but may with equal propriety remain in contiguity with ethnological collections, with which they have innumerable points of contact. Indeed the separation of the æsthetic from the industrial and ethnical series is, in the case of æsthetic races like those of eastern Asia, merely arbitrary and a matter of convenience.

> We value the specimens in an ethnological museum (writes Mr. C. F. Binns) because they reveal to us the manners and customs of a bygone age. We regard them as steps in education, as stages in the evolution of a people, but the moment that a work can be judged as artistic we remove it from the Department of Ethnography and place it upon a platform with the art work of all ages and all nations, to stand or fall by another criterion.*

This is a fair statement of the practice of most museum workers. Whether it is entirely justifiable, either on scientific or æsthetic grounds, or is absolutely fair and advantageous, is a difficult question, which deserves full consideration.

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*Binns, Charles F.: The Elements of Beauty in Ceramics. *Journal of the Society of Arts*, XLII, 409. April 6, 1894.

In addition to all these, there are the collections whose interest is chiefly historical—personal relics, national relics, portraits, autographs, coins, medals, memorials of past periods in the history of our own and allied races. These stand in a group by themselves, and are in popular estimation more interesting than anything else that can be shown, and their influence upon the people who see them is not to be undervalued. They are surely not without instruction, and beyond this, tend to the development of lofty and ennobling sentiments.

In the report for this year, the various collections assigned to the Department of Arts and Industries, except those which are under the control of a special curator, will be referred to only in rapid review.

Fisheries collection.—The fishery hall has been almost dismantled by the withdrawal of material to form part of the exhibition of the Fish Commission in Chicago. The attention of Capt. Collins, the curator, has been for two or three years devoted to other things, and few additions have been made to the collection.

The collection of naval models.—This, too, has been drawn upon largely for the exhibit of the Fish Commission at the World's Fair, many of the models of American fishing vessels having been withdrawn to be combined with a large number of additional models which have been constructed by the Commission. The entire series will be returned at the close of the Exposition.

The general collection of models is one of the most extensive in the world, embracing, as it does, a very large number of boats of savage and semicivilized races, and material for a very full exposition of the vessels of America. The models of modern steamships and vessels of war are very few, and no attempt will be made to extend the collection in this direction until there is more space. Three times the amount of exhibition room now available is desirable for the proper display of this collection. Among the interesting additions have been models of the historic ships *Sally Constant* and the *Mayflower*, prepared by the National Museum for Chicago, and exhibited in connection with the historical relics.

The animal products collection.—This collection, already referred to as forming an important part of the technological material belonging to the Museum, was transported to Chicago in its entirety and was greatly enlarged. Much attention has been given to developing a collection illustrating the races of domesticated animals, and a specially good series of the breeds of domestic birds has been gathered. To secure the domesticated mammals is a more difficult matter, attended with great expense and delay. Even this would have been carried much further in Chicago but for obstacles interposed by the accounting officers of the Treasury, who objected to the payment of vouchers for the purchase of foreign material.

An extensive exhibit selected from this collection was sent to Chicago. This exhibit is intended to illustrate the utilization of the various parts of the different animals and the uses of substances derived from the animal kingdom in the arts and industries. It includes the following:

Collections showing the utilization of hair, wool, bristles, etc.
Feathers, quills, and their uses.
Fish scales and articles made from them.
Tortoise shell and its manufacture.
Furs of various kinds.
Collection of leathers (including a loan collection of rare leathers belonging to Tiffany & Co., New York).
Horns and antlers and articles made from them.
Hoofs and claws.
Teeth of various kinds and collections illustrating the uses of different kinds of ivory.
Whalebone and its utilization.
Bone and objects made from same.
Shell, coral, and objects made from same.
Intestines and their utilization.

The collection of animal products is now fully equal to that in any other museum, not excepting the Bethnal Green Museum in London, which grew out of the London exhibitions of 1851 and 1862, and was classified and labeled under the direction of Dr. Edward Lankester. With proper space for exhibition, extensive enough to allow the addition of a series of the modern manufactured products, this collection would have great interest and educational value.

The collection of fibers and textiles.—This collection, which is tolerably complete, is being temporarily withdrawn from exhibition, in order to relieve the crowded condition of the building. The specimens are all admirably mounted and well labeled, and can, if necessary, within a week's time, be again displayed. Like the collection of animal products, it possesses much educational interest and is very attractive to visitors.

The collection of foods.—This collection, for which there is a great amount of material on hand, has never been developed for lack of room. It is especially rich in the food substances of the North American aborigines and of the Orient. A single group of objects from this collection was sent to the World's Fair. This included the cases representing the composition of the human body, the elements and chemical compounds which make up the composition of the man of average size, accompanied by supplementary exhibits showing a number of typical rations and the daily income and outgo.

The collection of musical instruments.—This collection has been nearly doubled within the past two years through the efforts of several of the U. S. consuls abroad and the collections made by the Assistant Secretary in southern Europe in the spring of 1892. A selected exhibit was sent to the World's Fair, which occupied a wall case 65 feet in length, and which was intended to show the method of installation adopted in the Museum and to illustrate the evolution of the various types of musical instruments. This was arranged in accordance with the following plan:

Self-vibrating instruments:
- Drums and tambourines, cymbal, gongs, castanets, "bones," and rattles.

Xylophones.

Stringed instruments played with the fingers or plectrum:
- Guitars, banjos, and mandolins
- Harps and lyres.
- Zithers and dulcimers.

Stringed instruments played with a bow:
- The violin.
- The viola.
- Mechanical instruments—hurdy-gurdy.

Stringed instruments, with keyboard. The predecessors of the piano, clavichord, virginal, and harpsichord.

Wind instruments, with simple aperture or plug mouthpiece:
- The trumpet and bugle.
- The trombone.
- The serpent and bagpipe.

Wind instruments, with bell mouthpiece, with keys—cornets, French horns, ophicleides.

Wind instruments with complicated systems:
- Accordions.
- Harmonicas and jewsharps
- Hand organs.

As soon as this material shall have been returned from Chicago, a complete rearrangement of the collection will be made in the two great wall cases in the main entrance hall, whose combined length is 150 feet. This collection is one of the most extensive in the world, being especially rich in the instruments of savage and semicivilized races, and the primitive forms, which are especially interesting when arranged by the progressive method as showing the types from which, in all probability, all of our modern instruments are derived.

Costumes.—Especial attention was devoted in the early days of the Museum to the collection of costumes, especially those of historical interest. Such of these as have been placed on exhibition are at present arranged with the ethnological collection, but there are many others. It is probable that at the next exposition in which the Government participates, a special display from this department will be arranged.

The collection of ceramics.—This collection, though it contains many valuable and important specimens, is exceedingly incomplete and unsatisfactory. The Hippisley collection of Chinese porcelains still remains on deposit, and it is hoped that through some good fortune this may in time become the property of the Government. It is recognized as one of the best for its size in existence, and is constantly examined by connoisseurs, who find in it material for study. There is also a small collection of Japanese porcelains, a selection from which was arranged and labeled by Mr. H. Shugio and exhibited by the Museum at the World's Fair. In this collection were shown typical products of each of the principal pottery centers of Japan, arranged by provinces in accordance with the following plan:

Ancient pottery.

Province.	Ware.	Province.	Ware.
Hizen	Karatsu.	Idsumi	Idsumi.
	Arita.	Yamato	Akahada.
	Hirada.	Suryo	Suryo.
	Nangawara.	Nagato	Hagi.
	Nabeshima.	Chikuzen	Takatovi.
	Kakiyemon.	Higo	Yatsushiro.
	Tsryi Gokushin.	Satsuma	Satsuma.
	Kameyama.	Settsu	Sanda.
	Bogasaki.		Kikko.
	Shiraishi.		Kosube.
Taishiu (Island of Tsushima).	Tsushima.	Iwaki	Soma.
Owari	Seto.	Kaga	Kutani.
	Horaku.	Ise	Banko.
Bizen	Bizen.	Sado	Sado.
Omi	Shigaraki.	Sanuki	Shido.
	Koto.	Yamashiro	Raku.
Kii	Zushi.		Kioto
Iga	Iga.	Musashi	Tokio.
Tamba	Tamba.		Ota.
Idzumo	Idzumo.		

In addition to the oriental porcelain and pottery, there are several smaller groups of objects, the most noteworthy of which is that illustrating the products of the imperial manufactory at Sèvres, presented by the French Government. This collection is of the greatest value to students of the decorative arts and to a large number of other visitors to the Museum, and it is hoped that it may receive extensive additions hereafter and be arranged in a hall by itself.

In this same connection, as occupying adjacent cases, may be mentioned the very instructive special cases of Japanese lacquer, showing the process of manufacture; of Japanese bronzes; of Russian and American casting in iron, and the cases of enamel and metal work presented by the Siamese Government. All these together form a nucleus which it is hoped in time will develop into a collection similar to that which is the chief glory of the South Kensington Museum in London, and which there has as yet scarcely been any effort made to reproduce in this country, save in the art museums of Boston, New York, and Cincinnati, whose plans, however, are somewhat different.

THE HISTORICAL COLLECTIONS.

A great portion of the time of Mr. A. Howard Clark, the curator, was necessarily devoted to his other duties as editor of the Proceedings and the Bulletins of the Museum, and in charge of printing descriptive labels, the year being the busiest in the history of the Museum in these branches of work, so that it is impossible to report much special work accomplished in advancing the historical collections, except in connection with the preparation of the exhibits for the World's Fair.

The crowded condition of the exhibition halls has necessitated the withdrawal and temporary storage of the entire collections of medals and money, and the general series of autograph papers of eminent Americans. The collections of historical objects remaining on exhibition include memorials and personal relics of Washington, Jefferson, Adams, Van Buren, Jackson, Lincoln, Grant, and other Presidents of the United States, and of soldiers, statesmen, and other eminent Americans, as well as memorials of important events in American history.

There have been 70 accessions to the collection during the year, aggregating nearly 1,000 specimens. The principal objects were a folio Bible belonging to Gen. Washington, with his autograph on the title page; a large number of memorials and personal relics of President Andrew Jackson; autograph letters of Gen. J. E. B. Stuart, of the Confederate Army, and of Hon. G. W. Randolph, Secretary of War of the Confederate States; specimens of the earliest copper money coined in America, dating about 1525; medals presented by the corporation of the city of London, commemorative of events in the history of that city; commissions bearing the signatures of Presidents John Quincy Adams and James Madison; a large collection of engraved and photographic portraits of eminent Americans, and a collection of the decorations of the military and civic orders of Europe and America. It was hoped that a large historical collection might be arranged for the World's Fair, but it was impossible to accomplish all that was planned, owing to lack of exhibition space. The exhibits sent to Chicago included—

(1) About 1,800 engraved and photographic portraits of members of the Continental Congress, the Federal Convention of 1787, the first Congress of the United States, members of the National Academy of Science, and of other eminent Americans—statesmen, jurists, philosophers, Army and Navy officers, physicians, clergymen, educators, artists, authors, merchants, and philanthropists:

(2) Medals, nearly 600 in number, illustrative of American history from the earliest Colonial period through the Revolutionary war to events of recent years, collegiate and ecclesiastical medals, and medals in memory of eminent Americans;

(3) A monographic collection of the metallic money of the colonies prior to the establishment of the United States Mint:

(4) A monographic collection of the American colonial and Continental paper money, and paper money issued by State and private banks and by merchants:

(5) A series of early maps illustrating the development of geographical knowledge of America, and of the territorial growth of the United States;

(6) A series of water-color drawings, about 200 in number, of decorated powder horns carried by soldiers of the American Revolution;

(7) Models of the *Sally Constant* and *Mayflower*, the first passenger ships of the Virginia and Plymouth colonies;

(8) Engravings illustrating the settlement of Jamestown, Va., the landing of the Pilgrims at Plymouth, and other colonial and later events in American history.

THE GRAPHIC ARTS COLLECTION.

The collections illustrating the graphic arts have continued, as hitherto, under the care of Mr. S. R. Koehler, who divides his time between the National Museum and the Boston Museum of Fine Arts, where he has similar responsibilities.

Nearly all the time available during the year has been devoted by him to supplying the specimens placed on exhibition with written labels, and this important task is so nearly finished that but for the Columbian Exposition it would probably have been completed by this time. That part of the collections which is not on exhibition is still awaiting its definite arrangement and classification.

The material so far gathered is not especially available for use in special researches. A useful series of notes on Japanese wood-cutting and woodcut printing was received from Mr. Tokuno, the chief of the Japanese Government printing office, which has been edited by Mr. Koehler and printed in the Museum report for 1892. This publication, which is fully illustrated, is the first treatise on this most interesting subject, based on authentic information received from a competent native Japanese source; it has all the value of a treatise based on original research.

Some additional specimens have been placed on exhibition, which serve to complete or better the series previously arranged, but no new series have been begun, nor, indeed, will this be possible, so long as the means and the space at command are as limited as they are at present.

Although the accessions by gift include a number of interesting and instructive specimens, it is difficult to point out any of them as of special importance, with the exception, perhaps, of an impression of Adolf Menzel's celebrated original lithograph, Christ among the Doctors, presented to the Museum by Mr. J. W. Osborne, and a fine large photogravure reproduction of Stuart's portrait of Washington, known as the Atheneum head, by Messrs. A. W. Elson & Co., of Boston. The thirty-three prints by Schongauer, Dürer, Goltzius, Rembrandt, Nanteuil, Wille, Bartolzzi, Walker, Mercuri, Gaillard, etc., which, together with a number of technical specimens, were bought for exhibition at the World's Columbian Exposition, at a cost of about $1,100, will of course add valuable material to the collections.

The exhibit prepared by Mr. Koehler for Chicago, though of necessity small, was exceedingly choice and instructive.

An adequate presentation of the subject being out of the question, the attempt was made to show the beginnings of the more important processes used in the production of printable pictures, and to contrast these with the latest achievements of the same processes, in the hope that, by thus placing into juxtaposition the two ends of the line of development, the advances made would become apparent at a glance. The whole collection was therefore to be looked upon as a tableau illustrating the condition of the multiplying arts at or about the time of the discovery of America, and the condition of the same arts in the nineteenth century, with added specimens of the principal processes introduced in the four hundred years intervening between these periods.

With this end in view, sixteen large frames were filled with prints, each frame containing on an average about six prints, and arranged as follows: Frame 1 contained woodcuts of the fifteenth and sixteenth centuries, while in frame 2, alongside of it, were shown wood-engravings by American wood-engravers, produced within the ten or twelve years last past. A similar arrangement was carried out for line-engraving and etching, which filled, respectively, frames 3 and 4, and frames 5 and 6. The later processes, the origin or at least the general acceptance and development of which dates from the seventeenth and succeeding centuries, had to be treated even more summarily. Thus, frame 7 was devoted to mezzotinting; frame 8 to dry-pointing and aquatinting; frame 9 to the crayon manner and stippling; frame 10 to lithography, and frames 11 and 12 to the various photo-mechanical processes. Frames 13 to 16 constituted a special division, in which the attempt was made to give some idea of the history of color-printing.

The curator was far from satisfied with this display, as will be shown by the following extract from his annual report, and it is not at all to be wondered at, since the possibilities were so great and the resources were so small, compared with those of any similiar collection in a European capital. I can say from personal observation, however, that the collection was greatly appreciated, and not only deserved but received much attention, as indeed a series of specimens so well selected and admirably arranged and labeled could not fail to do in any exhibition at home or abroad.

I can not well omit the curator's own somewhat low-spirited estimate of the value of his work for the Exposition, since his statement of the great needs and great opportunities in this connection may very possibly attract the attention of persons who may be interested in improving the present condition of affairs.

I must reiterate [writes Mr. Koehler] my remarks upon the necessity of more liberal appropriations for the section of graphic arts. The unfortunate consequences growing out of the present condition of things made themselves very seriously felt in connection with the World's Columbian Exposition, and I shall therefore beg leave to offer a few remarks on this subject.

Among the great achievements which make the fifteenth century one of the most important epochs in the history of the human race, the development of the reproductive or multiplying arts is by no means the smallest. Like the art of printing books from movable type, these arts were the outcome of the individualistic and humanistic movement of the time, and like it they have been instrumental in disseminating knowledge and training the human mind in the modern way of looking at things—the modern "world conception"—not only by accompanying the printed word by printed pictures in books of instruction, but still more by scattering broadcast among the people in vast numbers veritable works of art, which ministered to the reawakened feeling for the beauty of nature, while they quickened at the same time the powers of observation. It is worth noting, moreover, how closely the dates of importance in the first period of the history of the arts in question cluster around the date of the discovery of America. The first book illustrated with copperplate engravings, the Monte Sancto di Dio, appeared at Florence in the year 1477; Martin Schongauer, the first truly great artist north of the Alps who was active as an engraver, died in the year 1491, or thereabouts; the Nuremberg Chronicle, celebrated for its many illustrations by Wolgemuth, Dürer's teacher, is dated 1493; Dürer's Apocalypse, the first great woodcut publication ever produced, appeared in the year 1498, and Andrea Mantegna, the first truly great engraver south of the Alps, died in the year 1506. It would have seemed fitting, therefore, that in the picture of the world's progress since the discovery of America, which the Columbian Exposition was to present to its visitors, the history of the multiplying arts should have been illustrated quite fully. The limitations of means and space, however, made such an illustration impossible, and the result was an exhibition which commanded no attention, and, indeed, hardly deserved any.

Small and inadequate as this exhibition was,* its usefulness was still further crippled by the impossibility of having the descriptive pamphlet printed which had been prepared, and without which the fragmentary character of the collection must necessarily have proved puzzling, even to well-informed visitors.

As to the specimens shown, while they were all good, and some of them, indeed, very fine, there were nevertheless wanting quite a number of things which ought to have been included, but instead of which, from dire necessity, inferior examples were exhibited.

When an institution like the U. S. National Museum, the only institution of its kind under the care of the Government of the United States, attempts to illustrate the beginnings of line-engraving, of mezzotinting, of color-printing from metal plates, etc., it ought to be able to show the rarest and best things,—for instance, a specimen of the best of Schongauer's, instead of only a late impression from a Schongauer plate; a mezzotint by Von Siegen, instead of merely a Wallerant Vaillant; color-prints by Le Blon and Debucourt, instead of things of little importance by D'Agoty and Janinet, and so on to the end of the list. It is aggravating to be compelled to appear before the assembled delegates of the civilized nations of the world with such a confession of poverty, more especially when it is universally known that the insufficiency of the efforts put forth is due, not to the poverty of the nation, but to the neglect of the representatives of the people, into whose hands has been given the welfare as well as the upholding of the reputation of the United States.

What the curator has said merits serious thought, for the collections are undoubtedly pitifully poor in comparison with those of other nations, and a national print collection ought to be maintained in Washington worthy of the nation. It has, however, never been provided for, and what there is of that kind has grown up in connection with quite another plan, which was to illustrate fully the technology

*This was due to the unfortunate system of printing concessions made by the Exposition authorities, placing all printing privileges in the hands of a single establishment.

of the graphic arts. That the effort in this direction has been very successful is certain. In confirmation of this statement I quote a few sentences from the official report of Prof. William Roose, chief of the chalcographical division in the German Government printing office, who visited Washington and the Museum in the course of his mission to the World's Fair:

This wonderful collection in the National Museum [writes Prof. Roose] illustrates the graphic arts from their beginnings to the developments of the present day. It forms the most remarkable and unique collection of its kind, and probably stands alone in the world. It is not a so-called collection of engravings or of the productions of the graphic arts in the generally accepted sense, for the emphasis is not placed here upon the artistic value of the specimens shown. The aim is rather to illustrate how the graphic arts developed in the course of time, and how they are practiced at present. All kinds of intaglio engravings, etchings, mezzotints, aquatint, wood-engraving from its earliest products to the latest newspaper cut, lithography in all its varieties, the latest photo-mechanical reproductions in copper, gelatine, zinc, brass, etc., are shown in many hundred specimens, in all stages of development, and arranged in chronological series, accompanied by detailed descriptions—partly on the walls, partly in table cases—together with the plates, stones, electrotypes, etc., needed for their elucidation. The purpose here is to exhibit the technical, and to show how man managed to make pictures multipliable, what means he has thought out and used with this aim in view, from the beginning down to our own day. An original, one-sided, genuinely American, but certainly also a practical and sensible idea.

THE MATERIA MEDICA COLLECTION.

The work of this section, which is now under the care of Medical Inspector C. H. White, U. S. Navy, has been confined to the preservation of the collection in its present form and in the preparation of such new specimens as were found desirable for exhibition. The collection is in excellent condition for study, and the exhibition series is admirably installed, the greater part of it being a most admirable display in the field of economic botany.

The collection is so complete that novel additions are few.

DEPARTMENT OF ETHNOLOGY.

The ethnological collections are at present understood to include all objects illustrating the history and activities of mankind, save those classed as prehistoric and those which are assigned to the Department of Arts and Industries. The division is somewhat arbitrary, and there are of necessity constant changes of material, as the needs of the exhibition series show them to be necessary.

The ethnological collections are particularly complete for North America, but as years go by, through exchange and gift, they are becoming fairly representative of the whole world. The North American collections are especially rich in respect to the Eskimo stock, the stocks of the Northwest coast, the Shoshonean tribes of the Great Interior Basin, the buffalo-hunting tribes of the stocks along the Plains of the West, and those of the Pueblo region of the southwest, which have been so thoroughly explored by the Bureau of Ethnology under the direction of Maj. J. W. Powell.

Perhaps no portion of the Museum is so cramped by lack of space as this. The material already mounted and labeled for exhibition would fill five times the space which can now be assigned to it, and if installed in rooms of sufficient capacity, would form one of the most instructive and impressive ethnological collections in the world. At present, however, only a small portion of this treasure can be shown, and the result is far from satisfactory, since the effective display of such objects depends largely upon the manner in which they are arranged with reference to one another and to some great ruling concept, a result which can only be accomplished in halls of ample dimensions.

The curator of the ethnological collection, Prof. O. T. Mason, has for a number of years been bringing these vast materials under control, so that any object with its full history can be consulted without delay, a most ingenious system of storage, indexed by a card catalogue rendering the material available for the use of investigators. At the same time the material is at once ready for any new steps in the development of the exhibition series, and were space available, in a few weeks the entire collection could be placed before the public. If this could be once accomplished, the result, I am satisfied, would astonish those who are most familiar with the resources of the Museum in this field.

During the past year the entire time of the curator has been devoted to the World's Fair to the exclusion of any new Museum enterprises. The usual routine of receiving new material and caring for the general collection has gone on, but no new specimens have been put on exhibition in the Museum. The number of specimens received during the year was 5,094, and 3,161 entries were made in the departmental catalogue.

As has already been said, the participation of the Museum in expositions is a detriment to its scientific work. A certain compensation is found, however, in the opportunity to instruct the public by an exhibit systematically arranged and labeled, and in the increase to the collections.

In arranging for the ethnological and archaeological portion of the exhibit at the World's Columbian Exposition it was decided that the efforts of this Department should be combined with those of the Bureau of Ethnology, which is another branch of the Smithsonian Institution, and which has already been so closely connected with the Museum in its activities that it is impossible to separate the interests of the two. In developing the plans for the Exposition, many projects were discussed, and, but for the fact that a general ethnological display had been arranged for under the direct control of the World's Columbian Exposition, a more comprehensive anthropological collection would have been prepared. It being the first object, however, to avoid rivalry and duplication, and to contribute so far as possible to the general success of the fair, the scope of the National Museum exhibit was limited to North America.

In order to bring into sharp comparison the concepts of race, speech, and activities among the American aborigines, it was proposed by Prof. Mason that a special exhibit of arts and industries by linguistic stocks should be the main feature, and that this should be founded on the great linguistic map of North America, just then published by the Director of the Bureau of Ethnology, as the crowning result of ethnological labors on our continent during fifty years.

The details of this plan are quoted in the words of Prof. Mason, in the discussion of the labors of the Department of Ethnology. In this connection the staff of the Museum and Bureau of Ethnology cooperated—Prof. Mason representing the Museum and Mr. H. W. Henshaw the Bureau of Ethnology. This cooperation was interrupted for several months by Mr. Henshaw's absence from the city, but a month before the opening of the exhibit Prof. W. H. Holmes was assigned by Maj. Powell to represent the interest of the Bureau of Ethnology, and by him most efficient services were rendered, not only in preparing illustrations of his own remarkable investigations, but in advising and directing the preparators in arranging groups of costumed figures, etc. In this work Mr. Frank H. Cushing, through his familiarity with the customs and arts of the Pueblo people, rendered also most valuable services. Mr. James Mooney also participated, and the group of Kiowa children, prepared under his direction, was among the most attractive of them all. But for his absence in the field, collecting material, he would have been able to devise others of similar excellence. Dr. W. J. Hoffman superintended the preparation of groups of Northern Indians.

As has been stated, the plan upon which the combined exhibitions of the Bureau of Ethnology and of the National Museum were arranged, was developed by Prof. Mason, who describes in the following words its principal characteristics:

The plan of setting up the products of aboriginal art in accordance with the linguistic chart just published by the Bureau of Ethnology was carried out so far as the material would admit. Some of the stocks have disappeared altogether, and it would be impossible to give a picture of their arts. Others are reduced to such small numbers, and they are living now under such enforced circumstances, that it would be of little use to attempt to reproduce their primitive mode of life.

There are certain great stocks and groups of stocks, however, that are yet to be found in respectable numbers, and they were formerly spread out over vast areas, which in themselves constitute culture-regions. The stocks selected for representation at the Exposition were those which had developed unique types of culture; for example, the Eskimo for the Arctic area; the Koloschan, Wakashan, Haeltzukan, and Salishan stocks dwelling in the archipelagos and on the mainland of the northwest coast of America; the Athapascan stock, dwelling in three extremely different culture areas, to wit: in northwest Canada and Alaska; in northern California, and in New Mexico and Arizona; the Algonkian stock, whose tribes once covered the entire region of northern and eastern North America, bounded on the south by southern Tennessee and on the west by the 117th meridian; the Iroquoian stock, surrounding the Great Lakes; the Siouan stock, on the Missouri drainage; the Kiowan stock, forming an intrusion from unknown source into the buffalo region of the plains; the Shoshonean stock, covering the great interior basin and related to the Aztecs of Mexico; the tribes of California occupying the acorn and piñon and basket-making area; the Piman and Yuman stocks about the Colorado mouth; the Pueblo peoples in Arizona and New Mexico. These stocks enable the student to examine the relations that may exist between geography, ethnology, glossography, and technography. All technical and biological regions are covered by this arrangement, and all of the leading nationalities and tongues, and all of the characteristic Indian arts are also represented.

The result of this study is most interesting. In the supply of natural wants, the various tribes have yielded to regional or geographic forces. This is well shown, both in the plains of the great West and in the southern desert, and, indeed, throughout the continent, as appears in comparing Powell's map with Dr. Merriam's bio-geographic map, published by the Department of Agriculture. Along the eastern slopes of the Rocky Mountains were formerly to be found Algonkian, Siouan, Kiowan, and Shoshonean tribes. Their languages were radically different. Their tribal organizations, similar in plan, were still entirely unlike in their totemic systems. But the all absorbing occupation of buffalo hunting, combined with the limitations of vegetal and mineral material, determined the diet, the dress, the house, the tools, and the products of industry. That is, the materialistic activities were controlled by the environment.

Superadded to this series of effects, as anyone could see at the Exposition, were others of a more refined nature. The spiritualistic, metaphysical expressions in these same specimens were overwhelmingly ethnical and linguistic. The arrow for killing a buffalo must be of a certain material and form; nature determined that. But the feathering, the streaking, the symbolism on the arrow, were distinct for each tribe and tongue. The buffalo or bearskin robe was nature's gift to all, and it was cured after the same general fashion. But the paintings were national, totemic, special, almost independent of the environment.

The Pueblo region teaches some interesting lessons in these same particulars. Here are gathered also four stocks, the Shoshonean, the Tañoan, the Tewan, and the Zuñian, differing essentially in language and totemic system and mythology. But there are only certain articles of food to be had here naturally; the country lends itself kindly to the cultivation of corn, beans, and pumpkins. The peculiar geological formation, furnishing stone and adobe mud in abundance, almost forbade the erection of other than one style of house, the pueblo. Clay of the finest quality everywhere invited to the creation of pottery. As for textiles, the curious phenomenon is presented of tribes preserving their old arts in new areas. This remark may be supplemented by the observation that the bringing of sheep to this region by Spanish missionaries stimulated the trade of frame and loom weaving in all the linguistic stocks alike.

By the method of study pursued in this exhibit in Chicago, the lessons inculcated by other stocks are emphasized. For instance, while the Moki or Hopi Pueblos of northeastern Arizona are tenanted by Shoshonean tribes, the Utes, the Shoshones, the Bannacks, and even the Comanches, are of the same linguistic family. Now, in one of these is presented a buffalo-hunting people, in another an Indian of the woods, in a third the man of the desert, with corresponding occupations. The country has endowed and suggested the trades in each case. In one of the Hopi pueblos, furthermore, two styles of basketry are to be seen that are unknown among the other Shoshonean tribes. One of them, the coiled ware, resembled in technique, but not in material, that of the wild Apaches or the southern Californians. The other is a wicker type, really unknown among other tribes hereabout but common everywhere in North America east of the Mississippi. It is impossible to bring out all the minor lessons taught in this first attempt ever made to bring the concepts of tribe, language, and industry into the same line of comparative study through series of objects.

The following is a concise description of the exhibits. The plan was to set apart a definite space or alcove for each linguistic family or stock, to place in the center of each a group of lay figures of men and women or children, dressed in proper costume and engaged in typical occupations. About this group, in wall cases and screens, would be assembled as many examples of the handiwork of that people as possible. Especial attention was given to selecting such arts as were quite characteristic and distinctive in each case.

It is much to be regretted that the contracted space allowed in the Government building at Chicago prevented the curator from giving to the idea its fullest expansion. Enough was displayed, however, to bring into prominence the statement that the earth, with its climate and natural resources, has much to say about the material and the form of human industries. Blood and language and social life and religion have their say also in the arts of life, but their influence is superadded, and not fundamental.

In the development of this collection, in accordance with these plans, Prof. Mason was engaged for nearly three years, and a large amount of effort, which under other circumstances would have appeared in the form of contributions to the literature of ethnology, was devoted to the preparation of the descriptive labels and the educational material to be exhibited. In this work most effective assistance was rendered by various members of the Bureau of Ethnology and the Museum staff. Mr. James Mooney spent several months among the Moqui Indians of Arizona, and Kiowas of Indian Territory, and while in the field was also instrumental in obtaining the Voth collection from the Cheyenne and Arapahoes. The collections sent in embraced over one thousand objects. Dr. W. J. Henshaw also collected among the Crow Indians, and obtained among other things some very beautiful costumes, especially the dress and outfit of a Crow warrior. Mr. Henshaw while in California obtained an important collection of basketry and other objects of the Californian tribes.

Another interesting and important outgrowth of the work of this department was the result of the curator's especial interest in the work of woman in savagery, or woman's share in primitive industry. This subject was discussed by him in the lecture entitled "Woman's Share in Primitive Culture," delivered by him in the National Museum Saturday lecture course in 1888. The attention of many intelligent women was thus attracted to the subject, and at the special invitation of the Board of Lady Managers, and in accordance with the special resolution of Congress, an exhibit of woman's industries was prepared and installed in the Woman's building. The idea which this collection was intended to illustrate is described as follows:

The motive of this exhibit was to show woman's work in savagery, or woman's share in primitive industries. Reviewing Mr. Spencer's division of the course of history into an age of militancy and an age of industrialism, it occurred to the curator that this should rather be a sexual classification. This would give a sex of militancy, which is masculine, and a sex of industrialism, which is feminine. This is very clearly proved by this exhibit. The highest classific concept would be craft or trade—for example, the harvester, the miller, the cook, the tanner, the potter, the weaver, and so on. Under each of these heads, by a collection of specimens, it was shown what women from every savage area are capable of doing. The division was first technic and then ethnic. The whole title of the exhibit would read, "What women of savagery in each trade could do, and how these works appeared when compared ethnically."

Reference has already been made to the participation of the Smithsonian Institution in the Columbian Historical Exposition at Madrid, and to the fact that the larger portion of the material was lent from the National Museum.

As a matter of fact, most of the matter sent from the Museum was selected from the exhibits already prepared, mounted, and labeled for the World's Fair in Chicago, and but for the elaborate preparations which had already been made, it would have been impossible for the United States upon so short a notice to have made so creditable a showing upon this most important anniversary. It was a matter of much regret that the pressure of the preparation of the exhibit for Chicago was so great that Prof. Mason could not accompany the collection to Madrid, as it represented so much of his individual activity, especially since he had been identified from the beginning with the committee of organization, which was appointed by the Spanish minister in Washington, and which had already done much to excite public interest in this occasion. His assistant, Dr. Walter Hough, was attached to the American commission, and was charged with the installation of the material from this department, as well as with the preparation of the Spanish catalogue, an English translation of which will appear in the forthcoming report of the Madrid Exposition. This catalogue embodies the descriptive labels of a large portion of the collection which was sent to Chicago, and which will in time be utilized in the preparation of various memoirs illustrative of the Exposition material in the Museum.

Although allusion has been made to the Museum staff of preparators in connection with the Chicago exhibit, it seems only proper to refer here to the admirable work of those especially attached to the ethnological collections, notably Mr. Carl Bergman, in the mounting and costuming of groups of figures, and Mr. Thomas W. Sweeny in arranging and labeling the cases containing the comparative collections. Mr. Theodore A. Mills and Mr. Dunbar rendered excellent services in the modeling and casting of the bodies, heads, and limbs of the figures in groups.

All the activities of the department were so absorbed by the work which has just been described, that this and the preceding year's work upon papers and monographs upon the collection was to a large degree interrupted. A paper upon "The Ulu, or Woman's Knife of the Eskimo," by the curator, in the Report of the Smithsonian Institution, appeared during the year.* This paper was prepared especially for

* Report of the U. S. National Museum, 1890–'91, pp. 411–416, Pls. LII–LXXXII.

archæologists, to enable them to understand the functions of many stone implements in their cabinets.

An address was also delivered by him on "The Land Problem" before the Brooklyn Ethnological Society. During the year also appeared Mr. Hough's "Catalogue of the Bernadou, Allen, and Jouy Korean Collections in the National Museum,"* and also by the same student a paper on time-keeping by lighting and fire, and another upon the method of fire-making. Mr. J. D. McGuire's paper on the "Stone Hammer" was also written in connection with the Department of Ethnology and was prepared in the Museum. In this same connection should be mentioned the essay by Surg. Washington Matthews, U. S. Army, on the Catlin collection of Indian paintings in the National Museum.† Mr. McGuire also prepared a series of objects for the World's Fair to illustrate the processes employed by the North American Indian in working stone, by battering, boring, sawing, chipping, grinding, and polishing.

A series of these objects, together with the apparatus used, was displayed at the Exposition, and an exact account given of the time and method used in the preparation of each one on an accompanying label. The case containing this collection occupied a prominent aisle in the Smithsonian space, and attracted much attention, not only from Americans, but also from Europeans.

The most important accessions of American material have been, as usual, through the Bureau of Ethnology, including especially the valuable collection made in connection with the Exposition by Messrs. Henshaw, Mooney, and Dr. Hoffman. Mrs. M. M. Hazen deposited an exceedingly important collection of objects from the Sioux and Eskimo tribes, collected by her late husband, and from Lieut. W. E. Safford was obtained a most important collection of paintings of Peru by a native artist, as well as a large collection of dress and native material, including the very handsome feather costume, which is mounted upon the single figure of a Xivaro Indian. This was one of the most beautiful of the costumed figures shown in Chicago. The Museum obtained by purchase the ethnological collection procured by Lieut. Cook during his military services in the West; from Mr. Edward Palmer, a small collection from the Tarahumara Indians of Mexico, and from the heirs of Mr. J. Henry Turner, some interesting objects collected on the Upper Yukon, Alaska. Of special interest in this connection, was a wampum belt obtained from Mr. William Thompson, and said to belong to the great Shawnee chief, Tecumseh.

A small African collection was received from Mr. William Astor Chanler, the result of his explorations in the eastern part of the continent, and others were obtained for the National Museum at Loanda by Mr. Heli Chatelain, and by Mr. Carl Steckelman, from Mayumba.

* Report of the U. S. National Museum, 1891, pp. 429–488, Pls. II–XXXII.

† Report of the U. S. National Museum, 1890, pp. 593–610, Pls. CXXX–CL.

Dr. W. L. Abbott, whose magnificent contributions to the Museum are referred to elsewhere, sent an important collection of objects from Bombay. Erhard Bissinger, esq., U. S. consul at Beirut, Syria, sent a collection of Syrian games of chance.

Hon. W. W. Rockhill, Third Assistant Secretary of State, has placed at the disposition of the Museum a large and exceedingly important collection illustrative of the arts and customs of Tibet, which was obtained by him in his two journeys in the interior, and which is to be the subject of an illustrated catalogue to be published in the present report of the Museum. At Hoihow, China, Dr. Julius Neumann continued his friendly cooperation by sending additional illustrations of the native arts of northern China.

Polynesian collections were sent by Rounsevelle Wildman, esq., U. S. consul at Singapore, who made special collections under the direction of the Museum. Alexander R. Webb, esq., U. S. consul at Manila, sent by request a collection from the Philippines, including a very excellent series of games. Victor A. Jenny, esq., U. S. consular agent at Macassar, secured specimens illustrating the arts of New Guinea, while our old and valued correspondent, Prof. H. H. Giglioli, sent in exchange an important collection from the Andaman Islands, including over 100 objects.

PREHISTORIC ANTHROPOLOGY.

The hall containing this collection is the largest and most impressive in the Museum, and, owing to the extent and value of the material, chiefly in American archæology, it is one of the most noteworthy features of the establishment. Since the death of Dr. Charles Rau in 1887, by whom the collection was organized and first arranged, it has been under the charge of Dr. Thomas Wilson, who has increased it by the deposit of his own cabinet of European material.

The number of specimens at the end of the year is reported by the curator at 140,182, 1,164 having been added during the month of June.

Under the administration of the present curator many changes have been made, especially in the fundamental plan of classification. The collection is at present arranged in two series. The general principles adopted apply more to prehistoric objects from the Old World and are those of foreign archæologists. It has been deemed unwise by the curator to attempt any definite classification of the culture of antiquity in the United States more than to put it generally into the neolithic period.

1. A synoptical series, with reference to prehistoric man, assembling objects believed to have been employed during each given epoch of early civilization. These epochs are then arranged in series, beginning with the earliest forms and continuing down to historic times.

2. Geographical series, in which the greater portion of the collection is arranged with reference to political subdivisions. The objects from

the provinces of Canada, the various States of the United States, and the Latin Republics are brought together.

In this department, also, much of the energy of the year has been devoted to preparing collections for expositions. The curator was attached to the staff of the United States Commission at the Historical American Exposition at Madrid from August, 1892, until December, when he was unexpectedly called upon to return.

The exhibit prepared under his supervision for the World's Fair was shown also at Madrid, and is explained at length in the special paper to be included in the report of the American Commission. It is described in brief in the following statement from the pen of the author:

The exhibit of this department at Madrid comprised 2,500 prehistoric objects, which were displayed in 19 double slope-top cases in the main hall assigned to the United States. The exhibit at Chicago comprised 1,250 specimens, arranged in 7 flat-top cases in an alcove belonging to the space assigned to the U. S. National Museum. The general arrangement of objects in these two expositions was much the same; that is, it was both chronological and according to function. The implements and objects belonging to the earliest period showing human occupation were arranged in the first cases, and consisted principally of those belonging to that which is in England called the Alluvial or Drift Period; in France, the Chelléan Epoch of the Paleolithic Period. The various epochs of the Pâleolithic Age were represented by implements from northern and southern England; from all parts of France; from Italy, Spain, and Portugal; from Egypt, by a loan display from Prof. H. W. Haynes, of Boston; and from Hindostan, Asia. There were casts of several prehistoric skulls from Europe—the Neanderthal, Olmo, Laugerie Basse and Engis.

Implements similar in form, style, and manufacture to those of the Paleolithic Age of European countries were shown as coming from the United States, which objects, if found in Europe, would be undoubtedly accepted as paleolithic. The investigations in this respect in the United States of America have not been so profound as in Europe, and anthropologists are not unanimous concerning the conclusions to be drawn therefrom. There were shown a fossil human thorax and a fossil human skull and thigh-bone, the two latter changed to limonite, all from Florida, found by Judge John G. Webb; a fossil pyrula shell, bearing the prehistoric engraving of a mammoth; implements from the auriferous gravels under Table Mountain, California; others from the Walker River Canyon, in the extinct Quarternary Lake Lahontan, Utah; still others from Fossil Lake, Oregon. These were followed by prehistoric objects of the Neolithic or Polished Stone Age, those from Europe having precedence. England, France, Spain, Italy, Switzerland, Germany, Denmark, Sweden, Norway, Russia, the Island of Crete, Japan, and Cambodia were all represented. The implements from these countries were much the same as those from the United States.

In the display made from the United States every State and Territory was represented by objects belonging to prehistoric man—polished stone hatchets, grooved axes and drilled axes, arranged in series according to form, style, and size; stone mauls, adzes, gouges, some from the West Indies of shell; extensive series of caches of leaf-shaped and other stone implements, principally from Pennsylvania and Ohio, though some were from Tennessee and Arkansas; a full series of implements from the quarries and workshops of Flint Ridge, Licking County, Ohio; scrapers of all kinds; arrow- and spear-heads arranged in the latest classification, leaf-shaped, triangular, and stemmed, and those of peculiar form; large flint disks; ceremonial objects, ornaments and weapons, cup and pitted stones, drilled tablets, discoidal stones ("chungkee"), sinkers, pendants or charms; perforators; tubes, beads and pipes, shown as specimens of aboriginal drilling; club heads, digging sticks, riatas, mortars, and grinding stones; pestles; steatite vessels and the implements with which they were made; hematite objects; agricultural or digging implements, arranged in series; aboriginal sculptures; objects in shell, horn, and bone; stone daggers and swords; slate knives; copper implements from the United States; stone collars and zémés from Porto Rico; stone masks, clubs, and hatchets from the West Indies; jade, turquoise, rock crystal from Alaska, Mexico, Central and South America; obsidian from California and Mexico; gold objects and ornaments from Chiriqui and Antioquia, Central and South America; plaster models of aboriginal towns and monuments belonging to Indian tribes; and, for purposes of comparison, numerous objects from the modern North American Indians were shown in the glass case, duly labeled with the tribe, locality, and special point of comparison indicated.

The collection was arranged in groups, so that a single label would comprise as many objects as possible. The labels were prepared with care, printed on herbarium board, and displayed with the objects so as to be easily read by the public.

The collection was described in the official catalogue as follows:

The exhibit under this head deals with man before the dawn of history, and comprises implements, utensils, and other objects found in different parts of the world, and recognized as his handiwork.

OBJECTS OF THE PALEOLITHIC OR CHIPPED-STONE AGE.

A series of about sixty chipped stone objects from Europe, Asia, and Africa, belonging to the first, the alluvial or Chelleën Period of the Age, and representing the earliest accepted implements made by man.

Objects of the second, the Reindeer or Cavern Period.

Casts of four prehistoric human skulls Neanderthal, Olmo, Engis, and Laugerie Basse.

Implements of stone and bone from France and England (Cresswell and Kent's caverns, England; Moustier, Solutré, and La Madelaine, France).

Objects from the United States, of the same form as the preceding found in Post-pliocene formations and on the surface, and believed by some students to be implements of the same character as those of Europe. (Exhibited for comparison.)

OBJECTS OF THE NEOLITHIC OR POLISHED-STONE AGE.

A series from the Old and New worlds, comprising hammers, cores, flakes, hatchets, scrapers, disks, chisels, poignards, arrow- and spear-heads—polished and unpolished.

A collection to illustrate a classification of arrow- and spear-heads.

A series of objects of stone, including "banner stones," drilled tablets, and boat and bird shaped stones, etc., the uses of which are unknown, but which are supposed to have been connected with ceremonies, or used as ornaments or in games.

Objects of shell, bone, and horn.

Copper implements and ornaments of America.

Gold ornaments from Central and South America.

Bronze implements and ornaments from Europe.

A collection of ornaments, knives, hatchets, and other objects, of jade, turquoise, rock crystal and obsidian, from Alaska, Central and South America, Australia, and New Zealand.

A series of prehistoric Carib implements, including stone collars, zêmés, stone masks, clubs, hatchets, etc., from Porto Rico, West Indies.

In connection with the Exposition work, Mrs. Wilson's private collection of laces, mounted, and with an elaborate series of descriptive labels, was placed in the Woman's building.

An interesting and valuable collection of prehistoric antiquities comprising 178 objects was given by Mrs. Schliemann on behalf of her husband, lately deceased. They were gathered by the celebrated explorer during his excavations on the hill of Hissarlik and came from the buried cities on the site of Ancient Troy.

The curator continued his duties as editor of the department of anthropology in the "American Naturalist" and also published a paper upon "Anthropology at the Paris Exposition in 1889." In addition to the routine work already described, the preparation of a series of casts of typical prehistoric stone implements for distribution to colleges and museums has been continued.

THE COLLECTION OF ORIENTAL ANTIQUITIES.

This collection is an outgrowth of the Department of Ethnology and was established in 1888 under the honorary curatorship of Dr. Paul Haupt, professor of Semitic studies in Johns Hopkins University, chiefly for the purpose of calling attention to the fact that the National Museum was ready to receive and care for objects obtained by archæological exploring expeditions in the East, and also to meet the constant demand from visitors for collections corresponding to those known in London as of Biblical archaeology.

Owing in part to lack of space, the specimens have not been a very serviceable study collection. Special attention was given to the making up of a study series of casts of Assyrian and Babylonian seals, of which a large number were found to be in private possession of this country. It is hoped that in time this series will include a complete representation of every seal in America, and that this material of such importance for purposes of research will be elaborate enough to render it available for comparative study.

Owing in part to lack of space and still more to the fact that it is so difficult to obtain genuine material, the growth of this collection has been very slow, but it still occupies a prominent place in the Museum, and every effort will be made for its improvement.

A number of objects have recently been withdrawn from this series to form a portion of the collection of religious ceremonials which was prepared as a special feature for the World's Fair under the charge of Dr. Cyrus Adler, assistant curator of this department.

Among the most important recent accessions are two squeezes of ancient tablets at Persepolis, brought home by the Hon. Truxton Beale, from which have been made the beautiful plaster casts figured and described by Dr. Adler in another part of this report.

Another collection received during the year, which seems to deserve special remark in this place, is referred to in a statement prepared by the custodian of the collection:

The most notable and welcome collection was obtained through the kindness of Miss Olive Risley Seward, of Washington, who placed on deposit in the Museum an interesting collection of Cypriote and Phœnician objects. Aside from their intrinsic value these objects have a historical value, in that they were acquired at the actual scene of the excavation.

THE COLLECTION OF RELIGIOUS CEREMONIAL OBJECTS.

Since 1889, objects of religious ceremonial have been exhibited in connection with the collection of Oriental antiquities. A beginning was made by the formation of an exhibit to illustrate the Jewish religion, but the scope has since been widened and may in the future include the lower types of religion, with the exception perhaps of those which it would be difficult to illustrate by the separation of material from the general ethnological series.

The idea of a collection of this kind was first taken up in this country by the National Museum, and a proposal is made in regard to it in the Museum reports for 1881 and 1889.

In 1892 a similar project was taken up by the University of Pennsylvania, and an admirable loan exhibition was prepared under the direction of Mr. Stewart Culin.

In the "Biblical World" for January, 1893, the following allusion is made to the subject:

> An important and indeed indispensable adjunct to the study of religions is the Museum, which in its ideal form should represent a tableau of the course taken by religious rites in their development. Credit is due to the U. S. National Museum for having taken the initiatory steps in this direction. In his report for 1889,* the Secretary of the Smithsonian Institution called attention to the importance of collections of articles of worship, and since that time an excellent beginning has been made in the departments of American and Oriental antiquities. Messrs. Fewkes, Adler, and Rockhill have been instrumental in advancing the section of comparative religions in the National Museum and with the admirable facilities possessed by a Government institution for obtaining objects from all parts of the world, the scope of this section ought at an early day to be made coequal with the universe. At the University of Pennsylvania, also, the place of the Museum as the laboratory for study of religions was emphasized by a special loan exhibition of objects used in religious worship, which was opened last spring. The catalogue, which is of the entire exhibition, is due to the energetic and well-directed efforts of Mr. Stewart Culin, the director of the University museums, and is an admirable piece of work, distinguished for its method, clearness, and accuracy. The exhibition, embracing Egypt, India, China, Japan, America, and Mohammedanism, is noteworthy as the first of the kind in the country.

The history of the collection has been epitomized in a paper prepared by Dr. Adler for the Anthropological Congress in Chicago, a revision of which is printed in Part II of this Report.

The special exhibit shown in Chicago is limited to a selection from the religions of the nations inhabiting the Mediterranean basin, with special regard to the ceremonies, as forming the starting point for a comparative study of religions.

*The plan was first announced in the Report of the Assistant Secretary for 1881.

The exhibit comprises the following religions: Assyro-Babylonian, Jewish, Mohammedan, Greek, Roman, and Oriental Christian.

Assyro-Babylonian religion:

Bas-reliefs (casts) representing divinities and worshippers.

Seals (casts) engraved with representations of mythological and religious scenes.

Photographs of divinities and scenes of worship.

Jewish religion:

Objects used in the service of the Synagogue.

Sacred books: Manuscripts of the Law (Pentateuch), of the book of Esther.

Ornaments, veils and curtains of the Holy Ark, mantles and covers for the law; breastplates, bells, and pointers.

Outfit of the worshipper: Prayer-mantle, phylacteries, and prayer books.

Objects used on sacred occasions.

Sabbath: Kiddush cloth, habdalah set, lamps.

Passover: Complete set of the utensils of the passover meal, comprising glasses, dishes, cups, saucers, serviettes, and covers. The liturgy of passover evening.

New Year's day and day of atonement: Cornets (shofars). Liturgies of the Beni-Israel (Jews of Bombay in the Marathi language).

Feasts of tabernacles: Curtain of booth, palm branch (lulab), and citron (ethrog).

Objects used on special occasions: Circumcision, knife and cup. Consecration of child. Siyum. Marriage: Wedding rings, marriage contracts. Omer tablet. Other religious observances. Knife used for slaughtering animals. Hanukah (feast of dedication)—lamps. Mezuzah—tablet on the door post. Amulets. Mizrach.

Graphic illustrations: Ceremonies and implements of the synagogue. Ceremonies of festal days. Domestic ceremonies. Photographs of synagogues. Photographs of Jewish rabbis. Photographs of Samaritan pentateuchs and other MSS.

Mohammedan religion:

Objects used in the mosque: Koran, reading stand, crescent, lamps, ewer and basin for ablutions. Dress and paraphernalia of religious persons. Costume of Imam and Dervish. Dervish staff and drum. Vessel, amulets. Set of photographs of Mecca and the pilgrims. Photographs of mosques, fountains, religious persons and feasts, and burial places.

Greek religion:

Objects of worship. Principal divinities. Minor or secondary deities. Mythological scenes. Religious practice. Festal scenes and processions. Altar and sacrifices. Votive tablets. Sepulchral reliefs. Graphic illustration: Picart plates representing divinities, priests, altars, and other utensils of worship and various religious scenes.

Roman religion:

Objects of worship. Principal divinities. Minor or secondary deities. Tombstone.

Oriental Christian religion:

Armenian, Coptic, Ethiopian, and Greek ceremonial vessels, votives, ikons, manuscripts, etc.

The idea of a collection of religious ceremonial objects has excited much interest, and cooperation most valuable and enthusiastic has been given by a number of the friends of the Museum.

THE COLLECTION OF AMERICAN ABORIGINAL POTTERY.

This collection, a portion of which would seem to belong to that of prehistoric anthropology, has grown up under the direction of Prof. W. H. Holmes, of the Bureau of Ethnology, and in connection with his studies of American art in clay. It is arranged in one of the central courts of the Museum building by tribes and regions, including not only the magnificent series of Pueblo objects obtained by the Bureau of Ethnology, but also the general collection from the mounds of the Mississippi Valley and from the burial cemeteries of Central and South America, and forming one of the most impressive exhibitions of the kind ever brought together.

The series of vessels to represent the art of the Pueblo tribes was sent to the World's Fair They were grouped and arranged with life-size figures representing Zuñi women making and decorating pottery, executed by Mr. F. H. Cushing. Mr. Holmes also prepared for the World's Fair illustrations of his other investigations upon the quarrying and stone industries of the Indians.

The collections shown in Chicago illustrate the quarrying of stone by the aborigines of the United States, for utensils, pipes, ornaments, etc.; the manufacture of stone implements from flint, chert, novaculite, quartzite, and rhyolite; and the mining of copper and mica.

Exhibit illustrating the ancient quarrying of quartzite bowlders (and the manufacture of implements from them) on Piney Branch, District of Columbia; including a series of specimens, showing processes and progressive steps of manufacture; and photographs, drawings, and maps representing the site and nature of the aboriginal operations and the method of exploration.

A group of exhibits illustrating by means of specimens, maps, photographs, etc., the quarrying and manufacture of chert in Indian Territory, together with a mass of quarry refuse.

Exhibits representing the novaculite quarries of Garland County, Ark., including a series of hammer-stones.

Exhibits representing the flint quarries of Flint Ridge, Licking County, Ohio, and the manufacture of knives, spears, and arrow-heads.

An exhibit representing the quarrying and shaping of rhyolite by the ancient inhabitants of Pennsylvania.

Specimens illustrating the use of flint nodules in implement-making by tribes of Texas.

Specimens, photographs, and maps showing the aboriginal manufacture of soapstone utensils in the District of Columbia.

Collections from the ancient copper mines of Isle Royale, Lake Superior, supplemented by photographs, maps, and drawings.

An exhibit representing the sacred pipestone quarries of Southwestern Minnesota.

A collection representing ancient mica mining in North Carolina.

Costumed figures—two negro workmen engaged in breaking up and flaking flint.

The accessions of the year include a large number of entries, the most important being that of a series of ancient pueblo vases purchased from Mr. H. Hales, of New Jersey, to form a part of the department exhibit of aboriginal ceramics at the Columbian Exposition. Small collections, mostly shreds only, have been made by Mr. Gerard Fowke and Mr.

William Dinwiddie, of the Bureau of Ethnology in Virginia and Maryland, and Mr. C. Mindeleff and Mr. James Mooney, of the same Bureau have added to the collections of ancient and modern pueblo ware from Arizona. Donations have been received from Messrs. Thomas Dowling, W. H. Phillips, W. L. Abbott, C. Steckelman, E. A. Mearns, Thomas Lee, S. L. Frey, J. A. Maxwell, P. L. Jouy, and Miss E. Mayer.

The important collection of ancient pueblo pottery made by Mr. Thomas Keam, of Arizona, which has for a number of years been exhibited as a loan, was purchased by Mrs. Mary Hemenway, of Boston.

DEPARTMENT OF MAMMALS.

Very little regular work was done in the department during the year, owing to the work for the Columbian Exposition, and the detail of Mr. True, the curator, for general executive work of the Museum.

In preparing plans of this exhibit two considerations were kept in mind: First, that the Exposition commemorated the discovery of America, and hence that the exhibit ought, as far as possible, to be American in character; and, secondly, that as the general display of the Museum was intended to furnish an indication of the different branches of its exhibition-work, it was desirable to show, as far as possible, the several classes of such work in which the department was regularly engaged.

It was first proposed that a prominent feature of the exhibit should be a complete series of mounted skins of North American mammals, including every species, and also every variety that had received a distinctive name. It was intended that this exhibit should be a complete representation of the mammal fauna of the country, and at the same time should show the character and quality of the taxidermic work done by the department. To bring into stronger relief certain of the characteristic mammals of America, it was proposed, in addition, to exhibit groups of specimens, with accessories indicating natural surroundings. It was thought that these groups would also add to the attractiveness of the exhibit, and bring into view another branch of the taxidermic work of the Museum.

At a later date, in order to enhance the interest of the exhibit, it was proposed to include a representation of some of the characteristic mammals of Central and South America, or possibly the genera complete.

Finally, however, when the details of the allotment of space in the Government building became known, the plan underwent considerable modification.

The complete representation of species of North American mammals was then abandoned in favor of a display of all the American families, by genera, as a part of a general series of American animals, arranged on the same plan. Thus the exhibit, as finally installed, consisted of—

1. A series of single mounted skins, representing the families of American mammals, by genera.

2. A series of groups of characteristic North American mammals, each confined to a single species, and consisting of several specimens (adult males and females, and young of both sexes, in most instances), accompanied by accessories, indicating the surroundings and habits of the species in a state of nature.

It is unnecessary in this connection to give a detailed list of the genera included in the family series, as, with no great number of exceptions, the entire mammalian fauna of America was represented in this way. Only the North American genera of bats were included, as these mammals are, for the most part, small, and do not present salient external characters. They would hardly repay, in connection with an exposition, the time and labor which it would be necessary to bestow upon them. The Cetaceans were omitted, as not belonging strictly to the American fauna.

Among the rarer genera exhibited were *Chironectes*, *Chlamydophorus*, *Xenurus*, *Elasmognathus*, *Lagidium*, *Microdipodops*, *Solenodon*, and *Brachyurus* (or *Ouakaria*).

Of some of the rarest families, such as *Dinomyidæ*, no representatives could be obtained. Pictures of some of these were introduced.

A large proportion of the specimens included in this systematic family series were taken out of the Museum cases, but it was necessary to purchase a considerable number to fill gaps.

The families shown are as follows:

Cebidæ, the American Monkeys.
Hapalidæ, the Marmosets.
Felidæ, the Cats.
Canidæ, the Dogs.
Mustelidæ, the Weasels.
Ursidæ, the Bears.
Procyonidæ, the Raccoons.
Cercoleptidæ, the Kinkajous.
Otariidæ, the Sea-Lions.
Phocidæ, the Seals.
Odobænidæ, the Walruses.
Camelidæ, the Camels and Llamas.
Bovidæ, the Cattle.
Antilocapridæ, the Prong-horn Antelopes.
Cervidæ, the Deer.
Dicotylidæ, the Peccaries.
Tapiridæ, the Tapirs.
Trichechidæ, the Manatees.
Phyllostomidæ, the Leaf-nosed Bats.
Emballonuridæ, the Free-tailed Bats.
Vespertilionidæ, the Typical Bats.
Talpidæ, the Moles.
Soricidæ, the Shrews.
Centetidæ, the Tenrecs and Almiquis.
Sciuridæ, the Squirrels.
Haplodontidæ, the Sewellels.
Castoridæ, the Beavers.
Muridæ, the Rats and Mice.
Geomyidæ, the Pouched Gophers.
Saccomyidæ, the Pouched Rats.
Dipodidæ, the Jumping Mice and Jerboas.
Octodontidæ, the Spiny Rats.
Hystricidæ, the Porcupines.
Chinchillidæ, the Chinchillas.
Dasyproctidæ, the Agoutis.
Dinomyidæ (no English name; only one specimen known).
Caviidæ, the Cavies.
Lagomyidæ, the Pikas.
Leporidæ, the Hares.
Myrmecophagidæ, the Ant-eaters.
Bradypodidæ, the Sloths.
Dasypodidæ, the Armadillos.
Didelphyidæ, the Opossums.

The groups shown were as follows:

A male Pacific Walrus, from Walrus Island, Bering Sea.
A group of California Sea-lions from the coast of California.
Steller's Sea-lions, male and female, from the Pribilof Islands, Alaska.

A Sea-otter from Sannak Island, Alaska.

A family of Badgers from Kansas, with plants and ground-work, representing the natural surroundings of these animals on the plains.

A group of three Woodland Caribou, from Newfoundland, with accessories representing the more open portions of that island.

A group of Barren-ground Caribou from Alaska, on the "tundras," or treeless plains.

A group of four Rocky Mountain Goats, from Montana and British Columbia, represented as standing on a ledge of a rocky mountain side.

A group of six Rocky Mountain Sheep, from Wyoming and Montana, represented as climbing about a mountain peak, near the snow-line.

A group of nine-banded Armadillos, from Texas, with accessories showing the prickly vegetation of the arid regions.

A family of Virginia Opossums, showing nest and young.

Virginia Deer. A scene at the margin of a water-course in Virginia. A group, comprising two bucks, a doe, and a fawn, with accessories, consisting of trees and plants characteristic of Virginia, intended to convey an idea of the surroundings in which the Virginia deer was first seen by the European colonists.

Active work in installation was begun in May, 1891, when the curator visited the establishments of the larger dealers in natural history supplies, and obtained such materials and specimens as were needed to begin the work. The force of taxidermists was increased from three to nine, and divided into two parties, one of which worked on the groups and the other on the single specimens intended for the systematic series. Mr. William Palmer was appointed chief taxidermist, and had immediate charge of the work under the general supervision of the curator; by whose judgment and artistic taste the effectiveness of the groups was greatly enhanced.

In preparing the groups every effort was made to produce an artistic effect, not less than to secure complete fidelity to nature, and sound and finished workmanship. Every one employed contributed his share of special skill and knowledge, and advantage was taken, as far as possible, of advice given by competent field naturalists.

Photographs of living animals and of characteristic scenery were utilized when available. Special acknowledgment should be made to Mr. George Bird Grinnell, of New York, for advice and assistance in connection with the group of Mountain Goats; to Col. Cecil Clay, of Washington, and to Rev. M. Harvey, of Halifax, in connection with that of the Woodland Caribou. Mr. J. Stanley Brown obtained large quantities of lichens and mosses in Alaska for the group of Barren-ground Caribou.

A new feature in these groups was the introduction of natural leaves, grasses, plants, and sea weeds, prepared by a process invented and satisfactorily carried out by Mr. William Palmer. Vines with leaves and tendrils which had never been detached from the natural stalk, and other similar accessories, were used, producing effects which could not be obtained by artificial leaves fastened on artificial stems.

The production of these groups is attended with many difficulties, and the number which can be constructed in a given time would be disappointing to one unfamiliar with the conditions. It is often very difficult to obtain the skins of animals of the proper ages, or of both sexes. On account of the great geographical variation of American mammals, the specimens for any one group must be from a single locality. The obtaining of accessories—plants, characteristic rocks, soil, turf, etc.—is often difficult. Photographs of living specimens for the guidance of the taxidermists are not always accessible, and, furthermore, in many cases there is much diversity of opinion regarding habits. All these circumstances, together with the mechanical difficulties involved, cause the groups to be expensive both of time and labor.

While the taxidermic work was progressing, attention was given to the preparation of labels. Those for the groups were descriptive, and were in several instances accompanied by small maps on which the geographical distribution of the species was indicated. The single specimens in the systematic series were provided with labels throughout, giving names, localities, etc., and, in addition, a larger label was made for each family, in which a brief summary of the characters, distribution, and habits of the group was presented. All these labels were uniform with those regularly used in the Museum, and were printed at the Government Printing Office.

Mention has been made of the series of domesticated animals, in the preparation of which this department gave some assistance. The series, so far as mammals were concerned, was not so successful as was desired, but some forms little known in the United States were, nevertheless, exhibited. As examples, may be mentioned the yak, obtained in India for the Museum by the late Dr. J. Wood-Mason; the zebu of India, the domestic buffalo of Africa, and the paca of South America.

As ornaments to the general zoological exhibit a number of mounted heads of the large game of the world were displayed. The following species are represented:

Eland, African.
Greater Koodoo, African.
Lesser Koodoo, African.
Argali, or wild sheep of Thibet, Asiatic.
Burhel, or blue wild sheep, Asiatic.
Thar, or Himalayan wild goat, Asiatic.
Asiatic Ibex, Asiatic.
Beisa Antelope, African.
Nylghau, Asiatic.
Clark's Gazelle, African.
Waller's Gazelle, African.
Dorcas Gazelle, African.
Sömmering's Gazelle, African.
Speke's Gazelle, African.
Salt's Gazelle, African.
Sassaby, or Hartbeest, Africa.
Jackson's Hartbeest, African.
Siberian Boar, Asiatic.

While the arrangement of the exhibit was, on the whole, effective, the necessity of crowding the cases together detracted considerably from its appearance.

The curator has prepared the following statement of the events of the year:

The accessions are, many of them, of a very interesting character. The Museum is especially indebted to Dr. W. L. Abbott, for a collection from Aldabra, the Seychelles, and other islands of the Indian Ocean, in which are included three skeletons and two skulls of the genus *Prodelphinus*, accompanied by notes on the external coloration, which will doubtless throw light on the identity of the species of this genus of dolphins. The collection also includes several specimens of Fruit-bats, *Pteropus*, including some which appear to represent an undescribed species. Mr. William Astor Chanler deposited a collection of about 35 mounted heads of African antelopes. An excellent series of 31 skins of the large game of South Africa, including the true zebra, hartebeestes, gnus, and other antelopes, lions, hyenas, wart-hogs, etc., were presented by Mr. H. C. Moore. Dr. P. L. Sclater, secretary of the Zoological Society of London, presented a number of pelts of antelopes, and other East African mammals, collected in Berbera, Somali, by Capt. Swayne. Mounted specimens of *Anomalurus, Smutsia, Galeopithecus*, and *Bathyurgus* were purchased to fill gaps in the exhibition series. A number of small mammals of Burmah, from the collection of L. Fea, were also purchased. Skins of Brown's Kangaroo, the Spotted Cuscus, and the Papuan wild hog, characteristic mammals of New Guinea, were obtained from Bruno Geisler.

Dr E. A. Mearns, U. S. Army, continued his extensive collection of mammals from the Mexican boundary. Mr. P. L. Jouy made a collection in Mexico, and Prof. B. W Evermann in South Dakota. Mr. C. H. Townsend, of the U. S. Fish Commission, obtained a Californian Sea lion (in San Luis Bay, Lower California), three Sea elephants, and a Steller's Sea lion. Prof. C. H. Gilbert obtained for the Museum, near Monterey, Cal., a fœtal specimen of the rare Stearn's grampus, *Grampus stearnsii*. Forty-four mammals were received from the Zoological Park, including 4 bears, 2 Venezuelan deer, 3 llamas, a beaver, and several monkeys. A fine skeleton and a skull of the extinct Artic Sea cow, *Rhytina*, were purchased through the U.S. Fish Commission. The commission also obtained a skull of a Walrus. A skeleton of the Rocky Mountain Goat was purchased.

As already stated, few changes were made in the exhibition hall during the year. The collections presented a more or less chaotic appearance, owing to the necessity of withdrawing specimens for the Columbian Exposition.

The regular routine work of the department was carried on as usual. The skulls and skins deposited by the Department of Agriculture were entered; the work of cleaning skulls belonging to these collections progressed continuously, and 122 skins were made up, including 15 deer, 27 fur-seals, and other larger forms.

The system of cataloguing the skin and skull of the same individual under different numbers, which had been in operation since 1852, has been abandoned so far as the collections deposited by the Department of Agriculture were concerned, and all specimens derived from a single individual, whatever their character, now receive the same number. The same system will be applied to the regular series as soon as the present volume of the catalogue is closed. The first number of the new series is 50,001. The old plan, which was satisfactory while the collection was small, had become very burdensome, and was furthermore constantly producing confusion in numbers.

A space in the upper part of the south-entrance laboratory was made available for storage purposes by the construction of a gallery, or second floor, at the south end of the room.

As soon as they were relieved of work for the World's Fair, the taxidermists proceeded to overhaul the skins which had accumulated in the vats for the previous two years, and also early accessions. It was found that many had deteriorated more or less for lack of attention, and a few were entirely ruined As many as possible were dried for the study series and others were laid aside to be mounted at the earliest opportunity. This work was still in progress at the close of the year. The mounting of two antelopes, a gnu, and a hartbeest was begun. During the year 82 dry skins were made up for the study series of the Museum, and, as already stated, 122 skins belonging to the Department of Agriculture deposit.

Dr. E. A. Mearns, U. S. Army, with the aid of an assistant, continued for some months to make collections for the Museum on the Mexican boundary. Mr. P. L. Jouy was also engaged in field work in Mexico for a part of the year.

The specimens lent for study, dissection, or other purposes during the year were as follows:

To Dr. J. A. Allen, American Museum of Natural History, New York, 9 skins and 10 skulls of Field mice (*Sitomys*); 24 skins and 15 skulls of Pouched Gophers (*Thomomys*); 1 skin and 1 skull of Meadow mouse (*Arvicola*); 1 skin and 1 skull of Field mouse (*Sitomys*); 1 skin and 3 skulls of Harvest mice (*Ochetodon*). For study.

To Dr. Harrison Allen, Philadelphia, Pa., 3 skulls of bats (*Dasypterus*). For study.

To Prof. Dr. Wilh. Leche, Stockholm, Sweden, 2 young Star-nosed moles in alcohol; 2 young moles in alcohol. For dissection.

To the Madrid Historical Exhibition, Madrid, Spain, 10 mounted mammals characteristic of the North American fauna; 7 pairs of antlers. For exhibition.

To S. N. Rhoads, Philadelphia, Pa., 2 skins and 1 skull of Cooper's mouse (*Synaptomys*). For study.

The number of specimens in the several series, June 30, 1893, was as follows:

Mounted skins in the exhibition series	842
Skins and alcoholic specimens in the study and reserve series	10,204
Skins and alcoholic specimens received during the year*	728

The last entries in the several catalogues, June 30, 1893, were as follows:

Regular series—	
Catalogue of skins and alcoholics	20,994
Catalogue of skulls and skeletons	36,052
Department of Agriculture deposit:	
Old series—	
Catalogue of skins and alcoholics	36,939
Catalogue of skulls and skeletons	49,328
New series—	
General catalogue (beginning with 50001)	54,102

DEPARTMENT OF BIRDS.

The year's work consisted chiefly in preparing the exhibit of birds for the Columbian Exposition. This work, owing to the impossibility of securing an adequate number of skilled taxidermists, and extreme difficulty of obtaining necessary materials and specimens, and the elaborate character of the labels prepared, absorbed all the time of the curator and his assistants and stopped the regular operations of the department.

More than 1,300 birds mounted on pedestals, representing nearly 900 species, were sent to Chicago; but owing to a reduction of exhibition space many of these had to be repacked and stored. This collection of mounted birds contained representatives of every one of the families of birds found in the Western Hemisphere (104 in number), except the American ostrich family, which was represented by water-color pictures. Among the smaller birds, each family was represented by sufficient number of species (mostly of different genera) to show the extreme variations of size, form, and coloration.

*These statistics do not include the collections deposited by the Department of Agriculture, which are not directly in the custody of the curator. Forty-six specimens were received on deposit from other sources.

BIRDS.

The systematic series, showing representatives of all the families of birds occurring in America, was arranged as follows:

Fringillidæ, the Finches.
Icteridæ, the Hangnests.
Sturnidæ, the Starlings.
Corvidæ, the Crows and Jays.
Mniotiltidæ, Wood Warblers.
Cœrebidæ, Honey Creepers.
Tanagridæ, Tanagers.
Hirundinidæ, Swallows.
Vireonidæ, Vireos.
Laniidæ, Shrikes.
Dulidæ, Palm Chats.
Ptiliogonatidæ, Silky Flycatchers.
Ampelidæ, Wax-wings.
Cinclidæ, Dippers.
Troglodytidæ, Wrens.
Certhiidæ, Creepers.
Sittidæ, Nuthatches.
Paridæ, Titmice.
Chamæidæ, Wren-Tits.
Sylviidæ, Warblers.
Mimidæ, Mocking Thrushes.
Turdidæ, Thrushes.
Motacillidæ, Wagtails and Pipits
Alaudidæ, Larks.
Oxyrhamphidæ, Sharp-bills.
Furnariidæ, Oven Birds.
Dendrocolaptidæ, Wood-hewers.
Formicariidæ, Ant Birds.
Pteroptochidæ, Tapacolas.
Conopophagidæ, Ant-Pipits.
Phytotomidæ, Plantcutters.
Cotingidæ, Cotingas.
Pipridæ, Manakins.
Tyrannidæ, Tyrant Flycatchers.
Trochilidæ, Humming Birds.
Micropodidæ, Swifts.
Trogonidæ, Trogons.
Picidæ, Woodpeckers.
Capitonidæ, Barbets.
Rhamphastidæ, Toucans.
Galbulidæ, Jacamars.
Bucconidæ, Puff Birds.
Alcedinidæ, Kingfishers.
Momotidæ, Motmots.
Todidæ, Todies.
Caprimulgidæ, Goatsuckers.
Steatornithidæ, Oil Birds.
Cuculidæ, Cuckoos.
Psittacidæ, Parrots.
Bubondiæ, Owls.
Strigidæ, Barn Owls.
Pandionidæ, Ospreys.
Buteonidæ, Hawks, Kites, Eagles, and Vultures.
Falconidæ, Falcons.
Columbidæ, Pigeons or Doves.
Cracidæ, Curassows.
Perdicidæ, Partridges and Quails.
Tetraonidæ, Grouse.
Meleagridæ, Turkeys.
Opisthocomidæ, Hoatzins.
Cathartidæ, American Vultures.
Phaëthontidæ, Tropic Birds.
Fregatidæ, Man-o'-War Birds.
Anhingidæ, Anhingas.
Phalacrocoracidæ, Cormorants.
Sulidæ, Gannets.
Pelecanidæ, Pelicans.
Ardeidæ, Herons.
Cochleariidæ, Boatbills.
Ciconiidæ, Storks.
Plataleidæ, Spoonbills.
Ibididæ, Ibises.
Phœnicopteridæ, Flamingoes.
Anatidæ, Ducks, Geese, and Swans.
Anhimidæ, Screamers.
Rallidæ, Rails.
Aramidæ, Courlans.
Gruidæ, Cranes.
Psophiidæ, Trumpeters.
Cariamidæ, Cariamas.
Eurypygidæ, Sun Bitterns.
Œdicnemidæ, Thick-knees.
Recurvirostridæ, Avocets and Stilts.
Phalaropodidæ, Phalaropes.
Scolopacidæ, Snipes.
Jaçanidæ, Jaçanas.
Hæmatopodidæ, Oyster-catchers.
Aphrizidæ, Turnstones.
Charadriidæ, Plovers.
Thinocoriidæ, Partridge-plovers.
Chionidæ, Sheath-bills.
Pelecanoididæ, Diving Petrels.
Procellariidæ, Petrels.
Diomedeidæ, Albatrosses.
Laridæ, Gulls and Terns.
Rynchopidæ, Skimmers
Stercorariidæ, Skuas.
Alcidæ, Auks.
Urinatoridæ, Loons.
Heliornithidæ, Sun Grebes.
Colymbidæ, Grebes.
Spheniscidæ, Penguins.
Tinamidæ, Tinamous.
Rheidæ, Rheas.

Besides the synoptical collection there were shown the following special collections:

A Collection of Humming Birds comprising species of sixty-four genera.

A Collection of Birds of Paradise, embracing the following species:

Astrapia nigra, Incomparable Bird of Paradise.

Chlamydera maculata, Spotted Bower Bird.

Chlamydera nuchalis, Greater Bower Bird.

Cicinnurus regius, King Bird of Paradise.

Diphyllodes magnifica, Magnificent Bird of Paradise.

Drepanornis Albertisi, D'Albertis's Bird of Paradise.

Epimachus speciosus, Grand Promerops.

Lophorina superba, Superb Bird of Paradise.

Manucodia atra, Black Bird of Paradise.

Paradigalla carunculata, Wattled Bird of Paradise.

Paradisea apoda, Greater Bird of Paradise.

Paradisea Augusta-Victoriæ, Empress Augusta Victoria's Bird of Paradise.

Paradisea minor, Lesser Bird of Paradise.

Paradisea Raggiana, Raggi's Bird of Paradise.

Paradisea sanguinea, Red Bird of Paradise.

Parotia sefilata, Six-wired Bird of Paradise.

Phonygama Gouldi, Gould's Bird of Paradise.

Ptilonorhynchus violaceus, Satin Bower Bird.

Ptilorhis Alberti, Prince Albert's Rifle Bird.

Ptilorhis magnifica, Magnificent Rifle Bird.

Ptilorhis paradisea, Rifle Bird.

Schlegelia Wilsoni, Wilson's Bird of Paradise.

Seleucides nigra, Twelve-wired Bird of Paradise.

Semioptera Wallacei, Wallace's S andard Wing.

Sericulus melinus, Regent Bird.

Xanthomelus ardens, Fiery Bird of Paradise.

A collection of Game Birds, including representatives of the following families:

Anatidæ, Ducks, Geese, and Swans.

Charadriidæ, Plovers.

Columbidæ, Pigeons or Doves.

Cracidæ, Curassows.

Gouridæ, Crowned Pigeons.

Megapodidæ, Mound Fowls.

Meleagridæ, Turkeys.

Numididæ, Guinea Fowls.

Otididæ, Bustards.

Perdicidæ, Partridges and Quails.

Phasianidæ, Pheasants.

Rallidæ, Rails.

Scolopacidæ, Snipe.

Tetraonidæ, Grouse.

Tinamidæ, Tinamous.

A collection illustrating the confusion caused by the application of the same popular name to different species of birds. The following birds are represented: Bee Bird, Buzzard, Chimney Swallow, Goldfinch, Jacksnipe, Martin, Ortolan, Pheasant, Redstart, Robin, Screech Owl, Tree Sparrow, Woodcock, Blackbird, Carrion Crow, Coot, Jackdaw, Kingfisher, Oriole, Partridge, Quail, Redwing, Rook, Sparrow Hawk, Turtle Dove, Yellow-hammer.

Special groups, with natural accessories, as follows:

North American species approaching extinction: Carolina Paroquet, Ivory-billed Woodpecker, Passenger Pigeon.

To illustrate protective coloration: Ptarmigans in summer, Ptarmigans in winter.

To illustrate remarkable habits: Swallow-tailed Kite feeding, Carolina Paroquets roosting, California Woodpeckers and their storehouse, Jaçanas walking on lily-pads, Prairie Chickens courting, Flamingoes and their nests, Bower Birds and their playhouse, Crocodile Birds and crocodile, Lyre Birds and dancing mound of the male, Butcher Birds and their larder.

English Song Thrushes and their nest: An artistic group, presented by the artists, Mr. H. Minturn and Mrs. Mogridge, though the birds were mounted by the Museum taxidermist, Mr. H. C. Denslow.

The value of the entire exhibit, as an educational feature, is greatly enhanced by the careful and explicit labeling, in popular language, of every object contained in it.

The gifts of material in this department have been so numerous and valuable that it is not practicable to mention in this place even by name all the contributors. They are enumerated in the list of accessions in Appendix VI.

Among the collections containing more than fifty specimens may be mentioned those of Dr. W. L. Abbott, from Kashmir and Baltistan; of Dr. W. L. Abbott, from the mountains and vale of Kashmir; of P. L. Jouy, from Jalisco, Mexico; of Dr. E. A. Mearns, U. S. Army, from northern Mexico, and the adjacent parts of New Mexico, Texas, and Arizona, including 823 skins; of Lieut. Wirt Robinson, U. S. Army, from Colombia and Curaçao.

Mr. Ridgway reports as follows upon the state of the collection:

The present state of the collection is very satisfactory as regards preservation, but quite otherwise so far as the arrangement of the skin collection of the larger birds, stored chiefly in the west basement, is concerned. This is due to causes almost beyond control, the chief of which is the congested state of the collection, which has far outgrown the space available for storage. The difficulty is, moreover, constantly increasing. To remedy the trouble considerable progress has, however, been made in rearrangement; but the space is so much overcrowded with cases that work can only be done slowly and at great disadvantage. At least five times the space now occupied by the collection would be necessary for its proper arrangement, without consideration of future accessions.

It has long been intended to make an extensive distribution of duplicate specimens, both to relieve the congestion of our storage facilities and to advance the study of ornithology in the various institutions of learning throughout the country; but this has been delayed until the entire collection can be rearranged, since the two being simply different parts of the same undertaking, are necessarily carried on together.

The total number of specimens was, at the end of June, 1893, substantially as follows:

Total skin series at end of June, 1892	60,532
Additions during 1892-'93 *	1,985
Total skins at end of June, 1893	62,517
Exhibition collection at end of June, 1893	8,154
Total specimens at end of June, 1893	70,671
Total specimens at end of June, 1892	68,416
Increase during 1892-'93	2,255

The last entry at end of June, 1892, is 126,361.

The last entry at end of June, 1893, is 128,852.

Specimens were sent for study to the American Museum of Natural History, to Osbert Salvin, esq., and Count Salvadori, London; to Gurdon Trumbull, of Hartford; Witmer Stone, of Philadelphia, and other specialists.

DEPARTMENT OF BIRDS' EGGS.

The collection of birds' eggs still remains in the charge of Maj. C. E. Bendire, U. S. Army, retired, who, since the gift of his own unsur-

* Less additions to mounted collection (370 in number) and specimens distributed (136).

passed private collection to the Smithsonian Institution in 1884, has devoted his entire time to the development of the national collection and the preparation of the treatise upon the eggs and nesting habits of North American birds, for which the Institution has been collecting material for nearly fifty years.

Maj. Bendire has continued the preparation of his work on the Life Histories of North American Birds, and the text for another volume, which will include the Cuckoos, the Woodpeckers, the Goat-suckers and Swifts, the Humming Birds, the Flycatchers, the Horned Larks, the Crows, Jays, Magpies, Blackbirds, and Orioles, is well in progress, and the illustrations are being prepared under his direction by Mr. John L. Ridgway.

The first volume of this work has been received with much favor, and it is gratifying that American work in illustration should receive such hearty commendation from European authorities as have the colored plates accompanying this Bulletin.

Dr. Blasius, in the "Rundschau," February 4, 1893, says:

> The chromolithographs are perfect. The shading is so perfect, especially near the outlines of the eggs, which appear to be resting upon a light-gray surface, that one imagines himself to be looking at the original eggs. I am not acquainted with any work in English, German, or any other language, that has presented pictures of eggs approaching these in execution. One can not but express the highest regard for a scientific establishment like the Smithsonian Institution which produces so excellently executed a book, and we can but wish and hope that the entire work may be completed, so that we may have as comprehensive a treatise on North American oology as we have of its ornithology in Baird, Ridgway, and Brewer's History of North American Birds, published in 1874.

Dr. Hermann Schalow, of Berlin, in the "Ornithologische Monatsberichte," January, 1893, wrote:

> The original water-color drawings were made from nature by John L. Ridgway, and are reproduced in lithography in a most admirable fashion. The plates far surpass the best with which we are familiar.

Dr. R. Bowdler Sharpe, of the British Museum, in "Nature," November 2, 1893, wrote:

> The figures are beautifully rendered by chromolithography, and the publication is altogether a notable one. The letterpress is the work of Capt. Charles Bendire, who is known to be one of the most practiced oologists of the present day. He has described and figured in the present volume the eggs of all the North American game-birds, pigeons, and birds of prey, and he has used his opportunity to the greatest advantage by giving an excellent account of the life-histories of the species, together with the latest information respecting their geographical distribution. Capt. Bendire's work forms one of the most important of the recent contributions to ornithological knowledge, and the succeeding volumes will be awaited with interest by ornithologists.

Special allusion should be made to the very important cooperation of Dr. William L. Ralph, of Utica, N. Y. Dr. Ralph has for twenty years been forming a collection of the eggs and nests of North American birds, very complete for the entire continent, though especially rich in southern and extremely northern forms. This collection, which is one of the most important and most beautifully prepared in existence, is especially valuable to the student on account of the thorough and scholarly manner in which it is catalogued and labeled, has been given by him to the Smithsonian Institution, and nearly half of it, numbering about 3,250 eggs, has already been transferred to the custody of the curator.

The collection is being constantly increased, and Dr. Ralph spares no expense in obtaining representatives of rare species. By this agency alone at least sixty species, either not at all represented or represented by worthless specimens, have up to the present time been added.

A large number of other gifts have been received, of which those of Dr. A. K. Fisher, Dr. E. A. Mearns, U. S. Army, Lieut. H. C. Benson, U. S. Army, and Walter F. Webb are the most extensive, including each over fifty specimens.

The curator prints the following statistical memorandum:

Present state of the collection.

Specimens in North American series	37,338
Specimens in North American duplicates	11,759
Specimens on exhibition	1,491
Total	50,588
Species and subspecies in the North American series	781
Specimens in foreign series	4,419
Specimens in foreign duplicates	231
Total	4,650
Species in foreign series	624
Nests in North American reserve series	2,656
Nests on exhibition	235
Total	2,891

Last catalogue entry in June, 1892, 25,170.

Last catalogue entry in June, 1893, 25,935.

DEPARTMENT OF REPTILES AND BATRACHIANS.

Dr. Leonhard Stejneger, the curator of these collections, reports that if the progress of the department be measured by the number of specimens received and entered upon the books, the activity of the past year has been unprecedented, no less than 2,302 specimens having been catalogued.* Some of these have furnished types for quite a number of recently described species, both from this country and abroad.

As a consequence of the greatly increased number of specimens received during the present year, the routine work of installing, identifying, caring for, labeling, and reporting upon them has been more than twice as great as during any previous year. The department has

* For comparison it may be mentioned that the number of entries in 1891-'92 was 1,055; in 1890-'91, 908; in 1889-'90, 705; in 1888-'89, 784; in 1887-'88, 19; in 1886-'87, 138

also had on hand the preparation of its part of the exhibit for the World's Columbian Exposition in Chicago, so that the curator and his assistant have had their time fully occupied without much chance of effecting a better arrangement of the old collections.

The curator has been specially engaged in the care of the collection of reptiles obtained in Death Valley by the expedition sent out from the U. S. Department of Agriculture, in charge of Dr. C. Hart Merriam, and has furnished a special report which, accompanied by four plates, was published in North American Fauna, No. 7, May. 1893. In this are described 11 new species and subspecies, while a number of forms described by previous authors are more fully reported upon.

Among the most interesting additions to the collection is a new species of *Xantusia*, described by Dr. Stejneger as *X. Henshawi*.* This lizard belongs to a genus peculiar to California, two species only being previously known. The new species is remarkably distinct and forms altogether one of the most interesting herpetological novelties obtained in this country during recent years. I may add that the present species is only part of a very valuable collection sent home by Mr. Henshaw from southern California.

There has also been received another collection which throws considerable light on the geographical distribution of species in the southwestern portion of the United States and contains many rare species. This was presented by Dr. Timothy E. Wilcox, U. S. Army, who collected at Fort Huachuca, Ariz.

Of extralimital collections obtained during the present year may be mentioned those made by Mr. P. L. Jouy in various parts of Mexico; by Mr. Charles W. Richmond in Nicaragua, and by Mr. Harry W. Perry in Honduras.

Especially important have been the collections received from Africa. The Museum has been particularly deficient in material from that part of the world, but thanks to the zeal and generosity of two American gentlemen, this deficiency is now gradually being remedied. Mr. William Astor Chanler has sent collections from the east coast of the mainland between the mouth of the Tana River and Hameye, about 300 miles inland, and Dr. W. L. Abbott, others from the Seychelles and various other groups of islands off the east coast of Africa. The study of the former collection by Dr. Stejneger reveals many rare and undescribed species, while the latter furnishes the material for a full list of the herpetological fauna of the islands in question, which also shows a number of new species.

Among other prominent contributors are Profs. J. T. Scovell and A. J. Woolman; Julius Hurter, St. Louis, Mo.; F. Stephens, Santa Ysabel, Cal.; Herbert Brown, Tucson, Ariz.; Dr. E. A. Mearns, of the United States and Mexican Boundary Commission; George E. Harris,

* Discovered in southern California by Mr. H. W. Henshaw.

Cassville, Mo.; Prof. B. W. Evermann, of the U. S. Fish Commission; L. Belding, Stockton, Cal.

The work of Dr. Stejneger on the proposed supplementary volume of the Nomenclator Zoologicus has progressed as fast as could be expected, and by the end of the year more than 17,000 generic terms had been card-catalogued and arranged alphabetically by classes. It is evident that the original maximum estimate of 20,000 genera will be reached or even exceeded.

Excellent facilities for studying the collections have been extended to Prof. E. D. Cope, who, among other subjects studied, made extended anatomical researches for his new ophiological system, and to Dr. O. P. Hay, for finishing his work on the Indiana reptiles.

The estimate of the curator shows the status of the collection on June 30, 1893, to be as follows:

	Specimens.
Reserve series	18,222
Duplicate series	8,705
Unassorted and exotics	6,313
Grand total	33,240

Last catalogue entry in June, 1892, 18,191.
Last catalogue entry in June, 1893, 20,493.

The exhibit of the reptiles and batrachians at the World's Columbian Exposition comprised two classes of objects, viz: (1) Groups of casts and mounted specimens, and (2) a series of specimens illustrating representative American families.

Owing to lack of space and time three groups only were exhibited, though work on several more had been planned and partly begun.

The first group consisted of 14 casts of some of the more typical poisonous snakes occurring within the United States, as for instance, various species of rattlesnakes, the water moccasin, the copperhead, and the harlequin snake. The snakes were shown coiled or crawling among rocks, roots of trees, dead leaves, moss, etc. The accessories were not intended in every case to represent the actual surroundings of the species, as the specimens belonged to species inhabiting widely separated localities, and were exhibited together for the purpose of contrasting the various types. The casts composing the group were mostly of plaster, while two were made of a glue composition. They have in every instance been made from specimens sent alive to the Museum, several of them expressly for the Chicago exhibit. Among these I would call special attention to the magnificent Texas rattlesnake (*Crotalus atrox*) and the red California rattler (*C. rubidus*) from southern California.

The second group comprised 33 casts and mounted specimens of different types of land and fresh-water turtles inhabiting the United States, including gophers, box tortoises, terrapins, mud turtles, soft-shelled turtles, etc., the accessories, as in the snake group, illustrating in a general way only their natural surroundings, water and sandy beaches consequently predominating.

The third group showed a fine yellow boa, from Jamaica, in the act of climbing the branches of a tree, typifying the non-venomous snakes in contrast to the group of poisonous ones.

The second class of objects consisted of 68 species in alcohol, this series being destined to illustrate by typical specimens the families of reptiles and batrachians occurring in the Western Hemisphere. Altogether 48 families were shown, several of the larger ones being represented by a series of species to illustrate the extremes of forms included in them. All the specimens were carefully mounted upon glass plates, in imitation of the natural positions of the animals, and displayed in square glass jars, the larger ones in Dorflinger jars, the smaller, in Benedict plate-glass jars. The great advancement of this mode of exhibiting alcoholics over the old one of simply suspending the animal in a round jar, was very striking. The plate-glass jars especially are so beautiful and the animals show to such an advantage that it is hoped that the experiments which are now being made for improvements in their manufacture may meet with success. Each jar was provided with two printed labels, one family label giving in a few terms the scientific characteristics of the family, in addition to a brief popular account of its other peculiarities, as well as the geographical distribution, the other label being the specimen label containing the popular and scientific names, locality, Museum number, and donor's or collector's name.

A systematic series of alcoholic specimens, representing the following families of American reptiles and batrachians:

REPTILES.

Crocodiles, *Crocodilidæ*.

Tortoises, families *Chelydridæ*, *Kinosternidæ*, *Testudinidæ*, *Emydidæ*, *Cheloniidæ*, *Dermochelydidæ*, and *Trionychidæ*.

Lizards, families *Eublepharidæ*, *Gekkonidæ*, *Anolidæ*, *Iguanidæ*, *Helodermatidæ*, *Anguidæ*, *Anniellidæ*, *Xantusiidæ*, *Teiidæ*, *Scincidæ*, *Bipedidæ*, *Amphisbænidæ*.

Snakes, families *Typhlopidæ*, *Leptotyphlopidæ*, *Ilysiidæ*, *Boidæ*, *Charinidæ*, *Natricidæ*, *Nothopsidæ*, *Amblycephalidæ*, *Boigidæ*, *Elapidæ*, *Hydrophidæ*, *Crotalidæ*.

BATRACHIANS.

Salamanders, families *Proteidæ*, *Cryptobranchidæ*, *Amblystomatidæ*, *Plethodontidæ*, *Desmognathidæ*, *Salamandridæ*, *Amphiumidæ*.

Cæcilians, family *Cæciliidæ*.

Sirens, family *Sirenidæ*.

Toads and frogs, families *Bufonidæ*, *Pelobatidæ*, *Hylidæ*, *Cystignathidæ*, *Engystomatidæ*, *Dendrobatidæ*, *Ranidæ*.

Although not very extensive, the herpetological exhibit attracted much attention, particularly the two large groups, which were constantly surrounded by a crowd of interested and appreciative visitors to the Fair.

DEPARTMENT OF FISHES.

The honorary curator, Dr. Tarleton H. Bean, was placed in charge of the exhibit of the U. S. Fish Commission at the World's Columbian

Exposition, and this, together with his other duties in connection with the Commission, has enabled him to devote but little time to the work of the Museum. He has cooperated with the Assistant Secretary in the preparation of a Museum publication, "Oceanic Ichthyology," which is now in press. Mr. Barton A. Bean, assistant curator, has been engaged in the routine work of the department in the preparation of the exhibit for the Exposition at Chicago, and in the arranging of drawings of deep-sea fishes for publication. A general rearrangement of the collection of the department is needed, and will be undertaken this fall. There have been 418 catalogue entries; the number of specimens received is about 1,000.

The most important collections contributed have been received from the U. S. Fish Commission, especially the additional deep-sea and oceanic forms collected by the steamer *Albatross*.

This exhibit at the World's Fair consisted of 154 families and subfamilies, represented by 197 species of the fishes of North and South America. The specimens were displayed in rectangular glass jars, to which were attached labels giving a diagnosis setting forth the family characters, followed by a statement of the number of the genera and species in the family, their geographical range, and an account of their habits, food, and uses. Small species labels were also attached to designate individuals or groups of individuals. The object was to make a popular and instructive exhibit of the fishes of the Western Hemisphere, which aim was satisfactorily carried out by the means employed for the display.

The following is a list of the families and subfamilies represented:

FISHES.

Orthagoriscidæ, the Ocean Sun-fishes.
Tetrodontidæ, the Swellfishes.
Diodontidæ, the Porcupine-fishes.
Ostraciontidæ, the Trunk-fishes.
Balistidæ, the Trigger-fishes.
Hippocampidæ, the Sea-horses.
Syngnathidæ, the Pipe-fishes.
Malthidæ, the Bat-fishes.
Lophiidæ, the Anglers.
Ceratiidæ, the Small Anglers.
Antennariidæ, the Frog-fishes.
Soleidæ, the Soles.
Pleuronectidæ, the Flounders.
Macruridæ, the Grenadiers.
Fierasferidæ, the Fierasfers.
Ophidiidæ, the Donzellas.
Brotulidæ, the Brotulids.
Gadidæ, the Cod-fishes.
Merlucidæ, the Whitings.
Lycodidæ, the Eel Pouts.
Ammodytidæ, the Sand Lances.
Cryptacanthidæ, the Wry-mouths.
Stichiidæ, the Eel Blennies.
Xiphidiontidæ, the Butter Eels.
Anarrhichadidæ, the Wolf Fishes.
Cebedichthyidæ, the Monkey Blennies.
Blenniidæ, the Blennies.
Opisthognathidæ, the Big-eyed Blennies.
Batrachidæ, the Toad-fishes.
Leptoscopidæ, the Small Star-gazers.
Uranoscopidæ, the Star-gazers.
Bathymasteridæ, the Ronquils.
Chiasmodontidæ, the Great Swallowers.
Trichodontidæ, the Sand-fishes.
Gobiesocidæ, the Clinging Gobies.
Liparididæ, the Sea Snails.
Cyclopteridæ, the Lump-fishes.
Callionymidæ, the Dragonets.
Gobiidæ, the Gobies.
Triglidæ, the Gurnards.
Agonidæ, the Alligator-fishes.
Cottidæ, the Sculpins.
Hemitripteridæ, the Sea Ravens.
Scorpænidæ, the Rock-fishes.
Chiridæ, the Chiroids.
Scaridæ, the Parrot-fishes.

Labridæ, the Wrasses.
Pomacentridæ, the Demoiselles.
Cichlidæ, the Cichlids.
Embiotocidæ, the Viviparous Perches.
Gerridæ, the Moharras.
Polynemidæ, the Thread-fins.
Acanthuridæ, the Surgeons.
Chætodontidæ, the Chætodons.
Ephippidæ, the Angel-fishes.
Xiphiidæ, the Sword-fishes.
Trichiuridæ, the Cutlass-fishes.
Scombridæ, the Mackerels.
Carangidæ, the Pompanoes.
Coryphaenidæ, the Dolphins.
Stromateidæ, the Butter-fishes.
Pempheridæ, the Pempherids.
Zenidæ, the Dories.
Bramidæ, the Pomfrets.
Nomeidæ, the Nomeids.
Latilidæ, the Tile-fishes.
Mullidæ, the Red Mullets.
Holocentridæ, the Squirrel-fishes.
Berycidæ, the Beryxes.
Sciænidæ, the Drum-fishes.
Sparidæ, the Sea Breams.
Pimelepteridæ, the Rudder-fishes.
Pristipomatidæ, the Grunts.
Centrarchidæ, the Sun-fishes.
Elassomatidæ, the Elassomes.
Serranidæ, the Sea Basses.
Percidæ, the Perches.
Apogonidæ, the Coral Fishes.
Centropomidæ, the Snooks.
Pomatomidæ, the Blue-fishes.
Elacatidæ, the Cobias.
Priacanthidæ, the Big-eyes.
Aphredoderidæ, the Pirate Perches.
Sphyrænidæ, the Barracudas.
Echeneididæ, the Remoras.
Trachypteridæ, King-of-the-Herrings.
Atherinidæ, the Silversides.
Mugilidæ, the Mullets.
Gasterosteidæ, the Stickle-backs.
Aulorhynchidæ, the Flute-mouths.
Fistulariidæ, the Trumpet-fishes.
Centriscidæ, the Snipe-fishes.
Belonidæ, the Silver Gars.
Exocœtidæ, the Flying Fishes.
Amblyopsidæ, the Cave Fishes.
Luciidæ (Esocidæ), the Pikes.
Umbridæ, the Mud-minnows.
Dallidæ, The Dallias.
Cyprinodontidæ, the Mummichogs.
Characinidæ, the Characines.
Percopsidæ, the Trout Perches.
Halosauridæ, the Halosaurids.
Chauliodontidæ, the Tiger Fishes.
Sternoptychidæ, the Hatchet-fishes.
Stomiatidæ, the Stomiatoids.
Scopelidæ, the Pearl Fishes.
Synodontidæ, the Snake-fishes.
Argentinidæ, the Smelts.
Salmonidæ, the Salmons and Trouts.
Alepidosauridæ, the Handsaw Fishes.
Alepocephalidæ, the Alepocephalids.
Hiodontidæ, the Moon-eyes.
Albulidæ, the Lady-fishes.
Elopidæ, the Big-eyed Herrings.
Chanidæ, the Milk-fishes.
Clupeidæ, the Herrings.
Dorosomidæ, the Gizzard Shads.
Engraulidæ, the Anchovies.
Catostomidæ, the Suckers.
Cyprinidæ, the Minnows.
Sternopygidæ, the Electric Cat-fishes.
Gymnotidæ, the Electric Eels.
Siluridæ, the Cat-fishes.
Loricariidæ, the Loricarions.
Symbranchidæ, the Symbranchids.
Congridæ, the Conger Eels.
Anguillidæ, the Eels.
Murænidæ, the Morays.
Nemichthyidæ, the Snipe Eels.
Synaphobranchidæ, the Synaphobranch Eels.
Simenchelyidæ, the Pug-nosed Eels.
Saccopharyngidæ, the Gulpers.
Eurypharyngidæ, the Pelican Fishes.
Notacanthidæ, the Spiny Eels.
Amiidæ, the Bow Fins.
Lepidosteidæ, the Gar Pikes.
Polyodontidæ, the Paddle-fishes.
Acipenseridæ, the Sturgeons.
Chimæridæ, the Chimæras.
Myliobatidæ, the Eagle Rays.
Trygonidæ, the Sting Rays.
Torpedinidæ, the Torpedoes.
Raiidæ, the Skates.
Pristidæ, the Saw-fishes.
Squatinidæ, the Angel Sharks.
Heterodontidæ, the Port Jackson Sharks.
Alopeciidæ, the Thresher Sharks.
Sphyrnidæ, the Hammer-headed Sharks.
Galeorhinidæ, the True Sharks.
Spinacidæ, the Dog Sharks.
Scymnidæ, the Sleeper Sharks.
Petromyzontidæ, the Lampreys.
Myxinidæ, the Hag-fishes.
Branchiostomatidæ, the Lancelets.

DEPARTMENT OF VERTEBRATE FOSSILS.

The work in this department of the Museum during the past year has been partly devoted to mounting and labeling the specimens already placed in cases in the exhibition room, and this work has been under the special charge of Mr. F. A. Lucas.

The preparation of specimens secured by the honorary curator, Prof. O. C. Marsh, during his explorations in the West for the U. S. Geological Survey, has been continued at New Haven, and good progress has been made, but the want of proper space to exhibit such specimens has prevented any of these being placed on exhibition in the National Museum during the past year.

The curator proposes to use the wall space above the cases for a series of life-size restorations of the large extinct animals especially characteristic of North America, and an important beginning has been made by the production of a series of six restorations under the immediate direction of Prof. Marsh. These restorations represent on canvas the skeletons, natural size, of 2 gigantic Dinosaurian reptiles from the Jurassic formation, *Ceratosaurus* and *Stegosaurus;* 2 others from the Cretaceous, *Claosaurus* and *Triceratops;* and 2 huge mammals from the Tertiary. *Tinoceras* and *Brontotherium.* These restorations have been made with great care, from type specimens, and this exhibition will be of much interest to the general public. Similar restorations of other extinct animals are in preparation.

The curator has published, during the past year, several papers relating indirectly to the collections of vertebrate fossils mentioned above, though more intimately in connection with the U. S. Geological Survey. In memoirs now in preparation, however, he will describe fully the more important specimens he has already deposited in the National Museum.

There have been 13 specimens received during the year, involving the same number of catalogue entries.

DEPARTMENT OF MOLLUSKS.

The curator, Mr. W. H. Dall, reports that satisfactory progress has been made in routine work during the year. The arrangement of specimens in the exhibition cases in the lower hall has been completed. The general collection has been revised, the species conveniently arranged for reference, and index sheets for each drawer, containing a list of the genera and species in each tray, have been prepared. At the same time the names of the species have been checked off on an interleaved copy of Paetel's Catalogue of Mollusks, thus facilitating reference to the collection and indicating deficiencies more clearly. Duplicates have been eliminated and packed away in their proper boxes, as described in my last annual report. New material has been examined, labeled, and distributed to its proper place in the collection after registration. Much attention has been paid to the Tertiary fossils, in which the collection is very rich, and which were urgently needed for comparison with the material brought in by the U. S. Geological Survey. The entire collection of Tertiary fossils has been arranged for easy reference, and a provisional card catalogue of localities and horizons has been prepared. Much of the material from the Miocene has been cleaned, separated, arranged, and registered, and provided with labels showing locality, collector, etc., though in many cases the names had to be omitted until the specimens shall have been more thoroughly studied. A large part of the registration for the year has related to this class of specimens. The amount of registration is shown in the following table:

Species of duplicates catalogued	281
Card catalogue of the same	281
Drawings registered	29
Envelopes filled out for drawings	29
Total	620

Adding to these the number of actual registrations for the year we have a grand total of about 5,738 entries, as against a similar total of 7,700 for 1891-'92.

The number of accessions during 1892-'93 was 72, against 85 in 1891-'92. Several of them were of importance and many of great interest, but, as a whole, the accessions during the past year do not comprise any very large single masses of material compared with those of some previous years.

The most important contribution to the collection has been the result of a decision by the Rev. L. T. Chamberlain and Mrs. Frances Lea Chamberlain to contribute the means necessary to bring up to date and keep as complete as practicable the Lea collection of fresh-water mollusks, especially the *Unionidæ*. In pursuance of this very desirable object, they have generously furnished the means for the purchase of several unique series of Asiatic and African unios, and have authorized the ordering of others, when necessary, for the object in view. Nearly all the material thus acquired is rare and new to the collection, and of the utmost value for the study of the group to which it belongs. Looking forward to the publication of a catalogue of the Lea Collection as one of the special bulletins of the Museum, Mr. and Mrs. Chamberlain have also generously added to the sectional library by authorizing the purchase of such works of recent date on the *Unionidæ* as are necessary to the studies involved and not yet contained in the Museum library. Several costly and important works have already been ordered or received under this arrangement, and more will follow. Our sincere thanks are due to Mr. and Mrs. Chamberlain for their wise and considerate generosity, which not only benefits science and the Museum, but continues the association of the name of Lea with progress in the study of these groups of animals in a graceful and most gratifying way.

In completion of an exchange sometime since entered into between Mr. Dall and Mr. Maurice Cossmann, of Paris, the successor of Deshayes in the minute study of the successive eocene faunas of the Parisian basin, the latter has sent to the Museum about 700 named species of mollusks from that formation, which, coming from him, have the authenticity of types. Several desiderata of the Museum have been supplied by Mr. Hugh Fulton, of London, through an exchange arranged with him, all of which were new to the collection, and several of extreme rarity and value.

From Dr. W. L. Abbott has been received an interesting and very attractive lot of shells from the Seychelles and adjacent islands. The California Academy of Sciences, through Dr. J. G. Cooper, has donated about 75 specimens of land shells from the peninsula of Lower California, most of which were very acceptable additions to the collection. Our faithful correspondent, Mr. I. Greegor, has continued his contributions to the Museum by donating specimens in alcohol of the rare *Murex fulvescens* Sby., from Fernandina, Fla., and a number of interesting pathological specimens showing how mollusks repair the injuries they occasionally receive. Dr. H. von Ihering has contributed some interesting land and fresh-water shells from Brazil, and Rev. H. Loomis others from Japan. Dr. Edgar A. Mearns, of the International Boundary Survey between the United States and Mexico, has forwarded the mollusks collected by the party, including a new species of *Anodonta*, with a view to the preparation of a report on the expedition and its collections. From Mr. J. D. Mitchell and Mr. J. A. Singley, and also the State geological survey of Texas, have been received interesting miscellaneous collections, including several species not before reported from the Texas coast, and a few which appear to be undescribed. Mr. Charles W. Richmond has furnished a few interesting species from the Nicaraguan region. Mrs. Ada M. Walton sent to the Museum a collection of specimens from the coast of California, which, from certain circumstances connected with the donation, deserves special mention, though the collection added little to the Museum series which was not already represented there. Mr. Ed. Saxon Wyard presented a few large ornamental shells, which, from their unusual size and beauty, were very desirable for exhibition purposes. Mr. William Moss, of Ashton-under-Lyne, England, contributed some microphotographs of the radula, etc., of various British mollusks, which were exceptionally successful in showing difficult anatomical details. An exchange with Mr. B. H. Wright added a few desirable Unionidæ to the collection. The Department of Agriculture and the U. S. Fish Commision have contributed several lots of mollusks collected by members of their staffs.

Besides the work above referred to, the general operations of the department include the preparation of special reports on collections made under governmental auspices by various organizations, such as the U. S. Fish Commission, the U. S. Navy, the Revenue Marine, the Department of Agriculture, and special expeditions. Among them are two which bear particularly on the Tertiary geology and paleontology of the southeastern border of the United States. One of these (Bulletin 84 of the U. S. Geological Survey, by William H. Dall and Gilbert D. Harris) summarizes our knowledge of the post-eocene Tertiary geology of the United States, including Alaska, up to about 1890, the manuscript having been delayed in printing nearly two years. The other is the second part of a report by the writer on the Tertiary fauna of Florida, including the gastropods and containing much new material. A third part, to comprise the Pelecypods and a geological summary, will conclude the work. In addition may be mentioned certain reports on faunal collections of the Southern States and a small collection from eastern Siberia, and further researches by Mr. Simpson on the *Unionidæ*.

Mr. Dall speaks as follows of the state of the collection:

In previous reports I have explained why it is not possible to give the exact number of species, specimens, duplicates, etc., contained in the collection. In my last report it was estimated that the collection contained about 482,725 specimens, of which about 100,000 are preserved in alcohol. During the year about 5,600 specimens were received, which would make a present total of 488,325 specimens now contained in the collection. The number of entries in the register for 1892–'93 is 4,578, as shown in the appended table, representing some 13,734 specimens.

Volume.	From—	To—	Total.	Remarks.
XXIII	106,904	106,981	77	Volume in use.
XXIV	112,401	115,307	2,906	Reserved for fossils.
XXVI	124,663	125,425	762	Volume filled.
XXVII	125,426	126,259	833	Volume in use.
Total			4,578	

The total number of registrations to date, deducting all duplications and omissions in the register, is 107,591, representing about 322,800 specimens catalogued to date. The number of workers and their distribution in the building render it necessary to use simultaneously several volumes of the register, which explains why the foregoing table is necessary to show the total registrations for the year. The formal registration, with the gaps alluded to, terminates June 30, 1893, with the number 126,259.

The work of assisting students in various parts of the country to identify their local fauna, to intelligently direct their studies, and to answer their numerous queries on different branches of the subject has always been regarded as an important function of this department, and has been made a special care by Mr. Dall, who states that correspondence of this kind was conducted in 1891–'92 with 166 different persons, involving over 300 letters and 600 to 700 pages of writing, besides the identification of many hundred specimens, while in 1892–'93, 96 different persons received 330 communications, involving some 800 pages of writing, nearly all of which was the work of the curator. For want of time, owing to the press of work and absence of sufficient clerical assistance, the number of species identified for students has not been recorded. In 1891–'92 the number amounted to over 3,000 species, for each of which a label had to be written. During the past year the number sent for identification was considerably less.

DEPARTMENT OF INSECTS.

In this department, under Prof. C. V. Riley, honorary curator, considerable time has been devoted to the preparation of exhibits for the World's Columbian Exposition. In this work the Museum has cooperated with the Division of Entomology in the U. S. Department of Agriculture. The exhibit, while devoted largely to the science of entomology economically considered, also contained much material of purely educational or scientific value. The systematic collection of North American families and the collection of insects injurious to forestry were rearranged. A large amount of material has been identified for correspondents, and many students have been aided in their work by means of loans and exchanges.

Among the most important accessions were:

From Prof. A. L. Montandon, Bucharest, Roumania, 374 species, including 2,332 specimens, mostly exotic hemiptera not previously represented in our collection, and especially valuable as being identified by this well-known specialist.

Coleoptera, representing the saline fauna of Great Salt Lake Basin, Utah, 30 species from H. G. Hubbard, Detroit, Mich., and E. A. Schwarz, Washington, D. C.

A collection of East African insects of all orders (more than 300), from William Astor Chanler, Hameye-on-Tana, East Africa. Donated on condition of having them studied and afterwards divided with the Imperial Museum in Vienna, Austria.

A collection of miscellaneous insects (66 species), from Kashmir, from Dr. W. L. Abbott.

A collection of European Muscidæ (98 species), illustrating Brauer and Bergenstamm's classification of this group, from the Imperial Museum of Vienna, Austria, through Dr. F. Brauer.

North American Noctuidæ (63 species), from Prof. J. B. Smith, New Brunswick, N. J., mostly types of new species described by him either in the Museum Bulletins or in the journals especially devoted to North American entomology.

A collection of insects, mostly Coleoptera (296 specimens), collected in Mexico by J. T. Mason, Jalapa, Mexico, from the curator.

The following statement as to the condition of the collection is presented by the curator:

The following table indicates the number of specimens in the reserve, exhibition and duplicate series:

Specimens.	Collection.	Native or exotic.	Species.	Examples.
Hymenoptera	Reserve	Native	3, 500	20, 000
	do	Exotic	1, 000	2, 000
	Duplicate			2, 000
	Exhibit			1, 000
Neuroptera	Reserve	Native	500	2, 000
	do	Exotic	200	500
	Exhibit			200
Orthoptera	Reserve	Native	600	6, 000
	do	Exotic	400	2, 000
	Duplicate			3, 000
	Exhibit			1, 000
Coleoptera	Reserve	Native	7, 200	50, 000
	do	Exotic	7, 300	30, 000
	Duplicate			300, 000
	Exhibit			10, 000
Lepidoptera	Reserve	Native	4, 500	60, 000
	do	Exotic	3, 000	10, 000
	Duplicate			35, 000
	Exhibit			4, 000
Hemiptera	Reserve	Native	2, 500	20, 000
	do	Exotic	2, 000	5, 000
	Duplicate			3, 000
	Exhibit			1, 000
Diptera	Reserve	Native	4, 000	20, 000
	do	Exotic	800	2, 000
	Duplicate			2 000
	Exhibit			1, 000
Arachnida	Reserve	Native	350	2, 500
	do	Exotic	150	500
	Exhibit			200
Myriapoda	Reserve	Native	200	2, 000
	do	Exotic	50	200
	Exhibit			100
Total			38 250	598, 200

INCREASE OF THE COLLECTION.

The collection has increased during the year by the addition of about 7,000 specimens.

The last catalogue entry for June, 1892, was No. 1041.

The last catalogue entry for June, 1893, was No. 1260.

The routine work of the year has consisted chiefly of making up collections for exchange; reports on accessions for examination and report, about 100 such reports having been made during the year; naming of specimens for collectors (about 50 larger and smaller series of insects of all orders have been identified for correspondents, representing more than 2,000 species); the selection of material to send to specialists for study and determination; mounting and labeling of specimens; identifying the material of the accessions and incorporating it in the collections. This is generally done in connection with the work of arranging all the collections in permanent shape.

(*a*) *Reserve collections.*—In the *Diptera*, rearrangements have been made principally in the families *Tachinidæ* and *Bombyliidæ*. To the *Lepidoptera* much time has been devoted in all groups, both in the systematic and biologic series. In the *Coleoptera* several groups like the *Eumolpini* and *Hydrobinii* have been rearranged. In the *Hymenoptera* accessions have been incorporated. In the *Homoptera* all the unarranged material has been incorporated and the entire collection has been arranged.

(*b*) *Duplicate collections.*—These are generally arranged in connection with the corresponding reserve collections, but an exception was made this year in selecting a special series of North American *Coleoptera*, containing two specimens each of all the species (2,212) available from the general duplicate collection. This will facilitate exchanges.

(*c*) *Exhibit collections.*—In order to temporarily fill up the vacancies in the Museum exhibition hall caused by the transportation to Chicago of the larger portion of the material, 56 exhibit boxes were prepared from duplicates of native and exotic insects. At the beginning of the fiscal year a series of North American insects were selected, showing 181 species that have more commonly-used vernacular names. These were arranged in 7 boxes and put on exhibition.

Several of the papers by the curator, enumerated in the Bibliography (Appendix VII), are based largely on Museum material. Dr. A. S. Packard, who is engaged in the study of the North American Bombycid moths, has been allowed free study of the Museum collection, and was granted the loan of such species as required a more detailed investigation. Various papers have already appeared in the Canadian Entomologist and in the Journal of the New York Entomological Society on this subject. Mr. William Fox, of the Academy of Natural Sciences, Philadelphia, has borrowed the collection of the genus *Trypoxelon* of the family *Pemphredonidæ*, to assist him in his review of this group, published in the Transactions of the American Entomological Society. Prof. A. L. Montandon, of Bucharest, Roumania, has, by exchange material from the Museum, been assisted in studying the North American *Hemiptera-Heteroptera*, and as a result has published in the Proceedings of the Museum, Vol. XVI, pp. 45–52, "Notes on American *Hemiptera-Heteroptera*." Dr. F. W. Goding in his "Synopsis of the Subfamilies and Genera of the Membracidæ of North America" has studied Fitch's types, especially in the Museum collection, and his "Membracidæ of St. Vincent Island, West Indies," in the Canadian Entomologist for February, 1893, pp. 53–56, contains seven new species from types in the Museum collection. Mr. O. F. Cook has studied the *Lithobiidæ* in the collection and borrowed the African Myriapods of Abbott's collection for study and special report. Mr. Samuel H. Scudder has studied the Orthoptera of the Galapagos Islands, and Mr. William H. Ashmead has completed a valuable monograph of the *Proctotrypidæ*, based on material in the Museum. Mr. L. O. Howard has continued his work upon the host relations of parasitic Hymenoptera, and has also prosecuted certain special studies on the *Chalcididæ*, while Mr. C. L. Marlatt has been engaged upon the revision of the *Tenthredinidæ*.

Prof. Riley also contributes the following notice of the exhibits in entomology in the Government building at the World's Fair:

The fact of the intimate connection of the Department of Insects in the National Museum with the Entomological Division of the Department of Agriculture, led to a certain and necessary commingling of interests in the arrangement for the representation of the two at the World's Columbian Exposition. The main Government exhibit in entomology was therefore brought together in the agricultural section of the Government building, and while largely devoted to the economic phases of the subject, in which particular it more closely represented the Department of Agriculture, it contained also a large number of exhibits purely educational or scientific in scope, which appertained more strictly to the Museum material and work. Of the former also practically all the insect material was drawn from the Museum, largely, however, from the biologic and other collections transferred from the Department of Agriculture at or subsequent to the practical union of the two branches of Government work in entomology. The expense attending the preparation of all these exhibits, the securing of new cases, and the purchase of much new material, was defrayed, however, from the appropriation for the Department of Agriculture. In addition to the above, and to properly represent the Department of Insects in the National Museum, in conjunction with the exhibits of the Department of Agriculture, a showing was made in the Museum section covering a branch of the subject not included in the displays in the agricultural section. This consisted of a very elaborate and complete exposition of the characteristics of the families of American insects and their allies among the *Arthropods*. The general charge of the preparation of the exhibit of the Department of Agriculture was assigned to Mr. C. L. Marlatt, who also attended to its installation at Chicago, as well as of the Museum exhibit proper, which Prof. J. B. Smith was employed to prepare. The exhibits of the Agricultural Department and of the Museum may be described somewhat in detail as follows:

That of the Museum occupied 24 boxes of the standard Museum size, and consisted of a graphic representation, by means of specimens and figures, of the grosser features of the classification of insects and their near allies in the subkingdom *Arthropoda*. Included in this were illustrations of the subclasses, orders, and minor groups down to and including the families of the classes *Insecta, Malacopoda, Myriapoda, Acarida* and *Arachnida*. In addition to sample representative exhibits with each of the groups from class down to family, in many cases also with figures illustrating typical specimens or structural details, were brief but intelligent and accurate definitions of the groups, carefully prepared and in the form of large labels. The amount of labor thus entailed will be better appreciated from the fact that to do this required the preparation of over 500 group characterizations. This exhibit while not a large one in the amount of space occupied, was much more complete than anything hitherto attempted of its kind, and was most instructive in representing and defining in small space the entire scheme of the more general features of classification of *Arthropods*, other than Crustacea.

The larger and main display in the agricultural section, representing primarily the Division of Entomology of the Department of Agriculture, may be described under the several sections into which it naturally divides itself, viz: (1) Injurious and beneficial insects; (2) systematic and biologic entomology; (3) professional entomological exhibits; (4) insecticides and insecticide apparatus; (5) entomological publications, and (6) illustrations, maps, and charts. Of these the first three sections contain material drawn from the National Museum, with the addition of much new and original matter; the others are entirely original, and were prepared especially for the exhibit of the Division of Entomology of the Department of Agriculture.

The economic series, namely, insects injurious to agriculture, had, as a basis, the old economic material which has hitherto been exhibited at various previous expositions, but which, on account of its great educational value, could not well be omitted. It was, however, greatly extended and made to include the results of the later studies of life-histories and remedies, and was entirely remodeled and rearranged in new cases, with new labels, and was for the most part fresh material. It included over 600 special exhibits of injurious species, affecting 31 distinct cultivated plants, in addition to insects injurious to live stock and household pests. The number of exhibits of injurious species affecting some of the leading plants represented were cabbage, 34; apple, 35; orange, 36; cotton, 37; grape, 43; clover, 67; and Indian corn, 129. Each of these exhibits gave a life-history, illustrated by specimens and figures, natural enemies, together with references to the literature and instruction as to remedies. In this same category comes the collection of forest insects, which occupied eight standard Museum drawers, and included the principal insect enemies of the leading forest trees of economic importance.

A very prominent, if not the main feature of the present exhibit, distinguishing it from all its predecessors, was the special display of wax models of plants showing the perfect development in conjunction with representation of the results of insect injury, and the enlarged models of some of the more important of the injurious and beneficial species. Most noteworthy in connection with the many plant models were those of Indian corn, cotton, and hop. These three plants were selected and elaborated because representing typical and leading American crops: the corn more particularly as the leading staple of the Northern Central States, the cotton for the Southern belt, and the hop as a leading industry of the Northeast and Northwest. They were all intended to illustrate and draw attention to the affecting insects displayed in connection with them, which purpose they served admirably.

The important models of injurious insects comprised the Hop Louse, Chinch Bug, and Oyster-shell Scale, each represented in all of their several stages. The beneficial insects were represented by models of the imported Australian Ladybird (*Vedalia cardinalis*), showing life-history; structural models of the domestic silkworm, moth and larva; and of the Honey Bee, all stages and economy. A similar anatomical model of the European Cockchafer was also exhibited. A further exhibit of useful insects was the showing of silk moths, the larvæ of which either now furnish an important article of daily necessity or may be capable of doing so, comprising a representation of the different stages, in some cases with silk, of 12 important native and foreign species.

More strictly appertaining to the National Museum were the displays in systematic and biologic entomology and miscellaneous exotic and native insects, comprising Section 2. The systematic and biologic series were represented by means of some 23 sample boxes taken from the national collection and indicating the actual present condition of the collections in different orders and the system followed by the curator in the disposition and arrangement of the material, and was intended for the edification of visiting entomologists, who would be interested in the standard national collections as much if not more than the special educational displays in the economic series for the general public. Here also may be classed the general insect display consisting of some 28 boxes filled with the striking insect forms of Central America, Venezuela, Honduras, and Brazil, much of the material for which was recently collected by Mr. H. H. Smith, and is undetermined and undescribed. It was found possible to secure this valuable collection out of the fund allotted for this Department, and by so doing at once greatly enrich the national collection in Central and South American insects, and secure material for the making of a showy exhibit to represent the beautiful and varied forms and colors assumed by insect life near the tropics. With this last, and serving a similar purpose, may be classed the display of Golden-rod insects, which was designed to appeal to the æsthetic taste of those who see or are interested in the beautiful aspects of nature's handiwork, rather than in practical applications in the arts and sciences. The vast number of insects that frequent the Solidago, either to breed on the different parts of the plant or merely attracted to its bloom, together with the great beauty of the plant itself and its wide distribution and distinctive American habitat, led to its special treatment. A very realistic model plant, in wax, served as a center about and on which to display its more characteristic or common insect frequenters.

The remaining sections of the exhibit were economic in character and pertained more strictly to the Department of Agriculture, and may be very briefly referred to. What has been termed the professional exhibit was a display of the diverse apparatus and methods for collecting, rearing, mounting, and preserving insects, including in all some 66 displays of different styles of butterfly, sweeping and water nets, collecting umbrellas, sieves, collecting and pinning forceps, collecting bottles and boxes, breeding cages or vivaria of all sorts; spreading, drying, and mounting apparatus; preservative and mounting substances, vial-holders, and insect boxes. The insecticides and apparatus for applying these to plants comprised of the former 120 and of the latter 125 exhibits.

A display was also made of the official entomological publications of the Department of Agriculture and the U. S. Entomological Commission, and some 129 frames of entomological illustrations, maps, charts, and bromide enlargements. These illustrations will probably become Museum property, and are for the most part in standard Museum frames. They include 69 plates of illustrations of insects made up from figures published in Prof. Riley's reports on the insects of Missouri, and from illustrations from the reports of the Division of Entomology, Department of Agriculture, and the U. S. Entomological Commission. There were also a series of ordinal charts representing classification and transformations; charts of important insect pests representing life history; maps showing range of leading insects; views of insecticide operations and insect ravages, and a series of bromide enlargements representing exterior and interior views of the insectary of the Department of Agriculture and interiors of the entomological rooms in the Department of Agriculture and National Museum.

A detailed catalogue of 121 pages, covering the entire exhibit of the Department of Agriculture, was issued in midsummer as Bulletin 31 of the Division of Entomology, and was distributed to interested visitors during the remainder of the Exposition. In it a full statement of the exhibits is given, and much information relative to them which could not be well displayed with the exhibits themselves. This was supplemented by the stationing of some member of the division force at Chicago from time to time during the summer to more fully explain the exhibit.

MARINE INVERTEBRATES.

The honorary curator, Dr. Richard Rathbun, on account of his responsibilities to the U. S. Fish Commission, has been unable to give more than a general supervision to the work of this department during the year, but substantial advances have been made. The number of accessions have been larger than usual, one of which will add a new and interesting feature to the display collection. Early in the year it again became possible to open the exhibition hall to the public, and while circumstances prevented any extensive improvement in the arrangement of the cases, the chief cause of interference in that matter, the preparation of material for the World's Columbian Exposition, will necessarily prove of great benefit in the future. The introduction of a new style of rectangular glass jar for the display of alcoholic specimens will also permit of the extension of the exhibition series in a very important direction.

Much progress has been made by Mr. Benedict and Miss Rathbun in their studies of the higher crustaceans belonging to the department, and several papers bearing upon these subjects have been completed for publication. Arrangements have also been made with three well-known authorities in Europe for the study of our large collections of foraminifera, hexactinellid sponges, and deep-sea deposits, and it is expected that the assistance of other collaborators will soon be secured, a result which is greatly to be desired, in view of the large amount of original material from recent explorations now contained in our storerooms.

The accessions made to the collection number 56, an increase of 10 over last year. The most important one, from the standpoint of the exhibition series, consists of a large number of beautiful preparations obtained by purchase from the zoological station at Naples, Italy. These will add an interesting feature to the display collection, as the specimens are chiefly soft and delicate organizations, which few have learned the art of preserving in a manner at all presentable to the general public. Many groups are represented. From the U. S. Fish Commission have been received the collection of actinians made during the voyage of the steamer *Albatross* from Norfolk to San Francisco, and described by Prof. J. Playfair McMurrich, and a series of crustaceans resulting chiefly from recent explorations of the same vessel in the North Pacific Ocean.

Mr. W. L. Abbott has contributed a fine series of crustaceans, echinoderms, corals, and sponges from the Indian Ocean; Rev. H. Loomis, of Yokohama, crustaceans, echinoderms, and hydroids from Japan; Mr. Lewis Dexter, U. S. consul at Fayal, crustaceans, worms, and echinoderms from the Azores; Mr. H. R. Saunders, of Nassau, New Providence, 76 specimens of commercial sponges, representing the different Bahama grades; and Mr. Harlan I. Smith, many crayfishes and other fresh-water crustaceans from Ohio and Michigan. Other collections which also deserve mention here are specimens of crustaceans and leeches from the fresh waters of Mexico, presented by Mr. P. L. Jouy; crustaceans and worms obtained in Nicaragua by Mr. Charles W. Richmond; bird parasites from Mr. Walter Brett, of Lakeport, Cal.; blind crayfishes, including a new variety, from caves in Indiana, presented by Mr. W. P. Hay; microscopic slides of fresh-water crustaceans from Wisconsin, contributed by Prof. C. Dwight Marsh; crustaceans and worms collected in East Africa, from Mr. William Astor Chanler; and a number of starfishes and ophiurans from Canterbury Museum, Christchurch, New Zealand. While the remaining accessions are of smaller size than those above mentioned, containing only one or a few specimens each, they add altogether many interesting features to our collections.

The completion of the repairs in the west hall of the Smithsonian Institution during the summer of 1892 permitted the temporary coverings of the cases to be removed, and steps were at once taken to place the display collection in presentable condition, in order that the room might be reopened to the public. This was soon accomplished, but not without considerable work and a general overhauling of the specimens. At the beginning of the repairs, the large wall cases which surrounded the hall were boarded over and covered with a sloping metal top, which it was supposed would prevent the entrance of any moisture. Considering, therefore, that no harm could come to them, the stony and large gorgonian corals, the sponges, and some of the other groups were allowed to retain their places upon the shelves, as no other safe means of storing them could be provided. This supposed protection, however, proved entirely inadequate, and when the cases were finally uncovered it was observed that much damage had been occasioned by the rain. The sponges and gorgonians were covered thick with mold, and the glue used to repair many of the branching stony corals had become softened, allowing the different pieces to fall apart.

Before winter the exhibition room had been restored to its previous condition, but any improvement or increase in the display collection had to be temporarily deferred in consequence of the necessity of beginning preparations for the World's Columbian Exposition at Chicago.

The renewal of alcohol on the large collection now possessed by this department, the cataloguing of new accessions, and the continuation of the card or systematic catalogue as specimens are identified, have occupied much of the time of Mr. Benedict and Miss Rathbun, and, notwithstanding the crowded condition of the storeroom, it can be said that the entire collection has been maintained in good condition throughout the year.

Not taking into account the very small organisms, which it is impossible to enumerate, the number of specimens received by the department has been 2,690. The entries made in the serial catalogue books have been as follows:

Group.	Entries to—		Number of entries during year.
	June 30, 1892.	June 30, 1893.	
Crustaceans	16,987	17,815	823
Worms	4,958	4,967	9
Bryozoans and Ascidians	2,869	2,887	18
Echinoderms and Cœlenterates	17,759	17,858	99
Sponges and Protozoans	6,318	6,326	8
Total			962

Mr. Benedict, the assistant curator of the department, has continued during the year his work upon the large family *Paguridæ*, or hermit crabs, of which he is preparing a complete monograph, the same being now well under way. He has also spent much time in a study of the larger forms of anomura of the Pacific Ocean, belonging to other groups than the above, and has classified the sponges recently collected in the North Pacific, by a microscopic examination of their spicules, in order that the different groups may be sent to specialists for study.

The following papers by Miss Rathbun, completed during this period, have been submitted for publication in the Proceedings: "Catalogue of the Crabs of the family *Maiidæ* in the U. S. National Museum;" "Descriptions of new genera and species of crabs from the west coast of North America and the Sandwich Islands," based chiefly upon material recently collected by the steamer *Albatross;* and "Descriptions of new species of American fresh-water crabs." She has also completed the identification of the collection of *Brachyura* made in the

Pacific Ocean and Bering Sea by the steamer *Albatross* since the spring of 1888, with the object of preparing a catalogue of the same, having special reference to the faunæ of the fishing grounds, for publication by the Fish Commission.

The following specimens have also been identified, namely, the Abbott collection of crabs from the Indian Ocean, the invertebrates from Japan, contributed with a request for names by Rev. H. Loomis, both mentioned among the accessions, and a collection of crustaceans belonging to the Provincial Museum of Victoria, British Columbia, transmitted for examination and report.

The sponges belonging to the family *Hexactinellidæ*, collected in the Pacific Ocean by the steamer *Albatross*, have been sent to Prof. F. E. Schulze, of Berlin, the well-known authority on this subject, who is now preparing a complete revision of the group. He will also submit a special paper for the Museum Proceedings, describing the specimens supplied from here. Similar arrangements have been made with Dr. Axel Goës, of Sweden, to work up the foraminifera collected by the same vessel in the Gulf of Mexico, Caribbean Sea, and Pacific Ocean; and with Dr. John Murray, of Edinburgh, Scotland, to study the deep-sea deposits obtained by the *Albatross* and other United States vessels. The collections have accordingly been shipped to them. These same experts reported upon the corresponding subjects in the extensive series of volumes covering the results of the voyage of H. M. S. *Challenger*, and the Museum is therefore fortunate in securing their cooperation at this time.

Prof. Walter Faxon, of the Museum of Comparative Zoology at Harvard University, has continued to identify the crayfishes received from time to time by this department, and Dr. C. W. Stiles, of the Agricultural Department, has undertaken to study the intestinal parasites, which have now been set aside for his examination.

The Fish Commission steamer *Albatross* has been employed during the past year chiefly in connection with the sealing investigations in the North Pacific Ocean and Bering Sea, but she has also had the opportunity of doing some dredging work in the same region, from which important collections of natural history were obtained. Some of these have already been turned over to the National Museum. The natural-history work of the steamer *Fish Hawk* has been confined mostly to the oyster beds of Long Island Sound and Chesapeake Bay, and that of the schooner *Grampus* to surface towing and fishing off the New England coast, and to an investigation of the habits of the mackerel during the spring migrations. Mr. Benedict took part in the examination of the oyster beds in Long Island Sound, and through his own efforts was enabled to secure a much larger series of the smaller animals desired by the Museum than would otherwise have been obtained.

The duplicate specimens belonging to the regular Series No. IV, which have been distributed to institutions of learning during several years past, are now nearly exhausted, only a few sets still remaining. The following schools and colleges were supplied during the year: State Normal School, Oshkosh, Wis.; Clark University, Atlanta, Ga.; Columbia College, Van Allstyne, Tex.; Grammar School, Salem, Mass. A large general collection of marine invertebrates, representing mainly the dredging work of the Fish Commission, was also sent to the Imperial University, Moscow, Russia, and smaller collections were distributed as follows: Anomuran crustaceans to the Museum of Comparative Zoology at Harvard University; hermit crabs to Leland Stanford Junior University and the University of California; miscellaneous specimens to Clark University, Atlanta, Ga.; University of Georgia, Athens, Ga.; Normal School, Hampton, Va.; and Miss Mary V. Worstell, New York City; two species of sea urchins to Prof. Cuénot, Nancy, France; edible crustaceans to the Museum of Hygiene, Washington, through Dr. Howard E. Ames, U. S. Navy; echinoderms to Prof. A. J. Woolman, South Bend, Ind.; foraminifera to Smith College, Northampton, Mass., and Prof. E. R. Boyer, Englewood, Ill.

Collections were also sent to the following authorities for study and report, as mentioned elsewhere: To Prof. F. E. Schulze, Berlin, Germany, the hexactinellid sponges collected by the steamer *Albatross* in the Pacific Ocean, between 1887 and 1890; to Dr. Axel Goës, Linköping, Sweden, a large collection of foraminifera from the Caribbean Sea, Gulf of Mexico, and Pacific Ocean, obtained mostly by the steamer *Albatross*; to Dr. John Murray, Edinburgh, Scotland, a large series of deep-sea soundings, representing the character of the bottom in different oceans, and collected by the steamer *Albatross* and other exploring vessels of the United States; to Prof. Walter Faxon, Cambridge, Mass., the specimens of crayfishes recently received by the Museum.

The exhibit from this department at the World's Fair consisted of a synoptic series, showing by means of specimens, models, drawings and explanatory labels, important forms and anatomical details of the orders of invertebrates, contained in the groups *Protozoa*, *Porifera*, *Cœlenterata*, *Vermes*, and *Echinodermata*.

Marine invertebrates. A systematic series of specimens of marine invertebrates in alcohol, including representatives of 125 families, of the following classes:

Spongia, Sponges. *Anthozoa*, Coral Polyps. *Polypomedusæ*, Hydrozoa. *Crinoidea*, Sea Lilies. *Asteroidea*, Star fishes. *Echinoidea*, Sea Urchins. *Holothuroidea*, Sea Cucumbers. *Annelida*, Worms. *Crustacea*, Crabs, Shrimps, etc. *Bryozoa*, Moss Animals. *Tethyodea*, Ascidians. *Arachnida*, Sea Spiders.

A collection of marine invertebrates in alcohol, from the Bay of Naples, received from the Naples Zoological Station.

Mediterranean Octopus, a group, with accessories, representing the Octopus in its natural surroundings.

A series of economic marine invertebrates and of other specimens illustrating the principal features of the fishing grounds was likewise withdrawn by the Fish Commission for the same purpose. Mr. Benedict was in Chicago during about four weeks in April and May, arranging the collections sent by this department, and otherwise assisting in the preparation of the National Museum exhibit.

DEPARTMENT OF COMPARATIVE ANATOMY.

The time of the acting curator, Mr. F. A. Lucas, has been chiefly spent in the preparation and installation of material for the World's Columbian Exposition and in preparing copy for the numerous labels, especially the somewhat lengthy descriptive labels for that portion of the synoptic series of invertebrates there shown.

There have been few important accessions, the most noteworthy being a comparatively complete skeleton of the extinct Steller's Sea Cow (*Rhytina Stelleri*), received through the instrumentality of Prof. B. W. Evermann, of the U. S. Fish Commission. Dr. W. L. Abbott sent 4 skeletons of cetaceans (*Prodelphinus*) from the Indian Ocean, and also a fine example of the Aldabra Tortoise (*Testudo elephantina*). An important series of skulls of African mammals, collected by Mr. H. C. Moore, is mentioned in the report of the curator of mammals. A fine old male Mountain Goat (*Mazuma americana*) was procured from Mr. Allen Rupert.

A series of Sandwich Islands birds in spirits was secured by purchase and gift from Mr. Scott B. Wilson, and it is hoped that a study of these may throw a little light on the relationship of the avifauna of those islands.

Attention has been given to filling up gaps in the exhibition series, the additions being forms representing families, or important divisions of families. The general exhibition series of mammal skeletons is now fairly full, but few important forms being needed, while a limited number of pieces might perhaps be withdrawn. Many additions are necessary to the series of birds, while the collection of skeletons of fishes is very incomplete. The number of mounted skeletons is designedly restricted, as the distinctive features of various groups can be more clearly shown by a moderate than by a large number of specimens. On the other hand, the study series can not be too large, for only by large series of specimens can the relationships of species and the amount of individual variation be determined.

Among the series supplementing the general collection of skeletons, and illustrating various points of anatomy and morphology, that showing the homologies of the principal bones was completed for the Chicago Exposition.

Among the projected series is one showing some of the modifications of the skeleton for offense or defense, one to illustrate the morphology of the hyoid and branchial arches, and one to show the relations of the bones of the ear.

Work on the study series has been mainly confined to such rearrangement of material as has been rendered necessary by the steady growth of the collections. Owing to the lack of storage room it frequently happens that specimens are temporarily placed wherever space can be found for them and rearranged when room can be made available.

Mr. Lucas has been unable to devote any time to special researches, but the skulls of bears and of fur seals have been carefully studied by Dr. C. Hart Merriam, the latter in connection with the presentation of the case of the United States in the Bering Sea question.

The curator submits the following statement of the condition of the collections:

The condition of the collections is good; the increase, as indicated by the catalogues, is as follows:

	Last entry—		Increase.
	June 30, 1892.	June 30, 1893.	
Mammals	35,526	36,051	525
Birds	19,105	19,185	80
Reptiles and Batrachians	29,325	29,340	15
Fishes and Elasmobranches	26,149	26,159	10
Total			630

The number of specimens on exhibition June 30, 1893, was as follows:

Skeletons of—	
Mammals	196
Birds	83
Reptiles	41
Batrachia	9
Fishes	37
Elasmobranches	3
Skulls and specimens illustrating points of morphology, structure, etc	292
Anatomical models	25
Total	686

This total included museum specimens withdrawn for exhibition at the World's Columbian Exposition, but not those which have been purchased especially for that purpose.

In the World's Fair exhibit from this department an effort has been made to illustrate the methods adopted by the Museum to render the exhibition of anatomical material instructive and attractive. To this end the material exhibited comprised several fully labeled series, illustrating various points of morphology or structure, grouped under the following heads:

(1) HOMOLOGIES OF THE PRINCIPAL BONES IN THE VARIOUS CLASSES OF VERTEBRATES.

(*a*) *General homologies.*—Mounted skeleton of a man and a horse* having the principal bones of each labeled. Mounted and disarticulated skeletons of cat, crow, turtle, iguana, frog, and fish arranged in cases side by side, the disarticulated skeletons having the principal bones

* Illustrated in Plate 30.

labeled, thus rendering it possible to recognize the corresponding bones of each almost at a glance.

(*b*) *Special homologies; the skull.*—Skulls of sturgeon, gar pike, grouper, menopoma, frog, boa constrictor, turtle, alligator, penguin, goat, and puma, having the corresponding bones similarly colored. While this plan is not new, special attention was given to securing a harmonious color scheme, and the smaller skulls were represented by accurately enlarged models, thus showing details that would otherwise have been invisible.

(*c*) *Special homologies; the limbs.*—Articulated limbs of grouper, sea turtle, alligator, eagle, and dog, having the larger bones labeled and the smaller bones numbered, the specimens being accompanied by correspondingly numbered labels giving the names of the various bones of the wrist and ankle. Limbs of fish, sea turtle, manatee, cormorant, great auk, sloth, bat, monkey, and man, showing the homologies of limbs specially modified for various methods of locomotion. Manus and pes of a horse, camel, moose, tapir, seal, bear, and lion, with the larger bones labeled and the smaller numbered alike, intended to make clear the correspondence of parts in mammals having from 1 to 5 digits.

(2) LOCATION, GROWTH, AND STRUCTURE OF TEETH.

Series of skulls of mammals, reptiles, and fishes, exhibiting the teeth in various stages of growth, many having the outer surface so cut away as to show the young teeth not yet in place. Specimens illustrating the mode in which the teeth are replaced in some animals, and single teeth, or sections of teeth, displaying the varying proportions and disposition of the dentine, enamel, and cement, as well as some of the simpler and some of the more complicated patterns of tooth structure.

(3) STRUCTURE AND GROWTH OF HORNS.

Examples of horns which are merely outgrowths of the epidermis, as is the case in the rhinoceros; those which are permanent outgrowths of the frontal bones covered with hard epidermal structures, such as are found in sheep, goats, and oxen; and those which, as in the deer, are outgrowths of the frontal bones and are grown and shed annually. Sections of these various classes of horns are shown also.

(4) STRUCTURE OF THE LONG BONES.

A series of bisected humeri and femora exhibiting the light, hollow, structure of the long bones in animals of rapid movement, and the more or less dense character of the limb bones of aquatic animals or those of sluggish movements.

(5) STRUCTURAL VARIATIONS OF DOMESTIC ANIMALS.

Series of skulls of dogs, showing something of the cranial variations in different breeds. Series of skeletons illustrating the more marked differences in size and proportions among domestic dogs. Casts of brain cavities of wolf, fox, and dog, exhibiting the greater frontal development of the latter.

(6) ANATOMY, EMBRYOLOGY, AND VARIATION OF THE DOMESTIC FOWL.

(*a*) *Anatomy.*—Skeletons of different breeds. Model displaying muscles, blood vessels, and viscera.

(*b*) *Embryology.*—Model of genital organs of hen. Sixteen models, some enlarged to give details, showing various stages in the development of the fowl from the beginning of incubation to the newly hatched chick.

(*c*) *Variation.*—Wild jungle fowl, the stock from which the various breeds of domestic fowls have been derived. Mounted examples of several breeds to illustrate the marked differences of proportions, size, and color among domestic fowls.

(7) COMPOSITION OF THE HUMAN BODY.

Series of specimens and models showing the various elements and their proportions in the body of a man weighing 150 pounds.

This department was also charged with the preparation of the exhibit of domesticated birds, which are shown in two series:

(1) DOMESTIC PIGEONS.

Series of 34 specimens, including an example of the Wild Rock pigeon, grouped about a dovecot, and used to illustrate variation under domestication. The following races and breeds are represented:

Pouters.—Red; Blue; Isabella Pigmy Pouter.

Carriers.—Black Barb; Dun Carrier; Blue-rock Carrier.

Tumblers.—Booted White English Fantail; Blue-tailed Turbit; Yellow-winged Turbit; Yellow shell-crested Turbit; White Owl; Turbiteen; Black Tumbler; Red Parlor Tumbler; Black Bald Tumbler; Black Jacobin; Bluette; Salinette.

Trumpeters.—Common pigeons; Homers; Red-winged Swallow; Barred Blue-winged Swallow; Nun; Helmet; Archangel; Ice pigeon; Black Magpie; Yellow Magpie; Russian Trumpeter.

(2) BREEDS OF THE DOMESTIC FOWL.

American breeds.—Plymouth Rock, cock and hen; Black Java, cock and hen; Silver Wyandotte, cock and hen; Jersey Blue, cock and hen.

Asiatic breeds.—Light Brahma, cock and hen; Black Langshan, cock and hen; Partridge Cochin, hen; White Cochin, cockerel.

English breeds.—Silver-gray Dorking, cock and hen; White Dorking, cock and hen.

Hamburghs.—Silver-spangled Hamburgh, cock and hen.

French breeds.—La Fleche, cock and hen.

Games.—Red Pile Exhibition Game, cock and hen; Maroon Game, cock; Black Sumatra Game, cockerel and pullet.

DEPARTMENT OF INVERTEBRATE FOSSILS (PALEOZOIC).

The honorary curator, Mr. C. D. Walcott, has been obliged to devote his time almost exclusively to work connected with the U. S. Geological Survey. The department cooperated with the Survey in the preparation of an exhibit for the World's Columbian Exposition. Such time as could be spared to laboratory work was given to the preparation of a collection to be exhibited at the World's Columbian Exposition. A description of this exhibit is given at the close of this report.

The year's work upon the collections was mainly in the direction of working out and putting in condition for study the collections that had previously been made by the Geological Survey. Over 200 drawers of Upper Cambrian fossils have been worked up, preparatory to study in connection with the preparation of a monograph on the Upper Cambrian fauna. A large number of Middle Cambrian fossils were received from the field, cleaned, and record numbers entered upon them. None of this material, however, was transferred to the National Museum, as I thought it desirable to complete the study of the same before transmitting it.

In the laboratory, attention was given to painting the record numbers on the specimens belonging to the accessions, and to the recording of material which will be transferred from the Geological Survey as soon as the work upon it is completed.

The publications of the year based on Museum material are noticed in the Bibliography.

The catalogue numbers taken up were from 24153 to 24311, both inclusive. About 1,200 specimens have been added to the collection.

Owing to the pressure of other work, a number of the recent accessions to the Museum exhibition series have not yet been entered, but special instructions have been given to attend to this matter early in the next fiscal year.

Among the most interesting additions were the collections made by Mr. Walcott. One hundred and fifty specimens of fossils of the Oriskany formation, at Cumberland, Md., and 100 specimens of Lower Devonian corals, from Genesee County, N. Y., from the Geological Survey. Also a large collection of 325 individual crinoids, together with 12 magnificent crinoid slabs from the Lower Carboniferous at Crawfordsville, Ind., from Charles E. Beecher, Yale College, New Haven, Conn. Dr. A. L. Benedict, of Buffalo, N. Y., sent 24 specimens of fossils characteristic of the water-limestone of Buffalo, and L. W. Stuart, Monmouth, Iowa, a considerable collection of Niagara fossils from Monmouth, Iowa.

It was decided that the Museum should unite with the U. S. Geological Survey in the preparation of a paleontological exhibit for the World's Columbian Exposition. A large number of specimens belonging to the Survey were used for this purpose, and a number came from the collections of the Museum. All of the material has now, however, been transferred to the custody of the latter, and is now on exhibition in the Department of Geology.

The principal feature of the exhibit was the collection of characteristic fossils and rocks arranged stratigraphically. This contained about 1,850 species (probably 6,000 specimens) of fossils, and 543 rocks. There were also exhibited a restored skeleton of *Dinoceras mirabile*, 4 large slabs with *Lingula*, *Protichnites*, *Climachtichnites*, and *Dactyloidites*, 2 large casts of *Orthoceras*, 1 large specimen of *Baculites grandis*, 1 large special case containing showy specimens of Crinoids, Trilobites, Eurypterus, Ammonites, Corals, etc., and 2 special cases of showy fossil plants, principally Carboniferous, with a few from the Cretaceous and Tertiary.

DEPARTMENT OF MESOZOIC FOSSILS.

Comparatively little work has been done in this department during the past year. Owing to the fact that its personnel is only nominally or incidentally connected with the Museum, it has been impracticable to devote much more time to it than the most imperative of the routine forms required. This work has been mainly confined to the examination of and report upon accessions, and to the transference of certain collections to the Museum from the U. S. Geological Survey.

The most important accessions to the Museum through this department are those received from the Survey. Among these are the type specimens of fossils which have formed the basis of Bulletin No. 106 of the Geological Survey, of which Mr. T. W. Stanton is the author. This collection embraces 179 type specimens, all of which are figured in that bulletin.

During the past year the entries in the record book of this department have ranged from 22,170 to 22,959. There have been catalogued 6,440 specimens of fossils, 5,392 of which came from the U. S. Geological Survey, and 1,048 from all other sources.

Dr. C. A. White, the honorary curator, has during the past year been engaged in the preparation of a work upon the Bear River formation of Wyoming and Idaho, which is largely of a paleontological character. This work is not yet published, and no work based upon the collections of this department has been published during the year.

DEPARTMENT OF RECENT PLANTS.

Dr. George Vasey, honorary curator and botanist of the Department of Agriculture, died March 4, 1893, after a long and faithful service in connection with the National Herbarium and with the U. S. Department of Agriculture.* Mr. Frederick V. Coville, his successor,

* Notices of his life and scientific work have been published in the Bulletin of the Torrey Botanical Club, vol. 20, 1893, pp. 218 to 220, and in the Botanical Gazette, vol. 18, 1893, pp. 170 to 183.

was appointed honorary curator of the Department of Botany in the National Museum, March 28, 1893.

During the past year, up to the time of his death, Dr. Vasey was engaged upon researches in connection with a publication entitled "Monograph of the Grasses of the United States and British America," basing his work upon the very full collection of Gramineæ in the National Herbarium. The work on this subject was about four-fifths completed at the time of Dr. Vasey's death. The report on the botany of the Death Valley expedition, in preparation by Mr. Frederick V. Coville, was also continued during the first part of the present year and was finished in December, 1892. Work on the collections made by Dr. Edward Palmer in western Mexico during the years 1890 to 1892 was continued by Dr. J. N. Rose.

The Herbarium collection, which is deposited in the Department of Agriculture, consists of study and duplicate series only, no specimens having been prepared for exhibition purposes. In general the herbarium is in excellent condition, the system of classification being so carried out as to greatly facilitate access to the material contained in it.

During the year about 33,000 specimens were received, involving 567 catalogue entries. Specimens to the number of 14,308 were sent out as exchanges, and 4,117 mounted sheets were added to the Herbarium proper.

Mr. Coville reports as follows upon the important accessions received during the year:

A large collection of specimens from northwestern Idaho, collected by Dr. J. H. Sandberg and assistants. The whole collection contains 1,035 numbers.

A collection of 168 numbers from Yakutat Bay, Alaska, made by Frederick Funston during the summer season of 1892. These specimens are in excellent condition and excel in their value as specimens any collection heretofore received from Alaska.

Dr. Edgar A. Mearns, captain, U. S. Army, has continued to send in collections made upon the International Boundary Commission (United States and Mexico), which, although not yet critically examined, will furnish material for a future report on the botany of this region.

Dr. H. E. Hasse of Soldiers' Home, Los Angeles County, Cal., has contributed a set of 255 specimens from the southern portion of the State of California.

Mr. G. C. Nealley has continued his collections in Texas, having sent in about 1,650 specimens from that State.

Through Mr. P. A. Rydberg have been received a valuable collection from the Black Hills of South Dakota, containing about 2,500 specimens.

From Dr. Edward Palmer has been received a collection of specimens from middle California in the vicinity of San Francisco Bay, and in the Sacramento and San Joaquin valleys.

From Mr. J. W. Toumey, of Tucson, Ariz., was received a series of specimens collected on a journey from Tucson northward past San Francisco mountain to the Grand canyon of the Colorado and return.

From Dr. E. F. Franchschi was purchased a collection of 214 plants from Attica, Greece, the specimens in by far the best condition of any yet received from Europe.

From Mr. John Macoun, Ottawa, Canada, was purchased a set of 100 Canadian lichens and 100 Canadian mosses.

From Prof. C. S. Crandall, Fort Collins, Colo., has been received a collection of 587 Colorado plants.

From Mr. G. W. Letterman, of Allentown, Mo., was received a small but interesting and valuable collection consisting of 71 grasses of the genus Poa, collected at high altitudes in the Rocky Mountains of Colorado.

From C. G. Pringle, of Charlotte, Vt., was purchased a collection of his plants of 1892 from southern Mexico.

From Dr. Franz Buchenau, of Berlin, Germany, was received a collection of 164 specimens of the genus Juncus.

From Dr. H. H. Rusby, of New York City, a set of Miguel Bang's Bolivian plants was received.

Fascicles 8 and 9 of Mr. W. N. Suksdorf's collections made in the State of Washington have been acquired by purchase.

M. C. Copineau has sent in 260 specimens of French plants as an exchange.

From Dr. B. L. Robinson was secured a set of 420 specimens collected by the late Mr. H. E. Seaton, of Cambridge, Mass., on Mount Orizaba, Mexico.

In addition the first installments of several collections have been received from collectors which are more properly mentioned, together with the remainder of those collections, in the report for the succeeding year.

Through the Smithsonian Institution has been received from M. S. E. Lassimonne, of France, a collection of 200 specimens of plants from that country.

From Baron Ferdinand von Mueller, Melbourne, Australia, have been received several packages of Australian plants, in most cases new to the Herbarium.

From Miss Elizabeth Taylor, of Troy, N. Y., were received a set of 115 specimens collected by herself in a journey down the McKenzie River, British America, during the season of 1892.

From the U. S. Fish Commission was received a package of 650 specimens from the mainland and islands of Alaska, collected by Dr. B. W. Evermann.

In addition to these specimens many others, small in number but no less valuable in quality, have been received and incorporated in the Herbarium.

DEPARTMENT OF FOSSIL PLANTS.

The work of the year has been a continuation of that of the two preceding years, that is, the object kept constantly in mind has been "the arrangement of the specimens in such a manner as to facilitate their consultation and study."

Prof. Lester F. Ward, of the Geological Survey, continues his services as honorary curator, and Prof. F. H. Knowlton was reappointed assistant curator of this department in August. He was, however, only able to devote one-half of the time to this work for several months, but since December his whole time has been given to the Museum. Later by an arrangement made between the National Museum and the U. S. Geological Survey, Prof. F. H. Knowlton exchanged work with Mr. David White. The actual period of this exchange extended from November 28 to June 27. During this period Prof. Knowlton continued the revision of the flora of the Laramie group, mentioned in my last report, and at the end of the year he had settled the status of 241 species and had written about 450 pages of the preliminary manuscript. He has had prepared a large number of drawings to illustrate the new species, or those possessing peculiar or curious features. The work thus far accomplished represents all but about 25 of the species recorded in Lesquereux's Tertiary Flora. The whole flora of this group, as now known, will probably embrace about 350 species, and when completed it will represent, it is thought, one of the most satisfactory aids to geology that has been afforded.

Mr. White's work for the Museum has been entirely on the great Lacoe collection, and at the end of the year about 125 boxes, weighing 15,000 pounds, had been shipped to Washington. As the magnitude and value of this collection was stated at length in the report for last year, it is unnecessary to again refer to it. The larger part of this donation has now been labeled and sent to Washington, but much remains, especially in the way of duplicates It is probable that a further arrangement will be perfected whereby Mr. White will be enabled to complete the transfer.

No especially important accessions have been made during the year, the lots received being either single specimens or small collections from limited areas. The Museum has, however, obtained by purchase a very fine series of fossil cycadean trunks from Lower Cretaceous strata near Hot Springs, South Dakota. They are six in number, and range from 10 inches in length and 6 inches in diameter, to over 3 feet in length and 2 feet in diameter. The finest specimen, which weighs 721 pounds, is undoubtedly the largest example of the kind ever found. The specimens have been photographed in various positions, and will be made the subject of a special monograph.

The routine work in arrangement and classification of the collections has been of the same nature as in several previous years. We had constructed in the west tower-room a large storage-case, capable of accommodating about 500 3-inch unit trays. The entire miscellaneous Carboniferous collection, which is being studied by Mr. White, was put in this case, and the room on the balcony floor reserved for the Mesozoic and Tertiary plants. Five quarter-unit table cases were also placed in the west tower room, and the whole collection of fossil wood was placed in them. At the present time everything in the department is perfectly accessible. This condition is only brought about, however, by storing in the Armory building all that can not be accommodated in the cases. This arrangement, while probably the best that the present division of space will admit of, often causes serious inconvenience, as collections or specimens desired for study or comparison are in storage. When the great Lacoe collection is installed, the need of additional space will be much greater than now.

Prof. Ward's work during the year has been practically a continuation of that recorded as in hand in his last report. He has continued the exploration of the Potomac formation, both in the immediate vicinity of Washington and below Richmond, Va., with the result of discovering a number of new plant beds, from which a large number of new and interesting plants were obtained. The specimens from the Potomac formation, exclusive of those on which Prof. Fontaine based his monograph on the Younger Mesozoic Flora of Virginia, now fill 113 of the standard unit trays of the National Museum. These later specimens have come from Alabama, Virginia, the District of Columbia, Maryland, and New Jersey, and, combined with the earlier ones, make probably as complete a flora as that known for any formation. The results of their study will be embodied in a work on the correlation of the Cretaceous plants, now in preparation.

Besides the work of revision above mentioned, Prof. Knowlton has also studied collections and made reports as follows: Re-examination of the fossil plants at Silver Cliff, Colo.; list of the plants of the Post-Laramie beds of Colorado; report on a collection of fossil plants from Ellensburg, Wash.; report on fossil plants obtained by J. S. Diller in western Washington; report on two species of fossil plants from Oregon; identification of a collection of fossil plants from the auriferous gravels of California, obtained by H. W. Turner; report on the bearing of the fossil plants of the auriferous gravels on the question of the temperature and elevation at the time of their deposition; determination of fossil plants collected by W. H. Weed in the Crazy Mountains on Big Timber Creek, Park County, Mont.; report on collection of fossil plants from Cookville, Utah; report on fossil plants from Huefano Park, Colorado, as well as numerous reports relating to accessions received by the Museum.

Prof. William M. Fontaine, of the University of Virginia, has studied and made an elaborate report on a collection of plants from the Trinity rocks near Glen Rose, Tex. He has determined no less than 23 species, of which number 6 are new to science. His paper, illustrated by 8 plates, is published in the proceedings of the National Museum.

The last catalogue entry in June, 1892, is 555.

The last catalogue entry in June, 1893, is 584.

Total number of specimens added to the collection during the year is estimated at 2,000.

DEPARTMENT OF MINERALS.

Prof. Clarke reports that apart from the usual routine little was done in the department except to prepare, pack, and install its share of the exhibit made by the Museum at the World's Columbian Exposition. To that work all else was subordinated. The preparation of the crystallographic series for Chicago, by Mr. W. S. Yeates, involved the careful measurement and description of a large number of characteristic crystals, representing many mineral species. The data thus obtained appear upon the printed labels of the specimens, which have thus acquired new value for the permanent collection. Toward the end of April Mr. Yeates went to Chicago to install the collection; but early in May he resigned as assistant curator, to become State geologist of Georgia, and the work of installation was completed by Mr. Wirt Tassin and the Curator. The collection shown at the Exposition filled 2

Liverpool cases and 4 slope-top cases, and consisted entirely of choice, selected characteristic material. For the time being, of course, the exhibition series in Washington was perceptibly weakened.

During the year 348 entries were made in the catalogue of the department, representing 579 specimens. Of these a considerable number were bought with reference to exhibition at Chicago, especially a fine group of representative gems from Amelia County, Va., a superb series of crystallized sulphurs from Sicily, and a suite of anglesite crystals from Monteponi, Sardinia. Some remarkable Sicilian selenites and celestites, and the groups of fluorites from the Wilcox collection were also obtained in this way.

By gift, little was received during the year. The most notable accession of this kind was a series of 7 cut turquoises and 1 specimen of turquoise in the matrix, presented by the American Turquoise Company, of New York. The exchanges also were few in number. Sixteen specimens of miscellaneous minerals were thus obtained from Mr. E. E. Howell, and 51 specimens, all of European origin, were received from Prof. P. Groth, of Munich, in return for a collection previously sent to him. Still another exchange collection came from Prof. A. Brezina, of Vienna, but it was not catalogued during the year covered by this report.

When the collections now in Chicago shall have been returned to Washington, the incorporation of the new material obtained into the permanent series will involve a general reorganization of the exhibition hall. Much old material will be retired to the study and duplicate series, to make room for new and finer specimens. Until that work has been done, no satisfactory census of the mineral collection can be made.

The last catalogue entry of the preceding year, June 30, 1892, was No. 80640. The last entry of the present year, June 30, 1893, is No. 80991.

EXHIBIT OF MINERALS AT THE WORLD'S COLUMBIAN EXPOSITION.

The exhibit consisted of minerals, gems, and semi-precious stones, illustrating the principles of crystallography and those physical properties of minerals which apply to the eye, and included the following series:

Crystallography and the physical properties of minerals.

A series of crystallized minerals (with the principal forms in models of wood) to illustrate crystal form.

A series to illustrate parallel growths.

A series to illustrate the twinning of crystals.

A series to illustrate the imperfections of crystals.

A series of crystalline aggregates.

A series of pseudomorphs.

A series to illustrate structure.

A series to illustrate cleavage and fracture.

A series to illustrate diaphaneity, color, and luster.

A collection of gems and semi-precious stones, embracing two series, as follows:

A general series, arranged in the order of their intrinsic value.

A series of American gems and semi-precious stones.

DEPARTMENT OF GEOLOGY.

A very large portion of the year was devoted by Prof. George P. Merrill, the curator, and his assistants, to the preparation of an exhibit for the Columbian Exposition, a general outline of which was given in the curator's report for 1892. Lack of space necessitated a certain amount of curtailment in the original plans, but as carried out the exhibits were classified and arranged as below:

I. VULCANOLOGY.

(*a*) A map of the world showing in red the distribution of active and recently extinct volcanoes, compiled mainly from Meumayer's Erdgeschichte.

(*b*) A geological map of the United States showing in red the areal distribution of recent volcanic rocks in the United States, compiled by Prof. C. H. Hitchcock, in 1886, and published in the Transactions of the American Institute of Mining Engineers.

(*c*) A model of the Ice Spring Craters, a group of recently extinct volcanoes near Fillmore, Utah, modeled from surveys made under the direction of the U. S. Geological Survey; scale, 100 feet to 1 inch, horizontal and vertical the same; size of model, 5 feet square.

(*d*) A large series of photographs showing characteristic volcanic phenomena, as below:

(1) Two enlarged views of the volcano on Bogoslof Island, Bering Sea.

(2) A series of views of Bogoslof and mounts Shishaldin and Makushin, in Alaska.

(3) A series of views of Hawaiian volcanoes and lava flows.

(4) A series of views of Vesuvius, Italy, and the volcanoes of the adjacent islands, including Stromboli, Etna, and Vulcano, in various stages of volcanic activity.

(5) Views of a recent volcanic cone and lava fields near Snag Lake, California.

(6) Three views of the grand volcanic neck known as Mato Teepee, Bear Lodge, or the Devil's Tower, in Wyoming.

(7) Views of columnar volcanic rocks in the Yellowstone National Park, in the vicinity of Orange, N. J., and at Bonn, Prussia.

(8) Views of geysers and hot springs in the Yellowstone National Park.

(*e*) A series of specimens of volcanic products in characteristic forms, as lavas, fragmental ejectamenta, and sublimation products, as follows: *

(1) Columnar basalt, from Bonn, Prussia, and the Giant's Causeway.

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* These collections were accompanied, whenever possible, by photographs of the immediate regions from which they were collected.

(2) Slaggy and glassy lava, from the Hawaiian Islands and the Yellowstone National Park.

(3) Pumiceous and glassy lavas (obsidians), from the Yellowstone National Park and the Mono craters, California; vesicular lava, from near Flagstaff, Ariz.

(4) Lava showing the aa, pahoehoe, and other structures dependent upon their varying degrees of viscosity; lava stalactites and driblet cones from the Hawaiian Islands.

(5) Volcanic bombs, from Lipari, Etna, the extinct volcanoes of Mount Trumbull and Sunset Peak, Arizona; lapilli, from Ice Springs Buttes, in Utah, and Sunset Peak, Arizona.

(6) Sand, rock fragments, ash, etc., from Bogoslof Island.

(7) Fine pumiceous dust, from beds in Montana and Nebraska.

(8) A series comprising 40 hand specimens illustrating the various kinds of lavas, and also 2 large specimens of polished paleozoic lava (felsite), from eastern Massachusetts.

(9) Volcanic sublimation products, including sulphur, ammonium chloride and iron oxides from various American and foreign sources.

(10) Siliceous and calcareous sinters from the geysers and hot springs of the Yellowstone National Park, and travertines from extinct hot springs in Arizona. The possible economy of volcanoes was illustrated in the sulphur and other sublimation products, pozzuolani (a natural concrete) building-stone, and the beautiful "onyx marbles" or travertines.

II. GLACIERS AND GLACIAL PHENOMENA.

(*a*) Views illustrating living glaciers and icebergs.

(*b*) A relief map of the United States, showing the theoretical restoration of the ancient ice sheet at the stage of the Glacial period following the Main Silt epoch.

(*c*) A large series of photographs and other illustrations showing characteristic glacial phenomena, as below:

(1) Views of glacial deposits, as moraines, drumlins, and kames.

(2) Views of large drift bowlders the source of which has been traced with approximate accuracy.

(3) Views of glaciated rock surfaces.

(*d*) Actual specimens illustrating the transporting and eroding power of glaciers, as:

(1) Specimens of glacial clays, sands, and drift bowlders. Of particular interest in this series are bowlders taken from various altitudes in the White and Catskill mountains, and bowlders of peridotite and other rocks in Rhode Island, Ohio, and Illinois, the original source of which is known with approximate accuracy.

(2) Scratched and scarred bowlders from glacial till.

(3) Scratched and scarred bowlders from glaciers still existing.

(4) Glacial flour.

(5) Slabs of stone, grooved, scratched, or polished by glacial action.

(6) The possible economy of glacial products as shown in the utilization of glacial bowlders for building, and the glacial clays for brickmaking.

(7) The destructive effects of glaciation, as illustrated by fields covered by drift bowlders and other glacial debris, the stripping of the surface of soils, and the burial of forests; shown by photographs only.

III. LIMESTONE CAVERNS AND ASSOCIATED PHENOMENA.

(*a*) Actual plans and sections of Howe's Cave, N. Y; the Luray Caves, Va.; Mammoth Cave, Ky., and Wyandotte Cave, Ind.

(*b*) A series of photographs showing cave interiors, as follows: Howe's Cave, N. Y.; the Luray Caves, Va.; The Grottoes, Va.; Mammoth Cave, Ky.; Wyandotte and Marengo caves, Ind.

(*c*) A large series of cave deposits as below, many of the stalactites and stalagmites being cut and polished to show structure.

(1) Stalactites and stalagmites from the Luray Caves and The Grottoes, in Virginia.

(2) Gypsum rosettes and incrustations from Mammoth Cave, Ky.

(3) Gypsum incrustations and rosettes, epsom salt, and stalactites and stalagmites, from Wyandotte, Ind.

(4) Stalactites and stalagmites from Marengo, Ind.

(5) Stalactites and stalagmites from the Percy and Robertson caves, near Springfield, Mo.

(6) Botryoidal stalactitic masses from caves in the Organ Mountains, New Mexico.

(7) Stalactites from the Copper Queen Mines, Arizona.

(8) Large translucent selenite crystals from a cave in Wayne County, Utah.

(9) The possible economy of cave products, shown by cut, turned, and polished blocks of cave marble (stalagmite); nitrous earth, from Mammoth Cave, Ky., together with a small vial of calcium nitrate extracted from the same by leaching.

(10) A series of specimens in alcohol illustrating the fauna of caves.

(11) A small series of photographs, bone breccia and flint chips, illustrating the occupancy of caves by human beings.

(12) A section of a cave, some 2 by 4 feet, and 2½ feet high, constructed from materials collected in Marengo, Ind., the materials occupying their original positions as taken from the cave.

As completed, the exhibit occupied two wall-cases, each some 30 feet in length, and three special bases carrying relief-maps and cave-section. One of the most impressive and unique of these exhibits is the relief-map of the United States, modeled by Howell, and showing the restoration of the ice sheet of the Glacial epoch. This map is

RELIEF MAP SHOWING THE RESTORATION OF THE ICE SHEET OF THE GLACIAL EPOCH.

Modeled for the U. S. National Museum, under the direction of Mr. George P. Merrill, by E. E. Howell.

shown in the accompanying illustration (Pl. 57), the legend being reproduced below, as it is too illegible in the illustration:

U. S. NATIONAL MUSEUM
DEPARTMENT OF GEOLOGY
MODEL OF THE | UNITED STATES
showing the theoretical restoration of the | Ancient Ice-Sheet | at the stage of the Glacial Period | following the Main Silt Epoch. | Constructed from data furnished by T. C. Chamberlain and associates | of the U. S. Geological Survey; the outline of the ice follows | the outer terminal moraine next north of the main slit deposits, and | probably does not represent a strictly synchronous stage throughout, as later | advances of the ice at some points overrode earlier ones, making it difficult | to trace a perfectly synchronous line. The slope of the surface of the ice is | based on an adaptation of that of Greenland, as given by Nansen. |

The scale of the model is 1 inch to 40 miles. | It shows the correct curvature at sea-level, and is a section of a globe | 16½ feet in diameter; elevation and depression above and below sea-level exaggerated five times.

At the beginning of the fiscal year the curator was in southwest Missouri searching for materials to illustrate cave phenomena. This work was interrupted by leave of absence from July 8 to August 1, to be resumed again at a later date. On August 18 the curator returned to Washington. The materials collected during these trips are noted under the head of "important accessions." Mr. W. H. Newhall, assistant, made in November a trip to Weyer's and Fountain caves in Virginia, and obtained a fine series of products from these sources, which are also mentioned under the head of accessions. Our thanks are due to the managers of these caverns, as well as to those of Luray, Mammoth, Wyandotte, Marengo, Percy and Robertson's, for the lively interest manifested and the assistance afforded in procuring as fine a series as possible both for the Columbian Exposition and for the Museum. We are also greatly indebted for assistance of a high order to Prof. W. O. Crosby, of the Massachusetts Institute of Technology, and to Mr. F. W. Crosby, of this city. Prof. Crosby was instrumental in procuring a large proportion of our series of glacial products, and to the enthusiasm of Mr. F. W. Crosby we owe a large and exceptionally fine series of Sicilian sulphurs and associated rocks and minerals, volcanic bombs from Lipari, and other materials elsewhere noted. From April 15 to May 15 the curator was in Chicago, engaged in the work of installing the exhibit there.

Below is given a list of the more important accessions of the year:

A series of typical iron ores from Santiago, Cuba. Gift of the Sigua Iron Company.

A collection of asphalts and assorted rocks from Trinidad. Gift of Mr. Clifford Richardson.

A collection of rocks and ores from Texas. Gift of W. H. Streernwitz.

A collection of glacial materials made by Prof. W. O. Crosby for the World's Columbian Exposition.

Eruptive rocks from the vicinity of Montreal, Canada. Received from Henry Lampard.

A collection of stalactites and stalagmites from the grottoes, Shendun, Va. Collected for the World's Columbian Exposition by Mr. W. H. Newhall.

A fine, large collection of lavas from the volcanoes of the Hawaiian Islands. Collected for the World's Columbian Exposition by Mr. A. B. Lyons.

A large collection of stalactites and stalagmites from the caverns of Luray. Collected for the World's Columbian Exposition by Mr. J. H. Morrison.

A large and valuable series of cave products from caves in Virginia, Tennessee, Kentucky, Indiana, and Missouri; also onyx marbles from Arizona and Lower California. Collected by the curator.

A collection of rock types from the vicinity of Hot Springs and Magnet Cove, Ark., as described by the late Francis Williams.

A beautiful series of the wonderful selenite crystals from Wayne County, Utah. Obtained from Dr. J. E. Talmage.

A series of septarian nodules, stylotites, volcanic bombs, fulgurites, and onyx marbles. Obtained from Mr. H. L. Ward.

A fine mass of drift copper, weighing 55 pounds, found in the Earnshaw quarries, some 20 miles southwest of Chicago. Obtained from Ossian Guthrie.

An exceptionally fine collection, comprising Elban iron ores, volcanic bombs from Lipari, miscellaneous volcanic products from Stromboli, Vulcano, and Etna; basaltic columns from Bonn, Prussia, and a large and beautiful series of sulphur and associated rocks and minerals from Sicily. Collected by Mr. F. W. Crosby.

A collection of cave products from the Wind Caves of South Dakota. Gift of A. F. McDonald.

Eighty-five views of volcanic phenomena in the Hawaiian Islands. Obtained from I. Williams for the World's Columbian Exposition.

Sixty-six views of South Italian volcanoes. Obtained from Dr. H. J. Johnston-Lavis.

Twenty-five views in Howe's Caves, New York. Obtained from S. R. Stoddard.

Fifty-eight views of Mammoth, Wyandotte, and Marengo caves. From Ben. Hains, jr.

Twenty-six views of Mammoth Cave. Obtained from Miss F. B. Johnson.

Seventeen views of Alaskan glaciers. Obtained from Prof. H. F. Reed.

Thirty-five views of Luray Caves. Obtained from Mr. C. H. James.

Thirty views of glacial phenomena. Obtained from Prof. W. O. Crosby.

Fifty-three views of glacial phenomena. Obtained from Prof. G. F. Wright.

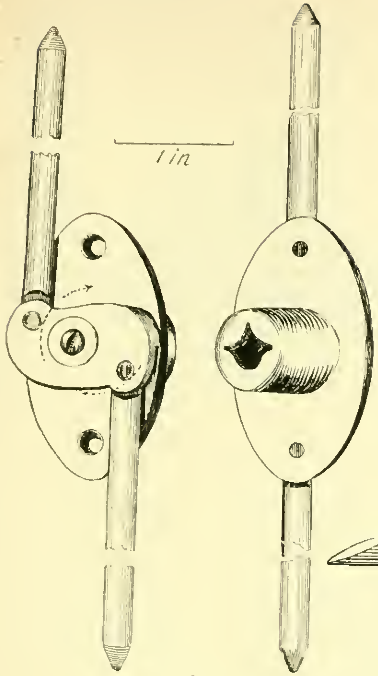
The character of the routine work has varied but little from that of previous years. Especial effort was made in planning the World's Fair exhibit to so arrange the labels that, when returned to Washington, it could be made to fill a definite place in our regular system of installation. Thus, excepting that it was impossible to devote a large portion of the time to a preparation of the three exhibits there included, and to work them out in considerable detail, almost no departure was made from ordinary museum methods, and but little labor actually lost. Copy for 1,175 labels was sent to the printer and 1,391 printed forms received.

A large proportion of the routine work of this department consists in the examination of geological material transmitted to the Museum for this purpose. During the year 130 packages of this character were examined and reported upon. The total number of packages of material of all kinds received during the year for examination was 516, and it is therefore evident that this department has its full share of this kind of work. A detailed list of the receipts of this character will be found in Appendix V.

It may be observed that although this class of work is recognized as a regular part of the duties devolving upon the officers of the Museum, and is always promptly performed, it is probable that no work undertaken by the Museum produces less beneficial results to itself. The Museum can not charge for making these examinations, and it rarely happens that any of the material transmitted has any value for addition to the collections.

The fact that the collections are now divided, a portion being in Chicago, renders it impossible to give accurate figures regarding the number of specimens either in the reserve, exhibition, or duplicate series. The clerical force of the department has not been sufficient to keep the records in shape to furnish this information otherwise than by an actual count. The accumulation of material has been greater than during any equal space of time since Mr. Merrill's connection with the department. The amount of new material that has been actually added to the Museum collections can, however, be scarcely in excess of that withdrawn for the World's Columbian Exposition. The catalogue numbers for the fiscal year run from 60,001 to 60,927, inclusive, and from 68.050 to 68,471, inclusive.

As during the year previous, Mr. Merrill has been assisted by Mr. W. H. Newhall, to whose energy, states the curator, is due much of the progress made.



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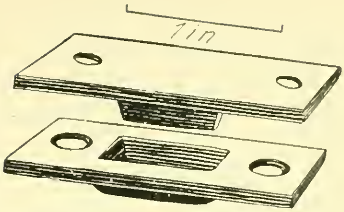

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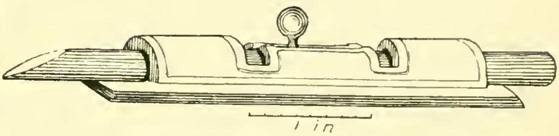

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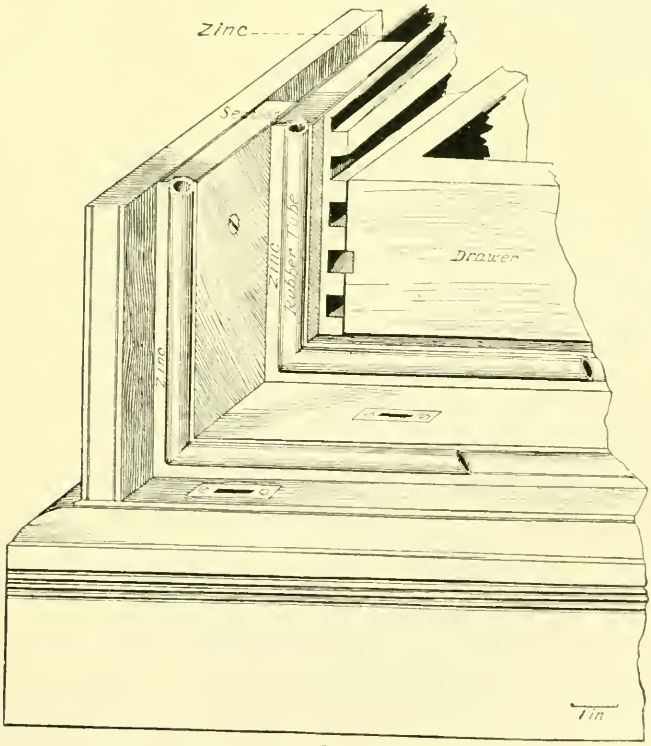

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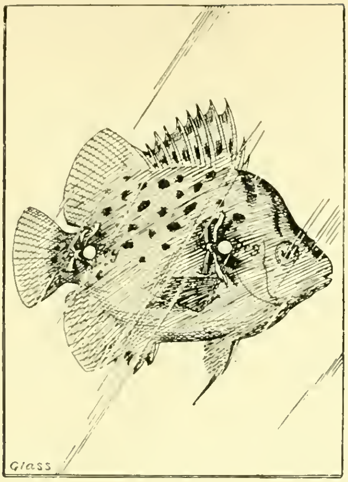
DETAILS OF FIXTURES FOR STORAGE CASES.

Fig. 1. Combined bolt and lock (p. 27).
Fig. 2. Corner section of storage case, showing method of dust proofing, etc (p. 28).
Fig. 3. Stub and plate (p. 28).
Fig. 4. Wedge bolt for binding doors (p. 28).



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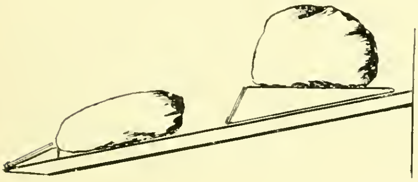

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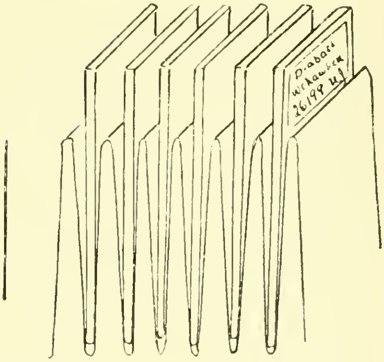

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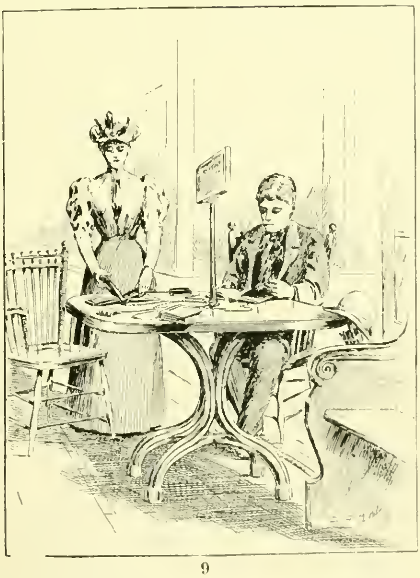

9

DETAILS OF INSTALLATION METHODS IN THE U. S. NATIONAL MUSEUM.

Fig. 5. Showing arrangement of specimens on sloping shelves (p. 31).
Fig. 6. Device for storing microscopical slides (p. 32).
Fig. 7. Rectangular jar (p. 33).
Fig. 8. Mounting fish in rectangular jar (p. 35).
Fig. 9. Reference table in exhibition hall (p. 41).

V.—ADMINISTRATION.

REVIEW OF THE WORK OF THE ADMINISTRATIVE BUREAUS.

OFFICE OF THE CHIEF CLERK.

The chief clerk's office remains under the supervision of Mr. W. V. Cox. The duties belonging to this office are mainly of an executive or administrative character. Among these duties are the general supervision of the expenditure of the appropriations; the preparation of proposals for supplies or labor; the opening of bids; awards of contracts; issuing orders for the purchase of supplies and employment of labor; the settling of accounts; the supervision of correspondence other than that of a scientific nature, or of that relating to specimens; the general supervision over employés and their assignment to duty; the granting of leaves of absence and other matters affecting the personnel of the Museum; the issuing of passes to the buildings; the conducting of boards of inquiry, inspection, and survey; the investigation of complaints, etc.

In Appendix II to this report a statement is presented showing the disposition of the unexpended balance on hand at the close of the year ending June 30, 1892. This is followed by a statement indicating the disbursements on account of the appropriation for the year ending June 30, 1893.

Since his last annual report, the chief clerk, the superintendent of buildings and labor, and the property clerk have had much of their time and that of their force occupied in the preparation of exhibits for the Columbian Historical Exposition in Madrid, and the World's Columbian Exposition at Chicago. Yet the extra work incident to the many additional requisitions made, and orders issued for supplies required to be purchased, together with the work to be done in the shops of the Museum by reason of these preparations, were all attended to by the regular employés, without additional cost to the Exposition, notwithstanding the fact that every purchase of supplies thus made and every order for work required the stating of a bill, and also involved a large amount of other incidental work. In the office of the chief clerk 666 vouchers, aggregating more than $78,000, were stated and otherwise completed for settlement, and transmitted to the Board of Managers for payment. To perform this amount of extra labor the clerks were compelled to devote longer hours to their duties.

CORRESPONDENCE AND REPORTS.

This division of the administrative work remains under the charge of Mr. R. I. Geare. At the beginning of the year the force consisted of 2 stenographers, 1 accession clerk, 1 record clerk, 1 index clerk, 3 typewriters and a messenger.

The amount of correspondence has largely increased each year since the establishment of this division. In 1886, the total number of official papers prepared for signature was a little over 2,000. In the year covered by this report the total was 10,040. The reason for this growth is readily explained. Every letter asking for information is answered as promptly as possible, and the information, if obtainable, is always supplied. The fact that requests of all kinds are thus noticed, soon spreads among the acquaintances of the writers, and before long they also are led to correspond with the Museum on some subject in regard to which they may desire information. Another reason for the large increase this year is that since May, 1892, the distribution of Museum publications has been added to the work of this office, necessitating a large number of letters on matters relating to the subject of Museum publications.

The correspondence of the Museum also includes letters pertaining to the acquisition of specimens, and to their acknowledgment when received; also letters reporting the results of examination of material submitted for qualitative analyses.

The preparation and general supervision of the proof of the Annual Report of the Museum is also a part of the work which has been assigned to this division.

Distribution of Museum publications.—The edition of the Proceedings and Bulletin is entirely inadequate to supply the numerous demands made upon it, and in order that the edition might be increased, an estimate of $18,000 for printing was made for the year ending June 30, 1892, an increase of $8,000 over the appropriation for the preceding fiscal year. The amount granted by Congress, however, was only $15,000. For the present fiscal year the sum of $18,000 was again asked for. The following extract from a letter accompanying the estimate will show how urgently this appropriation is needed:

> The sum of $18,000 was asked for last year, for the purpose of enlarging the mailing list so as to include in it the more important public libraries and educational institutions, and to render it possible, in response to urgent requests, to send the publications of the Museum to individuals who need them for use in connection with scientific investigations. The sum appropriated ($15,000) enabled the Museum to enlarge considerably its mailing list, but the full amount estimated for will be necessary to insure a satisfactory distribution.

The amount carried by the appropriation bill, as passed by Congress, however, was $12,000, and as a necessary consequence, this branch of the Museum work has been much crippled.

The report for 1890 was distributed during the year. Copies have been forwarded to all individuals and institutions upon the mailing lists for Museum reports, to the consular and other officers of the Government who have coöperated with the Museum, and to persons who contributed to the collections during the fiscal year covered by that report. Editions of 500 copies each of several ethnological papers included in the reports for 1890 and 1891 have been sent out. The fourteenth volume of the Proceedings of the National Museum has been mailed to all addresses upon the regular list for Proceedings volumes, and to more than 2,000 domestic and foreign libraries. Five hundred copies each of Proceedings Separates, Nos. 887 to 915, 919, 920, 922 to 926, 928, 929, 931, and advance copies of No. 944 have been sent to recipients upon the regular mailing lists and to persons making special application. Parts F and G of Bulletin 39, and Bulletin 40, have been distributed, and parts A to G, inclusive, of the former have been sent to all institutions upon the foreign and domestic library lists. Special Bulletin No. 1, entitled "Life Histories of North American Birds," by Major Charles Bendire, has been distributed. In addition to the regular distribution of Museum publications, more than 1,500 special sendings have been made during the year.

REGISTRATION AND DISTRIBUTION.

Mr. S. C. Brown, registrar, states that the total number of packages of all kinds received during the year was 29,409. The entries covering these receipts number 2,830, 863 of these packages containing specimens for the Museum, the others consisting of exchanges, supplies, etc. The record of outgoing packages for the year embraced 1,315 entries, covering 3,309 boxes and 902 packages, of which 853 contained specimens from the Museum, sent out as exchanges, gifts, and loans; 347 packages of specimens returned to owners, and 396 boxes contained material, exhibits, and cases sent to the Madrid Exposition. During the months of March, April, and May the exhibits prepared for the World's Columbian Exposition were shipped to Chicago. There were 1,340 packages of exhibits and cases transmitted by freight (twenty-six carloads), while packages containing the most valuable portions of the exhibits were forwarded by express. The storage record shows that 174 packages were stored and 51 were turned over to the curators.

The total number of accessions, *i. e.*, lots of specimens received for the Museum during the year, was 1,226. In addition, 516 packages of specimens were received for examination and report.

The records show that 13,581 specimens were sent out, including exchanges and specimens distributed to universities and colleges.

COLLECTIONS TRANSMITTED TO EDUCATIONAL ESTABLISHMENTS.

It has for many years been customary to distribute to educational establishments, as far as practicable, the duplicate material contained in the collections of the National Museum. Owing to the fact that there had accumulated a large number of applications for specimens from colleges and universities throughout the country, the curators of several of the departments were requested to separate into sets, for distribution, such of the duplicates in their charge as might be available for this purpose. The time necessary for work of this character could, however, be spared only with great inconvenience, on account of the fact that the preparation of exhibits for the World's Columbian Exposition demanded the greater part of the attention of the curators. It is expected that within the course of a few months collections of fishes, marine invertebrates, and birds' skins will be ready for distribution. A number of sets of minerals, rocks, and ores, and casts of prehistoric stone implements have been already prepared.

During the months of March and April, 1893, the work of distributing the collections of rocks and ores recently prepared by the curator of geology was undertaken, there being among the pending applications many requests for geological material. In a number of instances in which it was not apparent that the institution which had made the application was still in need of specimens, a letter requesting information on this point was addressed to the Senator or Representative who had indorsed the application. The reply in nearly every instance was to the effect that a collection would be acceptable.

There have been distributed during the year 130 collections of all kinds, including a large number of sets of minerals and rocks.

GEOGRAPHICAL STATEMENT OF THE DISTRIBUTION OF SPECIMENS DURING THE YEAR ENDING JUNE 30, 1893.

In Appendix III a geographical statement is given showing in detail the distribution of specimens of all kinds during the year. A brief summary of this statement is presented in the following table, which indicates the number of lots of specimens transmitted to institutions in the United States and in foreign countries:

United States:	
Alabama	2
Arkansas	3
California	4
Connecticut	1
Colorado	1
District of Columbia	10
Florida	1
Georgia	5
Illinois	7
Indiana	5
Iowa	13
Kansas	4
Kentucky	1
Maryland	2
Maine	4
Massachusetts	14
Michigan	5
Minnesota	3
Missouri	5
Nebraska	4
New Jersey	2
New York	11
United States—Continued.	
Ohio	5
Pennsylvania	12
Rhode Island	1
South Dakota	4
Tennessee	4
Texas	6
Vermont	1
Wisconsin	6
Wyoming	2
Other countries:	
Australia	1
Austria	2
Canada	4
England	4
France	3
Germany	3
Italy	3
Russia	2
Sweden	1
Total	171

BUILDINGS AND LABOR; POLICE AND PUBLIC COMFORT.

The force of watchmen, mechanics, and laborers is under the charge of Mr. Henry Horan, superintendent. In Mr. Horan's annual report there is included a statement of the work accomplished by the mechanics and laborers during the past year, a list of the machines, tools, and other property in his care, and a statement of the supplies purchased through his office. Extracts from his report, designed to indicate the character of the work performed by the employés connected with this department, will be found in Appendix IV.

WORK OF THE MUSEUM PREPARATORS.

TAXIDERMISTS.

Mr. William Palmer, chief taxidermist, reports that a large proportion of the time of his force has been devoted to completing and installing the exhibits for the World's Columbian Exposition. The actual work of mounting the specimens had already been finished, but the grouping of the pieces and the arrangement of the accessories remained to be done this year. Thirteen groups were prepared with great care, especial attention being given to making their surroundings as natural as possible. Some progress has been made toward reducing the number of skins in pickle, and two new lead-lined tanks have been provided for the better accommodation of those which are still awaiting attention. Numerous casts of various kinds have been made, and other incidental work attended to. The number of skins received during the year was 266, the total on hand June 30, 1893, being 427; 271 skins have been worked up.

About 30 specimens of fowls and pigeons have been added to the series of domestic animals during the year.

OSTEOLOGICAL PREPARATORS.

Mr. F. A. Lucas, in charge of this work, reports that the preparation of specimens for the exhibition series was interrupted somewhat by work for the World's Columbian Exposition, but still compares favorably with the records of previous years:

Number of specimens received, cleaned and mounted.

	Mammals.	Birds.	Reptiles.	Batrachians.	Fishes.	Total.
Received as fresh specimens:						
Entire skeletons	3	19	2	....	3	27
Incomplete skeletons	....	1	....	....	....	1
Cleaned:						
Entire skeletons	7	15	3	....	....	25
Incomplete skeletons	....	....	2	....	....	2
Skulls	634	3	3	1	4	645
Mounted:						
Skeletons	1	12	2	2	6	23
Limbs and other pieces	2	2	....	....	....	4
Skulls	2	1	5	2	3	13
Total	649	53	17	5	16	740

It may be stated that the labor involved in mounting the skulls is but partially indicated by the figures which appear in the table, since the mountings in most cases were complicated in their character and the component bones of the skulls were distinctively colored. In addition to osteological work, there have been made 3 anatomical models, and 45 casts of reptiles, invertebrates, and combs and gills of domestic fowls. Besides this a group was completed, showing the common octopus and its surroundings, and a large number of specimens have been mounted for the synoptic series of invertebrates.

PHOTOGRAPHER.

Mr. T. W. Smillie, the photographer, reports that 857 negatives and 3,402 silver prints have been made during the year. A large proportion of these was for the departments of ethnology, mammals, geology, reptiles and batrachians, and prehistoric anthropology.

In addition, 281 extra prints were mounted and 147 cyanotypes, 22 lantern-slides, and 4 enlargements were made.

The National Museum, as heretofore, has rendered assistance to the U. S. Fish Commission in photographic work, the Commissioner furnishing the material necessary, and one assistant to aid the photographer. In this connection there were made 645 silver prints, 121 cyanotypes, and 57 lantern-slides.

COLORIST.

During the early part of the fiscal year, Mr. A. Zeno Shindler continued his work on the series representing the races of man. Thirty paintings of this series have been finished and turned over to the Department of Ethnology, while five more are in course of completion. About fifty figures have been painted for use in groups for the exhibit of the Department of Ethnology at the Columbian Exposition. These include, among others, a Sioux warrior mounted on a horse, a Navajo woman spinning, a Navajo silversmith, a Ute woman burden-bearer, a South American Indian, and a Zuñi warrior.

APPENDIX I.

The Scientific and Administrative Staff.*

Director, ex officio.

S. P. Langley, Secretary of the Smithsonian Institution.

Executive Officers.

G. Brown Goode, Assistant Secretary of the Smithsonian Institution, in charge of U. S. National Museum, 1887. (1872.)

Frederick W. True, Executive Curator, 1892. (1879.)

W. V. Cox, Chief Clerk, 1886. (1879.)

R. E. Earll, Special Agent for World's Columbian Exposition, 1891.

Scientific Staff.

Department of Arts and Industries: G. Brown Goode, Curator, 1879. (1872.)

Section of Materia Medica: C. H. White,† Medical Inspector U. S. Navy, Curator, (1893).

Section of Animal Products: R. E. Earll, Acting Curator, 1889. (1878.)

Section of Naval Architecture: J. W. Collins,† Curator, 1891. (1880.)

Section of Foods: W. O. Atwater,† Curator, 1884.

Section of History: A. Howard Clark, Curator, 1882. (1879.)

Section of Transportation and Engineering: J. E. Watkins, Curator, 1887. (1885.)

Section of Graphic Arts: S. R. Koehler, Curator, 1887.

Section of Forestry: B. E. Fernow,† Curator, 1889.

Section of Physical Apparatus: W. C. Winlock, Curator, 1889.

Department of Ethnology: O. T. Mason, Curator, 1884; Walter Hough, Aid, 1885; W. H. Ryland, Aid, 1893.

Section of Oriental Antiquities: Paul Haupt,† Curator, 1888; Cyrus Adler, Assistant Curator, 1888.

Section of American Aboriginal Pottery: W. H. Holmes,† Curator, 1889.

Department of Prehistoric Anthropology: Thomas Wilson, Curator, 1889.

Department of Mammals: Frederick W. True, Curator, 1881. (1879.)

Department of Birds: Robert Ridgway, Curator, 1880. (1872); P. L. Jouy, Aid, 1887. (1876.)

Section of Birds' Eggs: C. E. Bendire,† Major, U. S. Army (retired), Curator, 1884.

Department of Reptiles and Batrachians: Leonhard Stejneger, Curator, 1889. (1884); Mr. F. C. Test, Aid, 1890.

Department of Fishes: Tarleton H. Bean,† Curator, 1880. (1874); Barton A. Bean, Assistant Curator, 1889. (1881.)

Department of Mollusks: William H. Dall,† Curator, 1880. (1866); R. E. C. Stearns, Associate Curator, 1884; C. T. Simpson, Aid, 1889.

Department of Insects: C. V. Riley,† Curator, 1882; M. L. Linell, Aid, 1889.

Department of Marine Invertebrates: Richard Rathbun,† Curator, 1880; James E. Benedict, Assistant Curator, 1890. (1879); M. J. Rathbun, Aid, 1893. (1886.)

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*The date following each official title is that of appointment to the office now held; that within parentheses indicates the time of first connection with the museum.

†Honorary.

DEPARTMENT OF COMPARATIVE ANATOMY: Frank Baker,† Curator, 1890; Frederick A. Lucas, Assistant Curator, 1886. (1882.)

DEPARTMENT OF BOTANY (NATIONAL HERBARIUM): F. V. Coville,† Curator, 1893.

DEPARTMENT OF VERTEBRATE FOSSILS: Othniel C. Marsh,† Curator, 1887.

DEPARTMENT OF INVERTEBRATE FOSSILS:

Paleozoic Section: C. D. Walcott,† Curator. 1882.

Mesozoic Section: C. A. White,† Curator, 1885.

Cenozoic Section: William H. Dall,† Curator, 1880. (1866).

Section of Fossil Plants: Lester F. Ward,† Curator, 1881; F. H. Knowlton, Assistant Curator, 1887.

DEPARTMENT OF MINERALOGY: F. W. Clarke,† Curator, 1883; W. S. Yeates, Assistant Curator, 1886. (1879.)

DEPARTMENT OF GEOLOGY: George P. Merrill, Curator, 1890. (1880); W. H. Newhall, Aid, 1887 (1885).

LIBRARY: Cyrus Adler, Librarian, 1892. (1888); N. P. Scudder, Assistant Librarian, 1882. (1879.)

ADMINISTRATIVE STAFF.

CHIEF CLERK: W. V. Cox, 1886. (1879.)

CHIEFS OF DIVISION:

Correspondence and Reports: R. I. Geare, 1890. (1880.)

Registration and Storage: S. C. Brown, 1881. (1876.)

Printing and Labels: A. H. Clark, 1882. (1879.)

Disbursing Clerk: W. W. Karr, 1888. (1879.)

Property Clerk: J. S. Goldsmith, 1891. (1886.)

Photography: T. W. Smillie, 1872.

Superintendent of Buildings: Henry Horan, 1880. (1857.)

PREPARATORS.

William Palmer, Chief Taxidermist, 1880. (1874.)

Joseph Palmer, Chief Modeler, 1889. (1873.)

A. Z. Shindler, Colorist, 1876.

J. W. Scollick. Osteologist, 1884.

Henry Marshall, Taxidermist, 1875.

N. R. Wood, Taxidermist, 1888.

A. H. Forney, Taxidermist, 1880.

APPENDIX II.

FINANCE, PROPERTY, SUPPLIES AND ACCOUNTS.

The disbursements from the unexpended balances of the appropriations for the previous fiscal year. ending June 30, 1892, are as follows:

PRESERVATION OF COLLECTIONS.

From the balance of $8,818.14, the following disbursements have been made:

Salaries or compensation, $440; special or contract services, $330.11; supplies, $337.50; stationery, $375.80; freight and cartage, $593.30;

† Honorary.

travel, $89.69; specimens, $6,220.23; books and periodicals, $414.46; a total expenditure of $8,801.09, leaving a balance, July 1, 1893, of $17.05.

FURNITURE AND FIXTURES.

The disbursements from the unexpended balance of this appropriation, $3,300.37, are as follows:

Special or contract services, $30; exhibition cases, $1,454; storage cases, $324; drawers, trays and boxes, $56.05; frames, stands, etc., $166.50; glass, $1,038.14; hardware, $43.88; tools, $19.48; cloth, cotton, etc., $8; glass jars, vials, etc., $22.29; lumber, $47.97; office furniture, $6; tin, lead, etc., $2.94; leather and rubber goods, $13.32; apparatus, $36.32; travel, $3.70; a total of $3,272.59, leaving an unexpended balance, July 1, 1893, of $27.78.

HEATING AND LIGHTING.

From the balance of $424.91, the following expenditures have been made:

Special services, $3; gas, $89; telephones, $201.55; electric work, $15; electrical supplies, $14.44; rental of call boxes, $20; heating supplies, $81.57; a total of $424.56, leaving a balance, July 1, 1893, of 35 cents.

On July 1, 1892, the unexpended balance of the appropriation for removing the old boilers under the Museum hall of the Smithsonian building, replacing them with new ones, and making necessary alterations, etc., was $61.53, and there has since been expended for brick-work previously contracted for, the sum of $60, leaving a balance of $1.53.

Of the appropriation for removing the decayed wooden floors in the Museum building, and substituting therefor granolithic or artificial-stone pavement, there was a balance of $525.36. Liabilities, amounting to $522.53, have since been paid, leaving an unexpended balance, July 1, 1893, of $2.83.

The appropriations for the fiscal year ending June 30, 1893, and the disbursements on account of the same, are as follows:

PRESERVATION OF COLLECTIONS.

The appropriation "for continuing the preservation, exhibition and increase of the collection from the surveying and exploring expeditions of the Government, and from other sources, including salaries or compensation of all necessary employés," was $132,500, together with a deficiency appropriation of $2,000, making a total of $134,500. The expenditures were as follows:

Salaries or compensation, $116,177.15; special or contract services, $2,224.83; supplies, $1,888.31; stationery, $723.25; freight and cartage, $1,889.75; travel, $407.88; specimens, $3,630.02; books and periodicals, $144.28; a total expenditure of $127,085.47, leaving an unexpended balance, July 1, 1893, of $7,414.53 to meet outstanding liabilities.

FURNITURE AND FIXTURES.

The amount appropriated "for cases, furniture, fixtures and appliances, required for the exhibition and safe-keeping of the collections of the National Museum, including salaries or compensation of all necessary employés," was $15,000. The following expenditures have been made from this appropriation:

Salaries or compensation, $7,903.47; special or contract services, $91.22; storage cases, $556.53; designs and drawings for cases, $34.50; drawers, trays and boxes, $252.60; frames, stands and miscellaneous woodwork, $16; glass, $774.92; hardware and interior fittings for cases, $649.50; tools, $25.08; cloth, cotton, etc., $47.53; glass jars, bottles, etc., $438.10; lumber, $501.44; paints, oils, glue and brushes, $383.35; office and hall furniture and furnishings, $48.22; tin and lead, $30.89; brick, plaster, etc., $6.50; leather and rubber goods, $21.86; apparatus, $118.20; skylights, $160; a total of $12,059.91, leaving a balance on hand, July 1, 1893, of $2,940.09 to meet outstanding liabilities.

The following is a list of cases made in the Museum shops during the year:

Two card-catalogue cases, 1 pine bookcase, 1 walnut bookcase, 2 small special cases, 2 unit storage cases, 12 unit table cases.

CASES REPAIRED AND ALTERED.

Four door-screen cases, 2 Chinese cases, 3 flat-top cases, 19 Kensington cases, 1 mahogany bird case, 6 slope-top cases, 9 storage cases, 5 upright cases, 3 wall cases, 1 walnut case, 1 card-catalogue case, 36 pine unit table cases, and 1 half-unit table case. In addition, 25 cases were glazed, and 231 were painted and cleaned.

Miscellaneous furniture and fittings made during the year:

Seventeen bases, 416 blocks for mounting specimens, 1 large storage rack, 100 packing boxes, 176 drawers for cases, and 115 frames for labels.

Miscellaneous furniture and fittings repaired and altered:

Five bases, 424 blocks for mounting specimens, 247 drawers for cases, 51 frames for labels, and 130 locks.

In addition to the work indicated above, many shelves, label-holders, screens, sash, ventilators, skylights, etc., were repaired or altered. Repairs were also made to the floors and roofs of the various buildings, and considerable painting was done from time to time.

HEATING AND LIGHTING.

The appropriation "for the expense of heating, lighting, electrical, telegraphic and telephonic service for the National Museum," was $11,000, to which was added a deficiency appropriation of $2,000 for heating, making a total of $13,000. From this appropriation the following disbursements have been made:

Salaries or compensation, $4,764; special services, $19; coal and wood, $5,003.04; gas, $1,253.64; telephones, $730.09; electric supplies, $67.73; rental of call boxes, $100; heating supplies, $222.47; a total of $12,159.97, leaving, July 1, 1893, an unexpended balance of $840.03, to meet outstanding liabilities.

During the year the watch boxes, burglar alarms, time clocks and call-bell system were overhauled, and the unserviceable wire connected therewith removed. The latter was replaced with okonite wire, nearly 8,000 feet being required for this purpose. The telephone system has also been overhauled, the old wires having been removed and new ones substituted. Owing to the small appropriation for heating, lighting, and electrical service, it was found necessary to reduce the number of telephones in service. This was reluctantly done, as the telephone has been very useful in taking the place of messengers.

APPENDIX III.

Statement of the Distribution of Specimens during the Year ending June 30, 1893.

NORTH AMERICA.

CANADA.

Dr. John H. Garnier, Lucknow, Ontario: Siredons (2 specimens). For study. (D. 7341.)

College of St. Laurient, Montreal: Duplicate collection of rocks and ores (76 specimens, set 146). Gift. (D. 7766.)

Geological Survey of Canada, Ottawa: Bones of Great Auk. Gift. (D. 7852.)

University College, Toronto: Duplicate collection of alcoholic fishes (160 specimens, set 29). Gift. (D. 7662.)

UNITED STATES.

Alabama. Blount College, Blountsville: Duplicate collection of rocks and ores (71 specimens, set 191). Gift. (D. 7666.)

State Agricultural and Mechanical College, Auburn: Duplicate collection of rocks and ores (66 specimens, set 196); duplicate collection of alcoholic fishes (166 specimens, set 40). Gift. (D. 7659.)

Arkansas. Arkansas Industrial University, Fayetteville: Duplicate collection of rocks and ores (68 specimens, set 198); duplicate collection of alcoholic fishes (166 specimens, set 42); duplicate collection of minerals (57 specimens, set 143). Gift. (D. 7567.) (D. 7594.) (D. 7667.)

California. Belmont School, Belmont: Duplicate collection of minerals. (57 specimens, set 134). Gift. (D. 7611.)

Leland Stanford Junior University, Menlo Park: Hermit crabs (13 specimens); alcoholic fishes (10 specimens). Gift. (D. 7486.) (D. 7764.)

Connecticut. Hartford Theological Seminary, Hartford: Duplicate collection of rocks and ores (75 specimens, set 174). Gift. (D. 7702.)

Colorado. University of Colorado, Boulder: Duplicate collection of rocks and ores (77 specimens, set 164). Gift. (D. 7733.)

DISTRICT OF COLUMBIA. George H. Boehmer, Washington, D. C.: Bird-skin. Exchange. (D. 7344.)

Eastern High School, Washington: Duplicate collection of minerals (57 specimens, set 141). Gift. (D. 7661.)

Public Schools, Washington: Duplicate collection of rocks and ores (104 specimens, set 2). Gift. (D. 7547.)

E. E. Howell, Washington: Ores (2,550 pounds); minerals (54 specimens); *Lepidosteus osseus* (1 specimen); rocks (18 specimens). Exchange. (D. 7337.) (D. 7373.) (D. 7572.) (D. 7593.)

J. J. Jones, Washington: Indian pottery (1 specimen). Exchange. (D. 7549.)

Bladen T. Snyder, Washington: Indian pottery (3 specimens). Exchange. (D. 7821).

FLORIDA. I. Greegor, Jacksonville: Copy of engraving "Ariadne." Exchange. (D. 7548.)

GEORGIA. University of Georgia, Athens: Brachipods, corals, hydroids, etc. (42 specimens). Gift. (D. 7556.)

Clark University, Atlanta: Duplicate collection of marine invertebrates (640 specimens, series IV, set 192); duplicate collection of marine invertebrates (2 boxes, special set); duplicate collection of minerals (57 specimens, set 147); duplicate collection of rocks and ores (75 specimens, set 173). Gift. (D. 7189.) (D. 7701.)

Central Grammar School, Augusta: Duplicate collection of minerals (57 specimens, set 150). Gift. (D. 7776.)

Emory College, Oxford: Duplicate collection of minerals (37 specimens, set 136). Gift. (D. 7663.)

ILLINOIS. Carthage College, Carthage: Duplicate collection of minerals (57 specimens, set 140); duplicate collection of alcoholic fishes (106 specimens, set 39); duplicate collection of rocks and ores (174 specimens, set 181). Gift. (D. 7645.)

C. F. Adams, Champaign: Birds' skins (66 specimens). Exchange. (D. 7449.)

E. R. Boyer, Chicago: Small collection of foraminifera. For study. (D. 7382.)

Lake Forest University, Lake Forest: Duplicate collection of rocks and ores (77 specimens, set 159). Gift. (D. 7737.)

University of Chicago, Chicago: Duplicate collection of rocks and ores (104 specimens, set 7); duplicate collection of minerals (57 specimens, set 137). Gift. (D. 7637.)

University of Illinois, Champaign: Duplicate collection of rocks and ores (57 specimens, set 195). Gift. (D. 7658.)

Anastasio Alfaro (Costa Rica Exposition Commission), Chicago: Mounted birds (268 specimens). Exchange. (D. 7753.)

INDIANA. Earlham College, Richmond: Duplicate collection of rocks and ores (68 specimens, set 194); duplicate collection of minerals (57 specimens, set 135). Gift. (D.7657.)

Hanover College, Hanover: Duplicate collection of rocks and ores (104 specimens, set 5.) Gift. (D. 7638.)

Indiana University, Bloomington: Alcoholic fish. Gift. (D. 7553.)

Capt. H. L. Johnson, New Albany: Pair of Canadian snowshoes. Exchange. (D. 7538.)

Wabash College, Crawfordsville: Duplicate collection of minerals (57 specimens, set 153); duplicate collection of rocks and ores (77 specimens, set 141). Gift. (D. 7813.)

IOWA. Iowa State Normal School, Cedar Falls: Duplicate collection of rocks and ores (77 specimens, set 158). Gift. (D. 7736.)

Coe College, Cedar Rapids: Duplicate collection of minerals (57 specimens, set 133); duplicate collection of rocks and ores (197 specimens, set 197). Gift. (D. 7590.)

IOWA. Museum of State Library, Des Moines: Duplicate collection of minerals (57 specimens, set 126); duplicate collection of casts of prehistoric stone implements (107 specimens, set 12); stone mortar and pestle; duplicate collection of rocks and ores (104 specimens, set 4); Indian pottery (3 pieces). Gift. (D. 7366.) (D. 7612.) (D. 7853.)

Des Moines College, Des Moines: Duplicate collection of rocks and ores (77 specimens, set 142). Gift. (D. 7836.)

High School, Emmetsburg: Duplicate collection of minerals (76 specimens, set 119); duplicate collection of rocks and ores (76 specimens, set 118). Gift. (D. 7754.)

Jefferson County Library Association, Fairfield: Skull of finback-whale; 46 mounted birds. Gift. (D. 7618.) (D. 7734.)

Iowa College, Grinnell: Duplicate collection of casts of prehistoric implements (set 14). Gift. (D. 7591.)

Hubert E. Brock, Mason City: Archaeological objects (44). Exchange. (D. 7444.)

Public School, Paulina: Duplicate collection of rocks and ores (77 specimens, set 114). Gift. (D. 7780.)

Western College, Toledo: Duplicate collection of rocks and ores (74 specimens, set 178); duplicate collection of minerals (57 specimens, set 138). Gift. (D. 7643.)

KANSAS. College of Emporia, Emporia: Duplicate collection of rocks and ores (77 specimens, set 165). Gift. (D. 7714.)

University of Kansas, Lawrence: Duplicate collection of minerals (set 122); duplicate collection of rocks and ores (77 specimens, set 154). Gift. (D. 7324.) (D. 7749.)

Oswego College, Oswego: Duplicate collection of rocks and ores (77 specimens, set 145). Gift. (D. 7774.)

KENTUCKY. Capt. J. R. Johnson, Louisville: Indian bow, quiver, and arrows. Exchange. (D. 7476.)

MARYLAND. Baltimore Manual Training School, Baltimore: Duplicate collection of rocks and ores (77 specimens, set 161). Gift. (D. 7730.)

Loyola College, Baltimore: Duplicate collection of rocks and ores (70 specimens, set 193). Gift. (D. 7656.)

MAINE. H. C. Merrill, Auburn: Marble (2 specimens). Exchange. (D. 7517.)

South Paris High School, South Paris: Duplicate collection of minerals (57 specimens, set 128). Gift. (D. 7387.)

Prof. W. S. Bayley, Waterville: Rocks (38 specimens). Exchange. (D. 7563.)

Colby University, Waterville: Duplicate collection of rocks and ores (103 specimens, set 49). Gift. (D. 7729.)

MASSACHUSETTS. Amesbury High School, Amesbury: Duplicate collection of rocks and ores (70 specimens, set 147); duplicate collection of casts of prehistoric implements (107 specimens, set 49). Gift. (D. 7767.)

Cushing Academy, Asburnham: Duplicate collection of rocks and ores (77 specimens, set 113). Gift. (D. 7819.)

Prof. W. O. Crosby, Boston: Rocks (36 specimens). Exchange. (D. 7592.)

Museum of Fine Arts, Boston: Impression from Pelham's plate of "Cotton Mather." Gift. (D. 7321.)

High School, Brookline: Duplicate collection of minerals (57 specimens, set 124). Gift. (D. 7342.)

Museum of Comparative Zoölogy, Cambridge. Hermit-crabs (15 specimens); *Lithodes spinosisimus* (2 specimens). Exchange. (D. 7513.) (D. 7633.)

Memorial Hall of Pocomtuck Valley Association, Deerfield: Arrow and spearheads from Georgia (24 specimens). Gift. (D. 7508.)

Natural History Society, Lawrence: Duplicate collection of minerals (set 123); duplicate collection of minerals (57 specimens, set 132). Gift. (D. 7333.) (D. 7559.)

MASSACHUSETTS. J. V. Jackman, Marlboro: Rocks (12 specimens). Exchange. (D. 7475.)

Smith College, Northampton: Foraminifera (12 vials). Gift. (D. 7454.)

Grammar School, Salem: Duplicate collection of minerals (57 specimens, set 139); duplicate collection of marine invertebrates (640 specimens, series IV, set 193). Gift. (D. 7660.)

George B. Frazar, West Medford: Red mercury ore. Exchange. (D. 7676.)

MICHIGAN. University of Michigan, Ann Arbor: Duplicate collection of rocks and ores (143 geological specimens, set 1). Gift. (D. 7470.)

Peter Lepp, East Saginaw: Birds' skins (4). Exchange. (D. 7550.)

Masonic Library, Grand Rapids: Duplicate collection of minerals (57 specimens, set 148); duplicate collection of casts of prehistoric implements (107 specimens, set 18). Gift. (D. 7706.)

Western Michigan College, Grand Rapids: Duplicate collection of alcoholic fishes (166 specimens, set 36). Gift. (D. 7681.)

Michigan State Normal School, Ypsilanti: Duplicate collection of casts of prehistoric stone implements (107 specimens, set 15). Gift. (D. 7661.)

MINNESOTA. Albert Lea College, Albert Lea: Duplicate collection of rocks and ores (71 specimens, set 190). Gift. (D. 7655.)

Hamline University, Hamline: Duplicate collection of rocks and ores (75 specimens, set 172.) Gift. (D. 7700.)

Stevens Seminary, Glencoe: Duplicate collection of alcoholic fishes (106 specimens, set 44); duplicate collection of minerals (57 specimens, set 131); duplicate collection of rocks (66 specimens, set 199). Gift. (D. 7510.)

MISSOURI. Missouri Wesleyan Institute, Cameron: Duplicate collection of rocks and ores (77 specimens, set 157). Gift. (D. 7735).

University of Missouri, Columbia: Duplicate collection of rocks and ores (71 specimens, set 190); duplicate collection of fishes (106 specimens, set 41). Gift. (D. 7654).

Hooper Institute, Clarksburg: Duplicate collection of rocks and ores (76 specimens, set 171). Gift. (D. 7707.)

Missouri Valley College, Marshall: Duplicate collection of rocks and ores (71 specimens, set 189). Gift. (D. 7653.)

Missouri School of Mines, Rollo: Duplicate collection of rocks and ores (72 specimens, set 188). Gift. (D. 7652.)

NEBRASKA. F. C. Kenyon, Lincoln: Myriopods (3 specimens). Exchange. (D. 7792.)

Lincoln Normal University, Lincoln: Duplicate collection of rocks and ores (101 specimens, set 46). Gift. (D. 7589.)

Nebraska Wesleyan University, Lincoln: Duplicate collection of rocks and ores (76 specimens, set 169). Gift. (D. 7718.)

University of Nebraska, Lincoln: Duplicate collection of rocks and ores (76 specimens, set 170). Gift. (D. 7719.)

NEW JERSEY. George F. Kunz, Hoboken: Package of iron ores. Exchange. (D. 7525.)

E. M. Museum of Geology and Archæology, Princeton: Duplicate collection of rocks and ores (103 specimens, set 50). Gift. (D. 7640.)

NEW YORK. Union Free School, Canandaigua: Duplicate collection of rocks and ores (74 specimens, set 127). Gift. (D. 7641.)

Hamilton College, Clinton: Duplicate collection of rocks and ores (104 specimens, set 2). Gift. (D. 7551.)

Union School and Academy, Cooperstown: Duplicate collection of minerals (57 specimens, set 144); duplicate collection of rocks and ores (74 specimens, set 176); duplicate collection of fishes (160 specimens, set 36); duplicate collection of casts of prehistoric stone implements (set 16). Gift. (D. 7671.)

Union School, Lockport: Duplicate collection of rocks and ores (75 specimens, set 180); duplicate collection of alcoholic fishes (160 specimens, set 37). Gift. (D. 7644.)

NEW YORK. College of the City of New York, New York City: Duplicate collection of rocks and ores (104 specimens, set 6). Gift. (D. 7639.)

Columbia College, New York City: Duplicate collection of alcoholic fishes (16 specimens, set 27). Gift. (D. 7458.)

J. D. Sherman, jr., New York City: Coleoptera (18 dry specimens). Exchange. (D. 7777.)

Miss Mary V. Worstell, New York City: Corals, Echini, starfishes and foraminifera. For study. (D. 7815.)

Bertin A. Wright, Penn Yan: Unios. Exchange. (D. 7674.)

Phelps Union School, Phelps: Duplicate collection of rocks and ores (74 specimens, set 178). Gift. (D. 7642.)

Prof. H. A. Ward, Rochester: Rocks (6 specimens). Exchange. (D. 7619.)

OHIO. Case School of Applied Sciences, Cleveland: Duplicate collection of minerals (57 specimens, set 154); duplicate collection of rocks and ores (78 specimens, set 140). Gift. (D. 7845.)

Ohio Wesleyan University, Delaware: Duplicate collection of rocks and ores (76 specimens, set 168). Gift. (D. 7717.)

Hopedale Normal School, Hopedale: Duplicate collection of minerals (57 specimens, set 127). Gift. (D. 7380.)

Mansfield Memorial Museum, Mansfield: Duplicate collection of rocks and ores (76 specimens, set 167). Gift. (D. 7716.)

Scio College, Scio: Duplicate collection of rocks and ores (77 specimens, set 163). Gift. (D. 7732.)

PENNSYLVANIA. Wilson College, Chambersburg: Duplicate collection of rocks and ores (73 specimens, set 187). Gift. (D. 7651.)

Central State Normal School, Lock Haven: Duplicate collection of rocks and ores (73 specimens, set 186). Gift. (D. 7650.)

Dr. Harrison Allen, Philadelphia: Skull of *Phocæna communis*. For study. (D. 7379.)

Stewart Culin, Philadelphia: Apache Indian playing-cards. Exchange. (D. 7346.)

H. F. Moore, Philadelphia: Alcoholic mollusks (15 specimens). For study. (D. 7722.)

Wagner Free Institute of Science, Philadelphia: Pliocene fossils. Exchange (D. 7768.)

Central High School, Pittsburg: Duplicate collection of rocks and ores (77 specimens, set 156). Gift. (D. 7742.)

Curry University, Pittsburg: Duplicate collection of rocks and ores (76 specimens, set 150). Gift. (D. 7713.)

Duquesne College, Pittsburg: Duplicate collection of rocks and ores (76 specimens, set 149). Gift. (D. 7712.)

Pennsylvania State College, State College: Duplicate collection of rocks and ores (77 specimens, set 155). Gift. (D. 7746.)

Warren Public Schools, Warren: Duplicate collection of rocks and ores (73 specimens, set 185). Gift. (D. 7649.)

RHODE ISLAND. Brown University, Providence: *Amphiuma means* (2 specimens); *Accipenser sturio* (4 specimens). Gift. (D. 7526.)

SOUTH DAKOTA. Redfield College, Redfield: Duplicate collection of rocks and ores (77 specimens, set 153). Gift. (D. 7757.)

State Normal School, Spearfish: Duplicate collection of rocks and ores (77 specimens, set 152). Gift. (D. 7756.)

State Normal School, Valley City: Duplicate collection of minerals (57 specimens, set 146); duplicate collection of rocks and ores (74 specimens, set 175). Gift. (D. 7688.)

State University, Vermillion: Duplicate collection of rocks and ores (77 specimens, set 151). Gift. (D. 7755.)

TENNESSEE. U. S. Grant University, Athens: Duplicate collection of minerals (57 specimens, set 125); duplicate collection of rocks and ores (74 specimens, set 184). Gift. (D. 7359.) (D. 7648.)

University of Tennessee, Knoxville: Duplicate collection of rocks and ores (74 specimens, set 183). Gift. (D. 7647.)

Maryville College, Maryville: Duplicate collection of alcoholic fishes (106 specimens, set 43). Gift. (D. 7541.)

TEXAS. University of Texas, Austin: Duplicate collection of rocks and ores (76 specimens, set 166.) Gift. (D. 7715.)

Public School, Bastrop: Duplicate collection of minerals (57 specimens, set 142). Gift. (D. 7665.)

Agricultural and Mechanical College, College Station: Duplicate collection of rocks and ores (77 specimens, set 160). Gift. (D. 7738.)

Columbia College, Van Alstyne: Duplicate collection of minerals (130 specimens, set 130); duplicate collection of marine invertebrates (640 specimens, set 191); duplicate collection of rocks (67 specimens, set 200); duplicate collection of alcoholic fishes (135 specimens, set 33); duplicate collection of casts of prehistoric stone implements (107 specimens, set 20). Gift. (D. 7417.) (D. 7773.) (D. 7891.)

VERMONT. Brattleboro Society of Natural History, Brattleboro: Duplicate collection of rocks and ores (74 specimens, set 182). Gift. (D. 7646.)

WISCONSIN. High School, Arcadia: Duplicate collection of minerals (57 specimens, set 152). Gift. (D. 7820.)

Jefferson High School, Jefferson: Duplicate collection of minerals (57 specimens, set 151). Gift. (D. 7775.)

High School, Linden: Duplicate collection of minerals (57 specimens, set 145); duplicate collection of casts of stone implements (107 specimens, set 17). Gift. (D. 7675.)

State Normal School, Oshkosh: Duplicate collection of marine invertebrates (Series IV, set 190). Gift. (D. 7367.)

Sparta High School, Sparta: Duplicate collection of alcoholic fishes (166 specimens, set 34). Gift. (D. 7686.)

H. P. Hamilton, Two Rivers: Indian pottery (20 pieces). Exchange. (D. 7516.)

WYOMING. University of Wyoming, Laramie: Duplicate collection of casts of prehistoric implements (107 specimens, set 13); duplicate collection of rocks and ores (77 specimens, set 162). Gift. (D. 7384.) (D. 7731.)

TRANSMISSIONS TO FOREIGN COUNTRIES.

AUSTRALIA.

NEW SOUTH WALES.

Australian Museum, Sydney: Specimen each of *Polyodon* and *Amia calva*. Exchange. (D. 7583.)

EUROPE.

AUSTRIA.

Dr. E. Keck, Aisterheim: Dried plants (2 packages). Exchange. (D. 7808.)

Dr. A. Brezina, Vienna: Specimen case of gypsum and photographs. Exchange. (D. 7569.)

ENGLAND.

Edward Lovett, Croydon: Ethnological objects (15). Exchange. (D. 7578.)

H. E. Dresser, London: Birds' skins (4 specimens). Exchange. (D. 7351.)

Hugh Fulton, London: Shells (25 specimens); shells. Exchange. (D. 7409.) (D. 7817.)

FRANCE.

Prof. Lucien Cuenot, Nancy: Echini (2 specimens). Exchange. (D. 7445.)

A. C. Bonnet, Paris: Archæological objects (132). Exchange. (D. 7741.)

S. E. Lassimonne, à Yseure (Allier): Botanical specimens (205). Exchange. (D. 7457.)

GERMANY.

Zoological Institute of the University, Berlin: Hexactinellid sponges (3 boxes). Exchange. (D. 7606.)

Dr. W. Kabelt, Schweneim am Main: Land-shells (8 specimens). Exchange. (D. 7752.)

Ludwig Molnar, Hollos: Birds' skins (15 specimens). Exchange. (D. 7477.)

ITALY.

Royal Museum, Florence: Archæological objects (48). Exchange. (D. 7338.)

Dr. H. J. Johnston-Lavis, Naples: Rocks (7 specimens). Exchange. (D. 7600.)

RUSSIA.

Dr. A. Krassnow, Charkow: Dried plants (3 packages). Exchange. (D. 7807.)

University of St. Petersburg, St. Petersburg: Cast of Trilobite (*Asaphus megistos*). Gift. (D. 7325.)

SWEDEN.

Prof. W. Leche, Stockholm: Alcoholic moles (4 specimens). Exchange. (D. 7816.)

LIST OF RECIPIENTS OF SPECIMENS TRANSMITTED, CHIEFLY FOR STUDY, DURING THE YEAR.

Dr. Harrison Allen, Philadelphia, Pa.: Skulls of three bats. (D. 7840.)

Dr. J. A. Allen, American Museum of Natural History, New York City: Mammal skins and skulls (37 specimens, including 8 type specimens). (D. 7696.) Six skins and 7 skulls of *Hesperomys sitomys*. (D. 7834.) Three skins and skulls of *Hesperomys*. (D. 7851.)

Frank M. Chapman, American Museum of Natural History, New York City: Birds' skins (18 specimens). (D. 7160.) Birds' skins (24 specimens). (D. 7814.)

Commissioner of Patents, Washington, D. C.: Nine typewriting machines (for exhibition at the World's Columbian Exposition). (D. 7169.)

W. E. Curtis, Washington, D. C.: Door of the convent of La Rabida, a bolt by which Columbus was chained, label for the same, and a piece of wood from the dungeon (for exhibition at the World's Columbian Exposition). (D. 7635.)

Leland Stanford Junior University, Palo Alto, Cal.: Alcoholic fish. (D. 7764.)

G. L. McKean, Chicago, Ill.: Oil portrait of George Washington (for exhibition at the World's Columbian Exposition). (D. 7558.)

H. A. Pilsbry, Academy of Natural Science, Philadelphia, Pa.: Specimens of chitons. (D. 7673.)

Hon. James B. Randal, Chicago, Ill.: Model of a quicksilver mine in California (for exhibition at the World's Columbian Exposition). (D. 7636.)

S. N. Rhoads, Academy of Natural Science, Philadelphia, Pa.: *Synoptomys cooperi* skull (2 type specimens). (D. 7576.)

Arthur Ruster, Baltimore, Md.: Bird-skin. (D. 7611.)

Prof. T. Salvadori, British Museum, London, England: Bird-skin. (D. 7423.)

Osbert Salvin, London, England: Birds' skins (21 specimens). (D. 7424.)

Witmer Stone, Academy of Natural Science, Philadelphia, Pa.: Birds' skins (29 specimens). (D. 7450.) Birds' skins (63 specimens). (D. 7531.)

Gordon Turnbull, Hartford, Conn.: Birds' skins (14 specimens). (D. 7574.)

U. S. Patent Office, Washington, D. C.: Three models of locomotives and fifteen firearms (for exhibition at the World's Columbian Exposition). (D. 7573.)

Prof. A. J. Woolman, South Bend, Ind.: Squid, shell, starfish, and sea-urchins (6 specimens). (D. 7516.)

Prof. A. A. Wright, Oberlin College, Oberlin, Ohio: Rock sections (14 specimens). (D. 7182.)

APPENDIX IV.

Buildings and Labor—Police and Public Comfort.

The following statement from the records of the Superintendent of Buildings is intended to indicate in a general way the character of the work performed by the mechanics and laborers during the year covered by this report:

1892.

July.—The labor involved in packing and shipping exhibits for the Madrid Exposition consumed a large amount of time during the month. The tinner was engaged for several days in making necessary repairs to the roof of the Museum building. The valves connected with the steam-heating apparatus have been repacked and the radiators overhauled.

August.—The lecture hall was cleaned and put in order after the completion of the work of preparing the exhibits for the Madrid Exposition. The windows of the east and west balconies were placed on pivots to provide better ventilation. The carpenters were engaged for a time in making packing cases for the shipment of exhibits to the World's Columbian Exposition. Considerable paving was done in the basement of the Museum building, and this necessitated the temporary removal of the material stored there.

September.—The buildings were suitably decorated on the occasion of the encampment of the Grand Army of the Republic, and the laborers were busy for many days preparing for the reception of the crowds of persons visiting the buildings. The furniture and apparatus of the chemical laboratory connected with the U. S. Geological Survey have been removed from the northeast pavilion, the Survey having found it necessary to make many changes on account of reduced appropriations.

October.—Improvements have been made in the system of installation of the telephone and other electric wires. To increase the efficiency of the telephone service it was found necessary to remove a number of instruments about the buildings. Various improvements have been made in the laboratory of the department of mammals, in the department of prehistoric anthropology, and in the telephone room. The exhibition cases throughout the Museum were cleaned during the month.

November.—A wagon shed was constructed south of the Smithsonian building. The exhibition cases in the north hall of the Museum were rearranged, and a number of specimens were withdrawn for transmission to the World's Fair. Work of a similar character in many of the departments demanded the attention of the laborers, and it was found necessary to use the lecture hall and several of the courts of the building for the preparation of exhibits. A workroom was fitted up for the use of the assistant curator of oriental antiquities.

December.—A number of specimens were transferred from the north hall to the department of prehistoric anthropology. The shed south of the Smithsonian building was painted, and also the hallway of the south tower. A number of storage-cases were removed from the northeast pavilion to the department of mammals

1893.

January.—Several extra carpenters and laborers have been employed in connection with the World's Fair work. A large number of specimens in the exhibition hall of the section of graphic arts were transferred to new cases. An air-shaft was constructed in the northwest pavilion. The buildings were draped in mourning in respect to the memory of ex-President Rutherford B. Hayes. Screens were placed between the pillars, above the wall cases, on both sides of the north hall, to provide a background for the collection of busts which has been arranged on these cases.

February.—An apparatus for the distillation of alochol was set up in the boiler room, and a new dynamo placed in the carpenter shop. Improvements were made in the laboratory of the mammal department at the south entrance. The shipment of exhibits to Chicago, for exhibition at the World's Columbian Exposition, was commenced on the 27th.

March.—Three of the basement rooms in the east wing of the Smithsonian building, which have been used by the registrar for storage purposes, were cleared out, to be refitted for the use of the Bureau of International Exchanges. The east shed was moved a short distance farther from the south wall of the building, in order to provide better light in the basement. On the 25th the lecture hall was prepared for the first lecture of the course to be delivered under the auspices of the Anthropological Society. The superintendent, and a number of men connected with his force, was ordered to Chicago, for the purpose of installing the exhibits.

April.—The material sent to the Exposition at Madrid was returned during the month, and a portion of the specimens were repacked for transmission to the Columbian Exposition. The last shipment of exhibits to Chicago was made on the 29th, the total number of carloads sent being twenty-four. Necessary repairs were made to the roof of the Smithsonian building.

May.—The carpenters were engaged for a time in constructing storage cases on the north balcony for the use of the department of historical collections. New copper gutters were laid on the roof of one of the towers of the Smithsonian building, and skylights were placed in the roof of the southeast pavilion of the Museum building, the work being done by outside contract. The steam-heating apparatus in the basement of the Smithsonian building was extended, and the entire basement whitewashed. The window frames around the roof and the skylight of the Museum were painted.

June.—The work on the roof and in the basement of the Smithsonian building was continued during the month. Awnings were put up at the windows of both buildings for the summer. The firemen were engaged in making repairs to the steam pipes and radiators. Twenty-six incandescent lamps were hung in the lecture hall, the current being supplied by the dynamo in the carpenter shop.

APPENDIX V.

Specimens Sent to the Museum for Examination and Report.

The following is a complete list of the specimens received for examination and report during the year ending June 30, 1893:*

* The first number accompanying the entries in the above list is that assigned to sendings "for examination" on the Museum records. The number in Arabic figures, in parentheses, relates to the record of permanent accessions. The third number, in Roman, and also in parentheses, indicates the department in the Museum to which the material was referred for examination and report.

Adams, Robert E., Huntington, W. Va.: Petrified wood. 1936 (XIV).
Albright, W. H., Detroit, S. Dak.: Insect. 1852 (X).
Allen, D. E., Baylis, Ill.: Ores. 1854, 1901, 1969 (XVII).
Allen, Prof. J. A., American Museum of Natural History, New York City: Birds' skins from Central America and other localities. 1996, 2010 (V-A).
André, Charles, Boon's Path, Va.: Insect. 2085 (X).
Andrews, J. O., Gainesville, Fla.: White substance found after a heavy rain. 1919 (XV).
Ankeny, William D., Mammoth, Pa.: 2 lead buttons. 1836 (XVII).
Anthony, A. W., Denver, Colo.: 4 birds. (Returned.) 1917 (V-A).
Ashcroft, M. E., Farmington, W. Va.: Insect. 1847 (X).
Atherton, F. J., Lodi, Cal.: 3 birds' skins. (Returned.) 2065 (V-A.)
Ayres, H. B., Carlton, Minn.: 3 fragments of pottery found in a mound in Aiken County. 1942 (III).
Babbitt, C. J., Flagstaff, Ariz.: Rock. 1812 (XVII).
Baker, A. J. & Joseph, Eversole, Ky.: Ore. 2183 (XVII).
Baker, F. H., Martinsburg, W. Va.: Insect. 1829 (X).
Baldwin, A. A., Star, Kans.: 2 archæological objects found by William Hodges. (Returned.) 1910 (III).
Baldwin, A. P., Newark, N. J.: Abnormal egg of hen. 2066 (I).
Baldwin, Charles, Great Falls, Mont.: 2 specimens of minerals. 1802 (XVI).
Balster, F. S., Ouray, Colo.: Concretion. (Returned.) 1865 (XVII).
Banner, W. S., Fort Apache, Ariz.: Insects. 2029 (X).
Barksdale, W. M., Mooresville, Ala.: Fish-skin. 1951 (VII).
Barnes, B. E., Boyett, N. C.: Minerals. 1868. (Returned.) 2037 (XVI).
Batchelder, C. F. (See under F. Stephens.)
Bates, J. R., Greenville, Miss.: Ancient coin. 2241 (I).
Becker, M. J., Fort Scott, Kans.: Fossils. (Returned.) 2263 (XIII-A).
Beckwith, M. H., Newark, Del.: Hydroids. 1912 (26284) (XI).
Bedwell, Ethel, Pentwater, Mich.: 2 insects. 1850 (X).
Behrens, Charles M., Dallas City, Pa.: Clay. (Returned.) 2257 (XVII).
Bertelsen, Mrs. H., Maquoketa, Iowa: Old-style watch. (Returned.) 2161 (II-A).
Betts, George W., Cumro, Nebr.: Moth. 1878 (X).
Biederman, C. R., Bonito, N. Mex.: Ore. 2087 (XVII).
Binkley, S. H., Alexandersville, Ohio: Stone from bowlder clay. (Returned.) 2106 (XVII).
Bird, Frank G., Park City, Utah: Ore. (Returned.) 1822 (XVII).
Bishop, U. S. Grant, Texas, Ky.: Fragment of stone. 2272 (XVI).
Blish, W. G., Niles, Mich.: Branches and leaves from American Arbor-Vitæ hedge. 1957 (XV).
Boisseau, Sterling, Crewe, Va.: Insects injurious to pine trees. 1914 (X).
Bonnett, E. H., Stonewall, Colo.: 2 stone implements. 1938 (III).
Borden, D., Somerset, Ky.: Mineral. 2163 (27190) (XVI).
Botsford, Z. E., Nordmont, Pa.: Moth. 2254 (X).
Bowie, Allen W., Clark's Gap, Va.: Earth and rock. 1807 (XVII).
Bowman, D. A., Bakersville, N. C.: Minerals. 1939, 2146 (XVI).
Boyd, G. W., Waynesboro, Tenn.: Geological material. 2079 (XVII).
Boyd, Stephen D., Leesburg, Va.: Minerals. 1961 (XVI).
Bradley, Rev. D. L., Cape Vincent, N. Y.: Egg-shaped stone. 2102 (XVII).
Bradley, Terrill, Lester Manor, Va.: Indian canoe and specimens of pottery. 1992 (26600) (II-A).
Branch Hydrographic Office, U. S., Lieut. O. E. Lasheer, in charge. (See under C. F. Pearson.)

Brantley, R. A., Milano, Tex.: Concretions. 2179, 2188 (XVII.)
Bresslir, D. W., Chattanooga, Tenn.: Minerals. 1796 (XVI).
Brett, Walter, Lakeport, Cal.: Duck's breast infested with parasites. 2082 (I).
Brimley, H. H. & C. S., Raleigh, N. C.: Mammal skins and 2 snakes. 1869 (26135). 2202 (IV, VI).
Brooke, Mrs. M. E., San Diego, Cal.: Stone head taken from a well. 1968 (III).
Brooks, Allan C., Mount Forest, Ontario, Canada: Skin of magpie. (Returned.) 1843 (V-A).
Bruce, H. W., Mangum, Tex.: Ore. (Returned.) 2286 (XVII).
Bruce, W. L., Nogal, N. Mex.: Rock. 1851 (XVII).
Brunot, H. S., Greensburg, Pa.: Skull of a fish. (Returned.) 2132 (VII).
Bryan, W. A. C., Nephi, Utah: Ore. 1924 (XVII).
Bryant, Walter E., Academy of Sciences, San Francisco, Cal.: 2 birds' skins. (Returned.) 2137 (V-A).
Butt, William F., Lehi City, Utah: Fossils; rocks and clay. 2285 (XIII-A, XVII.)
Caldwell, E. K., Monero, N. Mex.: Ore. (Returned.) 2259 (XVII).
Calfar, Frank H., Roswell, N. Mex.: Ore. (Returned.) 2070 (XVII).
Callihan, Dr. R., Rohnerville, Cal.: Stone. (Returned.) 2177 (XVII).
Campbell, J. J., Marshall, N. C.: Minerals. 2151, 2260 (XVI).
Campfield, C. H., Dulzura, Cal.: Mineral. 1786 (XVI).
Canute, James, Jacksonville, Fla.: Crustacean. 1795 (26062) (XI).
Capute, W. W. (See under Miss L. Maltern.)
Capwell, V. L., Luzerne, Pa.: Mineral. 2019 (XVI).
Carmicheal, J. J., Dallas, Colo.: 2 specimens of ore. 2043 (XVII).
Carpenter, F. E., Omaha, Nebr.: Skull of mammal. (Returned.) 2126 (IV).
Carter, E. L., Pittsburg, Pa.: Copper coin. 2191 (I).
Chapman, Frank M., American Museum of Natural History, New York City: 6 birds. (Returned.) 2004 (V-A).
Chesterman, W. D. (See under R. E. Robinson.)
Chidsey, Charles E., Scranton, Miss.: Plants. 1953 (XV).
Clayton, J. H., Summer Lake, Oreg.: Insect. 1895 (X).
Cole, Fred H., Hot Springs, S. Dak.: Fossil cycad trunk. 2131 (27013) (XIV).
Collier, D. C., San Diego, Cal.: Crystals and rock. 2135 (XVII).
Colson, Eugene H., Washington, D. C.: Mineral. (Returned.) 2091 (XVI).
Converse, H. D., Campo, Cal.: Supposed lithographic stone, and ores. 2053 (XVII).
Cook, R. E., Newton, Colo.: Fossil. 2242 (XIII-A).
Cooke, Joseph, Washington, D. C.: Mineral. 2115 (XVI).
Cooper, Dr. M., Wadena, Minn.: 5 specimens of minerals. (Returned.) 2092 (XVI).
Copp, Mrs. A., Burkeville, Va.: Sand. 1809 (XVII).
Corbett, E., Clarendon, Tex.: Ore. (Returned.) 2005 (XVII).
Cornett, Henry B., Greenville, Ky.: Stone implement. (Returned.) 2239 (III).
Corum, J. C., Spikenard, Oreg. Clay. 1785 (XVII).
Cory, C. B., Boston, Mass.: Birds' skins from Tobago. (Returned.) 1841 (V-A).
Crenshaw, J. W., Phœnix, Ariz.: Supposed lithographic stone. 2035 (XVII).
Crevecoeur, F. F., Onaga, Kans.: Insects. 1965 (X).
Crew, Henry, Lick Observatory, University of California, Mount Hamilton, Cal.: Negative from which a photograph was made of a curious piece of sculpture found in San Antonio Valley. 1844 (III).
Criswell, D. R., Buckholts, Tex.: Fiber-bearing weed. 2170 (XV).
Crouse, C. M., Syracuse, N. Y.: Celt and handle. 1782 (III).
Dana, D. S., Payson, Utah: Clay. (Returned.) 2120 (XVII).
Dann, Raymond G., Honeoye Falls, N. Y.: Indian beads. 2155 (II-A).

Davis, John W., Crescent City, Fla.: Butterfly. 1791 (X).

Davison, W., Tenafly, N. J.: Botanical specimens. 1879 (XV).

Day, E. L., Buckhannon, W. Va.: Ore. (Returned.) 2071 (XVII).

Detwiler, H. L., Jacksonville, Oreg.: Mineral. 2250 (XVI).

Dickey, Dr. J. A., Bristol, Tenn.: Ores. 1970 (XVII).

Dickson, L. E., Geological Survey of Texas, Austin, Tex.: Supposed fossil tooth of mammal from Iowa. (Returned.) 2045 (XII).

Doty, W. F., Marionville, Mo.: Rock. 1804 (XVII).

Dow, Mrs. Elizabeth K., New York City: 7 skins of Paradise Trogon. 2164 (27125) (V-A).

Draper, E. A., Litchfield, Nebr.: Insect. 1833 (X).

Drew, C. V., Ouray, Colo.: Rocks. 1985 (XVII).

Duffy, H. J., South Bend, Wash.: 5 specimens of ores. (Returned.) 1946 (XVII).

Dugès, Prof. A., Guanajuato, Mexico: Insect. 2227 (X).

Durock, P. H., Pecos City, Tex.: Mica. 1905 (XVII).

Dutcher, William, New York City, through Dr. Leonhard Stejneger: 2 young loons. (Returned.) 2221 (V-A).

Ebaugh, Jeremiah, Carrollton, Md.: Minerals. 3 specimens of ore; 1940 (2052, returned) (XVI, XVII).

Edwards, B. M., Marshall, N. C.: Insect. 1825 (25156). (X.)

Egleston, Dr. T., Columbia College, New York City: Minerals. 2006 (XVI). 1 specimen retained (26514), and the remainder returned.

Elliott, J. D., Young Island, S. C.: Insect. 1870 (X).

Elting, R. O., Kansada, Kans.: Mineral flakes. 1824 (XVI).

Enos, Mrs. D. C., Saratoga, N. Y.: Moths. 1805 (X).

Evans, Creed, Low Gap, N. C.: Minerals. 1874, 1959, 1976, 2025 (XVI).

Evans, H. Clay, Chattanooga, Tenn.: Ore. (Returned.) 1884 (XVII).

Fairchild, James H., Chicago, Ill.: Concretion. (Returned.) 2042 (XVII).

Finn, John, Washington, D. C.: Alcoholic fish. 1881 (VII).

Fish Commission, U. S. (See under W. R. Harris.)

Fisher, William H., Baltimore, Md.: 2 birds. 2008 (V-A).

Fitcher, E. C., Monarch, Colo.: Minerals. (Returned.) 2129 (XVI).

Fitzpatrick & Strickfaden, Anaconda, Mont.: Mineral. 2038 (XVI).

Fletcher, W. A., Rhodelia, Tenn.: Ore. 1803 (XVII).

Flood Brothers, Malden, Mass.: Coleoptera from North America and Tasmania. 1855 (X).

Floyd, C. H. B., Savannah, Ga.: Indian pottery and two stone implements. 2121 (27333) (II-B).

Foote, Dr. A. E., Philadelphia, Pa.: Minerals. 2122 (26833), 2123 (26831) (XVI).

Forester, S. N., Norcross, Ga.: Fragments of supposed aerolite. 2143 (XVI).

Forrester, Robert, Castle Gate, Utah: (Returned with one exception). 1973 (26690); shells, fossils, fossil bone, 2024; fossil (portion returned, and some retained) 2214 (27054); fossils, shells (returned) 2243 (XIII-A; IX; XIII-B).

Forristel, James, Bozeman, Mont.: Ore. 2201 (XVII).

Fowke, Gerard, U. S. Bureau of Ethnology: 2 axes found near the mouth of Straight Creek, Ohio. 2133 (III).

Foye, G. D., Hyattsville, Md.: Mineral. 2117 (XVI).

Fry, L., Rinkerton, Va.: Ores. 1960, 2021, 2048 (XVII).

Gant, A. B., Graham, Tex.: Grass. 2234 (XV).

Garrett, A. I., Lawrence, Kans.: Plants. 1999 (XV).

Gardner, Frank A., Riverside, Cal.: Insects. 1966 (X).

Gardner, W. D., Seattle, Wash.: Ore. (Returned.) 1863 (XVII).

Geological Survey of Texas, Austin, Tex.: Fossil unionidæ for study. 2211 (IX).

Gerndt, F. L., Paris, Ontario, Canada: Insects. 2036 (X).

Gilbert, Prof. Charles H., Leland Stanford Junior University, Palo Alto Cal.: Reptiles and batrachians. (Returned.) 2078, 2182 (VI).

Gilbert Brothers, Omaha, Nebr.: 4 birds. 2028 (26677, 26767) (V-A).
Glenn, Harvey L., Livingston, Mont.: Mineral. 1975 (XVI).
Godbey, S. M., Chapel City, Tex.: Shells. 2111 (26852); shells from Texas and California 2166 (26979); shells (returned). 2195 (IX).
Goldsmith, I., Duncan, Ariz.: Coal. 2278 (XVII).
Gorman, W. A., West Chester, N. Y.: Worms. 2290 (X).
Goudie, Robert, Nashville, S. Dak., through Mr. Whitcomb: Conglomerate and rocks. 2023 (XVII).
Granger, Dr. F. C., Randolph, Mass.: Insect from Washington, D. C. 1915 (X).
Greer, Dr. L. H., Yorktown, Ind.: Insect. 1778 (X).
Griffith, G. W., Wilmington, Del.: Shells. 2063 (IX).
Guilford, H. M., Minneapolis, Minn.: Bird. (Returned.) 1900 (V-A).
Haas, Miss H. V., Pekin, Ill.: Butterfly. 1788 (X).
Hale, C. E., Marble Hill, Ga.: Bird's claw. 2169 (IV).
Hales, Henry, Ridgewood, N. J.: Collection of ancient pueblo pottery and implements. 2114 (26917) (II-B).
Hammitt, J. M., Pittsburg, Pa.: Perforated mussel shell found in an old Indian fort. 1988 (26515) (III).
Hammond, L. F., Rensselaer Falls, N. Y.: Butterfly. 2246 (X).
Hampton, J. H., Chelsea, Ga.: Mineral, clay. (Returned.) 2105, 2118 (XVI, XVII).
Hardwick, W. P., Amarillo, Tex.: Nut. 1987 (XV).
Hardy, Manly, Brewer, Me., Bird-skin. (Returned.) 2019 (V-A).
Harper, John, Dye, Tex.: Insect. 2245 (X).
Harris, Frank, La Crescent, Minn.: Birds' eggs. 2026 (26573) (V-B).
Harris, G. E., Cassville, Mo.: Ore. 2162 (XVII).
Harris, T. S., Boston, Mass.: Mineral. 1780 (XVI).
Harris, W. R., Southwestern Academy of Sciences, Tyler, Tex., through U. S. Fish Commission. Shells (returned); shells (retained). 1913, 2101 (26759). (IX).
Harvey, Rev. M., St. John's, Newfoundland: Birds' skins. 2109 (26901, 26902) (V-A).
Hassett, E. B., St. Paul, Ark.: Ores. 2020, 2039, 2016 (XVII).
Hedges, H. S., Douglas City, Wash.: Minerals. 2229 (XVI).
Henley, Charles, Central City, S. Dak.: Mineral. 1982 (XVI).
Henselbecker & Bedell, Red Bluff, Mont.: Ore. (Returned.) 2208 (XVII).
Herbert, Dr. George, Richfield, Utah: Minerals. 2283 (XVI).
Herrera, Prof. A. L., Mexico, Mexico: Insects. 2062 (X).
Hershberger McD., East Marcus, Wash.: Mineral sand. 2147 (XVI).
Higdon, Hugh L., Globe, Ariz.: Ore. (Returned.) 2097 (XVII).
Hines J. J., Wilkesbarre, Pa.: Clay. (Returned.) 2175 (XVII).
Hodge, H. G., York, Ill.: Insects. 2200 (X).
Holt, Andrew, Stelicoom, Wash.: Substance of a mineral character. 2058 (XVI).
Holton, W. W., Shenandoah, Va., through Mr. William Palmer: Insects. 1815 (X).
Hood, Miss Jessie L., Lynn, N. C.: Butterfly. 2136 (X).
Hoppe, E. G., Cairo, Ill.: Silk cocoon (?). 1913 (X).
Hopping, Ralph, Kaweah, Cal.: Coleoptera. 1810. (Returned with the exception of 10 specimens which constitute acc. (26029); 62 species of Californian coleoptera 1899 (26193); 47 species of coleoptera 2196 (27028). (X).
Hourston, Joseph, Hudson's Bay Company, Cumberland House, Canada: Minerals. 1837 (XVI).
Hunt, J. A., Eureka, Utah: Mineral. 2061 (XVI).
Hunt, W. E., Greenville, Miss.: 2 specimens of pottery. 2016 (III).
Hutchins, Miss H. B., Chicago, Ill.: Plant. 1932 (XV).
Hutt, W. H., Casnovia, Mich.: Ore. (Returned.) 2217 (XVII).
Hux, M. W., Weldon, La.: Silver coin. 2247 (I).
Hyde, G. L., Eureka, Utah: Asphalt. 2270 (XVII).

Ingraham, D. P., Elmira, N. Y.: 3 birds. 1931 (26269) (V–A).
Intram, Robert, Chenowith, Wash.: Plant. 1872 (XV).
Jacquemin, C. B., Helena, Mont.: Minerals. 1927, 2098 (XVI).
Jaske, Hermann, St. Mary's Convent, Dayton, Ohio: Minerals and zinc products. (Returned.) 1986 (XVI).
James, A. J., Dallas, Tex.: Mineral. 2258 (XVI).
Jameson, W. C., Rixeyville, Va.: Insects. 2251 (X).
Jenkins, J. M., Westfield, Iowa: Supposed clay. 1991 (XVII).
Jerome, Charles W., Minneapolis, Minn.: Plant. 1816 (XV).
Johnson, Joseph, Stafford, Mo.: 3 specimens of rock. 1983 (XVII).
Johnson, Dr. W. C., Micanopy, Fla.: Alcoholic specimen of snake. 2214 (VI).
Jones, Rev. C. J. K., Louisville, Ky.: 2 worms. 2127 (X).
Jones, Mrs. J. G., Bushnell, Fla.: Butterfly. 1891 (X).
Jones, M. H., Guaymas, Sonora, Mex.: Beans. 1860 (XV).
Keam, T. V., Keam's Cañon, Ariz., through W. J. McGee, U. S. Geological Survey: Fossil bones from Arizona. 2158 (27072) (XII).
Kearney, R. A., Alexandria, Va.: Mineral. 2138 (XVI).
Keeler, C. A., San Francisco, Cal.: Crustacean from the Farallone Islands. (Returned.) 1813 (XI).
Kelly, R. A., Webster City, Iowa: Illinois third-vein coal with impressions of supposed human footprints. 2274 (27152) (III).
Kent, W. F., Lockport, N. Y.: Birds' skins. (Returned). 2153 (V–A).
Kenyon, F. C., Lincoln, Nebr.: Myriopods. 2193 (27005) (X).
Kerr, W. C., New Brighton, N. Y.: Sponge. 2150 (26940) (XI).
Kimball, S. D., Canton, N. Y.: Herb—supposed cure for the bite of the rattlesnake. 2224 (XV).
Kimber, Rev. A. C., New York City: Crab. 1776 (XI).
Kinley, Charles, Crescent City, S. Dak.: Mineral. 1982 (XVI).
Kirker, Miss A. J., Portland, Me.: Human skull, buttons, and other objects. 2248 (27468) (III).
Kirkland, Jacob, Thorp Springs, Tex.: Ore. (Returned.) 2215 (XVII).
Kitterman, G. B., Ottumwa, Iowa: Interglacial plants. 2213 (XIV).
Knight, L. R., St. Joseph, Mo.: Insect. 2203 (X).
Knight, W. C., Laramie, Wyo.: Stone implement, and 2 arrow-points. 2225, 2096 (26844) (III).
Knox, W. D., Hillsboro, Tex.: Insect. 1954 (X).
Kramer, E. D., Dayton, Ohio: Insect. 2081 (X).
Krlisi, Graf, Gais, Switzerland: Butterfly-net. 2199 (27249) (X).
Labouve, J. T., Derouen, La.: Insects. 2279 (X).
Lacoe, R. D., Pittston, Pa.: Fossil plants, type specimens of Volkmann's praelogue. 1893, 1903 (returned). (XIV).
Lake, G. H., Lewiston, Idaho: Ore. 2275 (XVII).
Lander, W. Tertsh, Williamston, S. C.: Tuckahoe or Indian bread. 2017 (26589) (II–A).
Lartigue, Dr. G. B., Blackville, S. C.: Plants. 1827 (XV).
Laws, Franklin, Windom, N. C.: Mineral. 1819 (XVI).
Lee, M. H., Thurber, Tex.: Coal (?). 1937 (XVII).
Lesser & Sawyer, Winslow, Ariz.: Meteoric iron. 2204 (27105) (XVI).
Lewis, B. and W. A., Express, Oreg.: Ores. 1853, 2041 (XVII).
Lewis, H. B., Fairhaven, Wash.: Plant. 1823 (XV).
Lewis, S. M., Fort Worth, Tex.: Skull of mammal. (Returned.) 1963 (XII).
Lind, Hon. John, House of Representatives. (See under E. E. Stoeckert.)
Linell, N. L., Fruita, Colo.: 3 species of locusts destructive to fruit trees. 1818 (X).
Livingston, Knox, Bennettsville, S. C.: Insect found destroying hickory tree, and sample of its work. 1904 (X).

Logan, Robert, Moapa, Nev.: Stone. 1922 (XVII).
Longenecker, B. F., Maria, Pa.: Arrow-head. 1984 (III).
Loomis, Rev. Henry, Yokohama, Japan: Fish. 2134 (VII).
Loomis, L. M., Tryon, N. C.: 7 specimens of new Junco from southern California. 2015 (V–A).
Loringshoff, H. F., Notor, Neschim, Government Tsernigoff, Russia: Book. 2228 (I).
Love, Dr. T. B., Gunsight, Tex.: Mineral. 1806 (XVI).
Lowrey, Col. W. L., Asheville, N. C.: 12 small fragments of minerals, mineral. 1801, 2013 (27176) (XVI).
Lucia, I. W., Lexington, Mich.: Insect. 1885 (X).
Lusk, Dr. P. B., Lewisburg, Ala.: Insect, leaf, stem, and root of plant. 1866, 2261 (X, XV).
Lyman, Miss M. E., Middlefield, Conn.: Leaves of plant. (Returned.) 1941 (X).
Lyon, James, Montpelier, Idaho: Oysters and small black mollusks. 1907 (XIII–A).
McConnel, E. A., Boise City, Idaho: Gills of fishes. 1861 (XII).
McGee, W. J. (See under T. V. Keam.)
McGregor, H. B., Pontiac, Ill.: 2 wax impressions of silver medal. (Returned). 2226 (I).
McGregor, R. C., Denver, Colo.: Birds' skins, and skin of Junco. 1995 (returned), 2061 (V–A).
McLellan, H. K., Hamilton, Ill.: Bone. 2069 (XII).
McManner, Dr. C. S., White Springs, Fla.: Mineral. 2115 (XVI).
McManus, J. E., Everett, Wash.: Coal. 1848 (XVII).
McNeill, Frank, Herndon, Va.: Worm. 1890 (X).
Maddox, R., Fort Wrangle, Alaska: Supposed ore. 1928 (XVII).
Maltern, Miss Luella, Forestville, N. Y., through W. W. Capute: Insect. 1952 (X).
Marsh, Charles H., Dulzura, Cal.: Brown rat; skin of bat. 1779 (25942), 1887 (26117) (IV).
Marshall, Dr. D. M., Williamstown, N. Y.: Insect. 1917 (X).
Marshall, John, Flagstaff, Ariz.: Mineral. 2076 (XVI).
Mathewson, J. O., & Co., Augusta, Ga.: White sand. 1877 (XVII).
Mattocks, J. H., Albuquerque, N. Mex.: Mineral. 1811 (XVI).
Maxwell, J. A., Fulda, Minn.: Fragment of pottery. 2216 (27060) (II–B).
Meeker, Dr. J. W., Nyack-on-Hudson, N. Y.: Plants. 1799, 1967, 2207, 2240, 2271 (XV).
Mellier Drug Company, St. Louis, Mo.: Plant. 2077 (XV).
Merrill, V. D., Bear Grove, Iowa: Bone and tooth of mammal (?). 1856 (IV).
Meyran, Barney, Moscow, Idaho: Ore. 2124 (XVII).
Mendenhall, M. O., Hot Springs, S. Dak.: Fossil skull of mammal. (Returned.) 2018 (VIII).
Miles, Cyrus, West Middlesex, Pa.: Rock. 2095 (XVII).
Miller, Charles, jr., Grand Rapids, Mich.: Insects, minerals, ores, minerals, minerals and clay. 1846, 2159 (2252 returned), 2072 (2090 returned). (X, XVI, XVII.)
Miller, C. F., Wolcottville, Ind.: Insect. 1908 (X).
Miller, Mrs. E. V. D., Washington, D. C.: Ores from Virginia. 1918 (XVII).
Miller, L. H., Little Falls, Wash.: 7 specimens of chemicals made by the aid of the new solvent of vegetable origin by Mr. Miller. 2253 (XVI)
Miller, W., Grand Rapids, Mich.: 5 specimens of minerals. 2027 (XVI).
Millis, F. T., Lehi, Utah: Ore. 2017 (XVII).
Minor, Dr. T. C., Cincinnati, Ohio: Insects. 1876 (X).
Mitchell, R. H., Memphis, Tenn.: 2 small fishes. 1956 (VII).
Mitchell, Dr. Weir, Bar Harbor, Me.: Salmon gills with parasites attached. 1787 (VII).
Mitchell, W., Prince Albert, Northwest Territory, Canada: Bird-skin. (Returned.) 2060 (V–A).
Mode, N. W., Leavenworth, Ind.: Ore. (Returned.) 1989 (XVII).

Moffett, Roscoe, Livingston Manor, N. Y.: Supposed meteoric stone. 1950 (XVI). (See under E. C. Welton.)

Morgan, T. M., Cliff Mills, Va.: Mineral. 2034 (XVI).

Morin, J., Hockinson, Wash.: Clay supposed to contain aluminum. (Returned.) 2280 (XVII).

Mosier, C. A., Seattle, Wash.: Head, wing, and tail of bird. 1955 (26369) V–A).

Mudge, E. H., Belding, Mich.: 6 small shells taken from a mound. 1935 (III).

Munson, M. S., Velasco, Tex.: Gorgonian. 2030 (26615) (XI).

Musser, R. W., Cynthiana, Ky.: Large bowlder impressed with tracks; residium from sap of sugar. 1862, 2151 (XVII, XV).

Myer, W. E., Carthage, Tenn.: Fossil. 1888 (XIV).

National Museum of Costa Rica, San José, Costa Rica: 2 birds' skins. 1873 (V–A).

Nay, Dr. H. E., Bristol, Conn.: Seed. 2057 (XV).

Neal, Dr. J. C., Stillwater, Okla: 3 specimens of ores. (Returned). 1840 (XVII).

Nelson, Peter, Charlotte Harbor, Fla.: Fish. 2194 (VII).

Newlon, Dr. W. S., Oswego, Kans.: Fossils. 2237, 2249, 2273 (XIII–A, XII. XIII–A).

Nielsen, J. A., Kooskia, Idaho: 3 specimens of minerals. 1958 (XVI).

Nier, H. F., Livingston, Mont.: Mineral. 2012 (XVI).

Nile, William, Dutch Flat, Cal.: Butterfly, with cocoon and eggs. 2235 (X).

Nye, S., Station Camp, Tenn.: Clay. 2054 (XVII).

Nye-Galbraith Drug Company, Boise City, Idaho: Plant, said to be cure for fevers. 2269 (XV).

Ober, F. A., Washington, D. C.: 22 stone implements. 2073 (26798) (III).

Odeneal, A. T., Paris, Tex.: Metal. 2119 (XVI).

Ogilvie, Dr. J. W., Allendale, S. C.: Fragment of jaw of fish. 2152 (VII).

Ohlwiler, F., Cooper Tract, Pa.: Fossil plant. 2080 (XIV).

Olmstead, Mrs. F. C., Stillwater, N. Y.: Stone implements from Ireland. 2112 (III).

O'Neal, W. H., Virginia Beach, Va.: Fish. 2093 (VII).

Orcutt, C. R., San Diego, Cal.: Bowlder taken from a well, showing material among which a stone head was found. 1909 (III).

Osman, Miss L. E., Hillsborough, New Brunswick: Plants. 1849, 2238 (XV).

Owens, Miss M. J., Jacksonville, Fla.: Specimen of earth supposed to contain kaolin. (Returned.) 2281 (XVII).

Owsley, Dr. W. T., Glasgow, Ky.: Living rattlesnake. 1789 (26071) (VI).

Paine, J. B., Ontario, Wis.: 7 specimens of minerals. 2222 (XVI).

Paine, O. J., Durango, Colo.: Clay and other material. 2276 (XVII).

Palmer, William. (See under W. W. Holton.)

Pasada, J. C., Medellin, United States of Colombia: 39 gold ornaments. (Returned.) 2165 (III).

Pattee, Orson, Jarbalo, Kans.: Supposed worm. 2174 (XI).

Patton, J. D., Cleveland, Tenn.: Fossil tooth of mammal. 2099 (XII).

Payn, Elias, J., Tres Piedras, N. Mex.: Bituminous coal and supposed tin ore. 2003 (XVII).

Peabody, P. B., Owatonna, Minn.: Bird. (Returned.) 1997 (V–A).

Pearson, C. F., Portland, Oreg., through U. S. Branch Hydrographic Office, Lieut. O. E. Lasheer, in charge: Waxy substance found on the inner beach at the mouth of the Nehalem River; sample of coal. 2032, 2168 (XVII).

Pennypacker, C. H., West Chester, Pa.: Mineral. (Returned.) 2068 (XVI).

Perkins, F. S., Burlington, Wis:. Fluted stone. 1790 (III).

Perry, A. K., Beverly, N. J.: Insect. 2256 (X).

Pfeiffer, F., Rock Springs, Wyo.: Supposed petrified hand and forearm of a man. 2107 (III).

Phillips, A. H., Hulberton, N. Y.: Stone. 1993 (XVII).

Pierce, G. W., Wellsville, N. Y.: Clay. (Returned.) 1797 (XVII).

Pitcher, Mary E., Madison, Ind.: Birds' skins. 2190 (V–A).

Pleasants, J. H., jr., Baltimore, Md.: Birds' skins. (Returned.) 2157 (V–A).
Poole, J. E., Haskell, Tex.: Insects. 2284 (X).
Poole, Richard, Poolesville, Md.: Mineral. 2094 (XVI).
Pope, H., Quebec, Canada: 2 skins, skulls, and bones of seals. 1839 (26021) (IV).
Potter, William, jr., New York City: Bird-skin from Africa. (Returned.) 2167 (V–A).
Price, Hon. Andrew, M. C., House of Representatives: Coal, 1859 (XVII).
Price, J. K., Holly Brook, Va., through D. W. M. Wright: 2 specimens of ores (Returned.) 2282 (XVII).
Price, W. H., Gainesville, Ga.: Worm. 1889 (X).
Pride, W. J., Lynchburg, Va.: 2 specimens of mineral. 1800 (XVI).
Putnam, J. H., Abbeville, La.: Substance found on the beach at Marsh Island. 2178 (27053) (XVII).
Qualey, E. J., & Co., McMinnville, Oreg.: Mineral. 2180 (XVI).
Raber, C. A., Prescott, Ariz.: Supposed rock, ore. 1911, 1925 (XVII).
Ragsdale, G. H., Gainesville, Tex.: Breast of bird, sterna of swans. 1972 (V–A, XII).
Rambo, M. E., Lower Providence, Pa.: 2 fossil bones from Bad Lands, South Dakota; stone. 2059, 2128 (XII, XVII).
Randall, C. W., Lockport, N. Y.: Insect. 1902 (X).
Rathbone, C. F. and E. H., Eureka, Utah, Ore. (Returned). 1798 (XVII).
Ray, Mrs. C. H., Philadelphia., Pa.: Suit of clothing supposed to form portion of a costume of South Sea islander. (Returned). 2187 (II–A).
Ray, G. D., Burnsville, N. C.: Mineral. 1820 (XVI).
Ray, J. B., Burnsville, N. C.: Mineral. 1794 (XVI).
Read, M. C., Hudson, Ohio: Crustacean. 1857 (XI).
Reeves, R. C., Salt Lake City, Utah: 2 specimens of ores. (Returned.) 2113 (XVII).
Reich, M., Union Star, Mo.: Insects. 1883 (X).
Resler, Arthur, Baltimore, Md.: Bird. (Returned.) 1930 (V–A).
Rhodes, W. H., Placerville, Idaho: 2 specimens of rock. 2192 (XVII).
Richmond, C. W., Bluefields, Nicaragua: Birds' skins, reptiles, fishes, insects, crustaceans; 2 skins of Cebus monkey with skulls, birds' skins, birds' nests and eggs, reptiles and batrachians, fishes, shells, insects, crustaceans, and worm parasites; through W. J. McClellan; 3 birds' skins, collection of mammal skins, birds' skins and skulls, humming bird's nest, reptiles, fishes, insects, and crustaceans from Nicaragua 1830 (26252) (V–A, VI, VII, X, XI); 1994 (26738) (except mammals) (IV, V–A, V–B, VI, VII, IX, X, XI); 1998 (V–A); 2083 (28121) (IV); (26809) (V–A); (26726) (V–B); (27382) (VI); (28042) (VII); (28181) (X); (27128) (XI).
Robinson, R. E., Richmond, Va., through W. D. Chesterman: Mineral. 1882 (XVI).
Robinson, Lieut. Wirt, U. S. Army: Mammal skin and photograph of mammal, birds' skins; humming birds, chiefly from Bogota. (Returned.) 1897, 1974 (IV, V–A).
Rockhill, W. W., Washington, D. C.: Ethnological objects. 2084 (27007) (II–A).
Rose, M. E., Washington, D. C.: 2 specimens of minerals, from Florida. 2033 (XVI).
Rose, J. T., Ubly, Mich.: Fossil tooth of supposed mammal, from South Dakota. 2055 (XII).
Ross, S. E., Cabin Hill, Va.: Ore. (Returned.) 2031 (XVII).
Rowe, C. H., Malden, Mass.: 25 specimens of North American coleoptera; insects. 1896, 2236; 1926, 1978. (Returned.) (X.)
Rost, Charles, Indianapolis, Ind.: Tree-frog. (Returned.) 2210 (VI).
Rynearson, W. S., Indian Valley, Idaho: Rock. (Returned.) 1777 (XVII).
Sackrider, C. A., Napoli, N. Y.: Mineral. 2181 (XVI).
Salvin, Osbert, London, England: Birds. (Returned.) 1935, 2002 (V–A).
Sandrock, W. J., Buffalo, N. Y.: Insects. 1858 (X).
Sayer, A. J., Mount Olive, Va.: Ore. (Returned.) 2268 (XVII).
Sayre, S. B., Elizabeth, W. Va.: Mineral. 1962 (XVI).

Scharf, W. I., Washington, D. C.: Worm from Virginia. 1898 (X).

Schmidt, Walter, White Plains, Va.: Ore and alkali. 1916 (XVII).

Schultz, B. F., Tazewell, Tenn.: Bulb or egg plowed up in a field. 2261 (XV).

Schwiertz, John, Marseilles, Ill.: Insect. 2267 (X).

Science College Imperial University, Tokio, Japan: Birds' skins. (Returned.) *1808 (V–A).

Scott, O. C., Oskaloosa, Iowa: Plant. 2289 (XV).

Scott, Tessia, Fort Klamath, Oreg.: Collection of butterflies. 1783 (X).

Seward, Percy L., Lawrenceville, Ill.: Chrysalis. 1894 (X).

Shaw, Lieut. C. P., U. S. Navy (retired): Plant supposed to be an antidote for the bite of a rattlesnake. 2220 (I).

Sherman, J. D., jr., New York City: 25 specimens of North American coleoptera. 2197 (27027) (X).

Shriver, Howard, Cumberland, Md.: Material resembling slate or plumbago; fossils. 2255 (returned) (XVII); 2288 (returned with exception of 1 specimen) (27390) (XIII–A).

Shutt, G. W., Hillsboro, Va.: Rock. 1934 (XVII).

Simpson, D. J., Sunnyside, Utah: Ore. (Returned.) 1864 (XVII).

Simpson, Stewart, Ruthburg, Idaho: Mineral. 2173 (XVI).

Singley, J. A., Austin, Tex.: 43 specimens, representing 13 species of birds; 91 archæological objects. (Returned.) 2071, 2141 (V–A, III).

Slack, C. W., Globe City, Ariz.: Ore. (Returned.) 1838 (XVII).

Smith, Mrs. F. A., Elizabethtown, N. Y.: Insects. 2230 (X).

Smith, G. H., Minneapolis, Minn.: Ore. 2223 (XVII).

Smith, H. I., South Lebanon, Ohio: Crayfish, crayfishes, spiders. 1826 (26350), 1871 (26104), 1880 (XI, X).

Smith, J. P., Price's Fork, Va.: Ore. 1981 (XVII).

Smith, J. B., Brown, Colo.: Mineral. 2277 (XVI).

Smith, Dr. L. H., Easton, Md.: Beetle. 1828 (X).

Smitherman, S. J., Troy, N. C.: Supposed clay. (Returned.) 2001 (XVII).

Smithsonian Institution, Bureau of Ethnology: Collection of ethnological objects; black steer robe painted with tribal history by a Piegan Indian. 1821 (26105), 1990 (II–A).

Snow, C. C., Farmington, Utah: Ore. (Returned.) 1875 (XVII).

Snyder, H. E., Beaver Dam, Wis.: 47 species of coleoptera. 1845 (X).

Spencer, E., Big Pine, Cal.: Chalk. 2185 (XVII).

Spray, S. J., Salida, Colo.: 4 specimens of minerals; 3 specimens of ores. 1945, 2100. (Returned.) (XVI, XVII.)

Sprinz, R., El Paso, Tex.: 2 antique ivory figures from Mexico. (Returned.) 2212 (II–B).

Stahl, M., Bayley, Iowa: Butterfly. 1831 (X).

Stedman & Co., Minnesota Lake, Minn.: Plant. 1832 (XV).

Stejneger, Dr. L. (See under William Dutcher.)

Stephens, F., San Bernardino, Cal., through C. F. Batchelder: 7 birds. (Returned.) 2007 (V–A).

Steward, A., Bridgeport, Conn.: Insects. 2051 (X).

Stewart, J. H., Broken Bow, Nebr.: Insect. (Returned.) 1793 (X).

Stoeckert, E. E., through Hon. John Lind, M. C., House of Representatives: Sand supposed to contain gold. 1784 (XVII).

Stouffer, Jeremiah, Wooddale, Pa.: Mineral. 1944 (XVI).

Strinegger, Alexander, Phœnix, Ariz.: Rock. (Returned.) 2176, 2184 (XVII).

Stump, J. M., White Oak, Ohio: Supposed bone of fossil mammal. 2219 (XIII–A).

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* A description of these birds' skins and also of No. 1712 sent previously, has been published in the Proceedings of the National Museum, Vol. XVI, No. 957.

Squyer, Homer, Mingusville, Mont.: Fossil shells. (Returned.) 2089 (XIII–B).

Swan, J. W., Bozeman, Mont.: Ore. 2287 (XVII).

Swingle, Mrs. O. H., Dudleyville, Ariz.: 2 specimens of ore. (Returned.) 2168 (XVII).

Talcott Brothers, Olympia, Wash.: Black sand; 2 specimens of ores. 1775; (2160 returned.) (XVII).

Tally, M. E., Parkersburg, W. Va.: Pods from pine tree. 1906 (XV).

Tappan, Mrs. C. C., Brooklyn, N. Y.: Flower. 2231 (XV).

Taylor, Miss E., Troy, N. Y.: Dress of Eskimo woman. (Returned.) 2011 (II–A).

The Druggists' Circular, New York City: Plant; portion of root, stem, and flower of a plant from Texas. 2022, 2198 (XV).

Thomson, N. A., Victoria, Tex.: Plant. 2110 (XV).

Thompson, E. E., Toronto, Canada: Birds' skins. (Returned.) 1923 (V–A).

Thompson, W. F., La Luz, N. Mex.: Rock. 2111 (XVII).

Thornton, M. E., Hickory, N. C.: Worm. 1979 (26419) (XI).

Thropp, Miss Amelia, Oil City, Pa.: 4 beetles from Brazil. (Returned.) 1971 (X).

Thurlow, Paul, Stamford, Colo.: Residuum left after the evaporation of a goblet full of snow. 2116 (XVII).

Tichar, G. C., New York City: 2 specimens of so-called Mexican onyx. (Returned.) 1964 (XVII).

Tilton, W. L. R., Prairie, Ohio: Plant. 2265 (XV).

Tristram, Rev. H. B., Canon of Durham, The College, Durham, England: Various specimens of *Procellariidæ*. (Returned.) 1892 (V–A).

Turnbaugh, L., Panaca, Nev.: 2 specimens of dendrites. 2209 (XVII).

Turner, A. C., Ellensburg, Wash.: Sand. 2086 (XVII).

Turner, J. H., Jonesville, Tex.: 2 specimens of minerals and seed of plant. 1867 (XVI, XV).

Tweed, J. W., Ripley, Colo.: Stone implements. 1817 (III).

Vanoy, E., Springdale, Ark.: Ore. (Returned.) 1920 (XVII).

Vinson, J. S., Pendleton, Oreg.: Clay. 2205 (XVII).

Voorhees, C. J., Millersburg, Ohio: 2 fossil bones of mammal from Texas. 2125 (XII).

Voss, C. F. E., Portland, Oreg. Clay. 2218 (XVII).

Wagner, Luther, Ruby, Wash.: Mineral. 2067 (XVI).

Wall, W. A., Champion, Ala.: Supposed slag. (Returned.) 2186 (XVII).

Walters, Bryon, Circleville, Ohio: 13 archæological objects. (Returned.) 2142 (III).

Ward, Rev. Philip J., Wyoming, Ohio: Insect. 1918 (X).

Ward's Natural Science Establishment, Rochester, N. Y.: Human skull. (Returned.) 1842 (XII).

Wardell, Caroline, Tougaloo, Miss.: Insect. 2014 (X).

Ware, C. T., Johnson City, Tenn.: Portion of a hen. 2140 (XII).

Wayne, A. W., Wallace, Idaho: 4 specimens of ores. 1949 (XVII).

Weaver, J. T., & Co., Lyerly, Ga.: Sample of geological material. (Returned.) 2075 (XVII).

Wells, G. H., Washington, D. C.: Copper knife found in a field in Michigan. (Returned.) 2050 (III).

Welton, E. C., and Roscoe Moffett, Livingston Manor, N. Y.: Supposed meteoric stone. 1950 (XVI).

Wheeler, E. S., Troy, N. Y.: Clay. (Returned.) 2189 (XVII).

Whitcomb, Mr. (See under Robert Goudie.)

White, Dr. C. D., Lexington, Minn.: Insect. 2139 (X).

White, G. W., Webster, Miss.: Clay. (Returned.) 1814 (XVII).

Whitehorn, Worth, Sizer, Nebr.: Mammal skin. 2130 (IV).

Wilkinson, E., Mansfield, Ohio: Mineral. 2088 (XVI).

Wilkinson, J. B., jr., New York City: Supposed marble. 1792 (XVII).

Willard, C. D., Cottonwood, Ariz.: Stone. 1921 (XVII).

Willard, G. M., Cottonwood, Ariz.: Mineral. 2103 (XVI).

Williams, J. A., Cloud Chief, Okla.: Mammal bone; wings, tail, and head of bird. 2040 (26722) (XII); 2149 (V-A).

Williams, W. A., Puyallup, Wash.: 2 stones. (Returned.) 1977 (XVII).

Wilson, Samuel, Richland, Tex: Fossil tooth of mammal and fossil shells. 2232 (XII).

Wilson, S. B., Surrey, England: Birds' skins from Hawaiian Islands. (Returned.) 1835 (V-A).

Wilson, Thomas, U. S. National Museum: Collection of 145 implements, ornaments, and pottery from Indo-China. 2262 (III).

Winton, G. B., San Luis Potosi, Mexico: 3 skins of imperial woodpecker. 2148 (26893) (V-A).

Wood, Miss C. M., Middleboro, Mass.: Plant from southern California. 2171 (XV).

Woods and Johnson, Jasper, Colo.: Ore. 1980 (XVII).

Woodward, Albert, Dayton, Wash.: Supposed silica. 2266 (27132) (XVII).

Worthen, C. K., Warsaw, Ill.: Mammal skins; 126 alcoholic bats and shrews; 100 alcoholic mammal skins; skin, skull, and leg-bones of *Felis yaguarundi;* mammal skins. 1781, 1834, 2056, 2104 (26763), 2172 (IV).

Wooster, A. F., Norfolk, Conn.: Mineral. (Returned.) 2233 (XVI).

Wright, D. W. M. (See under J. K. Price.)

Wright, J. W., Principal, Livingston Military Academy, Livingston, Ala.: Plant; insect; plant. 2156, 2206 (XIV, X, XV).

Wright, O. F., Chicago, Ill.: Supposed quartz. 2000 (XVI).

Yauger, E. R., Rockwood, Tenn.: Mineral. 1929 (XVI).

Yoder, George, Rosendale, Mo.: Deposit supposed to contain mineral. 2011 (XVI).

Young, J. W., Burnsville, N. C.: Mineral. 1886 (XVI).

Yount, Henry, Uva, Wyo.: 3 specimens of ores. (Returned.) 2009 (XVII).

Index to list of specimens sent for examination and report, arranged geographically.

Source.	No. of lot.	Total.
North America:		
British America	1837, 1839, 1843, 1849, 1923, 2036, 2060, 2238	8
Central America	1830, 1873, 1994, 1998, 2010, 2083	7
Mexico	1860, 2062, 2148, 2227	4
Newfoundland	2109	1
United States:		
Alabama	1866, 1951, 2156, 2186, 2206, 2261	6
Alaska	1928, 2187	2
Arizona	1812, 1838, 1911, 1921, 1925, 2029, 2035, 2076, 2097, 2103, 2158, 2168, 2176, 2184, 2204, 2278.	15
Arkansas	1920, 2020, 2039, 2046	4
California	1779, 1786, 1810, 1813, 1844, 1887, 1899, 1909, 1966, 1968, 2007, 2015, 2053, 2065, 2078, 2083, 2135, 2137, 2166, 2171, 2177, 2182, 2185, 2191, 2235.	25
Colorado	1817, 1818, 1865, 1917, 1938, 1945, 1980, 1985, 2043, 2061, 2100, 2116, 2242, 2276, 2277.	15
Connecticut	1911, 2051, 2057, 2233	4
Delaware	1912, 2063	2
District of Columbia	1881, 1915, 2073, 2091, 2145	5
Florida	1791, 1795, 1891, 1919, 2033, 2115, 2194, 2244, 2281	9
Georgia	1877, 1889, 2075, 2105, 2118, 2121, 2143, 2169	8
Idaho	1717, 1861, 1907, 1949, 1958, 2124, 2173, 2192, 2269, 2275	10
Illinois	1781, 1788, 1834, 1851, 1894, 1901, 1932, 1943, 1969, 2000, 2042, 2056, 2069, 2104, 2172, 2200, 2226, 2267, 2274.	19

Index to list of specimens sent for examination and report, etc.—Continued.

Source.	No. of lot.	Total.
United States—Continued.		
Indiana	1778, 1908, 1989, 2190, 2210	5
Iowa	1831, 1856, 1991, 2045, 2166, 2213, 2289	7
Kansas	1824, 1910, 1965, 1999, 2174, 2237, 2249, 2263, 2273	9
Kentucky	1789, 1862, 2127, 2151, 2163, 2183, 2239	7
Louisiana	1859, 2178, 2247, 2279	4
Maine	1787, 2019, 2248	3
Maryland	1828, 1930, 1940, 2008, 2052, 2091, 2117, 2157, 2255, 2288	10
Massachusetts	1780, 1855, 1896, 1926, 1978, 2236	6
Michigan	1846, 1850, 1885, 1933, 1957, 2027, 2050, 2072, 2090, 2159, 2217, 2252.	12
Minnesota	1784, 1816, 1832, 1900, 1942, 1997, 2026, 2092, 2139, 2216, 2223.	11
Mississippi	1814, 1953, 2014, 2106, 2241	5
Missouri	1804, 1883, 1983, 2044, 2077, 2162, 2203	7
Montana	1802, 1821, 1927, 1975, 1990, 2012, 2038, 2089, 2098, 2201, 2208, 2287.	12
Nebraska	1793, 1838, 1878, 2028, 2126, 2130, 2193	7
Nevada	1922, 2209	2
New Jersey	1879, 2066, 2114, 2256	4
New Mexico	1811, 1851, 2003, 2070, 2087, 2111, 2259	7
New York	1776, 1782, 1792, 1798, 1799, 1805, 1842, 1858, 1962, 1931, 1947, 1950, 1952, 1964, 1967, 1993, 1996, 2004, 2006, 2010, 2011, 2102, 2150, 2153, 2155, 2164, 2181, 2189, 2197, 2207, 2221, 2230, 2231, 2240, 2246, 2271, 2290.	37
North Carolina	1794, 1801, 1819, 1820, 1825, 1868, 1869, 1874, 1886, 1939, 1959, 1976, 1979, 2001, 2013, 2025, 2037, 2136, 2146, 2154, 2202, 2260.	22
Ohio	1826, 1857, 1871, 1876, 1880, 1918, 1986, 2081, 2088, 2106, 2133, 2142, 2219, 2265.	14
Oklahoma	1840, 2040, 2149	3
Oregon	1783, 1785, 1853, 1895, 2032, 2041, 2108, 2180, 2205, 2218, 2250.	11
Pennsylvania	1836, 1893, 1903, 1944, 1984, 1988, 2049, 2068, 2080, 2095, 2122, 2123, 2132, 2175, 2191, 2254, 2257.	17
South Carolina	1827, 1870, 1904, 2017, 2152	5
South Dakota	1852, 1982, 2018, 2023, 2055, 2059, 2128, 2131	8
Tennessee	1796, 1803, 1884, 1888, 1929, 1956, 1970, 2005, 2054, 2079, 2099, 2140, 2261.	13
Texas	1806, 1867, 1905, 1913, 1937, 1954, 1963, 1972, 1987, 2022, 2030, 2071, 2101, 2110, 2119, 2125, 2141, 2144, 2166, 2168, 2170, 2179, 2195, 2198, 2211, 2212, 2215, 2232, 2234, 2245, 2258, 2272, 2284, 2286.	34
Utah	1798, 1822, 1864, 1875, 1924, 1973, 2024, 2047, 2113, 2120, 2164, 2214, 2242, 2270, 2283, 2285.	16
Virginia	1800, 1807, 1809, 1882, 1890, 1898, 1914, 1916, 1934, 1948, 1960, 1964, 1981, 1992, 2021, 2031, 2034, 2048, 2085, 2093, 2138, 2220, 2251, 2268, 2282.	25
Washington	1775, 1823, 1848, 1863, 1872, 1946, 1955, 1977, 2058, 2067, 2086, 2147, 2160, 2229, 2253, 2266, 2280.	17
West Virginia	1813, 1829, 1847, 1906, 1936, 1962, 2072	7
Wisconsin	1789, 1790, 1745, 2222	4
Wyoming	2009, 2096, 2107, 2225	4
West Indies	1841	1
South America:		
Brazil	1971	1
United States of Colombia	1897, 1974, 2165	3

Index to list of specimens sent for examination and report, etc.—Continued.

Source.	No. of lot.	Total.
Europe, including—		
Great Britain	1892, 1935, 2002, 2112	4
Russia	2228	1
Switzerland	2199	1
Asia:		
China	2084	1
Indo-China	2262	1
Japan	1808, 2134	2
Africa	2167	1
Oceanica:		
Hawaiian Islands	1835	1
Tasmania	1855	1
Total		518

The numbers of lots of specimens referred to the various departments in the Museum, for examination and report, are indicated below:

Department.	Number of lots.
Arts and industries	8
Ethnology	9
American aboriginal pottery	4
Prehistoric anthropology	27
Mammals	14
Birds	44
Birds' eggs	3
Reptiles and batrachians	9
Fishes	12
Vertebrate fossils	1
Mollusks	9
Insects	85
Marine invertebrates	14
Comparative anatomy	15
Invertebrate fossils:	
Paleozoic	9
Mesozoic	4
Fossil plants	8
Botany	38
Minerals	94
Geology	130
Total	518

APPENDIX VI.

LIST OF ACCESSIONS TO THE U. S. NATIONAL MUSEUM DURING THE YEAR ENDING JUNE 30, 1893.

The accessions during the year embrace Nos. 25,885 to 27,150 inclusive. All material especially acquired for incorporation with the exhibit of the National Museum at the World's Columbian Exposition, and received during the fiscal year ending June 30, 1893, is included in this list. The objects acquired for this purpose previous to July 1, 1892, are grouped separately and follow the list.

ABBOTT, Miss GERTRUDE (Philadelphia, Pa.). Collection of ethnological objects, consisting of a buffalo head, antelope heads, ostrich feathers, a cloak made of the skins of the tree-coney, skins of black and white monkey from Mount Kilima-Njaro, and lion skins. Deposit. 25936.

ABBOTT, W. L. (Bombay, India). Collection of ethnological objects, bones of Lammergeyer and crow, 2 specimens of *Limax*, alcoholic reptiles, 183 birds' skins from Kashmir and Baltistan, and a large and valuable collection of mammal skins, skulls, and alcoholic mammals from Kashmir, including specimens of Vigne's wild sheep, Himalaya ibex, Himalaya bear, and new species of Voles and others (25997); dried skin of Cyprinoid, 28 inches long; mammal skins, skulls and bones; pottery; 52 birds' skins, representing 34 species from the Vale of Kashmir and adjacent parts of northern India, and a collection of insects from Kashmir, consisting of lepidoptera, neuroptera, hymenoptera, homoptera, diptera, and coleoptera; model of boat (26251); ethnological objects from Comoro, Seychelles Islands, 206 birds' skins, representing 69 species, from Aden, Seychelles, Aldabra, Glorioso, and adjacent islands; a fine collection of rare birds' eggs, consisting of 107 specimens, representing 19 species, several of which are new to science; also 23 birds' nests, 74 fishes, reptiles, and batrachians*, coral limestone, crustaceans, radiates and sponges, skeletons of *Testudo*, *Chelonia*, *Eretmochelys*, and *Emys*, and 2 skulls of sharks, collections of dry and alcoholic insects, mammals and shells, from the localities above named (27085).

ABEL, JOHN C. (Lancaster, Pa.). Collection of archæological objects, consisting of 2 hammer-stones of quartzite, 2 grinding-stones of the same mineral, 2 rude implements of white quartz, 5 worked flakes of jasper, 10 arrow or spear-heads, of porphyritic felsite, and a sample of calcareous sandstone (natural formation) from near Lancaster (26183); 51 hammer-stones, rude chipped implements, arrow-heads, perforators, worked flakes and fragments of pottery from the same locality (26259); 73 rude implements, spear-heads, worked flakes of quartz, quartzite, and jasper, drilled tablet, an unfinished ceremonial object, and water-worn pebbles from the Conestoga Hills (26463.)

ACADEMY OF SCIENCES (San Francisco, Cal.), through Dr. J. G. Cooper. Land-shells, representing 5 species from Lower California (gift) (26485); land-shells from Lower California (exchange) (26688).

ADAMS, C. F. (Champaign, Ill.). Specimen of *Sphenodon punctatum* from New Zealand. Purchase. 26212.

ADAMS, W. H. (Chase, Ill.). Cocoon of Cecropia silk-moth. 26912.

ADLER, Dr. CYRUS (Smithsonian Institution). Six musical instruments, comprising a zurna from Constantinople; dymbelek from Cairo, raha'b el Mooghun'nee, with bow; rebab with bow, biz man from Cairo, gaida from Tunis (gift) (25935);

*Special reports published in Vol. XV, and Vol. XVI, of Proceedings U. S. National Museum.

shofar or Jewish horn (gift) (25947); 52 photographs representing religious scenes in Turkey, Syria, Egypt, Tunis, and Algiers (deposit) (25950); facsimile of a document belonging to the Jews of Cochin India, written in the Tamil language (deposit) (25962); drum and staff used by the dervishes in Egypt (deposit) (26106); 3 Mohammedan talismans from Damascus (deposit) (26171).

AGRICULTURE, DEPARTMENT OF. Crayfishes from North Carolina, Mississippi, and Texas; Isopod parasitic on a shark, from San Diego, Cal. (26355); fresh-water and land-shells from California and Mexico, collected by Edward Palmer (26386); guinea pig in the flesh, obtained by Dr. F. L. Kilborne, director of Government Experiment Station, Bureau of Animal Industry, and transmitted to the Museum, through Mr. Albert Hassall, of the Department; living guinea pig (26910); crustaceans and starfishes obtained principally from Texas (27002).

Through Dr. A. K. Fisher: Land-shells, representing 5 species, from Minnesota and Mexico (27113).

Division of Ornithology and Mammalogy (through Dr. C. Hart Merriam). Seven hundred and seventy-four specimens, representing 46 species of reptiles and batrachians, collected by the Death Valley Expedition in California, Nevada, and Utah (deposit) (26017); land and fresh-water shells from the southwestern border of the United States (gift) (26339); specimen of *Microdipodops megacephalus*, and a specimen of *Arvicola* (*Chilotus*) *oregonus* (gift) (26343); fish-crow (gift) (26656).

Division of Entomology (through Prof. C. V. Riley). One hundred miscellaneous specimens of insects, collected in Texas by Mr. F. G. Schaupp (26239); 304 specimens, representing 60 species of Californian coleoptera (among which are 11 species new to the collection), collected by Mr. D. W. Coquillet (26122); 206 specimens, representing 80 species of coleoptera from southern California, also collected by Mr. Coquillet (26562).

AIKEN, J. B. (Breckenridge, Minn.). Stone mallet used by the Indians for breaking buffalo bones in order to obtain the marrow for making "pemmican;" collected by E. Connolly. 26189.

ALASKA COMMERCIAL COMPANY (San Francisco, Cal.). Skin of sea-otter, *Enhydris lutris*, with skull and bones of feet complete, obtained by the company and purchased for the Museum exhibit at the World's Columbian Exposition. 26526.

ALLEN, Dr. H. N. (Chicago, Ill.). Twenty-seven specimens of Korean pottery, 2 bronze bowls, and a stone pot. Deposit. 27062.

ALLEN, IRA R. (Fair Haven, Vt.). Five specimens of spessartite from Amelia Court-House, Va. Purchased for World's Columbian Exposition. 26904.

ALLEN, J. S. (Chicago, Ill.). Drum, sticks, and a rattle. 26632.

AMERICAN TURQUOISE COMPANY (New York City), through Mr. John R. Andrews, president. Specimen of turquoise in gangue, and 7 cut stones of turquoise from the Cerillos Mountains, near Santa Fé, N. Mex. 26804.

ANDREWS, Dr. E. A. (Johns Hopkins University, Baltimore, Md.). Larval form of conger eel, from Maryland (26046); crab (*Sesarma angustipes* Dana) (26061).

ANDREWS, HENRY W. (U. S. consul, Hankow, China), through Department of State. Two specimens of painted snipe, *Rostratula bengalensis*, from the Province of Hupeh, and 2 butterflies from the Province of Sgohnen, China. 26124.

ANDREWS, JOHN R. (See under American Turquoise Company.)

ANDRUS, W. J. (Hackensack, N. J.). La Fleche fowl. 26607.

ANGUS, JAMES (West Farms, N. Y.). Six rude implements and a fragment of steatite, from an aboriginal quarry at Johnstown, R. I. 26500.

ANTHONY, A. W. (San Diego, Cal.). Nine eggs (3 sets) of Townsend's junco, 2 eggs (1 set) of San Pedro partridge, and 4 eggs (1 set) of Guadalupe house-finch, with nest, new to the collection; also 4 eggs (1 set) of black-throated gray warbler, with nest, 3 eggs (1 set) of black-throated sparrow, 4 eggs (1 set) of Lincoln's sparrow, and 3 eggs (1 set) of streaked horned lark. Deposit. 26758.

Anthony, W. A. (Denver, Colo.). Egg of Xantus's murrelet, *Brachyramphus hypoleucus*, from Guadalupe Island, Lower California. Deposit. 26174.

Appleton, D., & Co. (New York City). Centennial memorial volume of Washington's Inauguration, April 30, 1789–1889. Purchase. 25992.

Appleton, Capt. Nathan (Boston, Mass.). Four photographs of the autograph of Sitting Bull, with letter and translation (26245); 2 copper coins, minted in Mexico or Santo Domingo about 1522, a letter mailed by balloon from Paris, January 1, 1871, during the siege of that city, photograph of the house at Pittsfield, Mass., which contained the clock that was made the subject of a poem by Longfellow, "The Old Clock on the Stairs", and a photograph of the yacht *Alice*, which made the first yacht trip across the Atlantic in 1866 (26250); 10 Spanish-Mexican copper coins, dated 1523–1535—found near the Ozuma River, outside the walls of Santo Domingo, and supposed to have been coined under authority of Cortez. (26374).

Arizona Onyx Company (Chicago, Ill.), through J. P. Sanxay. Two slabs of onyx marble from the quarries near Prescott. 26530.

Armstrong, John S. (See under Smithsonian Institution. U. S. Bureau of Ethnology.)

Armstrong, Thomas J. (Jersey City, N. J.). One-dollar Confederate note presented to Mr. Armstrong by Gen. Richard Taylor, of the Confederate army, for a cup of coffee. 26206.

Ashby, Scott (Delaplaine, Va.). Albino red-tailed hawk, *Buteo borealis*, in the flesh. 26549.

Association of Inventors and Manufacturers (Washington, D. C.). Portrait of Alfred Vail. Deposit. 26469.

Attwater, H. P. (Rockport, Tex.). Two sets of eggs of gray-tailed cardinal, representing 6 specimens new to the collection, and 2 nests of the same bird; egg of wood-thrush, 3 nests of painted bunting, nest each of verdin, yellow-throated vireo, Western blue grosbeak, and Acadian flycatcher (26609); 7 eggs of Texan horned lark, *Otocoris alpestris Giraudi* with nest, 4 eggs of rose-breasted grosbeak, *Habia ludoviciana* from Chatham, Ontario, Canada (26126); 5 specimens of an undescribed species of Southern prairie hen, *Tympanuchus attwateri* Bendire sp. nov., from Texas (27012).

Audenreid, Mrs. M. C. (Washington, D. C.). Military sash worn by Gen. W. T. Sherman at Atlanta, Savannah, and at the grand review of the Army in Washington City in 1865, and presented by Gen. Sherman to Mrs. Audenreid. 26566.

Australian Museum (Sydney, New South Wales), through Dr. E. P. Ramsay, curator. Australian graptolites. Exchange. 26775.

Avery, S. P. (New York City). Portrait of Franklin, taken from a terra-cotta medallion by T. M. Renaud. 27069.

Avery, W. C. (Corinth, Vt.). Butterfly (*Papilio asterias*) and a moth (*Arctia virgo*). 26041.

Baar, Dr. H. (New York City). Silver inkhorn from Jerusalem (deposit) (26534); 2 manuscript copies of the Hebrew Pentateuch, with silk cloaks and silver plate (lent for exhibition at the World's Columbian Exposition) (26108). Returned.

Bache, Rene (Washington, D. C.) Book containing decalcomanie pictures. 26385.

Bailey, G. E. (Chicago, Ill.). Fragment of meteoric iron from Bacubirito, Sinaloa, Mexico, weighing 14.4 grams. 26014.

Bailey, Maj. J. J. (Dansville, N. Y.). Bat (*Atalapha noveboracensis*). 26221.

Baker, Dr. Frank. (See under Smithsonian Institution. National Zoological Park.)

Baker, L. L. (Colesville, Md.), through C. A. Stewart. Red-tailed hawk, *Buteo borealis*, in the flesh. 26345.

Baldwin, A. H. (Smithsonian Institution). Skeleton of alligator. Purchased for World's Columbian Exposition. 26360.

Baldwin & Gleason Company, Limited (New York City). Collection of specimens of printing on celluloid. 26998.

BALES, C. H. (Fort Huachuca, Ariz.), through Dr. T. E. Wilcox, U. S. A. Alcoholic specimen of *Nyctinomus femorosaccus* Merriam. 26236.

BALFOUR, HENRY (Oxford Museum, Oxford, England). Collection of ethnological objects. Exchange. 26027.

BARAKKAT, Mrs. LAYYAH (Old Orchard, Me.). Collection of objects illustrating religious observances in Syria. Purchase. 25934.

BARNES, B. E. (care of Prof. F. W. Clarke, U. S. Geological Survey). Fragment of meteoric stone found in Boyett, Wilson County, N. C. 26015.

BARROWS, W. B. (Department of Agriculture). Nest of chimney swift, *Chætura pelagica* (25981); nest and 4 eggs (1 set) of olive-backed thrush, and nest and 5 eggs (1 set) of slate-colored junco, from New Brunswick (26796).

BARTLEMAN, R. M. (U. S. Legation, Carácas, Venezuela). Thirty specimens of insects, principally coleoptera. 26213.

BASKETT, J. N. (Mexico, Mo.). Skin of flicker (*Colaptes auratus*), with obscured plumage. 26873.

BASSETT, GEORGE W. (Mattawoman, Md.). Larva of royal walnut-moth, *Citheronia regalis*. 26209.

BAUR, Dr. G. (Worcester, Mass.). Collection of insects from the Galapagos Islands. 26662.

BAY, W. L. (Watrous, N. Mex.). Tree-boring beetle, *Acanthocinus spectabilis* (Lec.). 25922.

BEAL, KENNETH F. (Washington, D. C.). Crawfish from Mount Marshall, Va. 26354.

BEALE, Hon. TRUXTON. (See under Madame Schliemann.)

BEAN, BARTON A., and HARRON, L. G. (U. S. National Museum). Fishes collected at Fortress Monroe, and representing the following species: *Micropogon, Liostomus, Bairdiella, Centropristes, Stenotomus, Orthopristis, Sphyræna, Menidia, Stolephorus, Brevoortia, Larimus, Tautoga, Hemirhamphus, Tylosurus, Siphostoma, Alutera, Monacanthus, and Paralichthys.* 25957. (See under Fish Commission, U. S.)

BEAN, Dr. T. H. (See under Fish Commission, U. S.)

BECKWITH, M. H. (Newark, Del.). Statoblasts of fresh-water polyozoans (*Pectinatella*). 26284.

BEDNALL, W. T. (Adelaide, Australia). Specimen of *Cypræa eximia* from the Eocene formation of Victoria, Australia. 26620.

BEECHER, CHARLES E. (See under Yale College Museum.)

BEECHER, M. W. (Babylon, N. Y.), through J. E. Watkins. Piece of wood from deck-beams of the steamship *Savannah*, wrecked October 22, 1822. 26859.

BELDING, L. (Stockton, Cal.). Collection of reptiles and batrachians from southern California. (26637, 27052.)

BELL, Judge JAMES (Gainesville, Fla.). Specimen of Florida wild turkey, *Meleagris gallopavo osceola*. 27010.

BEMENT, C. S. (Philadelphia, Pa.). Crystal of apatite from Renfrew, Ontario, Canada. 26824.

BENDIRE, Maj. CHARLES E., U. S. Army (U. S. National Museum). Nest and 4 eggs of *Junco hyemalis carolinensis* from West Virginia (26167); 5 eggs of Audubon's shearwater from Ragged Island, Bahamas, West Indies (26238); 2 specimens of *Sarracenia purpurea* and one specimen of *Viburnum dentatum* (27141). (See under H. P. Attwater, D. B. Burrows, Lattin & Co., E. Kirby Smith, and F. H. Toby.)

BENEDICT, Dr. A. L. (Buffalo, N. Y.). Fossils from the Waterlime Group of Buffalo. 26038.

BENEDICT, JAMES E. (U. S. National Museum). Skin of Cooper's hawk, *Accipiter cooperi*, from Virginia (26784); snake (*Ophibolus rhombomaculatus*), from Woodside, Md. (27111).

BENGUIAT, HADJI E. (Boston, Mass.). Collection of objects illustrating Jewish ceremonies (26388); tapestry, cloth for synagogue, desk, pointer, and coin (26916). Deposited for exhibition at the World's Columbian Exposition.

BENJAMIN, W. E. (New York City). Collection of maps illustrating early explorations in America. Purchased for exhibition at the World's Columbian Exposition. 25990.

BENSON, Lieut. HARRY, U. S. Army (Three Rivers, Cal.). Five sets of birds' eggs (25904); collection of eggs from Sequoia National Park, Tulare County, Cal., consisting of 47 specimens, representing 6 species; also bird's nest (26149); 2 specimens of California junco, *Junco hyemalis Thurberi* from Sequoia Park (26153); 4 eggs of Thurber's junco; 4 eggs of California woodpecker; 4 eggs of spurred towhee, and 3 eggs of black-headed grosbeak (26615).

BERNICE PAUAHI BISHOP MUSEUM (Honolulu, Hawaiian Islands), through William T. Brigham, curator. Two specimens of *Acrulocercus nobilis,* and 1 specimen of an undetermined species (gift) (26874); 2 volumes containing specimens of Hawaiian kapa cloths (exchange) (27074).

BERRY, E. W. (Passaic, N. J.). Specimens of *Hippa talpoida* and *Talorchestia megalophthalma* from Asbury Park. 25963.

BIBBINS, ARTHUR. (See under the Woman's College of Baltimore.)

BIEDERMAN, C. R. (Bonito, N. Mex.). Ores; scraper from the glacial débris of Sierra Blanca, N. Mex., and piece of petrified wood. 26781

BISHOP, Dr. LOUIS B. (New Haven, Conn.), through J. E. Watkins. Egg of American crow, with unusual coloration. 26663.

BISHOP, T. S. (New Britain, Conn.). Ribbon badge of Stanley Post No. 11, G. A. R. 26962.

BISSINGER, ERHARD (U. S. Consul, Beirut, Syria).

Games of chance ("Mankaleh," "Duk-Watah," "Damah," "Barjiss"); wooden puzzle and wire-ring puzzle from Syria; musical instruments, consisting of "Oud" (lute), "Bizug" (lute long-neck), "Faggeishah" (castanets), 2 pairs; "Urgun" (double-pipe reed instrument); "Mijwiz" (double pipe reed instrument); "Derbouka;" (earthenware drum); "Manjairah" (vertical flute); "Rikk" (small tambourine); iron "Drah" or Pic; wood "Dra" or Pic; set of iron weights; set of copper weights; "Mud," cereal hollow measure and its fraction; scale of copper; copper pans; steelyard of iron; petrified clams obtained from Mount Lebanon at an elevation of from 2,500 to 3,000 feet above the level of the sea (gift). 25902.

BLACKBURN, Dr. J. W. (Government Asylum for the Insane, Washington, D. C.). Copperhead snake, *Ancistrodon contortrix,* juv. (26197); 2 snakes (26348).

BLAIR, THOMAS (Shelbyville, Tenn.). Distorted specimens of *Unio plicatus.* 26039.

BLAKE, Lady EDITH (King's House, Jamaica, West Indies). Four human skulls, 36 leg and arm-bones, and 67 fragments of ribs, vertebræ, etc., obtained from a cave near Pedro, parish of St. Elizabeth, Jamaica. 25976.

BLANEY, HENRY R. (Boston, Mass.). Three plates and a tracing, illustrating the dry-ground aquatint process. Purchased for exhibition at the World's Columbian Exposition. 26897.

BLATCHLEY, Prof. W. S. (Terre Haute, Ind.). Specimens of reptiles and batrachians from Mexico. 26198.*

BLAU, H. E. (Washington, D. C.). Sandstone concretion. 26216.

BLUNCK, A. E. (Johnstown, N. Y.). Red-pile exhibition game fowls, duck-wing game, black-breasted red exhibition game fowls, black-breasted red game fowls (26718); brown-red game chicken (26845); golden duck-wing game fowl (26855).

BOETTCHER, F. L. J. (Department of Agriculture). Frog. 26175.

BOSTON ART STUDENTS' ASSOCIATION (Museum of Fine Arts, Boston, Mass.). Three pamphlets relating to drawings for process reproduction. 26605.

BOSWELL, HENRY (Washington, D. C.). Black fantail pigeon. 26657.

BOSWELL, R. H. (Washington, D. C.). Blondinette pigeon. 26188.

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*A description of new species will be found in Prof. Blatchley's paper in *Proceedings*, Vol. XVI, No. 922, pp. 37–42. 1893.

Boucard, A. (London, England). Birds' skins from Central and South America, India, Formosa, and Borneo. Purchase. 26953.

Bourke, Capt. John G., U. S. Army (Fort Ringgold, Tex.). Copper cannon-ball (25896); saddle obtained from the Garza revolutionists, and a 3-legged metate and grinder (26024).

Bowman, D. A. (Bakersville, N. C.). Two specimens of anthophyllite in chlorite, from Bakersville. 26281.

Boyle, John (U. S. National Museum). Opossum (*Didelphys marsupialis*). 26701.

Bradley, Terrill (Lester Manor, Va.). Collection of pottery, pipes, Sora house, and Indian dugout canoe. Purchased for exhibition at the World's Columbian Exposition. 26600.

Brady, Gen. T. J. (Colonial Beach, Va.). Lincoln banner, used in the Presidential campaign of 1860. 25927.

Braida, Hon. S. C. (See under Hon. Frank von Phul.)

Bramblitt, Dr. W. H. (Pulaski, Va.). Two human skulls, 19 fragments of pottery, 2 flint chips, 6 fragments of jaw-bone of Virginia deer, jaw-bone of gray fox, 2 split bones and 2 burnt bones of an animal exhumed at Saltville, Va. 26866.

Brauer, Dr. F. (See under Imperial Austrian Museum, Vienna.)

Braverman, M. (Visalia, Cal.). Section of a cork tree grown at Visalia. 26467.

Breninger, George F. (Table Rock, Colo.). Skins of Mexican crossbill, with set of 4 eggs and nest (gift) (26752); skin of American crossbill, *Loxia curvirostra minor*, with set of eggs and nest, from El Paso County, Colo. (purchase) (26936).

Brett, Walter (Lakeport, Cal.). Specimen of double-crested cormorant, *Phalacrocorax dilophus*, from Clear Lake, Cal. (26177); bird parasites (26819).

Brezina, Dr. A. (See under K. K. Hofmuseum, Vienna, Austria.)

Brigham, William T. (See under Bernice Pauahi Bishop Museum.)

Brimley, C. S. (Raleigh, N. C.). Snake (*Ophibolus rhombomaculatus*). 27135.

Brimley, H. H. & C. S. (Raleigh, N. C.). Four mammal skins (purchase) (26135); 24 specimens, representing 4 species of reptiles and batrachians (gift) (26439); Salamander (*Amblystoma tigrinum*) (gift) (26682).

Brinton, Mrs. Emma G. (Chicago, Ill.). Collection of ethnological objects illustrating home life in the Black Forest, Germany. 26983.

Britts, Dr. J. H. (Clinton, Va.). Fossil plants. 26619.

Broadway, W. G. (Botanic Gardens, Trinidad, British West Indies). Two shells, and 6 eggs of a large land snail. 26507.

Brock, Dr. R. A. (Richmond, Va.). Five-dollar bill issued by James River and Kanawha Company, of Richmond, of which corporation Gen. Washington was the first president. 26919.

Broemer, William (Baltimore, Md.). Archangel pigeons (26991, 27134).

Brooks, A. C. (Mount Forest, Ontario, Canada). Eight specimens, representing 7 species of birds' skins from British Columbia (26011); 2 skins of little grebe, *Colymbus fluviatilis*, from India (26909).

Brothers, Dr. L. J. (Washington, D. C.). Black tumbler pigeon (26187); white owl pigeon (26358); 2 bluette pigeons and 1 satinette pigeon (26391).

Brown, Edward J. (Washington, D. C.). Seven specimens of seaside-sparrow, *Ammodramus maritimus*, from Cobb's Island, Va. (26194); skin of Australian robin, *Petroica phœnicea* (26370); skin of purple sandpiper, *Tringa maritima*, from Penobscot Bay, Maine (26880); skin of Scott seaside-sparrow, *Ammodramus maritimus peninsulæ*, from Tarpon Springs, Fla. (27133).

Brown, G. S. (Vandalia, N. Y.). Stone implement, 12 arrow-heads and piece of pottery. 26316.

Brown, Herbert (Tucson, Ariz.). Two species of snakes from Arizona. 26211.*

*One of these snakes is the second specimen of *Phyllorhynchus Browni* which has been obtained. The species was described in 1890.

BROWN, JASPER (Norway, Iowa). Birds' eggs. Exchange. 26610.

BROWN, J. STANLEY. (See under Treasury Department, U. S.)

BROWN, R. W. (Washington, D. C.). Two land-snails from Jamaica (26097); scorpion (*Buthus carolinianus* Beam) (26141); mud-turtle from Virginia (27030); spider (*Phidippus tripunctatus*) (27147).

BRUNETTI, E. (London, England), through Prof. C. V. Riley. Specimens of European diptera, representing 90 species. Exchange. 26996.

BRYANT, HENRY G. (Philadelphia, Pa.). Summer costume of an adult male of the most northern Eskimos of the Whale Sound region, North Greenland, collected by Mr. Bryant during the summer of 1892 while connected with the Peary Relief Expedition. 26841.

BULLMAN, CHARLES (New York City.). Two sheets of Chinese tracing-cloth or paper. 26205.

BULLOCH, Mrs. (See under National Society of the Daughters of the American Revolution.)

BULLOCK, EDGAR (Guiney's, Va.). Stone implement from Virginia. 26310.

BUREAU OF AMERICAN REPUBLICS (Washington, D. C.), through William E. Curtis. Two skins of motmots (*Momotus parensis* Scl.) from Para, Brazil, collected by Capt. Sawyer, U. S. Army. 26783.

BURGER, PETER (Washington, D. C.). Bat (*Adelonycterus fuscus*). 26002.

BURNHAM, WILLIAMS & Co. (Philadelphia, Pa.). Framed photograph of engine No. 385, Central Railroad of New Jersey, which made a mile run in 39¼ seconds. 25921.

BURNS, FRANK (Washington, D. C.). Fossil coquina from the Upper Eocene formation, Vicksburg, or white limestone group (26214); specimen of selenide of mercury (*Tiemanite*) from near Marysvale, Utah (26557). (See under Interior Department. U. S. Geological Survey.)

BURROWS, D. B. (Lacon, Ill.), through Capt. Charles E. Bendire, U. S. Army. Skin of Mexican black hawk, *Urubitinga anthracina*, from Starr County, Tex. 26178.

BUTTIKOFER, Dr. J. (Rejks Museum, Leiden, Holland). Ten specimens of birds' skins, chiefly *Ploceidæ*, representing 10 species, from Liberia, Africa. Purchase. 27040.

BYERS, Hon. S. H. M. (U. S. consul-general, St. Gall, Switzerland). Two Swiss alpine horns. Purchased for the World's Fair. 26757.

CADLE, W. W. (Harrisburg, Pa.). Collection of African ethnological objects. Purchase. 26446.

CALCUTTA BOTANIC GARDEN (Calcutta, India), through Dr. G. King, superintendent, transmitted by Consul-General Samuel Merrill, of Calcutta. A valuable collection of plants (25983); herbarium specimens (27112).

CALL, Dr. J. S. (U. S. Revenue Marine steamer *Bear*, Unalashka, Alaska). Collection of birds' eggs, consisting of 17 specimens, representing 6 species; also bird's nest. 26150.

CAMERON, JOHN (Washington, D. C.). Twenty-three ribbon badges of the G. A. R. (26559); collection of badges and medals of the G. A. R. and other patriotic organizations in the United States, and decorations of the Legion of Honor and other military and civic European orders (26203). Deposit. Returned.

CAMERON, S. T. (Washington, D. C.). United States Springfield muzzle loading musket with flint-lock altered to a breechloader. 26112.

CANFIELD, Mr. (Washington, D. C.). Staghound, in the flesh. 26334.

CANTERBURY MUSEUM (Christchurch, New Zealand), through F. W. Hutton, curator. Three species of ophiurans, and 6 species of starfishes. Exchange. 26947.

CANUTE, JAMES (Jacksonville, Fla.). Specimen of *Scyllarus æquinoxialis* (Fabr.) found near Cape Florida. 26062.

CARACCIOLO, H. (Port-of-Spain, Trinidad, West Indies), through Prof. C. V. Riley. Lizard (*Anolis bifurcatus*). 27092.

Caracristi, C. F. Z. (Washington, D. C.). Specimen of marble from Scott County, Va. 26457.

Cardeza, Dr. J. M. (Claymont, Del.). Specimen of cleavage feldspar from Brandywine Summit, Delaware County, Pa. Exchange. 26503.

Carpenter, J. S. (Paymaster U. S. Navy). Skeleton and skull of sea-cow (*Rhytina gigas*). Purchase. 26094.

Cary, William B. (North Stonington, Conn.). Letter of Gen. J. E. P. Steuart, dated June 20, 1862, to Hon. George W. Randolph, Secretary of War of the Confederate States, recommending Lieut. J. S. Mosby for commission of captain. 26270.

Caulfield, W. L. (Cloppers, Md.). Eggs of hog-nose snake. 26240.

Central New York Naval Veteran Association. (Amsterdam, N. Y.), through F. W. Rawdon. Badge and button of the National Association of Naval Veterans. 26679.

Chamberlain, Dr. L. T. and Mrs. Frances Lea (Philadelphia, Pa.). Specimens of *Unionidæ* from Asia and Africa, representing all varieties, many of which are new. 27001.*

Chambers, W. N. (England). Pair of gaiters and a pair of overshoes. 27058.

Chanler, William Astor (through Hon. Winthrop Chanler, of New York City). Thirty-seven mounted heads of large game from Masailand, East Africa. collected by Mr. Chanler (deposit) (26908); collection of ethnological objects, dry and alcoholic insects, alcoholic specimens of *Ambassis Commersonii* and *Periophthalmus Koelreuteri*, collected by Gustav Denhardt at the Island of Lamu, East Africa; specimens of lichens (*Usnea angulata* Ach., *Theloschistes flavicans* Wallr., and *Parmelia perforata* (Ach) Jacq.); 3 crabs, a shrimp, and earth worms, collected by Gustav Denhardt; specimen of *Ampullaria* sp. und., and a specimen of *Achatina acuta* Ferussac from the Tana River, East Africa; 3 specimens of sand, either loose or slightly consolidated and more or less strained by iron oxides, specimen of rare bat (*Vesperugo Rendalli*), and a new species of Eliomys (*Eliomys parvus*, True), also a new specimen of mouse (*Mus tana* True); collection of alcoholic reptiles. (26939).

Chanler, Hon. Winthrop. (See under William Astor Chanler.)

Chatelain, Héli (New York City). Collection of ethnological objects and articles illustrating the house and industrial life of the negro tribes of Angola (purchase) (26802); reptiles, marine shells, 13 specimens of woods and alcoholic specimens of insects from Loanda, West Africa, and alcoholic specimen of flying-fish, *Exocœtus* from near St. Thomas Island (26803).

Cherrie, George K. (National Museum, San José, Costa Rica). Nest and 3 eggs (1 set) of *Giraud's* flycatcher, nest and 3 eggs (1 set) of yellow-green vireo, both new to the collection. 26382. (See under National Museum of Costa Rica.)

Christie, James C. (Scotland). Three photographs of meteoric iron. 27043.

Claflin, E. K. (Wichita, Kans.). Specimen of salt and barite. 25960.

Clampitt, John A. (See under Fish Commission. U. S. Life-Saving Service, and Treasury Department.)

Clark, John A. (See under Mrs. James Grimshaw.)

Clark, John H. (New Orleans, La.). Manuscript: "Daguerreotyping in old times." 26556.

Clarke, Prof. F. W. (U. S. Geological Survey). Drillings of meteoric iron from Pulaski County, Va. 26604. (See under L. H. Igelström and Interior Department. U. S. Geological Survey.)

Cleveland, Rev. E. F. X. (Dundee, Ill.). Thirty-six photographs of Mexican scenery (27061); 10 photographs of native Mexicans (27136).

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* These specimens were purchased from a fund contributed by Dr. and Mrs. Chamberlain to complete the Isaac Lea collection in the National Museum.

Clisby, Capt. (See under Capt. J. O. Spicer.)

Close, A. J. (Dulinsville, Va.). Specimen of great leopard moth, *Ecpantheria scribonia*. 25969.

Cohen, Rev. Henry (Galveston, Tex.). Ritual of the Day of Atonement in Marathi (deposit) (26060); Jewish Propitiatory Prayer in Marathi, Jewish New Year's Prayer in Marathi, Jewish daily prayers—Spanish, Jewish prayers for New Year's and Day of Atonement—Spanish (deposit) (26095); Jewish cornet (shofar) (deposited for World's Columbian Exposition) (26130).

Colburn, Mrs. Rollinson (Washington, D. C.). Portrait of Seminole Indian, supposed to be that of Osceola, painted by King. Purchase. 26582.

Cole, F. H. (Hot Springs, S. Dak.). Six fossil cycad trunks. Purchase. 27013.

Cole, G. M. (Washington, D. C.). Engraving by Ormsby of Turnbull's oil painting, "Declaration of Independence." Purchased for World's Columbian Exposition. 25926.

Coleman, J. I. (Aqua Fria, Ariz.). Larva of swallow-tail butterfly, *Papilio turnus*. 26159.

Collett, Dr. R. (See under Zoological Museum of Christiania, Norway.)

Collins, Horace F. (Tucson, Ariz.). Specimen of Gecko (*Coleonyx variegatus*) from Cañon del Rio, Pinal County, Ariz. 26685.

Colson, Eugene H. (New York City). Shells found on Mosquito coast, and 2 caps made of palm from Nicaragua. 26997.

Columbian Historical Exposition (Madrid, Spain), through Department of State. Bronze commemorative medal conferred by the Columbian Historical Exposition at Madrid, 1892, in recognition of the exhibit of the U. S. National Museum. 26990.

Comstock, Cheney & Co. (Ivoryton, Conn.). Collection illustrating the manufacture of elephant ivory (gift) (26601); elephant's tusk for World's Columbian Exposition (lent) (26602).

Conge, B. M. (New York City). Elephant tusk from West Africa. 26771.

Conner, Earl (Eastland, Tex.). Specimen of spider (*Phidippus 8-punctatus*). 25913.

Connolly, E. (See under J. B. Aiken).

Cooke, Lieut., U. S. Army. (See under Smithsonian Institution. Bureau of Ethnology.)

Cooke, A. C. (Fort Recovery, Ohio). Tooth of hippopotamus, carved by a native from Mayomba, southwestern coast of Africa, and specimen of silkmoth (*Telea polyphemus*). 25980.

Cooke, Dr. Clinton T. (Minneapolis, Minn.). Eight eggs (2 sets) of little flycatcher, *Empidonax pusillus*, from near Salem, Oreg. 26169.

Cooper, Dr. J. G. (See under Academy of Sciences, San Francisco.)

Copp, J. B. (Chicago, Ill.). Articles of wearing apparel worn by Mr. Copp's ancestors during the years 1760–1800. 27084.

Cooper, W. B. (Washington, D. C.). Medal badge, "First Defenders, Washington, 1861." 26261.

Coquillet, D. W. (See under Department of Agriculture.)

Cornell University (Ithaca, N. Y.). Rocks from Magnet Cove, Hot Springs, Ark. Exchange. 26659.

Cory, Charles B. (Boston, Mass.). Twenty-six specimens, representing 14 species of birds' skins, principally from Tobago and Grand Cayman, West Indies. 26624.

Cossmann, M. (Paris, France). Fossils from the Paris Basin, France. Exchange. 26425.

Coues, Dr. E., U. S. Army. (Washington, D. C.), through James Whyte. Specimens of whooping crane, *Grus americanus*, in the flesh, from Texas. 26633.

Coville, F. V. (Department of Agriculture). Vegetable products from California. 26195.

Coyne, P. J. (Greaterville, Ariz.). Stone resembling the conical pipes common on the California coast. 26020.

COX, PHILIP (St. John, New Brunswick, Canada). Four specimens of a cryprinoid fish (*Couesius prosthemius*) from Loch Lomond, near St. John, (27086); alcoholic specimens of fishes (*Phoxinus* and *Semotilus atromaculatus*) (28080); 2 specimens of winninish (*Salmo salar*, var) from Loch Lomond (27127).

COX, P. E. (Franklin, Tenn.). Eight arrow-heads and a perforator (26881). (See under W. E. Cullum.)

COX, W. V. (U. S. National Museum). Specimen of rhinoceros beetle, *Dynastes tityus*, from Brightwood (25916); 10 photographs (26063).

CRAM, JACOB (Sheldrake, N. Y.), through Fish Commission, U. S.) Alcoholic specimen of "mud-puppy," *Necturus maculatus*, from Cayuga Lake. 25972.

CRAWFORD, JOHN B. (Swanville, Ind.). Specimen of Luna-silk-moth. 26976.

CREW, H. W. (Hardin Valley, Tenn.). Pileated woodpecker, in the flesh. 25907.

CRITES, GEORGE W. (See under W. W. Scott.)

CROSBY, F. W. (Washington, D. C.). Specimens of hematite from the Isle of Elba (purchase) (26869); 2 columns of basalt from Bonn, Prussia (purchased for the World's Columbian Exposition) (26889); collection of geological materials from Messina, Italy (purchased for the World's Columbian Exposition) (27015); collection of volcanic material from Italy and adjacent islands (gift) (27065). (See under Dr. Krantz.)

CROSBY, Prof. W. O. (Massachusetts Institute of Technology, Boston, Mass.). Specimens of Cumberland iron ore from Newport, R. I. (26288)*; specimens of clay and concretions from Croton Point, N. Y. (26289)*; geological material from Frye's Hill, Lebanon, N. Y. (26290)*; glacial material from Mount Washington (26291)*; glacial material from the Catskill Mountains (26292)*; specimens of clay from New Windsor, near Newburg, N. Y. (26293)*; specimens of pegmatite and kaolin from Blanford, Mass. (26294)*; iron ore and hard asbestus from Tilly Foster mine, Tilly Foster, N. Y. (26295)*; calcareous cement, cut on Fitchburg railroad, near Pownal, Vt. (26296)*; glacial material (26297)*; geological material from Narragansett Bay (26298)*; granite fragments from Cape Ann, Mass. (26299)*; specimens of zinc, iron, and manganese ore from Brandon, Vt. (26300)*; stratified clay from Gardiner, Me. (26301)*; glacial material from Buffalo, N. Y.) (26302)*; vein material from Port Henry, N. Y. (26303)*; glacial material from near Buffalo, N. Y. (25304)*; bowlders and clay from New York (26305); specimens of glacial materials (26596)*; large polished slab of verdantique marble from Roxbry, Vt. (exchange) (26603); through G. P. Merrill, specimen of baltimorite from Tilly Foster mine, Putnam County, N. Y., collected by Mr. Crosby (26626); photograph negatives of glacial phenomena (26650)*; 5 photographs of diabase dike at Medford, Mass., showing phases of rock decomposition (exchange) (26884).

CROSS, WHITMAN. (See under Interior Department. U. S. Geological Survey.)

CULIN, STEWART (Philadelphia, Pa.). Four packs of American cards and 1 pack of English domino cards (exchange) (25908); set of time-sticks from Hongkong (gift) (26003); "The Waterloo Medal," a quarto illustrated volume, by Isaac Myer, descriptive of the Napoleon medal known as the Waterloo medal (deposit) (returned) (26012); pack of old English playing-cards (gift) (26928); 7 photographs representing objects used in religious observances (27071).

CULLOM, W. E. (Dickson, Tenn.), through P. E. Cox. Discoidal stone from Tennessee. Deposit. 26882.

CUNNINGHAM, BURTON L. (Fort Klamath, Oreg.). Lepidoptera. 26157.

CURTIN, Hon. JEREMIAH (Queenstown, Ireland). Photograph of an Irish quern, or hand-mill. 27117.

CURTIS, WILLIAM E. (See under Bureau of American Republics.)

CUSHING, F. H. (Bureau of Ethnology). Parts of aboriginal weaving (deposited for World's Columbian Exposition) (26513); rabbit-skin robe (gift) (26963).

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* Purchased for World's Columbian Exposition.

CUTLER, H. D'B. (Glenwood, Mo.). Hen's egg. 26848.

DALL, W. H. (See under Interior Department. U. S. Geological Survey; and J. D. Mitchell.)

DALSHEIMER, SIMON (Baltimore, Md.). Photographs of paintings illustrating Jewish ceremonies (26054); arbâ Kanforth—Jewish ceremonial garment (26165).

DANA, Prof. E. S. (See under Yale College.)

DANIEL, F. M. (Mammoth Spring, Ark.). Moths. 25971.

DANIEL, Prof. E. (Omaha, Nebr.). Shells, plants, woods, minerals, rocks, and soils from Mexico. 27131.

DANIELS, L. E. (Morris, Ill.). The counterpart of type of *Neuropteris Clarksoni*, Lx., var. *minor* D. W. 26966.

DANIELS, WILLIAM H. (Fairhaven, Wash.). Two specimens of *Rosalia funebris*. 26052.

DAVIS BROTHERS (Diamond, Ohio). Two stone implements from Mahoning County and 1 from Portage County. 26621.

DAWES, Mrs. W. C. (Tip Top, Ariz.) Red mite (*Trombidium*, sp). 26125.

DAY, Dr. DAVID T. (See under Charles de Struve.)

DEMING, N. L. (New York City). Specimen of tree-cricket, *Ocanthus bipunctatus*, De Geer. 26190.

DENHARDT, GUSTAV. (See under William Astor Chanler.)

DESERET MUSEUM (Salt Lake City, Utah), through J. E. Talmage. Selenite from the southern part of Utah (gift) (26768); selenite crystals (exchange) (27087).

DE STRUVE, Mr. CHARLES (Envoy Extraordinary and Minister Plenipotentiary from Russia), through Dr. David T. Day. Cinnabar from Ekaterinoslav, Russia. 26089.

DETROIT AND CLEVELAND STEAM NAVIGATION COMPANY (Detroit, Mich.). Framed picture of steamer *City of Detroit*. 26342.

DEUTSCH, Prof. G. (Hebrew Union College, Cincinnati, Ohio). Manual of domestic devotion (Hebrew in manuscript). Lent for World's Columbian Exposition. 26616. Returned to owner.

DEVEREUX, Mrs. (See under National Society of the Daughters of the American Revolution.)

DIVINE, WILLIAM (San Antonio, Tex.). Vegetable substance resembling cotton from mountains in San Luis Potosi. 26495.

DEXTER, LEWIS (U. S. consul, Fayal, Azores). Shells, crustaceans, worms, sea-urchins, starfishes, and other marine invertebrates (26026); alcoholic specimen of *Trochosa madeirana*, alcoholic and dry marine invertebrates, and alcoholic mollusks (27016); 60 dried specimens of starfishes, alcoholic starfishes, sea-urchins, and specimens of *Scyllarus* (27129).

DEYROLLE, EMILE (Paris, France). Series of models showing development of fowl. Purchased for World's Columbian Exposition. 26664.

DICKEY, F. W. (East Smithfield, Pa.). Specimen of *Spirifera disjuncta*. 26886.

DILLE, FREDERICK M. (Denver, Colo.). Eggs of American magpie, showing variation in size, shape, and color. 26761.

DILLER, Dr. J. S. (See under Interior Department. U. S. Geological Survey).

DILYARD, ALBERT (Fredericksburg, Ohio), through I. Greegor. Primitive lamp. 26019.

DISMUKES, G. W. (St. Augustine, Fla.). Specimen of sphinx-moth, *Chærocampa tersa*. 26226.

DODGE, Mrs. K. T. (Fort Bayard, N. Mex.). Coleoptera (*Eleodes longicollis* and *Prionus californicus*). 26152.

DORSEY, Rev. J. OWEN. (See under Mrs. Helen McMurdy.)

DOW, Mrs. E. K. (New York City). Seven skins of Paradise trogon, *Pharomacrus Mocini*, from Guatemala. Purchase. 27125.

DOWNS, A. C. (Realitos, Tex.). Armadillo, in the flesh (purchased for World's

Columbian Exposition) (26079); specimens of cactus for armadillo group (for World's Columbian Exposition) (26082); armadillo, in the flesh (purchase) (26098).

Dresser, H. E. (London, England). Four birds' skins, from India and Korea. Exchange. 25966.

Dubois, James T. (Washington, D. C.). Ochre from Patuxent Camping Ground, Anne Arundel County, Md. 27046.

Dugès, Prof. A. (Guanajuato, Mexico). Eel, *Symbranchus* sp., from Tapijulapa River (26707); 2 specimens of *Penæus setiferus*, 2 specimens of *Pseudothelphusa*, and 1 specimen of *Cambarus* (27048). (See under William Hampton Patton.)

Durand, John (Paris, France). Seventeen plaster casts of objects representing Greek, Roman, and Assyrian religious observances. Purchased for World's Columbian Exposition. 26818.

Durden, Henry S. (San Francisco, Cal.). Aragonite "onyx marble" from Sulphur Creek, Colusa County, Cal. 26588.

Du Buysson, H. (Chateau du Vernet, per Brout-Vernet (Allier), France). Seventy-one species of European diptera, hymenoptera, and coleoptera. Exchange. 26181.

Easterbrook, F. D. (Warren, R. I.). Water-worn pebble. Deposit. 27100. Returned.

Edwards, B. M. (Marshall, N. C.). Specimens of rhinoceros beetle, *Dynastes tityus*. 26156.

Edwards, J. (Ramelton, Ind.). Stag-beetle, *Lucanus elaphus*. 26438.

Edwards, Vinal N. (Wood's Holl, Mass.) Alcoholic specimens of Spanish sardine (*Clupea pseudohispanica*). 26351. (See under Fish Commission, U. S.)

Egleston, Dr. T. (Columbia College, New York City). Limonite carving from Japan. Purchase. 26514.

Elliott, William F. (DeKalb, Ill.). Powder-horn. Deposit. 26455.

Ellis, C. C. (acting consular agent, Rangoon, India). Collection of Burmese musical instruments and 2 photographs; 2 Burmese games. 26703.

Elrod, Prof. M. J. (Des Moines, Iowa). Birds' skins. Exchange. 27126.

Elson, A. W. & Co. (Boston, Mass.). Photogravure "Portrait of Washington," after Stuart. 26717.

Elvin, R. J. (Indianapolis, Ind.). Two original parchment commissions of U. S. land officers, signed by President John Quincy Adams and President James Madison; also a series of State bank notes, national fractional paper money, and Confederate States paper money. Deposit. 26413.

Emerson, B. K. (See under Interior Department. U. S. Geological Survey.)

Emerson, Charles H. (Whitehall, N. Y.). Four boomerangs, and boomerang gun. 26725.

Emmett, Mrs. R. A. (London, England). Model of rockweed for octopus group (26868); skin of Swallow (*Chelidon rustica*) from England (27039). Purchased for World's Columbian Exposition.

Emmons, Lieut. G. T., U. S. Navy. "Steel" for strike-a-light, from Sitka, Alaska, illustrating one of the kind made by the Russians for trading (26453); photograph of Upper Lake doctor with his wives, and horn spoon of the Tlingit Indians (26494); unhairing tool used by the Tlingit Indians (27063).

Emmons, S. F. (U. S. Geological Survey). Twenty-five specimens of cretaceous and eocene fossils from Lower California. 27057.

English, F. H. (Colfax, Wash.). Horntail (*Tremex columba* Fab.). 26031.

English, George L. & Co. (New York City). Slab of grossularite and vesuvianite in calcite from Morelos, Mexico, pyroxene in calcite from St. Lawrence County, N. Y., agate from Brazil, smoky quartz from St. Gothard, Switzerland, 3 specimens of crocidolite quartz from Griqua Land, South Africa, and a specimen of prehnite from New Jersey, (26540); 3 cut stones of willemite from New Jersey, calcite from Egremont, Cumberland, England, and sphalerite from the same locality (26586); stalactites from Copper Queen Mine (26861). Purchased for World's Columbian Exposition.

ESLICK, JAMES A. (Helena, Mont.). Frog. 26597.

EVANS, J. M. (Kentucky). Rhinoceros-beetle, *Dynastes tityus*. 26359.

EVANS, W. H. & SON, (Knoxville, Tenn.). Marble from Champion and Knox quarries, also rain-eroded limestone and cement rock from near Knoxville, collected by Mr. George P. Merrill. 25951.

EVERMANN, Prof. B. W. (U. S. Fish Commission). Three eggs (1 set) of European snipe, sets of eggs of pintail-duck, Lapland-longspur, and sandwich-sparrow from Alaska (26658); 4 specimens of *Etheostoma Shumardi* from Indiana, 4 specimens of *Etheostoma evides* from the same locality, and 4 specimens of *Aphredoderus Sayanus* from Texas (26789). (See under Fish Commission, U. S.).

FALCONER, J. M. (Brooklyn, N. Y.). Ball of etching ground (part) wrapped in silk, and a silk dapper for laying ground. 26170.

FARRINGTON, O. C. (Arlington Heights, Mass.). Photograph negative of glacial phenomena in Massachusetts (26660); glacial pot-hole (27079). Purchased for World's Columbian Exposition.

FEA, L. (Museo Civico di Storia Naturelle, Genoa, Italy). Collection of mammal skins. Purchase. 27003.

FERNALD, Prof. C. H. (Amherst College, Amherst, Mass.). Type specimen of *Choreutes coloradella* fern. 26693.

FEWKES, J. WALTER (Boston, Mass.). Photographs illustrating Moki ceremonies. 27102.

FIGGINS, J. D. (Washington, D. C.). Box-turtle from Maryland. 27031.

FISH COMMISSION, U. S:

Through Col. Marshall McDonald, Commissioner: Amber-fish, *Seriola Lalandi*, from Wood's Holl, Mass. (25909); collection of alcoholic actinians made by steamer *Albatross* during the voyage from Washington to San Francisco, 1887–1888 * (25924); 11 specimens, representing 3 species, of crustaceans from North Carolina, collected by Dr. Hugh M. Smith during April, 1892 (25973); builders' model of steam-yacht (deposit) (26092), builders' model of steam-launch (deposit) (26093), skull of sturgeon (26264); fur seal from St. Paul Island, Alaska (male); Steller's sea-lion from Light-house Rocks, Alaska, and skull of walrus and bones collected in the summer of 1890 by the steamer *Albatross;* lithological specimens from Herendeen Bay, Alaska, collected by the *Albatross;* fossil shells and fossil plants † from Herendeen Bay, collected by Mr. Charles H. Townsend of the *Albatross* (26375); shells from Guadalupe Island, Lower California, collected during the cruise of the schooner *Santa Barbara*, under charge of Mr. Charles H. Townsend; volcanic rocks, adult male and female sea elephant and young male, collected from the same locality and during the same cruise (26376); 40 specimens, representing 25 species, of birds' skins from South Dakota and Wyoming, collected by Prof. B. W. Evermann; 12 mammal skins from South Dakota, including 2 specimens of *Cinomys*, 3 specimens of *Sciurus*, 4 specimens of *Tamias*, one specimen of *Mus*, and 2 specimens of *Neotoma*, also collected by Prof. Evermann (26449); 6 specimens of young sturgeon (*Accipenser sturio*) from the Delaware River (26461); types of marine fishes from the collections of the Fish Commission, described by Dr. David S. Jordan and Prof. Charles H. Gilbert; fishes collected by U. S. Fish Commission schooner *Grampus* from the Gulf of Mexico (26479); collection of fishes made by the *Grampus* on the

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* This collection is described in Proceedings U. S. National Museum, Vol. XVI, 1893, p. 119.

† A report on the specimens is published in Proceedings U. S. National Museum, Vol. XVII, 1894, p. 207.

tile-fish grounds, during the summer of 1892, consisting of *Squalus acanthias, Scylliorhinus retifer, Conger conger, Phycis tenuis, Phycis chuss*, and *Merlucius bilinearis* (26552); crustaceans obtained chiefly by the steamer *Albatross* in the North Pacific Ocean * (26567); type specimens of 27 new species of fishes collected by the *Albatross* in the Pacific Ocean, principally off the coast of Lower California (26574); water-snake, *Natrix*, collected by Dr. Henshall in west Florida (26669); alcoholic specimens of reptiles and batrachians collected in Iowa, Nebraska, and South Dakota by Prof. B. W. Evermann (26699); skin and skeleton of California sea-lion, *Zalophus*, obtained by the steamer *Albatross* in San Luis Gonzales Bay, Gulf of California (26710); 31 specimens of birds' skins collected by Mr. C. H. Townsend and Prof. Evermann in Alaska during the cruise of the *Albatross* in the summer of 1892 (26739); 11 specimens of Pacific coast fishes from the collections of the *Albatross*, consisting partly of the types of new species described by Prof. C. H. Gilbert, comprising *Icelinus cavifrons* G; *Citharichthys fragilis* G; *Citharichthys xanthostigma* G; *Icelinus filamentosus* G; *Symphurus fasciolaris* G; *Plectobranchus evides* G; *Ilyophis brunneus* G; *Zaniolepis frenatus* Eigenmann; *Platyglossus dispilus* Günther; *Chænomugil proboscideus* Günther (26745); 2 specimens of grunt and a parrot-fish (26766); specimen of lumpfish (*Cyclopterus lumpus*) captured by John A. Clampett, keeper of life-saving station at Lewes, Del. (26840); bronze commemorative medal conferred by the Columbian Historical Exhibition at Madrid, 1892, in recognition of the exhibit of the U. S. Fish Commission (deposited by the Fish Commission) (26987.)

Through Richard Rathbun, Acting Commissioner: Eggs of conch-shell and a collection of pressed plants, lichens and mosses, obtained by Prof. B. W. Evermann from Alaska during the summer of 1892, while engaged as naturalist on steamer *Albatross* (26822); specimens of pteropods and heteropods collected by the *Albatross* during the voyage from Norfolk to San Francisco in 1887–1888 (26961).

Through Dr. T. H. Bean: Alcoholic specimens of fishes used in connection with the exhibit for the World's Columbian Exposition (26792); 34 birds' skins, representing 16 species, collected by Vinal Edwards at Wood's Holl, and alcoholic specimen of reptiles collected by Theodor Holm (26820).

Through Mr. Barton A. Bean: Land and fresh-water shells, representing 6 species. from Spokane, Wash. (26788). (See under Jacob Cram, W. C. Harris, and William Ross Harris.)

Fisher, Dr. A. K. (Department of Agriculture). Four hundred and ninety-six specimens (157 sets) of birds' eggs, and 19 nests. 26531. (See under Department of Agriculture.)

Fisher, John (Deer Lodge, Mont.). Specimen of beetle (*Ergates spiculatus* Lec), 26110.

Flanagan, A. H. (Radford, Va.). Black-capped night heron. 26970.

Flechter, Victor S. (New York City). Harp-lute from England (26427); Viola d'amore (26484). Purchased for World's Columbian Exposition.

Flint, H W. (New Haven, Conn.). Twenty-eight specimens, representing 7 species of birds' eggs (26173); set of eggs of seaside-sparrow, nest of blue-winged warbler, and nest of short-billed marsh wren (26273).

Flood Brothers (Malden, Mass.). Eighty specimens of coleoptera, mostly from Tasmania. 26191.

Flügel, Dr. Felix (Leipzig, Germany). Two volumes and photographic atlas—Mekka, by Dr. C. Snouck Hurgronje. 26242. Purchased for World's Columbian Exposition.

Foote, A. E. (Philadelphia, Pa.). Engraved portraits of Chevreul, D'Arcet, Brongniant, and nine other men of science (purchase) (25946); 2 photographs of

* Specimens identified by J. E. Benedict and Miss M. J. Rathbun, of the National Museum.

meteoric iron from Cañon Diablo, Arizona (gift) (26144); 18 specimens of minerals from various localities; specimens of spinel, quartz after coral, selenite, celestite, laumontite, hematite, and a slab of hypersthene; specimens of crocoite, native sulphur, and brookite; 32 specimens of minerals from various localities (26539, 26833, 26834, 26875) (purchased for World's Columbian Exposition); specimen of anglesite on galena from Sardinia (gift) (26876).

FORD, H. CLAY (Washington). Grayhound, *Canis familiaris*, in the flesh. 26806.

FORD, T. C. (Aberdeen, S. Dak.). Five sketches of stone circles and figures from McIntosh County, N. Dak. 26779.

FOREST AND STREAM PUBLISHING COMPANY. (See under J. Ridler.)

FORRESTER, R. (Scofield, also Castle Gate, Utah). Specimen of *Pholadomya Kingii* (26000); fossil plants from the Laramie group (26096); rocks (26411); fossil Ophiuran (26690); 6 specimens of *Chemnitzia Coalvillensis*, Meek? (27054).

FOWLER, F. HALL (Fort Huachuca, Ariz.). Set of eggs of white-necked raven; set of eggs of scorched horned lark (the latter new to the collection) 26219.

FOX, WILLIAM J. (Academy of Natural Science, Philadelphia, Pa.). Three type specimens of *Odynerus Aldrichii* Fox (gift) (26952); 64 specimens, representing 19 species of hymenoptera, 6 species of hemiptera, and 3 species of diptera from Jamaica (exchange). (26274.)

FRANCIOLINI, LEOPOLD (Florence, Italy). Collection of musical instruments. Purchase. 26256.

FRANCIS, JOSEPH (Minneapolis, Minn.). Books and papers pertaining to Mr. Francis' inventions and travels. 26760.

FRAZAR, G. B. (West Medford, Mass.). Three hundred archæological objects consisting of rude and leaf-shaped implements, arrow and spear-heads, hammerstones, rubbing-stone, broken hatchet and pebbles slightly worked from Blackman's Point, Marshfield, Mass.; also small, rude, chipped implements, worked flakes, and other objects from "Goat's Acre," Arlington, Mass.; specimen of peat and piece of volcanic rock, two specimens of chabazite and stilbite from Nova Scotia. Exchange. 26569.

FREDD, JOHN J. (Pottstown, Pa.) Specimens of "ringing rocks" from Montgomery County, Pa. 26217.

FREELAND, JOHN J. (Washington). Copper mold for making pewter spoons, supposed to be over 80 years old. 26599.

FRIEDENWALD, Dr. A. (Baltimore, Md.). Kiddush cloth. 26371.

FRIES, Dr. T. (See under University of Upsala.)

FRY, Mrs. H. L. (New York City). Cane used by Ebenezer Fry, a soldier of the Revolution, who was wounded at the battle of Bunker Hill, June 17, 1775. 26776.

FULTON, HUGH (London, England). Two beetles (purchase) (27020); shells, representing 25 species (exchange) (27123).

GABEL, T. R. (Albuquerque, N. Mex.). Three specimens of onyx marble. 26684.

GABRILL CHICAGO PORTRAIT AND VIEW COMPANY (Chicago, Ill.). Eight photographs representing volcanic phenomena. Purchased for the World's Columbian Exposition. 26155.

GANTER, H. C. (Mammoth Cave, Ky.). Cave materials from the Mammoth Cave, collected by George P. Merrill for the World's Columbian Exposition (26154); 3 large and 1 small blind-fish, *Amblyopsis spelæus* (26794).

GATSCHET, Dr. A. S. (Seneca, Mo.). Modoc bow and arrow made by Sam Modoc, of Quapaw Reservation. 26323. (See under Smithsonian Institution. Bureau of Ethnology.)

GEOLOGICAL SURVEY OF TEXAS (Austin, Tex.), through J. A. Singley. Shells (26613); land-shells, representing 10 species, identified by Dr. Sterki (26813); fresh-water shells (26960).

GEORGE, W. A. (Forney, Tex.). Four specimens of an undetermined species of *Sphærulites*, and 1 specimen of *Ananchytes texana*, Cragin. 27139.

GERRARD, EDWARD (London, England). Three specimens representing 3 species of game birds (purchased for World's Columbian Exposition) (25996); 3 specimens of reptiles and amphibians (purchase) (26858).

GIGLIOLI, Prof. H. H. (Royal Museum, Florence, Italy), through Dr. G. Brown Goode. Two alcoholic specimens of scopeloid fishes (*Myctophum metapoclampum* and *M. Gemellari*), from the Mediterranean Sea. 25925. (See under Royal Museum, Florence, Italy.)

GILBERT, Prof. CHARLES H. (Leland Stanford Junior, University, Palo Alto, Cal.). Skull of common porpoise (*Delphinus delphis*). 26736. Returned. (See under Fish Commission, U. S.)

GILCHRIST, F. C. (Fort Qu Appelle, Canada). Alcoholic specimens of *Salmo mykiss, Salvelinus malma, Coregonus tullibee, Coregonus Williamsoni, Pogonichthys, Pimephales,* and *Eucalia inconstans.* 26972.

GILMAN, Dr. C. (See under Johns Hopkins University.)

GLENN, ROSCOE H. (Plankinton, S. Dak.). Specimens of miscellaneous insects from South Dakota. 26890.

GODBEY, S. M. (Chapel Hill, Tex.). Shells from Texas and California (26852, 26979).

GODDING, Dr. W. W. (Washington, D. C.). Copperhead-snake, *Ancistrodon contortrix.* 25920.

GOODE, Dr. G. BROWN (Assistant Secretary, U. S. National Museum). Decoration of the Legion of Honor of France, with crown and fleur-de-lis, as conferred during the Empire, and decoration of the Austrian Order of the Iron Crown (25906); New York Recorder solargraph (26037); musical instruments from Genoa, Italy (26410); 2 pair of castanuelas from Madrid, Spain; guallo and aborro from Granada; 5 perritos from Madrid (26532); string of imitation elk-teeth made from shells (26536); 3 dial compasses from Burgos, Spain, representing the time-pieces used there at present (purchased) (26543); a series of medals conferred for military service in Belgium, Italy, and Spain, and decoration of Belgian military order under Leopold in 1830, including Cuban Spanish campaign, 1873; Alfonso XII; Defenders of Bilboa; Pope Pius IX; Military Merit Medal of Belgium; Belgian Order, 1830; (26647); specimen of pine-mouse, *Arvicola pinetorum*, from Lanier Heights (27149); Dulzaina, from Biarritz, France. (See under Prof. H. H. Giglioli.)

GOWARD, G. (Chicago. Ill.). Three specimens of Korean pine nuts and one of tobacco. 26341.

GRANT, LOUIS B. (vice consul-general, Cairo, Egypt). Skin, skull, and leg-bones of Egyptian buffalo (purchased for World's Columbian Exposition) (26723); collection of Egyptian musical instruments (purchased for the National Museum by Mr. Grant at the request of the Secretary of the Smithsonian Institution) (25998).

GREEGOR, ISAIAH (Cuyahoga Falls, Ohio). Five-barreled pistol, patented in 1849 (deposit) (26515); 2 alcoholic specimens of *Murex fulvescens* and 5 marine-shells showing pathologic growth, mostly from Florida and the West Indies (26989); 4 specimens of shells showing interesting pathologic characters (26994). (See under Albert Dilyard.)

GREGORY, JAMES R. (London, England). Photograph of the large Youndegin meteorite (metoric iron) found at Youndegin, western Australia, in 1891. 27034.

GREEN, ERNEST S. (San Diego. Cal.). Stalactite needles from Fort Stanton Cave, Lincoln County, N. Mex. 26078.

GREENE, A. S. (U. S. Navy). African spear. 26222.

GREENE, F. W. (Washington, D. C.). Pair of antlers of moose (*Alces machlis*). Deposit. 26790. Returned.

GRIDER, R. A. (Canajoharie, N. Y.). Collection of water-color sketches of historic powder-horns (26510); 30 sheets of water-color paintings of powder-horns (26639). Deposit.

GRIERSON, A. R. (Ellsberry, Ohio). Monticuliporoid coral growing on a gasteropod. 26821.

GRIFFIN, M. R. (Fredericksburg, Va.). Skin of muskrat and 2 skins of woodchuck. 26077.

GRIMSHAW, Mrs. JAMES (New Orleans, La.), through John A. Clark. An original daguerreotype of John James Audubon, taken at the age of 81 years. Deposit. 25915.

GROTH, Prof. P. (See under Munich Academy, Munich, Bavaria.)

GUNDLACH, Dr. J. (Puentes Grandes, Havana, Cuba). Specimen of *Agelaius assimilis* (desiccated) from the Isle of Pines, Cuba. 27148.

GUNTHER, C. F. (Chicago, Ill.). Etching and photograph of Columbus' portrait by Sir Antonio Moro. 26493.

GURLEY, Dr. R. R. (U. S. Fish Commission). Specimens of fishes from Four Mile Run, Carlin's, Virginia, consisting of *Noturus, Rhinichthys, Catostomus, Phoxinus,* and *Notropis.* 26576. (See under E. O. Ulrich.)

GURLITT, FRITZ (Berlin, Germany). Ten casts of Tanagra figures, illustrating Greek religions. 26944. Purchased for World's Columbian Exposition.

GUTHRIE, OSSIAN (Chicago, Ill.). Copper drift bowlder (26856); bowlder from glacial drift (26899.) Purchased for World's Columbian Exposition.

HAINES, BENJAMIN (New Albany, Ind.). Twenty-five photographs of Wyandotte caves (purchased for World's Columbian Exposition) (26128); 34 photographs of the Mammoth Cave, Kentucky, for the World's Columbian Exposition (26306).

HALDERMAN, Gen. JOHN A. (Metropolitan Club, Washington). Siamese newspaper and story. 26462. (See under Dr. S. J. Smith.)

HALES, HENRY (Ridgwood, N. J.). Silver-grey dorking fowl (gift) (26564): collection of ancient pueblo pottery and implements (purchased for World's Columbian Exposition) (26917).

HALLOCK, CHARLES (Goshen, Mass.). Certificate of book copyright issued in the southern district of Georgia, entitled "Confederate States of America," June 13, 1863. 26004.

HAMLIN, HOMER (San Diego, Cal.). Post pliocene fossils from Coronado Beach, San Diego. 26013.

HAMMERBACHER & NORRIS (Baltimore, Md.). Pair of shoes. 26478.

HAMMITT, J. M. (Pittsburg, Pa.). Perforated mussel shell found in what is supposed to have been an old Indian camp or fort. 26515.

HARRIMAN, D. G. (See under Wyandance Brick and Terra Cotta Company.)

HARRINGTON, MARK W. (See under Capt. Frank P. Spratt.)

HARRIS, FRANK (La Crescent, Minn.). Birds' eggs (exchange) (26573); set of eggs of prothonotary warbler (gift) (26636).

HARRIS, GEORGE A. (Chicago, Ill.). Specimen of cecropia silk-moth. 25892.

HARRIS, GEORGE E. (Cassville, Mo.). Salamander from Giddis Hollow, Mo. (26045); 17 salamanders (26090); through Dr. L. Stejneger, larva of royal walnut-moth, *Citheronia regalis,* (26161); sand for glass-making (26857); 2 specimens of zinc ore (26883).

HARRIS, W. C. (New York City), through U. S. Fish Commission. Specimen of little cusk, *Ophidium grœllsi*, from Cedar Keys, Fla. 27140.

HARRIS, WILLIAM R. (Tyler, Tex.), through U. S. Fish Commission. Unios from Texas (26759); Unios principally from fresh waters of Texas (25987).

HARRON, L. G. (See under B. A. Bean.)

HARTMAN, JOSEPH (Pittsburg, Pa.). Three specimens of *Euryomia inda* from near New Galilee, Pa. 26100.

HARVEY, Rev. M. (St. John's, Newfoundland.) Five specimens of Allen's Newfoundland ptarmigan, *Lagopus lagopus Alleni,* and 2 specimens of Welch's ptarmigan, *Lagopus welchi* (26901, 26902).

HASBROUCK, E. M. (U. S. National Museum). Snake (*Lampropeltis rhombomaculatus*) from Bethesda Park, Md. (26357); 2 specimens of flying-squirrel, *Sciuropterus volucella* (26925); specimen of Henslow's sparrow, *Ammodramus Henslowi*, from the vicinity of Washington, D. C. (27090).

HASSALL, ALBERT. (See under Department of Agriculture.)

HAUPT, Prof. PAUL. (See under Johns Hopkins University.)

HAWKINS, ANDREW. (See under Dr. W. T. Owsley.)

HAWKINS, A. P. (New York City). English guitar and lyre-guitar. 26512. Purchased for World's Columbian Exposition.

HAY, W. P. (Washington, D. C.). Salamander (*Hemidactylium scutatum*) from Mount Vernon, Virginia (26314; large conglomeration of clay-cells of the mud-wasp (*Pelopæus cementarius*) (26447); alcoholic specimens of *Cambarus pellucidus* from Shiloh Cave, Indiana, and *Cambarus pellucidus Testii* (types) from Mayfield's Cave, Indiana (26992).

HAYNES, J. E. (Newark, N. J.). Photographs of "Early Settlers Monument" erected by the city of Newark in 1889, in memory of the first settlers of the town in 1666. 26971.

HAYWOOD, HOWARD (Raleigh, N. C.). Stone implements. 26653.

HAZEN, JOHN MCLEAN (Washington, D. C.). Military uniform, epaulettes, shoulder-straps, sash, field-glasses, and headquarters flag, used by Gen. Hazen; also captured Confederate flags. Deposit. 26913.

HEARD, AUGUSTINE (U. S. Legation, Seoul, Korea). Twelve musical instruments from Korea. 26255.*

HELIOTYPE PRINTING COMPANY (Boston, Mass.). Photolithograph. 26714.

HEMPHILL, HENRY (San Diego, Cal.). Cuttlefish, with two extra specimens of the endostyle. 26914.

HENSHALL, Dr. (See under U. S. Fish Commission.)

HENSHAW, H. W. (Witch Creek, Cal.). Collection of reptiles and batrachians, scorpions and hair-worms (26995); herbarium specimens (27006); stone implement found near Santa Ysabel (27008); rattlesnake, lizards, and a spider (27049); reptiles (27076); nest of *Myiarchus cinerascens* formed in a stump of a tree (27120); 8 reptiles, 1 specimen each of *Vespertilio nitidus* and *Vesperugo hesperus* (27137). (See under Smithsonian Institution. Bureau of Ethnology.)

HEROUX, A. A. (Lawrence, Mass.). Jacobin pigeon. 26847.

HEWLETT, S. G. (Eastbourne, Sussex, England). Collection of rude chipped flint implements, worked flakes, scrapers, cores, hammer-stones, broken polished hatchets (retouched), pieces of calcined flint from plowed lands near Brachy Head, South Downs, Sussex, England, also a scraper made of ox-hoof with edge of iron. Exchange. 26537.

HERRERA, Prof. A. L. (Mexico, Mexico). Two eggs of *Pipilo fuscus*. 26542.

HILL, Dr. W. SCOTT (Augusta, Me.). Ten fragments of pottery from an Indian fireplace in the vicinity of Augusta. 26076.

HILLEBRAND, Dr. W. F. (See under Interior Department. U. S. Geological Survey.)

HITCHCOCK, FRANK H. (Department of Agriculture). Two eggs of *Accipiter velox* from Sandy Spring, Md. (26166); 2 skins of fox-sparrow, *Passerella iliaca* (26832); nest and 3 eggs of yellow-throated vireo from Medford, Mass. (27009).

HITCHCOCK, ROMYN (Washington, D. C.). Fourteen spectographic photographs made by Mr. Schumann, of Leipzig, Germany, in 1888, with a rough descriptive memorandum of each (26501); æolian dust collected from a house in Tien-Tsin, China, after a dust-storm (26509); clays and paint ores from Pennsylvania (27118).

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*These objects were purchased by Mr. Heard for the National Museum at the request of the Secretary of the Smithsonian Institution.

HOASE, HUGH P. (National Military Home, Ohio). Tobacco hawk-moth, *Protoparce celeus* Hub. 26030.

HODGE, F. WEBB (Bureau of Ethnology). Eleven arrows of the Pima Indians of southern Arizona. 26535.

HODGE, H. G. (York, Ill.). Chrysalis of milk-weed butterfly, *Danais plexippus* (26065); larva of walnut-moth, *Citheronia regalis* (26142).

HOFFMAN, Dr. W. J. (Bureau of Ethnology). Eleven decorations and medals consisting of the Order of the Crown of Steel, of Arancanea; Royal Order of Melusine; Order of Nicahu-et-Iftikhar, of Tunis; Order of the Liberator, of Venezuela; Royal Order of the Crown, of Prussia; Order of the Zaehringen Lion, of Baden; Ancient and Illustrious order of St. James, of Portugal; Great Golden Medal of Merit for Science and Art, Austro-Hungary; Royal Norwegian Golden Medal of Merit, with crown, Norway; Royal Ludwig Medal for Science and Art, Bavaria; and Military Medal of Merit for service as Surgeon in Franco-Prussian War. Deposit. 26982.

HOLLIS, FRED S. (Boston, Mass.). Quartzite bowlder from Deerfield River Valley. 26058.

HOLLIS, George F. (See under H. C. Moore.)

HOLM, Theodor (Department of Agriculture). Soft-shelled turtle from Eustis, Fla. 26811. (See under U. S. Fish Commission.)

HOLT, H. R. R (Takoma Park). Great Dane hound (*Canis familiaris*). 26741.

HOLZNER, Frank X. (See under Smithsonian Institution. U. S. National Museum and Dr. E. A. Mearns.)

HÖÖK, FRIDOLF (Vladivostock, Russia); through J. Lyall, acting U. S. consul, Singapore. Stone implements, fragments of pottery, shells, and other objects from Vladivostock. 27089.

HOPPING, RALPH (Keweah, Cal.) Ten specimens of coleoptera (26029); specimens of Californian coleoptera, representing 65 species (26193); Californian coleoptera, representing 47 species (27028).

HOURSTON, JOSEPH (Cumberland House, Saskatchewan, Canada). Green garnet. 26057.

HOUGH, WALTER (U. S. National Museum). Four chromolithographic posters of the Madrid Columbian Exposition. 26999. (See under Smithsonian Institution. U. S. National Museum.)

HOWARD, L. O. (See under J. B. Lembert.)

HOWELL, E. E. (Washington, D. C.). Minerals and other geological material (exchange) (26127); cleaned skeleton of striped bass, 18 inches long (purchased for World's Columbian Exposition) (26265); 14 specimens of minerals from varions localities, consisting of rutile, harmotome, chalcopyrite, marcasite, massive rutile, chrysolite, hyalite, and anhydrite (exchange) (26529); specimen of pink tourmaline in lepidolite from San Diego, Cal. (exchange) (26713); 48 specimens of minerals from various localities (purchased for World's Columbian Exposition) (26827); specimen of rubellite in lepidolite from San Diego County, Cal. (gift) (26828); slab of glacial polished limestone from Rochester, N. Y. (purchased for World's Columbian Exposition) (26938).

HUBBARD, Mrs. H. G. (Detroit, Mich.). Seventy-two specimens, representing 30 species of coleoptera illustrating the saline fauna of Great Salt Lake. 26032.

HUBBARD, L. L. (Cambridge, Mass.). Five specimens of noselite and haüynite from Prussia. 26390.

HUNTER, Mrs. LIDA (Dayton, Ohio.). Four specimens of fungus-beetle, *Boletophagus cornutus* Fab. 26140.

HURTER, JULIUS (St. Louis, Mo.). Rattlesnake (26049); 12 specimens of Unios from Missouri, 2 turtles from Missouri, and a salamander from Alabama (26394). Exchange.

HUTTON, F. W. (See under Canterbury Museum.)

IGLESTRÖM, L. J. (Sunnemo, Wermland, Sweden), through Prof. F. W. Clarke. Specimen of friedelite. 26431.

ILLINOIS AND MISSISSIPPI CANAL COMPANY (Moline, Ill.), through G. W. Vinton. Spade with which the first earth was thrown in the construction of the Illinois and Mississippi Canal. 27150.

IMPERIAL AUSTRIAN MUSEUM (Vienna, Austria), through Dr. F. Brauer. Types of 98 species of European *Muscidæ*, illustrating Brauer and Bergenstamm's classification. Exchange. 27101.

INDIAN MUSEUM (Calcutta, India), through A. Alcock. Alcoholic specimens of deep-sea fishes from the Bay of Bengal and Andaman Sea (exchange) (26671); through J. Wood Mason, superintendent, specimen of domestic yak (*Bos grunniens*), from Kalinpong, India (purchased for World's Columbian Exposition) (26887).

INGRAHAM, D. P. (Elmira, N. Y.). Three skins of American flamingo, *Phœnicopterus ruber*, from the Bahama Islands. Purchase. 26269.

INTERIOR DEPARTMENT:

From J. J. Noah: Original printed copy of the Ordinance of the Board of Treasury, dated April 16, 1787, signed by Samuel Osgood and Walter Lexington, appointing five commissioners "for stating the accounts" of the several States against the United States for moneys due on account of the Revolutionary war (26672).

U. S. Indian Office. From Dr. Z. T. Daniel (Cheyenne River Agency, S. Dak.; Blackfeet Agency, Piegan, Mont.; Keshena, Green Bay Agency, Wis.; Pine Ridge Agency, S. Dak.), through Prof. O. T. Mason: Rattlesnake (26048); stone pipe made by "Petrified," a Piegan Indian woman; primitive skin-scraper of polished elk-horn, also made by a Piegan squaw, and a shell ornament worn by braves of the same tribe (26282); medicine-pouch of a Blackfeet Indian (26349); small leaf-shaped implement found on Wolf River, Wisconsin (26470); 6 brass bracelets obtained from an old burial-mound of the Blackfeet Indians (26750); catlinite napkin-ring and 2 marbles of catlinite made by the Sioux Indians (26797); quirt held by Keokuk in his treaty with Gen. Scott, at Fort Armstrong, Ill., September 21, 1832 (27064); fruit-picker (27124); wooden pipe (27142). From Charles H. Thompson (special agent Indian Service), through Hon. John Noble, Secretary: Ghost-shirt taken from a ghost-dancer, and a gun also obtained from a participant in the Custer massacre (26235).

U. S. Geological Survey. Minerals from Colorado, collected by Prof. S. L. Penfield (25891); 150 specimens of Oriskany fossils from Schriver's Hill, Cumberland, Md., collected by C. D. Walcott (25945); specimen of babingtonite from Buckland, Mass., collected by B. K. Emerson (25986); 2 specimens of powellite from Seven Devils Mines, western Idaho, collected by Dr. W. H. Melville (26088); photograph of the Monticellite locality at Magnet Cove, Ark., collected by Dr. W. P. Jenney (26146); 39 mounted photographs taken by Prof. I. C. Russell, during his work in the State of Washington under the auspices of the Survey (26204); 3 specimens of diaspore and 1 specimen of corundum in emery, collected in Chester, Mass. (26280); specimen of mixed iron sulphates from near Las Vegas, N. Mex., collected by Dr. W. F. Hillebrand (26435); specimen of flint from the chalk-beds near Austin, Tex., collected by Dr. J. S. Diller (26437); 31 specimens of ptilolite from near Silver Cliff, Custer County, Colo., 28 specimens of crystallized alunite and 23 specimens of crystallized diaspore from the Rosita Hills, Custer County, Colo., collected by Whitman Cross (26456); specimen of amesite with diaspore in emery, specimen of diaspore with corundophilite, specimen of margarite, large crystal of ilmenite, from Chester, Mass.; 4 specimens of cerite from Bastnäs, Sweden; 3 specimens of warwickite in calcite from Edenville, Orange County, N. Y., collected by Prof. F. W. Clarke (26490); gold in malachite from Peacock Mine, Seven Devils district, Idaho, collected by Dr. W. H.

Melville (26584); 17 photographs, (26916); large collection, consisting of 34 specimens of Jurassic invertebrates, representing 4 species, from Wyoming and California, and 5,358 specimens, representing 56 species, of cretaceous invertebrates from the Western States and Territories (27094).

Through Prof. F. W. Clarke: One specimen, consisting of 54 pebbles, of josephinite (original material), from Josephine and Jackson counties, Oreg. (26016); 9 specimens of minerals from various localities, consisting of xenotime, ulexite, gummite, uranimite altering to gummite, cyrtolite, stalagmite marble, stibiconite, topaz, and fergusonite (26136); monozite from North Carolina (26587).

Through William H. Dall: Fossil mammalian bones from the Miocene formation of Maryland and Virginia, collected by Frank Burns (26119).

Through C. D. Walcott: One hundred specimens of Lower Devonian corals from Genesee County, N. Y. (25891).

INTERNATIONAL BOUNDARY COMMISSION. (See under Smithsonian Institution. U. S. National Museum.)

INTRAM, ROBERT (Chenowith, Wash.). Specimen of gordius. 26648.

JACKMAN, J. V. (Marlboro, Mass.). Four specimens of green talc on steatite. 26432.

JAMES, J. F. (Department of Agriculture). Barnacles and bryozoans from Asbury Park, N. J. 26581.

JARVIS, J. F. (Washington, D. C.). Four stereoscopic views of the Giant's Causeway, coast of Ireland. 26894.

JENNEY, Dr. W. P. (See under Interior Department. U. S. Geological Survey.)

JENNINGS, F. H. (Washington, D. C.). Bottle of Chinese medicine in original package. 26492.

JOHNS HOPKINS UNIVERSITY (Baltimore, Md.), through Dr. D. C. Gilman, president; cast of the Chaldean Flood Tablet, as reconstructed by Prof. Paul Haupt (gift) 27146.

JOHNSON, Prof. E. H. (Chester, Pa.). Two albums of American celebrities. Deposit. 26218.

JOHNSON, H. L. (Louisville, Ky.). Collection of 249 archæological objects, consisting of leaf shaped implements, perforators, scrapers, worked flakes, arrow and spear-heads, fragments of pottery (26285); collection of rude stone implements, flakes, and chips from an Indian workshop in Stewart County, Tenn. (26392). Exchange.

JOHNSON, J. H. S. (Kent, Wash.). Specimen of *Papilio zolicaon*. 26158.

JOHNSON, Judge L. C. (U. S. Geological Survey). Pitted stone found in Prentiss County, Miss. 26253.

JOHNSON, PAUL J. (Globe, Ariz.). Specimen of *Perezia Wrightii*. 25978.

JOHNSTON, F. B. (Washington, D. C.). Twenty-six photographs, representing views in and about Mammoth Cave, Ky. Purchased for the World's Columbian Exposition. 26130.

JOHNSTON, Mrs. WILLIAM PRESTON (New Orleans, La.). Baskets made by the Choctaw Indians of Black Bay, near Bay St. Louis, Miss. (gift) (26362); 14 baskets obtained from the Attacapas Indians of southern Louisiana (exchange) (26698).

JOHNSTON-LAVIS, H. J. (Naples, Italy). Marialite from near Naples (gift) (26055); 67 photographs, representing views of south Italian and Icelandic volcanoes (purchased for the World's Columbian Exposition) (26132).

JONES, J. J. (Department of the Interior). Eight photographs of famous English inventors. Exchange. 26568.

JONES, J. T. (Washington, D. C.). Specimen of Baltimore oriole, *Icterus galbula*. 26313.

JONES, Dr. L. C. (Melrose, Mass.). Five birds' skins, representing 4 species, consisting of green heron, *Butorides virescens;* pectoral sandpiper, *Tringa maculata;* red phalaropes, *Crymophilus fulicarius*, common tern, *Sterna hirundo*. 26641.

JORDAN, Dr. D. S. (Palo Alto, Cal.). Two type specimens of *Salmo mykiss aqua-bonita* from California, and type specimens of *Salmo kamloops* from Kamloop Lake, British Columbia (26379); type specimens of *Couesius Greeni* and *Pollachius chalcogrammus* (wall-eyed variety) (26985). (See under U. S. Fish Commission.)

JOUY, P. L. (U. S. National Museum). Two hundred obsidian flakes or knives from Jalisco, Mexico. 27143. (See under Smithsonian Institution. U. S. National Museum.)

KALDENBERG COMPANY, F. J. (New York City). Collection of objects illustrating the utilization of pearl, ivory, and horn (purchased for World's Columbian Exposition) (26772 and 26773); pearl-shell cut to illustrate its manufacture into buttons (gift) (26862).

KALDENBERG, F. R. (New York City). Whale and walrus tusks, with Japanese and Chinese carvings (purchased for World's Columbian Exposition). 26770.

KAYSER, WILLIAM (Wapakoneta, Ohio). Insects, representing 35 species. 26377.

KEAM, THOMAS V. (Keams Cañon, Ariz.), through W. J. McGee. Collection of fossil bones, collected by Mr. Keam in Arizona. 27072.

KEELY, THOMAS (Washington, D. C.). Living bat. 26622.

KEITH, JOHN (San José, Costa Rica), through Lieut. George P. Scriven, U. S. Army. Collection of beetles, representing 70 species of coleoptera from Central America. 26734.

KELLER, F. (Philadelphia, Pa.). Arabic mosque lamp and Moorish candlestick. Purchase. 25911.

KELLOGG, W. A. (Norwalk, Conn.). G. A. R. badge of Buckingham Post No. 12, representing the oyster industry, twenty-sixth National Encampment at Washington. 26229.

KEMP, Prof. J. F. (Columbia College, New York City). Specimens of eruptive rocks from New Jersey, New York, and Massachusetts. 26378.

KEMPTON, C. W. (Ore Blanco, Ariz.). Beetle (*Strategus julianus* Burm.). 26287.

KENYON, F. C. (Lincoln, Nebr.). Seven species of myriopods. 27005.

KEPPEL, F. & Co. (New York City). Etching by Samuel Coleman (26729); soft-ground etching by "old Crome" (26896). Purchased for World's Columbian Exposition.

KERR, M. B. (New York City). Specimen of crested grasshopper, *Tropidacris dux*, from Panama. 26583.

KERR, WALTER C. (New Brighton, N. Y.). Sponge from South Beach, Staten Island. 26949.

KERSHAW, C. E. (Holmesville, Miss.). Indian bead, found in a field near Holmesville. 25898.

KEYER, W. D. (Sprinfield, Mass.). G. A. R. badge of E. K. Wilcox Post No. 16, twenty-sixth National Encampment at Washington. 26231.

KILBORNE, Dr. F. L. See under Department of Agriculture.

KIMBER, JOSEPH F. (Williamsport, Md.). Two specimens of lunar-moth, *Actias luna*. 26006.

KIMMEL & VOIGT (New York City). Collection of electrotypes, matrices, and proofs to illustrate the electrotyping and printing of etchings, aquatints, etc. Purchased for the World's Columbian Exposition. 26952.

KINCAID, TREVOR (Olympia, Wash.). One hundred and twenty-one species of North American insects (mostly coleoptera). 25967.

KING, Dr. G. (See under Calcutta Botanic Garden.)

KINGSBURY, C. H. (Allen, Ind. T.). Fossil tooth of mastodon, dug out of a bank near Allen. 26107.

KINNEY, Mrs, L. C. (Washington, D.C.). Ten pictures belonging to the "Catlin Collection." Deposit. 27051.

KIRBY & SMITH (Passaic, N. J.). Pair of Langshan fowls. Presented for World's Columbian Exposition. 26676.

K. K. Hofmuseum (Vienna, Austria), through Dr. A. Brezina, curator. Fifty specimens of minerals from various European localities. Exchange. 26488.

Kloeber, Charles E. (Washington, D. C.). Quartz crystal from Crystal Mountain near Hot Springs, Ark., and a specimen of manganopectolite from Magnet Cove, Ark. 26575.

Knight, W. C. (Laramie, Wyo.). Two specimens of rough arrow-points, found on the west shore of Cooper Lake, Albany County (26844); 5 rude chipped implements (27055).

Koch, F. W. (Twin Oaks, Cal.). Red rattlesnake. Purchased for World's Columbian Exposition. 26163.

Koch, Capt. (See under Dr. D. B. Northrup.)

Koehler, S. R. (U. S. National Museum). Forty-eight prints (lent for exhibition at World's Columbian Exposition) (26721) (returned); 21 specimens illustrating the etching processes (lent for World's Columbian Exposition) (26926); 3 specimens illustrating methods of color-printing (27070).

Kohl, Henry (Boston, Mass.). Photochromo-lithograph "Japanese Girl," after R. Blum, proof. Lent for World's Columbian Exposition. 26719. (Returned.)

Krantz, Dr. (Bonn, Prussia), through F. W. Crosby. Basaltic column. Purchased for World's Columbian Exposition. 26921.

Kuehling, J. H. (Washington, D. C.). Two specimens of hog-nose snake (25974); 2 snakes from Mount Vernon, Va. (26279); 2 flying-squirrels, in flesh (26384); snake (*Diadophis punctatus*) (26691).

Kulle, Albert (Washington, D. C.). Two turtles. 27032.

Kunz, George F. (New York City). Fifty brass eikons, 2 priests' robes, altar-covers, 2 silver ceremonial objects, gilded jar, glass jeweled crown, 6 wooden eikons, and embroidered insignia of an altar-boy (purchase) (25900); 2 etchings of meteoric iron from Glorieta Mountain, Santa Fé County, N. Mex., showing widmanstätten figures, one printed direct and the other from a copper electrotype (gift) (26143); 4 samples of platinum and platinum gravels from the Demidoff estate, Perm, Ural Mountains, European Russia (gift) (26617). (See under Smithsonian Institution. Bureau of Ethnology; and J. L. Story).

Lacoe, R. D. (Pittston, Pa.). Paleozoic plants (26102, 26965 *).

Lamb, T. F. (Portland, Me.). Photograph of a tourmaline crystal in quartz from Auburn. 26147.

Lamborn, Dr. R. H. (Washington, D. C.). One-dollar gold coin, 27 G (A. Bechtler, Carolina gold); one-dollar gold coin, 30 G (C. Bechtler, Carolina gold); five-dollar gold coin, 128 G (C. Bechtler, Georgia gold). Deposit for World's Columbian Exposition. 26935.

Lampard, Henry (Montreal, Canada). Rocks from near Montreal, and 8 specimens of calcite from the same locality. 26363.

Lander, W. Tertsh (Williamston, S. C.). Specimen of tuckahoe, or Indian bread. 26589.

Lane, Mert (Waynesville, Mo.). Spider (*Argiope riparia*), with egg-cocoon (26308); specimen of *Lycosa* sp. (26458).

Langdale, J. W. (Washington, D. C.). Native sulphate of iron (gift) (26383); stalactitic calcite and aragonite from Weyer's Cave, Virginia (exchange) (26733); concretions from Lamond Station, Metropolitan Branch, Baltimore and Ohio Railroad (gift) (27116).

Langshaw, J. P. (Lawrence, Mass.). Two cocoons of cecropia-moth, and 9 cocoons of promethea-moth. 26825.

Lansinger, W. H. (Littletown, Pa.). Royal walnut-moth, *Citheronia regalis*. 26005.

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* These two sendings form the second and third installments of a large collection of selected paleozoic plants presented by Mr. Lacoe.

LANO, ALBERT (Madison, Minn.). Nineteen specimens, representing 12 species of birds' skins, from Minnesota and Oregon. Exchange. 26554.

LANTHIER, L. A. (New York City). French harp. Purchase. 26533.

LARNER, JOHN Q. (U. S. Bureau of Engraving and Printing, Washington). Coot (*Fulica americana*). 26389.

LARTIGUE, Dr. G. B. (Blackville, S. C.). Arrow-head of quartz crystal. 25984.

LASSIMONNE, S. E. à Yseure (Allier), France. Dried plants from the interior of France. Exchange. 26208.

LATTIN & Co. (Albion, N. Y.), through Capt. C. E. Bendire, U. S. Army. Two specimens (male and female) of Magathan yellow-throat, *Geothlypis poliocephala* from Brownsville, Tex. 27011.

LATTIN, LOUNT (Staatsburg, N. Y.). Pair of black Java fowls. Gift for World's Columbian Exposition. 26667.

LATTINE, GEORGE W. (Newburyport, Mass.). G. A. R. badge, Department of Massachusetts. 26230.

LEE, THOMAS (care of U. S. Fish Commission). Ethnological objects obtained from graves and through other sources in southeastern Alaska. 27106.

LEIGHTON, J. F. (See under Ozark Onyx Company.)

LEMBERT, J. B. (Yosemite, Cal.), through L. O. Howard. Two specimens of *Colias Behrii*. 26051.

LENTZ, W. M. S. (Allentown, Pa.). Blue-tailed turbit pigeon. 26477.

LESSER & SAWYER (Winslow, Ariz.). Typical specimen of Cañon Diablo meteorite. 27105.

LEVY, L. E. (Philadelphia, Pa.). Pamphlet entitled "A new Photo-Intaglio Process" by Mr. Levy. 26612.

LEVY, R. J., Tarakdjilar Han, Stamboul, Constantinople. Illuminated Koran. Deposit. 26953.

LEWIS, G. A. (Wickford, R. I.). Lumpfish (*Cyclopterus lumpus*). 27035.

LIGHTFOOT, JEROME (Terrace Heights, Washington, D. C.), through Dr. Leonhard Stejneger. Two specimens of Helgrammites (larvæ of *Corydalus cornutus*). 26225.

LINCOLN, J. M. (New York City). Fossil teeth of *Oxyrhina hastata* and *Carcharodon megalodon*. 26594.

LITTLE, Dr. J. W. (Washington, D. C.), through Prof. O. T. Mason. Spider (*Epeira insularis* Hentz). 26364.

LITTLEJOHN, CHASE (Redwood City, Cal.). Egg of Nelson's ptarmigan from Unalashka Island, Alaska. New to the collection. 26352.

LOGAN, Mrs. W. P. (See under Caroline M. Northam.)

LOOMIS, Rev. HENRY (Yokohama, Japan). Crustaceans, echinoderms, hydroids, and shells from Japan. 26708.

LÖNNBERG, Dr. E. (Orlando, Fla.). Alcoholic specimens of *Etheostoma quiescens* Jordan and *Elassoma evergladei*. 26678.

LOVETT, EDWARD (Croydon, England). Stone implements, flints, human leg and arm-bones, fragments of crania from England, Ireland, Germany, and Belgium; also ethnological objects and a photograph. Exchange. 27077.

LOWDERMILK, W. H. & Co. (Washington, D. C.). Five Japanese scroll pictures, illustrating Aino life. Purchase. 25889.

LYALL, J. (See under Fridolf Höök.)

LYON, Mrs. ELIZA (Williamport, Pa.). Two large globes and stands, formerly the property of Dr. Priestley. 27050.

LYON, Mrs. Dr. THOMAS (Williamsport, Pa.). Piece of electrical apparatus belonging to Dr. Priestley. 26974.

LYONS, Prof. A. B. (Honolulu, Hawaiian Islands). Volcanic materials (26356, 26611). Purchased for World's Columbian Exposition.

MCASTRO, H. T. (See under Mrs. B. F. Poston.)

MCCONNELL, ALBERT E. (Washington, D. C.). Snakes from Virginia. 26782.

McCormick, L. M. (Smithsonian Institution). Specimens of *Necturus maculatus* from Lake Erie (26709); mounted specimens of Mexican crossbill, *Loxia curvirostra Stricklandi*, from Omaha, Nebr., (26878). Exchange. (See under C. A. Whitney.)

McDonald, A. F. (Wind Cave, S. Dak.). Stalactitic and stalagmitic material. Purchased for World's Columbian Exposition. 26969.

McDonald, Col. Marshall. (See under U. S. Fish Commission.)

McFarland, R. (Cumberland House, Hudson's Bay Company, Canada). Two albino minks (*Putorius vison*). 26380.

McGee, W. J. (See under Thomas V. Keam.)

McGuire, J. D. (Ellicott City, Md.). Apparatus for the manufacture of stone implements. 26504.

McIlhenny, E. A. (Avery, La.). Set of eggs of bobolink from southern Louisiana. (This gift is exeeedingly interesting on account of the locality, extending the breeding range of this species much farther south than had been previously known.) 26683.

McMurly, Mrs. Helen (Oneonta, N. Y.), through Rev. J. Owen Dorsey. Specimen of *Proteus* from Germany. Deposit. 25885.

Macfarland, Miss Alice (U. S. National Museum). House-sparrow (*Passer domesticus*), in the flesh. 26318.

Mager, Miss Ernestine (St. Boniface, Manitoba, Canada), through Dr. Cyrus Thomas. Temperance medal. 26160.

Mann, Rev. Albert (Newark, N. J.). Microscopic slides of diatoms. 26516.

Mann, Miss E. (Washington, D. C.). Collection of portraits of eminent men. 26595.

Mapel, H. B. (Columbus Grove, Ohio). Small leaf-shaped implements found *en cache* near Columbus Grove. 26765.

Marion Phosphate Company (Dunnellon, Fla.). Io-moth (*Hyperchiria io*). 26083.

Marsh, C. D. (through C. T. Simpson, U. S. National Museum). Slides of fresh-water crustaceans from Wisconsin. 27088.

Marsh, Charles H. (Dulzura, Cal.). Specimen of Western bat, *Vesperugo hesperus*, specimens of dusky-footed woodrats, *Neotoma fuscipes*, and 2 bats (25941, 26335) (purchased for World's Columbian Exposition), specimen of brown bat, *Vespertilio (?) nitidus*, specimen of *Adelonycterus fuscus*, and skin of bat (25942, 25943, 26117) (purchase).

Marshall, George (Smithsonian Institution). Two specimens of *Seiurus hudsonius* (25932); 2 specimens of hoary bat, *Atalapha cinerea*, and a specimen of shrew (*Blarina brevicauda*) from Laurel, Maryland (26336); 2 specimens of shrew (26397); specimen of pine-mouse, *Arvicola pinetorum* (26444); shrew (*Sorex* sp.), and red squirrel, *Sciurus hudsonius* (26517).

Marshall, Henry (Washington, D. C.). Birds' skins, representing 4 species from Laurel, Maryland (25944); American goldfinch, *Spinus tristis* (25961).

Marx, Dr. George (Department of Agriculture). Gossamer spider-web from Florida. 26769.

Mason, H. D. & Sons (Fabius, N. Y.). Golden Wyandotte fowl and hen (26846, 26980).

Mason, J. T. (Jalapa, Mexico), through Prof. C. V. Riley. Two hundred and eighty-eight specimens of coleoptera, 3 specimens of hemiptera, and 5 specimens of orthoptera. 26948.

Mason, J. Wood. (See under Indian Museum.)

Mason, Prof. O. T. (U. S. National Museum). Specimen of emperor-moth *Eacles imperialis*, from Mount Vernon, Va. (25970); robber wasp, *Sphecius speciosus*, and specimen of dog-day cicada, *Cicada tibicen* (26067). (See under Dr. Z. T. Daniel, Dr. J. W. Little.)

Matthews, W. (Fort Wingate, N. Mex.). Salamander (*Amblystoma tigrinum*). 26009.

MAXWELL, J. A. (Fulda, Minn.). Fragment of pottery found on the shore of the lake. 27060.

MEAD, C. H. (Sayreville, N. J.). Small collection of fossils from the Potomac formation (26047); fossil plants (26075, 26118, 26192, 26311). Exchange.

MEARNS, Dr. EDGAR A., U. S. A. (International Boundary Commission). The following collections have been obtained by Dr. Mearns for the Museum, while engaged with the International Boundary Commission: Collection of mammal skins, skulls, rocks; 48 specimens, representing 38 species, of birds' skins from the Mexican boundary (26022); 168 specimens, representing 53 species of birds from New Mexico, 7 specimens of miscellaneous insects and myriapods, 4 eggs of scaled partridge, 8 eggs of white-necked raven, nest and fragments of eggs of the hepatic tanager, and a nest of the western wood pewee; also nest of Arkansas flycatcher from near the boundary line between Mexico and the United States, alcoholic specimens of fishes, reptiles, mollusks, mammal skins, skulls, bones, and horns (26371); through F. X. Holzner, fragments of pottery and other objects of a similar character found near cave-dwellings in the vicinity of Camel Mountain, near El Paso, collected by Dr. Mearns and Mr. Holzner; fragments of pottery, collection of birds' skins, fossil shells, ores and rocks, plants, shells, birds' eggs, all collected as above stated (26499); stone implement "sinew comb" from Mexican boundary line south of Bisbee, Ariz., 8 alcoholic specimens of insects, 261 specimens, representing 105 species of birds' skins, fishes, fossil shells, fossil wood, alcoholic reptiles, rocks, shells, mammal skins, all obtained from the boundary line between Mexico and the United States and collected by Dr. Mearns and Mr. Holzner (26608); 18 specimens, representing 12 species, of birds' skins from Fort Worth, alcoholic specimens of fishes and reptiles, and collection of mammal skins and skulls (26689).

MEDER, F. (New York City). Eleven prints (26728); soft-ground etching, "The Passing Storm," by C. A. Vanderhoof (26838). Purchased for World's Columbian Exposition.

MELSON, HENRY (Crisfield, Md.). Piece of board from a house occupied by Rev. Joshua Thomas at the time he preached to the British soldiers on Tangier Island in 1814. 26724.

MELLICHAMP, Dr. J. H. (Bluffton, S. C.), through Prof. C. V. Riley. Tubes made by crustaceans, from May River, South Carolina. 25897.

MELVILLE, Dr. W. H. (See under Interior Department, U. S. Geological Survey, and William Tate Taylor.)

MENGEL, LEVI W. (Reading, Pa.). Set of eggs of king eider, *Somateria spectabilis*, from North Greenland; 2 sets of eggs of night hawk, *Chordeiles virginianus*; set of eggs of sharp-shinned hawk, *Accipiter velox*, from Berks County, Pa. Exchange. 26687.

MERCK & Co (New York City), through Dr. D. W. Prentiss. Four-gramme specimen of pure Pilocarpine, Merck. 27019. (See under Dr. D. W. Prentiss.)

MERRIAM, Dr. C. HART (Department of Agriculture). Cap worn by a squaw belonging to the Montagnais tribe of Indians, and iron tomakawk-blade found in the grave of an Indian belonging to the same tribe. 26411. (See under Department of Agriculture.)

MERRILL, GEORGE P. (U. S. National Museum). Fence-lizard, *Sceloporus undulatus*, and worm-snake *Carphophiops Helenæ*, from Wyandotte, Ind. (26176); onyx marbles and rocks from Lower California, below San Quentin, and a sample of fire-clay from Elsinor, Cal.; tree-frog, *Hyla regilla* and 8 specimens of miscellaneous insects from the same locality (26319); specimens of cave-salamander, *Spelerpes maculicaudus*, from Little Wyandott Cave, Ind. (26423).* (See under Prof. W. O. Crosby, W. H. Evans & Son, H. C. Ganter, Sal Mountain Asbestus Company, Smithsonian Institution, U. S. National Museum.)

* This species, only recently described, is yet quite rare.

MERRILL, H. C. (Auburn, Me.). Glacial views. Exchange. For World's Columbian Exposition. 26487.

MERRILL, Dr. JAMES C., U. S. A. (Surgeon-General's office). Wing of sora rail, *Porzana carolina*, from Fort Canby, Wash. 26666.

MERRILL, L. H. (Agricultural Experiment Station, Orono, Me.). Negatives of glacial views (deposit), and photographs representing the same objects (exchange). 26387.

MERRILL, Hon. S. (See under Calcutta Botanic Garden.)

MERTZ, FRANK C. (Weissport, Pa.). Arrow-heads from Carbon County. 26696.

MESSIKOMMER, H. (Zurich, Switzerland). Bronze helmet from Greece. 26428.

MEYER, ABRAHAM (Logan House, Pa.). Views of "Signal stations" in use during the war of 1861–1865. 26778.

MICHELI BROTHERS (Berlin, Germany). Casts of Greek and Roman antiquities. Purchased of World's Columbian Exposition. 26651.

MIDDLETON, Prof. J. HENRY (Director, Fitzwilliam Museum, Cambridge, England). Photographs of a Phœnician altar. 26164.

MILLER, CHARLES, Jr. (Grand Rapids, Mich.). Travertine (26791); jasperized wood from Woodruff, Ariz. (27025).

MILLER, H. D. (Plainville, Conn.). Archæological objects, consisting of rude chipped implements, worked flint flakes, scrapers, perforators, arrow and spear-heads, and fragments of potstone vessels. 26043.

MILLER, THOMAS (Heron Lake, Minn.). Twenty-one sets of eggs of Franklin's gull (58 specimens). 27095.

MILLER, W. (Grand Rapids, Mich.). Iron ring, coin, button, sleigh-bell, and some hand-forged nails found on the camping-ground opposite Queenstown Heights, where the Americans were encamped prior to the battle of 1814. 26810.

MILES, H. E. (Racine, Wis.). Photograph of a basket-carrying frame used by the Mojave Indians of Arizona. 26572.

MILLIS, S. B. (Lockport, N. Y.). Large arrow-head from Orleans County. 26751.

MINER, S. O. (Brattleboro, Vt.), through Robert Ridgway. Pair of silver-spangled Hamburg fowls (26565); feathers of silver-spangled Hamburg fowl (26668).

MINOT, JAMES (Concord, N. H.). Badge of G. A. R., Department of New Hampshire. 26248.

MITCHELL, J. D. (Victoria, Tex.). Unionidæ from Texas (26081); shells and marine invertebrates (26114); through W. H. Dall, 2 dry specimens of crabs (*Sesarma cinerea* and *Petrolisthes armatus*) (26414); shells and other similar specimens (26959).

MOHRMAN, J. H. (Talmage, Nebr.). Chrysalis of morning-cloak butterfly, *Vanessa antiopa*. 26224.

MONCKTON, Sir JOHN B. (See under Smithsonian Institution.)

MONTANDON, Prof. A. L. (Bucharest, Roumania), through Prof. C. V. Riley. Alcoholic specimen of bat, land shells, 26 specimens of reptiles and batrachians, including a fine series of *Molge Montandoni*, a salamander recently described and named in honor of the donor, collection of insects consisting of 2,200 specimens of heteroptera, 110 specimens of homoptera, and 22 specimens of European coleoptera. 25994.

MONTANÉ, Dr. LUIS (Havana, Cuba), through W. Hallett Phillips. Photographs of stone implements and carvings, fragments of pottery and human skulls, and 12 plates, the originals of which were collected by Dr. Montané near Cape Maisi, Island of Cuba. 26934.

MONTGOMERY, Prof. HENRY (Salt Lake City, Utah). Photographs representing views in Utah. 26927.

MOONEY, JAMES. (See under Smithsonian Institution. Bureau of Ethnology; and Rev. H. N. Voth.)

MOORE, CLARENCE B. (Philadelphia, Pa.). Archæological objects, consisting of fragments of human and other bones found in excavating a shell-heap on Hitchen's Creek, Florida, fragments of pottery from shell-deposits in Volusia and Lake counties, and pieces of painted pottery from a sand burial-mound near Volusia. 26520.

MOORE, H. C. (Cape Town, South Africa), through George F. Hollis, U. S. consul at Cape Town. Valuable collection of skins, skulls, and horns of antelopes and other large mammals, collected by the donor in South and South Central Africa. 26704.

MOORE, Prof. JOSEPH (Earlham College, Richmond, Ind.). Photographs of bones of *Castoroides ohioensis*. 26420.

MOORE, W. S. (U. S. Navy). Sea lily. 26767.

MORAIS, Rev. Dr. S. (Philadelphia, Pa.). Silver habdalah set. Lent for World's Columbian Exposition. 26815.

MORAN, PETER (Philadelphia, Pa.). Plates, tracing, and three proofs to illustrate the etching process. Purchased for World's Columbian Exposition. 26837.

MORELAND, WALTER (Washington, D. C.). Specimens of silver gar, *Tylosurus caribbæus*, from Chesapeake Bay, with parasitic crustaceans found in its mouth. 26007.

MORGAN, Dr. EDWIN L. (Washington, D. C.). Large parflesch, obtained from the Colispel Indians. 26808.

MORO, Sir ANTONIO. (See under C. F. Gunther.)

MORRIS, Mrs. MARY B. (See under National Society of the Daughters of the American Revolution.)

MORRIS, WILLIAM (Tucson, Ariz.). Specimen of Masena quail or partridge (*Cyrtonyx montezumæ*). 26440.

MOSBY, Lieut. J. S. (See under William B. Cary).

MOSIER, CYRUS A. (Seattle, Wash.). Head, wing, and tail of Clarke's crow or nutcracker (*Picicorvus columbianus*). 26369.

MOSS, WILLIAM (Ashton-under-Lyne, England). Photographs showing anatomy of mollusks. 26753.

MUNGEN, THEODORE (Washington, D. C.). Snake. 27029

MUNICH ACADEMY (Munich, Bavaria), through Prof. P. Groth. Rocks and minerals. Exchange. 26276.

MUNSON, M. S. (Velasco, Tex.). Gorgonians found on the Gulf coast near Velasco. 26645.

MUSEUM OF FINE ARTS (Boston, Mass.). Lithographs, "Portrait of a Lady," by Kriehuber, and "Feeding the Birdies," by Lasalle after Breton. Lent for World's Columbian Exposition. 26720. Returned.

NATIONAL MUSEUM OF COSTA RICA (San José, Costa Rica), through George K. Cherrie. Type specimen of a supposed new species of Zeledonia (*Zeledonia insperata* Cherrie), from the Volcan de Irazú, Costa Rica (26087); type specimen of *Cypseloides Cherriei*, a new species from the same locality (26262).

NATIONAL SOCIETY OF THE DAUGHTERS OF THE AMERICAN REVOLUTION (Washington, D. C.), through Mrs. Devereux and Mrs. Bulloch. Chinaware decorated in red and gold belonging to Mrs. Mary Bartelemy Morris, wife of Captain Daniel Morris of the Revolutionary war. Deposit. 26993.

NEOGRAPH PUBLISHING COMPANY (Boston, Mass.). Collograph, "The Burgomaster." 26737.

NEUMOEGEN, B. (New York City). Specimens of *Nyctemeridæ*. 26860.

NEVILLE, W. R. (Houston, Tex.). Hermit-crab and shell. 26561.

NEWHALL, W. H. (See under The Grottos Company.)

NEWLON, Dr. W. S. (Oswego, Kans.). Malachite in a partially decomposed granite, from the Chickasaw Nation, and favosites from the same locality. 25917. Returned.

NEWMAN & SON (Washington, D. C.). Three caligraphs. 26113.

NEWTON, Prof. H. A. (Yale University, New Haven, Conn.). Meteoric stone from Winnebago County, Iowa. Purchased for the World's Columbian Exposition. 26920.

NEWTON, WILLIAM (Salt Lake City, Utah). Block tin from the Newton American tin mines in Utah, and a lithographic stone from the Newton American lithographic stone quarry. 27109.

NEW YORK COIN AND STAMP COMPANY (New York City). One hundred and sixty-two medals commemorating events in the early history of the colonies and the United States (purchased for World's Columbian Exposition) (25954); 9 gold and silver coins of the United States (purchase) (26366).

NOAH, JOHN M. (U. S. National Museum). Bremen silver coin (one grote), dated 1749. 26368. (See under Pelham and Lloyd.)

NOBLE, Hon. JOHN W. (See under Interior Department. Indian Office, Charles H. Thompson.)

NORTHAM, CAROLINE M. (Philadelphia, Pa.), through Mrs. W. P. Logan. Pair of earrings made from the Charter-oak of Hartford, Conn. 26743.

NORTHRUP, Dr. D. B. (San Diego, Cal.). Silk-moth secured by Capt. Koch from Cedros Island, Mexico. 26580.

NUTTALL, G. H. F. (Johns Hopkins Hospital, Baltimore, Md.). Birds' skins and mounted birds from California and Mexico. 26877.

NUTTALL, Mrs. ZELIA (Florence, Italy). Models of the yoke and pails used by Venetian water-carriers. 26984.

NYE, WILLARD, JR. (New Bedford, Mass.). Shells, flint flake, and fragments of pottery from the surface of a mound on the Government reservation at Tampa, Fla. 26891.

OBER, F. A. (Washington, D. C.). Carib stone implements (26798); collection of Spanish-American gold, silver, and copper coins (26799). Purchased for World's Columbian Exposition.

OPPENHEIMER, S., & Co. (New York City). Intestinal products and articles manufactured therefrom. 26774.

ORTH, GEORGE S. (Pittsburg, Pa.). Birds' skins from Colorado. Exchange. 26661.

OSBORNE, J. W. (Washington, D. C.). Electrotypes made by Jewett & Chandler's wax process, plate ready for electrotyping by Mauch's process, electrotype made by Mauch's process (26548); lithograph, "Christ among the Doctors," by Adolf Menzel (26606).

OWEN, H. S. (Washington, D. C.). Rear-driving safety bicycle, and a woman's bicycle. Deposit. 27018.

OWENS, Prof. J. G. (See under Peabody Museum.)

OWSLEY, Mrs. W. T. (Glasgow, Ky.), through Dr. W. T. Owsley. Humming-bird, in the flesh. 25948.

OWSLEY, Dr. W. T. (Glasgow, Ky.). Rattlesnake captured near Mammoth Cave, Ky., by Andrew Hawkins of Glasgow Junction. 26071. (See under Mrs. W. T. Owsley.)

OZARK ONYX COMPANY (St. Louis, Mo.), through J. F. Leighton, president. Slab of stalagmite. Purchased for World's Columbian Exposition. 26888.

PALMER, Dr. EDWARD (Washington, D. C.). Collection of ethnological objects obtained from the Coahuillos Indians, Lower California, and also from other tribes (26324); specimens of crustaceans from Byron Hot Springs, Cal., and geological material (26372); sample of paper made from *Yucca filamentosa* and straw, from Golden, Colo. (26426). (See under Department of Agriculture.)

PALMER, JOSEPH (U. S. National Museum). Mink (*Putorius vison*) (26072); Miocene fossils from Papaw Hollow, near Leonardtown, Md., on St. Clement Bay (26103); raccoon (*Procyon lotor*), from Henrico County, Va., and 2 flying-squirrels, *Sciuropterus volucella* (26326); chipmunk (*Tamias striatus*), from Virginia (26329); ermine (*Putorius erminea*), from Arlington, Va. (26331).

PALMER, WILLIAM (U. S. National Museum). Specimen of red bat, *Atalapha noveboracensis* (26330); red squirrel, *Sciurus hudsonius*, from Mount Vernon, Va. (26337); 3 skins of hooded-warbler, *Sylvania mitrata*, from Hanover County, Va. (26433); meadow-mouse, *Arvicola riparius*, and house-mouse, *Mus musculus* (26541); bird and snakes (26911); 2 specimens of flying-squirrel, *Sciuropterus* (26923). (See under Smithsonian Institution, U. S. National Museum, and National Zoological Park.)

PARK, J. T. (Warner, Tenn.). Six specimens of purple and bronzed grackle, *Quiscalus quiscula* and *Quiscalus æneus*, and hybrids from Tennessee. 26115.

PARRY, MAGGIE (Carbondale, Pa.). White spider (*Misumena vatia* Clark) belonging to the family Thomisidæ. 25890.

PATTEE, F. B. (Valley Springs. Cal.). Set of eggs of killdeer (*Ægialitis vocifera*). 26151.

PATTEE, ORSON (Jarbalo, Kans.). Leech. 27075.

PATTON, WILLIAM H. (Hartford, Conn.). Wasp (*Astata montana*) representing a species new to the collection, obtained by Prof. A. Dugès, of Mexico. 27037.

PAVLOW, Prof. A. (Moscow University, Moscow, Russia). Fossils. Exchange. 26069.

PAYN, ELIAS J. (Tres Piedras, N. Mex.). Bituminous coal from New Mexico. 26468.

PEABODY MUSEUM (Cambridge, Mass.), through Prof. J. G. Owens. Two stuffed lizards, 4 specimens of birds, 10 nests of *Gymnostinops Montezumæ*, collected by Mr. J. G. Owens while connected with the Peabody Museum Honduras expedition. 26025.

PEALE, Dr. A. C. (U. S. Geological Survey). Photographs of oil portraits of Charles Wilson Peale, Titian Ramsay Peale, Chief Justice Edward Shippen, James Peale, Raphael Peale, and Dr. William Stoughton. 26871.

PEARSON, C. F. (Portland, Oreg.). Samples of wax (?) and specimens of coal from Nehalem River, Tillamook County, Oreg. 26673.

PECHIM, E. C. (See under The Grottos Company.)

PELHAM & LLOYD (Washington, D. C.), through John M. Noah. Soapstone from Fairfax County, Va. 26033.

PELTON, C. A. (Middletown, Conn.). Photograph of gravestone of Dr. Joseph Barratt, botanist. 26842.

PENFIELD, Prof. S. L. (Yale College, New Haven, Conn.). Minerals from Branchville, Conn. 26040. (See under Interior Department. U. S. Geological Survey.)

PERRY, HARRY W. (New Orleans, La.). Alcoholic reptiles, mammals, and bats; fishes consisting of *Batrachoides*, *Querimana*, *Heros*, *Citharichthys*, *Tetrodon*, *Rhypticus*, *Symbranchus*, *Carcharhinus*, and saw of *Pristis pectinatus*; beetles, spiders, and crested grasshopper, crabs, specimen of *Orthalicus zebra* (26975); skull of pelican, mammal skins and skulls, hammock made of bark, and bottle of hair-oil made from palm; stone implement, alcoholic insects, rostrum of sawfish (*Pristis pectinatus*), and dried gorgonian from Honduras (27078).

PERRY, R. S. (Piedmont, Ala.). Beauxite. 26735.

PERRY, W. G. (See under Post-Office Department.)

PESOA, Miss (Philadelphia, Pa.). Embroidered cloth (Spanish) used at the ceremony of circumcision. Deposited for World's Columbian Exposition. 26429. Returned.

PETERS, Mrs. S. D. (Washington, D. C.). Common marmot (*Hapale jacchus*) (26417). 26630.

PETTIGREW, J. A. (Chicago, Ill.). Skin of manatee (*Trichechus latirostris*) from Florida. Purchased for World's Columbian Exposition. 26442.

PHILLIPS, W. HALLETT (Washington, D. C.). Aboriginal pipes (one from North Carolina and the other obtained from the Blackfeet Indians, Idaho) (lent for World's Columbian Exposition) (26680); alcoholic reptiles and insects from Nicaragua and this country (26695). (See under Dr. Luis Montané.)

PICHER, Miss ANNIE B. (Pasadena, Cal.). Fourteen photographs illustrating Indian life in California. 26627. (See under The Pasadena Loan Association.)

PILLING, JAMES C. (U. S. Bureau of Ethnology). Photograph of the interior of a Maori Wharf Rumanaga, or Council Chamber, at Te Ore Ore, Wairarapa, New Zealand. 26955.

PILSBRY, H. A. (Academy of Natural Sciences, Philadelphia, Pa.). Land and fresh-water shells, representing 7 species, from Florida and the Catskill Mountains. 26070.

POLLOCK, GEORGE F. (Washington, D. C.). English bloodhound. 26915.

POND, Lieut. CHARLES F. (U. S. Navy). Skin of lizard. 25895.

POPE, H. (Quebec, Canada). Skins and bones of gray seals, from the Island of Anticosti. 26021.

POST-OFFICE DEPARTMENT:

WANAMAKER, Hon. JOHN (Postmaster-General). Persian lantern. Purchase. (25930).

Dead-Letter Office, through W. G. Perry, chief clerk: Millepeds found in the mail. (27083).

POSTON, Mrs. B. F. (Washington, D. C.). Piece of biscuit baked in camp by H. T. McAstro, a Confederate soldier. 26199.

POTTER, Rev. J. A., U. S. Army (Fort Clark, Tex.). Lizards and insects. 27138.

POWELL, CHARLES P. (Baltimore, Md.). Yellow turbit pigeon. 26405.

POWELL, Maj. J. W. (Director, U. S. Geological Survey). Photographs of a jade card-receiver with ebony base. 25985. (See under Interior Department. U. S. Geological Survey, and Smithsonian Institution. Bureau of Ethnology.)

POWELL, S. L. (John Hopkins University, Baltimore, Md.). Volcanic rocks from South Mountain, Pennsylvania. Exchange. 27091.

PRAETORIUS, CHARLES (London, England). Facsimiles in water-color of original drawings made by John White for Sir Walter Raleigh, and now in the Granville collection in the British Museum. Purchased for World's Columbian Exposition. 26851.

PRANG, L. & CO. (Roxbury, Mass.). Three chromolithographs and one photochromolithograph. 26715.

PREBLE, E. A. (Department of Agriculture). Three reptiles (27059); short-tailed shrew, *Blarina brevicauda* (27145).

PRENTISS, Dr. D. W. Alkaloids and salts made from *Pilocarpine pinnatifolus,* manufactured by Merck & Co. 27022. (See under Merck & Co.).

PRIESTLEY, Dr. (See under Mrs. E. Lyon and Mrs. Dr. Thomas Lyon.)

PUTNAM, J. HENRY (Abbeville, La.). Hydrocarbon closely related to asphalts. 27053.

QUANITANCE, A. L. (Lake City, Fla.). Whip-scorpion, *Thelyphonus giganteus.* 26675.

RABBITT, SAMUEL E. (Washington, D. C.). Red pouter-pigeon. 26409.

RALPH, Dr. WILLIAM L. (Utica, N. Y.). An exceedingly valuable collection of birds' eggs and nests, consisting of 1604 specimens (420 sets), representing 161 species and subspecies; also 37 nests, several of which are new to the collection (27026); 9 specimens, representing 5 species of birds' skins, and 1 mounted bird from Florida (27056).

RAMBO, M. ELMER (Lower Providence, Pa.). Fungus (*Polyporus sulphureus,* Bull.) 26742.

RAMSAY, ALLAN (Constantinople, Turkey). Collection of objects used in the Armenian church, consisting of staffs, musical instruments, and crosses. Purchased for World's Columbian Exposition. 26945.

RAMSAY, Dr. E. P. (See under Australian Museum.)

RANDALL, Mrs. BELINDA L. (Boston, Mass.). Hydrogen lamp. 26452.

RANDOLPH, Miss CORNELIA (Washington, D. C.). Ring of gold wrought by the Ashantee negroes of Africa with their teeth. 25968.

RANDOLPH, Hon. G. W. (See under William B. Cary.)

RANSDELL, HARRY (Washington, D. C.). Four living specimens of *Argiope riparia* Hentz. 26184.

RATHBUN, RICHARD. (See under U. S. Fish Commission.)

RAWDON, F. W. (See under Central New York Naval Veteran Association.)

RAWOLLE, Miss BERTHA. (See under Dr. T. E. Wilcox, U. S. Army.)

RAY, G. D. (Burnsville, N. C.). Quartz containing garnet of the almandine variety, from Ray's Mica mine. 25959.

RAYNOR, N. (Hampston, Va.). Congo-snake, *Amphiuma means*. 26393.

RENAUD, P. M. (See under S. P. Avery.)

REYNOLDS, O. L. & O. A. (Covington, Ky.). G. A. R. badge of department of Kentucky. 26232.

RHOADES, S. N. (Haddenfield, N. J.), through Allen Ruppert. Skeleton of a male Rocky Mountain goat. 26744.

RICE, Mrs. M. E. (Coryville, Pa.). Arrow-head, perforator, broken arrow-head, chip or flake of chalcedony, rude point, fragment of a drilled stone object, possibly part of a bead (25914); specimens of hawk-moth, *Deilephila lineata*, and 12 archæological objects consisting of arrow-heads and flint flakes from Clinton and McKean counties (26182); specimen of hawk-moth, *Protoparce celeus* (26412).

RICHARDS, T. W. (Washington, D. C.). Sets of eggs of fish-crow, American oyster-catcher, and prairie-warbler. 26321.

RICHARDSON, CLIFFORD (Washington, D. C.). Asphalt from La Brea, Island of Trinidad, British West Indies. 25923.

RICHMOND, A. G. (Canajoharie, N. Y.). Feather necklace. 26958.

RICHMOND, C. W. (Washington, D. C.). Alcoholic reptiles, 144 specimens representing 45 species, 3 specimens of *Panopeus serratus* Saussure, *Cardisoma*, sp. and *Palæmon* sp., 139 specimens of birds' skins, 5 specimens of fishes (purchase) (26252); volcanic rocks, breastbones of wood ibis and oriole, and an alcoholic specimen of *Synallaxis* (gift) (26460); 2 birds' skins from Nicaragua, representing types of *Trogon chrysomelas* and *Malacoptila fuliginosa* (26496); 3 breastbones (gift) (26711); collection of birds' eggs and nests, consisting of 50 specimens and 16 nests (purchase) (26626); 2 skins of *Cebus hypoleucus*, with skulls, 49 specimens, representing 30 species, of reptiles and batrachians in alcohol, mollusks, representing 30 species, alcoholic specimens of marine invertebrates, insects, 114 specimens of birds' skins, egg of Giraud's flycatcher, *Myozetes texensis*, 24 alcoholic specimens of fishes from the Escondido River (purchase) (26738); 22 specimens, representing 22 species of birds' skins from Nicaragua (purchased for World's Columbian Exposition) (26809); crab, *Pseudothelphusa* sp. nov. (gift) (27128).

RICHMOND, W. L. (Washington, D. C). Specimens of *Anolis principalis*, from Savannah, Ga. 26732.

RIDGWAY, AUDUBON (Brookland, D. C.). Snake and salamanders. 26940.

RIDGWAY, ROBERT (U. S. National Museum). Birds' skins from Richland County, Ill., and Knox County, Ind., (26275); nest of wood pewee, *Contopus virens*, from Brookland, D. C., (26642); 4 specimens of red-breasted nuthatch, *Sitta canadensis* (26646). (See under S. O. Miner; and Smithsonian Institution. U. S. National Museum.)

RIDLER, J. (St. Paul, Minn.), through Forest and Stream Publishing Co. Small-mouthed green bass, *Micropterus Dolomieu* from Lake Ida, Minnesota. 25912.

RILEY, Prof. C. V. (See under Department of Agriculture, E. Brunetti, H. Caracciolio, William J. Fox, J. T. Mason, Dr. J. H. Mellichamp, and Prof. A. L. Montadon.)

RITTENHOUSE, L. C. (Louisa, Ky.). Sigillaria with fragments of calamites on the reverse side. 26937.

ROBBINS, IRVIN (Indianapolis, Ind.). Badge of G. A. R. 26246.

ROBERTS, H. (Tryonville, Pa.). Fossil bones of *Elephas Colombi.* 26271.

ROBERTS, W. F. (Washington, D. C.). Snakes. 25940.

ROBINSON, AMOS G. (Fort Mitchell, Ala.). Snake. 26068.

ROBINSON, H. A. (Kingston, N. Mex.). Juniper wood carved by termites. 26854.

ROBINSON, T. B. (Des Moines, Iowa). Badge of G. A. R. 26249.

ROBINSON, Lieut. WIRT, U. S. Army (Fort McPherson, Atlanta, Ga.). Humming-birds from Bogota, South America, (26592); 127 specimens of birds' skins from Colombia and the Island of Curaçao (26700); land-shells from the Island of Curaçao, West Indies (26986).

ROCKHILL, W. W. (Berkeley Springs, W. Va.). Photo-negatives (deposit) (26505); collection of ethnological objects from China and Thibet (purchase) (26511); small box from Lanchou Fu, capitol of Kansu, used by opium smokers to hold the pills which are taken after smoking (gift) (26571); Colt's revolver and holder (deposit) (returned) (26625); books and specimens relating to Thibetan subjects, Thibetan spear (purchase) (26712); collection of about 300 Mongolian and Thibetan ethnological objects, with classified and detailed descriptions (purchase) (27007).

ROMEYN, Capt. HENRY, U. S. A. (Mount Vernon, Ala.). Lubber-grasshopper, *Dictyophorus micropterus* Serv. 26064.

ROMMEL, F. A. (Baltimore, Md.). White Russian, or Bokhara, trumpeter fowl. 26243.

ROOT, Mrs. E. C. (See under Wallace and Earl Root).

ROOT, WALLACE and EARL (Streetsboro, Ohio), through Mrs. E. C. Root. Devonian fossils. 25965.

ROSEBROOK, JOSEPH W. (Toledo, Oreg.). Bird's nest and eggs; 3 species of lepidoptera. 25979.

ROSENTHAL, ALBERT (Philadelphia, Pa.). Collection of etched and lithograph portraits of members of the Federal Convention of 1787, the Congress of 1787, the Congress of 1789, and of other prominent Americans (26800); etched and lithograph portraits of members of the Continental Congress (26801). Deposited for the World's Columbian Exposition.

ROTHROCK, D. M. (Wyandotte, Ind.). Stalactites from Wyandotte Cave. Purchased for World's Columbian Exposition. 26172.

ROWLANDS, WALTER (Allston, Mass.). Collograph "Charles I demanding the five impeached members", from the painting by Copley. 26272.

ROYAL MUSEUM (Berlin, Germany). Collection of casts of Assyro-Babylonian and Greek religious objects. Purchased for World's Columbian Exposition. 26943.

ROYAL MUSEUM (Florence, Italy), through Prof. Henry H. Giglioli, director. Two musical instruments, 100 archæological objects, consisting of fragments of pottery, shells, fragments of bone, piece of quartz from a kitchen midden near Port Blair, South Andaman Islands; ramus of lower jaw, teeth, and bones of *Ursus spelæus*, from a cave near Breonis (Verona); collection of ethnological objects from the Andaman Islands, and additional objects from different parts of the world. Exchange. 25949.

RUMPLE, J. W. (Grottoes, Va.). Section of stalactite. Purchased for World's Columbian Exposition. 26787. (See under The Grottoes Company.)

RUPPERT, ALLEN. (See under S. N. Rhoades.)

RUSSELL, Prof. I. C. (See under Interior Department. U. S. Geological Survey.)

RYUS, FLOYD E. (Childress, Tex.) Specimens of *Chœracampa tersa* and *Arctia arge.* 26111.

SAFFORD, Prof. J. M. (Vanderbilt University, Nashville, Tenn.). Two fragments of the Safford meteorite from Tennessee. 26056.

SAFFORD, W. E. (ensign, U. S. N.). Collection of Indian portraits and costumes (purchased for World's Columbian Exposition) (25958), ethnological objects from the Indians of Peru (deposit) (26315).

SAGE, JOHN H. (Portland, Conn.). Nest and eggs of golden-winged warbler. 26755.

SAL MOUNTAIN ASBESTUS COMPANY (Chicago, Ill.), through G. P. Merrill. Asbestus from mines near Nachoochee, Ga. 27042.

SANDBERG, C. P. (London, England). Sections of Sandberg Goliah-rail and splice-bar. 26634.

SANXAY, J. P. (See under Arizona Onyx Company.)

SAUNDERS, H. R. (Nassau, New Providence). Nassau sponges. 26814.

SAWYER, Capt., U. S. A. (See under Bureau of American Republics.)

SCHAUPP, F. G. (See under Department of Agriculture.)

SCHLIEMANN, Madame (Athens, Greece), through Hon. Truxton Beale. Antiquities obtained by the late Prof. Schliemann from the site of ancient Troy. 27023.

SCHLÜTER, WILHELM (Halle, Germany). Two skins of pheasant (*Phasianus mongolicus* and *Phasianus principalis*) from Asia, 2 specimens of Mlokosiwiczi's black cock, *Tetrao Mlokosiwiczi* from Caucasus Mountains, 14 birds' skins (chiefly trogons and toucans) from various countries (purchased for World's Columbian Exposition) (26010, 26116, 27021); specimen of *Xenopus mülleri* from East Africa (purchased) (26506).

SCHMID, EDWARD S. (Washington, D. C.). Gray African parrot and golden oriole (gift) (26472); 2 specimens of lesser prairie hen, *Tympanuchus pallidicinctus* (purchased for World's Columbian Exposition) (26590); monkey (*Hapale rosalia*) (gift) (26629); lizard (*Tupinambis teguixin*) from South America (gift) (26649); parrot (*Nymphicus novæhollandiæ*) (gift) (26655).

SCHOFF, S. A. (Greenfield, Mass.). Etching, "Portrait of Mrs. Otis," after Stuart. 27107.

SCHULZ, Dr. AUVEL (Johannesburg, Transvaal, South Africa). Gold-bearing conglomerate and ferruginous rock from the Johannesburg Mines. 26546.

SCHUMANN, Mr. (See under Romyn Hitchcock.)

SCHWARZ, E. A. (Washington, D. C.) Coleoptera, illustrating the Saline fauna of Great Salt Lake (gift) (26032); North American coleoptera, all new to the collection (exchange) (26424); specimen of *Sesia pictipes* (gift) (27110).

SCIENCE COLLEGE IMPERIAL UNIVERSITY (Tokio, Japan). Two birds from the province of Owari, Japan. 25937.

SCOLLICK, J. W. (U. S. National Museum). Skeleton of cochin fowl, and external skeleton of *Pseudopus Pallasii*. 26473.

SCOTT, W. W. (Canal Dover, Ohio), through George W. Crites. Siliceous concretion. 26968.

SCRIVEN, Lieut. GEORGE P. (U. S. A.). (See under John Keith.)

SEANEY, O. E. (Fort Wayne, Ind.). Collection of old-fashioned hats and bonnets. 26694.

SEER, A. S., THEATRICAL PRINTING COMPANY (New York City). Poster, cut on wood (portrait of Alexander Salvini). 26036.

SELLERS, JOHN, & SONS (New York City). Collection of tools and material used for etching. Purchase. 26850.

SEWALL, H. F. (New York City). Two prints, representing Mantegna's "Madonna and Child," and Marcantonio's "Virgin on Clouds." Lent for exhibition at World's Columbian Exposition. 26718. Returned.

SEWARD, Miss OLIVE RISLEY (Washington, D. C.). Cypriote collection, including specimens of Phœnician pottery, glasswork, Roman pottery, and other objects (25918); 104 specimens of Cypriote pottery, lamps, vases, dishes, glass jars, and other ethnological objects (25988). Deposit.

SHEPARD, Dr. C. U. (Charleston, S. C.). Minerals, including rutile, from Graves Mountain, Georgia, staurolite from Morganton, and apatite, augite, and titanite from Canada. 26547.

SHEPARD, Miss IDA (Long Beach, Cal.). Marine shells (25919). Pleistocene fossils (26907).

SHERMAN, CHARLES A. (Wyoming). Blades of stone skin-scrapers. 26618.

SHERMAN, JOHN D., Jr. (New York City). Coleoptera (exchange) (27000); North American coleoptera (gift) (27027).

SHERMAN, Gen. (See under Mrs. M. C. Audenreid.)

SHOTWELL, J. R. (Rahway, N. J.). Skull of "Obenobbe," a Pottawatamie chief. 26593. (Transferred to Army Medical Museum.)

SHUFELDT, Dr. R. W., U. S. A. (Takoma Park, D. C.). Reptiles, and 5 specimens of common shiner, or red-fin dace, *Notropis megalops*. 25888. (See under W. Wyndham.)

SHUGIO, HIEROMICH (New York City). Forty-three pieces of Japanese pottery, 2 pieces of Chinese pottery, and 1 piece of Spanish pottery (gift) (25910); 28 pieces of Japanese pottery (purchase) (26929); 100 specimens of Japanese porcelains and pottery (deposit) (27066).

SIBASIO, UNGER (Cape Colony, South Africa). Musical bow. Purchase. 26185.

SIBLEY, Mr. (No address given). Shell from the Dry Tortugas. 26023.

SIEMENS, WILLIAM (Berlin, Germany). Facsimile of a letter, dated November 20, 1833, written by Prof. Gauss, in relation to the installation of the first electric telegraph in Gottingen. 26086.

SIGOURNEY, C. F. (Washington, D. C.). Yellow-bellied sapsucker, *Sphyropicus varius*, in the flesh. 26312.

SIMONIS, M. L'ABBÉ PAUL MÜLLER (Strasburg, Germany). Photograph representing the festival of Beiram Ali, as practiced by the Persian Mohammedans. 26555.

SIMPSON, CHARLES T. (U. S. National Museum). Six species of *Strepomatidæ* from different parts of the United States (new to the collection). 26099. (See under C. Dwight Marsh and Bryant Walker.)

SINGLEY, J. A. (Austin, Tex.). Fresh-water shells (26831); skin of California gull, *Larus californicus* (26692); birds' skins from Galveston (26697). (See under Geological Survey of Texas.)

SIZER, FRANK L. (See under Capt. F. P. Spratt.)

SKINNER, A. (Smithsonian Institution). Specimen of a partial Albino bob-white, *Colinus virginianus*, from the vicinity of Washington (26416); 2 pieces of flint (26465).

SKINNER, O. E. (Claremont, Va.). Cocoon of cecropia-moth. 25903.

SKOW, LAWRENCE (Omaha, Nebr.). Hybrid tanager (*Piranga rubra erythromelas*). Exchange. 26677.

SMITH, E. KIRBY (Vera Cruz, Mexico), through Capt. C. E. Bendire, U. S. Army. Fossil shell, *Hippurites calamitiformis* Barcena, from a cave at the headwaters of the Rio Coatzacoalas, Mexico. 26730.

SMITH, H. I. (Madisonville and South Lebanon, Ohio, Ann Arbor and Saginaw, Mich.). Fossils from the wash on the rock exposures near Madisonville (25939); cedar-root grown around a rock (26035); crayfishes (26104); crayfish from Little Chain River (26350); crayfish from near South Lebanon, and surface crustaceans and other specimens from Saginaw River and vicinity (26353); fresh-water crustaceans from First Sister Lake, near Ann Arbor (26551); crayfishes (26570); crayfishes from Michigan and Ohio (26644).

SHITH, Dr. H. M. (See under Fish Commission, U. S.)

SMITH, H. S. (Saginaw East Side, Mich.). Helgrammites, or larvæ of *Corydalus cornutus*. 26223.

SMITH, Prof. JOHN B. (New Brunswick, N. J.). Noctuidæ (chiefly type specimens). 25977.

SMITH, R. W. KIRBY (Sewanee, Tenn.). Birds' eggs, representing 5 species, from the vicinity of Jataplan, State of Vera Cruz, Mexico. 26581.

SMITH, Dr. S. J. (Bangkok, Siam), through General John A. Halderman. Specimens of Siamese writing. 26489.

SMITH, WILLIAM G. (Loveland, Col.). Long-tailed weasel, *Putorius longicauda*, and Fremont's squirrel, *Sciurus hudsonius Fremonti*. Purchase. 26445.

SMITHSONIAN INSTITUTION. Medal to commemorate the one-hundredth anniversary of the battle and massacre of Wyoming, July 3, 1778, to July 3, 1878, presented to the Smithsonian Institution by the Wyoming Historical and Geological Society, of Wilkesbarre, Pa. (gift) (26263); old custom tariff of the Republic of Texas, as modified by the Second Congress, obtained by F. J. Stringfellow, Crewkerne, Somerset, England (gift) (26266); medal in commemoration of the visit of His Imperial Majesty the German Emperor to the city of London, on July 10, 1891, a gift to the Smithsonian Institution from the Corporation of the City of London, through Sir John Monckton (gift) (26524). Through W. C. Winlock: Bronze commemorative medal conferred by the Columbian Historical Exposition at Madrid in 1892 in recognition of the exhibit of the Smithsonian Institution (deposit) (26988).

Bureau of Ethnology, under direction of the Smithsonian Institution, Maj. J. W. Powell, director.

An interesting collection of ethnological objects, consisting of a papoose cradle (porcupine embroidery), pair of traveling-bags, bottle, ball, spoon, ornamented horn spoon, stiletto case, pair of garters, pair of moccasins, ornamented turtle, a tobacco-pouch and small bag (for World's Columbian Exposition) (26105); ethnological objects from the Kiowa tribe of Indians, apparatus belonging to the ghost dance, and miscellaneous objects obtained from the Sioux and other Indian tribes, by James Mooney (for World's Columbian Exposition) (26286); collection of Indian costumes, war-clubs, saddles, and other objects, collected by Lieut. Cooke, U. S. Army, for exhibit at the World's Columbian Exposition (purchase) (26404); collection of Navajo Indian silverware, collected by George F. Kunz (purchased for World's Columbian Exposition) (26475); black steer robe, painted with tribal history by a Piegan Indian, transferred from the Bureau of Ethnology to the National Museum for World's Columbian Exposition (26525); carrying-basket obtained from the Pima Indians, and transferred from the Bureau of Ethnology to the National Museum for the World's Columbian Exposition (26631); fine collection of Indian baskets obtained by H. W. Henshaw, and deposited in the National Museum (26635); plaited, woven, and coiled baskets, silversmiths' tools, and other objects obtained by Mr. James Mooney from the Moki Indians of New Mexico (purchase) (26756); 13 ethnological objects collected in Oklahoma by Dr. A. S. Gatschet, and transferred from the Bureau of Ethnology to the National Museum for the World's Columbian Exposition (26843); 8 blankets obtained from the Navajo Indians, and transferred from the Bureau of Ethnology to the National Museum for the World's Columbian Exposition (26905); 3 baskets made by the Biloxi Indians of Louisiana (27108); collection of costumes and ceremonial objects belonging to Indian tribes (deposit for World's Columbian Exposition) (25905). (See under Rev. H. N. Voth.)

U. S. National Museum, under direction of the Smithsonian Institution, Dr. G. Brown Goode, assistant secretary in charge.

Collected by Frank X. Holzner: Birds' skins and mammal skins and skulls from the United States and Mexican boundary, and transmitted by the International Boundary Commission to the National Museum (26471); 38 specimens, representing 16 species of birds' skins, mammal skins, and skulls obtained from the same localities (26528); 17 specimens, representing 10 species of birds' skins from Arizona, and mammal skins (26553).

Purchased by Walter Hough for the National Museum: Collection of ethnological and sociographic articles from Spain also 16 musical instruments and 12 pieces of Spanish earthenware (26981).

Collected by P. L. Jouy: Birds' skins, pottery, specimens of *Conorhinus dimidiatus*, toggle used in drawing the cinch tight over a pack-load, crustaceans, reptiles, specimens of *Spermophilus grammurus* and *Sciurus* sp., and specimens of *Ami-*

urus dugesi, Algansea, Hudsonius, Fundulus, Characodon, Menidia, from Mexico (25887); 14 mammal skins with skulls and 2 extra skulls, birds' skins from Mexico (25901); skins and skulls of mammals, turtles, and alcoholic specimens of reptiles, plants, alcoholic crabs, leeches, and shrimp, pair of gaffs used in cock-fighting, comb used by weavers to separate threads in weaving "Rebozo." "quactacomate," alcoholic specimens of birds for skeletons, obsidian spear-head, specimens of pottery, fragments of pottery and clay figures, bird-skin from Mexico (26207); mammal skins and skulls, alcoholic specimens of lizards, plants, birds' skins, alcoholic specimens of fishes from Mexico (26956); fishes, birds' skins, miscellaneous alcoholic insects and a Morpho-butterfly, crabs, shells, reptiles, mammal skins, and skulls from Mexico (26967).

Collected by G. P. Merrill; Cave materia's from Wyandotte Cave, Indiana, obtained for the World's Columbian Exposition (26101, 26134); land-shells from Wyandotte, Ind., and San Quention, Lower California (26123); cave material from Marengo, Ind., obtained for World's Columbian Exposition (26133); cave material from Percy & Robertson's cave, Springfield, Mo. for World's Columbian Exposition (26215); stalactites and stalagmites, from Andersonville, Tenn., for World's Columbian Exposition (26260); geological specimens from north of Phœnix, Ariz., (26344); 2 specimens of aragonite from onyx quarry, Yavapai County, Ariz., (26464).

Collected by William Palmer: Skin and skull of *Tamias striatus*, specimen of young guinea-fowl, *Numida meleagris*, 21 eocene fossils from Pamunky River marlbeds, and 3 snakes from Hanover County, Va. (25928).

Collected by Robert Ridgway: Two specimens of turkey-buzzard, *Cathartes aura*, and of crow (*Corvus americanus*) (26686).

Through William Palmer: Parrot (*Amazona farinosa*) (26066).

National Zoological Park, under direction of the Smithsonian Institution.

Through Dr. Frank Baker, acting manager: *Cariacus virginianus* (25933); bay lynx, *Lynx rufus* (26073); coyote (*Canis latrans*) and llama (*Lama glama*) (26074); prong-horned antelopes, *Antilocapra americana* (26139); bird-spider, *Eurypelma Hentzii* (26162); macaw (*Ara severa*) (26179); monkey (*Cebus* sp.), male juv., from South America, and red foxes, *Vulpes fulvus*, male, juv. (26325); cinnamon-bear, *Ursus americanus*, from Mammoth Hot Springs (26327); peccary (*Dicotyles tajacu*) (26328); coyote (*Canis latrans*), male, and llama (*Lama glama*), female, from Peru (26332); 2 specimens of coyote (*Canis latrans*), female, 3 deer (*Cariacus*, sp.), 2 males and 1 female, monkey (*Chrysothrix sciurea*), male, and a llama (*Lama glama*) (26338); monkey (*Hapale jacchus*) and porcupine (*Erethrizon dorsatus*) (26396); white ibis, *Guara alba* in transitional plumage (26407); bear (*Ursus*, sp.), (26450); sulphur-crested cockatoo (26482); peccary (*Dicotyles tajacu*) and monkey (*Cerocebus fuliginosus*) (26523); peccary (*Dicotyles tajacu*) (26544); specimen each of red-fox, *Vulpes fulvus*, and skunk (*Mephitis mephitica*) (26563); golden eagle, *Aquila chrysaëtos* in the flesh (26640); skunk (*Mephitis mephitica*), 2 specimens of kit-fox, *Vulpes velox*, and a monkey (*Cebus hypoleucus*) (26654); raccoon (*Procyon lotor*) (26702); skunk (*Mephitis mephitica*) (26740); specimen each of beaver (*Castor canadensis*) and porcupine (*Erethrizon dorsatus*) (26762); Humboldt's monkey, *Lagothrix Humboldtii* (26793); specimen each of spermophile (*Spermophilus grammurus*), Angora-goat, *Capra hircus angorenis*, and hedgehog (*Erinaceus europæus*) (26807); specimen of prairie-dog, *Cynomys ludovicianus* (26823); magpie in the flesh (26872); American magpie, *Pica pica hudsonica* in the flesh (26879); white-throated sapajou, *Cebus hypoleucus* (26900); squaw-duck (26957); 2 specimens of monkey (*Cebus* and *Chrysothrix*) (27044); Amazon parrot, *Amazona amazonica* in the flesh (27068); salamander (*Speterpes ruber*) (27114); 2 specimens of *Ursus americanus*, and a llama (*Lama glama*) (27144).

Smolinski, Joseph (Washington, D. C.). Starfish from the Adriatic Sea, 2 shells, *Pinna carbea* from the Isle of Lida, off the city of Venice, and a dried specimen of sea-horse, *Hippocampus heptagonus* from the Adriatic Sea (26836); specimen of *Gnaphalium leontopodium*, the "Edelweiss" of central Europe (27045).

SNYDER, BLADEN T. (Paris, France). Bill of lading dated Bristol, July 5, 1765. Exchange. 27093.

SOUHAMI, SADULLAH & CO. (Tarakdjilar Han, Constantinople, Turkey). Collection of objects representing Mohammedan and Jewish religious observances and costumes of Greek and American priests. Purchased for World's Columbian Exposition. 26942.

SOUTHWICK & CRITCHLEY (Providence, R. I.). Two skins of heath-hen, *Tympanuchus cupido*, from Martha's Vineyard, Mass. (26502, 26591). Purchased for World's Columbian Exposition.

SPAINHOUR, J. M. (Lenoir, N. C.). Collection of 697 small leaf-shaped implements found *en cache*, stone with worked flat surface on side and end, an unfinished stone pipe, and 15 large leaf-shaped implements found *en cache*. 27001.

SPEARS, J. R. (Northwood, N. Y.). Collection of photographs. 26109.

SPENCER, EMMONS (Big Pine, Cal.). Infusorial earth. 27099.

SPICER, Capt. JOHN O. (New London, Conn.). Eskimo coat and pants obtained by Capt. Clisby. 26309.

SPRAGUE, JOHN C. (New York City). Sets of eggs of sharp-tailed sparrow, chickadee, kingfisher, and red-tailed hawk. 26186.

SPRATT, Capt. FRANK P. (Helena, Mont.), through Frank L. Sizer and Mark W. Harrington. Fragments of sapphire. 26950.

SPRINKEL, J. W. (Dulinsville, Va.). Dried salamander (*Diemyctylus miniatus*). 26638.

SQUYER, HOMER (Mingusville, Mont.). Fossils (26933, 27122); specimens of *Anodonta plana* Lea (26941); land and fresh-water shells (26973).

STABLER, HAROLD B. (Sandy Spring, Md.). Blue-jay, *Cyanocitta cristata* in the flesh, (26268); barred-owl, *Syrnium nebulosum*, and field-sparrow, *Spizella pusilla*, in the flesh (26498).

STABLER, HAROLD B. and JAMES (Sandy Spring, Md.). Star-nosed mole, *Condylura cristata*. 26210.

STABLER, JAMES (Sandy Spring, Md.). Red-tailed hawk, *Buteo borealis*, in the flesh. 26408.

STALING, F. (Harrisonburg, Va.). Stalagmatic marble. 26085.

STANTON, T. W. (U. S. Geological Survey). Concretions from near Castle Gate and Scofield, Utah. 26476.

STARIN, JOHN H. (New York City.) Large colored crayon of Saratoga Battle Monument at Schuylersville, N. Y. 26954.

STATE, DEPARTMENT OF. (See under Henry W. Andrews, Columbian Historical Exposition, and Treasury Department.)

STEARNS, Dr. R. E. C. (U. S. Geological Survey). Piece of Japanese pottery. 26932.

STECKELMAN, CARL (Mayumba, Africa), through George C. Webster. Pottery and collection of ethnological objects and musical instruments from Africa. 26257.

STEINBECK, WILLIAM (Hollister, Cal.). Set of eggs of *Elanus leucurus*. 26122.

STEJNEGER, Dr. LEONHARD (U. S. National Museum). Two specimens of *Chasiempis Gayi* Wilson, sp. nov., from Oahu, Sandwich Islands (26497); 10 specimens of birds' skins from Bering Island, Kamtschatka (26558); specimen of *Catocala relicta* Walk, from San Francisco Mountains, Arizona, obtained at an elevation of 8,000 feet (27081). (See under George E. Harris and Jerome Lightfoot.)

STEPHENS, F. (Santa Ysabel, Cal.). Fossil wood from the Colorado Desert, about 6 miles east of Borego Springs (26805); 27 reptiles from Colorado Desert, including 4 specimens of the horned toad, *Phrynosoma McCallii* (25989).

STERKI, Dr. (See under Geological survey of Texas.)

STERNBURG, BARON H. S. (chargé d'affaires of Germany, Pekin, China). Skin of antelope (*Nemorhædus caudatus*) from the mountain region of north China. 27121.

STEUART, C. A. (See under L. L. Baker.)

STEUART, H. B. (Garrettsville, Ohio). Butterfly (*Papilio ajax*). 26277.

STEUART, Gen. J. E. P. (See under William B. Cary.)

STEVENSON, Mrs. CORNELIUS (Bryn Mawr, Pa.). Photograph of Ramses. 25956.

STILWELL, L. W. (Deadwood, S. Dak.). Fossil from Suggs, Wyo. 26091.

STODDARD, S. R. (Glens Falls, N. Y.). Photographs illustrating views in the vicinity of Howe's Cave, N. Y. Purchased for World's Columbian Exposition. 26129.

STORY, J. L. (The Dalles, Oreg.), through George F. Kunz. Two specimens of opal. 26434.

STRINGFELLOW, F. J. (See under Smithsonian Institution.)

STUART, L. W. (Monmouth, Iowa). Collection of 125 Niagara and Silurian fossils from Iowa. 25929.

STURGE, JOSEPH (Birmingham, England). Fruit-eating bat, *Brachyphylla cavernarum*. 27119.

SULZBERGER, D. (Philadelphia, Pa.). Knife used for the slaughter of cattle, according to the Jewish rite. Deposit. 26398.

SULZBERGER, MAYER (Philadelphia, Pa.). Eleven volumes illustrating the ceremonies and religious costumes of the world (26121); miniature copy of the Pentateuch (26817).

SWINGLE, Mr. (See under H. J. Webber.)

TABER, CHARLES, & CO. (New Bedford, Mass.). Nine collographic prints, "artotypes." 26527.

TAKAYANAZI, T. (New York City). Eight pieces of Japanese pottery. Purchase. 26931.

TALMAGE, J. E. (Deseret Museum, Salt Lake City, Utah). Two microscopic slides of male and female specimens of the brine-shrimp, *Artemia fertilis* Verrill, and a photo-micrograph of the female *Artemia*. 26459. (See under Deseret Museum.)

TAIT, Mrs. LIZZIE J. (See under The Woman's College of Baltimore.)

TATE, WILLIE B. (Washington, D. C.). Four specimens of *Argiope riparia* Hentz. 26184.

TAYLOR, CHARLES (New Britain, Conn.). G. A. R. badge of Stanley Post No. 11. 26227.

TAYLOR, Miss ELIZABETH (Troy, N. Y.). Birds' skins from western Manitoba and the Mackenzie River delta (26518); birds' nests and eggs from British North America; birds' skins from western Manitoba; harlequin duck from the rapids of Drowned Slave River; bird skeleton, Eskimo needle-case, and 115 specimens of plants from the Mackenzie basin. (26519).

TAYLOR, Rev. GEORGE W., D. D. (St. Barnabas Rectory, Victoria, B. C.). Specimens of *Acmæa* from British Columbia and Japan. 26136.

TAYLOR, Gen. RICHARD. (See under Thomas J. Armstrong.)

TAYLOR, Mrs. V. W. (Leitchfield, Ky.). Silk-moth, *Telea polyphemus*, and 2 swallow-tail butterflies. *Papilio troilus*. 25993.

TAYLOR, WILLIAM TATE (Bannack City, Mont.), through Dr. W. H. Melville. Gold in calcite, and two specimens of tiemannite from Piute County, Utah. 26585.

TEGIMA, S. (University of Tokio, Tokio, Japan). Two photographs of a meteoric stone which fell at Maêmê, Hishgori County, Province of Satsuma, Japan, in 1886. 26145.

TEST, FREDERICK C. (U. S. National Museum). Green frog, *Rana pipiens*, from Ocean City. 25995.

THE ALASKA INDIAN BAZAAR (Chicago, Ill.). Net-maker's outfit, consisting of grass, hackle, shuttle, spindle, and net. Purchase. 27101.

THE ART PUBLISHING COMPANY (Boston, Mass.). Twenty-seven specimens of photo-mechanical process work. 26716.

THE COLORADO TURKEY HONE STONE COMPANY (Denver, Colo.). Four whetstones and a grindstone. 26560.

The Forbes Lithograph Manufacturing Company (Boston, Mass.). Sixteen specimens of photo-lithographic work, etc. 26421.

The Grottoes Company (Shendun, Va.), through J. W. Rumple, president, and E. C. Pechim, general manager. Collection of cave materials from grottoes, collected by W. H. Newhall, of the National Museum, for World's Columbian Exposition. 26481.

The Knapp and Cowles Manufacturing Company (Bridgeport, Conn.). Eight mincing-knives. 26283.

The Massachusetts Arms Company (Chicopee Falls, Mass.). Objects illustrating the composition of the Maynard rifle. Deposit. 26835.

The Pasadena Loan Association (Pasadena, Cal.), through Miss Annie L. Pitcher. Plants used in their arts by the aborigines of Los Angeles and San Fernando, Cal. 26474.

The Scott Stamp and Coin Company (New York City). Colonial and other American medals (purchased for World's Columbian Exposition) (25975); colonial and continental paper-money. Purchase. (25991.)

The Woman's College of Baltimore (Baltimore, Md.), through Arthur Bibbins, curator. Specimen of *Branchiostoma lanceolatum*, obtained from Fort Tampa, Fla. by Mrs. Lizzie J. Tait, and specimens of *Cordylophora lacustris* Allm., bearing gonophores, collected from the pier of Fort Carroll, Patapsco River. 26785.

The Wyoming Historical and Geological Society (Wilkesbarre, Pa.). Medal to commemorate the 100th anniversary, July 3, 1878, of the battle and massacre at Wyoming, July 3, 1778. 26254.

Thomas, Dr. Cyrus. (See under Miss Ernestine Mager.)

Thompson, J. H., Jr. (Patterson, N. Y.). A young barred Plymouth Rock cock, in the flesh. 26521. (See under R. P. Thompson.)

Thompson, R. P. (Patterson, N. Y.), through J. H. Thompson, jr. A young White Cochin cock, in the flesh (26522); 2 white cochin hens (27024).

Thompson, William Nelles (Chatham, Ontario, Canada). Wampum belt said to have belonged to Tecumseh. Purchase. 26237.

Thornton, H. R. (New York City). Ivory coat of mail belonging to the Eskimo tribe of Cape Prince of Wales, and plates of iron dug up from the same locality. Purchased for World's Columbian Exposition. 26018.

Thornton, M. E. (Hickory, N. C.). *Gordius* from a fish-pond at Bridgewater, N. C. 26419.

Thorpe, Dr. H. H. (Liberty Hill, Tex.). Oyster shells cemented together (25886); fossils (25964); collection of pearls and corals, also string of coral (26764).

Tiffany & Co. (New York City). Silver Koran case and 2 silver Mohammedan talismans (26347). Purchased for the World's Columbian Exposition.

Tinkham, Asa W. (Brockton, Mass.). G. A. R. knapsack badge. 26228.

Tisdel, W. P. (Washington, D. C.). Marimba from Santiago de Veragua, Province of Chiriqui, Colombia. 27067.

Toby, F. H. (Fort Huachuca, Ariz.), through Capt. C. E. Bendire, U. S. A. Frontal bone of *Lepidosteus*. 26316.

Todd, E. R. (U. S. National Museum). Chipmunk (*Tamias striatus*), (26137); barred-owl, *Syrnium nebulosum*, in the flesh, from near Lower Cedar Point, Maryland. (26258.)

Townsend, C. H. (U. S. Fish Commission). Alcoholic specimens of crayfishes; larva of crane-fly, alcoholic reptile, and fishes, representing the genera *Campostoma*, *Rhinichthys*, *Notropis*, *Semotilus*, *Phoxinus*, *Hybognathus*, *Catostomus*, and *Etheostoma*, from Westmoreland County, Pa. (27014); mammal skins (27017). (See under Fish Commission.)

Traill, W. E. (Ashcroft, British Columbia). Specimen of *Sorex* sp., and alcoholic specimens of small salmon (*Oncorhynchus Kennerlyi*, Roach, and *Richardsonius* *lateralis*) and dace (*Apocope vulnerata*), (25938); alcoholic specimens of fishes from Stuart's Lake, British Columbia, consisting of *Uranidea, Richardsonius, Salmo mykiss*, and *Salmo Kennerlyi* (27103).

TREASURY DEPARTMENT, U. S. Three skins of female seals and skin of pup seal, collected by J. Stanley Brown, while acting as agent in charge of the Seal Islands; for use in connection with the Bering Sea arbritration, and also skin of seal (*Phoca vitulina*), (26395); fur-seal skins, skulls, and bones, collected by the revenue steamer *Corwin* during her summer cruise, collected at the request of the Secretary of State in connection with the Bering Sea arbitration (26418).

TRISTRAM, Rev. H. B. (The College, Durham, England). Birds' skins from New Guinea. Exchange. 25982.

TRITSCH, ALBERT (Johannesburg, Transvaal, South Africa). Copies of the Rhodesia Chronicle and Mashonaland Advertiser, the Mashonaland Herald and Zambesian Times, printed in cyclostyle. 26717.

TURNER, J. HENRY (through Alaska Commercial Company). Skulls of bear and moose, 4 birch-bark canoes, skin canoe, sled and ethnological objects, also fossil bones of Elephas (*Bison latifrons*), from Alaska. Purchase. 26892.

TYLOR, Dr. EDWARD B. (Museum of Natural History, Oxford, England). Two photographs of pottery made by the Santa Clara Indians. 26491.

ULRICH, E. O. (Newport, Ky.), through R. R. Gurley. Five specimens of *Inocaulis arbuscula* Ulrich, from Cincinnati group (lower beds). 26754.

UNIVERSITY OF UPSALA (Upsala, Sweden), through Dr. Theo. Fries. Large collection of dried plants, principally from Brazil. Exchange. 26148.

VALENTINE, E. K. (U. S. Senate). Copies of official programmes and Senators' tickets used in the Cleveland inaugural ceremonies in 1893. 26830.

VANCE, Dr. J. R. (Stanton, Tex.). Texas rattlesnake. Purchased for World's Columbian Exposition. 26400.

VAN DEMAN, H. E. (Department of Agriculture). Asphalt from Emery County, Utah. 26924.

VAN EPPS, PERCY M. (Glenville, N. Y.). Copper key bugle. 27073.

VAN RENSSELAER, Mrs. W. KING (New York City). Specimen of *Trombidium* from Weehawken, N. J. 26454.

VAUGHAN, T. WAYLAND (Cambridge, Mass.). Fresh-water shells from Louisiana and Texas. 26903.

VINTON, GEORGE W. (See under Illinois and Mississippi Canal Company.)

VON IHERING, Dr. H. (Rio Grande, Rio Grande do Sul, Brazil). Land, fresh-water, and marine shells from Southern Brazil (26577); shells (26028).

VON MUELLER, Baron FERDINAND (Melbourne, Victoria). Specimens of *Banksia odorata* and *Corysanthes unguiculata* (26034, 26120); herbarium specimens from Australia (26951).

VON PHUL, Hon. FRANK (vice-consul, San Juan del Norte, Nicaragua), through S. C. Braida, U. S. consul. Spider (*Gasteracantha cancer* Hentz), from Greytown. 26373.

VON STREERUWITZ, W. H. (Austin, Tex.). Specimens of marble from the Sierra Diablo and volcanic and metamorphic rocks from Van Horn Mountains, El Paso County (25999); ores and rocks (26080).

VORMUS, ALBERT (Greenville, Miss.). Flint chips, fragment of bone, 5 fragments of pottery, and 6 pieces of burnt clay from a mound near Greenville. 27096.

VOTH, Rev. H. N. (Lehigh, Kans.), through U. S. Bureau of Ethnology. Collection of Cheyenne Indian material, obtained by James Mooney and transferred from the Bureau of Ethnology to the National Museum. 26674.

WADE, Mrs. LEVI (Allegheny, Pa.). Song by Mrs. Wade, dedicated to the ladies of New England. 26042.

WAGGAMAN, THOMAS E. (Washington, D. C.). Three pieces of Japanese pottery. 26930.

WALCOTT, CHARLES D. (See under Interior Department. U. S. Geological Survey.)

WALKER, BRYANT (Detroit, Mich.), through C. T. Simpson. Specimens of *Anodonta*, representing 7 species. 26894.

WALKER, Dr. R. L. (Mansfield, Pa). Thirty-three photographs of living animals. 26578.

WALLACE, SAMUEL (Washington, D. C.). Homing pigeon. 26483.

WALNUT, Mrs. ADA U. (Los Angeles, Cal.). Collection of shells. 26399.

WANSTALL, WILLIAM (Washington, D. C.). Baker's tally-sticks (four) used in Philadelphia in 1818. 26317.

WARD, ROWLAND & CO. (London, England). Mounted heads of *Strepsiceros kudu*, *Orcas canna*, *Gazella walleri*, *Strepsiceros imberbis*, *Pantholops Hodgsoni*, *Capra megaceros*, *Ovis polii*, *Boselaphus tragocamelus* (26898); 12 large mounted heads of mammals (26922). Purchased for World's Columbian Exposition.

WARD'S NATURAL SCIENCE ESTABLISHMENT (Rochester, N. Y.). Game birds, chiefly foreign (25893)*; skull of boa constrictor (26138)*; specimen of precious coral (26200)*; 2 enlarged models of skulls, one of a penguin and the other of a frog (26233)*; peccary from Texas, sewellel from Washington, and meadow-mouse from Tennessee (26333)*; model of skull of *Menopoma* (26401)*; shell of argonaut, a paper *nautilus* (26402)*; raccoon skin (26466)*; disarticulated skeleton of horse (26598)*; five mounted birds, viz, Bengal vulture, *Gyps bengalensis*, black vulture, *Catharista atrata*, English pheasant, *Phasianus colchicus*, emu, *Dromaius novæ-hollandiæ*, adjutant, *Leptoptilus dubius* (26613)*; Auzoux model showing complete anatomy of a turkey (26665)*; mounted skeleton of man (26812)*; geological material from various localities (exchange) (26853); spiny-tailed squirrel, *Anomalurus pelii;* pangolin, *Smutsia temminckii;* mole-rat, *Bathyurgus maritinus;* wild ass, *Asinus onager* (purchase) (26864); 8 mounted mammals, viz, African mungoose, *Herpestes ichneumon*, Indian mungoose, *Herpestes griseus*, genet, *Genetta vulgaris*, fat-tailed sheep, *Ovis aries*, steatopyga, domestic goat, lop-eared rabbit, *Lepus cuniculus* var., guinea-pig, *Cavia aperea*, zebu, *Bibos indicus* (26867)*; geological material (26885)*; slab of serpentine and one of luxullianite from England, and slab of rapekivi granite from Finland (26895)*; mounted specimen of colugo, *Galeopithecus volans* (purchase) (27130).

WARNEKE, C. W. (Washington, D. C.). Specimen of *Putorius erminia*, in the flesh. 25931.

WARREN, S. (White Springs, Fla.). Larva of bombycid-moth, *Lagoa crispata*. 26365.

WASHINGTON, LAWRENCE (Marshall, Va.). Washington's Bible (folio volume with autograph of George Washington on title-page, and his name printed in the list of subscribers at the end of the book; oil portrait of Maj. Lawrence Washington (half-brother of George Washington, who built the mansion and named the estate Mount Vernon, and who bequeathed the property to George Washington; commission of Lawrence Washington as major in the King's army on the expedition under Admiral Vernon. Deposit. 25899.

WASHINGTON ONYX MINING AND MILLING COMPANY (Pomeroy, Wash.). Three specimens of opal from the "Onyx" mines in Garfield County, Wash. 26681.

WATKINS, J. E. (See under M. W. Beecher and T. S. Bishop.)

WEAVER, O. R. (Indianapolis, Ind.) Badge of the G. A. R., Department of Indiana. 26247.

WEBB, ALEXANDER R. (U. S. consul, Manila, Philippine Islands). Thirty-six photographs representing natives and houses, streets, and other scenes at the Philippine Islands (26220); 4 native games, Manila milkman's outfit consisting of 6 pieces, native costume, hat, shirt and breeches, pair of shoes for wet weather, and a collection of clay kitchen vessels. 26320.†

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*Purchased for World's Columbian Exposition.

†These objects were purchased by Mr. Webb for the National Museum at the request of the Secretary of the Smithsonian Institution.

WEBB, WALTER F. (Geneva, N. Y.). Six eggs of Audubon's shearwater, 10 eggs of man-o'-war bird, 20 eggs of sooty tern, 13 eggs of noddy tern, 12 eggs of booby from Bahama Islands, 3 eggs of cinnamon teal from California. 26278.

WEBER, F. C. (Chicago, Ill.). Spider (*Argiope transversa* Hentz). 26180.

WEBBER, H. J. (Eustis, Fla.). Turtle, in the flesh, obtained by Messrs. Webber and Swingle. 26906.

WEBSTER, GEORGE C. (See under Carl Steckleman.)

WEED, CLARENCE M. (Hanover, N. C.). Type specimens of North American harvest-spider, *Phalangiidæ*. 26978.

WEED, WALTER L. (Washington, D. C.). Kaolin from near Bethesda Park, Montgomery County, Md. 26826.

WEEMS, DAVID G. (Baltimore, Md.). Photograph of Mr. Weems, inventor. 26406.

WESLEY, WILLIAM & SON (London, England). Illustrated catalogue of the Anglo-Jewish Historical Exhibition (purchase) (26059); book entitled "Etching and Mezzotint Engraving," by H. Herkomer, London, 1892, illustrated (purchase) (26084); 6 photographs of Jewish antiquities (purchased for World's Columbian Exposition) (26241).

WHITE, Dr. C. H., U. S. Navy. Butterfly (*Timetas chiron*), obtained 200 miles off the northwestern coast of Mexico, 2 sphingid-moths, dragon-fly, and a specimen of *Hydrophilus* from Peru. 26964.

WHITE, E. H. (Astoria, Oreg.). Land and fresh-water shells. 26340.

WHITEAVES, J. F. (Geological Survey of Canada, Ottawa, Canada). Specimen of *Thetis affinis* Whiteaves, from Skidgate Inlet, British Columbia. 26623.

WHITELAW, W. H. (Hartford, Conn.). Nutmeg, made from the original Charter Oak tree. 26480.

WHITNEY, Miss ANNE (Boston, Mass.). Original plaster model of statue "Leif Erikson."

WHITNEY, C. A. (Piedmont, S. Dak.), through L. M. McCormick. Dry skin of bat (*Corynorhinus Townsendii*). 26652.

WHITTIER, JOSEPH H. (Manchester, N. H.), through S. S. Yoder. Badge of the Union Veterans Union, Department of New Hampshire. 26451.

WHYTE, JAMES. (See under Dr. Elliott Coues, U. S. Army).

WICKS, M. L., JR. (Los Angeles, Cal.). Skin of short-tailed albatross, *Diomedea albatrus*. Exchange. 26550.

WIDMANN, OTTO (Old Orchard, Mo.). Nest of Baltimore oriole, 3 nests of Traill's fly-catcher, and 3 nests of Acadian fly-catcher from the vicinity of St. Louis. 26839.

WILCOX, Mrs. MARY E. D. (Washington, D. C.). Collection of Jackson relics, consisting of a walking-stick presented to Gen. Andrew Jackson by a friend; Turkish scimetar presented by the Sultan of Turkey to Gen. Jackson; watch worn by Gen. Jackson at the battle of New Orleans; bead watch-guard presented to him by his wife; comb presented by the ladies of New Orleans to Mrs. Jackson; card-case used by Mrs. Jackson; racing-purse used by the general; veil presented by the ladies of Cincinnati to Mrs. Jackson; sleeve of a dress worn by Mrs. Jackson at the grand ball in New Orleans in 1816; nullification proclamation, printed on satin; copy of appendix to Blackstone used by Gen. Jackson when studying law in Salisbury, N. C.; copy of Koran; card of trinkets belonging to Mrs. Jackson; miniatures on ivory of President and Mrs. Jackson. Deposit. 26196.

WILCOX, A. C. (Washington, D. C.). Two arrow-heads found near Upper Marlboro, Md. 27097.

WILCOX, GLOVER P. (Fort Huachuca, Ariz.). Eggs of *Icteria virens longicauda* and *Icterus parisorum*. 26168.

WILCOX, JONES (East Chatham, N. Y.). Two silver Wyandotte fowls in the flesh (26628, 26670); silver-spangled Hamburg fowl.

Wilcox, Dr. Timothy E., U. S. A. (Fort Huachuca, Ariz.). Arachnida and myriopoda, alcoholic specimens of mammals, leeches, birds, and reptiles, collected by Dr. Wilcox, Master Harry Lawrence, Master Fred Ebert, Master Fred Fowler, Miss Bertha Rawolle, Miss Florence Scott, Messrs. Leahy and Walerius, hospital stewards, and E. Jenks, hospital corps (26403); insects from the vicinity of Fort Huachuca (26579). (See under C. H. Bales).

Wilkinson, E. (Mansfield, Ohio). Fossil tooth of mammal. 26044.

Willcox, Joseph (Philadelphia, Pa.). Minerals from various localities. Purchased for World's Columbian Exposition. 26829.

Williams, F. H. (Greene, N. Y.). Two hammer-stones, 2 rude chipped implements, 3 notched sinkers, 20 knives, scrapers, and other objects (27082); 60 stone implements, fragments of pottery, and three vessels of steatite (27115).

Williams, J. A. (Cloud Chief, Okla.). Fifth neck vertebra of an elk (*Cervus canadensis*). 26722.

Williams, J. W. (Springfield, Mo.). Specimens of stalactites and stalagmites for the World's Columbian Exposition. 26307.

Williams, Mrs. Talcott (Philadelphia, Pa.). Costume of man, costume of woman, a boy's costume, and man's cloak from Morocco. Purchased for World's Columbian Exposition. 26053.

Williams, T. (Honolulu, Hawaiian Islands). Eighty-five photographs representing views of Hawaiian volcanoes. Purchased for World's Columbian Exposition. 26131.

Willis, Merritt (Bronx Mills, West Farms, N. Y.). Chipped flint dagger or spear-head from Illinois, 12 arrow-heads from West Chester, N. Y., 1 from Indiana, and 1 from California. 26008.

Willson, George A. (Ashton, Md.). American barn-owl, *Strix pratincola*. 26050.

Wilson, F. E. (Greenville, Ohio). Musket flint and small arrow-point, also 2 buttons, supposed to be relics of campaigns under Gen. St. Clair and Gen. Anthony Wayne during the Revolutionary War. 26746.

Wilson, Scott B. (Surrey, England). Seventeen birds in alcohol from the Sandwich Islands. (26201, 26202). (Purchase, gift.)

Wilson, Thomas (U. S. National Museum). Archæological objects, consisting of scrapers, arrow-heads, and similar objects from Le Teil, Selles-sur-Cher, Loir-et Cher, France, obtained from the collection of A. Bonnet (26538); bronze sword and bronze hatchet from near Norfolk, England, (26795); 187 rude and leaf shaped implements, perforators, scrapers, arrow-heads, polished hatchets, grooved axes, pierced tablets and boat-shaped articles, hematite mullers, and a disk of banded slate from Ohio (26870). Deposit.

Wiltberger, Jacob (Brookland, D. C.). Rude implements and spear-heads of quartzite. 26413.

Winlock, W. C. (See under Smithsonian Institution.)

Winton, George B. (San Luis Potosi, Mexico). Skin of pectoral bobwhite, *Colinus pectoralis* (gift) (26614); skins of imperial woodpecker, *Campephilus imperialis*, from Michoacan, Mexico (purchased for World's Columbian Exposition) (26893).

Witchell, S. B. (San Antonio, Tex.). Cocoon of bag-worm, *Thyridopteryx* sp. 26001.

Wittkugel, Erich (San Pedro Sula, Honduras). Sixty specimens, representing 25 species of rare lepidoptera. Purchase. 26322.

Wittich, B. (Moline, Ind.). Fifty-four photographs illustrating the life and industries of the Indians of Arizona, New Mexico, and Lower California. 26244.

Wood, Miss E. M. (Cheshire, England). Six colored drawings of gregarinida (small parasitic invertebrates) (26234); five drawings of sponges and worms showing details of structure (27038). Purchased for World's Columbian Exposition.

WOOD, NELSON (U. S. National Museum). Sumatra pullet. 26486.

WOODWARD, ALBERT (Dayton, Wash.). Volcanic dust. 27132.

WOODWARD, KARL W. (Washington, D. C.). Trunk of fossil tree from the Potomac formation of the District of Columbia. 26918.

WOOSTER, A. F. (Norfolk, Conn.). Specimens of *Dicerca chrysea*, *Nyctobates pensylvanicus*, and *Lebia grandis*. 26777.

WORTH, S. G. (U. S. Fish Commission). Specimen of *Unio hyalinus* Lea, from Tygart's River, West Virginia. 26448.

WORTHEN, CHARLES K. (Warsaw, Ill.). Skin and skull of Yaguarundi's cat, *Felis yaguarundi*. Purchase. 26763.

WRIGHT, BERLIN H. (Penn Yan, N. Y.). Collection of shells. 26780.

WRIGHT, Prof. G. F. (Oberlin, Ohio). Glacial material from Ontario, Canada (26749); photographs illustrating phenomena of glacial drifts from Ohio to Canada (26786). Purchased for World's Columbian Exposition.

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WÜRTELE, F. C. (Quebec, Canada). Bromide enlargement of a photograph of working model of S. S. "*Royal William*," and a copy of transaction No. 20 of the Literary and Historical Society of Quebec, Canada, sessions of 1889–1891, containing the account and certified statement of steamship. Purchase. 27036.

WYANDANCE BRICK AND TERRA COTTA COMPANY (New York City), through D. G. Harriman, secretary. Pyrite deposited on wood. 26508.

WYARD, E. SAXON (Washington, D. C.). Eight large ornamented shells from the Indo-Pacific Ocean. 25966.

WYNANT, W. P. (Bealeton, Va.). Horned grebe, *Colymbus auritus*. 26706.

WYNDHAM, W. (H. B. M. consul, Surinam), through Dr. R. W. Shufeldt, U. S. A. Two crania of catfish, known as "crucifix" fish. 26267.

WYOMING HISTORICAL AND GEOLOGICAL SOCIETY. (See under Smithsonian Institution.)

YALE COLLEGE MUSEUM (New Haven, Conn.), through Charles E. Beecher, curator. Twelve slabs of crinoids from Crawfordsville, Ind. (26415); 325 specimens of fossil crinoids, brachiopods, and mollusca from the same locality (26977).

YALE COLLEGE (New Haven, Conn.), through Prof. E. S. Dana. The Henry magnet. Deposit. 26705.

YODER, S. S. (See under Joseph H. Whittier.)

YOUNG, R. J. (Chrystoval, Ariz.). Two snakes. 27033.

ZOÖLOGICAL MUSEUM OF CHRISTIANIA (Christiania, Norway), through Prof. R. Collett, director. Alcoholic specimens of *Raia nidrosiensis*, *Raia fullonica*, *Chimæra monstrosa*, *Spinax spinax*, *Bothus rhombus*, *Cottus scorpius*, *Callionymus lyra*, *Argentina sphyræna*, *Salvelinus alpinus*, *Onos mustela*, *Onos cimbrius*, *Gadus esmarkii*, and *Raniceps ranimus*. Exchange. 26865.

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NOTE A.

ACCESSIONS RECEIVED IN THE MUSEUM DURING 1890–1891, FOR EXHIBITION AT THE WORLD'S COLUMBIAN EXPOSITION.

Beath, J. W. (Philadelphia, Pa.). Collection of gems and minerals. 24360. Fifteen specimens of intaglios of bloodstone, agate, carnelian, sardonyx, and labradorite. 24363.

Brimley, H. H. & C. S. (Raleigh, N. C.). Six mammal skins. 24271.

English, G. L., & Co. (New York City). Thirty-eight minerals. 24375.

Foote, Dr. A. E. (Philadelphia, Pa.). Thirty-one minerals. 24370. Twenty-eight minerals. 24434.

Pennypacker, C. H. (West Chester, Pa.). Seven minerals. 24441.

Smith, Dr. Hugh M. (U. S. Fish Commission). Bat. 24284.

Tiffany & Co. (New York City). Collection of gems. 24359.

Wittkugel, Erich (Honduras). Twelve mammals from Honduras. 24394.

Worthen, C. K. (Warsaw, Ill.). Fourteen mammal skins. 24265.

NOTE B.

ACCESSIONS RECEIVED IN THE MUSEUM DURING 1891–1892, FOR EXHIBITION AT THE WORLD'S COLUMBIAN EXPOSITION.

Armstrong, F. B. (Brownsville, Tex.). Two skins of chachalaca, *Ortalis vetula maccali*. 25866.

Beath, J. W. (Philadelphia, Pa.). Twenty-two cut stones consisting of agatized wood, smoky quartz, amethyst, garnet, sapphire, green and white onyx cameo, moonstone, fowlerite, sphalerite, and oligoclase, and a specimen of spinel in calcite from Ogdensburg, N. J. 25089.

Boucard, A. (London, W. C., England). Eleven skins of birds of paradise, representing 11 species. 24946. Twenty-four specimens, representing 24 species of humming-birds' skins. 25047 Three specimens, representing 3 species of birds of paradise from New Guinea. 25458.

Deyrolle, Emile (Paris, France). Four mounted mammals. 24819.

Downs, A. C. (Realitos, Duval County, Tex.). Armadillo (*Tatusia novemcincta*). 25549.

English, G. L., & Co. (New York City). Eleven specimens of axinite, marcasite, fluorite, and calcite from various localities. 24975. Calcite ball from Japan and a specimen of stibnite from the same locality. 25238. Malachite slab from Siberia. 25420. Minerals from various localities, consisting of smoky quartz, chloropal, dolomite, pyrite, laumontite, inesite, titanite, azurite, native sulphur, rhodochrosite, minium, cassiterite, amber, ilvaite, and others. 25849.

Foote, Dr. A. E. (Philadelphia, Pa.) Specimen of matlockite and one of phosgenite from Cromford, Derbyshire, England. 25204. Eight specimens of rocks and other geological material. 25620 Minerals from various localities, consisting of calcite, pyrite, psilomelane, and barite. 25850.

Foster Bros. (Boston, Mass.). Picture of Swiss glacier. 25659.

Frazar, M. Abbott (Boston, Mass.). Skin of white ibis, *Guara alba* from Brownsville, Tex. 24936.

Gerrard, E. (London, England). Ten skins and an alcoholic specimen of mammal from Central and South America. 24669.

Golden, R. A. (Washington, D. C.). Specimen of greater snow goose, *Chen hyperborea nivalis* in the flesh. 25459. Two prairie-chickens, *Tympanuchus americanus* in the flesh. 25763.

Hamlin, Dr. A. C. (Bangor, Me.). Specimen of cut tourmaline from Paris, Me., and 2 cut zircons from Ceylon. 24926.

Harrison, Hon. Benjamin (Executive Mansion). Armadillo (*Tatusia novemcincta*), from Breckenridge, Tex., collected by Mr. R. R. Skagg. 24887.

Hasbrouck, E. M. (Washington, D. C.). Skin of Carolina parrakeet, *Conurus carolinensis* from Florida. 25109.

Howell, E. E. (Washington, D. C.). Three bird skins from Australia, consisting of a lyre-bird, *Menura superba* (female), and male and female specimens of satin bower-bird, *Ptilonorhynchus violaceus*. 25217. Nine specimens of minerals, consisting of scheelite, willemite, tschermigite, hyalite, cryolite, röttisite, evansite, and orpiment. 25262. Minerals from various localities, consisting of manganite, labradorite, calcite, chalcopyrite, pyrite, tourmaline, and jasper. 25263. Two specimens of agalmatolithe carving from China. 25467.

Knowlton, W. J. (Boston, Mass.). Ornamental stones. 24545. Four specimens of tourmaline from Siberia and 2 cut specimens of zircon from Ceylon. 24929.

Lamb, T. F. (Portland, Me.). Ten cut specimens of tourmaline from Auburn, Me., and a cut topaz from Chatham, N. H. 24927.

Morrison, Prof. J. H. (Luray, Va.). Cave materials from Luray Caverns. 25517.

Müller, Dr. August (Berlin, Germany). Skin of owl-monkey, *Nyctipithecus azaræ*, skin of cavy (*Diasprocta aguti*), skin of Honduras hare, *Lepus braziliensis*. 24780.

Nelson, E. W. (Bishop Creek, Cal.), through Dr. C. Hart Merriam. Ten skins of mountain sheep from the high desert mountains near Death Valley. 24706.

Palmer, William (U. S. National Museum). Bat (*Vespertilio gryphus lucifugus*) in the flesh. 24571.

Pratt, Capt. R. H., U. S. A. (Hampton Institute, Hampton, Va.). Collection of ethnological objects obtained from the North American Indians. 25516.

Richardson, Jenness (American Museum of Natural History, New York City). Four skins of passenger-pigeon, *Ectopistes migratorius* from Indian Territory. 24849. Eight specimens of Carolina parrakeet, *Conurus carolinensis* from Florida. 24826.

Rudinger, Louis (D'Hanis, Tex.). Little striped skunk, *Spilogale* sp. from Texas. 24570.

Sansom and Martin (Uvalde, Tex.). Civet cat, *Bassariscus astuta*. 25548.

SCHLÜTER, W. (Halle, Germany). Twelve mammal skins. 24655.

SCHMID, EDWARD S. (Washington, D. C.). Two peafowls (*Pavo cristatus*) in the flesh. 25759. Seven prairie-chickens, *Tympanuchus americanus* in the flesh. 25762.

SMITH, WILLIAM G. (Loveland, Colo.). Four mammal skins from Colorado. 25473. Pouched-gopher, *Geomys bursarius*. 25550. Beaver (*Castor canadensis*), prairie-hare, *Lepus campestris*. Rocky Mountain chipmunk, *Tamias quadrivittatus*, little striped skunk, *Spilogale gracilis*. 25555. Striped spermophile, *Spermophilus tridecemlineatus*. 25597. Two dusky grouse, *Dendragapus obscurus*. 25830. White-tailed ptarmigan, *Lagopus leucurus*. 25867.

SMITHSONIAN INSTITUTION. U. S. National Museum. Volcanic materials from the vicinity of Flagstaff, Ariz., collected by Mr. G. P. Merrill. 25231. Collection of volcanic rocks and stalactites from Organ Mountain and Bennett Stevenson Mine, New Mexico, collected by Mr. G. P. Merrill. 25384. Life-sized figure of a girl belonging to one of the mountain tribes of northwest Africa, in native costume, obtained by Dr. G. Brown Goode. 25882. Also terra-cotta wreath.

SOULE, GEORGE (Billings, Mont.). Male rocky-mountain sheep, *Ovis canadensis*. 25298.

SOUTHWICK & CRITCHLEY (Providence, R. I.). Fox-squirrel, *Sciurus niger niger*, from Florida. 24606. Skin of Peale's egret, *Ardea pealei*, from Andros Island, Bahamas. 24937. Three specimens of North American game birds, representing 3 species. 25833.

STUART, R. C. (Tampa, Fla.). Mounted ivory-billed woodpecker. *Campephilus principalis* from Florida. 25429.

TIFFANY & CO. (New York City). Carved amber for the gem exhibit. 25114.

WARD'S NATURAL SCIENCE ESTABLISHMENT (Rochester, N. Y.). Skin of *Alces machlis*. 24651. Specimen of fluorite from Cumberland, England, and 8 cut specimens of minerals from various localities. 24779.

WATROUS, B. P. (Washington, D. C.). Four wild turkeys, *Meleagris gallopavo* in the flesh from Virginia. 25026. Purchased. W. C. E.

WAYNE, ARTHUR T. (Old Town, Fla.). Skin of swallow-tailed kite, *Elanoides forficatus*. 25861.

WOODWARD, CHARLES L. (New York City). Three cartoons of Indian chiefs painted by George Catlin. 25777. Purchased. W. C. E.

WORTHEN, CHARLES K. (Warsaw, Ill.). Lynx-skin from Kansas. 25509. Purchased. W. C. E.

APPENDIX VII.

BIBLIOGRAPHY OF THE U. S. NATIONAL MUSEUM FOR THE FISCAL YEAR ENDING JUNE 30, 1893.

PUBLICATIONS OF THE MUSEUM.

ANNUAL REPORT.

Annual Report | of the | Board of Regents | of the | Smithsonian Institution, | showing | the Operations, Expenditures, and Condition | of the Institution | for the | year ending June 30, 1890. | — | Report | of the | National Museum. | — | Washington: | Government Printing Office. | 1891.

8vo., pp. XVIII+811. Plates I-CLXIII; figures 1-99.

PROCEEDINGS.

Smithsonian Institution. | United States National Museum. | — | Proceedings | of the | United States National Museum. | — | Volume XIV. | 1891. | — | Published under the direction of the Smithsonian Institution. | — | Washington: | Government Printing Office. | 1892.

8vo., pp. VI+750. Plates I-XXXIV; figures 1-3.

The papers in this volume comprise Nos. 842-886, all of which were published separately during the fiscal year ending June 30, 1892.

The dates of publication are given on page VI of the volume.

The papers included between Nos. 889-915, in Volume XV, and between Nos. 919-926 (excepting No. 921), and also an advance edition of No. 944, of Volume XVI, were published separately during the year, and distributed to a limited number of specialists at home and abroad.

BULLETIN.

Smithsonian Institution. | United States National Museum. | — | Directions for collecting and | preserving insects. | By | C. V. Riley, M. A., PH. D., | Honorary Curator of the Department of Insects, U. S. National Museum. | — | Part F of Bulletin of the United States National Museum, No. 39 | (with one plate). | — | Washington: | Government Printing Office. | 1892. |

8vo., pp. [1]-[147]. Plate I, figures 1-139.

Smithsonian Institution. | United States National Museum. | — | Instructions for collecting mollusks, | and other useful hints for | the conchologist. | By | William H. Dall, | Honorary Curator of the Department of Mollusks, U. S. National Museum. | | — | Part G of Bulletin of the United States National Museum, No. 39. | — | Washington: | Government Printing Office. | 1892. |

8vo., pp. [1]-[56]. Figures 1-8.

Parts A-E, inclusive, of Bulletin 39, were published during the preceding fiscal year.

Smithsonian Institution, | United States National Museum. | — | Bulletin | of the | United States National Museum. | No. 40. | Bibliographies of American Naturalists: | IV. The published writings of George Newbold Lawrence, 1844-1891. | By | L. S. Foster. | — | Washington: | Government Printing Office. | 1892. |

8vo., pp. XI+124. Frontispiece.

SPECIAL BULLETIN.

Smithsonian Institution. | United States National Museum. | Special Bulletin No. 1. | Life Histories | of | North American Birds | with special reference to | their breeding habits and eggs, | with | twelve lithographic plates. | By | Charles Bendire, Captain, U. S. Army (Retired), | Honorary Curator of the Department of Oölogy, U. S. National Museum, | Member of the American Ornithologists' Union. | — | Washington: | Government Printing Office, | 1892.

4vo., pp. VIII+446. Twelve plates.

PAPERS BY OFFICERS OF THE NATIONAL MUSEUM AND OTHER INVESTIGATORS WHOSE WRITINGS ARE BASED DIRECTLY OR INDIRECTLY ON THE COLLECTIONS OF THE MUSEUM.

ALPHABETICAL LIST OF NAMES.

Adler, Cyrus, Librarian, Smithsonian Institution; Assistant Curator, Oriental Antiquities and Religious Ceremonial, U. S. National Museum.

Allen, Harrison, 1933 Chestnut street, Philadelphia, Pa.

Allen, J. A., American Museum of Natural History, New York City.

Baur, G., University of Chicago, Chicago, Ill.

Bean, Barton A., Assistant Curator, Department of Fishes, U. S. National Museum.

Bean, Tarleton H., U. S. Fish Commission; Honorary Curator, Department of Fishes, U. S. National Museum.

Beecher, Charles E., Yale College, New Haven, Conn.

Benedict, James E., Assistant Curator, Department of Marine Invertebrates, U. S. National Museum.

Bendire, Charles, U. S. Army, Honorary Curator, Department of Birds' Eggs, U. S. National Museum.

Bigelow, R. P., Massachusetts Institute of Technology, Boston, Mass.

Blatchley, W. S., Terre Haute, Ind.

Bolles, T. Dix, U. S. Navy.

Bollman, Charles H., Indiana State University, Bloomington, Ind.
Canby, William, Wilmington, Del.
Carleton, M. A., Manhattan, Kans.
Clark, A. Howard, Curator of Historical Collections, U. S. National Museum.
Clark, J. A., U. S. Department of Agriculture.
Clarke, F. W., U. S. Geological Survey; Honorary Curator, Department of Minerals, U. S. National Museum.
Cope, E. D., 2102 Pine street, Philadelphia, Pa.
Coulter, John M., Bloomington, Ind.
Coville, Frederick V., Botanist, U. S. Department of Agriculture.
Dall, William Healey, U. S. Geological Survey; Honorary Curator, Department of Mollusks, U. S. National Museum.
Dewey, L. H., Assistant Botanist, U. S. Department of Agriculture.
Eaton, D. C., Yale University, New Haven, Conn.
Eckfeldt, J. W., 6320 Vine street, Philadelphia, Pa.
Eigenmann, Carl H., University of Indiana, Bloomington, Ind.
Elliott, D. G., American Museum of Natural History, New York City.
Evans, A. W., U. S. Department of Agriculture.
Evermann, Barton W., U. S. Fish Commission, Washington, D. C.
Fernow, B. E., Chief, Division of Forestry, U. S. Department of Agriculture; Honorary Curator, Section of Forestry, U. S. National Museum.
Fisher, E. M., Lake Forest, Ill.
Flint, James M., M. D., U. S. Navy.
Goës, A., Linkaping, Sweden.
Goode, G. Brown, Assistant Secretary, Smithsonian Institution, in charge of U. S. National Museum.
Harris, Gilbert Dennison, Russellville, Ark.
Hasbrouck, Edwin M., 1610 Fifteenth street N. W., Washington, D. C.
Haupt, Paul, Johns Hopkins University; Honorary Curator, Oriental Antiquities and Religious Ceremonial, U. S. National Museum.
Hay, O. P., Terre Haute, Ind.
Hill, Robert T., Washington, D. C.
Hitchcock, Romyn, 3858 Vincennes avenue, Chicago, Ill.
Holm, Theodor, U. S. Department of Agriculture.
Holmes, William H., Bureau of Ethnology; Honorary Curator, Department of American Aboriginal Pottery, U. S. National Museum.
Holzinger, Y M., U. S. Department of Agriculture.
Hough, Walter, U. S. National Museum.
Howard, Leland O., Assistant Entomologist, U. S. Department of Agriculture.
Jordan, David Starr, President, Leland Stanford Junior University, Palo Alto, Cal.
Keeler, Charles A., California Academy of Natural Sciences, San Francisco, Cal.
Kirsch, Philip H., Columbia City, Ind.
Knowlton, F. H., Assistant Curator, Department of Fossil Plants, U. S. National Museum.
Koehler, S. R., Curator, Section of Graphic Arts, U. S. National Museum.
Lindgren, Waldeman, U. S. Geological Survey, Washington, D. C.
Linton, Edwin, Washington and Jefferson College, Washington, Pa.
Lucas, F. A., Assistant Curator, Department of Comparative Anatomy, U. S. National Museum.
Ludwig, Hubert.
Marsh, O C., Yale College, New Haven, Conn.; Honorary Curator, Department of Vertebrate Fossils, U. S. National Museum.
Mason, Otis T., Curator, Department of Ethnology, U. S. National Museum.
Matthews, Dr. Washington, U. S. Army.
Mearns, Edgar A., U. S. Army, Fort Clark, Tex.

Meek, Seth E., Arkansas Industrial University, Fayetteville, Ark.
Merrill, George P., Curator, Department of Geology, U. S. National Museum.
Metcalf, Maynard M.
Montandon, A. L., Bucarest, Roumania.
Pilsbry, Henry A., Academy of Natural Science, Philadelphia, Pa.
Rathbun, Mary J., Assistant, Department of Marine Invertebrates, U. S. National Museum.
Rathbun, Richard, U. S. Fish Commission; Honorary Curator, Department of Marine Invertebrates, U. S. National Museum.
Ridgway, Robert, Curator, Department of Birds, U. S. National Museum.
Riley, Charles V., Entomologist, Department of Agriculture; Honorary Curator, Department of Insects, U. S. National Museum.
Rose, J. N., U. S. Department of Agriculture.
Sclater, P. L., F. R. S., 6 Hanover Square, W., London, England.
Scollick, J. W., U. S. National Museum.
Shufeldt, R. W., M. D., Takoma Park, D. C.
Simpson, Charles Torrey, U. S. National Museum.
Smith, Hugh M., U. S. Fish Commission, Washington, D. C.
Smith, John B., Orondo, Douglas County, Wash.
Stanton, T. W., U. S. Geological Survey, Washington, D. C.
Stearns, R. E. C., Adjunct Curator, Department of Mollusks, U. S. National Museum.
Stejneger, Leonhard, Curator, Department of Reptiles and Batrachians, U. S. National Museum.
Suchetet, André, Paris, France.
Test, Frederick C., Aid, Department of Reptiles and Batrachians, U. S. National Museum.
True, Frederick W., Curator, Department of Mammals, U. S. National Museum.
Vasey, George, Botanist, U. S. Department of Agriculture; Honorary Curator, Department of Botany, U. S. National Museum.
Verrill, A. E., Yale College, New Haven, Conn.
Walcott, Charles Doolittle, U. S. Geological Survey; Honorary Curator, Department of Paleozoic Fossils, U. S. National Museum.
Ward, Lester F., U. S. Geological Survey; Honorary Curator, Department of Fossil Plants, U. S. National Museum.
Watkins, J. Elfreth, Curator, Section of Transportation and Engineering, U. S. National Museum.
White, Charles Abiathar, U. S. Geological Survey; Honorary Curator, Department of Mesozoic Fossils, U. S. National Museum.
Williamson, Mrs. M. Burton, University, Los Angeles County, Cal.
Wilson, Thomas, Curator, Department of Prehistoric Anthropology, U. S. National Museum.
Woolman, A. J., Duluth, Minn.
Worth, John.

LIST OF PAPERS.

ADLER, CYRUS. Report on the Section of Oriental Antiquities in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 137-140.

—— Note on William B. Hodgson.

Proc. Am. Oriental Soc., 1892, pp. ccix-ccx.

William B. Hodgson was the earliest American collector of Oriental manuscripts. A portion of his collection is now deposited in the National Museum.

—— Christopher Columbus in Oriental literature, with special reference to the *Hadisi Ner* or *Tarikh Hind Gharby*.

Proc. Am. Oriental Soc., 1892, pp. ccx-ccxi.

The manuscript is accompanied by a unique map of America, and is apparently the first description of the New World in the Turkish language.

ALLEN, HARRISON. (1) On a new subfamily of Phyllostome bats; (2) description of a new genus of Phyllostome bats; (3) on Temminck's bat (*Scotophilus Temminckii*).

Proc. U. S. Nat. Mus., XV, Nos. 912-914, October 28, 1892, pp. 437-444.

This paper is based upon Museum material.

—— Introduction to a monograph of the North American bats.

Proc. U. S. Nat. Mus., XVI, No. 919, June 13, 1893, pp. 1-28.

The monograph from which this paper was extracted is based upon Museum material, and has since been published as Bulletin 43, of the National Museum.

—— Notes on the genera of Vespertilionidæ.

Proc. U. S. Nat. Mus., XVI, No. 920, June 13, 1893, pp. 29-31.

ALLEN, JOEL ASAPH. On a collection of birds from Chapada, Matto Grosso, Brazil, made by Mr. H. H. Smith. Part II, Tyrannidæ.

Bull. Am. Mus. Nat. Hist., IV, No. XVIII, December, 1892, pp. 331-350.

(Part I, Oscines. *Ibid*, III, No 2, September 29, 1891, pp. 337-380.)

Forty-six species are treated, special attention being given to variation in size and to coloration as affected by seasonal molts, abrasion of the feathers by age, and through general fading of the plumage. The relationships of the widely-dispersed South American *Myiarchus tyrannulus*, to certain closely-allied West Indian, Central American, and Mexican forms, is made the subject of a short resumé, based on

ALLEN, JOEL ASAPH—continued.

a much larger amount of material (over 300 specimens) than had previously been brought together. Critical notes and emendations of a number of species are given and many descriptions of first plumages. This paper is based upon Museum material.

—— On a collection of birds from Chapada, Matto Grosso, Brazil, made by Mr. H. H. Smith. Part III, Pipridæ to Rheidæ.

Bull. Am. Mus. Nat. Hist., V, No. 10, June 1893, pp. 107-128.

Seventy-five species are mentioned in this paper, of which one, *Pygmornis chapadensis*, is described as new. *Metopia galeata* is treated at some length, a series of 127 specimens taken in every month in the year showing in a very thorough manner the different stages of plumage. Other species critically considered are *Synallaxis Azaræ*, *Thamnophilus ambiguus*, *Thamophilus radiatus*, *Dysithamnus mentalis*, *Herpsilochmus longirostris*, *Nychtidromus albicollis Derbyanus*, and *Momotus momota subrufescens*.

In regard to the development of the central tail feathers in the last-named species and their denudation by the bird for purposes of personal adornment, some interesting notes are given, showing that in this species, at least, the barbs are forcibly removed by the birds themselves, in an attempt to make the feathers conform to a definite pattern. This paper is based upon Museum material.

—— Keeler on the evolution of the colors of North American land birds.

Auk, X, No. 2, April, 1893, pp. 189-195.

A critical review of Keeler's work, entitled 'Evolution of the colors of North American Land Birds,' crediting the author with originality and enthusiasm, but charging him with fallacious reasoning and arguing against premature conclusions.

BAUR, GEORGE. Bemerkungen über verschiedene Arten von Schildkröten.

Zoologischer Anzeiger, 1892, No. 389, pp. 155-159.

Remarks upon various species of chelonians, based in part upon material in the National Museum.

BEAN, BARTON A. The New Hampshire Fish Commission.

Forest and Stream, February 16, 1893, p. 142.

A review of the report of the fish and game commissioners for the year ending December 1, 1892.

BEAN, TARLETON HOFFMAN. Description of a new species of Star-gazer

BEAN, TARLETON HOFFMAN—continued.

(*Cathetostoma albigutta*) from the Gulf of Mexico.

Proc. U. S. Nat. Mus., XV., No. 896, July 22, 1892, p. 121–122.

—— Notes on the fishes collected in Mexico by Prof. A. Dugès, with descriptions of new species.

Proc. U. S. Nat. Mus., XV, No. 903, August 2, 1892, pp. 283–287, pl. XLIV.

—— [Ichthyological notes in *Forest and Stream*.] Whitefish and Grayling, August 4, 1892, p. 95, with illustrations. The Rainbow trout, August 11, 1892, p. 119, with illustrations. The Red-throated trout, August 18, 1892, p. 141, with illustrations. The Dolly Varden trout, September 22, 1892, p. 248, with illustrations. The Channel catfish, December 1, 1892, p. 471, with illustrations. California fish culture and protection, December 22, 1892, p. 538, with illustrations. Brook-trout deformities, December 29, 1892, p. 562, with illustrations. The Aquarium at the World's Fair (editorial), February 23, 1893, p. 155. The Lampreys, May 4, 1893, p. 387, with illustrations.

—— The Fishes of Pennsylvania.

Rep. Penna. Fish Com., *1889–90–91* (Harrisburg, 1893). Appendix, pp. I–VII, 1–149, pls. 1–35.

—— Report on the Department of Fishes in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 205–209.

BEECHER, CHARLES E. Revision of the families of loop-bearing Brachiopoda. The development of *Terebratalina obsoleta*, Dall.

Trans. Conn. Acad. Sci., IX, May, 1893, pp. 376–399, pls. I–III.

The material upon which these important papers were partly based was supplied by the National Museum from dredgings of the steamer *Albatross*.

BENDIRE, CHARLES. Smithsonian Institution. | United States National Museum. | Special Bulletin No. 1. | Life Histories | of | North American Birds | with special reference to | their breeding habits and eggs, | with | twelve lithographic plates. | By | Charles Bendire, Captain, U. S. Army, (Retired), | Honorary Curator of the Department of Oölogy, U. S. National Museum, |

BENDIRE, CHARLES—continued.

Member of the American Ornithologists' Union. | — | Washington: | Government Printing Office, | 1892. 4to. pp. I–VIII, 1–446, pls. I–XII, containing 185 chromolithographed figures of eggs.

This book discusses of 146 of North American species and subspecies. The main portion of the work is devoted to an exhaustive account of the life histories of the species, mainly from original and recent sources with reference to breeding and migratory ranges, food, and time of incubation, and, finally, the eggs of each species, when known, are carefully described, and in every case the measurements given are the author's own. The average measurements have been obtained with great care from large series of specimens, in some cases being the result of over two hundred separate measurements. The plates accompanying the volume are from drawings by John L. Ridgway.

The following families are treated in the present volume:

Family Tetraonidæ, species and subspecies	38
Family Phasianidæ, species and subspecies	2
Family Cracidæ, subspecies	1
Family Columbidæ, species and subspecies	15
Family Cathartidæ, species and subspecies	3
Family Falconidæ, species and subspecies	51
Family Strigidæ, species	1
Family Bubonidæ, species and subspecies	35

Published also in the series of Smithsonian Contributions to Knowledge (Vol. XXVIII).

—— Description of a new Prairie Hen.

Forest and Stream, XL, No. 20, May 18, 1893, p. 425.

Brief diagnosis and list of specimens of *Tympanuchus Attwateri*, Bendire (Southern Prairie Hen) from Arkansas County, Texas.

—— Report on the Department of Birds' Eggs in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 199–200

BENEDICT, JAMES E. Corystoid crabs of the genera *Telmessus* and *Erimacrus*.

Proc. U. S. Nat. Mus., XV, No. 900, August 4, 1892, pp. 223–230, pls. XXV–XXVII.

Three species are described and figured, one of which, *T. Isenbeckii*, is placed in a new genus, *Erimacrus*.

BIGELOW, R. P. Preliminary notes on the Stomatopoda of the *Albatross* collections, and on other specimens in the National Museum.

Johns Hopkins Univ. Circ., XII, No. 106, pp. 100–102.

The new species described are *Gonodactylus spinosus*, *G. lavanensis*, *Pseudosquilla megalophthalma*, *Squilla quadridens*, *S. mantoidea*, *S. aculeata*, *S. intermedia*, and *S. rugosa*.

BLATCHLEY, W. S. On a collection of batrachians and reptiles from Mount Orizaba, Mexico, with descriptions of two new species.

Proc. U. S. Nat. Mus., XVI, No. 922, June 13, 1893, pp. 37–42.

This paper is based upon Museum material.

BOLLES, THOMAS DIX. Chinese relics in Alaska.

Proc. U. S. Nat. Mus., XV, No. 899, August 4, 1892, p. 221, pl. XXIV.

This paper is based upon Museum material.

BOLLMAN, CHARLES HARVEY. A review of the Centrarchidæ or freshwater sunfishes of North America.

Rep. U. S. Fish Com., 1888, pp. 557–579.

This paper is based upon Museum material.

CANBY, WILLIAM.

(See under J. N. ROSE.)

CARLTON, M. A. Observations on the plants of Oklahoma Territory and adjacent districts.

Contrib. U. S. Nat. Herbarium, I, December 1892, pp. 220–232.

Some general observations upon the flora of Oklahoma and the adjacent region. This paper is based partly on Museum material.

CLARK, A. HOWARD. Report on the historical collections in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 141–145.

CLARK JOSEPHINE A. Systematic and alphabetical index of new species of North American phanerogams and pteridophytes published in 1891.

Contrib. U. S. Nat. Herbarium I, September, 1892, pp. 151–188.

CLARKE, FRANK W. Note on the constitution of Ptilolite and Mordenite.

Am. Journ. Sci., XLIV, August, 1892, pp. 101–102.

—— Letter on the name of the element Columbium.

Journ. of Analyt. and Appl. Chem., VI, October, 1892, p. 582.

—— The constitution of the Lithia Micas.

Journ. Am. Chem. Soc., XV, No. 5, May, 1893, pp. 245–250.

—— Report of work done in the Division of Chemistry and Physics mainly during the fiscal year 1890–'91.

Bull. U. S. Geol. Surv., No. 90, 1892, pp. 1–77.

CLARKE, F. W. Report on the Department of Minerals in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 241–242.

COPE, Edward D. A synopsis of the Teïd genus *Cnemidophorus*.

Trans. Am. Philosoph. Soc., XVII. Pt. I, pp. 27–52, pls. VI–XIII.

Based chiefly on Museum material.

COULTER, JOHN M.

(See under J. N. ROSE.)

COVILLE, FREDERICK VERNON. The Panamint Indians of California.

Am. Anthropologist, V, Oct., 1892, pp. 351–361.

Principally devoted to an account of the native plants used by these Indians.

—— The rediscovery of *Juncus Cooperi*.

Bull. Torrey Botan. Club, XIX, October, 1892, pp. 309–311.

An account of the discovery of this plant in the Death Valley, after a period of more than twenty years since the collection of the type specimen.

DALL, WILLIAM HEALEY. General notes.

Nautilus, VI, No. 4, August, 1892, p. 48.

Calls attention to the continuity and conformability of the Wallala and Chico beds at La Jolla, San Diego, Cal., and adds several notes on mollusks.

—— Contributions to the Tertiary fauna of Florida, with especial reference to the Miocene silex beds of Tampa and the Pliocene beds of the Caloosahatchie River. Pt. II, Streptodont and other Gastropods, concluded.

Trans. Wagner Free Inst. Sci., Phila., III, Pt. II, December, 1892, pp. 201–473, pls. XIII–XXII, and a geological map of Florida.

This second part is prefaced by an introductory note on the marine Pliocene beds of the Carolinas, in which it is shown that true Pliocene strata occur on the Waccamaw River, South Carolina, and the Neuse River, North Carolina, which are respectively named by the author the Waccamaw and the Croatan beds. In the descriptive text which follows the following new genera and species are described and figured: *Bulla attenuata*, *Utriculus vaginatus*, *Drillia myrmecoön*, *D. hoplophorus*, *D. aphanitoma*, and *var. oxia; D. schismatica*, *D. sigela*, *Glyphostoma Johnsoni*, *Daphnella elata*, *Cancellaria rotunda*, *C. sericea*, *Marginella eulima*, *M. onchidella*, *Volutella dacria*, *Aurinia dubia var. triplicata*, *Caricella podagrina*, *Perplicaria perplexa*, *Fasciolaria acuta* (*Emmons*), *F. elegans* (*Emmons*), *Glyptostyla*, *n.g.*, *G. panamensis*, *Fusus quinquespinus*, *Celatoco-*

DALL, WILLIAM HEALEY—continued.

nus nux, Ilyanassa schizopyga, I. isogramma, Nassa Johnsoni, Columbella styliola, Pteropur pura (*Jouss. em.*) *subg., Trophon engonatus Rapana tampaënsis, Opalia De-Boury, Scala Stearnsii, Syrnola caloosaënsis, Syrnola attenuata, Ondina fragilis, Turbonilla var. obsoleta, T. chipolana, T. protracta, Cassis* (*Phalium*) *globosum, C. Aldrichi, Strombus chipolanus, Triforis mitella, Cerithiopsis floridana, C. scariphus, Bittium chipolanum*, and *var. Burnsii, B. permutabile, B. Cossmanni, B. Annettæ, B. podagrinum, B. priscum, B. boiplex, B. cerithidioides, B. Adamsi, Cerithium caloosaense, C. ocalanum, C. Burnsii, C. platyneura, C. floridanum, C. callisoma, C. glaphyrea*, and *var. litharium, C. coccodes, C. chipolanum, Potamides hillsboroënsis* (*Hp.*), *P. transecta, P. acutus, Clava chipolana, C. caloosaensis, Alaba chipolana, Modulus Willcoxii, M. compactus, Cæcum compactum, C. coronellum, C. carolinianum, C. tortile, C. ibex, Meioceras cingulatum, Serpulorbis tenera, S. ballistæ, Turritella martinensis, T. mixta, T. tripartita, T. megalobasis, T. terebriformis, T. chipolana, T. Holmesii, T. subgrundifera, T. var. tensa. Tuba acutissima; Solarium* new sections, *Solariaxis, Patulaxis, Stellaxis, Solarium; Solarium Cossmannii, S. alabamense, S. periscelidum, S. Aldrichi, S. Leanum, S. vicksburgense, S. newtonense, S. amphitermum, S. Johnsoni, S. textilinum; Discohelix* new section *Discosolis; D. retifera, Hydrobia amnicoloides* (Pilsbry), *H. umbilicata* (Pilsbry). *H. mobiliana* Dall, *Gnathodon Johnsoni, Amnicola var. convexa* (Pillsbry), *A. omphalotropis* (Pilsbry); *Rissoa lipeus* Dall, *R. athymorhyssa, R. geræa* and *var. minor, R. callistrophia, R. microcharia; Rissoina Johnsoni, R. chipolana, Adeorbis strigillatus, A. Holmesii, A. Leai, Crucibulum var. chipolanum, Amalthea Willcoxii, Xenophora textilina, X. lapiferens* (Whitfield), *X. conica* Dall, *Natica alticallosa, N. floridana, Polynices internus* (Say) *P. rugifera, Ampullina Fischeri, A. solidula, Amauropsis Burnsii, Sigaretus chipolanus, S. multiplicatus, S. Conradii, S. carolinensis, Turbo rhectogrammicus, Astralium chipolanum, A. precursor, Collonia elegantula, C. radiata, C. chipolana, C. claibornensis, Chlorostoma limatum, Gibbula americana, Calliostoma eliminatum, C. basicum, C. Conradianum, C. metrium, C. Willcoxianum, C. permagnum, C. aluminium, C. grammaticum, C. exile, C. Wagneri, C. aphelium, C. erosum, C. Harrisii, C. cyclus, C. limulum, C. ceramicum, Margarita tampaënsis, Solariella louisiana, S. turritella, Liotia coronata, L. milium, L. perarmata, L. agenea, Teinostoma milium, T. caloosaense, T. chipolanum, T. opsitelotus, F. microforatis, T. steiratum, T. vortex, T. collinus, T. funiculus, T. pseudadeorbis, Cochliolepis striata* (Stimpson Ms.), *Cyclostrema chipolanum, Molleria duplinensis, M. minuscula; Nerita tampaënsis, Neritina chipolana, N. edentula, Fissuridea nucula, F. chipolana, F. caloosaensis, F. carditella, Emarginula caroliniana, E. Pilsbryi, Vaginella chipolana, Trachyodon*, n. subg., *T. eocenensis* (Conr.), *Ischnochiton tampaënsis, Dentalium Eugenii, D. oleacinum, D. caloosaense, D. prisma, D. caduloide, Cadulus floridanus, C. Burnsii.*

—— Note on *Cytherea convexa*, Say.

Nautilus, VI, No. 5, September, 1892, pp. 52-53.

This indicates the place of publication of Brongniart's prior species of the same name, and concludes that Conrad's name of *C. Sayana* for the American shell should be adopted.

—— Grand Gulf formation.

Science, XX, No. 502, September 16, 1892, p. 164, and No. 513, December 2, 1892, p. 319.

These letters discuss the place and extent of the Grand Gulf formation of Hilgard in the geology of the Gulf States.

—— Determination of the dates of publication of Conrad's "Fossils of the Tertiary Formation" and "Medial Tertiary."

Bull. Philosoph. Soc. Wash., XII, January, 1893, pp. 215-240.

In this paper the history and dates of publication of the two works referred to are discussed, and many hitherto doubtful points of nomenclature conclusively settled.

—— Additional shells from the coast of southern Brazil.

Nautilus, VI, No. 10, February, 1893, pp. 109-112.

This article enumerates shells received from Dr. von Ihering and other collectors on the east coast of South America.

—— Report on the Department of Mollusks in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 211-217.

(See also under Mrs. M. BURTON WILLIAMSON.)

DALL, WILLIAM HEALEY, and HARRIS, GILBERT DENNISON. U. S. Geological Survey correlation papers. Neocene.

Bull. U. S. Geol. Surv., No. 84, Washington, Government Printing Office, 1892, pp. 1-349, 43 cuts, and 3 geological maps.

This work summarizes our knowledge (to 1890) of the Post Eocene Tertiary of the United States, and contains a good deal of new material relative to Alaska and Florida, and an account of an hitherto unrecognized division of the Miocene in the Tertiary of the Gulf States. It forms one of a series of essays covering the Geology of the United States, prepared for the International Geological Congress of August, 1891, at Washington, by members of the U. S. Geological Survey.

DEWEY, LYSTER H. The Russian thistle and other troublesome weeds in the wheat region of Minnesota and North and South Dakota.

Farmer's Bull. No. 10, U. S. Dept. Agric., 1893, pp. 1-16.

Popular account of the introduction of the Russian thistle into this country, and some suggestions as to the best means of exterminating it. Based on National Herbarium.

EATON, DANIEL CADY. List of ferns from southern Patagonia.

Contrib. U. S. Nat. Herbarium, I, September, 1892, p. 138.

A list of the ferns collected by the U. S. Fish Commission Steamer *Albatross*, and now in the National Museum.

—— List of mosses from Fuegia and Patagonia.

Contrib. U. S. Nat. Herbarium, I, September, 1892, pp. 138-139.

Important notes on mosses collected by the U. S. Fish Commission Steamer *Albatross*, and now in the National Museum.

ECKFELDT, J. W. List of lichens from southern Patagonia.

Contrib. U. S. Nat. Herbarium, I, September, 1892, p. 142.

A list of the lichens collected by the U. S. Fish Commission Steamer *Albatross*, and now in the National Museum.

EIGENMANN, CARL H. The Fishes of San Diego.

Proc. U. S. Nat. Mus., XV, No. 897, August 4, 1892, pp. 123-178, pls. X-XVIII.

This paper is based upon Museum material.

—— Catalogue of the fresh-water fishes of Central America and southern Mexico.

Proc. U. S. Nat. Mus., XVI, No. 925, June 13, 1893, pp. 53-60.

ELLIOT, DANIEL GIRAUD. Vieillot's "Analyse" and Buffon's "Breve."

Auk, X, No. 2, April, 1893, pp. 184-188.

Replying to Dr. Stejneger, in which, while agreeing with him in regard to the proper names to be borne by the *Pittas*, contends that the evidence in regard to the other question as to the priority of the first four volumes of the "Nouveau Dictionaire" tends directly against it and more strongly to confirm our belief that the "Analyse" was a prior publication.

—— On the genus *Pitta*, Vieillot.

Auk, X, No. 1, January, 1893, pp. 51-52.

Shows that *Pitta* of Vieillot is a composite genus containing three short-tailed species. Therefore, if they are to be divided into separate genera, we should have *Anthocincla* with

ELLIOTT, D. G.—continued.

A. Phayrei as its type, *Pitta* with *P. sordida* for its type, comprising all the birds with very short, slightly rounded rectries, and *Eucichla* with *P. guaiana* as its type, including the species with rather elongated, pointed tails; sufficient not being known at present to establish the relationships of *Coracopitta*.

EVANS, A. W. List of liverworts from southern Patagonia.

Contrib. U. S. Nat. Herbarium, I, September, 1892, pp. 140-142.

Two new species are here described and figured. This paper is based upon Museum material.

EVERMANN, BARTON W. Report on the establishment of fish-cultural stations in the Rocky Mountain region and the Gulf States, consisting of (1) A reconnoissance of the streams and lakes of western Montana and northwestern Wyoming, and (2) A report upon investigations made in Texas in 1891.

Senate Mis. Doc. No. 65, Fifty-second Congress, first session, pp. 1-86, and *Bull. U. S. Fish Com.*, 1891, pp. 1-90.

—— Description of a new sucker, *Pantosteus Jordani*, from the Upper Missouri Basin.

Bull. U. S. Fish Com., 1892, pp. 51-56.

This paper is based upon Museum material.

FERNOW, BERNHARD EDUARD. Report on the Section of Forestry in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 163-164.

FISHER, E. M. Revision of North American species of *Hoffmanseggia*.

Contrib. U. S. Nat Herbarium, I, September, 1892, pp. 143-150.

All the North American species of *Hoffmanseggia* are described. This paper is based partly upon Museum material.

FLINT, JAMES MONROE. Report on the Section of Materia Medica in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 175-177.

GOÈS, AXEL. Reports on the dredging operations off the west coast of Central America to the Galapagos, to the west coast of Mexico, and in the Gulf of California, in charge of Alexander Agassiz, carried on by the U. S. Fish Commission Steamer *Albatross* during

GOËS, AXEL.—continued.

1891, Lieut. Commander Z. L. Tanner, U. S. Navy, commanding. III. On a peculiar type of arenaceous Foraminifer from the American tropical Pacific, *Neusina Agassizi*.

Bull. Mus. Comp. Zool., XXIII, No. 5, December, 1892, pp. 195–198, pl. 1.

This paper is based upon Museum material.

GOODE, GEORGE BROWN. Report upon the condition and progress of the U. S. National Museum during the year ending June 30, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 1–116.

HARRIS, GILBERT DENNISON. The Tertiary geology of Calvert Cliffs, Maryland.

Am. Journ. Sci., XIV, January, 1893, pp. 21–31, one map in the text.

In this article the author correlates the faunal zones in the Miocene of the region, showing that there are at least three fairly distinct faunæ represented, in ascending order, by the Plum Point, Jones' Wharf, and St. Mary's horizons. These facts had hitherto been ignored, confused, or their significance unrecognized. The material by which these conclusions are justified now forms part of the national collection.

—— Notes on Conrad's "Fossil Shells of the Tertiary Formation."

Am. Geologist, XI, No. 4, April, 1893, pp. 279–281.

Refers to the dates of some of Conrad's publications.

—— Republication of Conrad's "Fossil Shells of the Tertiary Formation of North America."

8vo., pp. 1–121, 20 plates and 1 map. Washington, May, 1893.

This is as nearly as possible an exact reprint of Conrad's Eocene volume, with an Albertype reproduction of the original plates, and of two unpublished plates, together with an introduction and index by the author. The work being practically inaccessible and very necessary for students of the American Eocene, was reprinted under Mr. Harris's editorship.

(See also under WILLIAM HEALEY DALL.)

HASBROUCK, EDWIN M. A presumably new fact relative to the Cedar Wax-wing (*Ampelis cedrorum*), with remarks upon the importance of a thorough knowledge of first plumages.

Science, XXI, No. 528, March 17, 1893, pp. 144–145.

HASBROUCK, EDWIN M.—continued.

Proves that the sealing-wax-like appendages to shafts of secondaries are, to some extent, at least, independent of age. This paper is based upon Museum material.

HAUPT, PAUL. On a modern reproduction of the eleventh tablet of the Babylonian Nimrod Epic and a new fragment of the Chaldean account of the Deluge.

Proc. Am. Oriental Soc., 1893, pp. ix–xii.

HAY, OLIVER PERRY. On the ejection of blood from the eyes of horned toads.

Proc. U. S. Nat. Mus., XV, No. 907, September 16, 1892, pp. 375–378.

The curious phenomenon recorded took place in the herpetological laboratory of the Museum.

—— Some observations on the turtles of the genus *Malaclemys*.

Proc. U. S. Nat. Mus., XV, No. 908, September 16, 1892, pp. 379–383.

Critical notes, chiefly on Museum material.

—— On the breeding habits, eggs, and young of certain snakes.

Proc. U. S. Nat. Mus., XV, No. 909, September 16, 1892, pp. 385–397.

The entire collection upon which these notes were based was donated to the Museum by the author.

—— The | Batrachians and Reptiles | of the | State of Indiana. | By Oliver Perry Hay, Ph. D. | Indianapolis: | B. Burford, Printer and Binder | 1893.

8vo., pp 1–204, pls I–III.

Based in part upon material belonging to the National Museum.

HITCHCOCK, ROMYN. The ancient pit-dwellers of Yezo, Japan.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 417–427, pls. LXXIII–LXXX, figs. 64–67.

—— The Ainos of Yezo, Japan.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 429–502., pls. LXXXI–CXVII, figs. 68–88.

—— Report on the Sections of Foods and Textiles in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 165–174.

HOLM, THEODOR. Notes on the flowers of *Anthoxanthum ordoratum* L.

Proc. U. S. Nat. Mus., XV, No. 910, October 3, 1892, pp. 399–403, pl. XLVIII.

This paper is based upon Museum material.

HOLMES, WILLIAM HENRY. Gravel man and paleolithic culture.

Science, XXI, No. 520, January 20, 1893, pp. 29-30.

—— Distribution of stone implements in the tide-water country.

Am. Anthropologist, VI, No. 1, January, 1893, pp. 1-14, pls. I-II, figs. 1-2.

—— Are there traces of man in the Trenton Gravels?

Journ. Geol., I, No. 1, January-February, 1893, pp. 15-37, figs. 1-6.

—— Traces of glacial man in Ohio.

Journ. Geol., I, No. 2, February-March, 1893, pp. 147-163, pl. II, figs. 1-2.

—— Vestiges of early man in Minnesota.

Am. Geologist, XI, No. 4, April, 1893, pp. 219-240, figs. 1-7.

—— Report on the Department of American Prehistoric Pottery in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 135-136.

HOLZINGER, JOHN M. On *Amaranthus crassipes*.

Botan. Gaz., XVII, August, 1892, pp. 254-256, pl. I.

A. crassipes is shown to be distinct from *A. polygonoides*.

—— List of plants collected by C. S. Shelton and M. A. Carlton in the Indian Territory in 1891.

Contrib. U. S. Nat. Herbarium, I, December, 1892, pp. 189-219.

Two new species are described and figured.

This paper is based upon Museum material.

—— *Polygonum persicarioides*, H. B. K.

Botan. Gaz., XVII, September, 1892, pp. 295-296.

The discovery of *Polygonum persicarioides* in the United States is recorded. This paper is based upon Museum material.

—— The systematic position of *Entosthodon Bolanderi*.

Botan. Gaz., XVII, November, 1892, pp. 380-381.

Reasons are given why *Entosthodon Bolanderi* should be referred to *Funaria*. This paper is based upon Museum material.

HOUGH, WALTER. Rare forms of polished stone implements and their probable use.

Science, XXI, January 6, 1893, p. 5.

Describes certain prehistoric grooved stones of unknown use, measuring about 3 by 2½ inches, found in Mexico and southward, correlates them with the Polynesian bark mallets, and suggests their probable use for beating out paper and cloth from bark. Corroborated by Dr. D. G. Brinton in *Science*, March 10, 1893.

—— Balances of the Peruvians and Mexicans.

Science, XXI, January 20, 1893, p. 30.

Describes balances and balance-beams from the *huacos* of Peru, in the Royal Archæological Museum in Madrid, and stone weights in the Mexican collection at the Columbian Historical Exposition in Madrid.

—— The Bernadou, Allen, and Jouy Korean collections in the U. S. National Museum.

Rep. Smithsonian Inst. (U. S. Nat. Mus.) 1891 (1893), pp. 429-488, pl. XXX.

A study based upon the large Korean collection in the U. S. National Museum, and information gathered from native Koreans and travelers through a period of six years.

—— Time-keeping by light and fire.

Am. Anthropologist, IV, No. 2, April, 1893, p. 207.

Presentation of unnoticed methods of reckoning time by combustible materials.

—— The methods of fire-making.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 395-409, pl. LI, figs. 51-63.

HOWARD, LELAND O. A new Icerya parasite.

Insect Life, IV, Nos. 11-12, August, 1892, pp. 378-379.

Description of *Cerchysius iceryæ*, n. s., reared at Kingston, Jamaica, by T. D. A. Cockerell from *Icerya rosæ*, R. & H. This paper is based upon Museum material.

—— An experiment against mosquitoes. (Read before the Association of Economic Entomologists at Rochester, N. Y., August 16, 1892.)

Insect Life, V, No. 1, September, 1892, pp. 12-13.

Four ounces of coal oil destroyed an estimated number of 7,400 insects (of which 370 were female mosquitoes) in a pool of water containin 60 square feet of surface, and kept the pool free from living insects of all kinds for ten days.

—— A new enemy to timothy grass. (Read before the Association of Economic Entomologists at Rochester, N. Y., August, 1892.)

Insect Life, V, No. 2, November, 1892, pp. 90-92, figs. 8, 9.

This species, *Oncognathus binotatus*, family *Capsidæ*, was found on Onteora Mountain, New York, and only at an elevation of 2,500 feet. It

HOWARD, LELAND O.—continued.

was observed in extraordinary numbers in the heads of the timothy, engaged in sucking the juices of the plant. This paper is based upon Museum material.

—— The Hymenopterous parasites of spiders.

Proc. Ent. Soc. Wash., II, No. 3, December, 1892, pp. 290–302, pl. II.

Twenty-four American Hymenopterous parasites of spiders are recorded and twelve new species are described. List of fifty-eight European Hymenopterous species parasitic upon spiders. This paper is based upon Museum material.

—— Note on the hibernation of Carpenter Bees.

Proc. Ent. Soc. Wash., II, No. 3, December, 1892, p. 331.

The author's abstract of a paper recording the finding of a living male of *Xylocopa virginica* in a burrow of a pine branch in March, showing that the male of the species, as well as the impregnated female, hibernates. This paper is based upon Museum material.

—— A note on the parasites of the Coccidæ.

Proc. Ent. Soc. Wash., II, No. 3, December, 1892, pp. 351–352.

Contends that Aurivilliuss' generalization in *Entomologisk Tidskrift*, IX, Nos. 3–4, 1888, to the effect that Pteromalid parasites of the Coccids belonging to the *Encyrtinæ* and *Aphelininæ* do not, when infesting female Coccids, kill their host or diminish the number of eggs laid by her, will not hold. In the majority of cases in his experience the females are pierced by their parasites at all stages of growth, and when thus pierced growth is arrested. This paper is based upon Museum material.

—— The "Fly Weevil" (*Gelechia cerealella*). (An address before the Farmers' Institute of the Seventh Congressional District of Virginia, at Manassas, Va., February 22, 1893.)

Bull. Dept. Agric., Virginia, May, 1893, pp. 12–16.

The early history and literature of the species are discussed and its life history briefly treated. Early thrashing is recommended in the case of wheat, but where the wheat must be left in the field the individual farmer should disinfect his granaries every year soon after the wheat is put in. This is best done with bisulphide of carbon, and the author gives the proper quantities to be used in rooms of various sizes. Against this insect as a corn pest the practice has been adopted of growing only such varieties of corn as have a close-fitting husk

HOWARD, LELAND O.—continued.

(thus preventing the insects from laying their eggs upon the corn in the field), and of storing in cribs without removing the husk.

—— Insects affecting the Musk-melon.

Am. Gardening, XIV, No. 4, April, 1893, pp. 209–216, 1 figure.

Discusses and suggests remedies for the melon worm (*Phakellura hyalinitalis*), the so-called pickle worm (*P. nitidalis*), the squash stem-borer (*Melittia ceto*), the melon-plant louse (*Aphis citrulli*), the cucumber-leaf beetle (*Epitrix cucumeris*), the 12-spotted and striped diabroticas (*Diabrotica 12-punctata* and *D. vittata*), of the so-called pumpkin beetle (*Epilachna borealis*), and the squash-bug (*Anasa tristis*).

—— Insects of the subfamily Encyrtinæ with branched antennæ.

Proc. U. S. Nat. Mus., XV, No. 905, September 16, 1892, pp. 361–369, pls. XLVI–XLVII.

This paper is based upon Museum material.

(See also under CHARLES V. RILEY.)

JORDAN, DAVID STARR. *Salmo kaloops.*

Forest and Stream, XXXIX, No. 19, November 10, 1892, p. 405.

This paper is based in part upon Museum material.

KEELER, CHARLES A. Evolution of the colors of North American Land Birds.

Occasional Papers Cal. Acad. Sci. III, San Francisco, January, 1893, pp. I–XII, 1–361, pl. I–XIX.

An important and highly original treatise, based to a large extent on the material of the U. S. National Museum. The work consists of two parts, and treats first of general questions: I. Introduction. The inheritance of acquired characters (pp. 2–50), Variation and natural selection (pp. 50–63), Laws conditioning evolution (pp. 64–80), Sexual selection (pp. 80–102). The nature of species (pp. 103–109), and isolation as a factor in the evolution of species (pp. 110–132). Part II is devoted to "The colors of North American Birds" (pp. 132–336), followed by a bibliography, explanations of plates, and an index.

KIRSCH, PHILIP H. Notes on the streams and rivers of Clinton County, Ky., with a description of a new darter.

Bull. U. S. Fish Com., 1890, pp. 289–292.

This paper is based upon Museum material.

—— Notes on a collection of fishes from the southern tributaries of the Cumberland River in Kentucky and Tennessee.

Bull. U. S. Fish Com., 1891 pp. 259–268.

This paper is based upon Museum material.

KNOWLTON, FRANK HALL. Fossil flora of the Bozeman coal field.

Proc. Biol. Soc. Wash., VII, pp. 153-154.

Gives a short summary of the flora of this locality and draws conclusions as to the age of the beds.

—— Flora of the Dakota group. A posthumous work by Leo Lesquereux. Edited by F. H. Knowlton.

Monogr. U. S. Geol. Surv., XVII, pp. 1-400, pls. I-LXVI.

Gives a complete description of the flora of this group. It embraces 460 species, of which number about one-fourth are new to science.

—— Letter to I. C. Russell on fossil wood from the Triassic of North Carolina and review of the Triassic plants of Prince Edward Island.

Bull. U. S. Geol. Surv., No. 85, p. 29.

—— Report on Inter-glacial earth from Iowa, in W J McGee's "Geology of Southwestern Iowa."

11 Ann. Rep. U. S. Geol. Surv., p. 493.

—— Bread-fruit trees in North America.

Science, XXI, p. 24.

Describes two species of bread-fruit trees, *Artocarpus Lessingiana* (the *Aralia pungens* and *Myrica Lessingii* of Lesquereux), from the Laramie of Colorado, and *A. californica*, a new species from the auriferous gravels of California.

—— The flora of the Dakota Group: A reply.

Botan. Gaz., XVIII, pp. 37-39.

A reply to a criticism of the editorial work on this mongraph.

—— Description of a new fossil species of *Chara*.

Botan. Gaz., XVIII, pp. 141-142. figs. 1-3.

Describes a new species (*Chara Stantoni*) from the Bear River formation at Cookville, Wyo.

—— A simple point in nomenclature.

Bull. Torrey Botan. Club, XX, pp. 212-213.

Raises the question as to where the interrogation mark should be placed when it is desired to question either of the members of a plant name.

—— Note on a supposed new endogenous tree from the Carboniferous.

Science, XXI, pp. 332-333.

Criticises the supposed finding of an endogenous tree (*Winchellina fascina*) in the Carboniferous of Ohio, showing that it is a fern-stem of a well-known type (*Psaronius*).

KNOWLTON, FRANK HALL. [Review of] Cretaceous fossil plants from Minnesota. By Leo Lesquereux.

Journ. Geol., I, pp. 302-303.

—— [Review of] On the organization of the fossil plants of the coal-measures. By W. C. Williamson.

Journ. Geol., I, p. 303.

KOEHLER, SYLVESTER ROSA. The photo-mechanical processes.

Technology Quarterly, V, No. 3, Boston, October, 1892, pp, 161-204.

A series of papers on the processes named, read before the Society of Arts, at the Massachusetts Institute of Technology, Boston.

—— Peter Lymen von Antwerpen (oder Brussell?).

Kunstchronik, Leipzig, June 30, 1892, cols. 523-524.

Concerning the identity of the portrait of Peter Lymen, by Van Dyck, owned by Mr. Francis Bartlett, Boston.

—— John Webber und die Erfirdung der Lithographie.

Kunstchronik, Leipzig, December 1, 1892, cols. 102-103.

Description of a print in the John Witt Randall collection, Harvard College, showing that the so-called lithographs by John Webber are soft-ground etchings.

—— Der Tiefstich auf Holz.

Zeitschrift für bildende Kunst. New series, IV, No. 6, illustrated. Leipzig, March, 1893.

On the invention and practice of intaglio engraving on wood.

—— White-line engraving for relief printing in the fifteenth and sixteenth centuries.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 385-394. pls. XLVII-L, figs. 48-50.

—— Report on the Section of Graphic Arts in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. U. S. Nat. Mus.), 1890 (1891), pp. 147-157.

LINDGREN, WALDEMAR. A sodalite syenite and other rocks from Montana.

Am. Journ. Sci., XLV, April, 1893, pp. 286-297.

Describes a peculiar series of rocks. The more striking among them are the syenites which were collected in the Moccasin and Bear Paw mountains during the summer of 1883 by Dr. C. A. White and J. B. Marcou, and which have been deposited in the U. S. National Museum.

LINTON, EDWIN. Notes on avian Entozoa.

Proc. U. S. Nat. Mus., XV, No. 893, August 8, 1892, pp. 87–113, pls. IV–VIII.

This paper is based upon Museum material.

LUCAS, FREDERIC AUGUSTUS. On the anatomical characters of Humming Birds.

Rep. Smithsonian Inst. (U. S. Nat. Mus.) 1890 (1892), pp. 290–294, pl. XV, figs. 1–4.

Published in the paper on Humming Birds by Robert Ridgway.

—— On *Carcharodon Mortoni* Gibbes.

Proc. Biol. Soc. Wash., VII, July 27, 1892, pp. 151–152.

Notes that the species is probably founded on an abnormal tooth.

—— A welcome correction.

St. Nicholas, October, 1892, p. 958.

Correcting an error in an article on snakes, and giving some details regarding their anatomy.

—— A neglected branch of Ornithology.

Auk, X, April, 1893, p. 210.

A letter indicating some reasons why the study of the anatomy of birds is neglected.

—— Articles on Alectorides, Anseres, Apteryx, Apteryges, Auk, Aurochs.

Johnson's Universal Cyclopædia, I, pp. 107, 226, 264, 411, 413.

LUDWIG, HUBERT. Vorläufiger Bericht über die auf den Tiefsee-Fahrten des *Albatross* (Frühling, 1891), im östlichen Stillen Ocean erbeuteten Holothurien.

Zoologischer Anzeiger, No. 420, 1893, pp. 1–10.

—— Reports on the dredging operations off the west coast of Central America to the Galapagos, to the west coast of Mexico, and to the Gulf of California, in charge of Alexander Agassiz, carried on by the U. S. Fish Commission Steamer *Albatross* during 1891, Lieut. Commander Z. L. Tanner, U. S. Navy, commanding. IV. Vorläufiger Bericht über die erbeuteten Holothurien.

Bull. Mus. Comp. Zool., XXIV, No. 4, June, 1893, pp. 105–114.

Preliminary descriptions are given of 1 new family, Pelagothuriidæ 8 new genera, *Synallactes*, *Mesites*, *Meseres*, *Scotodeima*, *Lætmophasma*, *Capheira*, *Palagothuria*, and *Sphærothuria*; 30 new species, *Pælopatides suspecta*, *Synallactes alexandri*, *S. ænigma*, *Mesites multipes*, *Meseres Macdonaldi*, *Eupheonides Tanneri*, *E. verrusoca*, *Psychropotes raripes*, *P. dubiosa*, *Benthodytes incerta*, *Deima pacificum*, *Oneirophanta affinis*, *Lætmogone Theeli*, *Scotodeima*

LUDWIG, HUBERT—continued.

setigerum, *Lætmophasma fecundum*, *Capheira sulcata*, *Peniagone intermedia*, *Scotoanassa gracilis*, *Pelagothuri natatrix*, *Phyllophorus aculeatus*, *Psolus pauper*, *P. digitatus*, *P. diomedeæ*, *Psolidium panamense*, *P. gracile*, *Sphærothuria bitentaculata*. *Caudina californica*, *Trochostoma granulatum*, *T. intermedium*, *Ankyroderma spinosum*; and 3 varieties, *Pannychia Moseleyi* var. *Henrici*, *Peniagone vitrea* var. *setosa*, and *Synapta abyssicola* var. *pacifica*. This paper is based upon Museum material.

MARSH, OTHNIEL CHARLES. Notes on Mesozoic vertebrate fossils.

Am. Journ. Sci., XLIV, August, 1892, pp. 171–176, pls. II–IV.

—— Restorations of *Claosaurus* and *Ceratosaurus*. Restoration of *Mastodon americanus*.

Am. Journ. Sci., XLIV, October, 1892, pp. 343–350, pls. VI–VIII.

—— A new Cretaceous bird allied to *Hesperornis*. The skull and brain of *Claosaurus*.

Am. Journ. Sci., XLV, January, 1893, pp. 81–86, pls. IV, V.

—— Restoration of *Anchisaurus*.

Am. Journ. Sci., XLV, February, 1893, pp. 169–170, pl. VI.

MASON, OTIS TUFTON. The Eskimo throwing-stick.

Science, XIX, New York, 1892, p. 322.

Calls attention to discoveries of new areas and gives a bibliography of recent papers on the subject.

—— The land problem.

Brooklyn Ethical Association, *Evolution Series*, No. 22, New York 1892, pp. 109–145.

An address before the Brooklyn Ethical Association, in which the history of land-owning and land-treatment are traced among primitive races of men, and the effects of each method pointed out.

—— Report on the Department of Ethnology, in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 119–134.

MATTHEWS, WASHINGTON. The Catlin collection of Indian paintings.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 593–610, pls. CXXX–CL.

This paper is based upon Museum material.

MEARNS, EDGAR A. A study of the Sparrow Hawks (Subgenus *Tinnunculus*) of America, with especial refer-

MEARNS, EDGAR A.—continued.
ence to the continental species (*Falco sparverius* Linn.).

Auk, IX, No. 3, July, 1892, pp. 252-270.

A critical discussion of the geographical races and incipient forms of the single continental species, with a synopsis. New subspecies described: *Falco sparverius deserticolus*, Mearns (p. 263), habitat, southwestern United States, north to northern California and western Montana, south to Mazatlan, in northern Mexico. *Falco sparverius peninsularis*, Mearns (p. 267); habitat, Lower California. *Falco sparverius æquatorialis*, Mearns (p. 269); habitat, Ecuador. This paper is based chiefly on Museum material.

MEEK, SETH E. A report upon the fishes of Iowa, based upon observations and collections made during 1889, 1890, and 1891.

Bull. U. S. Fish Com., 1890, pp. 217-248.

MERRILL, GEORGE PERKINS. Handbook of the Department of Geology in the U. S. National Museum. Part I, Geognosy: The materials of the earth's crust.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 503-591, pls. CXVIII-CXXIX, 10 figures in the text.

This forms the fourth of the series of handbooks relating to the Department thus far issued. and deals, as its title denotes, with the materials of the earth's crust in the least-changed conditions.

—— Discussion of the strength and weathering qualities of roofing slate.

Trans. Am. Soc. Civil Engineers, XXVII, December, 1892, pp. 685-687.

A discussion of Prof. Merriam's paper on the strength and weathering qualities of roofing slates, which appeared in the same volume, p. 33.

—— The architect and his materials.

Am. Architect and Building News, March 4, 1893, p. 134.

An article calling attention to what the writer believes to be a serious defect in architectural methods—that relating to the selection of materials.

—— A cheap form of box for microscopic slides.

Science, November 25, 1892, p. 298.

Describes briefly a new form of box now in use in the National Museum.

—— A new source of Mexican onyx.

Science, April 21, 1893, p. 221.

A brief note regarding a newly discovered deposit of the so-called onyx in Lower California.

—— A peculiar occurrence of beeswax.

Science, June 16, 1893, p. 331.

MERRILL, GEORGE P.—continued.

A brief note calling attention to deposits of supposed beeswax in the sands of the seashore near Portland, Oreg.

—— The building-stone industry of the United States.

Stone, July, 1892, pp. 131-139, pls. 2; August, 1892, pp. 263-268, pls. 2, 1 figure in the text; September, 1892, pp. 369-374, pls. 3, 2 figures in the text.

—— [Brief papers in *Stone*]. The marble region of Knoxville, Tenn., November, 1892, pp. 591-599, 1 map and 5 figures in the text. Remarks on prevalent methods of testing building stone, December, 1892, pp. 5-8. The strength and weathering qualities of roofing slates, January, 1893, pp. 135-139. The onyx deposits of Cave Creek, Ariz., February, 1893, pp. 204-205.

—— Report on the Department of Geology in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 243-249.

MERRILL, GEORGE P., and PACKARD, Robert L. On some basic eruptive rocks in the vicinity of Lewiston and Auburn, Androscoggin County, Me.

Am. Geologist, July, 1892, pp. 49-55, pl. I.

The paper describes the mode of occurrence, and general chemical petrographic characters of some of the basic eruptives of the vicinity noted, and which, on structural grounds, are provisionally referred to the camptonites.

METCALF, MAYNARD M. Notes upon an apparently new species of *Octacnemus*, a deep-sea Salpa-like Tunicate.

Johns Hopkins Univ. Circ., XII, No. 106, pp. 98-100, 6 figures.

Octacnemus patagoniensis, n. s. (?), dredged by the U. S. Fish Commission steamer *Albatross* off Port Otway, Patagonia, in 1,050 fathoms. This specimen will eventually be added to the Museum collection.

MONTANDON, A. L. Notes on American Hemiptera Heteroptera.

Proc. U. S. Nat. Mus., XVI, No. 924, June 13, 1893, pp. 45-52.

This paper is based upon Museum material.

PACKARD, ROBERT L.
(See under GEORGE P. MERRILL.)

PILSBRY, HENRY A. Monograph of the recent Chitonidæ.

Manual of Conchology (Academy of Natural

PILSBRY, HENRY A.—continued.

Sciences of Philadelphia), XIV, 1892, pp. I-XXXIV, 1-350, pls. 1-68.

This work is based in part on material furnished by the National Museum, and also partly on the manuscripts prepared for the Smithsonian Institution by the late Dr. Philip Pearsall Carpenter, which were turned over to Mr. Pilsbry by the Institution to facilitate the preparation of the monograph.

RATHBUN, MARY J. Catalogue of the crabs of the family Periceridæ in the U. S. National Museum.

Proc. U. S. Nat. Mus., XV, No. 901, August 6, 1892, pp. 231-277, pls. XXVIII-XL.

Based on 48 species, chiefly American, of which 15 are new: *Libinia mexicana*, *L. spinimana*, *L. Macdonaldi*, *Pericera atlantica*, *P. triangulata*, *P. contigua*, *Macrocœloma tenuirostra*, *Othonia rotunda*, *O. Nicholsi*, *O. carolinensis*, *Mittrax pilosus*, *M. sinensis*, *M. braziliensis*, *M. Hemphilli*, *M. bahamensis*.

RATHBUN, RICHARD. Report upon the inquiry respecting Food-fishes and the Fishing-grounds.

Rep. U. S. Fish Com., *1889 to 1891* (1893), pp. 97-171.

—— Report on the Department of Marine Invertebrates in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 223-229.

RIDGWAY, ROBERT. The Humming Birds.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 253-383, pls. I-XLVI, 47 figures in the text.

The subject of this memoir is treated as follows: Introduction, Early history, Names and their origin, Geographical distribution, Migrations, Habits, Abundance of individuals, Actions and attitudes, Manner of flight, Disposition, Intelligence, Nests and eggs, Voice, Food, Characters and relationships (with a summary of osteological and anatomical characters, prepared by Mr. F. A. Lucas), Variations, Head ornaments, Colors of the plumage, Cause of the changeable hues of humming birds, Brief descriptions of some of the more brilliantly colored kinds, and Humming Birds of the United States, with a key to the genera of humming birds occurring in the United States, Mexico, Cuba, and the Bahamas.

The first part of this treatise, as the titles of the chapters indicate, is of a popular character, intended to interest the general reader, and form an introduction to the study of this most wonderful and beautiful family of American birds. The second part is devoted to the scientific discussion and description of the seventeen species of humming birds which have

RIDGWAY, ROBERT—continued.

been found within the borders of the United States A key to all the genera of humming birds found in North America and the West Indies will enable the student to detect any addition to our fauna which he is likely to meet.

—— *Zonotrichia albicollis* in California.

Auk, IX, No. 3, July, 1892, p. 302.

Notes the capture of an adult specimen in spring plumage by Mr. L. Belding, at Stockton, Cal., April 22, 1892, being the third Pacific coast record of the species.

—— Spring arrivals at Washington, D. C.

Auk, IX, No. 3, July, 1892, pp. 307-308.

Records the date of first appearance in the vicinity of Washington of 37 species of spring migrants during the season of April 3 to May 4, inclusive.

—— Descriptions of two new forms of *Basileuterus rufifrons*, from Mexico.

Proc. U. S. Nat. Mus., XV, No. 895, July, 1892, p. 119.

Basileuterus rufifrons Jouyi and *Basileuterus rufifrons Dugesi* are described.

—— The systematic position of Humming Birds. A reply to Dr. Shufeldt's "Discussion."

Pop. Sci. News, XXVI, No. 11, November, 1892, pp. 164-165.

—— Shufeldt on the anatomy of Humming Birds and Swifts.

Am. Naturalist, December, 1892, pp. 1040-1041.

Reply to a criticism of "The Humming Birds" by Dr. Shufeldt, in the *American Agriculturist* for October, 1892, pp. 869-870.

—— Description of two supposed new species of Swifts.

Proc. U. S. Nat. Mus., XVI, No. 923, June 13, 1893, pp. 43-44.

Chaetura Lawrencei, p. 43, and *Cypseloides Cherriei*, p. 44.

—— Report on the Department of Birds in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 195-198.

RILEY, CHARLES V. The number of broods of the imported Elm-Leaf Beetle.

Science, XX, No. 492, July 8, 1892, p. 16.

A preliminary note recording the fact that on June 30, 1892, eggs laid by the second brood of beetles had been obtained at Washington.

—— Recent advances in dealing with insects affecting fruits.

Proc. Am. Pomological Soc., 23d Session, September, 1891, pp. 32-42. (July, 1892.)

RILEY, CHARLES V.—continued.

Discusses the use of the arsenites in the orchard, with specific directions; the combination of insecticides with fungicides; the gas treatment; the resin washes; the fluted scale, *Icerya purchasi*, Maskell; new injurious insects of a year; the apple maggot; insects which American pomologists would do well to be on their guard against; conclusions.

Partly reprinted in *Insect Life*, v, No. 1, pp. 16–19.

—— The first larval or post-embryonic stage of the Pea and Bean weevils.

Canadian Entomologist, v, XXIV, No. 7. August, 1892, pp. 185–186. (Also separate.)

A short note upon the curious temporary thoracic legs in *Bruchus fabæ* (*obtectus*) and *B. pisi*, which serve them in entering the bean or pea and are then lost with the first molt. The classificatory significance of these hereditary post-embryonic structures is discussed.

—— Some notes on the Margined Soldier-beetle (*Chauliognathus marginatus*).

Canadian Entomologist. v, XXIV, No. 7, August, 1892, pp. 186–187. (Also separate.)

Records and describes the eggs of this species hitherto unknown. As many as 300 are laid in a single mass. The first larva stage is also compared with the final stage.

—— Some interrelations of plants and insects.

Proc. Biol. Soc Wash., VII, May 28, 1892, pp. 81–104.

Insect Life, IV, No. 11-12, August, 1892, pp. 358–378, figs. 57–75.

Also as a separate.

Discusses the pollination of *Yucca filamentosa* by *Pronuba yuccasella;* the structural characteristics of Pronuba; the acts of pollination and oviposition, the development and transformations of Pronuba; the bogus Yucca moth; other species of *Prodoxus*; caprification of the figure. In generalizing from the facts, the author indicates three principal lines along which variation has proceeded; shows how these Prodoxids exemplify what he originally called "fortuitous variation;" and discusses the transmission of acquired characters through heredity.

—— Rose Saw-flies in the United States.

Insect Life, v, No. 1, September, 1892, pp. 6–11, figs. 1–2.

Observations upon the Bristly Rose-worm, *Cladius pectinicornis*, Fourcr.; the Banded Emphytus, or Curled Rose-worm, *Emphytus cinctus*, L.; and the American Rose-slug, *Monostegia rosæ*, Harris. Life history of the three species compared and original observations given. All are amenable to treatment with hellebore.

—— New injurious insects of a year. Extracted from a paper entitled "Recent Advances in Dealing with Insects Affecting Fruits," read before the American Pomological Society, September, 1891.

Insect Life, v, No. 1, September, 1892, pp. 16–19.

Forty-five hitherto unrecorded species, reported to the Department of Agriculture during one year as injuring various crops, are enumerated.

—— Further notes on the new Herbarium Pest.

Insect Life, v, No. 1, September, 1892 pp. 40–41.

The new herbarium pest, *Carphoxera ptelearia*. described in *Insect Life*, IV, pp. 108–113, was thought by Mr. R. McLachlan to be very like *Acidalia herbariata*, Fab., long known to injure herbarium specimens in Europe. By comparison of the imagin of the two species, however, the author finds that the European moth is twice as large as the American species, more glossy, and differently marked in detail. In structural characters *Carphoxera ptelearia* is easily distinguished from *Acidalia herbariata* by the spatulate tubercles of the larvæ, by the lateral projection on the fifth abdominal joint of the pupa, and by its much smaller size, more pulverulent, less glossy scaling, and different markings in the imago.

—— Preservation of hard-wood handles.

Scientific American, LXVII, No. 14, October 1, 1892, p. 216.

Report upon an insect damaging hard-wood handles; probably one of the powder-post beetles of the genus *Lyctus*, species undetermined. Soaking the infested handles in kerosene is recommended as a remedy.

—— California Beer Seed.

Scientific American, LXVII, No. 14, October 1, 1892, p. 217.

Report upon a specimen of a fermenting principle, the action of which is due to a bacterium and a fungus, the species of which have not been definitely settled, though the former is probably *Dispora caucasica* and the latter *Saccharomyces kefyr*.

—— An Australian *Scymnus* established and described in California. Paper read before the Rochester meeting of the Association of Economic Entomologists, August, 1892.

Scientific American, LXVII, No. 18, October 29, 1892, p, 275; *Insect Life*, v, No. 2, November, 1892, pp. 127–128.

An Australian Coccid-feeding Coccinellid brought over by Mr. Albert Koebele in 1888–'89, and subsequently lost sight of, has turned up in southern California and been described by Dr. F. E. Blaisdell under the name *Scymnus lophanthæ*. as an American species.

RILEY, CHARLES V.—continued.

—— *Galeruca xanthomelæna* polygonentic at Washington. Read before the Entomological Club of the American Association for the Advancement of Science, at Rochester, N. Y., August, 1892.

Canadian Entomologist, v. XXIV, No. 10, November, 1892, pp. 282-286.

Shows that while *Galeruca xanthomelæna*, according to Prof. John B. Smith's experiments, is single-brooded at New Brunswick, N. J., it is normally double-brooded at Washington, and by exception produces a third and even a fourth generation there. Discusses the bearing of these facts in the light of climatic influence in relatively short periods.

—— An additional note on the Bean Weevil.

Canadian Entomologist, v. XXIV, No. 10, November, 1892, pp. 291-299.

In a note in the August, 1892, number of the *Canadian Entomologist* the author stated that the eggs of the Bean Weevil "are preliminarily laid upon the bean pod in the field, but chiefly if not entirely upon those which are already matured and ripening." The present note records the fact that the eggs hitherto taken for those of the common Bean Weevil are, without much doubt, those of another Bruchus, either *Bruchus quadrimaculatus* or *B. scutellaris*, and that the eggs of the Bean Weevil are thrust into an aperture made by the jaws of the parent weevil along the ventral suture, or else laid in clusters on the inside of the pod wherever this is sufficiently ripe to cause a partial opening.

—— Coleopterous larvæ with so-called dorsal prolegs.

Proc. Ent. Soc. Wash., II, No. 3, December, 1892, pp. 319-324, figs. 22-23. (Also separate.)

Shows that two kinds of larvæ with supposed dorsal prolegs, referred to by Herbert Osborn and others at the Indianapolis (1890) meeting of the American Association for the Advancement of Science, belong to *Mordellistena*, and to some Cerambycid, and that the "prolegs" are but abnormally developed tubercules to facilitate motion within the hollow stems. Cites authorities and records the larva of *Mordellistena pustulata* in dry stalks of *Xanthium strumarium*; of *M. unicolor* in stems of *Ambrosia artemisifolia*; of *M. nubila* from stems of *Triodia cupræa*; full transformations of *M. floridensis* in stems of *Uniola paniculata*; and of *Oberea schaumii* in stems of cottonwood.

—— What the Department of Agriculture has done and can do for apiculture.

Proc. 23d Ann. Meeting of the North American Bee-keepers' Association, December 27-29, 1892.

RILEY, CHARLES V.—continued.

Reprinted in the *Canadian Bee Journal* and various other apicultural journals.

A review of past work in apiculture, with recommendations for the future. The address signalizes the fact that the first introduction of Italian bees into the United States was due to the Department of Agriculture, and touches upon the work of the apicultural stations at Aurora, Ill., in 1885, and at Michigan Agricultural College in 1891, summarizing the results of experiments upon foul brood, the relation of bees to fruit, spraying with the arsenites as affecting bees, selection in breeding, etc. Recommendations follow that the Department of Agriculture secure the introduction and domestication of desirable foreign races of bees, experiment in the crossing and mingling of races already introduced, in artificial fertilization, the true causes of disease, etc.

—— New species of Prodoxidæ.

Proc. Ent. Soc. Wash., II, No. 3, December, 1892, pp. 312-319, figs. 15-21.

Includes technical descriptions of the following new species: *Pronuba synthetica* (larva, chrysalis, and imago); *Prodoxus pulverulentus*, *P. y-inversus*, *P. reticulatus*, *P. coloradensis*, and *P. sordidus*.

—— On certain peculiar structures of Lepidoptera.

Proc. Ent. Soc. Wash., II, No. 3, December, 1892, pp. 305-312, figs. 13-14. (Also separate.)

The paper describes some of the remarkable structures of the species of *Pronuba* and *Prodoxus* under the heads: (1) The radiate bodies in the *receptaculum seminis* of *Pronuba* and *Prodoxus*; (2) *Pseudo-cenchri*; (3) The tegulæ and the patagia. The radiate bodies referred to, if they occur at all in other insects, are never found in anything like the remarkable development in which they exist in the species of the family Prodoxidæ. Their function seems to be to liberate the spermatozoa from the spermatophores. In connection with two cenchri-like spots on the metathorax of *Pronuba synthetica*, the author discusses the cenchri of Lepidoptera and concludes that they are more likely organs of sound than of any other sense. In discussing the tegulæ and patagia it is shown that much confusion on the part of authors in the use of these terms has existed, and the original definitions of Westwood and Kirby and Spence are held to be the proper guides.

—— Report of the Entomologist.

Rep. Sec. Agric. 1892, Washington, Government Printing Office, 1893, pp. 153-180.

Contains the following titles: Introduction, pp. 153, 154; The work of the season, pp. 154-167; Work of the field agents, pp. 167-170; The Pea and Bean Weevils (*Bruchus pisi*, L. and *B. obtectus*, Say), pp. 170-172; The Sugar-beet Web-worm, *Loxostege sticticalis*, Linn., pp. 172-

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175; The Shot-borer or Pin-borer of the Sugar Cane (*Xyleborus perforans*, Woll), pp. 175–178; The Insectary of the Division, 178–179.

Also printed as a separate under the title "Report of the Entomologist for 1892," Washington, 1893, with table of contents, plates and index.

—— Note on *Loxostege maclura*, n. s.

Insect Life, v, No. 3, January, 1893, pp. 157–158.

A supplementary note to an article by Miss Mary E. Murtfeldt on this insect, characterizing the species, hitherto undescribed.

—— Insect communities. A lecture delivered at the Brooklyn Institute, February 3, 1893.

Brooklyn Daily Eagle, February 4, 1893.

Habits of some social insects, and the polity of the hive of the honey bee. Refers to instincts of many social insects, and concludes that instinctive and inevitable actions on the part of insects are associated with others which result from the possession of intelligence, of conscious reasoning and reflective powers.

"Just among the mammalia, the higher intellectual development, as in man, is physiologically correlated with the longest period of dependent infancy; that this helpless infancy has been, in fact, a prime influence in the origin, through family, clan, tribe, and state, of organized civilization; so in the insect world we find the same physiological correlation between the highest intelligence and dependent infancy, and are justified in concluding that the latter is in the same way the cause of the high organization and division of labor, the cause and explanation which so baffled Darwin in the application of his grand theory of evolution to social insects."

—— Hickory wood carved by worms.

Scientific American, March 11, 1893, p. 148.

A popular account of *Scolytus caryæ*, Riley (*4-spinosus*, Say), with illustrations of a particularly fine specimen of its work, and that of *Saperda discoidea*, which is almost always associated with it.

—— The genus *Dendrotettix*.

Insect Life, v, No. 4, April, 1893, pp. 254–256.

A characterization of *Dendrotettix longipennis*, new genus and species. The paper was read by title before the Entomological Society of Washington, March 9, 1892.

—— Report on a small collection of insects made during the Death Valley Expedition.

North Am. Fauna, May, 1893, pp. 235–255.

Also separate, published by the Division of Ornithology and Mammalogy of the U. S. Department of Agriculture.

RILEY, CHARLES V.—continued.

A list of the species of Coleoptera, Lepidoptera, Hymenoptera, Orthoptera, and Neuroptera, collected by Mr. Albert Koebele during the expedition, with conclusions drawn from the same. Also comprises reports with descriptions of new species from P. R. Uhler on the Hemiptera, and from S. W. Williston on the Diptera.

—— (Editor.) Reports of the United States Commissioners to the Universal Exposition of 1889 at Paris. Vol. v. Agriculture, 1891, pp. 1–935, pls. 1–78, figs. 1–219.

Report as expert commissioner of the eighth group, and as representative of the Department of Agriculture. Part I contains: Report on agriculture, vine cultivation, etc., including a report on field trials of machinery. Part II contains: Report on the agricultural exhibit and agricultural products of the United States. Besides the introductory chapter, the following articles by the editor are contained in Part I: Agronomy and agricultural statistics; Organization, methods, and appliances of agricultural instruction; Field trials of machines, and Vine cultivation. By C. V. Riley and Amory Austin: Farm improvements and agricultural work; Exhibitions of live stock. Part II contains chapters by the editor entitled: Brief history of the exhibit; Injurious and beneficial insects in the United States.

—— Parasitism in insects. Annual address of the president.

Proc. Ent. Soc. Wash., II, No. 4, June, 1893, pp. 397–431. Also separate, pp. 1–35.

A general consideration of the subject of parasitism among arthropods. As a useful working system the author divides insect parasites into: I. Parasites proper, or those which can not exist apart from the host; II. Fatal parasites, which as a rule involve the death of the host; and III. Inquilinous parasites, including those insects which sponge on the labors of other insects. These primary divisions permit of subdivision, and the subject is dealt with in detail under the following subheads: Animals affected; the parasites among insects, dealt with by orders; the derivative origin of insect parasitism; effects of the parasitic life; economic bearing of parasitism; conclusions.

—— Is *Megastigmus* phytophagic?.

Proc. Ent. Soc. Wash., II, No. 4, June, 1893, pp. 359–363.

The author presents facts gathered from Herman Borries, of Denmark, the writings of Partitt, Mayr and Wachtl, and his own observations, and concludes that while there is every reason to believe that the genus is essentially parasitic, some of its species may be phytophagic.

RILEY, CHARLES V. Further notes on Yucca insects and Yucca pollination.

Proc. Biol. Soc. Wash, VIII, June 20, 1893, pp. 41–54. pl. IX. Also separate, author's edition.

Supplementary to the author's previous paper on "Some Interrelations of Plants and Insects," in Volume VII of the same Proceedings.

Summarizes the observations of Prof. William Trelease and D. W. Coquillet on the habits of *Pronuba maculata* in pollinating *Yucca Whipplei*; also the former's observations on the habits of *Pronuba synthetica* on *Yucca brevifolia*. Records a black variety (*aterrima* Trelease) of *Pronuba maculata*, confined to the *graminifolia* variety of *Y. Whipplei*, and extends the range of *Pronuba yuccasella* to the Pacific coast. Describes *Prodoxus intricatus* n. s. from *Yucca guatemalensis* and characterizes the hitherto unknown male of *Prodoxus intermedius* and the larvæ of *P. coloradensis* and *P. cinereus*. The larva of *P. cinereus* is remarkable in that it bears on its ventral plate two stout, brown decurved horns, resembling those of the larva of *Trogosita*. Mentions the only other known instances of similar anal hooks in Lepidopterous larvæ, viz, in *Alucita Kellicottii*, Fish, another Pterophorid, undescribed, and the larva of *Hadena stipata*, Morr., and argues that these structures, approaching as they do, those which are common to many boring Coleopterous larvæ, are independent consequences of habit and environment, and show the relative valuelessness of larval characters for taxonomic purposes.

—— Reports of observations and experiments in the practical work of the division.

Bull. Div. Ent., No. 30, U. S. Dept. Agric., Washington, June, 1893, pp. 1–67.

Contains the reports of the field agents of the Division of Entomology, with letter of transmittal and introductory summary by C. V. Riley.

—— Report on the Department of Insects in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus). 1890 (1891), pp. 219–221.

RILEY, CHARLES V., and HOWARD, L. O. The first larval stage of the Pea Weevil.

Insect Life, IV, No. 11–12, August, 1892, p. 392.

The pea weevil, as well as the bean weevil, passes through a post-embryonic stage, during which it possesses false legs, which are afterwards lost.

—— On the nomenclature and oviposition of the Bean Weevil.

Insect Life, V, No. 1, September, 1892, pp. 27–33.

In Dr. Horn's revision of the Bruchidæ the Bean weevil is given as *Bruchus obsoletus*.

RILEY, CHARLES V., and HOWARD L. O.—continued.

Say, but the authors consider that the Bean weevil is distinct from *obsoletus*. Say found *obsoletus* on a species of *Astragalus*, from which he also obtained *Apion segnipes*.

Mr. Schwarz has found a *Bruchus* in connection with this very *Apion segnipes* on *Tephrosia virginiana*, near Washington, and this *Bruchus* agrees fully with Say's description of *B. obsoletus*. All who have gone over the synonymy carefully will admit that *B. obtectus*, Say, which precedes *B. obsoletus* in the descriptions, is more plainly referable to our Bean weevil. The synonymy of the species from *B. obtectus* Say (1831) to *B. subarmatus* Janson (1889) is given. Its habits of oviposition in the field are discussed, and it is found that the eggs are invariably placed in the pod.

—— The Australian enemies of the red and black scales.

Insect Life, V, No. 1, September, 1892, pp. 41–43.

Records the observations of Mr. D. W. Coquillet on the condition of *Orcus chalybeus* and *O. australasiæ*, introduced from Australia for the purpose of destroying *Aspidiotus aurantii* and *Lecanium oleæ*.

—— A curious Chrysalis.

Insect Life, V, No. 2, November, 1892, p. 131.

A brief note upon the remarkable Bombycid chrysalis of *Saturnia arnobia*, Westwood, found by Mr. Good in West Africa.

—— The Glassy-winged Sharpshooter (*Homalodisca coagulata*, Say).

Insect Life, V, No. 3, January, 1893, pp. 150–154, fig. 10.

From the peculiar effect of its punctures on young cotton bolls, and also from its power of rapidly and forcibly ejecting minute drops of liquid, this insect derives its name of "Sharpshooter" in the South. A single application of kerosene emulsion to young poplar growth along the borders of cotton fields about the second week in May is recommended.

—— Food-plants of North American species of *Bruchus*.

Insect Life, V, No. 3, January, 1893, pp. 165–166.

A table of the food-plants of various species of *Bruchus*, compiled from Riley's records, those of the Division of Entomology, and from other sources.

—— An interesting Water Bug (*Rheumatobates Rileyi*, Bergroth.)

Insect Life, V, No. 3, January, 1893, pp. 189–193, figs. 18–20.

Detailed description of this curious Hydrometrid, with figures by O. Heideman, who cap-

RILEY, CHARLES V., and HOWARD, L. O.—continued.

tured specimens of both sexes near Washington. Two forms of male occur, those with normal and those with abnormal and incrassated hind legs.

—— The Orange Aleyrodes (*Aleyrodes citri*, n. s.).

Insect Life, v, No. 4, April, 1893, pp. 219-226, figs. 23-24.

This is perhaps the most important of the family Aleyrodidæ. infesting oranges in Florida and Louisiana and greenhouses further north. It is described and figured in detail, and its habits and life-history, natural enemies and remedies, are discussed.

—— The pear-tree Psylla.

Insect Life, v, No. 4, April, 1893, pp. 226-230, figs. 25-29.

A careful and critical review of Bulletin 44, Cornell University Experiment Station, by Mark V. Slingerland, some of the author's figures being reproduced by permission.

—— Editorials and notes.

Insect Life,, IV, Nos. 11-12, August, 1892; v, Nos. 1-4, September, 1892, to April, 1893.

See table of contents of each number of *Insect Life*.

—— Correspondence of the Division of Entomology, U. S. Department of Agriculture.

Insect Life, IV, No. 11-12, August, 1892; Nos. 1-4, September, 1892, to April, 1893.

Selected letters from correspondents, with replies.

ROSE, JOSEPH NELSON. List of plants collected by Dr. Edward Palmer in 1890 on Carmen Island.

Contrib. U. S. Nat. Herbarium, I, September, 1892, pp. 129-134.

An account of Carmen Island is given, with a list of the species. Five species and a variety are described as new. This paper is based upon Museum material.

—— A new *Tabebuia* from Mexico and Central America.

Botan. Gaz., XVII, December, 1892, pp. 418-419.

Tabebuia Donnell-Smithii is described and figured. This tree is the *Primavera* or white mahogany of commerce, and for a number of years has been extensively brought into the eastern markets from Mexico. This paper is based upon Museum material.

—— *Agave angustissima*.

Garden and Forest, VI, January, 1893, pp. 5-6.

ROSE, J. N.—continued.

An account of the rediscovery of this little-known plant, with a fuller description and illustrations. This paper is based upon Museum material.

—— Undescribed species from Guatemala.

Botan. Gaz., XI, June, 1893, pp. 198, 206, 207.

Three new species are described from J. Donnell Smith's third distribution of Guatemalan plants. This paper is based upon Museum material.

ROSE, J. N., and CANBY, WILLIAM M. George Vasey: A biographical sketch.

Botan. Gaz., XVIII, May, 1892, pp. 170-183, with portrait.

ROSE, J. N., and COULTER, JOHN M. Notes on North American Umbelliferæ.

Botan. Gaz., XVIII, February, 1892, pp. 54-56.

A list of the Umbelliferæ in Mr. John Donnell Smith's distribution is given, and one new species and a new genus are described. The latter is figured. This paper is based upon Museum material.

—— New and little-known plants collected on Mount Orizaba in the summer of 1881.

Proc. Am. Acad. Arts and Sci., XXVIII, June, 1893, pp. 118-119.

Two new species of Mexican Umbelliferæ are described by Mr. Henry L. Seaton. This paper is based upon Museum material.

ROSE, J. N. (and others). List of plants collected by the U. S. Fish Commission steamer *Albatross* in 1887-'91 along the western coast of America.

Contrib. U. S. Nat. Herbarium, I, September, 1892, pp. 129-134.

A list of the plants of Cedros Island and Galapagos Island, with a description of one new species. This paper is based upon Museum material.

SCLATER, PHILIP LUTLEY. Lucas on explorations in Labrador.

Ibis, IV, No. 15, p. 453.

Editorial review of paper in *Rep. Smithsonian Inst.* (U. S. Nat. Mus.), 1889, p. 709.

—— Ridgway on the genus *Sittasomus*.

Ibis, IV, No. 15, p. 457.

Editorial review and criticism of paper in the *Proc. U. S. Nat. Mus.*, XIV, p. 507.

—— Stejneger on the cubital coverts of the Paradise Birds.

Ibis, IV, No. 15, p. 463.

Editorial notice of paper in the *Proc. U. S. Nat. Mus.*, XIV, p. 499

SCLATER, PHILIP LUTLEY. Mr. P. L. Jouy's collection.

Ibis, IV. No. 16, p. 577.

Editorial notice of the acquiring of the collection of Korean and Tsushima birds by the National Museum, with brief reference to the more important species mentioned.

—— Stejneger on Mr. Henson's collection from Yezo, Japan.

Ibis, V, No. 18, pp. 272-273.

Editorial notice and commentary on paper in *Proc. U. S. Nat. Mus.*, XV, p. 289.

SCOLLICK, J. W. On the making of gelatin casts.

Proc. U. S. Nat. Mus., XVI, No. 926, June 13, 1893, pp. 61-62.

Describes a method of making casts of invertebrates, combs of fowls, etc.

SHUFELDT, ROBERT W. More inspirational archæology.

Religio-Philosophical Journ., 3, No. 11, Chicago, August 6, 1892, p. 166.

A study of the Indian pestles in the collection of the U. S. National Museum, pointing out the fraud of certain parties who claimed to have discovered one, assisted by spirit influence, near Unadilla, N. Y. Written at the request of a member of the Society of Psychical Research of London.

—— A maid of Walpai.

Proc. U. S. Nat. Mus., XV, No. 889, August 4, pp. 29-31, pl. I.

A popular description of the life of one of the young girls of the Wolpai Pueblo of Arizona.

—— The evolution of house-building among the Navajo Indians.

Proc. U. S. Nat. Mus., XV, No. 902, August 2, 1892, pp. 279-282, pls. XLI-XLIII.

An account which goes to show the progressive changes which have taken place in the building of primitive Indian houses, due to the advances of civilization. Plates give figures of the original "hogan" and the modified houses now built by the Navajoes, from photographic views by the author.

—— Review of some recent publications of the U. S. National Museum.

Science, XX, No. 498, New York, August 19, 1892, pp. 106-107.

—— A discussion of Mr. Ridgway's notions in regard to the systematic position of the Humming Birds.

Pop. Sci News, XXVI, No. 9, Boston, September, 1892, p. 131.

—— Studying birds with an opera glass.

Observer, III, No. 9, Portland, Conn., September, 1892, pp. 283-284.

SHUFELDT, R. W. A comparative study of some Indian homes.

Pop. Sci. Monthly, XLI, No. 6, New York, October, 1892, pp. 798-810, 5 figures.

Compares the houses built by the Moquis, the Acomas, the Apaches, the Navajoes, and other pueblan and field Indians of Arizona and New Mexico.

—— Ridgway on the Humming Birds.

Nature, No. 1194, vol. 46, London, September 15, 1892, p. 465.

A brief criticism of Mr. Ridgway's work on "The Humming Birds."

—— Ridgway on the anatomy of Humming Birds and Swifts.

Am. Naturalist, Philadelphia, October, 1892, pp. 869-870.

—— Scientific Taxidermy.

Great Divide, VIII, No. 4, Denver, Colo., December, 1892, pp. 197-198.

This article is illustrated by the reproduction of a photograph of the polar bear, one of the mounted specimens in the collection of the U. S. National Museum. The article comments upon the progress being made in the science of taxidermy at the National museums in Washington.

—— On the vernacular name of the genus *Harporhynchus*.

Science, XX, No. 54, New York, December 9, 1892, p. 333.

—— The systematic position of the Humming Birds: A rejoinder to Mr. Ridgway.

Pop. Sci. News, XXVII, No. 1, Boston, January, 1893, pp. 3-4.

—— *Sitta canadensis* appearing in numbers in the District of Columbia.

Auk, No. 1, January, 1893, p. 88.

—— Comparative notes on the Swifts and Humming Birds.

Ibis, V, No. 17, Art. VII, London, January, 1893, pp. 84-100, 6 figures in the text. This paper is based upon Museum material.

—— Notes on Palæopathology.

Pop. Sci. Monthly, XLII, No. 5, New York, March, 1893, pp. 679-684, 2 figures in the text.

Palæopathology is a word coined by the author to indicate the science which takes into consideration the study of the evidences of accidents and diseases in the fossil remains of animals, and comparing them with those affecting the corresponding tissues in existing forms. Fossil fractures are figured and described.

SHUFELDT, ROBERT W. A chapter on snakes.

Great Divide, Denver, Colo., March, 1893, pp. 16-17, 5 figures in the text.

A popular description of harmless and poisonous snakes of this country and elsewhere, as well as characters by which they may be distinguished. Reference made to many specimens collected by the author and now in the U. S. National Museum.

—— On the classification of the Longipennes.

Am. Naturalist, XXVII, No. 315, Philadelphia, March, 1893, pp. 233-237.

It proposes a suborder for the Longipennes, to be divided into three families, viz, the Laridæ, the Stercorariidæ, and the Rhyncopidæ. The Laridæ to be divided into subfamilies, viz, the Larinæ and the Sterninæ. The study is based upon an examination of the osteological material in the National Museum and in the author's own collection.

—— The Chionididæ. A review of the opinions on the systematic position of the family.

Auk., X, No. 2, New York, April, 1893, pp. 158-165.

Proposes the following classification: Suborder, *Chionides;* family, Chionididæ; genera, *Chionarchus, Chionis;* species, *Chionarchus minor, Chionis alba.* Tshi paper is based upon Museum material.

—— Ridgway on the anatomy of the Humming Birds and Swifts: A rejoinder.

Am. Naturalist, XXVII, No. 316, Philadelphia, April, 1893, pp. 367-371.

— Comparative osteological notes on the extinct bird *Ichthyornis.*

Journ. Anatomy and Physiology, XXVII, new series, VII, Part III, Art. 2. London, April. 1893, pp. 336-342.

Critically compares *Ichthyornis* with *Larus*, *Sterna* and allied forms, and points out the fact that there are a number of osteological resemblances between the skulls of *Ichthyornis* and *Rhynchops*, and a great many more than we find between *Ichthyornis* and *Sterna*, as was supposed to be the case by Marsh.

This paper is based upon Museum material.

—— Humming Birds and Swifts again.

Pop. Sci. News, XXVII, No. 5, Boston, May, 1893, p. 75.

—— Queer Beasts.

National Tribune, XII, No. 44, (whole No. 616), Washington, D. C., June 1, 1893, p. 8.

A popular illustrated article describing a number of the fossil remains of animals in the collections of the U. S. National Museum and elsewhere, and other matters pertaining thereto.

SIMPSON, CHARLES TORREY. Collecting notes.

Nautilus. VI, No. 4, August, 1892, pp. 37-40.

—— Notes on the Unionidæ of Florida and the Southeastern States.

Proc. U. S. Nat. Mus., XV., No. 911, October 28, 1892, pp. 405-436, pls. XLIX-LXXIV.

The above paper attempts an outline of the natural system of classification of the Unionidæ and of their distribution in North America. The species of the region in question are compared and arranged in groups, illustrated with outline figures, and a large number are reduced to synonymy. *Unio subluridus* Simpson, *U. singleyanus* (Marsh. MS.), and *U. ferrisii* (Marsh. MS.), are described as new.

—— On a revision of the American Unionidæ.

Nautilus, VI, No. 7, November, 1892, pp. 78-80.

—— A new *Anodonta.*

Nautilus, VI, No. 12, April, 1893, pp. 134-135.

Anodonta Mearnsiana, from Arizona, described as new.

—— *Unio coruscus, subluridus*, etc.

Nautilus, VI, No. 12, April, 1893, pp. 143-144.

—— On the relationships and distribution of the North American Unionidæ, with notes on the west coast species.

Am. Naturalist, XXVII, No. 316, April, 1893. pp. 353-358.

In this paper a more elaborate statement is made of the distribution and relationship of our North American naiades, and an attempt is made to trace the origin of the Pacific Coast forms.

—— A review of von Ihering's classification of the Unionidæ and Mutelidæ.

Nautilus, VII, No. 2, June, 1893, pp. 17-21.

—— A reply to Prof. Wheeler.

Nautilus, VII, No. 2, June, 1893, pp. 22-23.

SMITH, HUGH M. Report on a collection of fishes from the Albemarle region of North Carolina.

Bull. U. S. Fish Com., 1891, pp. 185-200. This paper is based in part upon Museum material.

SMITH, JOHN B. Revision of the genus *Cucullia;* revision of the Dicopinæ; revision of *Xylomiges* and *Morrisonia.*

Proc. U. S. Nat. Mus., XV, Nos. 890-892, August 8, 1892, pp. 33-86, pls. II-III. This paper is based upon Museum material.

STANTON, TIMOTHY W. The faunas of the Shasta and Chico formations.

Bull. Geol. Soc. Am, IV, June 1893 pp. 245–256.

A brief discussion of the cretaceous fossils of the Pacific Coast region, based mainly on collections from the Sacramento Valley, in northern California. It is shown that the Shasta and Chico formations are closely related faunally, having many species in common, and they are therefore regarded as parts of one continuous series. This paper is based upon Museum material.

STEARNS, ROBERT E. C. Death Valley Expedition, Part II, No. 5. Report on mollusks.

North Am. Fauna, No. 7, May, 1893, pp. 269–283, 2 figures in the text.

Fluminicola Merriami, Pilsbry and Beecher, and *Amnicola micrococcus*, Pilsbry, are described as new, and the existence in a living state of *Tryonia clathrata*, Stm., is announced.

—— Preliminary descriptions of new molluscan forms from west American regions, etc.

Nautilus, VI, No. 8, December, 1892, pp. 85–89.

Uvanilla regina, *Chlorostoma gallina*, var. *multifilosa*, *Bulimulus Habeli*, *Onchidium Lesliei*, *Littorina* (*Tectarius*) *galapagiensis*, *Nitidella incerta*, and *Littorina* (*Tectarius*) *atyphus* are described as new.

—— Description of a new species of *Nassa* from the Gulf of California.

Nautilus, VII, No. 1, May, 1893, pp. 10–11. *Nassa brunneostoma* described as new.

STEJNEGER, LEONHARD. Notes on a collection of birds made by Harry V. Henson in the Island of Yezo, Japan.

Proc. U. S. Nat. Mus., XV, No. 904, August 6, 1892, pp. 289–359, pl. XLV.

New species and subspecies described: *Parus Hensoni*, p. 342, and *Hypsipites amaurotis Hensoni*, p. 347. Four additions to the Japanese fauna are noted, viz: *Hemichelidon griseisticta*, *Otocorys alpestris*, *Falco rusticolus*, and *Urinator pacificus*. Species new to the Island of Yezo are *Turdus obscurus*, *Cichloselys sibiricus*, *Tringa canutus*, *Terekia cinerea*, and *Nettion formosa*. Sixty-five species are noted in the present paper, twenty-eight of which are discussed critically, and are accompanied by copious notes and emendations of synonymy.

Changes in nomenclature are as follows: *Podicepsnigricans* (Scop.) for the Little Grebe, in place of *P. auritus* γ (L), *P. fluviatilis*, Tunstall, *minutus*, Lath., or *philippensis*, Bonaterre. *Ceryle lugubris* (Temm.) is retained for the name of the Japanese bird which is considered distinct from the Himalayan, which it is proposed to call *C. guttulata*, as *C. guttata* of Vigors is preoccupied. The name *Cichloselys* is restricted to the Siberian thrush as being the only species of the group requiring a separate name. *Monticola manilla* (Bodd.) is provisionally adopted for the eastern form of the Rocky Mountain thrush which is distinguished from the European bird by size, color, and wing-formula. *Cyanoptila bella* (Hay) for the Blue and Black Flycatcher, *C. yanomelæna* and *C. gularis* being both untenable. *Poliomyias ferruginea* (Gmel.) in place of *P. luteola* Pallas, or *P. mugimaki* of Temminck. *Uroplexis* (new genus) is substituted for *Urosphena*, preoccupied. *Sturnia violacea* (Bodd.) takes precedence over *pyrrhogenys* of Temm. & Schleg. *Sturnus cineraceus*, Temm. is placed in the genus *Acridotheres*. An exhaustive study of the two forms of Pied wagtails of Japan is given; all the various stages of plumage are described and further distinguished by a tabular synopsis, plate XLV illustrating the wing feathers of *Motacilla lugens*.

—— Two additions to the Japanese Avifauna, including description of a new species.

Proc. U. S. Nat. Mus., XV, No. 906, September 16, 1892, pp. 371–373.

Tringa Temminckii (Leisl.) and *Acanthopneuste ijimæ* Stejn., the latter being now described for the first time.

—— Supplementary remarks on the genus *Pitta*.

Auk, X, No. 2, April, 1893, pp. 181–184.

A critical review of Mr. Elliott s paper on the genus *Pitta*, Vieillot, with a discussion as to the dates of publication of Vieillot's "Analyse" and the fourth volume of the "Nouveau Dictionaire d'Histoire Naturelle."

—— Report on the Department of Reptiles and Batrachians in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 201–203.

—— Preliminary description of a new genus and species of Blind Cave Salamander from North America.

Proc. U. S. Nat. Mus., XV, No. 894, August 4, 1892, pp. 115–117, pl. IX.

Described as a new genus, *Typhlotriton*; as a new species, *T. spelæus*, from Rock House Cave, Mo. Type, U. S. National Museum, No. 17903.

—— Diagnosis of a new California lizard.

Proc. U. S. Nat. Mus., XVI, No. 944, advance sheet, May 27, 1893, p. 467.

Described as a new species, *Xantusia Henshawi*, from Witch Creek, Cal. Type, U. S. National Museum, No. 20339.

STEJNEGER, LEONHARD. Skeletons of Steller's Sea-cow preserved in the various museums.

Science, XXI, February 10, 1893, p. 81.

Correcting an article by Prof. B. W. Evermann in a previous number of the same journal.

—— Notes on the generic name *Chirotes*.

Science, XXI, March 24, 1893, pp. 157-158.

Shows that *Bipes* Latr. has priority over *Chirotes* Cuv. Full synonymy of the genus.

—— Annotated list of the reptiles and batrachians collected by the Death Valley Expedition in 1891, with description of new species.

North Am. Fauna, No. 7, pp. 159-228, pls. I-IV.

A full report upon the herpetological collections of the Death Valley Expedition, with interpolated field notes by Dr. C. Hart Merriam. One new genus name is proposed, viz, *Hemitheconyx*, for *Psilodactylus* Gray, preoccupied. New species and subspecies described: *Coleonyx brevis*, *Sceloporus Boulengeri*, *Sceloporus Orcutti*, *Phrynosoma cerrœnse*, *Phrynosoma Goodei*, *Gerrhonotus scincicauda Palmeri*, *Hypsiglena texana*, *Bascanion flagellum frenatum*, *Pituophis catenifer deserticola*, *Bufo boreas nelsoni*, *Rana Fisheri*. All the types are in the National Museum.

SUCHETET, ANDRÉ. Les Oiseaux Hybrides rencontrés à l'état sauvage. Troisiéme partie. Les Passereaux.

Mém. Soc. Zool. de France, V, 1882, pp. 253-525. (Reprint, with new title-page and pagination, pp. 179-451.)

An elaborate treatise on wild hybrids, in which many specimens in the U. S. National Museum are mentioned.

TEST, FREDERICK C. Fish-cultural investigations in Montana and Wyoming. Annotated list of the reptiles and batrachians collected.

Bull. U. S. Fish Com., 1891, pp. 57-59.

Report upon a collection made by Prof. B. W. Evermann in Montana and Wyoming, while investigating the rivers of those States.

TRUE, FREDERICK W. An annotated catalogue of the mammals collected by Dr. W. L. Abbott in the Kilima-Njaro region, East Africa.

Proc. U. S. Nat. Mus., XV, No. 915, October 26, 1892, pp. 445-480, pls. LXXV-LXXX.

—— Report on the Department of Comparative Anatomy in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 231-232.

TRUE, FREDERICK W. Report on the Department of Mammals in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat Mus.), 1890 (1891), pp. 189-193.

VASEY, GEORGE. Report of the Botanist for 1892.

Rep. Sec. Agric., 1892, pp. 201-214.

Principally an account of the office work, publications, and experiments carried on by the Division of Botany.

—— Grasses of the Pacific Slope.

Bull. Div. Bot., No. 13, U. S. Dept. Agric., Part I, October, 1892; Part II, June, 1893.

One hundred species of the principal grasses of the Pacific slope are described and figured.

—— Report on the Department of Botany in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 237-239.

VERRILL, A. E. The Marine Nemerteans of New England and adjacent waters. Dinophilidæ of New England.

Trans. Conn. Acad. Sci., VIII., June and December, 1892, pp. 1-30, 411-458, pls. XXXIII-XXXIX.

Based partly on material collected by the U. S. Fish Commission between 1871 and 1887, which will be added to the Museum collection. Two new genera are described, *Nectonemertes* and *Hyalonemertes*. The new species are *Amphiporus multisarus*, *A. heterosorus*, *A. tetrasorus*, *A. frontalis*, *A. mesosorus*, *A. cœcus*, *Tetrastemma roseum*, *Lineus bicolor*, *Micrura dorsalis*, *M. rubra*, *Nectonemertes mirabilis*, *Hyalonemertes atlantica*. New varieties: *Tetrastemma vermiculus* var. *catenulatum* and *T. dorsale* var. *unicolor*.

WALCOTT, CHARLES DOOLITTLE. Notes on the Cambrian rocks of Virginia and the southern Appalachians.

Am. Journ. Sci., XLIV, July, 1892, pp. 52-57.

This paper is an account of fieldwork on the Cambrian rocks of Virginia in the vicinity of Balcony Falls and of their southwestward extension across Tennessee and into Georgia. It records the study of a large Middle Cambrian fauna in Tennessee and the identification of a Lower Cambrian horizon in Virginia and Tennessee.

—— The North American Continent during Cambrian time.

12 Ann. Rep. U. S. Geol. Surv., 1890-'91 (1892), pp. 523-568, 3 maps, and 1 page of sections and figures.

This is a memoir on the condition and development of the North American Continent dur-

WALCOTT, CHARLES D.—continued.

ing Middle Paleozoic time. It is accompanied by three maps, one of which illustrates the relative amount of sedimentation within the typical geologic provinces of North America during Cambrian time. The second is a hypothetical map of the continent at the beginning of Lower Cambrian time, and the third is one of the same character, representing the continent at the beginning of Lower Silurian (Ordovician) time. Several important conclusions were arrived at. Among them are:

1. The pre-Cambrian Algonkian continent was formed of the crystalline rocks of the Archean nuclei, and broad areas of superjacent Algonkian rocks that were more or less disturbed and extensively eroded in pre-Cambrian time. Its area was larger than at any succeeding epoch until Mesozoic time.

2. At the beginning of Cambrian time three principal areas of sedimentation existed: (*a*) The Atlantic coast province, including various seas between the several pre-Cambrian ridges; (*b*) a narrow sea extending along the western side of the Paleo-Appalachian range, from the present site of Labrador to Alabama; (*c*) a broader sea on the western side of the continent, west of the Paleo-Rocky Mountain ranges, that extended from the southern portion of the present site of Nevada northward into British Columbia and probably toward the Arctic Circle, and south to the Paleo-Gulf of Mexico, and thus connecting with the Paleo-Appalachian Sea.

3. The Cambrian age began to invade the great interior continental area in late Cambrian time, and extended far to the north toward the close of the period, as indicated on Pl. XLV.

4. The depression of the continent in relation to sea level began in pre-Cambrian time and continued with few interruptions until the close of Paleozoic time.

5. The relative positions of the continenta area and the deep seas have not changed since Algonkian time.

6. The sediments of Cambrian time were accumulated to a great extent in approximately shallow seas, except in portions of the Paleo-Rocky Mountain and Paleo-Appalachian seas.

7. The lower Cambrian fauna lived in the seas of the Atlantic coast province, the Paleo-Appalachian and the Paleo-Rocky Mountain seas.

8. The Middle Cambrian fauna of the Atlantic basin is not known to have penetrated into the Paleo-Appalachian or Paleo-Rocky Mountain seas, except in the case of a few species now found in Alabama and probably eastern New York. The portion of the fauna occupying the same relative stratigraphic position in the group is essentially the same as the Paleo-Appalachian and Paleo-Rocky Mountain sections.

9. The Upper Cambrian fauna was distributed over the broad interior continental area and in the Paleo-Appalachian and Paleo-Rocky Mountain seas, but it has not been recognized by the same genera and species in the Atlantic coast province, the fauna of the latter being more closely allied to that of the Upper Cambrian of the eastern side of the Atlantic basin.

—— Notes on the Cambrian rocks of Pennsylvania and Maryland, from the Susquehanna to the Potomac.

Am. Journ. Sci., XLIV, 1892, pp. 469–482.

This paper is a continuation of the study of the Cambrian rocks of the Appalachian range north of Virginia, between the Potomac and the Susquehanna rivers. It records the discovery of the Middle Cambrian fauna in a series of quartzites that extend from Harpers Ferry on the Potomac to South Mountain in Pennsylvania, and which also occur in York County, Pa., on the Susquehanna. It was also discovered that a series of limestone shales severa thousand feet in thickness belong to the Lower Cambrian series.

—— Report on the Department of Paleozoic Fossils in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891). pp. 233–234.

WARD, LESTER F. [Abstract of] The plant-bearing deposits of the American Trias.

Proc. Am. Assoc. Adv. Sci., XL (Washington meeting), 1891, pp. 287–288.

Abstract of paper of same title published in *Bull. Geol. Soc. Am.*, III, 1891, pp. 23–31.

—— [Abstract of] Principles and methods of geologic correlation by means of fossil plants.

Proc. Am. Assoc. Adv. Sci., XL (Washington meeting), 1891, pp. 288–289.

Abstract of paper of same title in *Am. Geologist*, IX, 1892, pp. 34–47.

—— [Abstract of] The science and art of Government.

Proc. Am. Assoc. Adv. Sci., XL (Washington meeting), 1891, pp. 420–421.

A paper read in abstract before Section I (Economics and Statistics) of the American Association for the Advancement of Science, at its Washington meeting, in August, 1891. Published in *Science*, XVIII, November 20, 1891, p. 281.

—— [Abstract of] A national university; its character and purpose.

Proc. Am. Assoc. Adv. Sci., XL (Washington meeting), 1891, pp. 421–422.

A paper read in abstract before Section I (Economics and Statistics) of the American Association for the Advancement of Science, at

WARD, LESTER F.—continued.

its Washington meeting, in August, 1891. Published in *Science*, XVIII, November 20, 1891, p. 281.

—— Notice of "The Paleontology of the Cretaceous formation on Staten Island; by Arthur Hollick, New York, 1892," in *Trans. N. Y. Acad. Sci.*, Vol. XI, New York, 1892.

Am. Journ. Sci., 3d series, XLIV, New Haven, September, 1892, p. 259.

—— Notice of "Untersuchungen über fossile Hölzer Schwedens; von H. Conwentz;" in *Kongl. svenska Vetenskaps-Akademiens*, Bandet 24, No. 13.

Am. Journ. Sci., 3d series, XLIV, New Haven, September, 1892, p. 260.

—— [Review of] Weismann's new essays.

Public Opinion, XIII, Washington and New York, September 10, 1892, p. 559.

Short review of Weismann's essays upon heredity and kindred biological problems, Vol. II. Authorized translation, Oxford, 1892. The second essay is criticized as embodying a *reductio ad absurdum*. The concluding essay on *Amphimixis* is highly commended.

—— Notice of "Albirupean studies;" by P. R. Uhler; in *Trans. Md. Acad. Sci.*, 1892, pp. 185–201.

Am. Journ. Sci., 3d series, XLIV, New Haven, October, 1892, pp. 333–334.

—— Notice of "The fossil flora of the Bozeman coal field, by F. H. Knowlton;" in *Proc. Biol. Soc., Washington*, VII, Washington, July, 1892, pp. 153–154.

Am. Journ. Sci., 3d series, XLIV, New Haven, October, 1892, p. 334.

—— Notice of "Paléontologie Végétale (Ouvrages publiés en 1890) par R. Zeiller," from l'Annuaire Géologique Universel, VII, 1890, Paris, 1892, pp. 1115–1157.

Am. Journ. Sci., 3d series, XLIV, New Haven, October, 1892, pp. 334–335.

—— Notice of "Sylloge Fungorum Fossilium hucusque cognitorum; auctore A. Meschinelli. Patavii, 1892;" from Saccardo's Sylloge Fungorum, X.

Am. Journ. Sci., 3d series, XLIV, New Haven, October, 1892, p. 335.

—— Notice of "I Tronchi du Bennettitee dei Musei Italiani. Notizie storiche, geologiche, botaniche; dei Professori Senatore G. Capellini e Conte E. Solms-Laubach;" from serie V, tomo II, della Mem. Real. Acad. Sci. Ist. di Bologna. Bologna, 1892.

Am. Journ. Sci., 3d series, XLIV, New Haven, October, 1892, pp. 335–336.

—— Notice of "Ueber den gegenwärtigen Standpunkt unserer Kenntniss von dem Vorkommen fossiler Glacialpflanzen; von A. G. Nathorst;" from the Bihang till svenska Vet.-Akad. Handlingar, Band 17, Afd. III, No. 5, Stockholm, 1892.

Am. Journ. Sci., 3d series, XLIV, New Haven, October, 1892, p. 336.

—— The psychologic basis of social economics.

Ann. Am. Acad. Political and Social Science, III, Philadelphia, January, 1893, pp. 72–90.

The distinction is pointed out between what is described as animal or biologic and human or psychologic economy. The former is carefully formulated, explained, and illustrated, and it is shown that the current political economy as well as the individualistic philosophy of Herbert Spencer and his disciples is primarily founded upon it. Examples of the prodigality of nature are given to show that it is not economical, and a sharp contrast is shown between nature's methods and those of rational man. The fundamental defect of all systems of economics is thus shown to be that they rest upon biology or the law of unregulated nature, instead of upon psychology or the law of mind. A true system of economics will be based upon the latter, which is antithetical to the former and is economical in the correct sense of the word.

—— Nomenclature of the Rock Creek region.

Am. Anthropologist, VI, Washington, January, 1893, p. 45.

A list of the names furnished to the committee of the Anthropological Society appointed to suggest to the District Commissioners appropriate names for localities and objects in the District of Columbia. These names were given to the various streams, bluffs, ridges, and valleys on account of the discovery at or near these places of rare or interesting plants during many years of botanical exploration, which resulted in the publication of the Guide to the Flora of Washington and Vicinity. (*Bull. U. S. Nat. Mus.*, No. 22, 1881.) Some of them were either mentioned in the text of that work or recorded in the map accompanying it, but the greater part were taken from the author's unpublished notes.

—— The psychologic basis of social economics.

Proc. Am. Assoc. Adv. Sci., XLI, 1892; Salem, 1892. pp. 301–321.

WARD, LESTER F.—continued.

Address of the Vice-President of Section I, Economic Science and Statistics, delivered at Rochester, August 17, 1892. This paper is the same in substance as that published in the Annals of the Academy of Political and Social Science at Philadelphia, for January, 1893, except that in the latter certain paragraphs were omitted to reduce its length.

—— The new botany.

Science, XXI, New York, January 27, 1893, pp. 43–44.

A plea for the establishment of post-graduate chairs in the leading American universities for the study of botany from all points of view, especially from the paleontological side, for the working out of the phylogeny of plants in America.

—— Notice of "Additions to the Paleobotany of the Cretaceous Formation on Staten Island, by Arthur Hollick;" in *Trans. N. Y. Acad. Sci.*, XIII, New York, 1892, pp. 1–12, pls. I–IV.

Am. Journ. Sci., 3d series, XLV, New Haven, May, 1893, p. 437.

—— Notice of "The organization of the fossil plants of the coal measures, Part XIX, by W. C. Williamson;" in *Phil. Trans. Roy. Soc.*, London, CLXXXIV, B, 1893, pp. 1–38, pls. I–IX.

Am. Journ. Sci., 3d series, XLV, New Haven, May, 1893, pp. 437–438.

—— Notice of "Fossil plants as tests of climate," by A. C. Seward. London, 1892.

Am. Journ. Sci., 3d series, XLV, New Haven, May, 1893, p. 438.

—— Notice of "Flora Tertiaria Italica; auctoribus A. Meschinelli et X. Squinabol." Patavii, 1893.

Am. Journ. Sci., 3d series, XLV, New Haven, May, 1893, pp. 438–439.

—— Notice of "The correlation of early Cretaceous floras in Canada and the United States," by Sir William Dawson; in *Trans. Roy. Soc. Canada*, X, Section IV, pp. 79–93.

Am. Journ. Sci., 3d series, XLV, New Haven, May, 1893, p. 439.

—— Notice of "A new Tæniopteroid fern and its allies," by David White, in *Bull. Geol. Soc. Am.*, IV, 1893, pp. 119–132, pl. I.

Am. Journ. Sci., 3d series, XLV, New Haven, May, 1893, pp. 439–440.

WARD, LESTER F. Frost freaks of the Dittany.

Botan. Gaz., XVII, Bloomington, Ind., May, 1893, pp. 183–186, pl. XIX.

Describes remarkable forms of frost crystals observed on plants of *Cunila mariana*, December 5, 1892, near Accotink, Va., with illustrations.

—— Dr. Newberry's work in Paleobotany.

Trans. N. Y. Acad. Sci., XII, New York, May, 1893, pp. 162–163

Abstracted from a letter to Prof. H. L. Fairchild, dated 1893. Embodied in a memoir of Prof. John Strong Newberry, by Herman LeRoy Fairchild.

—— Note on fossil Cycads from South Dakota.

Science, XXI, New York, June 30, 1893, p. 355.

Brief account of a collection of six fossil cycadean trunks, purchased by the U. S. National Museum from owners near Hot Springs, S. Dak., who found them on the surface of the ground, overgrown with lichens. They were very large, and exhibit certain peculiar and remarkable features.

—— Discussion of a paper by Dr. E. A. Ross, entitled "A New Canon of Taxation," read, August 24, 1892, at Chautauqua, N. Y.

Publications of the American Economical Association, VIII, No. 1, 1893, pp. 50–51.

Part of report of the Proc. Am. Economic Assoc. Fifth meeting.

Emphasizes the importance of considering the social as well as the fiscal effect of a tax, and of giving to laws an attractive character, whereby the person taxed will be induced through interest to act for the good of society.

WATKINS, JOSEPH ELFRETH. The log of the *Savannah*.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 611–639, pls. CLI–CLVI.

—— (Editor). Proceedings and Addresses. | Celebration | of the | Beginning | of the | Second Century | of the | American Patent System | at Washington City, D. C., | April 8, 9, and 10, 1891. | Published by the Executive Committee | Washington, D. C:—Press of Gedney & Roberts Co. | 1892.

8 vo., pp. I–V (1) 1–554.

—— Catalogue of the exhibit of the Pennsylvania Railroad Company at the World's Columbian Exposition. pp. 1–158.

WATKINS, J. ELFRETH—continued.

—— Report on the Section of Transportation and Engineering in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 159-162.

WHITE, CHARLES ABIATHAR. Report on the Department of Mesozoic Fossils in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 235-236.

WILLIAMSON, Mrs. M. BURTON. An annotated list of the shells of San Pedro Bay and vicinity, with a description of two new species by W. H. Dall.

Proc. U. S. Nat. Mus., XV, No. 898, August 4, 1892, pp. 179-219, pls. XIX-XXII.

This paper comprises a list prepared by Mrs. Williamson, with notes on the species from various collectors. *Vitrinella Williamsoni, Ocula barbarense, Amphissa bicolor* are described by Mr. Dall as new, and many species of the region are figured for the first time. Based partly upon Museum material.

WILSON, THOMAS. [Anthropological notes in the *American Naturalist.*] Man and the Mylodon. No. 407, July, 1892, pp. 629-631. Importance of the science and of the department of prehistoric anthropology. No. 308, August, 1892, pp. 681-690; No. 310, October, 1892, pp. 809-816. International Congress of Americanists. No. 315, March, 1893, pp. 300-305; No. 318, June, 1893, pp. 579-581. Language *v.* anatomy in determining human races. No. 318, June, 1893, pp. 581-582. The Nephrite of New Zealand. No. 318, June, 1893, pp. 582-583.

—— Ancient Etruria.

Am. Antiquarian, XV, No. 1, pp. 25-32.

—— Anthropology at the Paris Exposition in 1889.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 641-680, pls. CLVII-CLXIII, fig. 99.

—— Report on the Department of Prehistoric Anthropology in the U. S. National Museum, 1890.

Rep. Smithsonian Inst. (U. S. Nat. Mus.), 1890 (1891), pp. 179-187.

WOOLMAN, ALBERT J. Report of an examination of the rivers of Kentucky, with list of fishes obtained.

Bull. U. S. Fish. Com., 1890, pp. 249-288.

This paper is based in part upon Museum material.

—— A report upon the rivers of central Florida, tributary to the Gulf of Mexico, with list of the fishes inhabiting them.

Bull. U. S. Fish. Com., 1890, pp. 293-302.

WORTH, JOHN. The lives and loves of North American birds.

Nineteenth Century, April, 1893, pp 586-605.

A review of *Special Bulletin* No. 1, of the U. S. National Museum, entitled "Life Histories of North American Birds," by Capt. Charles Bendire.

APPENDIX VIII.

Lectures and Meetings of Societies.

The course of Saturday lectures for the season of 1892–'93 was as follows:

March 25.—The Human Body. By Dr. D. S. Lamb.

April 1.—The Anthropology of the Brain. By Dr. D. Kerfoot Shute.

April 8.—Status of the Mind Problem. By Prof. Lester F. Ward.

April 15.—The Elements of Psychology. By Maj. J. W. Powell.

April 22.—The Evolution of Inventions. By Prof. Otis T. Mason.

April 29.—The Races of Men. By Dr. Daniel G. Brinton.

May 6.—The Earth, the Home of Man. By W. J. McGee.

May 13.—Primitive Industries. By Dr. Thomas Wilson.

At the meeting of the American Ornithologists' Union, which was held from November 15 to November 17, 1892, the following papers were presented:

1. Birds of Lewis and Clarke in 1892. By Dr. Elliott Coues.

2. Summer Birds of Indiana and Clearfield Counties, Pennsylvania. By W. E. Clyde Todd.

3. The Geographical Distribution of the Genus *Megascops* in North America. By E. M. Hasbrouck.

4. Summer Birds of Prince Edward Island. By Jonathan Dwight, jr.

5. A Partial List of the Birds of White Head Island, Maine. By Arthur H. Norton.

6. The Origin and Geographical Distribution of North American Birds. By Dr. J. A. Allen.

7. The Life Areas of North America, considered especially in relation to their Classification and Nomenclature. By Dr. J. A. Allen.

8. The Fly-catchers of the *Myiarchus mexicanus* and *M. cinerascens* groups. By Dr. J. A. Allen.

9. Notes on Birds observed in Cuba. By Frank M. Chapman.

10. Remarks on the origin of West Indian Bird-life. By Frank M. Chapman.

11. A Review of the Faunal Literature of North America. By Frank M. Chapman.

12. Some Eccentricities in Geographical Distribution. By D. G. Elliot.

13. Habits of the Knot (*Tringa canutus*) in Massachusetts. By George H. Mackay.

14. Migration of *Charadrius dominicus* in Massachusetts in 1892. By George H. Mackay.

15. The Autumnal Plumage of the Hooded Warbler. By William Palmer.

16. Food-habits of the Common Crow. By Walter B. Barrows.

17. A Preliminary investigation of the Food-habits of *Ampelis cedrorum*. By F. E. L. Beal.

18. Notes on *Helminthophila chrysoptera, pinus, leucobronchialis,* and *lawrencei* in Connecticut. By John H. Sage.

19. Additions to the List of Manitoban Birds. By Ernest E. Thompson.

20. Feeding and Breeding habits of the Manitoban Icteridæ. By Ernest E. Thompson.

21. Feeding-habits of the Pinewood Woodpeckers. By Ernest E. Thompson.
22. The Distribution of the Genus *Harporhynchus*. By T. S. Palmer.
23. Exhibition of specimens of the Imperial Woodpecker. By T. S. Palmer.

The papers read before the National Academy of Sciences, at its annual meeting in April, 1893, are indicated below:

I. On the Systematic Relations of the Ophidia. By Prof. E. D. Cope.

II. Biographical Memoir of Gen. Montgomery C. Meigs. By H. L. Abbott.

III. On the Nature of Certain Solutions, and on a new means of investigating them. By M. C. Lea.

IV. The Relations of Allied Branches of Biological Research to the Study of the Development of the Individual, and the Evolution of Groups. By Prof. A. Hyatt.

V. The Endosiphonoidea (Endoceras, etc.), considered as a new order of Cephalopods. By Prof. A. Hyatt.

VI. A New Type of Fossil Cephalopods. By Prof. A. Hyatt.

VII. Results of Recent Researches upon Fossil Cephalopods of the Carboniferous. By Prof. A. Hyatt.

VIII. Biographical Memoir of Julius Erasmus Hilgard. By Prof. E. W. Hilgard.

IX. Monograph of the Bombycine Moths of America, North of Mexico: Part I—Notodontidæ. By Dr. A. S. Packard.

X. Intermediary Orbits. By G. W. Hill.

XI. The Relations between the Statistics of Immigration and the Census Returns of the Foreign-born Population of the United States. By Richmond Mayo-Smith.

XII. Statistical Data for the Study of the Assimilation of Races and Nationalities in the United States. By Richmond Mayo-Smith.

XIII. Telegraphic Gravity Determinations. By Dr. T. C. Mendenhall.

XIV. Comparison of Latitude Determinations at Waikiki. By Dr. T. C. Mendenhall.

XV. A One-volt Standard Cell. By H. S. Carhart.

XVI. Fundamental Standards of Length and Mass. By Dr. T. C. Mendenhall.

XVII. Peptonization in Gastric Digestion. By R. A. Chittenden.

APPENDIX IX.

Documents Relating to the World's Columbian Exposition.

AN ACT to provide for celebrating the four hundredth anniversary of the discovery of America by Christopher Columbus by holding an international exhibition of arts, industries, manufactures, and the products of the soil, mine, and sea in the city of Chicago, in the State of Illinois.

Whereas, it is fit and appropriate that the four hundredth anniversary of the discovery of America be commemorated by an exhibition of the resources of the United States of America, their development, and of the progress of civilization in the New World; and

Whereas, Such an exhibition should be of a national and international character, so that not only the people of our Union and this continent, but those of all nations as well, can participate, and should therefore have the sanction of the Congress of the United States: Therefore,

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That an exhibition of arts, industries, manufactures, and products of the soil, mine, and sea shall be inaugurated in the year eighteen hundred and ninety-two, in the city of Chicago, in the State of Illinois, as hereinafter provided.

Sec. 2. That a commission, to consist of two commissioners from each State and Territory of the United States and from the District of Columbia and eight commissioners at large, is hereby constituted to be designated as the World's Columbian Commission.

Sec. 3. That said commissioners, two from each State and Territory, shall be appointed within thirty days from the passage of this act by the President of the United States, on the nomination of the governors of the States and Territories, respectively, and by the President eight commissioners at large and two from the District of Columbia; and in the same manner and within the same time there shall be appointed two alternate commissioners from each State and Territory of the United States and the District of Columbia and eight alternate commissioners at large, who shall assume and perform the duties of such commissioner or commissioners as may be unable to attend the meetings of the said commission; and in such nominations and appointments each of the two leading political parties shall be equally represented. Vacancies in the commission nominated by the governors of the several States and Territories, respectively, and also vacancies in the commission at large and from the District of Columbia may be filled in the same manner and under the same conditions as provided herein for their original appointment.

Sec. 4. That the Secretary of State of the United States shall, immediately after the passage of this act, notify the governors of the several States and Territories, respectively, thereof and request such nominations to be made. The commissioners so appointed shall be called together by the Secretary of State of the United States in the city of Chicago, by notice to the commissioners, as soon as convenient after the appointment of said commissioners, and within thirty days thereafter. The said commissioners, at said first meeting, shall organize by the election of such officers and the appointment of such committees as they may deem expedient, and for this purpose the commissioners present at said meeting shall constitute a quorum.

SEC. 5. That said commission be empowered in its discretion to accept for the purposes of the World's Columbian Exposition such site as may be selected and offered and such plans and specifications of buildings to be erected for such purpose at the expense of and tendered by the corporation organized under the laws of the State of Illinois, known as "The World's Exposition of Eighteen hundred and ninety-two:" *Provided,* That said site so tendered and the buildings proposed to be erected thereon shall be deemed by said commission adequate to the purposes of said exposition: *And provided,* That said commission shall be satisfied that the said corporation has an actual bona fide and valid subscription to its capital stock which will secure the payment of at least five millions of dollars, of which not less than five hundred thousand dollars shall have been paid in, and that the further sum of five million dollars, making in all ten million dollars, will be provided by said corporation in ample time for its needful use during the prosecution of the work for the complete preparation for said exposition.

SEC. 6. That the said commission shall allot space for exhibitors, prepare a classification of exhibits, determine the plan and scope of the exposition, and shall appoint all judges and examiners for the exposition, award all premiums, if any, and generally have charge of all intercourse with the exhibitors and the representatives of foreign nations. And said commission is authorized and required to appoint a board of lady managers of such number and to perform such duties as may be prescribed by said commission. Said board may appoint one or more members of all committees authorized to award prizes for exhibits, which may be produced in whole or in part by female labor.

SEC. 7. That after the plans for said exposition shall be prepared by said corporation and approved by said commission, the rules and regulations of said corporation governing rates for entrance and admission fees, or otherwise affecting the rights, privileges, or interests of the exhibitors or of the public, shall be fixed or established by said corporation, subject, however, to such modification, if any, as may be imposed by a majority of said commissioners.

SEC. 8. That the President is hereby empowered and directed to hold a naval review in New York Harbor, in April, eighteen hundred and ninety-three, and to extend to foreign nations an invitation to send ships of war to join the United States Navy in rendezvous at Hampton Roads and proceed thence to said review.

SEC. 9. That said commission shall provide for the dedication of the buildings of the World's Columbian Exposition in said city of Chicago on the twelfth day of October, eighteen hundred and ninety-two, with appropriate ceremonies, and said exposition shall be open to visitors not later than the first day of May, eighteen hundred and ninety-three, and shall be closed at such time as the commission may determine, but not later than the thirtieth day of October thereafter.

SEC. 10. That whenever the President of the United States shall be notified by the commission that provision has been made for grounds and buildings for the uses herein provided for and there has also been filed with him by the said corporation, known as "The World's Exposition of eighteen hundred and ninety-two," satisfactory proof that a sum not less than ten million dollars, to be used and expended for the purposes of the exposition herein authorized, has in fact been raised or provided for by subscription or other legally binding means, he shall be authorized, through the Department of State, to make proclamation of the same, setting forth the time at which the exposition will open and close, and the place at which it will be held; and he shall communicate to the diplomatic representatives of foreign nations copies of the same, together with such regulations as may be adopted by the commission, for publication in their respective countries, and he shall, in behalf of the Government and people, invite foreign nations to take part in the said exposition and appoint representatives thereto.

SEC. 11. That all articles which shall be imported from foreign countries for the sole purpose of exhibition at said exposition, upon which there shall be a tariff or customs duty, shall be admitted free of payment of duty, customs fees, or charges under such regulations as the Secretary of the Treasury shall prescribe; but it shall be lawful at any time during the exhibition to sell for delivery at the close of the exposition any goods or property imported for and actually on exhibition in the exposition buildings or on its grounds, subject to such regulations for the security of the revenue and for the collection of the import duties as the Secretary of the Treasury shall prescribe: *Provided*, That all such articles when sold or withdrawn for consumption in the United States shall be subject to the duty, if any, imposed upon such articles by the revenue laws in force at the date of importation, and all penalties prescribed by law shall be applied and enforced against such articles, and against the persons who may be guilty of any illegal sale or withdrawal.

SEC. 12. That the sum of twenty thousand dollars, or as much thereof as may be necessary, be, and the same is hereby, appropriated, out of any moneys in the Treasury not otherwise appropriated, for the remainder of the present fiscal year and for the fiscal year ending June thirtieth, eighteen hundred and ninety-one, to be expended under the direction of the Secretary of the Treasury for purposes connected with the admission of foreign goods to said exhibition.

SEC. 13. That it shall be the duty of the commission to make report from time to time, to the President of the United States of the progress of the work, and, in a final report, present a full exhibit of the results of the exposition.

SEC. 14. That the commission hereby authorized shall exist no longer than until the first day of January, eighteen hundred and ninety-eight.

SEC. 15. That the United States shall not in any manner, nor under any circumstances, be liable for any of the acts, doings, proceedings or representations of the said corporation organized under the laws of the State of Illinois, its officers, agents, servants, or employes, or any of them, or for the service, salaries, labor, or wages of said officers, agents, servants, or employes, or any of them, or for any subscriptions to the capital stock, or for any certificates of stock, bonds, mortgages, or obligations of any kind issued by said corporation or for any debts, liabilities, or expenses of any kind whatever attending such corporation or accruing by reason of the same.

SEC. 16. That there shall be exhibited at said exposition by the Government of the United States, from its Executive Departments, the Smithsonian Institution, the United States Fish Commission, and the National Museum, such articles and materials as illustrate the function and administrative faculty of the Government in time of peace and its resources as a war power, tending to demonstrate the nature of our institutions and their adaptation to the wants of the people; and to secure a complete and harmonious arrangement of such a Government exhibit, a board shall be created to be charged with the selection, preparation, arrangement, safe-keeping, and exhibition of such articles and materials as the heads of the several Departments and the directors of the Smithsonian Institution and National Museum may respectively decide shall be embraced in said Government exhibit. The President may also designate additional articles for exhibition. Such board shall be composed of one person to be named by the head of each Executive Department, and one by the directors of the Smithsonian Institution and National Museum, and one by the Fish Commission, such selections to be approved by the President of the United States. The President shall name the chairman of said board, and the board itself shall select such other officers as it may deem necessary.

That the Secretary of the Treasury is hereby authorized and directed to place on exhibition, upon such grounds as shall be allotted for the purpose, one of the life-saving stations authorized to be constructed on the coast of the United States by existing law, and to cause the same to be fully equipped with all apparatus, furniture, and appliances now in use in all life-saving stations in the United States, said building and apparatus to be removed at the close of the exhibition and re-erected at the place now authorized by law.

SEC. 17. That the Secretary of the Treasury shall cause a suitable building or buildings to be erected on the site selected for the World's Columbian Exposition for the Government exhibits, as provided in this act, and he is hereby authorized and directed to contract therefor, in the same manner and under the same regulations as for other public buildings of the United States; but the contracts for said building or buildings shall not exceed the sum of four hundred thousand dollars, and for the remainder of the fiscal year and for the fiscal year ending June thirtieth, eighteen hundred and ninety one, there is hereby appropriated for said building or buildings, out of any money in the Treasury not otherwise appropriated, the sum of one hundred thousand dollars. The Secretary of the Treasury shall cause the said building or buildings to be constructed as far as possible, of iron, steel, and glass, or of such other material as may be taken out and sold to the best advantage; and he is authorized and required to dispose of such building or buildings, or the material composing the same, at the close of the exposition, giving preference to the city of Chicago, or to the said World's Exposition of eighteen hundred and ninety-two to purchase the same at an appraised value to be ascertained in such manner as he may determine.

SEC. 18. That for the purpose of paying the expenses of transportation, care, and custody of exhibits by the Government and the maintenance of the building or buildings hereinbefore provided for, and the safe return of articles belonging to the said Government exhibit, and for the expenses of the commission created by this act, and other contingent expenses, to be approved by the Secretary of the Treasury, upon itemized accounts and vouchers, there is hereby appropriated for the remainder of this fiscal year and for the fiscal year ending June thirtieth, eighteen hundred and ninety-one, out of any money in the Treasury not otherwise appropriated, the sum of two hundred thousand dollars, or so much thereof as may be necessary: *Provided*, That the United States shall not be liable, on account of the erection of buildings, expenses of the commission or any of its officers or employees, or on account of any expenses incident to or growing out of said exposition for a sum exceeding in the aggregate one million five hundred thousand dollars.

SEC. 19. That the commissioners and alternate commissioners appointed under this act shall not be entitled to any compensation for their services out of the Treasury of the United States, except their actual expenses for transportation and the sum of six dollars per day for subsistence for each day they are necessarily absent from their homes on the business of said commission. The officers of said commission shall receive such compensation as may be fixed by said commission, subject to the approval of the Secretary of the Treasury, which shall be paid out of the sums appropriated by Congress in aid of such exposition.

SEC. 20. That nothing in this act shall be so construed as to create any liability of the United States, direct or indirect, for any debt or obligation incurred, nor for any claim for aid or pecuniary assistance from Congress or the Treasury of the United States in support or liquidation of any debts or obligations created by said commission in excess of appropriations made by Congress therefor.

SEC. 21. That nothing in this act shall be so construed as to override or interfere with the laws of any State, and all contracts made in any State for the purposes of the exhibition shall be subject to the laws thereof.

SEC. 22. That no member of said commission, whether an officer or otherwise, shall be personally liable for any debt or obligation which may be created or incurred by the said commission.

(Public—No. 81.) Approved, April 25, 1890.

JOINT RESOLUTION authorizing the Secretary of the Smithsonian Institution to send articles illustrative of the life and development of the industries of women to the World's Columbian Exposition.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Smithsonian Institution be, and he hereby is, authorized to prepare and send, for exhibition in the Woman's Building of the World's Columbian Exposition, any article now in his custody, or on exhibition in the National Museum, illustrative of the life and development of the industries of women.

(Public resolution—No. 17.) Approved, March 3, 1893.

WORLD'S COLUMBIAN EXPOSITION.

GOVERNMENT EXHIBIT: For the selection, purchase, preparation, transportation, installation, care and custody, and return of such articles and materials as the heads of the several Executive Departments, the Smithsonian Institution and National Museum, and the United States Fish Commission may decide shall be embraced in the Government exhibit, and such additional articles as the President may designate for said Exposition, and for the employment of proper persons as officers and assistants to the Board of Control and Management of the Government exhibit, appointed by the President, of which not exceeding ten thousand dollars may be expended by said Board for clerical services one hundred and fifty thousand seven hundred and fifty dollars; of which sum fifty thousand dollars shall be immediately available, *Provided,* That the sum of eight thousand dollars or so much thereof as may be necessary, may be expended under the supervision of the board of Control of the United States Government exhibit in the collection, preparation, packing, transportation, installation, and care while exhibited of articles loaned or donated by the colleges of agriculture and mechanic arts in the several States for the display in the agricultural building of the Exposition, of the means and methods of giving instruction in the so-called land-grant college of the United States, and for re-packing and returning this property at the close of the Exposition, the same to be taken from the sum apportioned to the Agricultural Department; and ten thousand dollars additional for special expenses attending the naval exhibit of the model of a battle ship.

WORLD'S COLUMBIAN COMMISSION: For the World's Columbian Commission, two hundred and eleven thousand three hundred and seventy-five dollars, of which sum ninety-three thousand one hundred and ninety dollars shall be used for the Board of Lady Managers; and twenty-five thousand dollars of the last sum is hereby made immediately available; and ten thousand dollars of the appropriation for the Board of Lady Managers shall be paid in souvenir coins of the denomination of twenty-five cents, and for that purpose there shall be coined at the mints of the United States silver quarter dollars of the legal weight and fineness, not to exceed forty thousand pieces, the devices and designs upon which shall be prescribed by the Director of the Mint, with the approval of the Secretary of the Treasury; and said silver coins shall be manufactured from uncurrent subsidiary silver coins now in the Treasury; and all provisions of law relative to the coinage, legal-tender quality, and redemption of the present subsidiary silver coins shall be applicable to the coins herein authorized to be issued; and a sum not exceeding five thousand dollars may be used by the Director-General in his discretion for incidental and contingent expenses of his office.

To enable said Commission and the Board of Lady Managers to give effect to and execute the provisions of section six of the act of Congress approved April twenty-fifth, eighteen hundred and ninety, authorizing the World's Columbian Exposition, and appropriating money therefor, relating to committees, judges, and examiners for the Exposition, and the granting of awards, five hundred and seventy thousand eight hundred and eighty dollars, or so much thereof as in the judgment of the Lady Managers may be necessary, of which sum twenty-five thousand dollars shall be immediately available: *Provided*, That of this sum one hundred thousand dollars shall be devoted to the payment of judges, examiners, and members of committees to be appointed by the Board of Lady Managers, as authorized by said section. *And Provided further*, That said sum of five hundred and seventy thousand eight hundred and eighty dollars shall be a charge against the World's Columbian Exposition, and that of the moneys appropriated for the benefit of the World's Columbian Exposition, amounting to two million five hundred thousand dollars, under the act of August fifth, eighteen hundred and ninety-two, five hundred and seventy thousand eight hundred and eighty dollars shall be retained by the Secretary of the Treasury until said World's Columbian Exposition shall have furnished to the satisfaction of the Secretary of the Treasury, full and adequate security for the return and repayment, by said World's Columbian Exposition to the Treasury, of the sum of five hundred and seventy thousand eight hundred and eighty dollars, on or before October first, eighteen hundred and ninety-three; and until such security shall have been furnished by said World's Columbian Exposition, this appropriation, or any portion thereof, shall not be available.

That section three of the act in aid of the Columbian Exposition, approved August fifth, eighteen hundred and ninety-two, is hereby amended to read as follows:

"SEC. 3. That not to exceed fifty thousand bronze medals and the necessary dies therefor, with appropriate devices, emblems and inscriptions commemorative of the said Exposition celebrating the four hundredth anniversary of the discovery of America by Christopher Columbus, shall be prepared under the supervision of the Secretary of the Treasury; and the Bureau of Engraving and Printing, under the supervision of the Secretary of the Treasury, shall prepare plates and make therefrom not to exceed fifty thousand impressions for diplomas at a total cost not to exceed one hundred and three thousand dollars. Said medals and diplomas shall be delivered to the World's Columbian Commission, to be awarded to exhibitors in accordance with the provisions of said act of Congress approved April twenty-fifth, eighteen hundred and ninety, and there is hereby appropriated from any moneys in the Treasury not otherwise appropriated, the sum of one hundred and three thousand dollars, or so much thereof as may be necessary, to pay the expenditures authorized by this section"

And every person who within the United States or any Territory thereof, without lawful authority, makes, or willingly aids or assists in making, or causes or procures to be made, any dies, hub, plate, or mold, either in steel or of plaster, or any other substance whatsoever, in the likeness or similitude as to the design, or inscription thereon, of any die, hub, plate, or mold, designated for the striking of the medals and diplomas of award for the World's Columbian Exposition, as provided in section three of the act approved August fifth, eighteen hundred and ninety-two, or conceals or shall have in his possession, any such die, hub, plate, or mold hereinbefore mentioned, with intent to fraudulently or unlawfully use the same for counterfeiting the medals and diplomas hereinbefore mentioned, or who shall fraudulently or unlawfully have in his possession or cause to be circulated any duplicate or counterfeit medal or diploma not authorized by the Secretary of the Treasury, shall upon conviction thereof be punished by a fine of not more than five thousand dollars, and be imprisoned at hard labor not more than ten years or both, at the discretion of the court.

(Public—No. 124.) Sundry Civil Act Approved March 3, 1893.

WORLD'S COLUMBIAN EXPOSITION.

GOVERNMENT EXHIBIT: For the selection, purchase, preparation, and arrangement of such articles and materials as the heads of the several Executive Departments, the Smithsonian Institution and National Museum, and the United States Fish Commission may decide shall be embraced in the Government exhibit, and such additional articles as the President may designate for said Exposition, and for the employment of proper persons as officers and assistants to the Board of Control and Management of the Government exhibit, appointed by the President, of which not exceeding five thousand dollars may be expended, by the said Board for clerical services the sum of three hundred and fifty thousand dollars is hereby appropriated for the service of the fiscal year ending June thirtieth, eighteen hundred and ninety-two; and any moneys heretofore appropriated in aid of said Government exhibit may be used in like manner and for like purposes: *Provided*, That all expenditures made for the purposes and from the appropriation specified herein shall be subject to the approval of the said Board of Control and Management, and of the Secretary of the Treasury, as now provided by law.

WORLD'S COLUMBIAN COMMISSION: For the World's Columbian Commission, ninety-five thousand five hundred dollars, of which sum thirty-six thousand dollars shall be used for the Board of Lady Managers.

For expenses connected with the admission of foreign goods to the Exposition, as set forth in section twelve of the act creating the Commission, approved April twenty-fifth, eighteen hundred and ninety, twenty thousand dollars;

For contingent expenses of the World's Congress Auxiliary of the World's Columbian Exposition, two thousand five hundred dollars.

And the several sums herein appropriated for the World's Columbian Exposition shall be deemed a part of the sum of one million five hundred thousand dollars, the limit of liability of the United States on account thereof fixed by the act of April twenty-fifth, eighteen hundred and ninety, authorizing said Exposition.

(Public—No. 143.) From Sundry Civil Act. Approved March 3, 1891.

WORLD'S COLUMBIAN EXPOSITION.

GOVERNMENT EXHIBIT: For the selection, purchase, preparation, transportation, installation, care and custody, and arrangement of such articles and materials as the heads of the several Executive Departments, the Smithsonian Institution, and National Museum, and the United States Fish Commission may decide shall be embraced in the Government exhibit, and such additional articles as the President may designate for said Exposition, and for the employment of proper persons as officers and assistants to the Board of Control and Management of the Government exhibit, appointed by the President, of which not exceeding five thousand dollars may be expended by said Board for clerical services, four hundred and eight thousand two hundred and fifty dollars: *Provided*, That all expenditures for the purposes and from the appropriation specified herein shall be subject to the approval of the said Board of Control and Management and of the Secretary of the Treasury, as now provided by law.

WORLD'S COLUMBIAN COMMISSION: For the World's Columbian Commission, two hundred and thirty thousand dollars of which sum one hundred and ten thousand dollars shall be used for the Board of Lady Managers: *Provided*, That all expense of administration and installation in the Woman's building shall be paid by the World's Columbian Exposition: *Provided* That the salaries of the Director-General and Secretary of the Commission shall not exceed eight thousand dollars and three thousand dollars respectively per annum, and a sum not exceeding five thousand dollars may be used by the Director-General in his discretion for incidental and contingent expenses of his office, and there shall not be more than two meetings of the World's Columbian Commission or of the Board of Lady Managers during the fiscal year eighteen hundred and ninety-three.

And the sums herein appropriated for the World's Columbian Exposition shall be in full of the liability of the United States on account thereof: *Provided*, That the Government Exhibits at the World's Columbian Exposition shall not be opened to the public on Sundays.

That the Secretary of War be, and he hereby is, authorized at his discretion to detail for special duty in connection with the World's Columbian Exposition, such officers of the Army as may be required, to report to the general commanding the Department of the Missouri, and the officers thus detailed shall not be subject to loss of pay or rank on account of such detail, nor shall any officer or employee of the United States receive additional pay or compensation because of service connected with said Exposition from the United States or from said Exposition.

(Public—No. 202.) From Sundry Civil Act. Approved August 5, 1892.

APPENDIX X.

Documents in Relation to the Columbian Historical Exhibition in Madrid, 1892.

No. 1.

ACT OF CONGRESS PROVIDING FOR THE REPRESENTATION OF THE UNITED STATES AT THE COMMEMORATION OF THE FOURTH CENTURY OF THE DISCOVERY OF AMERICA.

[Public—No. 62.]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums, or so much thereof as may be necessary, be, and the same are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, for the objects hereinafter expressed, for the service of the fiscal year eighteen hundred and ninety-two, namely:

Columbian Historical Exposition at Madrid: For the expense of representation of the United States at the Columbian Historical Exposition to be held in Madrid in eighteen hundred and ninety-two in commemoration of the four hundredth anniversary of the discovery of America, fifteen thousand dollars, or so much thereof as may be necessary, to be expended under the direction and in the discretion of the Secretary of State; and the President is hereby authorized to appoint a commissioner-general and two assistant commissioners, who may, in his discretion, be selected from the active or retired list of the Army or Navy, and shall serve without other compensation than that to which they are now entitled by law, to represent the United States at said exposition; that it shall be the duty of such commissioners to select from the archives of the United States, from the National Museum, and from the various Executive Departments of the Government such pictures, books, papers, documents, and other articles as may relate to the discovery and early settlement of America and the aboriginal inhabitants thereof; and they shall be authorized to secure the loan of similar articles from other museums and private collections, and arrange, classify, and install them as the exhibit of the United States at the said exposition; that the President is authorized to cause the detail of officers from the active or retired list of the Army and Navy, to serve without compensation other than that to which they are now entitled by law, as assistants to said commissioners; and the said commissioners shall be authorized to employ such clerical and other assistance as may be necessary, subject to the approval of the Secretary of State.

Approved May 13, 1892.

In the Sundry Civil appropriation bill, approved August 5, 1892, an appropriation was made in the following words:

Columbian Historical Exposition at Madrid: For expenses of representation of the United States at said exposition, ten thousand dollars.

No. 2.

DECREE OF THE QUEEN REGENT OF SPAIN CONCERNING THE COMMEMORATION OF THE FOURTH CENTURY OF THE DISCOVERY OF AMERICA.

Atendiendo á las razones que Me ha expuesto el Presidente del Consejo de Ministros;

En nombre de Mi Augusto Hijo el Rey D. Alfonso XIII, y como Reina Regente del Reino,

Vengo en decretar lo siguiente:

ARTICULO 1. La Comisión nombrada por el segundo de los Reales decretos de 28 de Febrero de 1888, con ocasión de los festejos acordados por el Gobierno para conmemorar el cuarto Centenario del descubrimiento del Nuevo Mundo, y de la cual forman parte las más altas representaciones del Estado, continuará funcionando como hasta aquí, y poniendo por obra las resoluciones que haya adoptado ya, ó que en lo sucesivo adopte.

ART. 2. Habrá, por separado, en adelante, una Junta directiva del Centenario, compuesta de los tres individuos del Gobierno que más eficazmente puedan intervenir en su celebración, de varios miembros de la Comisión referida, y de las personas que se designarán después, la cual ha de atender, en primer término, á la ejecución de los proyectos que dieron especial materia al primero de los decretos antes citados, ejecución encargada entonces á los Ministros de Estado, Guerra y Ultramar. Al propio tiempo servirá de vínculo esta Junta entre el Gobierno en su conjunto, la Comisión ya existente, y cuantas Corporaciones ó Sociedades coadyuven voluntariamente al mayor lustre del Centenario.

ART. 3. La Exposición de objetos americanos de que trata el art. 2º del referido primer decreto, no se extenderá ya á aquellos que en la actualidad caracterizan la cultura de los pueblos de América, ni á otros ningunos de la misma región que sean de posterior fecha á la mitad del siglo XVI. Limitaráse, por tanto, ahora á presentar de la manera más completa que sea posible, según preceptuaba la priera parte de dicho art. 2º, el estado en que se hallaban por los días del descubrimiento, y de las principales conquistas europeas, los pobladores de América, agrupando al efecto cuantos objetos concurran á dar idea del origen y progreso de su relativa cultura.

ART. 4. Todo lo demás dispuesto por virtud del artículo que lleva este mismo número en el primer decreto mencionado permanece en su vigor, con exclusión de la misión marítima que el anterior artículo prevenía.

ART. 5. Juntamente con la Exposición definida en el tercer artículo de este decreto, se celebrará otra, en Madrid también, la cual ha de comprender las manifestaciones todas del trabajo y la cultura peninsular, desde principios de la restauración visigoda hasta la segunda mitad del siglo XVI.

ART. 6. El Gobierno adoptará por sí, y desde luego, cuantas disposiciones sean necesarias para que una y otra Exposición cuenten con edificios públicos capaces y bajo todos conceptos apropiados al caso.

ART. 7. Habiéndose asimismo de celebrar el próximo Congreso de Americanistas en España, el Gobiérno de S. M., á quien ha quedado confiada la designación de ciudad y de edificio, acuerda que tenga aquél lugar en la provincia de Huelva y su monasterio de Santa María de la Rábida, inmediato á Palos de Moguer.

ART. 8. De conformidad con la precedente resolución, el Gobierno tomará sin demora también las medidas indispensables para la consolidación, restauración, apropiación y embellecimento posible del antecitado monasterio y sus alrededores, haciendo por igual manera más accesible el embarcadero de Palos, á fin de facilitar las visitas que ha de atraer la conmemoración del grande acontecimiento en aquellos sitios comenzado.

ART. 9. La Junta directiva, como la Comisión establecida tiempo hace, tendrá por Presidente al del Consejo de Ministros, y su Vicepresidente será asimismo miembro de la última.

Art. 10. Formarán parte de esta Junta los Ministros de Estado, Fomento y Ultramar, directamente obligados á ejecutar sus acuerdos, el Alcalde de Madrid y los dos Secretarios de la Comisión varias veces citada, sin contar otros miembros de ella que por distintos conceptos sean llamados. Serán particularmente invitados á compartir los trabajos de la Junta el Ministro Plenpotenciario de Portugal y uno de las Repúblicas hispano-americanas. De igual modo se invitará á los Presidentes de la Unión Ibero-americana, desde su fundación, á los que actualmente lo sean del Ateneo Científico, Literario y Artístico de Madrid, del Fomento de las Artes, de la Cámara de Comercio, del Círculo de la Unión Mercantil y el de la Sociedad de Escritores y Artistas. Con idéntico derecho que los demás tomarán asimismo parte en las deliberaciónes de dicha Junta, cuando lo soliciten, los Alcaldes de Granada, Valladolid, Barcelona y Huelva, y el Presidente de la Sociedad Colombina Onubense. Cuando no asuma su representación correspondiente cualquiera de las personas antecitadas, podrá hacer sus veces la que legítimamente le sustituya en sus funciones.

Art. 11. El Gobierno agregará á esta Junta en lo sucesivo á los representantes autorizados de cualesquiera otras corporaciones que contribuyan á las fiestas del Centenario.

Art. 12. Tendrá la Junta dos Secretários y dos Vicesecretarios, escogidos fuera de las mencionadas categorías, pero con voz y voto como los demás.

Art. 13. La Junta directiva se dividirá en cuatro Secciones: una que el Ministro de Estado presidirá, y ha de tener á su cargo las necesarias gestiones para que de América y Europa se remita á Madrid el mayor número posible de los objetos que requiere la Exposición de Arqueología y de Historia americana, así como todo lo concerniente á su organización; otra, de que será Presidente el Ministro de Fomento, que á la preparación de los lugares y edificios públicos consagrados á Exposiciones y festejos, reunirá el especial encargo de estimular y disponer la Exposición del trabajo peninsular, durante las épocas ya determinadas; otra que, bajo la presidencia del Ministro de Ultramar, entenderá en todo lo referente al Congreso de Americanistas en Huelva y á los festejos oficiales que en aquella provincia se celebren, preparando y ordenando ademas el transporte á la Península de los objetos que de América se destinen á las Exposiciones; otra, por último, cuya presidencia desempeñará el Vicepresidente de la Junta directiva, y que ha de tomar á su cargo cuanto tenga relación con las Corporaciones no oficiales que bajo cualquier forma tomen voluntaria parte en la conmemoración del Centenario.

Art. 14. Los dos Secretarios y los dos Vicesecretarios se repartirán entre estas cuatro Secciones. Se distribuirán asimismo los Vocales de la Junta directiva con la proporción posible entre las dichas Secciones, procurando que á cada cual pertenezcan los que representan elementos más congruentes á su especial encargo.

Art. 15. A cada Sección corresponde el nombramiento de Delegado general y Delegados especiales que hayan de estar al frente de las Exposiciones acordadas y de los demás actos y festejos que para la conmemoración del Centenario dispongan.

Art. 16. Las reuniones de la Junta directiva como la de la Comisión existente, se convocarán por su presidencia común, la cual deberá acordarlas siempre que los Presidentes de Secciones lo demanden.

Art. 17. Las fiestas de Huelva podrán dar principio el 3 de Agosto de 1892, al amanecer, y dilatarse hasta el 3 de Noviembre del mismo año. Las Exposiciones y festejos de Madrid empezarán con iluminación de los edificios públicos y de los particulares que lo tengan á bien en la noche del 11 al 12 de Setiembre del año citado.

Art. 18. La nueva Junta directiva, así como sus Secciones, disfrutarán en sus comunicaciones oficiales la franquicia postal y telegráfica que, tratándose de un servicio público, corresponde.

Art. 19. A la propia Junta queda especialmente sometida la reglamentación general de las Exposiciones y de los festejos combinados, y desde luego irá preparándola para su oportuna publicación.

ART. 20. Queda derogado el primero de los decretos de 28 de Febrero de 1888, en cuanto se oponga á las presentes disposiciones. También se entenderá modificado el segundo, si en algo se opone á ellas.

Dado en Palacio á nueve de Enero de mil ochocientos noventa y uno.

MARÍA CRISTINA.

El Presidente del Consejo de Ministros,
ANTONIO CÁNOVAS DEL CASTILLO.

No. 3.

REPORT OF THE MINISTRY OF SPAIN TO THE QUEEN REGENT, CONCERNING THE COMMEMORATION OF THE FOURTH CENTURY OF THE DISCOVERY OF AMERICA.

[Translation.]

SEÑORA: In deference to the glorious past of the country, your majesty's previous ministry submitted for royal approval the two decrees of February 28, 1888, for an exposition to commemorate, in a worthy manner, the fourth centenary of the discovery of America. In order to carry out these plans, inspired by sincere sentiments, with the efficacy and rapidity which such enterprises demand, we have clearly traced, and indeed gone over, in great part, the road by which the desired end will be reached. But in spite of the good will of all, and for reasons which it would be idle to investigate at the present time, almost three years have gone by without anything having been prepared or even considered.

Some very important rules have been adopted, notwithstanding, and are about to be put into execution by the zealous commission appointed under the second of the aforenamed royal decrees. It will publish, without delay, scholarly volumes intended to illustrate minutely the history of the discovery and, in greater or lesser degree, cause the creation of works of art to contribute to the commemoration of that unparalleled exploit. But even though counting upon such efforts, and upon the special poetic award recently offered by the Royal Spanish Academy, and upon other interesting projects of private associations, there is still much to be done and the time is very short. In order to facilitate the carrying out of the work, the present decree is offered which, upon some points, alters the former provisions, but retains the essential bases and elaborates them.

It is well known that though Columbus tore away the veil which hid the New from the Old World, to our country belongs the honor. If the holy Christian religion illumines to-day the consciences of the human race from Cape Horn to the heart of Mexico it is due to the Spaniards. If Europeans enjoy the wealth of the rich American soil, they owe a debt of gratitude to the untiring labor and to the unyielding valor of our forefathers. For these reasons, though the event may be of international and cosmopolitan interest, it concerns above all the Spanish people on both hemispheres. So certain is this that foreign potentates repress the murmurings of their *amour propre*, and tacitly or expressedly accord to Spain the right to take the initiative in the commemoration of the event. And the peoples of the New World will admit, with greater reason even, that Spanish soil is like the fatherland of the Europeans in America, although they are not all descended from us, nor even speak our native tongue. But whilst we cannot refuse, without dishonor, to undertake the flattering task assigned us, it would, on the other hand, be presumptuous to try to compete with the gigantic national demonstration of pride and enthusiasm which have been displayed in other places than Spain. For many well known reasons we are unable, for the present, to enter into such costly rivalries.

The modesty of the people who have lost what once they held within their grasp, the destinies of the world, is suited to their dignity which might be compromised by vain ostentation, This must have been the conviction of your majesty's former ministry when it did not think, as others did, that the fourth centenary of the discovery of America should be celebrated in Madrid by an international exposition. But what is now proposed goes still farther, and does not limit the exposition simply to an industrial exhibit by the Hispano-Americans, who recently proved, in their sumptuous structures at the Paris exhibition, their common and increasing prosperity. It is not obligatory, for this reason, that such a display should be made at the approaching centenary. Fortunately, we of the Peninsula and of America possess other elements which, together with those we may be able to borrow, for the purpose from foreigners, would be sufficient to form a basis for a demonstration appropriate to the occasion. No Hispano-American country can fail to possess, as does the mother country, in museums, and in the hands of private individuals, pre-Columbian relics and those contemporaneous with the discovery which, brought together, would excite their common remembrances with no slight benefit both as to science and art. Hence the Government of your majesty proposes to organize a simple exhibit of such articles, renouncing, for lack of sufficient means and time, any more arduous enterprise. From such an exposition might be gathered abundant fruits for the study of archæology, anthropology, and above all of history, if, in view of the wishes of Spain and still more of the occasion which inspires them, other nations should concur, as there are many such possessing full collections of the desired objects.

The commission constituted in February, 1888, had begun to discuss another sort of exposition, and the present ministry has hastened to put it into execution. The plan is to collect the greatest number possible of the specimens of Iberian productions anterier to the discovery of America, from the time when the new nations of the Peninsula were being formed until, when triumphant within themselves, they sought and found vast territories beyond the seas in which to extend their power. By this means it will not only be possible but easy to compare the respective conditions of culture of conquered and conquerors at the time when they came together, without discriminating among the latter, between Spaniards and Portuguese, although at present they belong to separate and independent states. The fame of incomparable discoverers belongs to us in common, and Spain has always included Portugal in its present plans. No one is ignorant that the cathedrals, churches, museums and private galleries of the nobility of the Peninsula contain precious works of Iberian art collected during the long period referred to, and, perhaps, for the greater part unknown. It may be hoped, therefore, that this second exposition, combined with the first, will redound to the credit of both.

Meanwhile, it is an important fact that the present ministry does not forget that these two enterprises are not restricted by their official character, but will rather stimulate the zeal of private individuals, in general, and that of their several and independent centers of action. Anyone who wishes to do so may bring to the common treasury his intelligence and abilities with all the enthusiasm and freedom he possesses. But it cannot be denied that it is necessary that between the private individuals and the officials there should be established sufficient union as to render each other effectual assistance, and avoid, at least, disturbing each other in their respective efforts, so that the free actions of each may not degenerate into anarchy. And in fact it must be stated that this is not the least of the means, in virtue of which, the ministry now proposes to your majesty to appoint a committee of direction which shall concentrate, assist, and lend organic force to all the elements offered to the enterprise.

As a matter of course your majesty's ministry will still have the supreme control, because of its greater powers and its national character; but this will not interfere with any private efforts which coincide with the endeavors to obtain a good result.

The expositions alluded to and many of the larger entertainments will, of course, take place in Madrid; but the ministry also desires that the assistance of the committee of direction, as well as that of the existing commission, should be extended to the provinces and cities desiring it, and above all to such as possess the clearest titles as prominent actors in the centenary celebration. Granada, Santa Fé, Valladolid, Barcelona, Sevilla and certain places in Huelva, all of which are doubtless included in the number, will to the best of their respective abilities join with Madrid in this laudable and patriotic manifestation. But it is impossible not to recognize that Huelva, with its never-to-be-forgotten though modest monastery of Santa Maria de la Rábida, and its neighboring coast, rather than port, of Palos de Moguer, where Columbus found asylum, resources and men to second and accompany him, and from which sailed the ships that first reached the New World, deserves on the part of the Government particular attention. It has been arranged that that place and that arm of the sea will be traversed, during the first days of the centenary celebration, by the members of the congress of Americanists who will celebrate in Huelva their ninth anniversary.

On the other hand, the committee appointed under the second of the decrees of 1888, so frequently cited, had already thought of commencing operations in those famous places on the occasion of the centenary. It is now the part of the Government to see that those intentions are extended and fulfilled. And when all the foregoing shall have been well considered, it will be clearly seen that there remains so much to be done to carry out the intentions of the former and of the present ministry, that assiduous and active work will be needed so as to combine all the elements into a useful and complete entirety. This is the object to be attained by the committee of direction which, in virtue of this decree, is to be appointed. In particular the ministers, who form an important part of the committee, from henceforward have no time to lose, knowing that, of necessity, they will have a most difficult and complicated part to perform. In these special duties the whole ministry will assist, whenever necessary, without extravagant expectations but without discouragement, should your majesty give your approval to the accompanying project of the royal decree.

Madrid, January 9, 1891.

Señora: A. L. R. P. de V. M.,

ANTONIO CÁNOVAS DEL CASTILLO.

No. 4.

CLASSIFICATION FOR THE HISTORIC AMERICAN EXPOSITION, MADRID, 1892.

I.—PRE-COLUMBIAN PERIOD.

FIRST GROUP.

Caverns.—Models, reproductions, plans, drawings, etc., of ancient American caves which may show indications of having served as habitations of Man.

Monuments, etc.—Models, reproductions, plans, drawings, etc., of the prehistoric monuments of America, from the menhir, to the dolmens, tumuli, and other megalithic monuments.

Lake-dwellers.—Models, reproductions, etc., of remains of lacustrine dwellings. (The representations of prehistoric monuments should be accompanied by the objects found in or near them or by reproductions.)

Prehistoric arts, etc.—Paleolithic and neolithic periods.—Arms and instruments of stone; instruments of horn and bone; ceramics; adornments and utensils of bone, ivory, marble, wood, stone, or any other substance; objects carved or engraved with stone instruments; stone hammers and mortars; fossils or bones of animals which serve to verify archæological discoveries; copper and bronze objects; objects belonging to other sciences, such as geology and paleontology, which may serve to throw light upon the so-called prehistoric age of America.

SECOND GROUP.

Historic times.

Monuments of architecture.—Models or reproductions of ancient American buildings, military, civic, religious, funereal, etc. Remains of walls, busts, capitals, architraves, friezes, cornices, etc. Polychromatic architecture. Architectonic monuments restored in models or in drawings and plans.

Monuments of sculpture.—Statues, pieces or fragments of the same, busts, reliefs, etc., including intaglio work.

Monuments of painting.—Paintings of all kinds.

Monuments of engraving.—Incised designs of all kinds.

THIRD GROUP.

Industrial and fine arts.

Dress.—Costumes and parts and accessories. Adornments.

Weapons and arms.—Offensive and defensive weapons of wood, copper, bronze, and iron.

Gold and silver work.—Gold and silver articles, necklaces, earrings, etc.

Carving.—Objects of bone, ivory, etc.

Ceramics.—Objects of clay of all kinds. Glass.

Copper and bronze work.—Copper and bronze objects of all kinds.

Ironwork.—Ironwork of all kinds.

Woven goods.—Woven tissues and the textile products used in their manufacture.

Stone and marble work.—All kinds of objects made of stone.

Industrial and artistic materials.—Instruments, machinery, manufactures, and everything relating to the production of industrial or artistic articles. Means of locomotion by land, river, or sea.

FOURTH GROUP.

Literary productions.

Epigraphy.—Ancient inscriptions on different materials.

Paleography.—Documents, manuscripts, etc.

Cartography.—Plans, charts, diagrams, and everything relating thereto.

FIFTH GROUP.

Appendix to the first section.

Naval architecture, etc.—Remains or models of vessels, objects, utensils, etc., used in voyages toward America previous to the Columbian period, classified according to antiquity.

II.—COLUMBIAN AND POST-COLUMBIAN PERIOD.

SIXTH GROUP.

Nautical adjuncts to the Discovery of Columbus.—Caravels, models, and reproductions or drawings of the same, parts, rigging, etc. Astrolabes and mathematical and nautical instruments which may have been used in the vessels of discovery. Sailing charts and maps.

SEVENTH GROUP.

Columbus relics.—Objects which might have belonged to Columbus.

EIGHTH GROUP.

Fine arts.

Monuments of architecture in post-Columbian architecture, the product of American art as well as that of the Spanish or other European nations.

Monuments of sculpture in America, of the post-Columbian period, the product of American, Spanish, or European art.

Monuments of painting of all kinds, American or European.

Monuments of engraving of all kinds, American or European.

NINTH GROUP.

Industrial and artistic productions of this historic period either of purely American art or of Spanish and European art, if the fruits thereof were realized in America, dividing this group into dress, armor, etc.

TENTH GROUP.

American numismatics.—Coins, paper money, and postage stamps, from earliest times down to 1892.

ELEVENTH GROUP.

Scientific and literary productions.—Charts, plans, and works of all kinds, in manuscript as well as printed, prepared since the discovery to the middle of the seventeenth century, or relating to the period of discovery, exploration, conquest, and colonization, American, Spanish, or belonging to other European nations.

III.—APPENDIX.

TWELFTH GROUP.

American ethnography.—Portraits, photographs, models, dress, etc., belonging to the ancient American races still in existence; manikins, with the dress, arms, etc.; models of habitations, etc. In this group American craniography will form a special division.

No. 5.

CLASSIFICATION FOR THE HISTORIC EUROPEAN EXPOSITION, MADRID, 1891.

I.—FINE ARTS.

FIRST GROUP.

Sculpture.—Statues, figures and reliefs in metal, stone, wood, or marble. Medals, medallions, and seals. Cameos and glyphs.

Painting.—Diptyches, triptyches, and other paintings upon wood, canvas, parchment, or copper. Miniatures, codexes, and parchments. Drawings with pencil or pen. Mosaics, inlaid, or incrusted work.

Engraving.—Engravings and etchings.

I.—INDUSTRIAL ARTS.

SECOND GROUP.

Fine metal work and jewelry.—Reliquaries, chalices, tablets, paxes, shrines, etc. Crosses. Halos and coronas. · Censers, candelabras, candlesticks, and lamps. Crosiers, clasps, amulets, and crosses for the neck. Fine metal work, repoussé, filigree, niellos, and enamels. Jewels and jewelry. Enamels. Objects of rock-crystal, and precious stone. Hilts of batons, swords, and poniards. Tobacco boxes, etc. Rings, brooches, etc.

THIRD GROUP.

Metal work.—Figures, ornaments, etc., of iron work. Figures, ornaments, etc., of bronze, copper, or other metals, chiseled, repoussé, or molded.

FOURTH GROUP.

Panoply.—Defensive arms, armor, cuirasses, helmets, and pieces of armor, shields, targets, bucklers, etc. Offensive arms, as swords, daggers, poniards, knives, maces, lances, halberds, partizans, pikes, javelins, arrows, crossbows, arquebuses, muskets, firelocks, pistols, pistolets, culverins, etc. Banners, flags, and other insignia.

FIFTH GROUP.

Apparel.—Miters and sacerdotal vestments. Masks and jewels, male and female gala dresses. Badges and stars. Watches, fans, and lace. Toilet utensils and needlework.

SIXTH GROUP.

Tapestry.—Altar ornaments, banners, and traveling cloaks. Woven cloths embroidered or painted.

SEVENTH GROUP.

Furniture.—Chests of metal, marble, and wood. Boxes, buffets, chests, secretaries, etc.

EIGHTH GROUP.

Ceramics and Glassware.—Earthenware, porcelain, terra cotta, glass, etc.

NINTH GROUP.

Artistic and Industrial Implements.—Musical instruments. Instruments belonging to the arts and sciences. Bookbindings. Coaches, litters, sledges, and other vehicles.

No. 6.

LIST OF MEDALS (DIPLOMAS) AWARDED TO THE UNITED STATES EXHIBITORS.

GRAND DIPLOMA OF HONOR.

To the Government of the United States.

GOLD MEDAL WITH DIPLOMA.

U. S. National Museum.
Smithsonian Institution.
Bureau of Ethnology of the United States, Washington, D. C.
Mrs. Mary Hemenway, of Boston, Mass.
Department of Archæology and Paleontology of the University of Pennsylvania.
Dr. George Brown Goode.
Mr. William E. Curtis.
Dr. J. Walter Fewkes.
Geological Survey of the United States.
U. S. Mint.
Industrial School for adult Indians, Carlisle, Pa.
Rear Admiral S. B. Luce.

SILVER MEDAL WITH DIPLOMA.

U. S. Navy Department.
Military Medical Museum.
Prof. Thomas Wilson.
Numismatic and Antiquarian Society, Philadelphia, Pa.
Department of Public Instruction of the United States.
Academy of Natural Sciences, Philadelphia, Pa.
Peabody Museum of Archæology.
Mrs. Zelia Nuttall.
Mr. Stewart Culin.
Prof. Otis T. Mason.
Mr. Walter Hough.
Mr. W. H. Holmes.
Mr. H. C. Mercer.
Mr. James W. Ellsworth.
U. S. Fish Commission.
U. S. Census Office.
Mrs. M. E. Stevenson.
Mrs. M. M. Hazen.

BRONZE MEDAL WITH DIPLOMA.

Society of the Sons of the American Revolution.
Postal Department of the United States.
Meteorological Survey of the United States.

BRONZE MEDAL WITH DIPLOMA—cont'd.

Coast and Geodetic Survey of the United States.
Warren K. Moorehead.
Dr. James C. Welling.
Dr. Cyrus Adler.
Department of Agriculture.
Forestry Division of the United States.
Dr. John E. Younglove.
Dr. W. J. Hoffman.
H H. Bancroft.
Edwin E. Howell.

HONORABLE MENTION.

S. Brownlow Gray.
Pilgrims' Society (Plymouth).
F. S. Perkins.
Byron S. Dodge.
C. N. Crounse.
Dr. Hilborn T. Cresson.
Dr. T. H. Bean.
Walter C. Clephane.
Col. Gates F. Thruston.
Rev. Stephen G. Peet.
Capt. John G. Bourke.
Dr. Henry Carrington Bolton.
J. C. Pilling.
James Terry.
Dr. Joseph Jones.
Rev. J. Owen Dorsey.
Dr. Cyrus Thomas.
Prof. Edward S. Morse.
James Mooney.
H. W. Henshaw.
Col. F. A. Seely.
James Stevenson.
Dr. C. Hart Merriam.
Lieut. A. P. Niblack, U. S. Navy.
Joseph Sabin.
Houghton, Mifflin & Co.
Charles Scribner's Sons.
Charles S. Reynolds.
Col. H. M. Flagler, U. S. Army.
Alexander Brown.
Dr. Franz Boas.
Eben Norton Horseford.
Dr. Frederick Starr.
Ellen Russell Emerson.
Dr. R. H. Lamborn.
Harper Brothers.

Total, 80.

No. 7.

LIST OF EXHIBITORS OF THE UNITED STATES OF AMERICA.

U. S. National Museum, Washington, D. C.
Smithsonian Institution, Washington, D. C.
U. S. Mint.
Society of the Sons of the American Revolution.
Plymouth Pilgrim's Society, Massachusetts.
U. S. Navy Department.
Bureau of Ethnology of the United States.
Department of Public Instruction of the United States.
Census Office of the United States.
U. S. Coast and Geodetic Survey.
Military Medical Museum, Washington, D. C.
U. S. Fish Commission.
U. S. Geological Survey.
U. S. Meteorological Survey.
U. S. Post-Office Department.
Department of Agriculture.
Forestry Division.
Mrs. Hazen, widow of Gen. Hazen.
Dr. G. Brown Goode.
S. Brownlow Gray, Bermuda.
School for Indian adults (industrial), Carlisle, Pa.
F. S. Perkins.
Byron E. Dodge, Michigan.
C. M. Crounse, New York.
Dr. Hilborn T. Cresson.
Dr. John E. Younglove.
Prof. Thomas Wilson.
Mrs. Mary Hemenway, Boston, Mass.
Historical-American Association, Washington.
American Folk-lore Society.
Anthropological Society, Washington.
Virginia Historic Society, Richmond.
Department of Archæology and Paleontology of the University of Pennsylvania.
Numismatic and Antiquarian Society of Philadelphia.
Academy of Natural Sciences, Philadelphia.
Museum of Comparative Zoology, Cambridge.
Peabody Museum of Archæology and Ethnology, Cambridge, Mass.
Mrs. Zelia Nuttall.
Dr. T. H. Bean, Washington.
Walter C. Clephane, Washington, D. C.
Col. Gates J. Thruston, Nashville, Tenn.
Stewart Culin, Philadelphia.
Rev. Stephen G. Peet, Avon, Ill.
Dr. James C. Welling, Washington, D. C.
John G. Bourke, captain Seventh Regiment, U. S. Army.
Dr. Henry Carrington Bolton, New York.
Dr. C. Hart Merriam, Washington, D. C.
J. C. Pilling, Geological Survey.
Prof. Otis T. Mason, U. S. National Museum.
Walter Hough, U. S. National Museum.
W. H. Holmes, Bureau of Ethnology.
James Terry, New York.
Dr. Joseph Jones, New Orleans, La.
Rev. J. Owen Dorsey, Bureau of Ethnology.
Dr. Cyrus Thomas, Bureau of Ethnology.
Prof. Edward S. Morse, Salem, Mass.
James Mooney, Bureau of Ethnology.
H. W. Henshaw, Bureau of Ethnology.
Col. F. A. Seely, Patent Office of the United States.
Mrs. M. E. Stevenson, Bureau of Ethnology.
James Stevenson.
Lieut. A. P. Niblack, U. S. Army.
Warren K. Moorehead, Xenia, Ohio.
Joseph Sabin, New York.
Houghton, Mifflin & Co., New York.
Harper Brothers, New York
Charles B. Reynolds, New York.
Col. H. M. Flagler, U. S. Army.
Alexander Brown, Norwood, Va.
William E. Curtis, Chief of Latin-American Department, World's Columbian Exposition, Chicago, Ill.
Dr. Franz Boas, Worcester, Mass.
Eben Norton Horseford.
Frederick Starr.
Ellen Russell Emerson.
H. C. Mercer.
Dr. R. H. Lamborn.
Dr. Cyrus Adler.
Dr. W. J. Hoffman.
H. H. Bancroft.
Edwin E. Howell.
Charles Scribner's Sons, publishers, New York.

PART II.

PAPERS DESCRIBING AND ILLUSTRATING COLLECTIONS IN THE U. S. NATIONAL MUSEUM.

THE POISONOUS SNAKES OF NORTH AMERICA.

BY

LEONHARD STEJNEGER,
Curator, Department of Reptiles and Batrachians, U. S. National Museum.

CONTENTS.

THE POISONOUS SNAKES OF NORTH AMERICA.

By Leonhard Stejneger.

Curator, Department of Reptiles and Batrachians, U. S. National Museum.

It is the purpose of the present paper to give in a convenient form a review of our knowledge concerning the poisonous snakes of North America; to make the results of the specialists in the field accessible to a larger public; to bring together in one place a summary of an immense literature very often beyond the reach even of the student; to point out where our knowledge is defective, and to suggest new avenues of research.

Many popular errors will be corrected, while others will be disposed of by a simple statement of facts, from which the reader is expected to draw his own conclusions. No attempt will be made to discuss and controvert the purposely exaggerated stories with which the literature of the day abounds.

THE SO CALLED "HARMLESS" POISONOUS SNAKES.

If a snake is caught, killed, or seen, and any question raised as to its poisonous or harmless nature, it will be found that the presumption of guilt is against it, and that incontrovertible proof will be required by even highly educated people, not specially informed, before they are willing to believe in its innocence. An expert insisting that the snake in question belongs to a species wholly devoid of poison would probably during this discussion be met with the statement that a serious case of poisoning had once come under the observation of one of the persons present, the result of a bite of this very kind of snake. In spite of the fact that nothing is commoner and easier than misidentification of snakes, and that consequently the bite might have been caused by a really different kind of snake, the expert would not be in a position to contradict the accuracy of the statement, though he might be able to recall to his opponent quite a number of similarly serious cases resulting from the bites of animals unquestionably non-poisonous in the accepted meaning of the word. He might quote Livingston's statement that the bite of the large felines is commonly followed by symptoms of poisoning, and he would relate cases of swelling and inflammation of serious extent, perhaps even death, undoubtedly caused by the bites of rats, dogs, cats, cows, horses, and even man himself.

It is clear then that we can not always conclude that a snake belongs to a venomous kind from the fact that its bite results in symptoms of poisoning. Modern science shows us that such results in other animals are due to the presence in their saliva of those minute organisms, the bacteria whose name at least is nowadays so well known to everybody. The general public knows these cases as blood-poisoning, the professional man refers to them as cases of septicæmia. The fact that the poison of snakes is only a modified saliva should not lead anybody to suppose that snake poison and the bacteria-infected saliva—though both may lead to fatal results—have anything in common in their nature. On the contrary, the sooner both the general public and the medical practitioner understand this difference and act accordingly, the better.

When speaking of poisonous or venomous snakes, therefore, I shall only refer to such snakes as are provided with a specific—to them peculiar—poison and an apparatus especially adapted for the introduction of this poison into the wound of the victim.

The question naturally will be asked: "Which, then, are our poisonous snakes?"

The proper answer would be that only those of our snakes are referable to this category which are possessed of a movable or constantly erect poison fang at the anterior end of the upper jaw bones, and even those who, on slight information, profess to be well informed, would in most cases admit that the above answer is correct. But it may be shown that this is only partly so.

Students of snakes have for more than fifty years kept an eye on a certain category of snakes as "suspects."

It seems that the Dutch professor, Reinwardt, while in Java, was the first to discover that certain snakes, dreaded by the inhabitants of that island as venomous, are provided with long grooved fangs at the posterior end of the maxillary bone. He communicated this discovery to Dr. H. Boie in Leyden, who published it in 1826.* The suspicion expressed by Prof. Reinwardt that this channel or groove on the anterior side of these fangs might convey the fluid from a poison gland led to several important investigations, the first of which to be published was Dr. Hermann Schlegel's memoir on the salivary glands of the serpents with grooved teeth.†

He came to the conclusion that inasmuch as he found the structure of their glands to be similar to that of other salivary glands, there could be no doubt that they secrete "a fluid similar to the ordinary saliva;" and as "recent observations of travelers" served to show that the bites of snakes with grooved teeth produce no fatal results to man, he

*Oken's Isis, 1826, p. 213.

†Nova Acta Acad. Leop. Nat. Curios., Bonn, XIV, 1828 (pp. 145-154).

asserted with characteristic positiveness that it is "erroneous" to class with venomous serpents those snakes which have the posterior teeth long and channeled. However, a short time after, Prof. G. L. Duvernoy, of Strasbourg, published a no less important treatise on the subject.* He pointed to the yellow portion of the supramaxillary gland as being structurally different from the white portion, and from its being connected with a large grooved fang by a single duct he concluded, with equal assurance, that we have here before us a venom apparatus only in degree differing from that of the snakes with poison fangs fixed to the anterior end of the maxillary bone. His results were accepted and introduced into the classification adopted in the monumental herpetological work of Duméril and Bibron, the Erpétologie Générale, in which the snakes with grooved posterior fangs were placed in a separate group as "*Opistoglyphs.*" On the other hand, Schlegel, paying no attention whatever to Duvernoy, in his "Physiognomie des Serpentes," maintained his standpoint, and so great was the authority of the learned Leyden professor that his view was until quite recently accepted by some of the most prominent systematists. It seems that neither side ever attempted to end the dispute by direct experiments, and gradually the *Opistoglyphs* to many herpetologists ceased even to be "suspected."

About ten years ago the interest in this question was suddenly revived, and as it may now be fairly regarded as a burning one, some space will be devoted to a short review of several of the recent investigations into this theme.

Two Italian students, M. G. Peracca and C. Deregibus, were led to make special investigations into the possible venomous nature of *Malpolon lacertina* (=*Cœlopeltis insignitus*), a snake common about Nizza and in parts of Italy. In a communication to the Academy of Medicine at Turin, in May, 1883,† after first describing the grooved fangs, the glands, and the duct leading to the fang, they recounted their experiences with the snake in question:

Their experiments were carried out with two specimens of *Cœlopeltis* (=*Malpolon*), one of medium size, the other much larger; the victims consisted of lizards, frogs, and toads. The snake did not bite them voluntarily; it was necessary to open its mouth and to force the animal, into its throat; whereupon the snake inoculated the venom, the motion of the bone carrying the poison fangs being very distinctly seen on account of the manner in which they were standing out from the posterior part of the head. The act of biting lasted some moments, and the snake repeated this act several times without allowing its prey to escape.

The animals were bitten in the hind limb; in the case of the frog the skin had to be removed from the part to be bitten, as the irritating

*Ann. Sci. Nat., XXVI, 1832, pp. 144–156; XXX, 1833, pp. 6–26.

†Giornale della R. Accademia di Medicina di Torino, (3) XXXI, 1883, pp. 379–383.

secretion of the skin appeared to be particularly distasteful to the snake. Without reciting the various experiments in detail, the authors state the more apparent phenomena accompanying them to be, (1) the suspension of the respiration, which, in the main, occurs in a very few minutes (thirteen minutes being the maximum in a toad) and may happen suddenly, or may be preceded by a gradual sinking interrupted by a deep breathing pause; (2) the cessation of reflex movements in the bitten limb, while still persisting for some time in the rest of the body; the excitements applied below the bitten point ceased almost immediately to be transmitted to the medulla and to show reflexes. This alteration maintained itself local for some time, afterwards progressing toward the periphery along the nerves of the wounded limb. The general paralysis does not delay long in coming. It is but rarely accompanied by convulsions. The heart continues to beat for a long while (in the toad) but its strength decreases gradually. The blood revealed nothing notable under the spectroscope; as a matter of course it had become venous at the suspension of the respiration. The rapid changes which were observed at the wounded point are noteworthy; the muscular tissue became livid and inexcitable. Death ensued generally in half an hour, or less; in a toad it took place in twenty-six minutes. The heart of a frog continued to beat for many hours after. The authors then call attention to the interesting similarity between the above symptoms and those accompanying the poisoning by the cobra de capello, and finally state that they have made controlling experiments with innocuous snakes which did not have such effect upon the animals bitten.

In a subsequent résumé of this article* the same authors add that the effects of the bite of the *Malpolon* are not to be feared by man. "It seems," they say, "that the bite is only dangerous to reptiles, birds, and small mammals (mice); young dogs have resisted the poison rather well."

Similar investigations and experiments were carried out about the same time, or a little earlier (1882), on an American species in Guanajuato, Mexico, by Prof. A. Dugès, who has published his notes concerning *Trimorphodon biscutatus*,† a snake belonging to a genus representatives of which have been found along our Southern border. He gives figures of his dissections, showing the venomous gland with its duct supplying the grooved posterior fangs with the poison. He records his experience as follows:

> One day as I was admiring the snake I saw him seize a *Cnemidophorus sexlineatus* [the striped swift, a lizard], at the middle of the body, advancing its jaws so as to bring the corner of the mouth in contact with the body of the lizard; for several moments it *chewed* (a rare occurrence in a snake) its victim without the latter moving, letting go after having killed it; but at this juncture the saurian was swallowed

* Archives Italiennes de Biologie, v, 1884, pp. 108–109.

† La Naturaleza, (Mexico), vi, 1884, pp. 145–148.

by another snake (*Ophibolus doliatus*) which was kept in the same cage, thus preventing me from finishing the observation. A few days after, the same Trimorphodon caught another *Cnemidophorus* by the left arm and *chewed it several times.* At the end of a few minutes the bitten animal died without convulsions, without agitation, as if asleep, a little blood issuing from the wound.

A little later (1885), Mr. Otto Edmund Eiffe* published some observations, also made in 1882, on *Tarbophis vivax*, an opistoglyph snake inhabiting the countries bordering on the Eastern Mediterranean, and from his account we quote as follows:

I offered the half-grown snake a perfectly healthy *Lacerta vivipara*, which he at once commenced to lap with his tongue and then grasped slowly behind the fore legs. The lizard defended itself as best it could and used its teeth well on the enemy. In less than a minute the lizard was almost motionless, the jaws were powerless, and the eyes closed; before the expiration of another half minute the lizard died, and was then swallowed.

Prof. Léon Vaillant, of the Museum of Natural History, at Paris, observed the poisonous effect of the bite of another of the opistoglyph snakes, *Tragops prasinus*, Wagler, and gives the following interesting account of one of the observations:†

A small living green lizard was presented to the snake by means of a forceps. The snake seized it across the neck without descending from the shrubbery among which it used to live, and by the play of the jaws drew it back to the corner of the mouth. The lizard tossed and bent about, winding its body and tail round the head of the snake; three minutes later it hangs down inert, only the tail still trembling; after a similar space of time convulsions of the whole body occur again, twining itself around the head, then relapsing without motion, except some spasmodic undulations of the tail; this lasts for two minutes, and the animal is dead. It will be seen that this poison must have been tolerably active, as it caused the death of the lizard in about eight minutes after the puncture by the fangs, which must have taken place when the lizard reached the angle of the mouth, as the snake made no movement after that.

It seems quite plain from these observations that we have here to do with a specific poison. The victims succumbed within a very short time, and while it is evident that death was not caused by the mechanical injury inflicted by the bite, much less by the shock, there is as little room for assuming that it was due to the action of bacteria-infected ordinary saliva.

These experiments have again roused the interest in the morphology and physiology of these glands, and two years ago, sixty years after Duvernoy's work, Mr. F. Niemann published‡ some investigations upon this subject. Among other snakes he dissected and described two species with posterior grooved fangs, and he clearly demonstrates that, in both, the yellowish gland has already passed the innocuous stage and become a true poison gland, though structurally somewhat intermediate—as are, in fact, the fangs. He found in both species the yellowish gland well circumscribed and clearly differentiated from the

* Zool. Garten, 1885, p. 45.

† Mém. Centen. Soc. Philom., 1888, Sc. Nat., p. 44 *.

‡ Archiv f. Naturgeschichte, LVIII. i, 1892, pp. 262–286, pl. XIV.

true supralabial gland, although both glands are contained in the same envelope of connective tissue, and he was able to trace the single duct leading from the yellowish gland to the groove of the posterior elongated fang. One of the species was *Tragops prasinus*, Wagler (the same species with which Prof. Vaillant experimented), and an inhabitant of the East Indies, the other being *Leptodeira annulata*, (L.), from tropical America. Fig. 1 is a copy of Mr. Niemann's schematic representation of the arrangement in the former. Fig. 2 shows a section of the grooved fang near its base, copied from the same author.

Fig. 1.
DIAGRAMMATIC LATERAL VIEW OF THE HEAD OF TRAGOPS.
a Poison gland; *b* supralabial gland.
(After Niemann.)

That these snakes are not entirely harmless, even to man, is evident from the very recent experience of Mr. J. J. Quelch, of Georgetown, British Guiana,* who was bitten on the first finger by a large specimen of the common red-white-and-black-banded snake, *Erythrolamprus venustissimus*, driving its hinder grooved teeth three times down into the flesh. About half an hour after, the finger became much swollen at the place and distinctly very painful. It was not till about four hours afterward that real relief was obtained, though the place was tender for a much longer time. Another case was that of the clerk in the Museum, who was bitten on the finger by a young specimen of the common frog snake or Mattipi, *Xenodon severus*, whose hinder enlarged teeth were driven deeply into the flesh, with a result similar to that described in the case of the other snake.

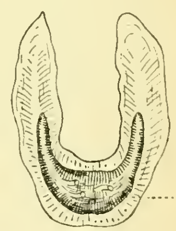

Fig. 2.
CROSS - SECTION OF GROOVED FANG OF TRAGOPS PRASINUS, NEAR BASE.
Enlarged. *a* Poison groove; *b* pulp cavity.
(After Niemann.)

It will be observed that while the snake by which Mr. Quelch himself was bitten is a true opistoglyph with grooved posterior fangs, the one which caused a similar result in the clerk, viz, the *Xenodon*, has the enlarged posterior teeth solid and not grooved. I would call attention to the fact, however, that this identical species is described by Duvernoy† as having the yellowish gland well differentiated. That the bite of the allied species, *Xenodon rhabdocephalus*, did apparently have no unpleasant effect on Dr. Stradling‡ is not difficult of explanation in view of the fact that occasionally the bite of even some of the most dangerous snakes has been ineffective, but enough is said to show that the question is not an unreasonable one: Is it essential for a truly venomous snake to possess *grooved* fangs?

As a matter of fact, at the very moment of this sentence going to press, the question seems answered conclusively in the negative by the experiments of Phisalix and Bertrand, who have shown that the saliva

* Zoologist (3), XVII, January, 1893, pp. 30–31.
† Ann. Sc. Nat., XXX, 1833, pp. 14–15.
‡ Referred to in Miss C. C. Hopley's, "Snakes, etc." 1882, p. 400.

of even ordinary solid-toothed harmless snakes contains the same specific poison which characterizes the dreaded thanatophidia. Fuller account of their discoveries will be found in the concluding chapter of this treatise.

However, since the character of the saliva of the harmless snakes does not seem to play any role in their economy, so far as obtaining food, or defending themselves against enemies, is concerned, we are still justified in regarding the opistoglyphs as a distinctly specialized group of poisonous snakes, aside from any consideration of their probably more or less close genetic relationship.

Although thus in the strictest sense poisonous, these comparatively harmless snakes do not claim the deep interest which snakes, dangerous to human life, through dread of the mysterious power excite in the popular mind. No attempt will be made then to treat of their structure and other peculiarities, in the present connection, beyond remarking that we have within the confines of the United States the representative of four genera of opistoglyph snakes, which may easily be referred to their respective divisions by the following characters:

Synopsis of the Opistoglyph Snakes occurring in the United States.

a^1 Head but slightly distinct; pupil round; no scale-pits.
b^1. No loreal .... *Tantilla.* *
b^2. Loreal present .... *Coniophanes.* †
a^2 Head wide, very distinct; pupil vertical; two scale-pits.
b^1. One loreal .... *Leptodeira.* ‡
b^2. Two or more loreals .... *Trimorphodon.* §

THE CORAL SNAKES.

Family Elapidæ.

There has been almost as much doubt about the poisonous nature of the Coral Snakes, *Elapidæ*, as of those mentioned in the preceding chapter, but as there has been enough evidence to show that the bite of these pretty animals may be fatal even to man, and as they are undeniably very nearly related to the deadly cobra, ‖ the scourge of India, the verdict has decided against them long ago.

There are numerous doubters yet, however. Letters are often received from Florida asking whether the Coral Snake, or Harlequin Snake found

* *Tantilla*, Baird and Girard, Cat. N. Am. Serp., p. 131 (1853) [=*Homalocranion*, Duméril, Prodr. Class. Ophid., p. 94 (1853)]. Type *Tantilla coronata*, B. & G.—Four species, ranging from South Carolina to southern California and south.

† *Coniophanes*, Hallowell, Proc. Acad. Phila., 1860 (p. 484). Type *C. fissidens*, Günth. One species from extreme southern corner of Texas.

‡ *Leptodeira*, Fitzinger, Syst. Rept., p. 27 (1843). [*Sibon* of authors, but not of Fitzinger.] Type, *Dipsas annulata*, Schleg.—One species from extreme southern corner of Texas.

§ *Trimorphodon*, Cope, Proc. Acad. Phila., 1861, p. 297. Type, *T. lyrophanes*, Cope.—One species from southern Arizona.

‖ See plate 19.

there, is poisonous or not, and the Museum is asked to decide bets made by persons taking opposite sides on this question.

The cause of this diversity of opinion is usually that the person defending the character of the Harlequin Snake, by quoting cases in which the bitten persons did not suffer any more injury than if they had been bitten by an ordinary gartersnake, has mistaken the identity of the snake and confounded the really poisonous Harlequin Snake, or *Elaps*, with one or the other of two or three entirely innocent snakes which resemble it greatly in color and which inhabit the same locality. It is a remarkable fact that this curious imitation or "mimicry" of the gaily colored *Elaps* by one or more harmless species takes place almost throughout the range of the former. So close is the resemblance in some instances that even alleged experts have been deceived.

On the other hand, it appears that some, at least, of the species of *Elaps* are of a temperament so gentle that they only use their weapon in very extreme cases. Prince Max von Wied seems to have been the first to have raised the question as to the venomous character of two Brazilian members of the genus (*Elaps corallinus* and *Elaps marcgravii*), for he states* that he used to carry them about his person and that they never even attempted to bite. The prince can not well be suspected of mistaking the species, for not only was he an expert herpetologist, but he described and figured them both most accurately and minutely. Our own well-known *Elaps fulvius* has a defender of no less high standing among the students of reptiles, Mr. Holbrook, the South Carolinian author of the monumental "North American Herpetology," printed in five sumptuous quarto volumes, who states† that the individuals he had seen had been of a very mild character, and could not be induced to bite under any provocation whatever. "Indeed," he remarks, "although possessed of poisonous fangs, they are universally regarded as innocent snakes, and are constantly handled with impunity, never to my knowledge having injured any one." ‡

The "instruments of destruction" (which he refers to in the same paragraph) are the hollow fangs, fastened, one on each side of the upper jaw, to the anterior end of the maxillary bone. It will be seen that this is an arrangement exactly the reverse of what obtains in the opistoglyph snakes of the previous chapter, hence the genus *Elaps* and its allies are known as *proteroglyphs*. § The fang being at the front of the mouth makes it much more effective as a weapon—in the opistoglyphs it can even hardly be regarded as such—and in it will be shown that the little beauty is fully capable of using it when required.

The following case is a celebrated one, and in many respects highly

* Beitr. Naturg. Brasil. I, p. 402 (1825).

† N. Am. Herpet., III, 2 ed., pp. 49–52 (1842).

‡ LeConte's statement to the same effect (Southern Med. Surg. Journ., IX, 1853, p. 652) is scarcely more than a copy of Holbrook's.

§ From the Greek πρότερος (proteros), anterior; γλυφή (glyphe), a groove.

instructive. For full details the reader is referred to the report upon it pubished by Mr. Frederick W. True* after the occurrence. A brief account is, however, inserted here.

The victim was Mr. Zeno Shindler, an employee of the U. S. National Museum, and the offender a medium-sized *Elaps fulvius*, received from Mr. James Bell, of Gainesville, Fla.

On June 1, 1882, between 2 and 3 o'clock in the afternoon, preparatory to making the color sketch from the live snake which should serve for a guide in painting the plaster cast to be made from it, Mr. Shindler attempted to transfer the snake from the terrarium to a glass jar, holding it tightly by the neck. At the moment he let go, the snake's tail touched the bottom of the jar, and before he had time to remove his hand the snake fastened its fangs in his left index finger. The snake did not strike like the rattlesnake, but bit hard closing the lower jaw upon the finger, and held on so firmly that it had to be wrenched off, by which operation one of the fangs was broken off in the wound.

The first symptoms, which appeared immediately after the bite, according to Mr. True, consisted of violent pain at the wound. The symptoms continued without material change to 4:30 p. m. At that hour the first symptoms of drowsiness or unconsciousness made their appearance, and remained until the morning of the third day.

At 7:30 p. m. on the day of the bite Mr. Shindler felt so ill that he deemed it prudent to call upon his physician, Dr. L. M. Taylor, of Washington, whose treatment is given in full in Mr. True's report.

In three days after treatment the patient felt in good health again. About two months after the event, however, pain set in once more at the bitten finger, extending to the knuckles; and after a few days an ulcer made its appearance above the latter.

Mr. Shindler's troubles were not yet over, and as the periodical recurrence of the symptoms have been very marked, I shall bring it down to date (December, 1894†).

Mr. Shindler tells me that every summer, a few days before June 2, the day he was bitten, the wounded finger commences to pain, mostly at night. A sore is formed and soon breaks open, and as a result the nail invariably comes off. The attack lasts for about two weeks.

Two years ago, however, and ten years after the accident, the recurrence was prevented by a remedy commonly used in Brazil against snake bite, and brought to Mr. Shindler from that country by his friend, Dr. A. de Bausset. The remedy consists of the leaves and stem of a vine (*Micania guacho*) an infusion of which was taken internally immediately before the expected recurrence of the symptoms, with the result that, although the pains arrived on time, no eruption took place. His experience in 1893 and 1894 was similar.

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* American Naturalist, XVII, January, 1883, pp. 26–31.

† Dr. Yarrow has already reported the case up to 1886 (Medical News, L, 1887, p. 624).

Mr. True, in the same article, also published letters from two Texan physicians reporting three cases of bites by Coral Snakes, two of which ended fatally, the first ones on record, I believe.*

Dr. Thomas Kearney, of San Antonio, relates one case, as follows:

The following case of a bite of a Coral Snake, followed by death, occurred near Corpus Christi, Texas, during the last year of the "late unpleasantness." An infant child of Mr. Alexander Stringer was playing in the yard, and being attracted by the bright colors of a coral snake, grasped it near the middle. The screams of the child brought its parents to its relief, but too late; the snake had done its work. The child lingered in great agony until the following morning and died, as above stated. The snake, as described to me, was about 18 inches long.

The other cases were reported by Dr. J. Herff, also of San Antonio, who wrote that one of the bitten men died in twenty-four hours, while the other one recovered after an almost fatal prostration of thirty-six hours' duration:

The fatal case I know of came under my observation a few minutes before death occurred under the symptoms of paralysis of tne heart. The second case was brought soon enough for me to try stimulants—whisky, hypodermic injections of ammonia, and fomentations of digitalis leaves over the region of the kidneys. The man, a strong young Scotchman, recovered in three days, and felt only a feeling of tingling in his extremities for some time after. * * * Both men kept the snakes as pets, and the last one used to put his finger in the animal's mouth very often to show how tame he was. One day he put it in a little deeper than usual, and while trying to extricate it the teeth bit him.

It would, however, seem that death from the bite of this snake is not so very uncommon, for Mr. Frederick A. Lucas informs me that a brother of Mr. S. A. Robinson, of Orlando, Fla., has told him that he knows of three fatal cases. I may also refer to the cases recently reported by Dr. Einar Lœnnberg in the Proceedings of the U. S. National Museum (vol. xviii, 1894, p. 334).

That great authority on snake poison, Dr. S. Weir Mitchell, of Philadelphia, nevertheless asserted† as late as 1889 that "the beautiful Coral Snake, the little *Elaps* of Florida," is "too small with us to be dangerous to man." Dr. Paul B. Barringer, of the University of Virginia, in a well-written account of "The Venomous Reptiles of the United States," read before the Southern Surgical and Gynecological Association, November 12, 1891,‡ strongly protests against this and quotes a case, reported by Mr. Charles E. Coe,§ of a workman at Oakland, Orange County, Fla., who died from the effects of a bite. About half an hour after being bitten pains came on in his hand and arm, followed by drowsiness and a dull pain in the head. A doctor was called, but the man died eighteen hours after receiving the bite.

* Harlan, however, states that the Harlequin Snake "may be fatally mistaken for the scarlet snake." (Med. and Phys. Researches, 1835, p. 127.)

† Century Magazine, XXXVIII, August, 1889, p. 505.

‡ Venomous Reptiles of the United States, p. 3.

§ Scientific American, LXIV, June 27, 1891, p. 401.

In view of these facts before us it will no longer answer to apply such adjectives as "harmless"* or "innocuous to man"† to a snake of which it is positively known that its bite is dangerous. It is granted that *Elaps* is comparatively rare; that it is retiring in its habits, mostly living under ground, and that it has a very gentle and amiable temperament. When it does bite, however, its bite is as venomous as that of a rattlesnake or moccasin of the same size, and even more so. It is probably quite true that the snake, in all the cases referred to above, was handled roughly and provoked beyond endurance; but it is also true that it would not, in most cases, have had an opportunity to do the mischief, if it had not enjoyed such an excellent reputation.

It has been repeatedly asserted that the mouth of the *Elaps* is so small that it can not bite as well as the other poisonous snakes. This, however, is somewhat of a mistake. Externally and superficially the head of the *Elaps* appears very short and narrow, and the opening of the gape of but slight capacity. An examination of the skeleton, however, shows the skull to be comparatively large and rather elongate, especially the cranial part, which occupies fully two-thirds of the total length of the head. The articulation of the lower jaw, which is correspondingly lengthened, is consequently far enough back to permit, by means of the elasticity of the ligaments, the opening of the mouth quite out of proportion to the external aspect of the snake.

That this capacity is not a theoretical one is shown by the fact that an *Elaps fulvius* has been found which contained a well-preserved whip snake, of the same length as the *Elaps*, besides the half-digested remains of a garter snake. The body of the *Elaps* was so distended that the scales, instead of overlapping, were separated from each other by considerable spaces of skin.‡

The good reputation of the *Elaps* in combination, on the one hand, with the apparent insignificance of the wound and the lack of alarming local symptoms, on the other with the great similarity it bears to really harmless snakes, makes its bite more fatal in proportion to the number of reported cases than any other snake in the country. The wounded person usually does not know his danger, and does not take the proper measures against a puncture which on the surface looks so innocent; and as the action of the specific venom of the *Elaps* is both quick and violent when admitted into the circulation of the blood, the remedies when finally applied can do but little good.

Morphologically the *Elaps* is not distantly related to the cobra of India,§ that is, they agree closer in external and internal structure than either of them does with the typical harmless snakes on the one hand, or with the vipers on the other.

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* Jordan, Manual Vertebr. Anim., 5th ed., 1888, p. 198.

† Cope, Proc. U. S. Nat. Mus., XIV, p. 680 (1892).

‡ Matthes, Denkschr. Naturw. Ges. Isis, 1860, p. 58.

§ For an illustration of this, the most terrible of all the death-serpents, see pl. 18.

That their venom also is more nearly the same than is that of the cobras and the rattlesnakes there can be no doubt. As will be shown later on, the poison of these last-mentioned snakes has been investigated and found to be considerably different, and although no examination of the chemical composition of the *Elaps* poison has been made as yet, as far as I know, the similarity in the symptoms shows that the venom of the cobra and the Coral Snake are very much alike.

In Mr. Shindler's case the doctor's report does not mention any local symptoms beyond the swelling of the finger, and Mr. Shindler informs me that there was no discoloration, as in the case of rattlesnake bites, beyond the reddening near the wound. The absence of special mention of violent local changes in the other cases is indication enough that none took place, while Dr. Herff expressly states that "different from our common poisonous snakes, the bitten part would neither swell nor become discolored," nor could anything be observed on the wound, except the small impression caused by the teeth of the serpent. But this absence of local effect is just one of the essential characteristics of the cobra poison as contrasted with that of the rattlesnake.

I have alluded to the extraordinary similarity between the *Elaps* and several perfectly harmless snakes inhabiting the same region, and it is quite probable that the innocent nature of the latter is in a great measure responsible for the former's good reputation, just as reversely several of the harmless snakes have received bad names on account of their external similarity to the venomous moccasin or copperhead.

It will therefore not be amiss to institute a comparison between the coral snakes and their imitators,* in order to furnish a means of readily distinguishing the venomous and dangerous reptiles from the innocuous ones.

With the dead specimens in hand the correct identification is not difficult. In the first place, the *Elaps* is provided with permanently erect, perforated fangs, that is, there is found at the front end of each upper jawbone one solitary curved tooth, which has a channel running through its center and a groove on its anterior surface, and which is not followed by any other teeth † on the upper jawbone, while the other snakes with which it can be confounded have no such perforated fang but instead a series of smaller solid teeth on the entire length of the bone in question (figs. 3 and 4). Running the point of a pin or a penknife along the bone just inside the upper lip will soon disclose the presence or absence of these teeth. There are several other minor points of structure and proportion which serve to distinguish the *Elaps*.

* It seems as if the harmless snakes are the imitators, and not *vice versa*, because the peculiar coloration of the various species of *Elaps* is more or less the same everywhere, while the harmless snakes resembling them belong to many different genera, in some of which there occur species of widely different color and pattern.

† Except, of course, the reserve fangs, likewise grooved.

Thus it has very small eyes, smaller than the shields between which the nostrils are placed, while in the inoenous snakes the eyes are considerably larger. The snout of the *Elaps* is short, blunt, and rounded, while in the others it is elongate, conical, more or less pointed. Moreover, in the former the frontal shield is small, less than one-half the size of one of the parietals, the latter much more than one-half.

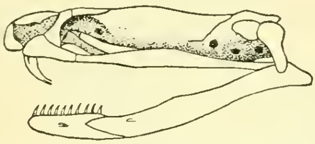

Fig. 3.
PROFILE VIEW OF SKULL OF ELAPS.
(After Jan.)

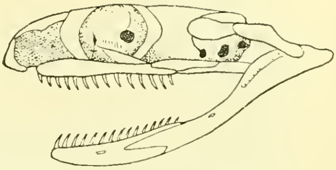

Fig. 4.
PROFILE OF SKULL OF LAMPROPELTIS
(After Jan.)

With the live animals, free or captive, these characteristics are often difficult of application. In such cases it is necessary to rely upon differences in the color pattern as a means of identification.

There are in the United States only two well-defined species of *Elaps*. The characteristic coloration of these consists of a series of transverse rings of black, vermilion, and yellow. This pattern is repeated in several species and subspecies of the genus *Lampropeltis* (or *Ophibolus*), known as "Scarlet King-snake," *L. doliatus;* "Red king snake," *L. coccineus;* "Ringed King-snake," *L. annulatus;* "Arizona king snake," *L. pyrrhomelas*, etc., as well as "Osceola's Snake," *Osceola elapsoidea;* the "Scarlet Snake," *Cemophora coccine*, and to a less extent in "Le Conte's Snake," *Rhinocheilus lecontei*, all or some of which inhabit the same region as one or the other species of *Elaps*. In all of these red, black, and yellowish is arranged in more or less perfect transverse rings. Le Conte's Snake is less characteristic and like the *Cemophora*, easily told apart by having the entire under surface whitish, while in the others, including the *Elaps*, the red and black is more or less continued across the belly. There is one fundamental difference in the arrangement seen in the species of *Elaps* within our boundary and that in *Lampropeltis*, *Osceola*, and *Cemophora*, which is that in our *Elapes* that black rings are oorderd on each side by a yellowish ring (fig. 5) while in the others the yellow rings are bordered on each side by a black ring (fig. 6).

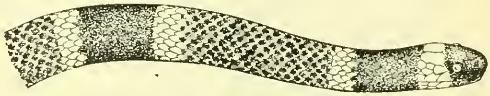

Fig. 5.
COLOR PATTERN OF ELAPS.
(After Jan.)

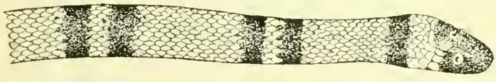

Fig. 6.
COLOR PATTERN OF LAMPROPELTIS.
(After Jan.)

The difference is well shown in the accompanying figures, which also bring out several of the structural characters referred to above.*

A formal though condensed account of the natural history of the *Elapidæ* occurring within the United States is here presented.

Genus ELAPS,† Schneider.

THE CORAL SNAKES.

1801.—*Elaps*, SCHNEIDER, Hist. Amphib., II (p. 289).—GÜNTHER, Proc. Zool. Soc., Lond., 1859, p. 84.

Postfrontal bone wanting; internasal plate not reaching labials; two nasals; no loreal; subcaudal shields (urosteges) divided; eyes very small, pupil a short vertical ellipsoid.

The snakes of this genus are cylindrical, rather elongate, but with short tail, and characterized by bright colors of red, black, and often yellow, forming rings. In many of the exotic species the black rings are arranged in threes, while in the North American species those of the body are equidistant. The scales are smooth and iridescent.

The exact number of species can not be given at present on account of the uncertainty of the status of many of the described forms, but at least twenty inhabit the New World, of which only two occur north of Mexico.

While the poison apparatus of the rattlesnakes and their nearest relations has been studied very minutely, that of the genus *Elaps* has been sadly neglected, as has been, in fact, its entire anatomy. Drs. Matthes and Voigtlænder have given short and superficial accounts of *Elaps fulvius*, from which ‡ I make a few abstracts: The functional fang in *Elaps fulvius* is followed by reserve fangs of the same structure as the functional one, but successively smaller. The functional fang is solidly united to the maxillary bone, being directed backward at a permanent angle of about 45° with the latter. Although comparatively smaller than the fangs in the crotalid snakes, that of *Elaps* is large enough to distinguish it at the first glance as different from the solid teeth of the palate and of the lower jaws. In front, at the base of the fang, the opening of the canal is distincly visible, and on the convex, or anterior, surface of the fang a shallow groove. The terminal slit, being the lower opening of the canal, is situated slightly on the *outer* side of the fang.

As already stated there are found in the United States only two well defined species of *Elaps*, but these are so sharply defined that they may be told apart at a glance, by the following characters:

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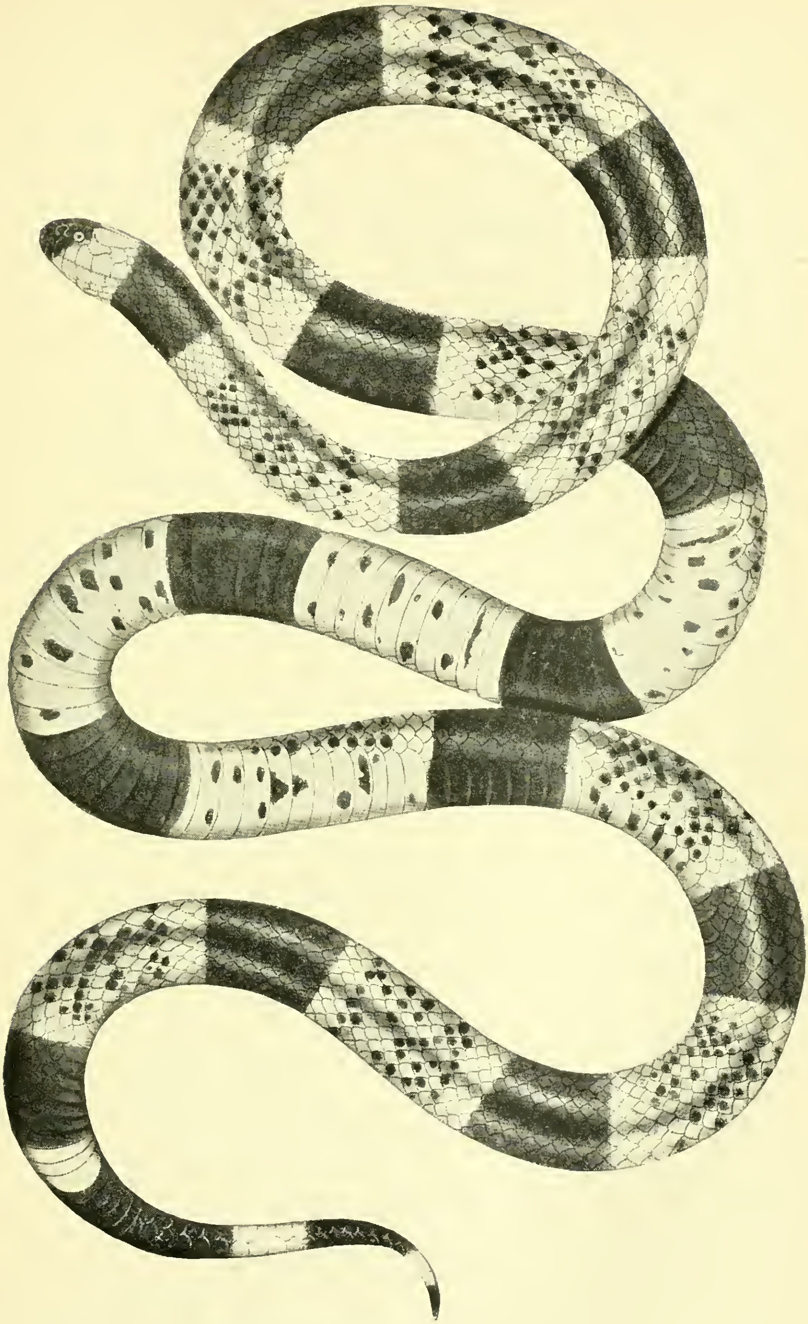
* The brilliant colors of all these snakes fade soon in alcohol; the red becomes grayish or light brownish; the yellow grows pale, often quite white; and the deep black, often bluish, turns a dull brown.

† From ἔλαψ (elaps), a Greek name for a snake.

‡ Denkschr. Naturw. Gesell. Isis, 1860, pp. 52–59, and p. 64.



HARLEQUIN SNAKE,—ELAPS FULVIUS.

From Baird, Rep. Mex. Bound. Surv

Synopsis of species of Elaps occurring in the United States.

a^1 Snout and frontal black, parietals yellow, followed by a broad black ring. *Elaps fulvius.*

a^2 Snout, frontal, and parietals black, followed by a yellow ring and this by a broad red one .... *Elaps euryxanthus.*

There are, besides, several important characters derived from structural and proportional differences, notably in the size of the frontal and the internasal shields.

As a rule *E. fulvius* differs from *E. euryxanthus* in having the second row of temporals consisting of only one shield against two in latter; but this character is by no means constant.

THE HARLEQUIN SNAKE.

*Elaps fulvius,** (Linnæus).

Plate 1.

1766.—*Coluber fulvius*, LINNÆUS, Syst. Nat., 12 ed., I, p. 381.—DAUDIN, Hist. Nat. Rept., VII, p. 306 (1803).—SAY, Sillim. Am. Journ. Sc., I, 1819, p. 262.—*Elaps fulvius* FITZINGER, Neue Class. Rept., p. 61 (1826).—HOLBROOK, N. Am. Herpet., 1 ed., II, p. 87 (1838);—2 ed., III, p. 49 (1842).—DEKAY, Zool. N. Y., III, p. 58 (1842).—GIRARD, in Baird and Girard, Cat. N. Am. Serpents, p. 21 (1853).—LE CONTE, South. Med. Surg. Journ., IX, 1853, pp. 651, 652.—DUMÉRIL and BIBRON, Erpét. Gén., VII, ii, p. 1215 (1854).—GÜNTHER, Cat. Colub. Snakes Br. Mus., p. 235 (1858).—COPE, Proc. Phila. Acad., 1859, p. 344 (1860).—COPE, Bull. U. S. Nat. Mus., No. 17, p. 24 (1880).—COPE, Proc. U. S. Nat. Mus., XII, 1888, p. 398 (1889).—JAN, Prodr. Icon. Ophid., p. 6 (1859).—JAN, Elenco Sist. Ofid., p. 113 (1863).—MATTHES, Denkschr. Naturw. Ges. Isis, 1860, p. 52.—VOIGTLÄNDER, Denkschr. Naturw. Ges. Isis, 1860 p. 64.—SMITH, Rep. Geol. Surv. Ohio, IV, p. 676 (1882).—GARMAN, N. Am. Ophid., pp. 105, 168 (1883).—GARMAN, Bull. Essex Inst., XXIV, p. 5 (1892).—TRUE, Amer. Naturalist, XVII, 1883, p. 27.—TRUE, in Hammond's Sou h Carolina, p. 235 (1883).—YARROW, in Buck's Ref. Handb. Med. Sc., VI, p. 166 (1888).—JORDAN, Man. Vert. North. U. S., 5 ed., p. 198 (1888).—FERREIRA, Jorn. Acad. Sc. Lisbon (2) II, Sept. 1891 (p. 94).—BARRINGER, Ven. Rept. U. S., p. 2 (1891).—BUTLER, Journ. Cincinnati Soc. Nat. Hist., 1892, p. 178.—HAY, Batr. and Rept. Indiana, p. 121 (1893).—*Vipera fulvia*, HARLAN, Journ. Phila. Acad., V, ii, 1827, p. 364.—HARLAN, Med. Phys. Researches, p. 127 (1835).

1802.—*Coluber fulvus*, SHAW, Gen. Zool., III, i, p. 469.—LATREILLE, Hist. Nat. Rept., IV, p. 140 (1802).—*Elaps fulvus*, HOY, Smiths. Rep., 1864, p. 433.—GÜNTHER, Proc. Zool. Soc. Lond., 1859, p. 85.—BIGNEY, Proc. Md. Ac. Sc., 1891, p. 151 (1892).

1825.—*Coluber fulvius*, var. (H). HARLAN, Journ. Phila. Acad., V, i, p. 155.—HARLAN, Med. Phys. Res., p. 180 (1835).

1853.—*Elaps tenere*, GIRARD, in Baird and Girard, Cat. N. Am. Serpents, pp. 22, 156.—MATTHES, Denkschr. Naturw. Ges. Isis, 1860, p. 52.—GARMAN, Bull. Essex. Inst., XXIV, p. 5 (1892).

1853.—*Elaps tristis*, GIRARD, in Baird and Girard, Cat. N. Am. Serpents, p. 23.—MATTHES, Denkschr. Naturw. Ges. Isis, 1860, p. 52.—YARROW, Bull. U. S. Nat. Mus., No. 24, p. 82 (1883).

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*From the Latin *fulvius*, for *fulvus*, tawny; misnamed from the the color of an alcoholic specimen.

1859.—*Elaps tener*, BAIRD, U. S. Mex. Bound. Surv., II, Rept., p. 15.—GÜNTHER, Proc. Zool. Soc. Lond., 1859, p. 86.
1875.—*Elaps fulvius*, subspecies *fulvius*, COPE, Bull. U. S. Nat. Mus., No. 1, p. 34.
1875.—*Elaps fulvius*, subspecies *tener*, COPE, Bull. U. S. Nat. Mus., No. 1, p. 34.
1883.—*Elaps fulvius fulvius*, YARROW, Bull. U. S. Nat. Mus., No. 24, p. 81.
1883.—*Elaps fulvius tener*, YARROW, Bull. U. S. Nat. Mus.. No. 24, p. 81.
1883.—*Elaps fulvius*, var. *tener*, GARMAN, N. Am. Ophid., p. 169.
Figures. AUDUBON, Birds, I (pl. XLIV).—HOLBROOK, N. Am. Herpet., 1 ed., II, pl. XVIII (1838); 2 ed., III, pl. X (1842).—BAIRD, U. S. Mex. Bound. Surv., II, Rept., pl. VII; fig. 1 (1859).—BAIRD, Pac. R. R. Rept., X, pl. XXV, fig. 15 (1859).—MATTHES, Denksch. Ges. Isis., 1860, pl. —, figs. 1–5.—JAN, Iconogr. Ophid., livr. 42, pl. II, fig. 2 (1872).—BOCOURT, Miss. Scientif. Mexique, Rept., livr. 4, pl. XXIII (1874).—GARMAN, N. Am. Ophid., pl. VIII, fig. 3 (1883).—YARROW, in Buck's Ref. Handb. Med. Sc., VI, p. 167, fig.—(1888).

*Description.**—The red may be considered as the ground color of the body, though the black rings occupy nearly as much space above as the red, so as to give the general appearance of succession of red and black rings. The yellow is intermediate. The anterior part of the head from the posterior point of the vertical plate [frontal] embracing the orbits is black, as is also the tip of the lower jaw. A yellow ring passes across the occipital [parietal] region down to the inferior surface of the head, embracing the space between the posterior rim of the eye and the angle of the mouth. Then comes a black ring, covering 8 dorsal scales, margined posteriorly with yellow. From this region to the origin of the tail, the black and red rings from 14 to 19 in number each, alternate, being separated from each other by a narrow band of yellow. The black rings cover 7 entire scales, and 2 halves; the intermediate red space 5 entire scales and 2 halves, and the yellow either 1 and 2 half scales or 2 halves only. Some red spaces may occasionally cover 9 and 10 scales. The tail is alternately black and yellow: the first caudal ring is black and embraces 10 scales; the second is yellow and covers 3 scales. Two black and 2 yellow succeed and cover the same ground. The tip of the tail is black on 5 scales. The tip may be either black or yellow, for according to the size there are either 3 or 4 black rings. Underneath the colors are the same but dull; occasionally one or more black rings may not surround the body. The reddish spaces are irregularly blotched with deep black as also sometimes on the upper surface.

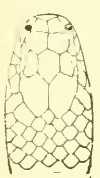


Fig. 7.

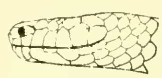


Fig. 8.

HEAD OF ELAPS FULVIUS.
Shown from top and side.
(From Baird.)

Number of ventrals [gastrosteges], 202–237; of sub-caudals [urosteges], 25–45.

Variation.—The typical form of *Elaps fulvius* occupies the southeastern States, including Florida. Further west there is a slight

*By C. Girard in Baird and Girard's Catalogue of North American Reptiles in the Museum of the Smithsonian Institution, Part I.—Serpents, 1853, p. 21.

tendency toward increasing the number of ventral shields (*gastrosteges*), narrower frontal and parietals, widening of the yellow rings, and greater size of black spots in the red rings. Individuals showing these characters well developed have been called *Elaps tenere*, or *Elaps fulvius tenere*, but there does not occur in any locality a sufficient percentage of individuals typical of the form to make it profitable to recognize a subspecies.

The status of some Florida specimens differing considerably in pattern from normally colored *E. fulvius* has not been satisfactorily settled as yet. They are stated not to differ at all in structure or proportions. Only a few specimens seems to have been collected—I have myself only seen one—and that in a locality in which the normal form also occurs. More material is highly desirable. Prof. Cope calls them *Elaps distans*. The chief difference from typical *E. fulvius* consists in the greater width of the red rings, which are not spotted with black, and the consequent narrowing of the black rings to 2 or 3 scales.

Geographical distribution.—I do not know how reliable the information was, upon which Holbrook states that the range of this species may "be said to begin in North Carolina and southern Virginia," for I am not aware of any definite record of specimens taken in those States, though it may well occur there, as we have quite a number of records and specimens from South Carolina even as far north and back in the country as Society Hill and Columbia. It extends over Georgia and the entire State of Florida. From Alabama, Mississippi, and Louisiana there are numerous records. The Bead Snake evidently follows the Mississippi River up a considerable distance notwithstanding the meagerness of details known, and notwithstanding the fact that the vigilant observers in St. Louis, among them Mr. Julius Hurter, have failed to find it. It even ascends the Missouri River, as Dr. Hoy obtained it near that river in about 39° latitude. How much reliance can be placed upon the identity of the specimen which Holbrook quotes as in the possession of Prof. Green, of Philadelphia, and said to have been brought by Lewis and Clarke from the "Upper Missouri," I do not know, but almost certainly there is some mistake. Recently two specimens have been captured in southeastern Indiana and southwestern Ohio under circumstances which make it appear probable that the species occurs along the Ohio River (Hay, Batr. Rept. Indiana, p. 122; Butler, Journ. Cincinn. Soc. Nat. Hist., 1892, p. 178). In the southern part of Texas this snake is found in all suitable localities, ascending a considerable distance into the interior along the great river valleys. Thus along the Rio Grande it extends up to the mouth of the Pecos, even ascending the latter, as Capt. John Pope's specimens were collected certainly not farther south than the thirty-first parallel. In southern Texas, moreover, it reaches a higher altitude than farther east, viz, over 1,000 feet, while none of the records of the eastern localities show it to reach even an altitude of 500 feet.

Habits.—Comparatively little is known of the habits of this beautiful snake, which like its harmless mimickers is often known as the bead snake, beyond the paragraph by Holbrook (op. cit. p. 50) repeated by most writers on the subject since his days, viz, that it is found living under ground in the sweet potato fields, and is frequently dug up by the laborers when harvesting.

The food of the Harlequin Snake seems to consist chiefly of other snakes and reptiles. I have already referred to a specimen which had swallowed a *Bascanion* as long as itself before it had fully digested a garter snake. Dr. Matthes (op. cit., p. 58) opened three more *Elapes* with the following result: No. 1 contained a half-grown *Eumeces fasciatus;* No. 2 had in its stomach a small snake, remnants of a lizard and a few beetles, the latter possibly the contents of the lizard's stomach; No. 3 also contained a small snake besides remains of a small rodent. Dr. O. P. Hay (Batr. and Rept. Indiana, 1893, p. 122) reports having found a Storer's snake, 13½ inches long, in a Florida *Elaps*, 21 inches long.

Nothing at all seems to be known of the breeding habits of our harlequin snakes.

This group offers a promising field for study by persons having the opportunity to observe these snakes alive.

THE SONORAN CORAL SNAKE.

Elaps euryxanthus,* Kennicott.

Plate 2.†

1860.—*Elaps euryxanthus*, KENNICOTT, Proc. Phila. Acad., 1860, p. 337.—COPE, Proc. Phila. Acad., 1861, p. 296.—COPE, Proc. Phila. Acad., 1866 (p. 307).—COPE, Bull. U. S. Nat. Mus. No. 1, p. 34 (1875).—COPE, Bull. U. S. Nat. Mus. No. 32, p. 86 (1887).—COPE, Proc. U. S. Nat. Mus., XIV, 1892, p. 681 (1893).—COUES, Wheeler's Surv. W. 100 Mer., V, p. 611 (1875).—STREETS, Bull. U. S. Nat. Mus. No. 7, p. 40 (1877).—YARROW, Bull. U. S. Nat. Mus. No. 24, p. 82 (1883).—GARMAN, Rept. Batr., N. Am., Ophid., pp. 107, 169 (1883).—CRAGIN, Bull. Washburn Laborat., I, 1884, p. 8.

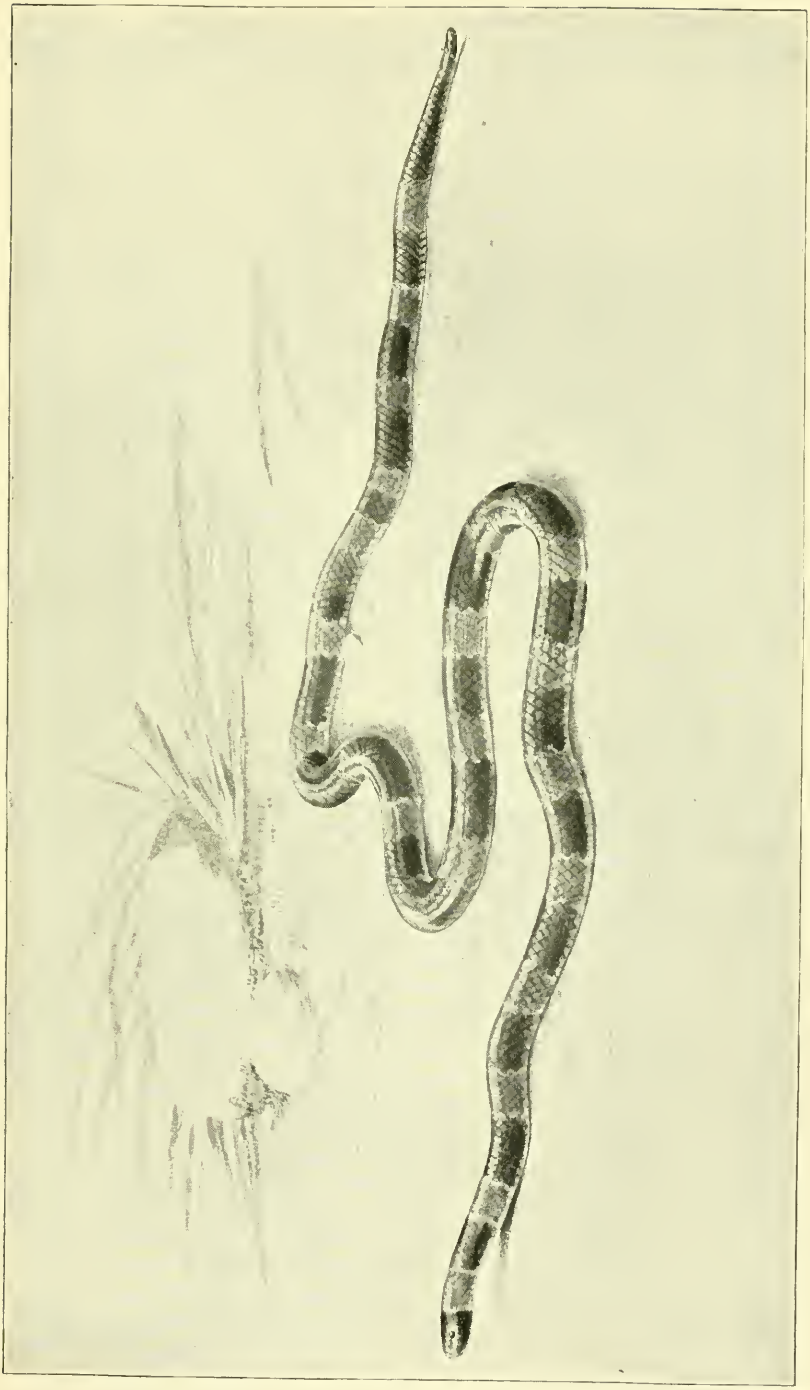
Figures. None.

Description.‡—Body rather stout, but less so than *E. fulvius.* Dorsal scales large; plates of the head small, except the rostral, which is very large and extends upward between the prefrontals [internasals]. Prefrontals [internasals] elongated laterally, more so than in *E. tener.* Postfrontals [prefrontals] small, elongated laterally; vertical [frontal] very small and narrow, subhexagonal, pointed anteriorly, elongated and tapering posteriorly; it enters but slightly between the occipitals. Occipitals [parietals] small, subtriangular, the anterior edge square,

* From the Greek εὐρύς (eurus) broad; ξανθός (xanthus), yellow.

† The figure cited is a half-tone reproduction of a colored drawing, hence the yellow interspaces are entirely too dark; it should be carefully compared with the description.

‡ Original description by Kennicott, Proc. Phila. Acad., 1860, p. 337.



SONORAN CORAL SNAKE,—ELAPS EURYXANTHUS

From a specimen in the U. S. National Museum.

very slightly notched for the vertical [frontal]. Seven labials above; posterior very small.

The fore part of the head is black, but the black, instead of passing forward from the anterior part of the occipitals [parietals] to near the eye, and there leaving the three posterior labials yellow as in *E. fulvius* and *E. tener*, involves nearly the whole of the occipitals [parietals], and passes backward entirely behind the angle of the mouth and involves the whole of the lower jaw to behind the posterior labial, leaving a broad emargination in the black on the occiput, in the bottom of which emargination are seen the white posterior tips of the occipitals [parietals].

Behind this is a creamy-white ring (probably yellow in life), which is situated more posteriorly than in *E. fulvius*, and involves only the posterior tip of the occipitals [parietals] and none of the labials. Next behind this white ring, instead of a black ring, as in the other species, is a broad light brick-red one involving eleven scales. A creamy-white ring three and a half scales wide separates this first red ring from a black one eight scales in width. Behind this are alternate immaculate black and red rings, seven or eight scales wide, and separated by white rings three to three and a half scales in width. There are eleven black and eleven red rings on the body, separated by twice as many white ones. The tail is ringed with black and white without any red. All the rings run entirely around the body of the same color and are wholly without spots above or below.

Number of ventrals (gastrosteges), 215–241; of subcaudals (urosteges), 21–29.

Geographical distribution.—This species is yet so little known that its distribution can only be mapped out in a preliminary manner. It belongs to the "Lower Sonoran" province, but seems restricted to the regions east of the great Colorado River and west of the Continental Divide. It has been found as far north as Fort Whipple and at various places in southern Arizona, extending south into Mexico at least as far south as Batopilas, in the State of Chihuahua, in the interior, and to Guaymas, Sonora, on the Gulf of California.

In Arizona it reaches an altitude above the sea of at least 5,000 feet.

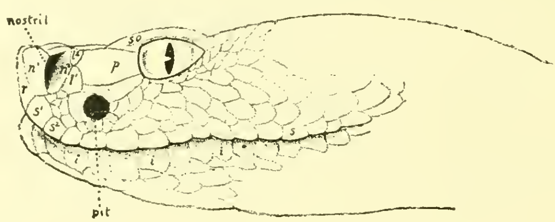
Habits.—Absolutely unknown.

THE PIT VIPERS.

Family Crotalidæ.

"Pit Viper" is a "book name" meant to include the Rattlesnakes, Moccasins, Copperheads, etc., but unlike many others it is a most excellent one, for not only does it indicate the relationship of these snakes to the true vipers, but it also contains a reference to the remarkable character which at once distinguishes them both from the vipers and from all other snakes as well.

The name refers to the deep pit or hole found in the Rattlesnakes and their nearest relations on the side of the face between the nostril and the eye, and well shown in fig 9. This cavity sinks deep into the maxillary bone and represents a "blind" sac lined with epidermis and is not connected with any of the other cavities or organs in the head by any inside opening or canal. There is nothing similar to be found in any known reptiles outside of this family, if we except the labial pits in the pythons and boas, nor is there in any other class of animals. When the earlier zoologists came to examine this peculiar structure they, of course, tried to compare and identify it with other organs already known, some hinting at the closed nostrils of the fishes, while others pointed out its similarity, in position at least, to the so-called "tear-sacs" of the deer. It was even suggested that in view of the close approximation of the pit to the poison apparatus it might have for object the admission of air to act in some unknown way upon the secretion of the venom glands, thus rendering the poison more powerful.



HEAD OF CROTALUS, FROM SIDE.

i Infralabials; *l* loreal; l^1 lower loreal; l^2 upper loreal; *n* nasal; n^1 anterior nasal; n^2 posterior nasal; *p* preocular; *r* rostral; *s* supralabials; s^1 1st supralabial; s^2 2d supralabial, etc.; *so* supraocular

It was plain, however, even to those who proposed these explanations, that they were not the true solution of the question, and most authors were satisfied with a reference to the pits as "mysterious."

In the meantime naturalists have become compelled to assume the existence of a "sixth sense" in various animals, for which they had discovered special sense organs, such as, the lateral line in fishes.

It was quite natural, then, that Prof. Leydig should come to the conclusion that the pit of the *Crotalidæ* is the organ of a sixth sense, when upon a microscopic examination of the pit's lining he found it supplied with a thick nerve, ending in a way the only analogue of which is found in the retina of the eye or the labyrinth of the ear.

Leydig's material was in some respects defective, for he had only specimens preserved in alcohol, and in his valuable memoir* on the subject twenty-five years ago he distinctly encouraged the North American naturalists to take the matter up and continue his investigations on fresh specimens, but, as far as I know, nobody has as yet done so. It may therefore not be out of place to give a brief synopsis of his observations.

*Nova Acta Acad. Caes. Leopold. Nat. Curios., XXXIV, 1868, No. 5, pp. 89–96, pl. iv, figs. 28–32.

The external layer of the lining of the pit Leydig found to be a continuation of the outer skin, which, however, upon entering the cavity becomes thin and considerably modified. The granular tubercles gradually disappear toward the bottom, and the surface is found to be composed of large angular epidermis plates containing nuclei (fig. 10). Underneath this he found a layer of connective tissue, in which the fine ramifications of the thick nerve supplying the pit are lost in a granular substance which under high power reveals itself as containing numerous true, rounded, but pale nuclei. The granular substance he found arranged around the nuclei in such a way as to form groups or islands of various forms and sizes separated by light narrow spaces. These structures can only be regarded as terminal ganglions, and it does not seem doubtful that we have here to do with a true sense organ.

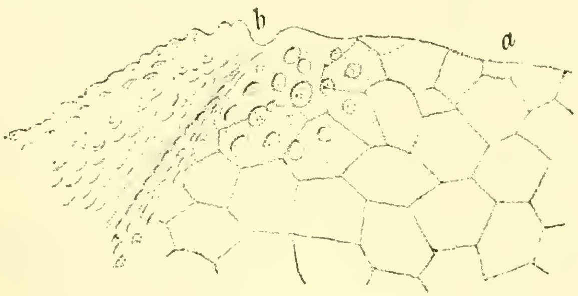


Fig. 10.

PIECE OF SURFACE OF EPIDERMIS LINING THE PIT.

Greatly enlarged. *a* Smooth, thin portion from the pit proper; *b* tubercular portion at the edge.

(After Leydig.)

Wherein this "sixth sense" consists we do not know, nor do we know of anything in the habits of these snakes which would indicate its nature, or to what use the animal puts the organ. Future research may reveal it, though perhaps man will never fully comprehend the nature of a sense which he himself does not possess.

The "loreal" pit, so called because of its location in that portion of the snake's face in herpetological terminology known as the "lores," being a character exclusively pertaining to the Crotalid snakes, its presence in any of our North American snakes at once designates it as a dangerously poisonous snake. It is an unfailing character of our native "death vipers," with the exception of the *Elaps*, which I have already characterized.

Another unfailing character is, of course, the presence of long curved fangs in the anterior portion in the upper jaw. Since an account of our poisonous snakes would manifestly be incomplete were I to omit a description of the poison apparatus, a brief outline of its structure is here presented.

I stated above that *Elaps* has two permanently erect and perforated fangs in the anterior portion of the upper jaw. In the Pit Vipers there are similar fangs, but much larger, and differing from those of the *Elaps* by being folded up toward the palate, somewhat like the blades of a jackknife when not in use. This must not be understood to mean that the fangs themselves are movable; on the contrary, the

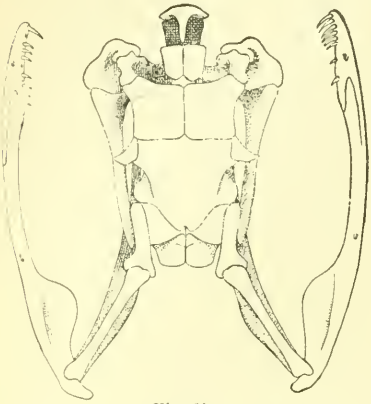


Fig. 11.
SKULL OF RATTLESNAKE, FROM ABOVE.
(After Jan.)

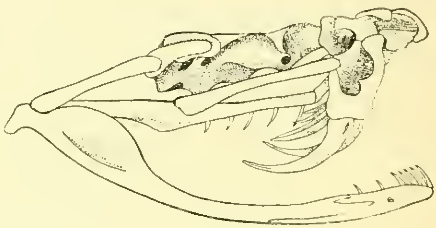


Fig. 12.
SKULL OF RATTLESNAKE, FROM SIDE.
(After Jan.)

viper's fangs are as solidly fixed in their sockets as are those of the *Elaps*, but while in the latter (see fig. 3) the maxillary bones, into which the fangs are fastened, are elongated and horizontal, as in the harmless snakes (see fig. 4), in the Crotalids they are extremely shortened and higher than long, so as to appear in a vertical position. In the former the fangs are consequently inserted nearly at right angles, like the pickax on its handle, while in the latter the fang more nearly represents the blade, and the jawbone the handle of a knife, and it is the jawbone which is movable in the vertical plane, not the fang alone.

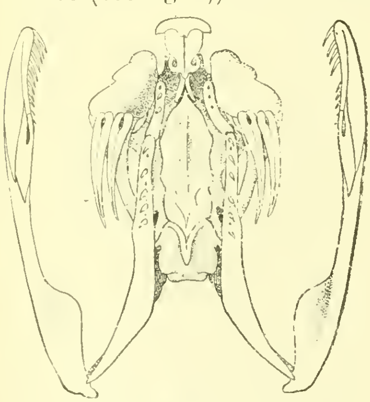


Fig. 13.
SKULL OF RATTLESNAKE, FROM BELOW.
(After Jan.)

In order fully to understand the mechanism in question, it is necessary to remember that the bones of the head of nearly all snakes (figs. 11–13) are so loosely joined together as to allow a most extraordinary amount of movement and distention. Elastic ligaments connect bones which in other animals are either grown solidly together or articulated by means of close joints, hence a snake is capable of swallowing a prey many times as thick as the snake's own body.

As already noted, the upper jawbones (maxillaries) are situated vertically, one on each side of the anterior portion of the mouth, the hollow fang being fastened into the lower end of the bone. On the outer face of the bone there is above a deep cavity forming the bony walls of the "pit" already referred to, which separates two articular surfaces. The upper one at the top of the maxillary forms with the corresponding concave face of the lachrymal bone, which projects from and articulates with the frontal bone, a hinge-like joint, allowing considerable freedom of motion. The lower surface receives the flattened anterior end of the external pterygoid bone. It will be seen from the accompanying cut (fig. 14) that if the latter bone (*a*) be moved forward or backward, the maxillary hinges on the lachrymal, and that if the pterygoid be pushed forward, the fang is erected.

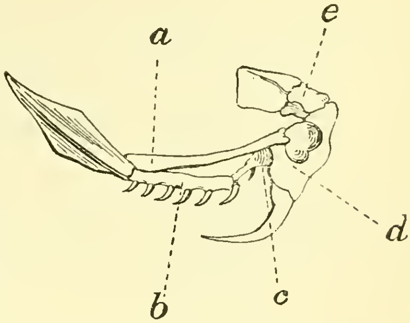


Fig. 14.

POISON APPARATUS OF THE RATTLESNAKE.

Right side. *a* External pterygoid bone; *b* internal pterygoid bone; *c* palatal bone; *d* maxillary bone; *e* lachrymal bone.

(After Mitchell.)

There are several muscles engaged in producing this erection and the opposite motion, the depression of the fang, but we shall only mention the two principal ones.

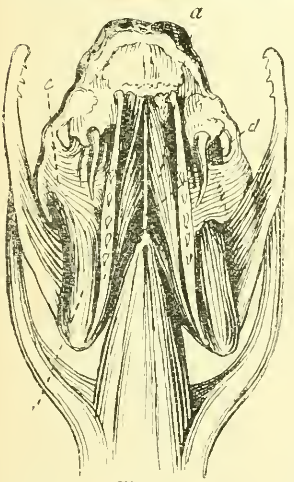


Fig. 15.

MUSCLES OF POISON APPARATUS OF RATTLESNAKE, PALATAL VIEW.

a Spheno-pterygoid muscle; *b* external pterygoid muscle; *c* fascial sheath of this muscle attached to the capsule of the gland; *d* median ridge of base of skull.

(After Mitchell.)

The elevator muscle of the fang is the spheno-pterygoid muscle (fig. 15, *a*), which arises along the median ridge of the base of the skull (*d*), and running backward is inserted upon the enlarged posterior end of the pterygoid bone. The contraction of this muscle pulls (direction *l–m* fig. 16) the pterygoids forward, which thus push the lower end of the maxillary forward, the upper end being held in position by the lachrymal hinge. The tip of the fang describing part of a circle, finally points downward instead of backward. The chief retractor muscle, which antagonizes the elevator muscle by acting in the opposite direction, is the external pterygoid (ecto-pterygoid) muscle (fig. 15, *b*), which arising from the joint between the quadrate bone and the lower jaw, runs forward and is inserted on the outside of the maxillary bone a little below the joint of the latter with the outer pterygoid bone. It will be seen that contraction of this muscle means a pulling backward of the maxillary bone (in the direction *p–e* fig. 16), resulting in the backward and upward movement of the point of the fang.

The fang itself is a large, very pointed, and curved tooth containing two cavities, the pulp cavity and the poison canal, the former situated on the concave side, the latter on the convex side of the tooth (fig. 20). The poison canal has a more or less slit-shaped opening near the base, on the anterior side of the fang, and another slit, narrower and longer on the same side, some little distance from the very sharply pointed tip. Between these openings it is often possible to trace a more or less well-defined depressed line. A microscopic inspection of cross sections of the fang reveals the fact that the canal is nothing but a deep groove, the walls of which have closed over it anteriorly, the depressed line indicating the meeting of the walls, or the "seam." This structure of the fang may be easily understood by comparing it to a leaf curling up in drying, the edges meeting and overlapping in the middle, leaving an upper and a lower opening. By making sections of growing and full-grown fangs of the same individual, the evolution of the grooved fang into the "perforated" fang is easily traced, and the inexactness of the latter term clearly demonstrated. As a consequence of this origin of the canal, it is lined with the same hard layer of dentine as the outer side of the fang, for it will be seen that this inner lining of the canal is in reality the anterior surface, while the outer layer is only the posterior surface of the normal tooth. An inspection of the accompanying figure (fig. 17), which represents a cross section through the upper jaw, with the functional full-grown fang followed by the more or less undeveloped reserve fangs, will show this plainly, as the same principle is involved in the Pit Vipers.

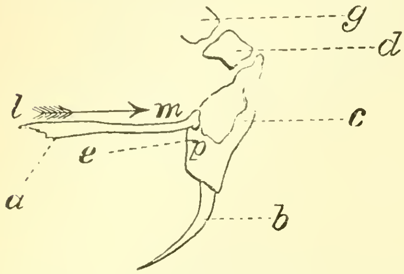


Fig. 16.

DIAGRAM OF THE BONES CONCERNED IN RAISING THE FANG.

a Pterygoid bone; *l–m* arrow marking its line of motion; *p–e* external pterygoid muscle; *g* frontal bone; *d* lachrymal bone; *c* maxillary bone; *b* fang.

(After Mitchell.)

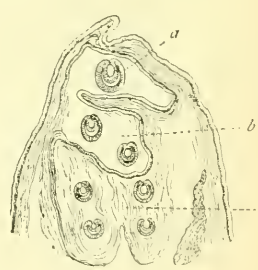


Fig. 17.

ARRANGEMENT OF THE RESERVE FANGS IN BUNGARUS SEMIFASCIATUS, ILLUSTRATING THE DEVELOPMENT OF THE GROOVED FANG INTO THE CANALED FANG. Enlarged.

After Niemann.

As already stated, the fang is above fixed firmly in the socket of the maxillary bone, "its base being luted to the portion of the bone around its side and anterior aspect," to borrow Dr. Weir Mitchell's words.* "Posteriorly, the bone possesses a hollow, in which is lodged the tooth sac. In the open mouth of this alveolar process, within the mucous membrane, and upon the pterygoid bone, lie one behind and below another, the reserve fangs, each smaller than the one in front and less

*Researches upon the Venom of the Rattlesnake. Smithsonian Contributions to Knowledge. Washington, 1861, p. 16.

and less developed, until the situation of the last which is visible is marked by a minute papilla alone. I have counted from 8 to 10 of these on each side. When the fang is lost by natural process, it is replaced within a few days; when violently displaced, several weeks sometimes elapse before the next fang is fixed firmly enough to be useful to the snake. If the functional fang be lost or shed, the next tooth gradually assumes its position," and finally, occupying the place of the lost one, becomes anchylosed.

In the same manner as the hollow fang is developed from the grooved fang, and this again from the plain solid tooth, so is the poison gland evolved from the ordinary salivary gland by a specialization of the yellow portion of the latter, as already mentioned under the opisthoglyph snakes.

The typical venom gland is found in its fullest development among the Pit Vipers, and is located on each side of the head below and behind

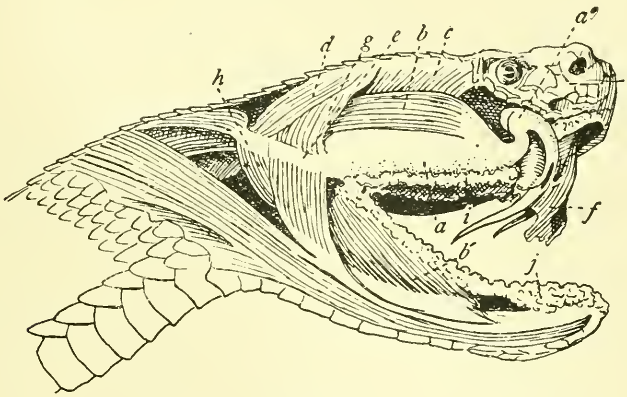


Fig. 18.

POISON APPARATUS OF RATTLESNAKE; VENOM GLAND AND MUSCLES.

Lateral view. *a* venom gland; *a'* venom duct; *b* anterior temporal muscle; *b'* mandibular portion of same; *c* posterior temporal muscle; *d* digastricus muscle; *e* posterior ligament of gland; *f* sheath of fang; *g* middle temporal muscle; *h* external pterygoid muscle; *i* maxillary salivary gland; *j* mandibulary salivary gland.

(After Duvernoy.)

the eye. The shape is that of a flattened almond, the pointed end toward the front and below the eye, tapering to a narrow duct, which carries the poison to the inlet at the base of the fang. The relative size of the organ may best be understood by a glance at the accompanying figure (fig. 18.)

The interior structure of the gland may be described briefly as consisting of a basal cavity into which the small ducts of the glands open. These ducts run toward the walls of the gland, branching, and finally ending in minute blind bags, the whole system of ducts being supported by a network of numerous fine threads and thin sheets of fibrous tissue. The ducts are lined with a more elongated epithelium, the blind pouches with angular nucleated epithelial cells.

The external covering of the gland is made up of two more or less distinct layers of fibrous tissue, the outer one being continued posteriorly in a ribbon-like ligament running backward and inserting itself upon the joint of the jaw (fig. 18, *e*). A short ligament on the side facing the skull attaches the gland firmly to the latter, and a third one below connects with the external pterygoid muscle (fig. 15, *c*).

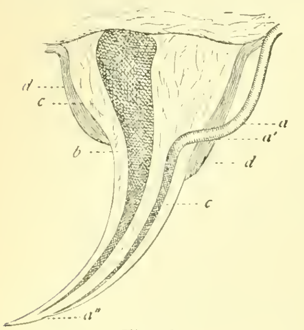


Fig. 19.
LONGITUDINAL SECTION OF POISON FANG OF BOTHROPS

Enlarged. *a* Poison duct entering the fang at *a′*; *a″* opening of poison canal near tip of fang; *b* pulp cavity; *c* dentin; *d* connective tissue.
(After Niemann.)

At the anterior end of the gland the capsule continues as the outer covering of the duct which carries the poison from the gland to the fang. This duct, in its normal position, makes a sudden upward curve (fig. 18, a^1) under the eye, descending from which it follows the posterior wall of the pit and finally passes over the rounded outer front edge of the maxillary bone, at the base of which it meets the upper opening, or inlet, of the canal through the fang.

Until Prof. Jeffries Wyman, in 1860, and, about simultaneously, Dr. Christopher Johnston, published opinions to the effect that the poison duct does not enter the canal of the fang, it was generally held that it actually continued inside of the channel. This latter view has been revived quite recently by Dr. F. Niemann, who not only describes this arrangement, but figures longitudinal and transverse sections of it as seen by him in a crotaloid snake, *Bothrops lanceolatus*.* The longitudinal section is reproduced here as fig. 19, the transverse one as fig. 20. The latter shows at a^1 the poison canal lined with the duct, which, even inside of the fang is characterized by its epithelial lining. As this opens up the question again, and makes future research necessary, and as Mr. Niemann seems to be ignorant† of the investigations referred to, it may be well to quote their evidence a little more fully.

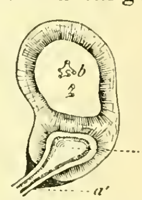


Fig. 20
TRANSVERSE SECTION OF BOTHROPS FANG.

Prof. Wyman's account of some dissections of the poison apparatus of the Rattlesnake was read at a meeting of the Boston Society of

* Beiträge zur Morphologie und Physiologie der Oberlippendrüsen einiger Ophidier. Wiegmann's Archiv f. Naturg., LVIII, i, pt. 3, Sept., 1892, pp. 262–286 + pl. XIV.

† In spite of the apparent conclusiveness of Mr. Niemann's figures, I am compelled to remark that his paper contains several indications of carelessness which makes it imperative to receive his conclusions with extreme care. That anyone should attempt an investigation of that kind without knowing and quoting Dr. S. Weir Mitchell's epoch-making labors, is scarcely reassuring in the first place, but there seems to be even less reason for a confusion of such terms as Solenoglyph for Opistoglyph on p. 282, and the mistaken identification of the ectopterygoid bone for the maxillary, pp. 277 and 279.

Natural History, May 16, 1860 (Proceedings, Vol. VII; published July, 1860, pp. 293–294), and is quite brief, as follows:

> The duct proper does not reach the opening at the base of the tooth, but ends at a short distance from it. The communication beyond this is made by means of the sheath of the tooth, which is too loose to prevent the poison from escaping around the exterior of the tooth instead of entering its canal, were it not for the circumstance that as the tooth is protruded the sheath is crowded back, and thus made to fit tightly the circumference.

Dr. Johnston's statement is much more elaborate, and includes an interesting account of the successive growth and advance of the reserve fangs. It was written by him as early as October 3, 1859, and given to Dr. Weir Mitchell for publication.*

After discussing the probability of a periodical shedding of the fangs and describing the successive formation and growth of the secondary or reserve fangs, Dr. Johnston proceeds as follows:

> At length the prime fang is removed, if spontaneously, by the atrophy of the pulp, and, I believe, by erosion of the basal anchylosed portion; if it be broken off by violence the freedom of the pseudo-socket is accomplished by the same means. And now the first tooth of reserve is urged forward into a recess in the maxillary bone directly adjacent to and on the inner side of the fallen fang; and the requisite advancement is brought about by the developmental *vis à tergo* of the remaining reserve pulp, and probably also by the traction in front exerted by the cicatrizing parts. It is evident that the fang emerges from its capsule, and that the point and crown repose in the den, but the base is closely invested with the capsular remains under the form of a periosteal expansion, which is the mediate bond of union between the base and the new and shallow socket of the maxilla.
>
> As may be perceived upon examination at this stage, two sockets coexist in the same jaw, the inner, new one, supporting the recently promoted fang, and the outer, old, and now vacant one, which is fast becoming disencumbered of the vestiges pertaining to its former resident. In this maxilla the new fang occupies the innermost part, having the old socket on the outer side, while in the opposite maxilla, the older venom fang may be discovered in its normal situation, leaving the recess to its inner side vacant for the temporary lodgment of its successor. Or, both fangs being recently fixed to the jaw, the vacuities will both be formed on the outside, and all the reserve fangs will appear to follow backward and outward in direct line.
>
> Now, let us look at the situation of the poison duct and examine into the mode by which it is brought into relation with the fang.
>
> The venom duct arising from the gland makes a bend upward, immediately beneath the eye, then advances forward under the skin as far as the crotaline fossette [pit], and lying upon the maxilla externally, plunges downward, and pierces the gum in front of the fang, where it terminates in a papilla, which projects slightly into the proximal aperture of the tooth. In this position it is maintained by the gum, which clasps the base laterally and in front with considerable firmness, its inferior or distal edge encompassing the annular enlargement already alluded to. Nor is there any other than a mediate application of the poison papilla against the fang, for, as the whole venom canal of each tooth is really upon the outside of the organ, no special membrane lines it, which might be continuous with the duct that discharges into the upper aperture.
>
> Such is the condition of things in an old fang, occupying its normal exterior position. But when the tooth drops out, or is broken, the gum is left entire; or, if its

*Researches upon the Venom of the Rattlesnake, pp. 17–19. (Published January, 1861.)

exodus has been forced, the gum escapes with laceration only. In either case, however, the gum remains as a barrier, limiting the progress of the advancing reserve fang; and while the latter is establishing itself provisionally the gum encircles it, clasps it tenaciously, and brings the poison papilla in opposition with its dental aperture. As time passes, the new fang moves gradually outward to its permanent seat; the inner maxillary recess is restored, and the first fang of reserve is again discovered on the inner side of its senior, resting with its pulp attachment in the bottom of the recess. Thus, the reserve fang has become an adult functioning fang, nor does its pulp relax its hold until fate or mischance dislodge the now fatally-armed tooth which it animates.

Dr. Mitchell adds that although it is often, or usually, the case that, as stated by Dr. Johnston, the first reserve fang enters the semilunar socket in the maxilla to the inside of the active fang, it is not uncommon to find the two fixed fangs unsymmetrically placed, one on the inner, the other on the outer side, of their respective sockets, or both on the inner side; or again, both on the outer side. He also expressly states that in all other points his own researches agree with those of Dr. Johnston, and he presents the diagram, here reproduced (fig. 21), to illustrate their views as to the direction taken by the new fang in its progress toward the alveolar socket.

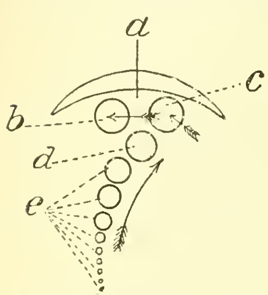


Fig. 21.
DIAGRAM ILLUSTRATING THE SUCCESSION OF THE FANGS.
a Alveolar socket; *b* functionary fang; *c* its successor; *d* the next fang in order of age; *e* remaining germs.
(After Mitchell.)

I have previously mentioned the special muscles engaged in erecting and depressing the fang. I shall now call attention to those which force the poison through the duct into the hollow fang.

In the non-poisonous snakes the closing of the mouth is effected by the three temporal muscles, the anterior, the middle, and the posterior. The anterior temporal arises from the parietal crest and its continuation on the postfrontal bone, turns backward around the joint of the lower jaw and is inserted on the latter bone; the middle temporal arises from the posterior half of the parietal crest, runs downward and forward under the former and is similarly inserted, while the posterior temporal, the strongest of them all, arises from the quadrate bone and is inserted on the inside of the entire length of the angular bone of the lower jaw.

In the crotalids this arrangement is considerably modified (fig. 18). The posterior (*c*) and middle (*g*) temporal muscles remain essentially as in the non-venomous snakes, and their function is also the same, viz, by contraction to pull the lower jaw up against the upper one, or, in other words, to close the mouth. The anterior temporal (*b*), however, has now both a different rise and a different function. Instead of connecting with the cranial wall, it has lost all connection with the latter and arises from the upper posterior portion of the firm, tendinous capsule of the poison gland (*a*), runs backward under the ribbon-like ligament (*e*) which fastens the gland to the joint of the jaw, winds around this joint and inserts itself (b^1) broadly upon the lower jaw. It may easily be shown that a contraction of these muscles will produce a tremendous pressure upon the poison gland. It is also apparent that the closing of the mouth does not necessarily affect the gland, as only the posterior and middle temporals need be employed in the action, and that the pressure exerted by the anterior temporal is voluntary, as well as independent of the closing of the jaw.

While thus the flow of poison is regulated by the pressure upon the gland, there are additional safeguards against waste of the precious fluid. Dr: Weir Mitchell has discovered that the visible thickening of the poison duct anterior to the sudden turn under the eye is due to an increase in the amount of the fibrous tissue of the walls, and not to any widening of the canal. As he also found the walls of the duct at this place to contain nonstriated muscular tissue, he concludes that the enlargement is a real ring-muscle, or sphincter, which by its contraction closes the duct, and he demonstrated the correctness of his conclusion by experiments. He found that when in the living and active Rattlesnake the jaws were separated, and the fangs caught on the edge of a cup and erected, it was usually very difficult to produce a flow of venom against the will of the snake, even when the operator pressed upon the glands, but that on the contrary it was easy to force the poison out along the duct and through the fang, if the snake was dead or insensible from chloroform.

The whole poison apparatus has very appropriately been compared to a hypodermic bulb syringe, the needle, with its obliquely cut point and slit-like outlet, representing the fangs, the bulb corresponding to the poison glands, and the muscles of the hand which presses the bulb performing the same task as the anterior temporal muscle.

The nature of the poisonous fluid secreted by the gland in the pit vipers seems to be almost as diagnostic as the apparatus itself. The discussion of its properties is so closely connected with the question of antidotes and remedies that a summary of the interesting results of Drs. Mitchell and Reichert's recent studies and discoveries in this field will be reserved for quotation in the closing chapter of this paper, and I shall now devote some space to the action of the snake in utilizing the formidable weapon which has been described.

The action referred to is not a "bite" pure and simple, it is the combination of a bite and a blow delivered with such lightning rapidity that it is very difficult, if not impossible, for the unaided eye to follow the various movements composing it and to record their occurrence in the proper sequence. The testimony furnished by our eyes as to the movements and sequence involved in an action as familiar and comparatively slow as that of a running horse was proven utterly false by the instantaneous photographs, and it is very likely that there are similar surprises in store for us when some one shall have rigged up a "battery" of cameras and fixed the successive movements of the striking

Rattlesnake on paper in such a manner as to leave no more room for guesses, interpretations, and disputes.

How desirable such a series of pictures is may well be understood by a reference to an extended discussion which was carried on in the well known New York weekly, Forest and Stream, about two years ago. In the issue for May 26, 1892,* the editor called attention to a statement by the greatest herpetological authority in the country with regard to the action of the Rattlesnake, and which the editor characterizes as "very extraordinary." The statement is to the following effect:

The species of this genus [*Crotalus*] are of rather sluggish movements, and are not quick to bite, unless trodden on. They throw the body into a coil and sound the rattle, giving a sigmoid flexure to the anterior part of the body, on which the head is poised with open mouth ready for action. At this time drops of the poisonous saliva fall from the fangs, and by a violent expulsion of air from the lungs are thrown at their enemy.†

It is evidently the last half of the account which called forth the criticism and led the editor to call upon the readers "to contribute some evidence on the point in question." In the very next number two observers controvert the statement in decided language. Few men are such keen observers or have had such opportunities for observation as Maj. Charles E. Bendire, from whose reply‡ we quote as follows:

During a residence of more than twenty-five years in the western portion of the United States, a considerable part of this time having been spent in the field, where Rattlesnakes were and are still common, and during which time I have seen hundreds of these reptiles, I have never yet observed one with its mouth open when coiled and ready to strike; neither have I ever seen one attempt to throw poison, even when teased and much provoked.

The other reader, who signs himself J. M. W., and who evidently has had some experience with Rattlers, concludes § a similar protest with the following statement:

While living in southern Illinois I had a captive nearly 5 feet long—a vicious fighter, who would strike at any object thrust toward him, and often caught his curved fangs in the fine wire netting covering the cage, thus holding his open mouth in position for a fraction of a minute. The venom from each fang, a light amber-colored fluid in drops about the size of No. 6 shot, could be seen on the gauze where it collected when he struck, but there was nothing more, no saliva, no spitting or hissing, nor have I ever seen these manifestations in any of the many individuals that have come under my immediate notice. Nor have I ever seen a snake's mouth open, with fangs exposed, while waiting a chance to strike. When they strike, the jaws open at an angle of nearly 180 degrees, but not until the final moment.

In the next issue is a very interesting note by Dr. M. G. Ellzey,‖ from which the following sentence is quoted:

I have seen Rattlers in coil, and seen them strike from coil very often, but never saw one holding its mouth open, with erect fangs, dripping poisonous saliva.

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* Forest and Stream, XXXVIII, p. 493.

† Proc. U. S. Nat. Mus., XIV, 1891 (No. 882), p. 687.

‡ Forest and Stream, XXXVIII, June 2, 1892, p. 518.

§ Forest and Stream, loc cit.

‖ Forest and Stream, XXXVIII, June 9, 1892, p. 538.

For several weeks similar accounts, some, however, more or less mixed with decided "snake stories," appeared in the columns of the paper,* with one exception, that of "E. D. W. S." (June 16, 1892, p. 562), whose experience in California with a "Black Rattler," which "arched his head and neck and hissed or blew quite a quantity of *froth or spittle*," seems to prove nothing, as it proves too much. The discussion was finally concluded by Prof. E. D. Cope, who disclaimed having represented in the paragraph criticised the normal action of the rattler when ready to strike, as the following quotation † shows:

I did not state that Rattlesnakes always maintain the position described when about to bite. On the contrary, it is only when prevented from either biting or running away that they act in the manner mentioned. If a Rattlesnake is annoyed by being stirred up with a stick and pebbles, etc., thrown at him, and is prevented from escaping, if he is in good condition and the weather is warm he will sometimes act as I have stated from actual observations made on the *Crotalus confluentus* in New Mexico. When the mouth is opened widely, the masseter muscle compresses the poison gland, ‡ and, if the latter is full, forces some of it to escape through the duct, and it drops from the fangs. This is an observation which has been often made on various venomous snakes. If the snake expels air from the lungs in hissing, as it generally does when on the defensive, the drops will be thrown out with the air toward the enemy. I do not suppose, and did not state, that this was done voluntarily by the snake; it is simply a necessary consequence of the mechanical conditions.

I have reviewed this controversy so fully because it shows the necessity of an authoritative account of the *normal* action of the snake when striking. During the discussion one writer quoted a few disconnected passages from Dr. S. Weir Mitchell's elaborate article on the subject, but as a clear understanding of the action involved can only be gained from a detailed account, I have no hesitation in reprinting nearly the entire chapter devoted by the famous specialist on the rattlesnake and its poison, especially because the original is now out of print, and there is no other account equaling it in accuracy and clearness, and there is not apt to be much added to it or corrected in it until we shall have the series of photographs alluded to above. His account is published in the third chapter of his "Researches upon the Venom of the Rattlesnake" (published in 1861 by the Smithsonian Institution as one of the Smithsonian Contributions to Knowledge), entitled "The Physiological Mechanism of the Bite of the Crotalus," and is to the following effect: §

When the Rattlesnake is in repose and unmolested, it sometimes lies at length, sometimes coiled or wrapped fold on fold in the loops formed by other snakes which

* "M. E. J." and "Whippoorwill," June 16, p. 562; S. D. Kendall, George H. Wyman, and "W.," June 23, p. 588; "Barker," June 30, p. 610.

† Forest and Stream, XXXIX, August 11, 1892, p. 114.

‡ The masseter muscle is the same as is above called the temporal muscle. It is difficult to see how in opening the mouth this muscle can compress the poison gland. This can only be done by a contraction of the muscle, but this contraction must necessarily close the mouth.

§ Pp. 20–25.

may happen to be in the same box. So soon, however, as cause is seen for alarm, the snake extricates itself, if among others, and at once throws its body into the coil so familiar to any one who has seen serpents, whether venomous or not. Sometimes on the edge, more often in the center of the coil, the tail projects far enough to admit of its vibrating freely and with singular swiftness. The head is raised a little above the rest of the body, but not usually more than 3 or 4 inches, even in large snakes. The neck and upper end of the trunk are not thrown into complete circles, but lie in two or three abrupt curves across the mass of the coiled body. The snake is now in position to strike. While thus at bay, in an attitude of singular grace, the long black tongue is frequently protruded—a common movement among all serpents when irritated. Just before the blow the snake makes a hissing sound, which is caused by the act of expiration, and is due to the passage of air through the narrow glottis. It is louder in certain innocent serpents than in the crotalus.

The mechanism of the forward cast of the body, which next occurs, is a very simple matter. The muscles which lie upon the convexity of the bending formed by the upper part of the snake are suddenly and violently contracted, so as abruptly to straighten the body, and thrust it forward in a direct line. The force resulting from this motion is not very great, as I have often ascertained when a snake has struck the end of a pole which I was holding, nor could it alone suffice to bury the fang in a tough skin were it not for the acts which follow and aid it. In effecting this forward thrust of the neck and head the serpent employs only the upper part of its body, and consequently is unable, under any circumstances, to strike at a greater distance than one-half its length, while usually its projectile range does not exceed a third of its length. An impression prevails that when the snake lies coiled its head is raised very high to enable it to strike downward. It seems, however, to be of no moment in what direction the danger threatens, since it can at will cast itself forward, downward, or almost directly upward.

As the animal comes within reach, of which the snake does not always judge with accuracy, the latter executes the movement just described. At the instant and while in motion the jaws are separated widely and the head is bent somewhat back upon the first cervical bones, so as to bring the point of the fang into a favorable position to penetrate the opposing flesh. Owing to the backward curve of the tooth, this of necessity involves the opening of the jaws to such an extent that an observer standing above the snake can see the white mucous membrane of the mouth as the blow is given. The peculiar articulation of the lower jaw upon an intermediary bone in place of upon the body of the skull greatly facilitates this action. On examining the neck and head it will also be seen that the head, under the influence of the cervical prolongation of the mass of the spinal muscles, is capable of being bent backward to no inconsiderable extent. Consentaneously with the forward thrust of the body and with the opening of the mouth the spheno-pterygoids act from their firm cranial attachments to draw forward the pterygoid plate, and thus, through its attachment to the maxillary, to erect the fang. The function of elevating the fang belongs alone to this muscle, which has no analogue in the other vertebrate animals. I have frequently tested its power to raise the fang by stimulating it with galvanic or other irritants, after decapitating the snake, and, although some French observers seem to have had doubts as to the agencies which effect the elevation and depression of the fang, there does not seem to me to be any reason to doubt the share which the spheno-pterygoid takes in this mechanism. That the mere act of opening the mouth of necessity raises the weapon has often been affirmed, but it is only necessary to separate the jaws of a crotalus to be convinced that this is not the case, and that even when the mouth is widely opened the animal has the most perfect control over the movement of the fang, raising or depressing it at will.

As the spheno-pterygoid acts, the maxillary bone rocks forward upon its lachrymal articulation. When the motion reaches its limit, and is checked by the ligament which I have described, the supporting lachrymal bone, in turn, yields to the power applied through the maxillary bone. These movements elevate a little the muzzle of the snake, so as to give to the face a very singular expression during the act of striking. Their more obvious and important result is the elevation of the fang, which, rising, thrusts off from its convexity the cloak-like vagina-dentis so that it gathers in loose folds at its base (fig. 22.)

As the unsheathed tooth penetrates the flesh of the victim a series of movements occur, which must be contemporaneous, or nearly so. The body of the snake, still resting in coil, makes, as it were, an anchor, while the muscles of the neck contracting draw upon the head so violently that when a small animal is the prey it is often dragged back by the effort here described. If now the head and fang remained

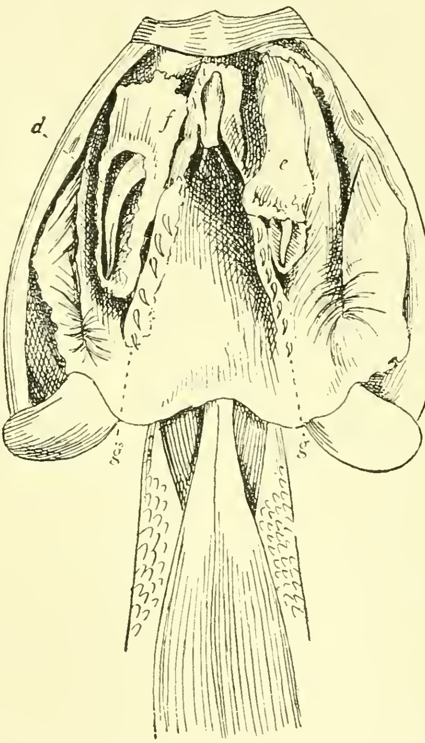

Fig. 22.

PALATE OF THE RATTLESNAKE.

d Fang; *e* sheath (vagina dentis) covering the fang; *f* sheath thrown back so as to show the fang; *g* palatine teeth. (After Duvernoy.)

passive the pull upon the head would withdraw the fang too soon; but at this moment the head is probably stayed in its position by the muscles below, or in front of the spine; while the pterygoideus externus and spheno-palatine acting upon the fang through their respective insertions, into the posterior apophysis of the submaxillary bone, and the inside of the palate bone, draw its point violently backward, so as to drive it more deeply into the flesh. The muscles alluded to, therefore, antagonize the spheno-pterygoid. At this instant occurs a third series of motions, which result in the further deepening of wound and in the injection of the poison. The lower jaw is closed upon the bitten part or member. Where the surface struck is flat and large this action will have but slight influence.

Where the jaw shuts on a small limb or member, the consequent effects will be far more likely to prove serious, since the power thus to shut the mouth materially aids the purpose of the blow. The closure of the jaw is effected by the posterior, middle, and anterior temporal muscles. The first two tend simply to shut the mouth; the anterior temporal, however, is so folded about the poison gland that while it draws up the lower jaw it simultaneously compresses two-thirds of the body of the gland. This force is applied in such a manner as to squeeze the fluids out of the upper and back parts of the gland and drive them forward into the duct. The anterior lower angle of the gland, as well as a portion of the duct, is subjected to similar pressure at the same instant, owing to the flat tendinous insertion of a part of the external pterygoid upon the parts in question.

It will thus be observed that the same muscular acts which deepen the wound fix the prey, and inject the venom through the ducts and into the tissues penetrated by the teeth. The whole process here described at such length is the work of an instant, and the serpent's next effort is to disentangle itself from its victim. This step is effected by relaxing the muscles of the neck so as to leave the head passive, while the continued traction of the muscles of the body pull upon it, and thus withdraw the fang, over which glides the elastic mucous sheath as the pterygoid, again acting, depresses the fang, and the serpent recovers its posture of defense.

It happens, not infrequently, that the teeth of the lower jaw catch in the skin of the bitten animal, and thus prevent the snake from retreating at once. When this takes place the serpent shakes its head from side to side with a motion which so nearly resembles the shake a dog gives its prey that it has been mistaken by at least one observer for an expression of rage. It is really an attempt to escape; nor is it always successful, since a large animal will often drag a snake until the fangs themselves break loose and are left in or on the bitten part.

In considering this portion of our subject it is well to notice what has been too much overlooked, the fact that, while the snake commonly employs both fangs, it does often inflict but a single wound. When obtaining venom from living snakes, I have been accustomed to allow them to bite upon the inner edge of a cup, and I have observed that on some occasions both fangs were used at once, and that on others only one was active. Or, the fangs were used in succession, an appreciable interval of time intervening. If this occur when a snake at freedom strikes an object, it is, of course, possible that the animal may escape before the second fang is driven in by the traction of its proper external pterygoid muscle. At all events, it is certain that these facts should receive due appreciation in estimating the danger of a given bite and the value of an antidote.

There remains for consideration one muscular motion, which I have observed to accompany the effort to bite when the snake is held by the back of the neck. It consists in a turning outward of the points of the fangs, so as to separate them from one another.* This divergence of the fang points is disadvantageous, inasmuch as it causes them to enter somewhat obliquely, and frequently throws one fang beyond the part bitten, when that part happens to be small. It has a use with reference to the snake itself, since the fang points, when thus widely separated, lie oustide of the lower jaw, and are thus prevented from wounding it. This purpose is greatly aided by the action of a muscle analogous to the mylo-hyoid, which approximates the anterior extremities of the lower maxillary, or mandibular bones, so as to make narrow the extremity of the jaw. The protection thus obtained is very essential, since the serpent always closes the jaw violently when biting, but does not always succeed in seizing its prey. Whether or not this divergence of the fang points occurs when the snake bites unrestrainedly, I can not say, but as I have been very often astonished at the distance between the wounds, when both fangs had taken effect, it is highly probable that it occurs under all circumstances.

The power with which the venom is ejected from the tooth depends somewhat upon the amount contained in the gland and its ducts. When the snake fails to

*I could not determine whether this divergence took place when the snake, at freedom, struck an animal.

strike the object aimed at the poison is sometimes projected several feet. In one case which is known to me, it was thrown into the eye of a man standing 5 or 6 feet from the snake, when it struck upward at a stick held above its coil.

The study of the complicated mechanism which we have endeavored to explain will aid us in understanding several points of interest in connection with the bite of the rattlesnake.

It must be perfectly apparent that in a sequence of movements so elaborate it will occasionally happen that, from a failure in some one of the essential motions, the ultimate purpose of the whole will be interfered with. Thus, it sometimes chances that the serpent miscalculates the distance, and fails from this cause. Or, again, when the object aimed at is very near, the initial force of the blow is lost, and the tooth does not enter; no uncommon occurrence, where the animal struck is an old dog with a tough skin. Again, if the upper jaw be not elevated sufficiently, the fangs are sometimes driven backward, by the force of the forward impulse, as they touch the part attacked, and the venom is then apt to escape between the tooth and the covering mucous cloak. Upon one occasion, having allowed a small snake to strike a dog, the former became entangled, owing to the hooked teeth of the lower maxillary bone having caught in the skin. Upon examining the snake closely, the dog being held, I found that the convexity of the fangs lay against the skin, on which were thrown one or two drops of venom. On removing the snake, and inspecting the part struck, I could find no fang wound, although the skin was visibly torn by the smaller teeth. I have seen the rattlesnake strike with great apparent ferocity, a number of times, when I have been unable to discover any fang wound whatsoever, and this has taken place, occasionally, with small animals, such as the rabbit, which must have been seriously effected by even a small amount of venom.

It scarcely ever happens that an animal is bitten without a part of the injected venom being cast on the skin near the wound made by the fangs. This wasted material probably escapes from the duct, where it is in opposition with the lower opening of the fang canal, and may be merely that excess of fluid which the fang can not carry. In some cases, however, it is quite possible that the relations of the fang and the duct are so disturbed that the venom never enters the tooth at all. It is certainly true, as has been already stated, and as Dr. Wyman has shown, that the fang must be fully erected in order that the duct shall be so firmly held in contact with the fang, as to insure the passage of the venom through this latter organ.

Finally, it sometimes happens that the blow is given, the fang enters, and from the quick starting of the animal injured, or from some other interrupting cause, it is withdrawn so soon that the larger portion of the poison is thrown harmless upon the surface near the wound. Under these circumstances, the resulting symptoms are, of course, trifling, and how well such an occurrence would be calculated to deceive the observer, who employed an antidote in a like case, can be readily conceived.

In a more popular paper* Dr. Mitchell remarks that the nervous mechanism which controls the act of striking seems to be in the spinal cord, for if we cut off a snake's head and then pinch its tail the stump of the neck returns and with some accuracy hits the hand of the experimenter if he has the nerve to hold on. A little Irishman who took care of the doctor's laboratory astonished him by coolly sustaining the test, but did it by closing his eyes and so shutting out for a moment the too suggestive view of the returning stump. In the memoir previously quoted, on the other hand, he mentions that in one or two instances persons who were ignorant of the possibility of this movement have been so terrified at the blow which has greeted them as to faint on the

*Century Magazine, XXXVIII, August, 1889, pp. 503-514.

spot. The educated public which has seen so many wonderful tales concerning snakes disproved have in turn become skeptical about almost everything told about them not of the most commonplace character. Hence, the somewhat ironical introduction to the following story, which made its round through the daily press of the country, and which is no doubt correct in every particular:

Prof. Brewer, of Yale, recently told a good snake story. Years ago he was in California and had his tripod and other surveyor's instruments in the field. Stepping along in the bushes he felt a movement under his feet, and found that he was standing on a 4½-foot Rattlesnake—a large, vicious and fighting fellow. But the snake was so pinioned that he could not strike the thick boot that held him fast. Prof. Brewer held the rattler's head down with his tripod and cut it off. Then he cut off his rattles. Stepping aside, he saw the body of the snake, partly coiled, lying very still. Taking out his rule to measure its length, the professor took hold of the serpent to straighten him out.

"Quick as an electric shock," said Prof. Brewer, "that headless snake brought the bloody stump over and struck a hard blow upon the back of my hand." He added: "I knew that his head was off and that he could not poison me, but that quick and hard blow of the rattler made my hair stand on end."

However, the most dramatic incident of this kind is undoubtedly Mr. George Catlin's adventure on the Rio Trombute, one of the tributaries of the Amazon River in South America. The story as told by Mr. Catlin's companion * is to the effect that Mr. Catlin having shot at the head of a huge Rattlesnake had apparently missed it, as the snake was seen to strike and hit him in the breast, where it left a bloody spot on the shirt. The dress was torn open and one of his half-breed companions prepared to suck the poision out of the supposed wound; but looking a moment for the puncture, he got up, and with a smile of exultation he said, "There's no harm; you'll find the snake without a head." In the weeds near-by the snake was found, closely coiled up, where he had fallen, with his headless trunk erect and ready for another spring, the head having been shot off.

If we make some allowance for the necessarily high coloring of the narrative and the exaggeration almost inseparable from an account of an occurrence so strange and exciting, there seems to be no good reason to doubt that it took place in the main as related.

Beyond the "pit" there is but little to distinguish the Pit Vipers as a whole from the other vipers, and, beyond the poison apparatus and the changes in the various organs of the head directly or indirectly connected with this apparatus, they differ not materially from the bulk of the snakes. One group of the pit vipers possesses, however, an organ quite unique, not only among the vipers, but among all the snakes as well, so that it seems the better plan to treat of it in the present connection instead of later on under the head of that particular group. I refer to the "rattle" of the Rattlesnakes.

* See Catlin's, "Life amongst the Indians" (New York; Appleton & Co., 1867), pp. 247-249.

It may seem superfluous to describe this well-known instrument in detail, but as the internal structure may not be clear to everybody, and as without such a knowledge it will be difficult to explain the development and use of this organ, we are obliged to investigate it more closely.

It will be seen (figs. 23, 24) that the tail end of the Rattlesnake instead of gradually tapering to a point covered by a cone-shaped more or less

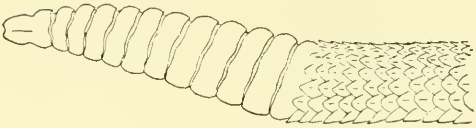

Fig. 23.
PERFECT RATTLE OF A LARGE BANDED RATTLESNAKE.
Side view. Three-fourths natural size.
(After Garman.)

acute scale, as in most other snakes, continues rather thick to where the rattle is appended. The rattle itself in its perfection is shown in the above figures, and appears externally to consist of a series of strongly compressed horny rings joined rather loosely together, the terminal one, the so-called "button," ending in a compressed, somewhat cone-shaped cap, which is set off from the basal swelling by a slight constriction.

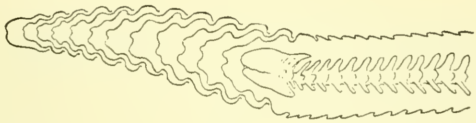

Fig. 24.
LONGITUDINAL SECTION OF RATTLE.

The upper and lower outlines of the rattle will be seen not to be straight but curved lines, the tendency of the joints to sag downward by their own weight being counteracted by the fact that the width of each ring is greater at the lower edge of the rattle than at the upper. Mr. Quelch, the director of the museum in Georgetown, Demerara, has shown that the object of this arrangement is to protect the rattle

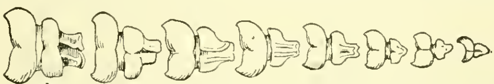

Fig. 25.
SEPARATE SEGMENTS OF DISJOINTED PERFECT RATTLE OF CROTALUS.
Side view.
a button; *h* basal joint.
(After Czermak.)

against injury and moisture when the snake is moving over the ground by keeping the somewhat delicate instrument automatically raised.

In order to study the internal structure of the rattle so as to learn how the various joints are linked together we will have to either pull them apart separately (fig. 25) or make a longitudinal section through the organ (fig. 24). It is then seen that each "ring" is in reality a "button" that fits over and conceals the terminal portion of the foregoing (proximal) joint, leaving exposed only the basal swelling, the ring. The joints are consequently a series of partly overlapping thin horny capsules or "cones." These "cones" have a wavy outline consisting of two or three swellings and two constrictions. It will also be observed that the free edge of the cone is bent inward and fits into the basal groove of the preceding cone, so that the basal swelling of the more distal cone clasps around the second swelling of the one nearer the body. The opening being narrower than this swelling, the two cones are effectually linked together by means of a kind of restricted ball-and-socket articulation, modified by the shape of the joints.

It will furthermore be noted, upon actually dissecting the tail end of the body, that the basal cone of the rattle forms the horny cover of a strong thickening of the skin which, in turn, envelops a more or less cone-shaped compressed bone. This bone terminates the vertebral column, being in fact the 7 or 8 last vertebræ enlarged and fused together into one.

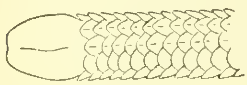

Fig. 26.
TAIL END OF EMBRYO OF MASSASAUGA.
Side view. Three times natural size.
(After Garman.)

Upon this dermal thickening surrounding the terminal bone, the epidermal horny capsule is evidently formed. The latter, in the same manner as the rest of the epidermis in the snakes, in the course of its growth becomes detached from the secretory layer, and a new epiderm is formed beneath it, but while on the rest of the body this renewal of the outer skin results in the well-known process of sloughing, the peculiar shape of the horny capsule of the end of the body and its greater thickness and strength prevents its slipping off in the same manner. It is consequently pushed out from the end of the tail closely clasping around the median constriction of the new cone which now appears externally as the basal "ring."

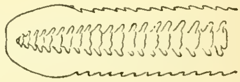

Fig. 27.
DIAGRAMMATIC LONGITUDINAL SECTION OF FIG. 26.

Prof. Samuel Garman has carefully worked out and beautifully illustrated the successive stages of the growth of the rattle from the first indication in the embryo to the perfected organ in the full-grown snake, and from his paper* the following account is mainly taken:

In very early embryos of the Ground Rattlesnake, *Sistrurus miliarius*, some of them already 3 inches long, the tail was not yet furnished with scales, though the entire body was well provided. Outwardly the tail was short, thick, blunt, slightly compressed, but with no indication of the characteristic feature so prominent after birth. Embryos of a nearly allied species, the Massasauga, *S. catenatus*, however, which were older and twice as large, showed a distinct promise of the future rattle in the shape and size of the terminal cap, or button (figs. 26, 27),

*The Rattle of the Rattlesnake. Bulletin Mus. Comp. Zoöl. Harv. Coll., XIII, No. 10, pp. 259–268, pls. I, II. August, 1888.

which is as yet incomplete and but little more than half what it ultimately becomes. There are now scales on the tail, but they show no fusion with the button around its front border. Within the button the vertebræ are still distinct and surrounded by muscle. The next step is illustrated by one-week-old young ones of the same species (figs. 28, 29), $8\frac{1}{4}$ inches in length, which show a decided gain, the externally visible

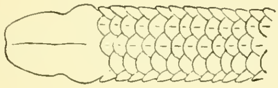

Fig. 28.
TAIL END OF ONE-WEEK-OLD MASSASAUGA.
Side view. Nearly three times natural size.
(After Garman.)

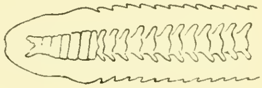

Fig. 29.
DIAGRAMMATIC LONGITUDINAL SECTION OF FIG. 28.

part of each ring having been now acquired. In no case is there any disposition on the part of the scales to fuse with the button. Inside of the latter the changes have been even greater; the vertebræ, still plainly outlined, have consolidated into a single elongate mass, the size of which is being increased by both lateral and terminal growth; the vertical processes have grown together; and the muscles have been displaced by the enlarging bone and the thickening skin. Figs. 30 and 31 finally show us the status of a 14-inch-long Prairie Rattlesnake,

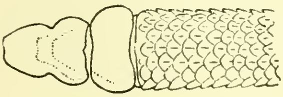

Fig. 30.
INCIPIENT RATTLE OF YOUNG PRAIRIE RATTLESNAKE.
Side view. $1\frac{1}{2}$ natural size.
(After Garman.)

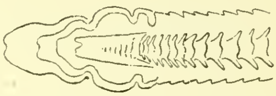

Fig. 31.
DIAGRAMMATIC LONGITUDINAL SECTION THROUGH FIG. 30.

Crotalus confluentus, which was taken, with the third button about half grown, when the process of pushing back the second ring was well under way. The first ring had been set free with the first slough, holding only by the collar, and if the snake had been allowed to live a little longer, the second sloughing would have discovered the third button perfected, clasped by the second ring, the latter pushed back and loosened from the balance of the epidermis.

It should be added that the period of appearance of the first joints seems to vary, inasmuch as there are apparently trustworthy records of embryos having been found with more than one joint.* It is interesting, in this connection, to remember Dr. Hay's observation that hognose snakes commenced to shed their skin within a few minutes after having left the egg.† As the young Rattlesnake leaves the egg covering before being born, may it not also occur that it sheds its skin before birth—at least, sometimes?

* Hopley, Snakes, 1882, p. 299.

†Proc. U. S. Nat. Mus., xv, 1892, p. 394.

How hard it is to overcome a popular error which has once taken hold of the public mind is strikingly exemplified in the matter of the growth of the rattle. It was observed long ago, and commented upon by competent observers and scientists, that the common belief that each ring on a Rattlesnake's rattle represents a year of its life, and that its age consequently can be ascertained by simply counting the number of rings, is entirely erroneous. Still, the belief is so common that every scientific writer who treats of Rattlesnakes finds it necessary to repeat the (in print) threadbare denunciation of this fallacy, but evidently without the slightest effect so far as the general public is concerned, for the next newspaper report of the latest Rattlesnake killed in the neighborhood, and the newest edition of certain "popular" natural histories, repeat the same old fallacy. I do not expect to have better success than my predecessors in this respect, though it would not seem to be difficult to make people understand that the rattle is a delicate instrument which easily breaks; that old and huge Rattlers are often found with but one or a few rings; that a variable number of joints are added each year; and that the production of a ring can be accomplished in the course of every two or three months.

On the other hand, it is often asserted by good scientific authorities that a new joint is formed at each general sloughing of the skin. Schlegel * seems to have been the first to suggest this idea, which has been indorsed, among others, by Garman, who says (*op. cit.*, p. 259) that the Rattlesnakes differ from other snakes "in retaining a portion of each slough, that covering the tip of the tail, to form one of the rings of the rattle."

It has already been shown that the formation of the rings, or buttons, is a process of sloughing analogous to, or rather identical with, that of the rest of the outer skin, but this does not necessarily imply that the sloughing takes place at the same time, or that a new button is formed every time a sloughing of the skin takes place. Recent observations by a prominent Russian investigator, Dr. A. E. Feoktistow, seem to indicate that the two processes are, to some extent at least, independent. His conclusions are sufficiently important to warrant the following quotations from his paper: †

In June, 1887, I received ten living specimens of *Crotalus durissus*, which I have since been able to observe closely. Owing to want of a sufficient quantity of suitable food (the animals refused to eat anything but very young rabbits), I lost five of them in the course of the first six months. The remainder are in good condition, and now (August 16, 1888) devour birds in addition to rabbits. They live in a large terrarium provided with a spacious water reservoir, cement floor, and a permanent hot-water heating apparatus which renders it possible to maintain the temperature of the air in the interior at 20° to 22° R (=77° to 81.5° F). The snakes are provided with living food in sufficient abundance, and are equally lively in winter and summer.

* Essai sur la physionomie des serpens, 1837, II, p. 557.

† Zur Physiologie der Klapper des Crotalus durissus. Bull. Acad. Sc. St. Pétersbourg (n. s.) I, 1889, pp. 1–4. Also in Mél. Biol. Acad. Sc. St. Pétersb., XII, livr. 1, 1891, pp. 1–4. Translated in Ann. Mag. Nat. Hist. (6) XI, Jan., 1893, pp. 54–58.

This opportunity has enabled me to make accurate observations upon the growth, falling off, and renewal of the rattle. I am in the fortunate position of having been able to make certain observations upon healthy specimens with good appetites, which decide these questions.

In five of my snakes the long rattles fell off independently at different times, and I was now able especially to observe how rapidly these redevelop. I would first, however, remark that it is perfectly natural for the rattle of the Rattlesnake to fall off periodically or at irregular intervals, for the organ in question consists of dead, horny tissue, developed into the well-known hollow "cones," which, while partly inclosing one another to form the rattle, are yet only somewhat loosely connected together. Now, it may be readily understood that such a series of links, when it attains a certain length, is greatly exposed to mechanical injury, and, consequently, may easily break off. Without any harm to the snake itself, this chain may be also cut off or torn off by force. This is, indeed, the simple reason why the rattle never becomes particularly long, and rattles with 15 to 18 joints are rare. As a rule, the rattle only lasts long enough to become 8 or 9 jointed.

As I have already stated, I was able to follow the reproduction of the rattles in the case of five of the Rattlesnakes which had lost these organs. So long as their rattles remained short, the snakes were naturally also unable to make a noise. But the joints were gradually replaced, and in such a way that in all cases, in the course of from three to four months, two new ones were added to the remaining (now terminal) joint. Three-jointed rattles like these produced already a fairly loud sound. In the course of a year the rattles developed into chains with from 5 to 6 joints, and were then capable of producing the usual intense rattling sound. The reproduction of the rattles had no connection with the recurring sloughing of the skin. It is well known that the epidermis is shed without the rattle, separating close to the margin of the latter, and, indeed, in such a way that the end of the tail in the cast skin is represented by an aperture with finely notched edges corresponding to the rows of scales.

It consequently follows from my observations that a joint of the rattle can be produced in the course of every two to three months (during winter, autumn, and spring, of course by means of artificial warmth, the growth of the rattle evidently proceeding much more slowly in the natural state), and I do not understand why other observers have not noticed the growth of the rattle in captive Rattlesnakes. Probably the snakes were kept under conditions unfavorable for their welfare, whereby the vital processes were checked. Perhaps, too, the observations were not conducted with sufficient care.

Dr. Feoktistow's strictures upon previous observers are not quite well founded, for Dr. Holbrook has recorded, as early as 1838, that he knew two joints to have been added in one year, and that Dr. Bachman had observed four produced in the same period.* It has also been stated before that Dr. Cotton, of Tennessee, "had a Rattlesnake which shed its skin on an average twice a year, and he observed a new link to the rattle on each shedding."†

The observations made by the Russian naturalist do not in all particulars agree with those of a somewhat later investigator, whose facilities were not inferior. On the contrary, Mr. J. J. Quelch, who conducted his experiments with snakes born in confinement in the museum in

* N. Am. Herpet., 1 ed., II, 1838, p. 85; 2 ed., III, 1842, p. 14.

† Hopley, Snakes, 1882, p. 298.

Georgetown, Demerara, consequently in a tropical climate and the home of the snakes, must be said to have had even superior advantages. In a very interesting paper published in "Timehri,"* of which he is editor, he gives as his experience that the sloughing, or exuviation, of the general skin and that of the terminal button, or cap, of the tail forming the new rattle joint take place at the same time and are part of the same process. It is consequently possible that Feoktistow's results may have been caused by irregularities of the sloughing process, due to the captivity. Out of twenty-four specimens bred in a cage in the museum, Mr. Quelch brought two up on mice till they reached a length of more than 3 feet, when the paper was written. Here is an abstract of his account relating to these specimens:

At birth they were from 9–10 inches in length and ¼ to ½ inch thick, and like the other 22 of the set possessed but a terminal, elongated, horny, stump, though under the termination of the scales an anterior piece was to be observed. Now, 16 months after, they are more than two feet in length and more than an inch thick—one, which has throughout been the more voracious, being somewhat longer and thicker than the other—and the larger one possesses a rattle of four separable links, while the other has six of these, but the individual links considerably smaller than those of its brother. In the case of the smaller snake, with six pieces in the rattle, these correspond with each exuviation, the rattle being perfect, and bearing the terminal elongated stump with which it was born. In the other, with four, three terminal links have been lost, these having been detached during its sixth exuviation. During 16 months, therefore, the one has had seven exuviations, and the other and smaller but six.

In a later note, supplementary to the above (*op. cit.*, pp. 170–171), Mr. Quelch adds the following:

Since writing the foregoing paper it has been possible, from actual observation of these young forms, to trace the development of the rings still further. On February 5th the larger of the two young specimens was about 2½ feet in length and possessed four rattle rings. Since then two exuviations have taken place, one on Wednesday, March 25th, when an extra ring was added to the rattle, thus making five; and again, about two months after, on May 27th, when the sixth ring was added. In the case of the smaller snake, which on February 5th was about 1¾ feet in length, two exuviations have also taken place, at intervals also of about two months between each exuviation. On February 28th an extra ring was added by change of skin; and again on May 4th, when 8 rattles were registered in total number. It is noteworthy that in the larger specimen of these two young ones there are only six rings, three having been lost in early changes, while in the smaller specimen there are eight, the total number from birth being retained, as shown by the presence of the original terminal button with which they were born. The larger specimen is now (June 11th) about 3¼ feet in length, while the smaller is about 2¾ feet. During early life these vipers are thus, with free diet, observed to exuviate and thus add to the rings of the rattles every two months.

Dr. Feoktistow, where he speaks of rattles with from 15 to 18 joints as being rare, adds in a footnote that "rattles of 42 joints, as figured by Seba, surely exist only in the imagination." There is said, however, to be a later account and figure of a rattle of no less than 44 joints,

*The Rattlesnake.—The Growth of the Rattle. Timehri (n. s.), v, pt. 1, June, 1891, pp. 1–11+plate.

viz, in the "Columbian Magazine or Monthly Miscellany" for November, 1786, as follows:

> The common number of fibulæ seldom exceeds 14 or 15 in a rattle; but the one given (fig. 4) is certainly a very great curiosity, even to a person who has seen a great number of this genus of snakes. The fibulæ are 44 in number. The snake from which this rattle was taken was not, as might be expected, of a size proportionate to the prodigious length of its rattle, but rather of a middling-sized snake. It was killed some time in the summer of this year, at Fort Allen.*

The most plausible explanation seems to be that some practical joker joined several rattles, thus deceiving the unwary paragrapher.† The greatest number of joints recorded so far by a fully trustworthy authority is, I believe, 21 as seen by Holbrook (N. Am. Herpet., 1 ed., II, p. 85), unless we accept Miss Hopley's somewhat vague statement, possibly only made on hearsay, that "a Crotalus [species not given] at the London Reptilium had twenty-five links at one time" (Snakes, p. 301), or Catesby's figure of a *C. horridus* with 24 joints. (Carolina, 1743, II, pl. xli.)

If the reader will again examine the representation of a perfect and full-grown rattle, given above (fig. 23), it will be seen that the basal rings are nearly equal in size, while the terminal ones rapidly diminish in size toward the tip. The latter were, of course, formed during the early years of the snake's life, when its growth was rapid, the increasing size of each succeeding joint testifying to the corresponding increase of thickness of the end of the tail. Later on this increase is much slower and the new joints do not materially differ in diameter from the preceding one. If, therefore, in the adult snake the rattle breaks near the base, the new rattle which will grow out to succeed the lost one will have an entirely different shape, the upper and lower outlines being nearly parallel and the terminal button as large as the basal ring, while the perfect, unbroken rattle tapers off toward a small and rather elongate button. This difference between the parallelogrammic rattle and the tapering rattle was once held to indicate specific differences and was used as a systematic character, but Garman has effectually disposed of this notion in the paper on the rattle so often referred to above.

When crawling over the ground the rattle, as shown in fig. 23, is carried with the greatest width vertical and somewhat raised off the ground, so as to prevent it from dragging.

It is often sounded even in this way, but the usual position assumed by the snake when vibrating the rattle in earnest is when coiled up and

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* Quoted from DeKay, Zool. N. Y., III, 1892, p. 56, footnote. Of course, we place no more credence in the story of the man who told Kalm that in his younger days he had killed a Rattler with 30 joints than in the one quoted above. (Kalm, Svenska Vetensk. Acad. Handl., XIII, 1752, p. 316.)

† A correspondent recently informed the Smithsonian Institution that he was in possession of a "fossil rattle" of about 45 joints. The fossil, when received, proved to be an *Orthoceras*, a mollusk of the Devonian age.

ready for defense or offense. The rattle is then as a rule raised nearly vertically in the middle of the coil, though it not only can, but really does, rattle with the instrument poised outside of the body rings. When shown the original drawing of the Banded Rattlesnake, now reproduced on pl. 9, a friend of mine criticised the position as unnatural, since in his opinion the snake could not sound the rattle outside of the coil. Fortunately I had a huge live Texas Rattler, *Crotalus atrox*, near by, and upon repairing to the cage and trying to induce the monster to rattle, his very first performance was given in the position shown in the criticised illustration.

The rattling sound is produced by a vigorous shaking and vibrating of the end of the tail, the dead, horny cones producing a noise of different pitch and volume dependent upon the size and vigor of the animal and the dryness of the rattle. Under ordinary circumstances the sound is not kept up constantly for any length of time, but that is not for want of ability, for it is well known that captive Rattlesnakes may be induced to rattle continuously for hours.

Dr. Feoktistow, in the memoir already quoted, has given an account of an interesting experiment made for the purpose of ascertaining the number of vibrations which the rattle makes per minute, which deserves to be reproduced here:

> A large Rattlesnake was grasped by the neck, while an assistant thrust a needle through the middle joint of its seven-jointed rattle in such a way that it pierced the rattle in its greatest diameter, consequently from above downward, if we imagine the snake lying quiet with its tail outstretched upon the ground. Now, since the rattle (in the position in which we have supposed the snake to be) is, in making a noise, moved from left to right and back again, the needle was able to trace curves of vibration upon paper blackened with soot. As a registering apparatus I used Dudgeon's polygraph, with a strip of blackened paper which was made to slide rapidly forward by means of the clockwork. The tail of the snake was, to a certain extent, fixed by my holding the snake with my hand in the region in front of the vent. After much trouble I succeeded in bringing the needle in a suitable manner into contact with the strip of paper, and in obtaining curves of vibration, from which the number of the vibrations per minute (the rapidity of the progression of the strip of paper being known) could be calculated with a fair degree of accuracy. In this manner it was found that the movements of the rattle are composed of great vibrations of the entire tail itself and of smaller vibrations of the actual rattle in such a way that the tail makes 75 and the rattle, on the other hand, 110 vibrations per minute. These are approximate average numbers, since I was able to obtain only faulty curves, because the rattle does not perform its vibrations precisely in one plane. Movements kept up for hours with rapidity like this are absolutely amazing. When observed with the naked eye, only a blurred image is seen of the rattle moving at this rate.

The Russian investigator was not the first, however, to attempt a determination of the vibrations of the Rattlesnake's tail. Dr. Isaac Ott, as early as 1882, tried an experiment similar to that of Dr. Feoktistow. From his statement* it may be sufficient to quote the following:

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* The Vibration of the Rattlesnake's Tail. Journ. Nerv. and Mental Disease, New York (n. s.), VII, Jan.-Oct., 1882, pp. 514-516.

The snake experimented with was one which had been kept about nine months, and was not as energetic as one recently caught, but the note of his rattle was as usual. His head was secured by means of a wire around the neck, and at the end of his rattle was attached a short piece of thin copper wire by means of sealing wax; then the tail was taken in hand and the point of the copper pen directed against the smoked revolving drum of a Marey-Secretan apparatus. A tuning fork was run over the drum to determine the rate of movement of the drum. By an analysis of the curve it was found that the rate of vibration of the tail was about 60 per second.

Dr. Ott, it should be added, admits the possibility that the number of vibrations recorded are less than the actually normal number. Remembering the fact that the snake experimented upon was less than normally energetic, the result agrees tolerably well with that obtained by Feoktistow seven years later.

The question, "For what purpose does the snake rattle?" is still an unsolved one. Possibly it will ever remain so if we continue to look for one single purpose which may be considered so important in the animal's economy as to have brought about development of such a specialized instrument. Philosophers when attempting to explain the utility to the snake of acquiring the rattle have often failed, because it seemed evident that the rattle, so far from being useful to the snake, in most cases appears to be a disadvantage, which has led to the almost total extinction of the Rattlers in the cultivated and more densely inhabitated districts of the country. It must not be forgotten, however, that the rattle was evolved long before man appeared upon the stage, and that the question of its disadvantageousness in the struggle against his supremacy could have no influence upon its evolution. The history of evolution is full of similar examples of animals having acquired an advantageous character which, when new enemies appeared, was turned against the owner because it could not be undone or modified to suit the new conditions, thus leading directly to his extermination.

The theories of the use of the rattle are numerous, even though we exclude from the discussion the one that it is "a providential arrangement to prevent injury to innocent animals and man."

An interesting discussion of this question was started by Prof. N. S. Shaler about twenty years ago, in a paper entitled "The Rattlesnake and Natural Selection,"* in which he receded from the position previously held by him that "the tail appendage of the Rattlesnake was not to be explained on the doctrine of natural selection, inasmuch as it could contribute in no way to the advantage of the animal." Having once himself in the field mistaken the rattling for the sound made by the "locust," *Cicada rimosa*, Say, he conceived the idea that the object of the noise is to decoy insect-eating birds "into the range of the serpent's spring" by an imitation of the cicada's sound, and he consequently admitted that the case of the Rattlesnake did no longer seem "the bar to the acceptance of the theory it once did."

* American Naturalist, VI, 1872, pp. 32–37.

The similarity of the rattling sound to that of certain grasshoppers has been commented on by many writers both before and since, and is indeed in many cases astonishingly deceptive; but there are several great difficulties about this theory, chief of which are that birds seem to form a very small portion of the Rattlesnake's diet, and that on the other hand the birds do not seem to rely principally on their ear in hunting grasshoppers.

Prof. F. W. Putnam (*op. cit.*, pp. 693-694) took issue with Prof. Shaler, and suggested that the true function of the rattle is most likely to serve to call the sexes together. This theory received shortly after valuable support from an observation made by Prof. Samuel Aughey, who recorded* his experience while surveying in July, 1869, along the Logan River in Wayne County, Nebraska.

> While washing a collection of unios at the water's edge [he writes] I heard the familiar rattle of the Massasauga (*Crotalophorus tergeminus* [=*Sistrurus catenatus*]). I quickly crept up the bank and cautiously looking over the level bottom I saw, at the distance of about 30 feet, a rattlesnake coiled up with the head erect and gazing in an opposite direction from my position. Every three or five minutes the snake would cease rattling for a minute or more and then commence again. In about half an hour from the time that I first saw the snake I observed another Rattlesnake approach the first one. Closer and closer the second one approached, until at length they met and indulged in a sexual embrace. I watched them for at least an hour and left them at last without disturbing them.

He also related an instance where three Rattlesnakes made their appearance on the scene of a battle between hogs and another Rattlesnake, apparently called in by the rattling of the latter.

The same observer also hints at another use of the rattle, suggesting that the noise may possibly frighten and thus paralyze the victim into submission, at the same time explaining the phenomena which by other observers have been attributed to a peculiar "charming" power supposed to be possessed by these reptiles, and of which we shall hear more further on.

The theory which appears most commonly accepted nowadays is one which was elaborated by J. G. Henderson, in a reply † to Shaler's article above referred to. He advanced the idea that the sounding of the rattle, so far from inviting the destruction of the snake,

> is one of the most effective means of self-protection, and is as useful to it in the race for life as is the growl of the tiger when threatened with danger. The snake does not sound its rattles until it considers itself discovered, and not then unless it apprehends danger. It throws itself in position to strike and says in unmistakable language, "Look out, I am ready for you!" If pushed upon, it makes its leap at its antagonist, and again throws itself in position to renew the conflict, and again sounds the note of defiance. * * * The ability of the snake to defend itself does not consist in its strength or size, or in its power of overcoming its adversary by a prolonged conflict, for most of its enemies are its superior in size and strength. Nor does its deadly poison act quickly enough to secure its own safety when it is

* American Naturalist, VII, 1873, pp. 85-86.

† Use of the Rattle of the Rattlesnake. American Naturalist, VI, 1872, pp. 260-263.

attacked, but, in most cases, the victim, after the deadly stroke is given, may still revenge itself by the destruction of the snake. But the certainty of the effect of the poison serves as a warning and is advantageous, not in defense after the attack is made, but in preventing an attack from being made.

The point here made is certainly a strong one, and the theory has been given a further application by the consideration, especially advocated by Garman,* that inasmuch as the success of the snake in capture of food depends on an ever-ready supply of poison, the rattling sound is advantageous if it keeps away disturbers which can not serve as food and thus prevents useless expenditure of venom or even the breaking of the fangs.

If we now look at the various explanations given, it seems possible to accept them all as partly true. The rattle having once been acquired it seems even probable that the snake used the sound for the various purposes indicated, though of course it may be difficult to point out which one has mostly influenced the evolution of the instrument. To me the rattling appears as a substitute for a *voice*, and I think it is quite logical to conclude that it may be put advantageously to all the uses to which an animal may apply its voice.

It has long been known that most snakes when agitated produce a whirring or rustling sound, which often strongly resembles the noise of the Rattlesnake, by rapidly vibrating the end of the tail among dead leaves, or against some other object, even their own body. Many an innocent snake has, on this account, suffered an untimely death, having been mistaken for the deadly rattler. This fact has been used as an argument in favor of the preventive theory, since, if the rattling is advantageous to the rattlesnake in preventing attack by its enemies, the imitation of the noise must also prove advantageous to the mimickers. The fact that this pseudo-rattling is indulged in by the deadly snakes without a rattle does not mitigate against this theory of imitation, for of course, if it is advantageous to the rattlesnake to have a means of preventing unneccessary waste of poison or useless exposure to breakage of the fangs, the imitation must be equally advantageous to the Copperhead or the Moccasin. But the futility of the theory is shown not only in the fact that this vibration of the tail is so universal, but still more so because it does not seem to be confined to the snakes of America, to which part of the world the Rattlesnakes are restricted.

It is evident, then, that this vibrating of the tail, so far from being an imitation of the rattlesnake's way of making itself heard, was a common characteristic of most snakes before the Rattlesnake evolved from the common ancestral stock of Pit Vipers. Whatever the cause of this phenomenon—and we may well accept Herbert Spencer's suggestion, as applied by Shaler (*op. cit.*, p. 36), that the wagging of the dog's tail and similar movements of that appendage is an escape of nervous force restrained from other modes of expression at the moment—we may take

*Ophid. N. Amer., 1883, p. xxvi; Bull. Mus. Com. Zool., XIII, 1888, p. 261.

it for granted that the forms from which the Rattlesnake evolved were in the habit of vibrating the tip of the tail at a high rate of speed. This condition clearly understood, there is no difficulty in tracing the origin of the rattle.

In this connection I may again call attention to Garman's often quoted article,* and to reproduce his figure of the tail and of a specimen of the Copperhead, *Agkistrodon contortrix* (fig. 32). It does not need long explanation to show how easily a tail cap like the one represented might be modified into the button, the ring-like swellings of which would prevent the slough from being pushed off. The development once started, the increasing irritation would lead to heightened nutrition and excessive accumulation of tissue. In tracing mentally this evolution it must not be forgotten, as Garman on a later occasion (Science, xx, 1892, p. 17) remarks, that the present development of the rattle "embraces much that is a consequence of its possession, much that has been induced by its presence and use."

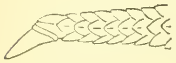

Fig. 32.
TAIL END OF THE COPPERHEAD
Side view. Nearly twice natural size.
(After Garman.)

Garman expressly protests against the assumption that the rattlesnakes have been derived directly from the copperhead, and thinks it more probable that the two rattlesnake genera have had a double origin, *Sistrurus* having been derived from a stock more nearly related to *Agkistrodon;* the *Crotali* proper, with small head scales, from forms nearer to *Lachesis.*

I can not agree to this proposition, which lays more stress on the number and size of the head shields than upon the rattle and the other characteristics of these snakes. The rattle is a highly specialized instrument, essentially alike both in *Crotalus* and in *Sistrurus*, while the nine large head shields, in the possession of which the latter genus agree with *Agkistrodon*, is the common, generalized arrangement which they share with nearly all the nonvenomous snakes, and which was undoubtedly a characteristic of the ancestor from which they all—including *Lachesis* and *Crotalus*—have been derived. There are, indeed, numerous examples among various species of *Crotalus* of individuals showing a tendency to a reversion to this ancestral arrangement.

The popular belief in the power of the poisonous snake to "charm" its victims into a state of helplessness is by no means exterminated. In spite of all that has been argued and explained against it there are people still who profess to have ocular proof of this power. Time and again it has been related by trustworthy observers how birds or small mammals have been seen to approach the coiled snake, drawn toward it as by a magic spell they were unable to withstand; how, under the influence of an excitement which made them forgetful to everything around them, apparently dreading the terrible fate awaiting them yet unable to avoid it, they finally ventured too near, only to be hit by the lightning stroke of the hitherto almost motionless snake, whose only

* Bull. Mus. Comp. Zool., XIII, pl. ii, fig. 14; Science, xx, 1892, p. 17, fig. 5.

sign of life consisted in the following of the victim's mad efforts with the staring eyes and the incessant darting out and in of the rapid tongue. Many of these blood-curdling tales are unfortunately embellished with such absurd details, evidently the children of an inflamed imagination, as to throw discredit on the whole story. It is not uncommon to hear it stated that the eyes of the snake were emitting fire, and that the unfortunate victim finally darted directly into the widely expanded mouth of the expectant reptile.

In spite of these extravaganzas, however, there is evidently enough truth in the numberless observations of this nature to keep the scientists (whose duty it is to doubt and dissect all these things) busy trying to evolve a theory by which to explain so much of the stories as appeared worthy of being admitted as facts. Old as the stories are, the explanations and theories of the doubters are not of yesterday either. One hundred and forty years ago Peter Kalm, a Swedish naturalist, and pupil of Linnæus, wrote a detailed and, considering the time, accurate and interesting account* of the Rattlesnake, based upon his experience during his travels in Eastern North America, in which he gives an elaborate description of how the fascination is said to take place. He then continues as follows:

This is the story as commonly told by the inhabitants of North America, both by the common people and by the better classes, by the ignorant as well as by the learned. I myself have never seen it, and have even now great difficulty in believing it. Among the many hundreds who have told me of it not more than ten or twelve asserted that they had seen it with their own eyes. However, among these there were some men so trustworthy, and their accounts agreed in most particulars so well, that I almost gave up all doubt as to the truth.

I have attempted to explain this alleged charm in this way: I have seen in America how numerous birds in the woods were running on the ground in search of food and so tame that a man could approach very close; they might in the same manner get too near to the snake, which is lying quiet and thus might easily have a chance to strike them; the bird is unable to get away farther than the nearest tree, where it is obliged to rest and finally falls down, the snake now seizing its prey. This explanation was particularly suggested to me by the story told me by a woman in America, who had once seen a rabbit running across the road, then suddenly stop and fall down as if crazy. She then saw a Rattlesnake which had followed the rabbit, but she did not take time to observe what followed. We often see that when a cat is out hunting, the little birds collect about him from some distance, uttering a certain cry. If the bird has its nest in the neighborhood, the greater noise it will make and the nearer it will approach. The cat walks quietly along, as if it does not concern him at all; the bird becomes the more daring; it approaches nearer and nearer till it comes within reach of the cat, or even darts down upon his back; that is the opportunity of the cat to grab it. Some small birds in America, not at all afraid or having their nest near the roadside, often act in the same manner at the approach of man, often flying almost direct in the faces of the passers-by. As the sparrows pursue the hawk, thus small birds make outcries at their enemies and become more daring the quieter the latter are; the same, possibly, takes place with the fascination of the rattlesnake. Or may it be that they approach too close out of curiosity, since his eyes glitter and burn like fire when angry or when said to be fascinating? Or is it

* Sv. Vetensk. Acad. Handl., XIII, 1752, pp. 308–319; XIV, pp. 52–67; pp. 185–194.

possible that the charm is due to some fetid and poisonous odor which he emits and by which the animals are overcome and made unconscious? Or may not every one of these suggestions contribute toward the result?

The speculations of a century and a half have added scarcely any new suggestion of apparent plausibility to those of Dr. Kalm, except, perhaps, the idea that the whirring noise of the rattle might produce such a terror in the intended victims as to completely paralyze their will power.

On the other hand, there has accumulated a mass of negative evidence in the shape of observations on snakes in captivity, which have led some authorities to deny entirely the actuality of the phenomenon. Dr. S. Weir Mitchell, who has had unexcelled opportunities of observation, has this to say* upon the subject:

I have very often put animals, such as birds, pigeons, guinea pigs, mice, and dogs, into the cage with a Rattlesnake. They commonly exhibited no terror after their recovery from alarm at being handled and dropped into a box. The smaller birds were usually some time in becoming composed, and fluttered about in the large cage until they were fatigued, when they soon became amusingly familiar with the snakes, and were seldom molested, even when caged with six or eight large *Crotali*. The mice, which were similarly situated, lived on terms of easy intimacy with the snakes, sitting on their heads, moving round on their gliding coils, undisturbed and unconscious of danger. Larger animals were not so safe, especially if they moved abruptly and rapidly about the snakes. The birds, mice, and larger animals often manifested an evident curiosity, which prompted them to approach the snake cautiously. Sometimes this was rewarded by a blow, as was sure to be the case when a dog indulged his inquisitiveness by smelling the snake with his muzzle. Sometimes the snake retreated, and struck only when driven to bay. Usually, the smaller animals indulged their inquisitive instinct unhurt, and were allowed to live for days in the same cage with the dreaded reptile.†

These are the sole facts which I have seen bearing any relation to the supposed fascinating faculty. They appear to me to lend no strength to the idea of its existence.

Similar evidence is given by numerous other observers, some expressly adding that even the most threatening rattling did not seem to have any terrorizing effect upon the captive animals.

It should not be forgotten, however, that Rattlesnakes in captivity, as a rule, are very timid, dull, and with but very little desire to eat. Their victims, moreover, if wanted, are within easy reach, consequently there would be no necessity for exerting any faculty of fascination, even if the snake possessed it.

Dr. Alfred Brehm's experience, on the other hand, is more positive and seems directly to corroborate Kalm's first suggestion. According to Prof. F. L. Oswald's version, Brehm procured a couple of able-bodied Rattlesnakes and turned them loose in a well-lighted garret, where he could observe all their movements without betraying his presence. At first

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* Researches on the Venom of the Rattlesnake, 1861, p. 5.

† It is proper to add that the curiosity thus exhibited by animals, and especially by mice and dogs, was as active when the snake was not regarding the intruder as at other times.

his prisoners stayed in their lair in the recess of an open box, but on the morning of the third day they began to show symptoms of appetite, and the professor treated them to a breakfast of live blackbirds. About five minutes after the appearance of the newcomers, one of the snakes left her headquarters and crawled across to the corner next to the front window, while her mate took post behind a waterpot near the center of the room. The birds were too busy to notice them at all. The temptation to attempt escape in a lightward direction seemed to occupy them too much to mind such inferior incidents as the maneuvers of a crawling object on the floor. The front window with its large panes seemed to prove specially attractive, and the ambushed snake had just contracted her coils for the third time when the descent of a fluttering bird gave her a chance to bring matters to a crisis.

"No need of charming in this case," thought the professor when the stricken blackbird recoiled with a frightened squawk. But there was still need of patience. For nearly a minute the doomed bird fluttered about in an aimless way before the chemicals began to operate in earnest and he fell over on his side with half-opened wings. He was too far gone even to keep on his legs, and only then the snake crawled up to take possession of her prey, though she had all along watched her victim with glittering eyes.

Brehm repeated his experiment with sparrows, gophers, common rats, weasels, quails, woodpeckers, and meadow larks, and always with an analogous result, except in the case of a woodpecker that made its way to the top of the window and died out of reach of the serpent. In every other case the victim at first made its escape, but was captured *in articulo mortis*, after betraying its waning strength by all sorts of curious symptoms. Even the weasel gave up its attempt at retaliation after a short struggle, and in its last moments staggered out of its hiding-place and finally directly toward the approaching enemy.

I think I have seen it suggested somewhere, though I am now unable to find the reference, that the alleged faculty of fascination might be of a hypnotic nature. This suggestion may not be so entirely absurd as at first appears, if we remember the highly nervous and excitable nature of the birds and the ease with which some of them, at least, are brought under influences similar to those of hypnotism. In this connection I may call attention to a very curious device used in some parts of Germany for decoying larks, the so-called "lark mirror" (*Lerchenspiegel*). As described and figured by Naumann* it consists of an oval piece of wood studded with small pieces of broken looking-glass, some not larger than a pea, which is made to revolve upon a low stick put into the ground. The glittering of the revolving glass pieces reflecting the sun seems to attract the larks, which dart down upon it and are then caught in the nets. The flickering light seems to "fascinate" the bird.

* Naturgeschichte der Vögel Deutschlands, IV, pp. 186–187 (1824).

After all, is not the objection which some authors make to the power of "charming" or "fascinating" more directed against the use of these words themselves than against the phenomenon which they are intended to describe?

The possibility, already expressed by Kalm, that the victims might be overcome by a special fetid smell, said to be emitted by the snake, does not seem to have any foundation in fact, much less the more fanciful suggestion by more "popular" writers that the cause is a poisonous quality of the snake's breath. It is true that there are situated some glands about the vent which eject a fluid of a penetrating odor, if the snakes are handled roughly, but it is a common observation that the crotalids under ordinary circumstances issue no peculiar odor. Dr. Mitchell states that the fluid referred to is of a yellow or dark brown color; that it may be ejected to a distance of 2 or 3 feet, and that it is irritant when it enters the eye, although not otherwise injurious. I am not aware that these glands and their secretion in the pit vipers have been studied in detail.

Occasionally we hear of the finding of large numbers of Rattlesnakes or copperheads in caves in rocks brought to light by blasting for a railroad or a quarry. We are also all familiar with the periodically recurring story, now at least 200 years old, however, of the man who built his log cabin against the side of the mountain in such a manner that the perpendicular face of the rock formed the back wall of the hut, and who with his family had to spend the first night among the rafters because the heat from the fire had thawed out the inhabitants of a vast rattlesnake "den" somewhere in the rock, the noisy serpents coming out by the hundreds and taking possession of the floor and the beds. We have also heard the more modern and improved edition of this story, apparently due to the vivid imagination of western journalists, according to which the Kansas farmer erected the same log cabin in the same position—not for himself, however, but for his son, who intended to spend his honeymoon in it, and who, with his young bride, was found the morning after the wedding, killed and partly eaten by an army of the loathsome reptiles. It would fill an entire volume were I to mention all the gruesome snake stories that are served up by an enterprising press with an ever increasing amount of high seasoning to satisfy the cravings of a public now habitually fed on sensations. Stripped of all the lurid word painting, of all the epithets suggesting sliminess and other qualities not belonging to any snakes, and of all exaggerations as to numbers, stench, and noise, there lies at the bottom the truth that these poisonous snakes, like many others of the harmless kind, in winter often congregate in great numbers in some cavity in the ground or among rocks. In these retreats they spend the cold season in a state of more or less deep stupor, or lethargy, until warm weather comes to quicken their pulses, when they issue from their winter quarters, spreading out over the neighboring region and passing the summer solitary or in pairs. In very hot and dry climates this hibernation has an equivalent in the æstivation, by which term Dr. Cooper has designated a similarly lethargic state during the hottest and driest portion of the summer.

Considering the small number of these snakes met with in the fields or in the woods during the warm seasons, the large numbers sometimes found in these Rattlesnake dens in winter is simply astounding. It seems as if all the pit vipers of the surrounding country had come together in one spot, and there are good reasons to suppose that so is actually the fact. The question naturally arises: How have all these snakes obtained their information about this apparent place of rendezvous and how have they been able to find their way to it? It is a phenomenon in its nature not unlike that of the migration of birds, and is apparently even more difficult of a satisfactory explanation. The old pre-darwinian conception of the inherent and infallible instinct explains neither, but how is the more scientific idea of the inherited, unconscious knowledge accumulated and crystallized, as it were, during countless generations, how is it to apply in the present case?

As a matter of fact we know yet too little of the habits of the snakes and of their whole life history to give any explanation much better than a conjecture. I shall, therefore, not attempt any solution of the question here, but for the benefit of those who might want to take it up I shall quote an ingenious theory propounded recently by Mr. W. H. Hudson,* whose charming pictures of animal life in the Argentine Republic has made his name a household word among naturalists. After having briefly alluded to the habit of the rattlesnake to hibernate socially in dens, he proceeds as follows:

> Clearly in this case the knowledge of the hibernating den is not merely traditional—that is, handed down from generation to generation, through the young each year following the adults, and so forming the habit of repairing at certain seasons to a certain place—for the young serpent soon abandons its parent to lead an independent life; and on the approach of cold weather the hibernating den may be a long distance away, 10 or 20, or even 30 miles from the spot in which it was born. The annual return to the hibernating den is then a fixed unalterable instinct, like the autumnal migration of some birds to a warmer latitude. It is doubtless favorable to the serpents to hibernate in large numbers massed together, and the habit of resorting annually to the same spot once formed, we can imagine that the individuals—perhaps a single couple in the first place—frequenting some very deep, dry, and well-sheltered cavern, safe from enemies, would have a great advantage over others of their race; that they would be stronger and increase more, and spread during the summer months farther and farther from the cavern on all sides, and that the farther afield they went the more would the instinct be perfected, since all the young serpents that did not have the instinct of returning unerringly to the ancestral refuge, and that, like the outsiders of their race, to put it that way, merely crept into the first hole they found on the approach of the cold season, would be more liable to destruction.

* The Naturalist in La Plata (London, 1892), pp. 321–322.

Of all our native snakes, the habits of none are better known than those of our pit vipers, yet there are many points in dispute which it will require time and patience and good luck to settle. Other questions which we have considered to be answered must be discussed over again, because later observations seem to cast doubt upon the conclusions long since arrived at. Thus, we have believed it an undoubted fact that all the Pit Vipers bring forth their young alive. Gradually the conclusion had been gained that all of them in this respect are essentially alike, and that the progeny is comparatively limited in number. The constantly repeated stories of Copperheads having had innumerable young ones have been shown to rest on confusion with the young of the spreading adder. The average number of young Pit Vipers born by species occurring in our country seems to be 8 or 9, exceptionally as high as 14, while as many as 24 have been authentically recorded for some exotic forms. But now we read in the very latest edition of Brehm's "Thierleben" (Vol. VII, 1892, p. 444) that credence is given to the account of Geyer that he has observed a nest of about 40 Rattlesnake eggs in the very act of hatching! Now it is quite true that there are reptiles in which the time of the hatching and that of the expulsion of the eggs are so close that sometimes the young ones are hatched within the body of the mother, and thus born alive, but with these snakes the case is somewhat different, for the egg covering is so thin that it is most improbable that the eggs are ever expelled before the young have broken through.

In close connection with the above we are confronted by a not unfamiliar question: "Do the snakes swallow their young for the sake of protection?" Concerning, as it does, the snakes in general and not the pit vipers in special, except in so far as they are reported to be among the ones observed to do this very thing, I should have left this theme at the present occasion with a reference to Dr. G. Brown Goode's admirable summary of all the evidence up to 1873,* as it would carry us too far to present all that has been written about the subject since then in this connection, but from the many unpublished letters in my possession bearing upon the question, and which I have reserved for a later separate publication, I wish to print the following extracts from one by the late Dr. William C. Avery, of Greensboro, Ala., because they pointedly expose the inconsistency of some of those who deny the actuality of an occurrence testified to by numerous and competent witnesses, simply because it seems improbable and because they have not seen it themselves. Apropos of an account in a previous letter of how he himself once saw a young water moccasin run down its mother's throat, Dr. Avery wrote as follows:

My reason for mentioning in my last letter the fact that I had seen a snake take her young into her throat was that it had been denied by some writers. In a work

*On the question "Do Snakes Swallow their Young?" Proc. Amer. Assoc. Advanc. Science, Portland Meeting, 1873 (pp. 176-185).

by Charles C. Abbott, M. D., entitled "Model Book of Natural History," the writer says, on page 499: "The threadbare subject of snakes swallowing their young has been discussed again and again. The sum and substance of the matter is—they don't." * * * The fact of the matter is—*they do;* and men believe they do, because they have seen the young in the act. Dr. Abbott denies this truth, and yet on page 72 of his "Model Book," he writes: "Honey badgers are said to sit on their haunches and shade their eyes with one paw while on the lookout for a bee tree. This may seem a fishy story, but there is no reason for not accepting it. The world is more full of marvels than mankind have imagined."

Surely, the alleged performance of the snakes is not any more marvelous than that of the honey badger!

It was noted under the Harlequins, or Bead Snakes, that those poisonous snakes are closely imitated by certain kinds of harmless ones, so close, in fact, that it is sometimes necessary to discriminate very nicely in order to distinguish them. Some of the crotalids are subjects of a similar mimicry which has given rise to a similar confusion of names. Thus the ordinary and very harmless hog-nose snake, or spreading adder, is in many districts known as the copperhead, on account of its superficial resemblance to the latter and the dread inspired by its certainly formidable looking antics is still heightened

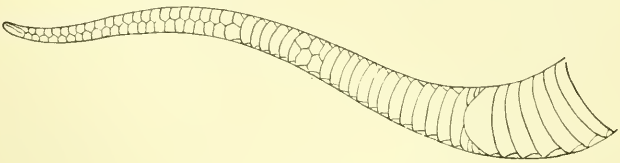

Fig. 33.
UNDER SIDE OF TAIL OF WATER MOCCASIN.

by the terror which tradition attaches to the name. The case of the water moccasin is similar. The name Moccasin has nearly lost its significance and needs a qualifying adjective in order to convey with certainty the meaning of the employer whether he intends the poisonous or the harmless kind. Dr. G. Brown Goode has called attention * to the close imitation of *Agkistrodon piscivorus* (the Moccasin) by the Banded Water-snake, *Natrix fasciatus*, and asks justly, "Is not this a fair case of protective mimicry?"

There should never be any difficulty in distinguishing these imitators from the poisonous species they mimic, with the specimens in hand, for the absence or the presence of the "pit" would at once settle the question. Very often the slayer of the serpent deems it a religious duty to immediately put his heel to its head and crush it out of all recognition. In such cases the tail may serve as a distinguishing character, for in the hog-nose snake, *Heterodon*, and in the water snake, *Natrix*, the large scales covering its under side are divided on the middle line, while in the venomous Copperhead and Water Moccasin the greater majority of these subcaudals are undivided. The accompanying figures (figs. 33, 34) show this distinction, and the heads of the harmless

* Mimicry in Snakes. Amer. Naturalist, VII, Dec. 1873, pp. 747–748.

imitators (figs. 37, 38, 39, 40) may also serve to aid in the identification when compared with figures 35 and 36 and with those of the various venomous species given farther on under the heads of the latter.

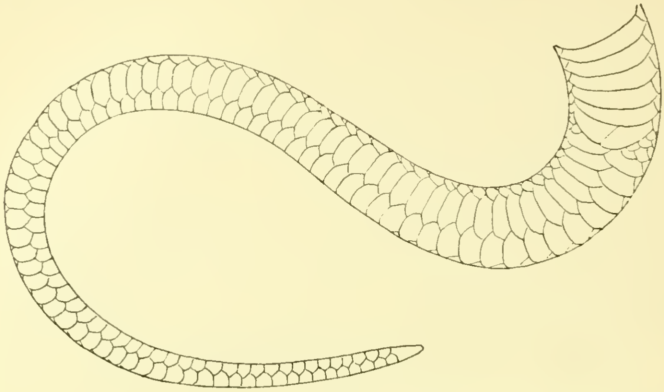

Fig. 34.
UNDER SIDE OF TAIL OF WATER SNAKE, NATRIX.

With living snakes the matter is more difficult. To the person familiar with the various kinds of snakes, their appearance and their habits, there may be no special difficulty in quickly recognizing them, if he gets a good view of them, but it would be useless to attempt by

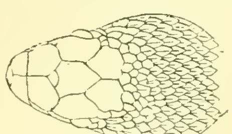

Fig. 35.

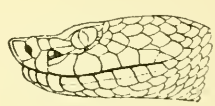

Fig. 36

HEAD OF COPPERHEAD, SHOWN FROM TOP AND SIDE.
(After Baird.)

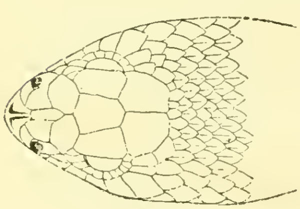

Fig. 37.

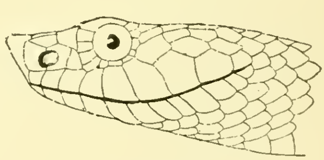

Fig. 38.

HEAD OF SPREADING ADDER (HETERODON), SHOWN FROM TOP AND SIDE.

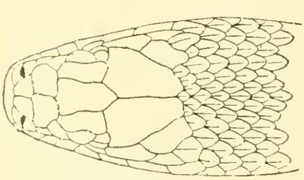

Fig. 39.

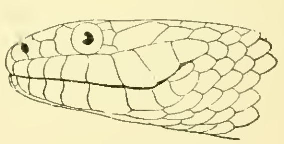

Fig. 40.

HEAD OF WATER SNAKE (NATRIX), SHOWN FROM TOP AND SIDE.

description, or even by figure, to make the differences of the living snakes so plain to those who have not learned to discriminate between them, with the specimens in hand, that it would be of any value to him.

COPPERHEAD,—AGKISTRODON CONTORTRIX.

From a cast in the U. S. National Museum.

Synopsis of the Crotalid genera inhabiting North America north of Mexico.

a^1 Tail without rattle, ending in a point.......................... AGKISTRODON.
a^2 Tail provided with a rattle.
b^1 Top of head covered by regular shields .... SISTRURUS.
b^2 Top of head covered by numerous scales.......................... CROTALUS.

Genus AGKISTRODON,* Beauvois.

THE MOCCASINS.

1799.—*Agkistródon*, BEAUVOIS, Trans. Am. Philos. Soc., IV, p. 381 (Type *A. mokasen* Beauv.).

1802.—*Scytale*, LATREILLE, Hist. Nat. Rept., III, p. 158 (same type).

1803.—*Cenchris*, DAUDIN, Hist. Nat. Rept., V (p. 358) (same type; not of Beauv., 1799).

1819.—*Scytalus*, RAFINESQUE, Sillim. Journ., I, p. 84 (emend.).

1826.—*Tisiphone*, FITZINGER, N. Class. Rept., pp. 34, 63 (type *T. cuprea* Fitz.).

1836.—*Acontias*, TROOST, Ann. Lyc. Nat. Hist. N. Y., III, p. 176 (type *A. leucostoma*).

1836.—*Toxicophis*, TROOST, Ann. Lyc. Nat. Hist. N. Y., III, p. 190 (same type).

1854.—*Ancistrodon*, BAIRD, Serp. N. Y., p. 13 (emend.).

Synopsis of the species of Agkistrodon occurring in the United States.

a^1. A loreal; orbit separated from supralabials by scales; usually 23 scale-rows. *A. contortrix*.
a^2. No loreal; supralabials entering orbit; 25 scale-rows .... *A. piscivorus*.

THE COPPERHEAD.

Agkistrodon contortrix,† (Linnæus.).

Plate 3.

1766.—*Boa contortrix* LINNÆUS, Syst. Nat., 12 ed., I, p. 373.—*Scytale contortrix*, LATREILLE, Hist. Nat. Rept., III, p. 159 (1802).—*Cenchris contortrix*, GRAY, Ann. Philos., 1825, p.—. — GRAY, Cat. Snakes Br. Mus., p. 16 (1849).—GRAY, Zool. Miscell., p. 50 (1842).—*Trigonocephalus contortrix*, HOLBROOK, N. Am. Herpet, 1 ed., II, p. 69 (1838).—HOLBROOK, N. Am. Herpet, 2 ed., III, p. 39 (1842).—KIRTLAND, in Mather's Sec. Rep. Geol. Surv., Ohio, 1838, p. 167.—DE KAY, Zool. N. Y., III, p. 53 (1842).—LE CONTE, South. Med. Surg. Journ., IX, 1853, pp. 651, 665.—DUMÉRIL et BIBRON, Erpét. Génér., VII, ii, p. 1494 (1854).—HALLOWELL, in Sitgreave's Exp. Zuñi Colo. Riv., p. 147 (1854).—HALLOWELL, Proc. Phila. Acad., 1856 (p. 249).—JAN, Rev., Mag. Zool., 1859, Extr. p. 29.—JAN, Elenc. Sist. Ofid., p. 125 (1863).—*Agkistrodon contortrix*, BAIRD and GIRARD, N. Am. Serp., p. 17 (1853).—JORDAN, Man. Vertebr. North. U. S., 5 ed., p. 199 (1888).—HAY, Proc. U. S. Nat. Mus., XV, 1892, p. 386.—HAY, Batr. Rept. Indiana, p. 123 (1893).—HURTER, Trans. St. Louis Acad. Sc. VI, p. 258 (1893).—H. GARMAN, Bull. Essex Inst., XXVI. 1894, p. 36.—*Ancistrodon contortrix*, BAIRD, Serp. N. Y., p. 13 (1854).—BAIRD, Mex. Bound. Surv., II, Rept., p. 15 (1859).—COPE, Proc. Phila. Acad., 1859, p. 336.—COPE, Bull. U. S. Nat. Mus., No. 1, p. 31 (1875).—COPE, Bull. U. S. Nat. Mus., No. 17, p. 24 (1880).—COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 683 (1892).—ALLEN, Proc. Boston Soc. Nat. Hist., XII, 1868, pp. 11, 35.—COUES, Proc. Phila. Acad., 1871, p. 48.—CRAGIN, Trans. Kansas Acad.

* From the Greek ἀγκιστρον (agkistron), a hook; ὀδών (odon), a tooth.
† From the Latin *contortrix*, one who twists.

Sc., VII, p. 121 (1881).—SMITH, Rep. Geol. Surv. Ohio, IV, 1882, p. 675.—TRUE, in Hammond's South Carolina, p. 235 (1883).—KUNZE, Amer. Natural., XVII, 1883, p. 1229.—YARROW, Bull. U. S. Nat. Mus., No. 24, pp. 12, 80 (1883).—GARMAN, Rept. Batr. N. Am., I, Ophid., pp. 120, 178 (1883).—DAVIS and RICE, Bull. Ill. State Lab. Nat. Hist., I, No. 5 (p. 28) (1883).—DAVIS and RICE, Bull. Chic. Acad. Sc., I, p. 28 (1883).—HAY, Amph. Rept. Indiana, p. 13 (1885).—H. GARMAN, Bull. Ill. State Lab. Nat. Hist., III, p. 314 (1892).

1799.—*Agkistrodon mokasen*, BEAUVOIS, Trans. Am. Philos. Soc., IV, p. 370, footnote.

1803.—*Cenchris mokeson*, DAUDIN, Hist. Nat. Rept., V, p. 358.

1819.—*Scytalus cupreus*, RAFINESQUE, Sillim. Journ., I, p. 84.—HARLAN, Med. Phys. Res. (p. 130) (1835).

1819.—*Scytale mockeson*, SAY, Sillim. Journ., I, p. 257.—*Cenchris mockeson* HARLAN, Journ. Phila. Acad., V, 1827 (p. 366).—HARLAN, Med. Phys. Res. (p. 128) (1835).

1827.—*Cenchris marmorata*, BOIE, Isis, 1827, p. 562.

1836.—*Acontias atrofuscus*, TROOST, Ann. N. Y. Lyc. Nat. Hist., III, p. 180.—*Toxicophis atrofuscus*, BAIRD and GIRARD, N. Am. Serp., p. 150 (1853).—*Trigonocephalus atrofuscus*, HOLBROOK, N. Am. Herpet., III, p. 43 (1842).—DE KAY, Zool. N. Y., III, p. 55 (1842).—*Cenchris atrofuscus*, GRAY, Cat. Snakes Brit. Mus., p. 16 (1849).—*Ancistrodon atrofuscus*, COPE, Bull. U. S. Nat Mus., No. 1, p. 34 (1875).

1837.—*Trigonocephalus cenchris*, SCHLEGEL, Essay Physiogn. Serp., I, p. 191; II, p. 553.—MAX V. WIED, Verz. Rept. Reise N. Amer., p. 77 (1865).

1853.—*Trigonocephalus histrionicus*, DUMÉRIL, Mém. Acad. Sc. Paris, XXVIII (p. 534); Prodr. Class. Serp., p. 138.

1883.—*Ancistrodon contortrix*, var. *atrofuscus*, GARMAN, Rept. Batr. N. Am., I, Ophid., p. 178.

Figures.—DAUDIN, Hist. Nat. Rept., V (pl. LXX, figs. 3, 4), (1803).—HOLBROOK, N. Am. Herpet., 1 ed., II, pl. XIV (1838); 2 ed., III, pl. VIII; pl. IX (*atrofuscus*) (1842).—DE KAY, Zool. N. Y., III, pl. IX, fig. 18 (1842).—BAIRD, Serp. N. Y., pl. I, fig. 3 (1854).—BAIRD, Pac. R. R. Rep., X, Rept., pl. XXV, fig. 12 (1859).—JAN, Icon. Ophid., livr. 46, pl. V, fig 1 (1874).—BOCOURT, Miss. Scient. Mexique, Zool. III, Rept., pl. XXVIII (1882).—GARMAN, Rept. Batr. N. Am., I, Ophid., pl. VIII, fig. 1 (1883).—Brehm's Thierleben, 3 ed., VII, p. 468 (1892).

It does not appear that any competent herpetologist has ever examined a specimen of the so-called "Highland Moccasin," described by Troost as *Acontias atrofuscus*, and said to occur in the mountain regions from Virginia southward, and its status is therefore so doubtful that I have not ventured to treat it as a separate form. Even Holbrook, who gave a figure and a lengthy description, did not see a specimen, and furnished it only on Troost's authority. On the whole, this variety appears to be only a partial melanism, as we frequently find it among snakes in similar localities.

Description.*—Loral present. Labials not entering into the orbit. Dorsal rows of scales, 23. Color, light chestnut, with inverted Y-shaped darker blotches on the sides. Labials yellowish white (figs. 41 and 42).

More slender than *Toxicophis* [*Agkistrodon*] *piscivorus*. Plates on neck and side smaller. Two anterior orbitals, one above the other, the lower narrower and forming the posterior wall of pit. A distinct loral

* By S. F. Baird, in Baird and Girard's N. Am. Serp., p. 17.

between these and the posterior nasal. Labial not forming part of the orbit, but separated by the four post and suborbitals. Labials not so largely developed; 8 above, third and fourth largest; 9 below.

Above light hazel brown, rather brighter on the top of the head, and everywhere minutely mottled with very fine, dark points. On each side is a series of 15 to 26 darker chestnut-colored blotches resting on the abdominal scutellæ [ventrals, or gastroteges], and suddenly contracting about the middle of the side, so as somewhat to resemble an inverted Y. These blotches extend to the vertebral line, where they may be truncated or end in a rounded apex. Generally, those of opposite sides alternate with each other, but frequently they are confluent above, forming continuous bands. They are so disposed that the intervals between the successive blotches are pretty much of the same shape and size, though inverted. The centers of the blotches are lighter; in some cases

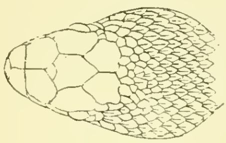

Fig. 41.

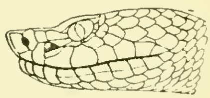

Fig. 42.

HEAD OF COPPERHEAD, SHOWN FROM TOP AND SIDE.
(After Baird.)

so much so as greatly to increase the Y-shaped resemblance. Color beneath dull yellowish, with a series of distinct large, dark blotches, 35 to 45 in number, on each side. Chin and throat unspotted. Sides of head cream color; the line of demarcation very distinct; this passes along the upper edge of head, in front of the eye, and involving the lower three-fourths of the orbit, intersects the middle of the second postorbital plate (counting from above), and extends along the first row above the labials to the posterior edge of the last labial. The line then comes back through the middle of the lower labial range, where it is marked by a narrow black line. Rostral of the same color. A small areolated dark spot near the inner edge of each occipital [parietal] plate.

Number of gastrosteges, 150 to 154; urosteges, undivided, 31 to 48; divided, 0 to 18 pairs.

Fresh colors of Agkistrodon contortrix (young)—No. 19261; District of Columbia, Government Insane Asylum grounds; Dr. J. W. Blackburn, collector, September 16, 1892 (died in captivity October 31, 1892). Ground color above dull vinaceous-cinnamon (Rob. Ridgway, Nomenclator of Colors, pl. IV, fig. 15), head darker, drab (III, 18), marked with tawny on the temples; dark markings, dark Prout's brown (III, 10), gradually fading into drab on the sides; tip of tail for the extent of about 20 mm., both above and below, bright olive-yellow (VI, 16), the general ground color gradually fading into it at about 25 mm. from the tip; ground color below ecru-drab (III, 21), dark markings seal-brown (III, 1); lips pale ecru-drab, the dark edge externally shaded with tawny-olive. Iris silvery vinaceous-cinnamon.

Variation.—There is considerable individual variation in the size of the parietal plates, and the number of supralabials varies between 7 and 8, as shown by Prof. Cope. The regular number of scale rows across the middle of the body is 23, but occasionally a specimen may be found with 25.

We have already referred to the probably melanistic variation of specimens from Tennessee which have been described as *A. atrofuscus*. The number of dark cross-bands is also very variable, as shown in the description given above. Mr. Ragsdale has, in letters to me, alluded to the fact that the specimens taken by him in Texas had the tip of the tail greenish, while in eastern specimens it is stated to be blackish. The material at hand, faded through long immersion in alcohol, throws but little light upon the question, but in freshly killed specimens from the neighborhood of Washington, I find that in the adult specimens the tip of the tail above is of the same dark brownish color as the dorsal blotches; in the young specimens, however, it is bright greenish yellow, and it seems quite probable that in half-grown specimens it may be of an intermediate olivaceous color.

Geographical distribution.—In a general way the range of the Copperhead is coextensive with that of the Banded Rattlesnake, *Crotalus horridus*, though as a rule it does not extend quite as far North. As a compensation it goes considerably further South in the western portion of its range, extending into the southern part of Texas.

In the Northeast it does not seem to reach further North than central Massachusetts, though De Kay states that Holbrook had received specimens from Vermont. Dr. J. A. Allen (Proc. Boston Soc. Nat. Hist., XII, 1868, p. 11) speaks of its occurrence in Massachusetts as follows:

> There is a well-known den of this species on Mount Tom, near which a considerable number of specimens are annually killed by different individuals. I have not heard of it elsewhere in the State [Massachusetts], though Linsley has reported it from Connecticut.

It is repeatedly asserted that the Copperhead does not occur in Florida; but while it does not appear to be found in the peninsula proper, it has been taken at its very base, as testified by specimens from Gainesville sent to the National Museum by Judge J. Bell.

In Michigan, Wisconsin, and Nebraska it is lacking, and apparently also in Iowa, as I find no reliable record of its capture in that State.

In Indiana, writes Dr. Hay, this venomous serpent, once abundant in most localities of the southern half of the State, is now happily becoming rare; in most localities it is probably entirely exterminated. Where, however, the country is not thickly settled, and where there are abundant forests and rocks, it may even yet be found in considerable numbers. In the northern portion of the State it has probably always been scarce, but still present. The record for Illinois as given by H. Garman is similar: "Throughout the State; rare north, frequent south."

West of the Mississippi it has been recorded from Missouri and

Kansas, Indian Territory, Louisiana, all the way down to the pine woods north of Lake Pontchartrain, where Dr. G. Kohn informs me that it is scarce, however. In Texas it seems well represented east of the one hundredth meridian and north of the twenty-ninth parallel.

Habits.—It is agreed by almost all observers that the Copperhead, or Upland Moccasin, Chunk-head, Deaf Adder, or Pilot Snake, as it is called in various localities, is a much more vicious animal than the Rattlesnake; not only because it strikes without giving the warning of the rattle, though it is sometimes known to attempt this by quickly vibrating the tail against some hard and dry objects, but also because it is of a much more aggressive nature. However, although considerably quicker of motion than the Rattler, it is a comparatively slow snake, and as Dr. Weir Mitchell has shown that its poison in proportion to the quantity is less virulent than that of the Rattlesnake, its bite is less dangerous, and as it but seldom exceeds 3 feet in length,* it is a much less terrible animal than generally supposed.

Dr. H. C. Yarrow has reported quite an interesting series of cases of poisoning from bites of copperheads (Am. Journ. Med. Sc. (n. s.), LXXXVII, 1884, pp. 422–435). Of the many cases recorded in the medical journals he had only found one fatal case, viz, that of a 6-year-old boy, although some of them were very severe, particularly the one which came under his own observation, a case the more remarkable as the snake was very small, "not over 14 inches long." It is plain from the symptoms, however, that the case owed but very little of its severity to the venom injected by the snake, and it is an excellent example of how complicated such cases may be, and how difficult it is in cases both of recovery and death to say how much is due to the activity of the venom and how much to other circumstances.

Dr. R. E. Kunze (Am. Natural., XVII, 1883, pp. 1229–1238) thinks that the Copperhead does not strike from a regular coil, like the Rattlesnake, but that its effective blow is delivered when the middle of the body is thrown into long, almost rectangular curves, and the head held only slightly elevated above the ground.

S. Garman, as quoted by Dr. Hay, having studied the Copperhead in captivity, states that they usually eat the prey as soon as it is dead and even before it ceases to struggle. Sometimes lively mice would elude two or three strokes, and this would seem to throw the snake into an ecstacy of excitement. They would not eat fishes.

The Copperhead produces living young like the other crotalids, the average number apparently varying between seven and nine. Statements often seen in newspapers referring to female copperheads with an enormous number of young ones having been killed are due to a confusion of this species with other snakes.

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*A large male killed this year near Washington, D. C., and presented by Dr. J. W. Blackburn to the Museum, measured, when fresh, 38 inches (about 965 mm.), while a female killed near the same place last year was only about 1 inch shorter.

THE WATER MOCCASIN.

Agkistrodon piscivorus * (Lacépède).

Plate 4.

1789.—*Crotalus piscivorus*, LACÉPÈDE, Hist. Nat. Serp., II, Table Méth., p. 130.—*Scytale piscivora*, LATREILLE, Hist. Nat. Rept., III, p. 163 (1802).—*Scytale piscivorus*, DAUDIN, Hist. Nat. Rept., V, p. 344 (1803).—*Natrix piscivorus*, MERREM, Tentamen, p. 131 (1820).—*Trigonocephalus piscivorus*, HOLBROOK, N. Am. Herpet., 1 ed., II, p. 63 (1838).—HOLBROOK, N. Am. Herpet., 2 ed., III, p. 33 (1842).—DE KAY, Zool. N. Y., III, p. 55 (1842).—LE CONTE, South. Med. Surg. Journ., IX, 1853, pp. 651, 664.—DUMÉRIL et BIBRON, Erpét. Génér., VII, ii, p. 1491 (1854).—JAN, Rev. Mag. Zool., 1859, extr. p. 29.—JAN, Elenc. Sist. Ofid., p. 125 (1863).—*Cenchris piscivorus*, GRAY, Zool. Misc., p. 51 (1841).—GRAY, Cat. Snakes Brit. Mus., p. 16 (1849).—EFFELDT, Zool. Garten, XV, 1874 (p. 1).—*Toxicophis piscivorus*, BAIRD and GIRARD, N. Am. Serp., p. 19 (1853).—BAIRD, Pac. R. R. Rep., X, Whipple's Route, Rept., p. 40 (1859).—SMITH, Rep. Geol. Surv. Ohio, IV, p. 676 (1882).—*Ancistrodon piscivorus*, COPE, Proc. Phila. Acad., 1859, p. 336.—COPE, Proc. Am. Philos. Soc., 1877, p. 64.—COPE, Bull. U. S. Nat. Mus., No. 17, p. 24.—COPE, Proc. U. S. Nat. Mus., XI, 1888, p. 393.—COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 683 (1892).—COUES and YARROW, Proc. Phila. Acad., 1878, p. 26.—TRUE, in Hammond's South Carolina, p. 235 (1883).—GARMAN, Rept. Batr. N. Am., I, pp. 121, 178 (1883).—GARMAN, Bull. Essex Inst., XXIV, p. 4 (1892).—BOETTGER, in Brehm's Thierleben, 3 ed., VII, p. 469 (1892).—H. GARMAN, Bull. Ill. State Lab. Nat. Hist., III, p. 315 (1892).—*Agkistrodon piscivorus*, JORDAN, Man. Vert. North. U. S., 5 ed., p. 199 (1888).—H. GARMAN, Bull. Ill. State Lab. Nat. Hist., III, p. 187 (1890).—H. GARMAN, Bull. Essex Inst., XXVI, p. 36 (1894).—HAY, Proc. U. S. Nat. Mus., XV, 1892, p. 386.—HAY, Batr. Rept. Indiana, p. 184 (1893).—LŒNNBERG, Proc. U. S. Nat. Mus., XVII, 1894, p. 336.

1802.—*Coluber aquaticus*, SHAW, Gen. Zool., III, p. 425.

1829.—*Trigonocephalus tisiphone*, CUVIER, Règne Anim., 2 ed., II (p. 89) (in part).

1836.—*Acontias leucostoma*, TROOST, Ann. N. Y. Lyceum Nat. Hist., III, p. 176.

1853.—*Toxicophis pugnax*, BAIRD and GIRARD, N. Am. Serp., pp. 20, 156.—HALLOWELL, Proc. Phila. Acad., 1856, p. 307.—BAIRD, Mex. Bound. Surv., II, Zool. Rept., p. 15 (1859).—*Ancistrodon pugnax*, COPE, Proc. Phila. Acad., 1859, p. 336.

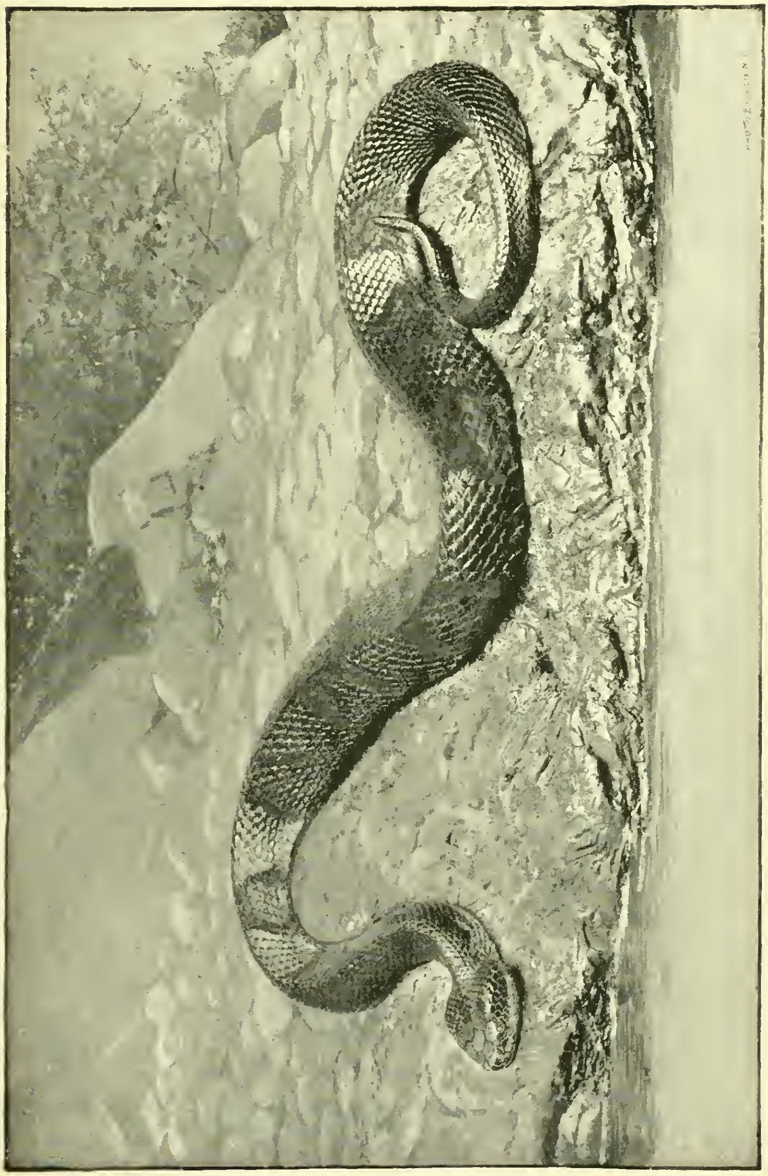
1854.—*Trigonocephalus atrofuscus*, HALLOWELL, in Sitgreave's Exp. Zuñi and Colo. Riv., p. 147 (not of Troost).

1863.—*Trigonocephalus piscivorus*, var. *pugnax* JAN, Elenc. Sist. Ofid., p. 125.—*Ancistrodon piscivorus*, subsp. *pugnax*, COPE, Bull. U. S. Nat. Mus., No. 1, p. 34.—GARMAN, Rept. Batr. N. Am., I, Ophid., p. 159 (1883).—YARROW, Bull. U. S. Nat. Mus., No. 24, pp. 12, 80 (1883).

1875.—*Ancistrodon piscivorus*, subsp. *piscivorus*, COPE, Bull. U. S. Nat. Mus., No. 1, p. 34.—YARROW, Bull. U. S. Nat. Mus., No. 24, pp. 12, 79 (1883).—DAVIS and RICE, Bull. Ill. State Lab. Nat. Hist., I, No. 5 (p. 28) (1883). DAVIS and RICE, Bull. Chic. Acad. Sc., I, p. 28 (1883).

Figures.—TROOST, Ann. N. Y. Lyc. Nat. Hist., III, 1836, pl. V.—HOLBROOK, N. Am. Herpet., 1 ed., II, pl. XIII (1838), 2 ed., III, pl. VII (1842).—BAIRD, Pac. R. R. Rep., X, Rept., pl. XXV, figs. 13, 14 (1859).—BAIRD, Mex. Bound. Surv., Zool. Rept., pl. VI (1859).—JAN, Icon. Ophid., livr. 46, pl. IV (1874).—BOCOURT, Miss. Sc. Mex., III, Zool., Rept., livr. 8, pl. XXVII (1882).—GARMAN, Rept. Batr. N. Am. I, Ophid., pl. VIII, fig. 2 (1883).—BREHM'S Thierleb., 3 ed., VII, p. 470 (1892).

* From the Latin *piscivorus*, at fish-eating.



WATER MOCCASIN,—AGKISTRODON PISCIVORUS.

From a cast in the U. S. National Museum.

*Description.**—No loral. Inferior wall of orbit constituted by third labial: 25 dorsal rows. Dark chestnut brown, with indistinct vertical dark bars. Line from superciliary along the edge of the head, through the middle of the second supralabial row. A second line from the lowest point of the orbit parallel to the first (figs. 43 and 44).

Scales all large and well developed; those on the sides and back of head conspicuously so. Two nasal plates, with the nostril between them. Anterior orbitals 2, one above the other, the upper extending from the eye to the posterior nasal, the lower linear and forming the upper wall of the pit. Lower and posterior wall of pit constituted by a narrow plate resting along the third labial and terminating on the second. Third labial very large, constituting the inferior wall of the orbit, of which 3 scales form the posterior. Upper labials 8, very large and broad; lower 10. Occipitals [parietals] terminated each by a triangular plate. All the scales on the back of the head carinated. Dorsal scales all carinated.

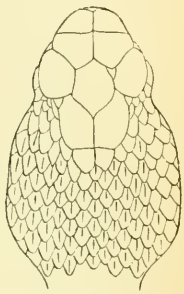


Fig. 43.
HEAD OF AGKISTRODON PISCIVORUS FROM ABOVE.
(After Baird.)

General color, dark chestnut-brown with darker markings. Head above, purplish black. An obsolete chestnut-brown streak passes from the posterior end of the superciliary along the upper edge of the head, through the middle of the second row of supralabial scales. A narrow yellowish white line passes from the third labial, or begins just below the lowest part of the orbit, and passing backward parallel with the first stripe crosses the angle of the mouth at the seventh labial and meets the first stripe on the side of the neck, where it is confluent with yellowish white of the throat. On the lower labial are 3 short, nearly vertical, light bars; on fourth, sixth, and seventh, the rest of the jaw itself, as well as the interval between the stripes on the sides of the head, dark purplish brown, of which color is also the space in front and below the eyes. General color above, dull dark chestnut-brown. On each side a series of 20 or 30 narrow, vertical, purplish black bars 1 or 2 scales wide. Of these, sometimes 2 contiguous to each other on the same side are united above into an arch, inclosing a space, the center of which is rather duskier than the ground color; at others, corresponding bars from the opposite sides unite and form half rings, encircling the body. Sometimes there is a lighter shade bordering the dark bars. Beneath, black, blotched with yellowish white.

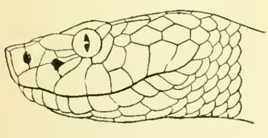


Fig. 44.
SAME FROM SIDE.

Number of ventrals [gastrosteges], 130 to 145; of subcaudals [urosteges], 39 to 45, of which divided, 0 to 21.

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*By S. F. Baird, in Baird and Girard's N. Am. Serp., p. 19.

Variation.—The supposed species, or subspecies, *A. pugnax*, was based upon an alleged different arrangement of the anterior supralabials in specimens from Texas, the second being crowded up from the commissure by the first and third. Later investigations of much additional material have shown that the character is very variable and entirely too unstable to serve as a foundation for a division.

The number of divided urosteges is also highly variable and seems to have no significance.

In the young specimens the colors are much lighter and the pattern better defined than in the adults.

Geographical distribution.—In the main, the Water Moccasin, or the Cotton-Mouth, as it is also often called from the whiteness of its mouth, has the same range in the United States as the harlequin snake, *Elaps fulvius*, extending as it does from North Carolina along the coast to the Mexican boundary, including the entire peninsula of Florida. It is also found a considerable distance up the Mississippi River and some of its southern tributaries.

In North Carolina it is found in several localities. We have specimens from Wilmington and New Berne, and Messrs. Brimley, of Raleigh, inform me that in the summer of 1891 one specimen over 3 feet long was taken on Neuse River, 1 mile above Milburne, some 6 or 8 miles east of Raleigh. According to Coues and Yarrow, it is very numerous in woods of Bogue banks on the mainland near wet and marshy places. Holbrook locates its northern limit at Pedee River. In the coast regions of South Carolina, Georgia, Alabama, and Mississippi it is very numerous, as well as over the whole of Florida as far as Key West. The same may be said of Louisiana, and Dr. Gustave Kohn informs me that the moccasin, or the Congo serpent, as it is called by the Creoles, is common even within the limits of the city of New Orleans. Along the Mississippi River it ascends into southern Missouri, Illinois, and Western Kentucky. In Illinois it occurs along the Wabash River at Mount Carmel, and Mr. Robert Ridgway assures me that trustworthy witnesses have told him of its former occurrence as far as Vincennes, in Indiana. On the west side it ascends the Arkansas River the entire breadth of the State of Arkansas, and seems to reach as far up as the boundary of Oklahoma Territory at least. In eastern Texas it follows the rivers into the interior even as far up as Dallas, where Cope regards it as still abundant, but in the western, more arid portion of the State it does not seem to go farther up than about the thirtieth parallel, though on the coast it is quite plentiful.

Habits.—Unlike the other Pit Vipers inhabiting the United States, the Water Moccasin, as the name implies, is distinctively a water snake. Holbrook, who had plenty of opportunity to observe its habits, writes that it is found about damp swampy places, or in water—far from which it is never observed. In summer, numbers of these serpents are seen resting on the low branches of such trees as overhang the water, into which they plunge on the slightest alarm. Catesby, he continues, thinks they select these places to watch for their prey. They merely choose them in order to bask in the sun; for in those situations deprived of trees, as the ditches of rice fields, their basking places are often on dry banks. They are the terror of the negroes that labor about rice plantations, where they are more dreaded than the Rattlesnake, which only bites when irritated, or in self-defense, or to secure its prey; the water moccasin, on the contrary, attacks everything that comes within his reach, erecting his head and opening his mouth for some seconds before he bites.

Notwithstanding the fact that the poison of the Water Moccasin has been found proportionately less virulent than that of the Rattlesnake and the Copperhead, the fear it inspires is well founded, for it is a much larger and especially much heavier snake than the Copperhead. I do not know the extreme length to which it may grow, but it probably exceeds 4 feet considerably, as the largest specimen in the National Museum collection measures 45¾ inches (1.160 m.) with a circumference around the thickest part of the body of not less than 7½ inches (190 mm.). Records of cases of Moccasin bites are rather scarce, however, and the fatalities are probably not numerous. A serious case was recently reported to the writer by Mr. E. P. Alexander, of Georgetown, S. C., of a woman bitten in one finger. On September 26, 1893, he wrote again:

> The woman recovered, but suffered much for two weeks, flesh sloughing from finger, so that amputation of the finger, or even of the hand, was seriously considered by the attending physician.

The habits of the Water Moccasin have been studied very little in their native haunts, but as this Crotalid seems to bear captivity better than any of the others, there have been made very valuable observations in the Zoological Garden in Berlin by Rudolph Effeldt.* He obtained four specimens, which had been born in the Zoological Garden in London, and reared there with great success. They became exceedingly tame and gentle toward their keeper, who finally handled them without fear in an almost reckless manner. They would take the food, preferably fishes, but also other cold or warm blooded animals, or even raw meat, from the forceps in the hand of the keeper. Toward other snakes, including Rattlesnakes, they were very savage, and, curiously enough, their bite proved dangerous to other poisonous snakes, but not to others of their own species. They would often fight among themselves, chiefly for a place in the water basin or during the pairing season.

The pairing was observed by Effeldt repeatedly at various seasons, in spring, summer, and even in the autumn as late as October 10, and described by him in detail. A pair which he obtained in 1871 and

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* Zool. Garten, xv, 1874 (pp. 1–5).

1872 paired on January 21, 1873, and on the following July 6 he found 8 recently-born young in the cage. They were about 260 mm. long by 15 mm. thick, and, unlike the parents, of a pale flesh color, with blackish brown zigzag bands. After the first molt, about two weeks after birth, the ground color became more reddish brown, and at the next one, about five weeks later, copper brown, the head being more brightly colored in all stages. This color lasted into the second year, when they gradually assumed the dark color of the parents. During the first two weeks they took no food, then they accepted young frogs, but refused fishes. At the end of two months they were 340 mm. long, with a proportionally large head. The parents seemed to show some affection for their offspring.

Genus SISTRURUS,* Garman.

The Ground Rattlesnakes.

1822.—*Crotalus*, Fleming, Philos. Zool., II, p. 294 (type *C. miliaris*) (not of Linn., 1758).

1825.—*Crotalophorus*, Gray, Ann. Philos., 1825 (p. 205) (not of Houttuyn, 1764).

1826.—*Caudisona*, Fitzinger, N. Class. Rept., p. 34 (type *C. miliarius*) (not of Laurenti, 1768).

1883.—*Sistrurus*, Garman, N. Amer. Rept., I, Ophid., pp. 110, 176 (same type).

Between 1822 and 1826 several authors, led by Fleming, for the first time undertook to subdivide the old genus *Crotalus* into two genera according to the scutellation of the top of the head, but they were very unfortunate in adopting for the ground rattlers names which had been used before. Considerable confusion in the nomenclature of the rattlesnakes was the result, as partly pointed out under the head of *Crotalus*. S. Garman was the first to fully understand the situation, and, in 1883, to supply a tenable name for the genus of the ground rattlers. He has fully demonstrated the correctness of his position.†

The Ground Rattlesnakes form a small compact genus of only three species, one of which is confined to Mexico. Their distribution in the United States is rather curious, inasmuch that they are found in the eastern portion east of the Rocky Mountain region proper, although one form enters the Sierra Madre plateau, even occurring on the western slope of it in Arizona.

The two species inhabiting the United States occupy two distinct areas, which only overlap to a comparatively slight extent in the Indian Territory and adjacent region.

Synopsis of the species of Sistrurus found in the United States.

a^1. Prefrontals not in contact with the loreal proper (lower loreal, if two be present); a whitish stripe from posterior nasal below eye to angle of mouth (fig. 45).

b^1. Number of scale rows usually 25.

c^1. Spots larger .... *S. catenatus*

c^2. Spots smaller .... ? *S. c. consors*

* From the Greek σεῖστρον (seistron), a rattle; οὐρά (oura), a tail.

† Science, XIX., May 20, 1892, p. 290.

b^2. Number of scale rows usually 23............................*S. c. Edwardsii*
a^2. Prefrontals in contact with the loreal proper; a whitish stripe from below center of eye to angle of mouth (fig. 46)..................................*S. miliarius*

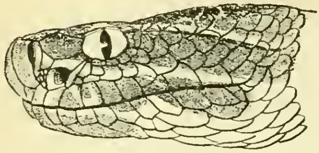


Fig. 45.
HEAD OF SISTRURUS CATENATUS.
From side, showing color pattern.

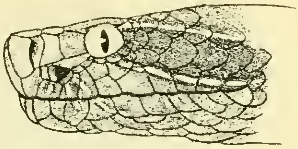


Fig. 46.
HEAD OF SISTRURUS MILIARIUS.
From side, showing color pattern

A pretty good character in dubious cases between *S. catenatus* typical and *S. miliarius* consists in the pattern of the parietals, if visible.

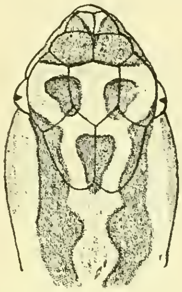


Fig. 47.
COLOR PATTERN OF TOP OF HEAD OF SISTRURUS CATENATUS.

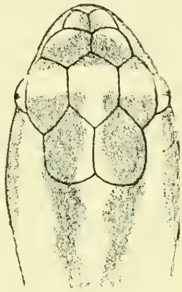


Fig. 48.
COLOR PATTERN OF TOP OF HEAD OF SISTRURUS MILIARIUS.

In the former there is a dark patch covering the center of the parietal suture (fig. 47), while in the latter the light portion forms a narrow band down the entire length of this suture (fig. 48).

THE MASSASAUGA.

Sistrurus catenatus,* (Rafinesque).

Plate 5.

1818.—*Crotalinus catenatus*, RAFINESQUE, Amer. Monthl. Mag., IV, 1818, p. 41.—*Crotalus catenatus*, GARMAN, N. Am. Rept., I, Ophid., p. 118 (1883).—*Sistrurus catenatus*, GARMAN, N. Am. Rept. I, Ophid., p. 176 (1883).—JORDAN, Man. Vert. North. U. S., 5 ed., p. 199 (1888).—TAYLOR, Ann. Rep. Nebraska State Board Agric., 1891, p. 355 (1892).—OSBORNE, Part. Cat. Anim. Iowa, p. 9 (1892).—H. GARMAN, Bull. Ill. State Lab. Nat. Hist., III, p. 312 (1892).—H. GARMAN, Bull. Essex Inst., XXVI, 1894, p. 62.—HAY, Batr. Rept. Indiana, p. 126 (1893).—HURTER, Trans. Acad. Sc. St. Louis, VI, p. 258 (1893).—*Crotalophorus catenatus*, COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 685 (1892).—HAY, Proc. U. S. Nat. Mus., XV, 1892, p. 387.

1823.—*Crotalus tergeminus*, SAY, in Long's Exped. Rocky Mts., I, p. 499.—HARLAN, Journ. Phila. Acad., V, 1827, (p, 372).—HARLAN, Phys. Med. Res., p. 135, (1835).—DUMÉRIL ET BIBRON, Erpét. Génér., VII, ii, p, 1479 (1854).—COPE, in Mitchell's Res. Ven. Rattlesn., p. 125 (1861).—HAYDEN, Trans. Am.

* From the Latin *catenatus*, chained, chain-like.

Philos. Soc., XII, 1862, p. 177.—*Crotalophorus tergeminus*, GRAY, Synops. Rept., p. 78 (1830).—GRAY, Cat. Snakes Brit. Mus., p. 18 (1849).—HOLBROOK, N. Am. Herpet., 2 ed., III, p. 29 (1842).—DEKAY, Zool. N. Y., III. p. 57 (1842).—BAIRD and GIRARD, N. Am. Serp., p. 14 (1853).—BAIRD, Serp. N. Y., p. 11 (1854).—GEBHARD, Sixth Rep., State Cab. Nat. Hist. N. Y., (p. 22) (1853).—KENNICOTT, Trans. Ill. State Agr. Soc. I., 1853–'54 (p. 592).—COPE, Proc. Phila. Acad., 1859, p. 336.—MAX V. WIED, Verz. Rept. Reise N. Amer., p. 74 (1865).—SMITH, Rept. Geol. Surv. Ohio, IV, p. 674 (1882).—HIGLEY, Trans. Wisc. Acad. Sc., VII, p. 161 (1884).—*Caudisona tergemina*, WAGLER, Nat. Syst. Amph., p. 176 (1830).—COPE, Bull. U. S. Nat. Mus., No. 1, p. 34 (1875).—COUES and YARROW, Bull. Geol. Geogr. Surv. Terr. (Hayden's), IV, 1878, p. 269.—CRAGIN, Trans. Kansas Acad. Sc., VII, p. 121 (1881).—DAVIS and RICE, Bull. Ill. State Labor. Nat. Hist., I, No. 5 (p. 28) (1883).—DAVIS and RICE, Bull. Chic. Acad. Sc., I, p. 28 (1883).—YARROW, Bull. U. S. Nat. Mus., No. 24, pp. 12, 79 (1883).—HAY, Amph. Rept. Indiana, p. 13, pl. II, fig. 15 (1885).—GARNIER, Proc. Canad. Inst. Toronto (3), V, 1888, (p 255).—GIBBS, Wolver. Natural., I, Feb., 1890, p. 12.—GIBBS, Forest and Stream, XXXIX, July 7, 1892, p. 7.

1838.—*Crotalus miliarius*, KIRTLAND, in Mather's Sec. Rep. Geol. Surv. Ohio, 1838, p. 167 (not of Linn).—W. L. SCLATER, Snakes, Ind. Mus., p. 74 (1891).

1838.—*Crotalus messasaugus*, KIRTLAND, in Mather's Sec. Rep. Geol. Surv. Ohio, 1838, p. 190 (footnote).

1842.—*Crotalophorus kirtlandi*, HOLBROOK, N. Am. Herpet., 2 ed., III, p. 31.—DE KAY, Zool. N. Y., III, p. 57 (1842).—GRAY, Cat. Snakes Brit. Mus., p. 18 (1849).—*C. kirtlandii*, BAIRD and GIRARD, Cat. N. Am. Serp., p. 16 (1853).—KENNICOTT, Trans. Ill. State Agr. Soc., I, 1853–'54 (p. 592).—COPE, Proc. Phila. Acad., 1859, p. 336.

1850.—*Crotaphorus*, sp., AGASSIZ, Lake Superior, p. 381.

1854.—*Crotalophorus massasauga*, BAIRD, Serp. N. York, p. 12.

1882.—*Crotalophorus tergeminus*, var. *kirtlandii*, SMITH, Rep. Geol. Surv. Ohio, IV, p. 674.—HIGLEY, Trans. Wisc. Acad. Sc., VII, 1884, p. 161.

1882.—*Crotalophorus catenatus catenatus* COPE, Proc. U. S. Nat. Mus., XIV, 1891 (No. 882), p. 685.—TAYLOR, Amer. Natural., XXVI, Sep., 1892, p. 752.

Figures.—HOLBROOK, N. Am. Herpet., 2 ed., III, pll. V, VI (1842).—AGASSIZ, Lake Superior, pl. VI, figs. 6–8 (1850).—DUMÉRIL and BIBRON, Erpét. Génér., Atlas, pl. LXXXIV *bis*, fig. 5 (1854).—BAIRD, Pac. R. P. Rep., X, Rept., pl. XV, figs. 9, 11 (1859).—GARMAN, Rept. Batr. N. Am., I, pl. IX, fig. 2 (1883).

Description.*—Twenty-five rows of dorsal scales, strongly carinated, with the exception of the first row, which is perfectly smooth. Vertical

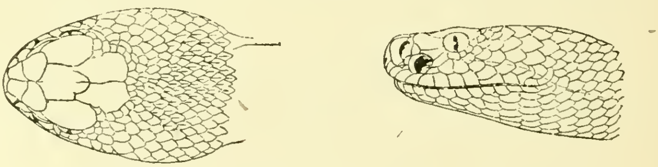
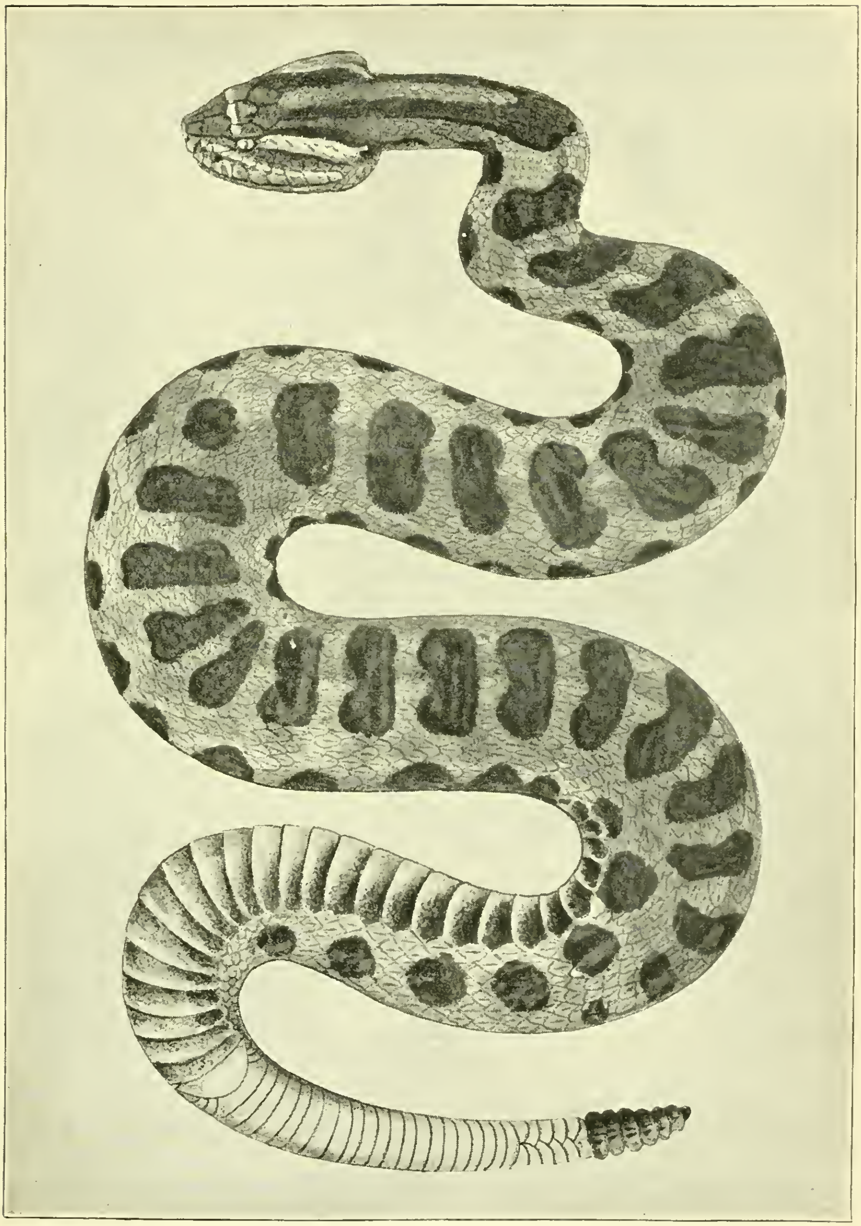


Fig. 49. Fig. 50.

HEAD OF SISTRURUS CATENATUS, SHOWN FROM TOP AND SIDE.

plate [frontal] subhexagonal, pointed posteriorly. Seven longitudinal series of blotches. A narrow band of yellowish white extends from the pit to the neck in passing close to the angle of the mouth (figs. 49, 50).

* By C. Girard, in Baird and Girard's N. Am. Serp., p. 14, from specimens from Wisconsin, Michigan, and Ohio.



MASSASAUGA,—SISTRURUS CATENATUS.
From Holbrook, North Am. Herpetology.

The ground color above is brown; the blotches are deep chestnut-brown, blackish externally, and with a yellowish-white margin. The dorsal blotches are 34 in number from the head to the region opposite the anus, 26 of which are transversely and irregularly oblong, anteriorly and posteriorly emarginated—less so, however, posteriorly; 8 are subcircular. Five or 6 exist on the tail from the anus to its tip, extending on the sides, the last two forming sometimes a complete ring. The next series on either side is composed of small blotches, but as intensely colored as in the other series. They alternate with the dorsal ones. They have no regularity either in outline or position. The second lateral row is composed of the largest lateral blotches. They are transversely oblong or oval on the second, third, fourth, fifth, and sixth rows of scales, and opposite the blotches of the dorsal series; consequently alternating with third series above. The first lateral series again is composed of blotches intermediate in size between those of the third and second series; they occupy the first and second rows of scales, and extend somewhat to the abdominal scutellæ [ventrals, or gastrosteges], and alternating with the adjoining series. Two undulated vittæ extend from the supraorbital plates along the neck to the first dorsal blotch, and often confluent with the latter. A linear vitta margined with yellowish white extends from the posterior edge of the eye to the sides of the neck; the inferior yellow margin is the broadest, and passes from the pit close to the angle of the mouth, turning forward to the middle of the lower jaw, inclosing a semielliptical brown patch. Two elongated yellowish spots may be observed diverging from both sides of the pit to the lip. The cephalic plates are deep chestnut-brown; a transverse light brown band extends across the head from one orbit to the other.

Variation.—The ground color varies from brownish gray, through brown, to blackish, the latter being the so-called *C. kirtlandi.* It appears that specimens living in swamps and marshy places are chiefly of the latter color. The alleged differences in the shape of the head between Ohio and Wisconsin specimens (Smith, *loc. cit.*) I have been unable to verify.

Geographical distribution.—The area inhabited, now or formerly, by the Massasauga lies approximately between the seventy-seventh and ninety-eighth meridians and the thirty-eighth and forty-fifth parallels.

In the State of New York they have been found in Genesee County, in the western portion, draining into Lake Ontario, where their occurrence in the town of Byron was recorded for the first time in 1853 by Mr. John Gebhard. They then inhabited a white-cedar swamp containing an area of about 1,000 acres. In Ohio, whence came the types of Kirtland's *C. messasaugus* (or Holbrook's *C. kirtlandi*), they are presumed to occur in all parts. It is also common in parts of Michigan, though it must be remembered that this expression "common" in all these snakes is a very indefinite term. The accessible record may show them to have been common in a given place at the time it was made, yet at the present day one may search long and often in the same place and not find one. Dr. Hay says that it is yet abundant in some localities in Indiana, but he has not been able to confirm its occurrence south of Indianapolis. He also states that on the prairies of Illinois, before the country became thickly populated, they were extremely abundant, and the killing of two or three dozen of them in a season was not an unusual thing for any farmer's boy, while now, in that same region, not one is seen in years. H. Garman states that it occurs on the prairies throughout Illinois, but I can find no reliable records for the southern part. The only place where Hurter has found it there is the "Wet Prairie," near Edwardsville, Madison County, where they seem to be common, however. The massasanga also occurs in suitable localities in Wisconsin, Minnesota, and Iowa. Taylor quotes it as common in eastern and middle Nebraska, and the record for Kansas is similar. Farther in the Southwest it is replaced by *S. edwardsii*. In the Northeast the Massasauga extends into Canada, where it occurs in various localities in the peninsula of Ontario. The National Museum has a specimen from Lucknow, by Dr. Garnier (No. 12752), and Mr. James M. Macoun informs me that he knows of specimens from Georgian Bay, Lake Huron, and Pelee Point, Lake Erie.

Habits.—The Massasauga is emphatically a species of the prairies and their swamps and marshes. Its life history offers as yet some unsolved or disputed questions, but thanks to Dr. O. P. Hay's interesting studies of this species, much light has of late been thrown upon it, and to those who want a more detailed biography I would recommend his article, "The Massasauga and its Habits," in the American Naturalist (Vol. XXI, 1887, pp. 211–218), which also contains some interesting observations on two specimens which brought forth living young—one five, the other six—in captivity.

Being a comparatively small species, the maximum length probably not exceeding 40 inches, its bite is correspondingly less dangerous than the larger Rattlesnakes. There seems to be great diversity of opinion, however, as to the extent of its poisonous power, for while Dr. Kirtland asserts that the bite is scarcely more than the sting of a hornet, the farmers fear it very much, and Dr. Hay thinks that one Massasauga would probably be equivalent in virulence to a whole colony of hornets, which I think is more nearly correct.

Dr. Hay also characterizes the statement that the sound of the rattle of the Massasauga is so feeble that it is scarcely audible, as certainly incorrect, asserting from experience that it can be heard at a distance of several feet. Dr. Morris Gibbs, who has examined a great many specimens, found the largest number of rings in the rattle to be 10. The largest number in any specimen in the National Museum is 9 (No. 12752).

Dr. Taylor, writing of the Massasauga in Nebraska, states that an examination of the contents of the stomachs of this species shows that its food is almost wholly made up of mice and other rodents, and he consequently considers it decidedly useful, aside from its venomous qualities. It seems hardly advisable, however, to suggest protection for this species on this account, but I would advise that the farmers spare the life of every large harmless snake on their land, and there would be no harm in killing off every Rattler, for harmless snakes will destroy the mice fully as well as the poisonous ones.

The Gulf-coast Massasauga.

Sistrurus catenatus consors,* (B. & G.).

1853.—*Crotalophorus consors*, Baird and Girard, Cat. N. Am. Serp., p. 12.—Duméril and Bibron, Erpét. Génér., vii, ii, p. 1482 (1854).—Baird, Pac. R. R. Rep., x, Reptiles, p. 14 (1859).

1883.—*Sistrurus catenatus*, var. *consors*, Garman, Rept. Batr. N. Am., i, Ophid., p. 176.

1892.—? *Sistrurus catenatus*, Garman, Bull. Essex Inst., xxiv, p. 4.

Figure.—Baird, Pac. R. R. Rep., x, Rept. pl. xxiv, fig. 8 (1859).

The status of the present form is very doubtful. It was described by Baird and Girard from a single specimen collected at Indianola, Tex., which now appears to be lost. The original description does not furnish any very tangible character by which to separate it from typical *S. catenatus* with 25 scale rows, but its scutellation is compared chiefly with *S. miliarius*, which seems to indicate that it may have had the preocular and posterior nasal separated, although the otherwise so characteristic color pattern of the head is that of *S. catenatus*. The figure in the Pacific Railroad Report [pl. xxiv, fig. 8], gives only the top of the head, but the above suggestion is strengthened by that figure, which certainly seems to show a separation of the shields mentioned by a loreal, but whether by an upper loreal, detached from the anterior portion of the preocular, or by a large loreal proper, is not clear, although the former alternative seems most probable. In that case we have probably to do with an individual variation only, and the only ground for the separation of the subspecies would be the smallness of the dorsal spots. The 25 scale rows would then distinguish it from the subspecies *S. c. edwardsii*.

I am inclined to think that the *S. catenatus* reported by Garman (Bull. Essex. Inst., xxiv, 1892, p. 4.) from Deming's Bridge, Matagorda County, Tex., not very far from the type locality of *S. consors*, and which, like the latter, had 25 scale rows, belong here. They have, moreover, 48 to 51 dorsal blotches.

For the sake of completeness, I add the original description by C. Girard.

Description.—Twenty-five rows of dorsal scales, all carinated except the two first rows on either side. Seven series of blotches, one dorsal and 3 on each side, all very small. A yellowish white line passing from behind the nostril below and behind the eye.

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*From the Latin *consors*, a partner, companion, or relative.

Resembles *C. miliarius* in its general appearance, but without the vertebral brownish red line. The ground color is olivaceous brown, the blotches of a deeper brown, encircled with a black fillet margined with a whitish yellow line. There are about 50 blotches in the dorsal series, emarginated anteriorly only, 30 of which are transversely elongated, very irregular; the 20 remaining ones nearly circular, with regular outlines. The blotches of the lateral rows are comparatively small and of nearly equal size, though sometimes one of either row may appear much the largest. The blotches of the first lateral series are opposite to those of the dorsal and affect the first, second, and third rows of scales and the extremities of the abdominal scutellæ [ventrals, or gastrosteges]. The blotches of the second series alternate with these, extending on the third, fourth, and fifth rows of scales. The blotches of the third series are obsolete and alternate with those of the second series, and are generally opposite to those of the dorsal series situated in the fifth, sixth, and seventh rows. The upper surface of the head is brown; there are 2 vittæ extending from the vertex along the neck to the first dorsal blotch. A broader and deep chestnut-brown band extends from the eye to the neck. The frontal region is deeper brown than the vertex. A yellowish white line starts from the nostrils near the upper surface of the head, extending backward, in passing between the eye and the pit, to the angle of the mouth. A vertical whitish bar extends from each side of the pit to the labial. The belly is yellowish white, marbled with black, transversely oblong patches. The vertical plate [frontal] is cordiform; the anterior frontal plates [internasals] proportionally small; the occipital [parietal] rather broad. The scales of the body are elongated, a little smaller than in *C. miliarius*, but not quite so acute posteriorly. The 2 lateral and smooth rows are much broader than the rest, and conspicuous. Most of the scales of these 2 rows are black, with the posterior edge straw-colored, giving the appearance of a succession of distinct crescents. The tail is conical and tapering; the rattle composed of one ring besides the terminal one.

EDWARDS' MASSASAUGA.

Sistrurus catenatus edwardsii,* (B. & G.).

Plate 6.

1853.—*Crotalophorus edwardsii*, BAIRD and GIRARD, Cat. N. Am. Serp., p. 15.—DUMÉRIL et BIBRON, Érpét. Gén., VII, ii, p. 1483 (1854).—BAIRD, U. S. Mex. Bound. Surv. Rept., p. 15 (1859).—*Caudisona edwardsii*, COPE, Bull. U. S. Nat. Mus. No. 1, Check list, p. 34 (1875).

1874.—*Crotalus miliarius*, JAN, Icon. Ophid., livr. 46, pl. III, fig. 6 (not of Linn).

1883.—*Sistrurus miliarius*, var. *edwardsii*, GARMAN, Rept. Batr. N. Am., I, Ophid., p. 177.

1892.—*Crotalophorus catenatus edwardsii*, COPE, Proc. U. S. Nat. Mus., XIV, 1891, No. 882, p. 685.—COPE, Proc. Phila. Acad., 1892, p. 336.

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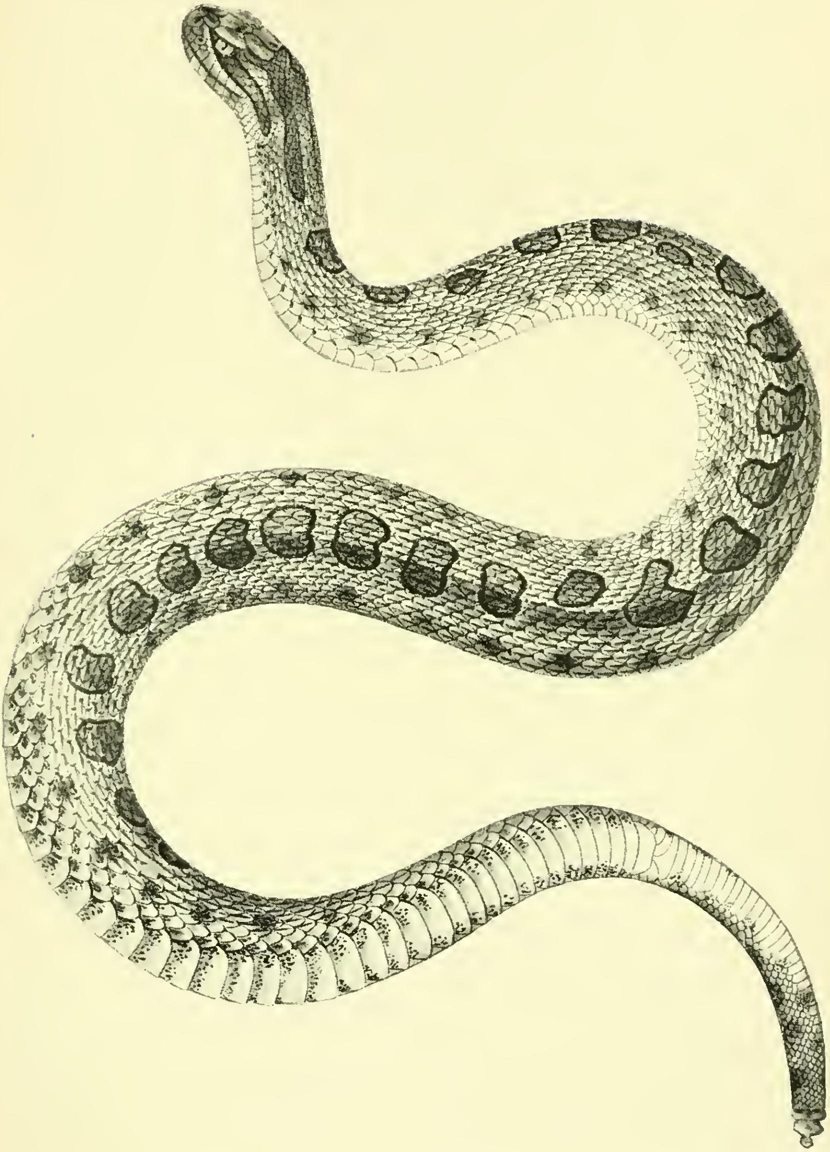
* Named in honor of Dr. L. A. Edwards, U. S. A.



EDWARDS' MASSASAUGA,—SISTRURUS CATENATUS EDWARDSII.

From Baird, Rep. Mex. Bound. Surv.

Figures.—BAIRD, Mex. Bound. Surv., II, Rept., pl. V, fig. 1 (1859).—BAIRD, Pac. R. R. Rep., X, Rept., pl. XXV, fig. 10 (1859).—JAN, Icon. Ophid. livr. 46, pl III, fig. 6 (1874).

*Description.**—Twenty-three rows of dorsal scales; first and second lateral rows smooth. Vertical plate [frontal] subpentagonal, tapering posteriorly. Lateral rows of blotches proportionally very small.

The ground-color is yellowish-brown, with three lateral series of deep chestnut-brown blotches. Two elongated brown blotches extend from the superciliaries [supraoculars] backward. A narrow band of chestnut brown, from the posterior frontal plates [prefrontals], passes over the eyes to the neck, under which a yellowish stripe extends from the nostril to the angle of the mouth. The snout and upper jaw are brown, with two yellow fillets diverging from the pit. The lower jaw and chin are mottled with brown and yellow. There are about 42 dorsal brown and irregular blotches, margined with deep black and encircled with a yellow fillet, from the head to the tip of the tail, the thirty-fourth opposite the anus, the last three passing to the sides of the tail, but do not meet below. Subcircular on the posterior half of the body, the blotches on the anterior half are longer transversely than longitudinally, emarginated anteriorly only.

The blotches of the two lateral series are proportionally small. The blotches of the upper series are more or less obsolete, and alternate with the dorsal ones. Those of the second lateral series are the smallest, and alternate also, being of as deep a color as the dorsal ones, but do not extend beyond the anus, occupying the second, third, and fourth rows of scales. The first and lower series affect the first and second rows and only one scale. The belly is of a light straw color, dotted and sprinkled irregularly with brown.

Scales elliptical, subtruncated posteriorly, constituting 23 rows, strongly carinated, except the two lateral rows, which are smooth.

Head, when seen from above, subelliptical; vertical plate [frontal] proportionally more elongated than in *C. tergeminus* [=*S. catenatus*].

Number of ventrals [gastrosteges], 143 to 153; of caudals [urosteges], 24 to 31; scale rows across middle of body, 23.

Variation.—The chief variation in scutellation I have found in this subspecies consists in the occasional separation of the anterior prolongation of the preocular so as to form an upper loreal separating the preocular from the posterior nasal.

In coloration there is considerable difference between the specimens, chiefly consisting in an obliteration of the markings on top of the head, thus obscuring the characteristic dark spot on the middle of the parietal suture.

Geographical distribution.—The present subspecies represents the typical Massasauga in the Southwest. Curiously enough it does not

* Original description by C. Girard in Baird and Girard's N. Am. Serp., p. 15; from specimens Nos. 506-508, U. S. Nat. Mus.

extend further north than the southern limit of the latter. It is found from Indian Territory through western Texas to the Mexican border. Its known range has recently been extended a considerable distance west, as Dr. Timothy E. Wilcox has sent a specimen from Fort Huachuca, Ariz.

Habits.—Nothing is definitely known, but the habits are probably similar to those of the typical form, though it may have to be satisfied with more arid localities.

THE GROUND RATTLESNAKE.

Sistrurus miliarius,* (Linnæus).

Plate 7.

1766.—*Crotalus miliarius*, LINNÆUS, Syst. Nat., 12 ed., I (p. 372).—DAUDIN, Hist. Nat. Rept., V, p. 328 (1803).—SAY, Am. Journ. Sc., I, 1819, p. 263.—HARLAN, Journ., Phila. Acad., V, 1827 (p. 370).—HARLAN, Phys. Med. Res. (p. 134) (1835).—SCHLEGEL, Ess. Phys. Serp., I, p. 193; II, p. 569 (part) (1837).—HOLBROOK, N. Am. Herpet., 1 ed., II, p. 73 (1838).—DUMÉRIL et BIBRON, Erpét. Génér., VII, ii, p. 1477 (1854).—JAN, Rev. Mag. Zool., 1859, extr., p. 28.—JAN, Elenc. Sist. Ofid., p. 124 (1863).—COPE, in Mitchell's Res. Ven. Rattlesn., p. 124 (1861).—GARMAN, Rept. Batr. N. Am., I, Ophid., p. 119 (1883).—*Crotalophorus miliarius*, GRAY, Ann. Philos., 1825 (p. 205).—GRAY, Cat. Sn. Brit. Mus., p. 17 (1849).—HOLBROOK, N. Am. Herpet., 2 ed., III, p. 25 (1842).—DE KAY, Zool. N. Y., III, p. 57 (1842).—BAIRD and GIRARD, Cat. N. Am. Serp., p. 11 (1853).—LE CONTE, South. Med. Surg. Journ., IX, 1853, pp. 651, 652.—HALLOWELL, in Sitgreave's Exp. Zuñi Colo. Riv., p. 117 (1854).—BAIRD, Pac. R. R. Rep., X, Whipple's Route, p. 10 (1859).—COPE, Proc. Phila. Acad., 1859, p. 336.—COPE, Proc. U. S. Nat. Mus., XI, 1888, p. 393.—PUTNAM, Amer. Natural., II, 1868, p. 134.—HAY, Proc. U. S. Nat. Mus., XV, 1892, p. 388.—*Caudisona miliaria*, FITZINGER, N. Class. Rept., p. 63 (1826).—*C. miliarius*, GRAY, Zool. Miscell., p. 51 (1842).—COPE, Bull. U. S. Nat. Mus., No. 1, Check list, p. 34 (1875).—COPE, Proc. Am. Philos. Soc., XVII, 1877, p. 64.—COPE, Bull. U. S. Nat. Mus., No. 17, p. 24 (1880).—COUES and YARROW, Proc. Phila. Acad., 1878, p. 26.—TRUE, in Hammond's South Carolina, p. 235 (1883).—YARROW, Bull. U. S. Nat. Mus., No. 24, pp. 12, 78 (1883).—*Sistrurus miliarius*, GARMAN, N. Am. Rept., I, Ophid., p. 177, (1883).—GARMAN, Bull. Essex Inst., XIX, 1887, p. 123.—GARMAN, Bull. Essex Inst., XXIV, 1892, p. 4.—LŒNNBERG, Proc. U. S. Nat. Mus., XVII, 1894, p. 335.

1799.—*Crotalus miliaris*, BEAUVOIS, Trans. Am. Philos. Soc., IV, p. 367.

Figures.—CATESBY, Carol., II (pl. XLII) (1743).—SCHLEGEL, Ess. Phys. Serp., Atlas, pl. XX, figs. 17, 18 (1837).—HOLBROOK, N. Am. Herpet., 1 ed., II, pl. XV (1838).—HOLBROOK, N. Am. Herpet., 2 ed., III, pl. IV (1842).—BAIRD, Pac. R. R. Rep., X, Rept., pl. XXIV, fig. 7 (1859).

Description.†—Twenty-two or 23 dorsal rows of scales, all of which are carinated, the lateral and first row but slightly; a vertebral brownish red line; 7 series of blotches, 1 dorsal and 3 lateral, on each side, the uppermost of which is obsolete, and the lowest subject to irregular-

*From the Latin *miliarius*, millet-like, with millet-like spots.

†Description by C. Girard, in Baird and Girard's N. Am. Serp., p. 11, from specimens Nos. 198–502, U. S. Nat. Mus.

GROUND RATTLESNAKE,—SISTRURUS MILIARIUS.

From a cast in the U. S National Museum.

ities. Vertical plate [frontal] subcordiform, occipital [parietal] oblong and elongated. A narrow white line commences at the lowest point of the orbit and passes obliquely backward to the angle of the mouth. Ground color dark grayish ash, minutely mottled. A series of 38 to 45 subcircular dorsal blotches extending from head to tail, dark brown, each with a narrow, distinct yellowish border. Interval rather narrower than the spots themselves. A broad band of purplish red passes from head to tail through the blotches. On each side may be distinguished three series of blotches, the first on the first and second lateral rows of scales and partly on the abdominal scutellæ [ventrals or gastrosteges]; the second alternating with this on the second, third, fourth, and fifth rows of scales, and opposite the dorsal series; the third alternating with the second and the dorsal series on the fifth, sixth, seventh, and eighth rows of scales. The latter series is dusky and obsolete; the others are uniform and distinctly black.

The shape of the blotches is subjected to some variation, according to individuals. Generally subcircular or slightly oblong, they become sometimes a transversely elongated quadrangle, three times as long as wide. Their shape varies according to the region of the body on which they are found. On the anterior third they are subquadrangular, anteriorly and posteriorly emarginated; on the middle region they elongate, and toward the posterior third become nearly circular. Backward of the arms the five or six blotches of that region extend on the sides, without, however, meeting on the lower surface. The blotches of the first lateral row are subquadrangular and a little smaller than those of the second and third rows, the blotches of the second row being transversely oblong and largest on the middle region of the body. Side of the head purplish brown, a narrow, distinct white line from the lowest part of the orbit passing obliquely backward to the angle of the mouth. Above and continuous with that white line a deep chestnut-brown vitta is observed, of the same length but broader, and lined above with a narrow, dull, yellowish margin. Two undulated dark brown vittæ extend from the vertex to the first dorsal blotch and confluent with it. A double crescentic blotch is observed on the frontal scutellæ [internasals and prefrontals], leaving a transversal fulvous band across the head between the orbits. The color underneath is reddish yellow, marmorated with brownish black blotches and minute dots.

The scales are elongated, carinated, and acute posteriorly. Those of the lateral row are slightly carinated also, but narrower than in *C. consors*, and more acute posteriorly.

Number of ventrals [gastrosteges], 132 to 136; of caudals [urosteges], 27 to 36; scale rows, 21 to 23.

The greatest number of joints to any rattle of this species in the U. S. National Museum is nine.

Variation.—While the scutellation of this species appears rather constant, there is considerable variation in color, inasmuch as specimens from moist localities appear much darker, often quite blackish with large spots, while in those from more arid districts the ground color is much paler, and the markings more restricted. There is also a certain amount of variation with regard to the red dorsal stripe, which seems to be wanting in the young.

Geographical distribution.—Holbrook asserts that on the Atlantic coast this species does not occur north of the thirty-fifth parallel, and I am aware of no later record which contradicts this. In fact, the most northerly record I have been able to find seems to be that of Drs. Coues and Yarrow (Proc. Phila. Acad., 1878, p. 26) from the neighborhood of Fort Macon in North Carolina, a little south of the latitude mentioned. They write that a few individuals are said to have been seen on Bogue banks; none, however, observed or secured by them; but that they are quite common on Shackleford banks, a few miles from Fort Macon, and that it has also been taken on the mainland. The ground rattler is found south of this point along the coasts of North Carolina, South Carolina, Georgia, and Florida. In the latter State it is distributed all over the peninsula and along the Gulf coast to Alabama, Mississippi, and Louisiana. It ascends the Mississippi River Valley and the valleys of its southern tributaries, but curiously enough seems to be more common on the western side of the great river, being apparently common in Arkansas and Indian Territory even as far west as central Oklahoma, whence the National Museum has a young specimen collected by Dr. Edward Palmer at Old Fort Cobb.

In Texas Prof. Cope has recorded it as occurring at Dallas; Mr. Ragsdale has collected it in Cooke County, and Capt. Pope brought a specimen (No. 494) home from the head waters of the Colorado River, at about the one hundred and first meridian. On the coast of Texas Mr. Garman has recently recorded it (Bull. Essex Inst., XXIV, 1892) from Matagorda County.

Habits.—The Ground Rattler appears to prefer dry ground, and Holbrook states that it is found among leaves, and frequently in high grass in search of small field mice, on which it feeds.

The only observation about its breeding habits of which I am aware is a note by Prof. F. W. Putnam in the American Naturalist (Vol. II, 1868, p. 134) that he had once dissected a specimen having 14 eggs, all with embryos two inches in length in the oviduct.

According to Holbrook the common people dread the ground rattler and consider it much more destructive than the Banded Rattlesnake, both on account of its greater aggressiveness, the scant warning its faint rattling affords, and the supposed greater activity of its venom. He, however, satisfied himself by experiments of the fallacy of the alleged greater virulence of its poison, for while he found it sufficient to kill small birds, or field mice, repeated bites failed to affect a cat beyond causing it to droop for thirty-six hours, at the end of which time the effects of the poison entirely disappeared.

While thus the bite of these small snakes may be attended with comparatively little danger, a person bitten would act very foolishly were he to neglect to pay proper attention to the wound and to apply as soon as possible proper remedies, as otherwise he might pay dearly enough for his carelessness.

Although, as a rule, not fatal to man, the Ground Rattler is not harmless enough to secure it against destruction wherever it may be found. It is undoubtedly useful in destroying a great quantity of small rodents, but the protection of the other innocuous snakes will compensate for the killing of any number of Ground Rattlers.

Genus CROTALUS* Linn.

The Rattlesnakes.

1758.—*Crotalus*, Linnæus, Syst. Nat., 10 ed., I, p. 214 (type *C. horridus*).
1764.—*Crotalophorus*, Houttuyn, Linn. Natuurl. Hist., VI, p. 290 (emend.).
1768.—*Caudisona*, Laurenti, Syn. Rept., p. 92 (same type).
1818.—*Crotalinus*, Rafinesque, Am. Month. Mag., III (p. 446), IV, p. 41 (emend.).
1830.—*Uropsophus*, Wagler, Syst. Amph., p. 176 (type *C. triseriatus*).
1843.—*Urocrotalon*, Fitzinger, Syst. Rept., p. 29 (type *C. durissus* Linn.).
1861.—*Aploaspis*, Cope, Proc. Phila. Acad., 1861, p. 206 (type *C. lepida*).
1875.—*Æchmophrys*, Coues, Wheeler's Surv. W. 100 Mer., V, p. 609 (type *C. cerastes*).
1883.—*Haploaspis*, Cope, Proc. Phila. Acad., 1883, p. 13 (emend.).

There has, at various times, been some confusion in the application of the generic terms of this and the following genus. From 1861 to 1875 Prof. Cope used Laurenti's *Caudisona* for the present group, restricting *Crotalus* to the Ground Rattlers, following Fleming's example of 1822. In 1875, however, he suddenly reversed the two names, employing *Caudisona* for the Ground Rattlers. This latter has later been exchanged for *Crotalophorus*, as will be shown under the following genus.

The case is very simple. When Linnæus, in 1758, first applied the binominal nomenclature he did not know or name any of the ground rattlers, consequently the name *Crotalus* can only be used as done here. Houttuyn's *Crotalophorus* is identical with Linnæi *Crotalus* of the tenth edition of his Systema Naturæ, being, in fact, simply an emendation and, therefore, nothing but a synonym. The status of Laurenti's *Caudisona* is exactly similar.

The geographical distribution of the genus *Crotalus* is highly interesting.

Jointly with the other genus, *Sistrurus*, the Rattlesnakes are peculiar to the New World. Their center of distribution appears to be the tableland of Mexico with its extension northward into the southwestern United States, at least 8 out of a total of the 17 species constituting the genus *Crotalus* occurring at, or near, the boundary between the United States and the Mexican Republic.

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* From the Greek κρόταλον (Krotalon), a rattle.

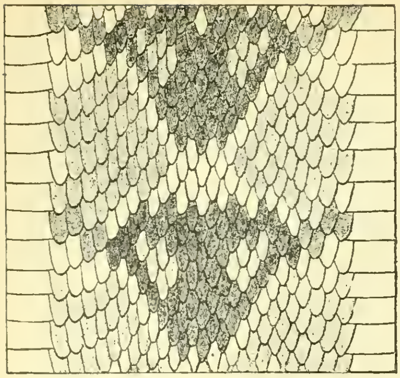

Fig. 51.
DORSAL COLOR PATTERN OF CROTALUS MOLOSSUS.

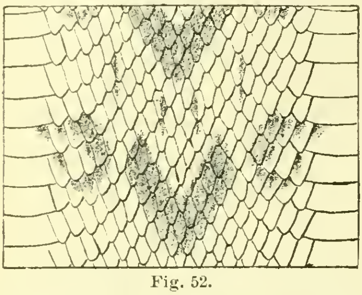

Fig. 52.
DORSAL COLOR PATTERN OF CROTALUS HORRIDUS.

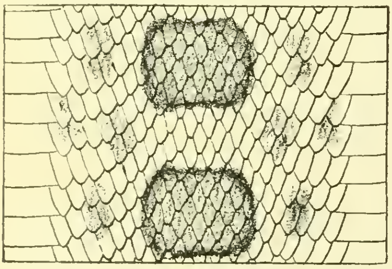

Fig. 53.
DORSAL COLOR PATTERN OF CROTALUS CONFLUENTUS.

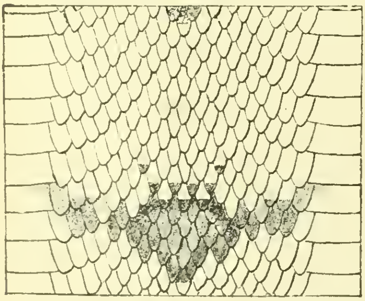

Fig. 54.
DORSAL COLOR PATTERN OF CROTALUS LEPIDUS.

No rattlesnake occurs in any of the West India Islands proper, and only one species appears to be confined to South America, where also another species occurs, the range of which, however, extends into southern Mexico.

Within the United States not less than ten species, with several subspecies, are found; but their distribution within that area is very uneven. Thus, while there are but few localities in which Rattlesnakes do not occur, or did not occur before they were exterminated by man, yet the area inhabited by more than one species of *Crotalus* is comparatively very limited. Thus in the southeast the range of the Diamond Rattlesnake, *C. adamanteus*, is overlapped to a great extent by that of the Banded Rattlesnake, *C. horridus*, while in the center of the Union there is another limited area inhabited by two species, viz, the Banded Rattlesnake, *C. horridus*, and the Prairie Rattler, *C. confluentus*.

As we approach the Mexican boundary and the northward extension of the Sierra Madre the density of the distribution of the species increases rapidly, until in southern Arizona we find no less than 7 different species of Rattlesnakes, viz: *C. molossus*, *C. atrox*, *C. confluentus*, *C. tigris*, *C. cerastes*, *C. lepidus*, and *C. mitchellii pyrrhus*, out of a total of 10 species inhabiting the entire area of the United States.

North of our northern boundary only two species of *Crotalus* extend a short distance into the British possessions, in the western part *C. lucifer* and in the central portion *C. confluentus*.

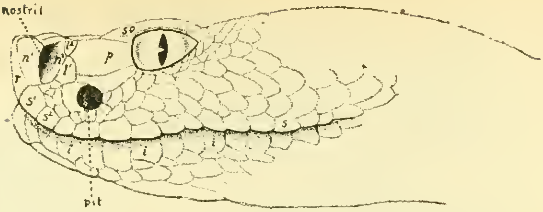

Fig. 55.

HEAD OF CROTALUS, FROM SIDE.

i Infralabials; *l* loreal; l^1 lower loreal; l^2 upper loreal; n^1 anterior nasal; n^2 posterior nasal; *p* preocular; *r* rostral; *s* supralabials; s^1 1st supralabial; s^2 2d supralabial; *so* supraocular.

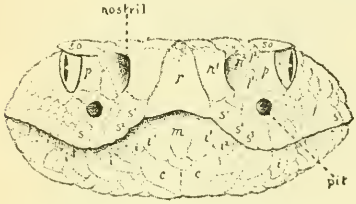

Fig. 56,

FRONT VIEW OF PRECEDING FIGURE.

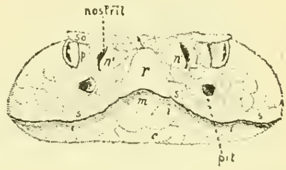

Fig. 57.

HEAD OF CROTALUS MITCHELLII FROM FRONT.

(See explanation of Fig. 55.)

Synopsis of the species of Crotalus occurring in North America north of Mexico.

a^1 Anterior nasal in contact with rostral (figs. 55, 56).

b^1 Upper preocular not divided vertically (figs. 55, 56).

c^1 External border of supraocular not produced into a horn-like process (figs. 55, 56).

d^1 Dark spots on back with two symmetrical light spots, one on each side of median line (fig. 51) .... *C. molossus.*

d^2 Dark spots on back, solid, or with only one median light spot.

e^1 Dorsal pattern, consisting of dark chevron bands (fig. 52) ...... *C. horridus.*

e^2 Dorsal pattern, consisting of more or less squarish spots or straight cross bands (figs. 53, 54).

f^1 Rostral at least as high as wide (fig. 63).

g^1 Light postsuperciliary line reaches the second scale row above commissure at least two scales anterior to angle of mouth (fig. 58).

h^1 A well-defined vertical white line on first labial and anterior nasal, occupying the posterior half of the latter (fig. 58) .. *C. adamanteus.*

h^2 No white line on first labial and nasal, which are uniform in color and more or less dusted over with minute blackish dots.

i^1 Predominant color grayish-brown .... *C. atrox.*

i^2 Predominant color reddish-brown .... *C. atrox ruber.*

g^2 Light postsuperciliary line reaches the second scale row above commissure at corner of mouth or not at all (figs. 59, 60).

h^1 Light postsuperciliary line one scale wide; dark postocular patch starts from below anterior angle of eye (fig. 59) .... *C. confluentus.*

h^2 Light postsuperciliary line two scales wide; dark postocular patch starts from below center of eye (fig. 60) .... *C. lucifer.*

f^2 Rostral wider than high (fig. 61) .... *C. tigris.*

c^2 External border of supraocular produced into a horn-like process (fig. 66) .... *C. cerastes.*

b^2 Upper preocular divided vertically (fig. 62) .... *C. lepidus.*

a^2 Anterior nasal separated from rostral by scales (fig. 63).

b^1 Predominant color whitish.. *C. mitchellii.*

b^2 Predominant color red .... *C. mitchellii pyrrhus.*

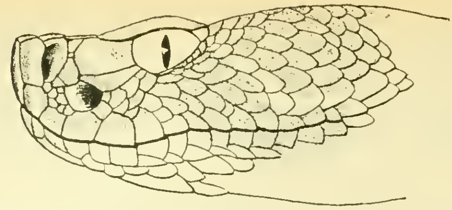

Fig. 58.
COLOR PATTERN OF SIDE OF HEAD OF CROTALUS ADAMANTEUS.

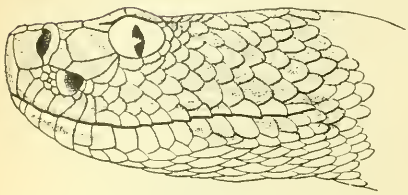

Fig. 59.
COLOR PATTERN OF SIDE OF HEAD OF CROTALUS CONFLUENTUS.

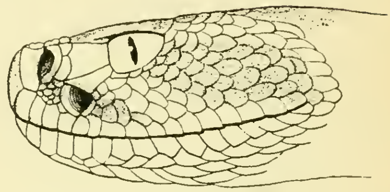

Fig. 60.
COLOR PATTERN OF SIDE OF HEAD OF CROTALUS LUCIFER.

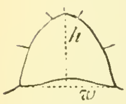

Fig. 61.
DIAGRAM OF LOW ROSTRAL.
h Height; *w* width.

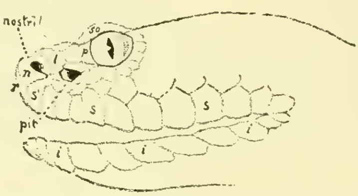

Fig. 62.
HEAD OF CROTALUS LEPIDUS FROM SIDE.
(See explanation of Fig. 55.)

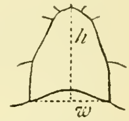

Fig. 63.
DIAGRAM OF HIGH ROSTRAL.
h Height; *w* width.

THE DOG-FACED RATTLESNAKE.

Crotalus molossus,* Baird & Girard.

Pl. 8.

1853.—*Crotalus molossus*, BAIRD and GIRARD, N. Am. Serp., p. 10.—BAIRD, Mex. Bound. Surv., II, Rept., p. 14 (1859).—COPE, Proc. Phila. Acad., 1859, p. 338.—COPE, Bull. U. S. Nat. Mus., No. 1, p. 33 (1875).—COPE, in Wheeler's Surv. W. 100 Mer., V, p. 533 (1875).—COPE, Proc. Phila. Acad., 1883, p. 12.—COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 689 (1892).—YARROW, Bull. U. S. Nat. Mus., No. 24, pp. 12, 78 (1883).—GARMAN, Rept. Batr. N. Am., I, Ophid., p. 113, (1883).—*Caudisona molossus*, COPE, in Mitchell's Res. Ven. Rattlesn., p. 124, (1861).—COPE, Proc. Phila. Acad., 1866, pp. 307, 308.—COUES, in Wheeler's Surv. W. 100 Mer., V, p. 605 (1875).

1854.—*Crotalus ornatus*, HALLOWELL, Proc. Phila. Acad., 1854, (p. 192).—HALLOWELL, Pac. R. R. Rep., X, Parke's Route, p. 23 (1859).—COPE, Proc. Phila. Acad., 1859, p. 338.

1883.—*Crotalus durissus*, var. *molossus*, GARMAN, Rept. Batr. N. Am., I, Ophid., p. 171.

Figures.—BAIRD, Mex. Bound. Surv., II, Rept., pl. II (1859).—BAIRD, Pac. R. R. Rep., X, Rept, pl. XXIV, fig. 5.—HALLOWELL, Pac. R. R. Rep., X, pl. II (1859).

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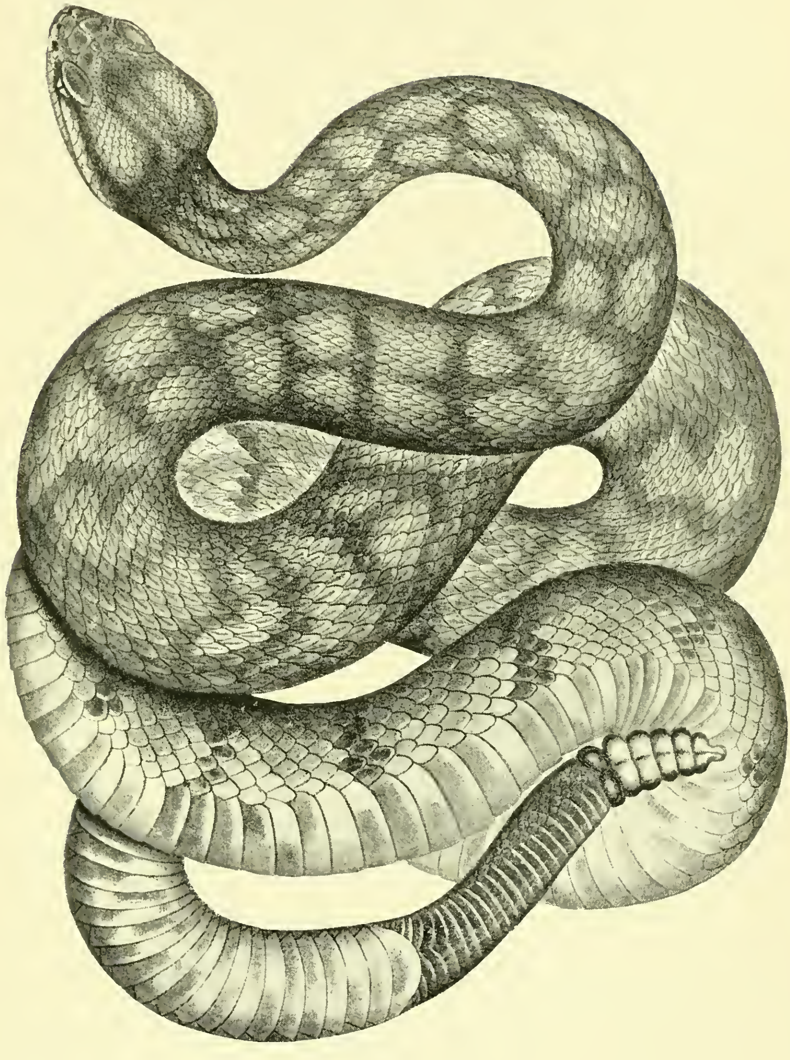
* From the Greek *μολοσσός* or Latin *molossus*, the Molossian wolfdog, bulldog.



DOG-FACED RATTLESNAKE,—CROTALUS MOLOSSUS.
From Hallowell, Pacific R. R. Rep.

*Description.**—Muzzle broad; rostral small. Scales between superciliaries [supraoculars] small, uniform, except the two anterior. Two frontal plates [internasals], 4 postfrontal [prefrontals], 2 intersuperciliary [interorbitals], all in contact. Five rows scales between the labials and suborbital row; middle row not extending beyond the middle of the orbit; labials, 18 above, fifth and sixth largest; 17 below. Dorsal rows of scales, 29; two external rows, small. Tail uniform black. Color roll sulphur; a series of chestnut-brown transverse lozenges [fig. 53] with exterior corners produced to the abdomen; centers of lozenges with one or two spots; each scale but one color; a brown patch below and behind the eye.

One of the most strongly marked of all species. Head very broad in front; outline nearly rectangular. Rostral small. Two anterior frontals [internasals]; behind these, four plates, the exterior resting on the superciliary; behind these two other plates, between and in contact with the superciliaries [supraorbitals]. Anterior nasal subtriangular. Top of head with numerous smooth subtuberculous scales. Suborbitals large, extending to the anterior canthus. General aspect smoother than in crotali generally; scales rounded at the posterior apex, carinated but slightly.

General color above, that of roll sulphur; beneath, pale yellowish; posteriorly, very faintly clouded with brownish. Tail black. Anteriorly the scutellæ [ventrals, or gastrosteges] are entirely immaculate. Along the back is a series of transverse reddish or chestnut-brown lozenges embraced in a width of 12 or 14 scales and 4 or 5 scales long, and with the exterior angles produced to the abdomen [fig. 53]. These lozenges are frames with the outline generally one scale in width and with the centers of the ground color; sometimes divided by a median line of brown so as to show two yellowish spots inside of the lozenges. The scales exterior to the lozenges are rather lighter. Sometimes the brown rings and the lozenges widen at the abdomen and indicate lateral spots of four scales; at others, and especially anteriorly, the rings are obsolete and the brown is in a dorsal series. In fact for the anterior fourth of the body we have a dorsal patch of brown showing alternately, at successive intervals, one large yellowish spot and then a pair of smaller ones, owing to the confluence of the successive lozenges. The superciliaries and scales anterior to them, as well as broad patch below and behind the eye, light greenish-brown. Tail uniform dark-brown above, paler beneath.

A remarkable character of this species is that each individual scale is of the same uniform tint to its base, and not showing two colors as in other species.

Variation.—The head scutellation of the present species is exceedingly variable. I have seen about nine specimens, hardly two of which

* Original description by S. F. Baird, in Baird and Girard's N. Am. Serp., p. 10, from a specimen from New Mexico, U. S. Nat. Mus., No. 485.

are alike in that respect. In all of them the snout is covered above with large shields, which sometimes extend to between the orbits, but their number and mutual relation is very variable, and often they are more or less separated by small scales. The size and shape of the rostral also varies, and the rows of scales between eye and labials vary between 4 and 6.

The coloration of this undoubtedly our most beautifully tinted crotalid is more stable. The chief variations consist in the greater or lesser degree of definition of the spots, and in the color of the tail, which in most specimens is solidly blackish though in a few it presents alternating cross bands of black and light color.

Geographical distribution.—In the main the range of *C. molossus*, at least within the borders of the United States, coincides with that of *C. lepidus*, being confined to the States and Territories bordering upon the Mexican frontier.

It was first described from a specimen collected at Santa Rita del Cobre, near the present Fort Bayard, in New Mexico, and not far from that locality it has since been taken by Prof. Cope. Henshaw procured it in southern Arizona, probably not far from Fort Buchanan, whence the Museum got a specimen from Dr. Irwin, while quite recently Dr. Thimothy E. Wilcox has sent it from Fort Huachuca. Two specimens, collected by Dr. E. Coues on San Francisco Mountain, Arizona, were identified by Cope as the present species. *C. lepidus* has not been found so far from the Mexican boundary. The range into Mexico is unknown.

The Texan specimen, upon which Hallowell based the *C. ornatus*, was collected by Dr. Heermann at the Pecos River, en route between El Paso and San Antonio, and is so far the only specimen obtained in Texas.

Habits.—Nothing is known of its habits, except that it is found among rocks.

The Banded Rattlesnake.

Crotalus horridus,[a] Linnæus.

Plate 9.

1758.—*Crotalus horridus*, Linnæus, Syst. Nat., 10 ed., i, p. 214.—Linnæus, Syst. Nat., 12 ed., i, p. 372 (1766).—LeConte, Proc. Phila. Acad., 1853 (p. 417).—Cope, Proc. Phila. Acad., 1859, p. 338.—Cope, Bull. U. S. Nat. Mus., No. 1, Check-list, p. 33 (1875).—Cope, in Wheeler's Surv. W. 100 Mer., v, p. 534 (1875).—Cope, Proc. U. S. Nat. Mus., xiv, 1891 (No. 882), p. 693 (1892).—Yarrow, Bull. U. S. Nat. Mus., No. 24, Check List, pp. 12, 74 (1883).—Cragin, Trans. Kansas Acad. Sc., vii, p. 121 (1881).—Garman, N. Am. Rept. Batr., i, Ophid., pp. 115, 174, pl. ix, fig. 1 (1883).—Garman, List. N. Am. Rept. Batr., p. 35 (1884).—True, in Hammond's South Carolina, p. 235 (1883).—Davis and Rice, Bull. Ill. State Lab. Nat. Hist., i, No. 5, 1883 (p. 27).—Davis and Rice, Bull. Chic. Acad. Sc., i, p. 28 (1883).—Hay, Amph. Rept. Indiana, p. 13 (1885).—Hay, Batr. Rept. Indiana, p. 128 (1893).—Jordan, Man. Vert. North. U. S., 5

[a] From the Latin *horridus*, horrible, terrible.

BANDED RATTLESNAKE.—CROTALUS HORRIDUS.

From a cast in the U. S. National Museum.

ed., p. 199 (1888).—BARRINGER, Ven. Rept. U. S., p. 4 (1891).—H. GARMAN, Bull. Ill. State Lab. Nat. Hist., III, p. 311 (1892).—H. GARMAN, Bull. Ess. Inst., XXVI, 1894, p. 36.—*Crotalophorus horridus*, HOUTTUYN, Linn. Natuur. Hist., VI, p. 309 (1764).—*Caudisona horrida*, FLEMING, Philos. Zool., II. p. 294 (1822).—COPE, in Mitchell's Res. Ven. Rattlesn., p. 122 (1861).—COPE, Proc. Phila. Acad., 1866, p. 309.—COUES, Proc. Phila. Acad., 1871, p. 48.

1768.—*Caudisona durissus*, LAURENTI, Syn. Rept., p. 93 (in part only).—*Crotalus durissus*, GMELIN, Syst. Nat., I, iii, p. 1081 (in part only) (1788).—LATREILLE, Hist. Nat. Rept., III, p. 190 (1802).—DAUDIN, Hist. Nat. Rept., V, p. 304, pl. LXVIII, fig. 1, 2 (1803).—HARLAN, Journ. Phil. Acad., V. 1827, p. 368.—HARLAN, Med. Phys. Res. (p. 135) (1835).—SCHLEGEL, Ess. Phys. Serp., I, p. 192; II, p. 565 (1837).—KIRTLAND, in Mather's Sec. Rep. Geol. Surv., Ohio, pp. 167, 189 (1838).—STORER, Rep. Rept. Mass., p. 233 (1839).—HOLBROOK, N. Am. Herp., 1 ed., II, p. 81, pl. XVII (1838); 2 ed., III, p. 9, pl. I (1842).—DEKAY, Zool. N. Y., III, p. 55 (1842).—THOMPSON, Hist. Vermont, I. p. 118 (1842).—BAIRD and GIRARD, Cat. N. Am. Serp., p. 1 (1853).—LECONTE, South. Med. Surg. Journ., IX, 1853, pp. 651, 663.—BAIRD, Serp. N. York, p. 9 (1854).—BAIRD, Pac. R. R. Rep., X, Reptiles, p. 14, pl. XXIV, fig. 1 (1859).—BAIRD, Pac. R. R. Rep., X. 35th Par., Whipple's Route, p. 39 (1859).—DUMÉRIL et BIBRON, Erpét. Gén., VII, p. 1465 (1854).—KENNICOTT, Trans. Ill. State Agr. Soc., 1853–1854, I (p. 592).—JAN, Rev. Mag. Zool., 1859, Extr., p. 28.—JAN, Elenc. Sist. Ofid., p. 123 (1863).—FOGG, Sec. Ann. Rep. Nat. Hist. Geol. Maine, p. 141 (1863).—VERRILL, Proc. Boston Soc. Nat. Hist., IX. 1863, p. 197.—HOY, Smithson. Rep., 1864, p. 435.—ALLEN, Proc. Boston Soc. Nat. Hist., 1869, pp. 179, 203.—SMITH, Rep. Geol. Surv. Ohio, IV, 1882, p. 672.—HIGLEY, Trans. Wisc. Acad. Sc., VII, 1884, p. 161.

1799.—*Crotalus boiquira*, BEAUVOIS, Trans. Am. Philos. Soc., IV, p. 368, pl. fac. p. 380, low. fig.

1802.—*Crotalus atricaudatus*, LATREILLE, Hist. Nat. Rept., III, p. 209.—DAUDIN, Hist. Nat. Rept., V, p. 316 (1803).

1818.—*Crotalinus cyanurus*, RAFINESQUE, Amer. Month. Mag., III (p. 446); IV, p. 41.

1859.— ? *Crotalus durissus*, var. *concolor*, JAN, Rev. Mag. Zool., 1859, Extr., p. 28.

1859.—*Crotalus durissus*, var. *melanurus*, JAN, Rev. Mag. Zool., 1859, Extr., p. 28.

1883.—*Crotalus horridus*, var. *atricaudatus*, GARMAN, Rept. Batr. N. Am., I, Ophid., pl. IX, fig. 1.

Figures: CATESBY, Carolina, II. pl. XLI (1743).—LACÉPÈDE, Quad. Ovip. Serp., II, (pl. XVIII, figs. 1, 3) (1789).—BONNATERRE, Ophiol., (pl. II, fig. 3) (1790).—SHAW, Gen. Zool., III, pl. LXXXVIII (1802).—DAUDIN, Hist. Nat. Rept., pl. LXVIII, figs. 1, 2 (1803).—GUERIN, Icon. Règne Anim., (pl. XXIII, fig. 2) (1829–'38).—SCHLEGEL, Ess. Phys. Serp., Atlas, pl. XX, figs. 15, 16 (1837).—HOLBROOK, N. Amer. Herpet., 1 ed., II, pl. XVII (1838); 2 ed., III, pl. I (1842).—DEKAY, Zool. N. York, III, pl. IX, fig. 19 (1842).—BAIRD, Serp. N. York, pl. I, fig. 1 (1854).—DUMÉRIL et BIBRON, Erpét. Gén., Atlas, pl. LXXXIV bis, fig. 1 (1854).—BAIRD, Pac. R. R. Rep., X, pl. XXIV, fig. 1 (1859).—JAN, Icon. Ophid. livr. 46, pl. I, figs. 1, 2 (1874).—GARMAN, Rept. Batr. N. Am., I, Ophid., pl. IX, fig. 1 (1883).—BREHM'S Thierleben, 3 ed., VII, p. 440 (1892).

*Description.**—Head angular. Scales between the superciliaries small, numerous, uniform. Plates above snout, 2 anterior frontal [internasals] and 5 postfrontal [prefrontals]. Suborbital chain continuous, of

* By S. F. Baird, from a specimen from Huntingdon Co., Pennsylvania, U. S. Nat. Mus., No. 245. Baird & Girard, N. Am. Serp., pp. 1–2.

large scales: two rows between this and labials. Labials 12 to 14 above, fifth largest; 13 to15 below. Rows of scales on the back 23 to 25, all carinated: carination on outer row obsolete. Tail black. Above sulphur-brown, with 2 rows of confluent brown lozenges. Light line from superciliary to angle of the mouth; behind this a dark patch (figs. 64, 65).

Head above covered with small subtuberculous scales. Superciliaries (supraoculars) large. Anterior frontals (internasals) large, triangular, emarginated behind to receive a series of three small plates. A single subhexagonal plate between the superciliary (supraocular) and anterior

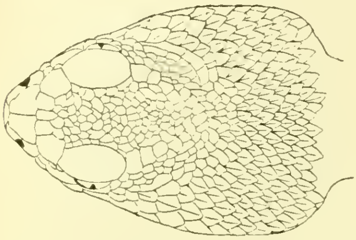


Fig. 64.
HEAD OF CROTALUS HORRIDUS, TOP VIEW.
(After Baird.)

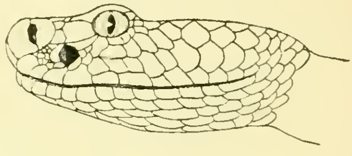


Fig. 65.
HEAD OF CROTALUS HORRIDUS, SIDE VIEW.
(After Baird.)

frontal (internasal). The exterior plate of the posterior frontal (prefrontal) row is much the largest, and is in contact with the superciliaries (supraoculars). A series of 3 or 4 large flat scales extend from the posterior extremity of the superciliary (supraocular). Scales on the cheeks (temporals) very large, truncate. Anterior orbitals (preoculars) double; the upper one rectangular, elongated longitudinally, separated from the (posterior) nasal by 2 small plates (loreals).

General color above that of roll sulphur; beneath, whitish yellow. Along the back is a double series of subrhomboidal blotches, looking as if they had been in contact, and then the line of junction partially effaced for the 3 or 4 central rows. (See fig. 52.) The impression conveyed of the color of these blotches is that of coarse mottlings of soot or gunpowder grains, more crowded exteriorly. There are 21 of these blotches from the head to the anus, the tail being entirely black. The rhomboids are inclosed within about 12 dorsal series of scales. Directly opposite to these spots on each side is a series of subtriangular blotches similarly constituted as to color, and extending from the abdomen to about the fifth lateral row, and some 6 or 7 scales long. Anteriorly these are distinct from the dorsal series, but posteriorly they are confluent with them, forming a series of zigzag blotches across the body. The scutellæ below show more or less of the grain-like mottlings. Posteriorly the yellow of the body is suffused with darker.

There are no markings of lines distinctly visible on the sides of the head. In the center of the spaces between the dorsal and lateral series of blotches are indications of small obselete spots, and in some cases the yellow scales external to the blotches are of a lighter color than the rest.

Number of ventrals (gastrosteges), 166; of subcaudals (urosteges), 25; dorsal scale rows, 23.

Total length, 42 inches; tail, 5 inches.

Variation.—There is considerable individual variation, both in scutellation of the head and the ground color of the body.

The variation in the scutellation on top of the head is especially marked with regard to the prefrontals and the scales covering the canthus rostralis. Normally the large plates consist of 2 internasals, 2 supraoculars, and between these, on each side, a large shield, the prefrontals usually being small scales like those covering the rest of the head. In two of our specimens, however (Nos. 277 and 12748), there are a pair of large prefrontals following the internasals, while in Nos. 277 and 248 there are 2 scutes between the internasal and the supraocular on each side instead of 1.

The ground color varies greatly from light yellowish and light reddish gray through brown to almost black in some instances. In old specimens the tail is generally uniform black, but in the young ones it is banded light and black. In many specimens from localities in the Alleghany Mountains, with a moist climate, this black of the tail and sometimes even of the entire posterior half of the body is often of a deep velvety gloss.

In the majority of the Western specimens there is a broad, ill-defined, but very distinct, ochraceous band running down the center of the back. Most of them also have the postocular dark band darker and better defined than Eastern specimens; but I have been unable, with my material, to draw any line sufficiently constant.

Geographical distribution.—In former times the Banded Rattlesnake, or "Timber Rattlesnake," as it is often called in regions where other species also occur, was commonly distributed in suitable localities all over the eastern United States, except the peninsula of Florida, as far west as the subarid portion of the Great Plains, but they have now become exterminated or nearly so, in many localities, having been driven back to the wilderness by the advancing cultivation of the country.

Prof. Verrill (Proc. Boston Soc. Nat. Hist., IX, 1863, p. 197), speaking of the reptiles of Norway, Me., states that it is rare, and only found in Albany and Raymond; he had never detected it east of the Androscoggin River. In Massachusetts, according to Allen (Proc. Boston Soc. Nat. Hist., XII, 1868, p. 179), it is not unfrequent on Mount Tom, and occasionally killed on rocky hills in several of the towns near or adjoining Springfield; it also occurs at a few similar localities in the eastern part of the State.

In 1886 Prof. A. S. Packard had an article in the American Naturalist on "The Rattlesnake in New England" (Vol. XX, pp. 736–737) from which I quote the following:

We have been told that Rattlesnakes are still occasionally killed in Connecticut near the Rhode Island border. It is generally stated that the last Rattlesnake was killed in Rhode Island twenty years ago, but we are informed by Prof. Battey that one was killed at Tiverton, R. I., within a period of four years. Its skin is now in the museum of the Friends' School at Providence. Mr. Henry H. Buxton, a member of this school, from Peabody, Mass., gives us the following statement regarding its occurrence at that locality:

"In South Peabody there is a rock called Rattlesnake Rock, surrounded by woods in which there are a great many snakes, including the Rattlesnake. During the last year three or four have been killed by different persons. They confine themselves to the part of the town which is the most rocky and slightly elevated. In the winter they get under this rock and go to sleep."

Rattlesnakes are still common in the Milton Hills, near Boston, and at Hyde Park.

In confirmation of the occurrence of the Rattlesnake in Connecticut, my friend, Mr. John H. Sage, sent me two specimens in 1893 from Portland. He wrote me at the same time that quite a number are killed in this immediate vicinity (Portland) each season. As early as 1842 Thompson (Hist. Vermont, I, p. 119) says that in Vermont they have now nearly disappeared, but that formerly they were found in considerable numbers, though mostly confined to a very few localities.

In the same year De Kay speaks of the Rattlesnake in the State of New York (Zool. N. Y., III, p. 57) as follows:

The Rattlesnake is common in various parts of the State, and in the Northern States generally appears to prefer rocky situations. They abound in Clinton, Essex, and Warren counties, along the shores of Lakes Champlain and George. Some idea may be formed of their numbers in certain districts in this State by the following extract from the Clairon newspaper, published in Warren County:

"Two men, in three days, killed 1,104 Rattlesnakes on the east side of Tongue Mountain, in the town of Bolton. Some of the reptiles were very large, carrying from 15 to 20 rattles. They were killed for their oil, or grease, which is said to be very valuable."

Although numerous in the rocky, mountainous districts of this State, they are rare or entirely wanting in those elevated regions which give rise to the Moose, the Raquet, and the Hudson rivers. They are found in the counties of Sullivan, Ulster, Orange, and Greene. A few still linger in the swamps of Suffolk County.

This may be supplemented with the following statement from Prof. Baird's "Serpents of New York," p. 10 (1854):

In New York it seems to be most abundant on the shores of Lake George and Lake Champlain; especially in Rattlesnake Mountain of the former and Rattlesnake den of the latter, a rocky bluff between Westport and Essex. It is a little remarkable that the rattlesnake does not occur in the Adirondack regions of New York; at least, an instance has never come to my knowledge. Such a region in Pennsylvania would be infested by them.

As indicated in the last sentence it is still fairly common in the Alleghany Mountains, from Pennsylvania southwards, though by no means confined to the high altitude, as we have specimens from Wilmington, in North Carolina, Liberty County and Saint Simons Isle, Georgia, while Dr. E. Coues quotes it as common in the vicinity of Fort Macon, North Carolina, and certainly occurring on the islands as well.

The Banded Rattlesnake probably does not enter the Florida peninsula proper, but the National Museum is indebted to Judge Bell for a fine specimen from Gainesville, in the interior, at the base of the peninsula. It occurs also in all the other Southern States, and I have even seen a specimen from Houma, in the pine lands southwest of New Orleans.

In the mountains of Tennessee and Kentucky the Banded Rattlesnake is still fairly common, but not so in Ohio and Indiana. Kirtland, as early as 1838 (in Mather's Sec. Rep. Geol. Surv. Ohio, p. 167), stated that in the former State it was then but rarely seen, though formerly very abundant, and with regard to Indiana we have Dr. O. P. Hay's recent assertion (Batr. Rept. Indiana, 1893, p. 129) that it is to be found, in all probability, in nearly all the counties of Indiana, though in most places quite rare. He can only name two localities where it has been taken recently and record of it preserved, viz, New Harmony and Monroe County. In Michigan it appears to be rare, the only definite record I can lay hand on at present being that of Dr. Morris Gibbs (Wolverine Naturalist, February, 1890, p. 12) of a specimen killed in Kalamazoo County.

H. Garman (Bull. Ill. State Lab. Nat. Hist., III, 1892, p. 312) is authority for the statement that it occurs throughout Illinois in hilly, forest regions, though being rapidly exterminated, while Higley (Trans. Wis. Acad. Sc., VII, 1884, p. 161), in regard to its distribution in Wisconsin, has only this to say, that it was formerly very common, but is now seldom met, and that it may be found in the rocky bluffs of the larger rivers.

Mr. Julius Hurter (Trans. St. Louis Acad. Sc., VI, Dec. 1893, p. 258) has an interesting note on a local increase of this snake. Years ago, he says, it was rather scarce in St. Clair County, Ill., as in those days there was no stock law, and the pigs roamed around and exterminated a good many snakes, but since the stock law has gone into effect, compelling swine to be penned up, the snakes have become more numerous again. In early spring they are found near the bluffs under rocks, but later on they go to the wheat fields and meadows, where they are very safe till harvest time, when a good many are destroyed by the farm hands.

West of the Mississippi they are still found in eastern Iowa, at least, Kansas, Missouri, Arkansas, and Indian Territory. The Banded Rattlesnake even extends into Texas, as Dr. Shumard sent to the Smithsonian Institution a specimen collected on the upper Brazos during Capt. Marcy's exploration of that river.

Habits.—In a general way most of what has been written about the habits of the rattlesnake refers to the present species. In contradistinction to the Water Rattlesnake, *C. adamanteus*, and the Prairie Rattlesnake, *C. confluentus*, the present species is often called the "Timber Rattler," because of its predilection for wooded districts. It does undoubtedly often in summer take up its abode in prairies and meadows; but it prefers rocky and mountainous places, where it can find holes and crevices to hide itself, or sunny ledges, where it may enjoy the heat of the day.

It has been repeatedly denied that the Rattlesnake climbs trees, and it is certain enough that it does not do so habitually. It is but ill fitted for climbing, yet there are unquestionable proofs that they do so occasionally. Of course, they do not climb up tall, smooth, perpendicular trunks, but it is not more difficult for it to climb up a rough-barked slanting tree with plenty of side branches than to wriggle up the rocks of a mountain side.

The food of the Banded Rattlesnake consists in all sort of smaller warm-blooded animals which may come its way, as rabbits, squirrels, rats, mice, and an occasional bird. Holbrook pictures this species as remarkably slow and sluggish, lying quietly in wait for his prey, and never wantonly attacking nor destroying animals, except as food, unless disturbed by them. A single touch, however, will effect this; even rattling the leaves in his neighborhood is sufficient to irritate him. On such occasions he immediately coils himself, shakes his rattles violently in sign of rage, and strikes at whatever is placed within his reach. In his native woods, Holbrook continues, one may pass within a few feet of him unmolested. Though aware of the passenger's presence, he either lies quiet or glides away to a more retired spot. He never follows the object of his rage, whether an animal that has unwarily approached so near as to touch him, or only a stick thrust at him to provoke his anger, but strikes on the spot, and prepares to repeat the blow, or he may slowly retreat like an unconquered enemy, sure of his strength, but not choosing further combat.

Compared with the Diamond-backed Rattlesnake, the Banded Rattler is the more timid and less aggressive. Speaking of these animals one does not quite feel like characterizing any of them as "gentle," yet this is an expression used by many a one who has had plenty of experience with them. The late Gen. Kirby Smith once told me of an incident which illustrates the amount of provocation a Rattlesnake will pass unnoticed under certain circumstances. Gen. Smith's home in Tennessee was located on a high plateau, and a narrow path led from the house to the small railway station in the valley below. One day a party of ladies went down the path in Indian file, the general in the lead, and the rear being brought up by a barefooted lad carrying a valise. Suddenly the latter shouted. A Rattlesnake was lying coiled in the path, and he had just discovered it in stepping over it without touching it. By the merest chance they had all avoided stepping upon it, though it seemed almost impossible that the ladies' dresses should not have touched it. Gen. Smith said he felt like sparing the snake's life. In captivity a Banded Rattlesnake may be handled with impunity by a self-possessed man, if he moves quietly and deliberately, not frightening it by any sudden and unexpected movements. There even seems to be truth in some of the stories about children having been found playing with and carrying about live Rattlesnakes without having been hurt.*

It is somewhat curious that the breeding habits of this species are still almost unknown. At least, very little definite information is on record. The time of pairing is difficult to ascertain. The number of young born at one birth appears to be about nine. The largest of a number of embryos preserved by Prof. S. F. Baird (U. S. Nat. Mus., No. 1292) and apparently ready to be born is about 245 mm. (9½ inches) long, with a diameter of 12 mm. (one-half inch).

THE DIAMOND RATTLESNAKE.

Crotalus adamanteus, Beauvois.

Plate 10.

1799.—*Crotalus adamanteus*,† BEAUVOIS, Trans. Am. Philos. Soc. IV, p. 368.—SAY, Sillim. Am. Journ. Sc., I, 1819, p. 263.—HOLBROOK, N. Am. Herpet., 1 ed., II, p. 77 (1838).—HOLBROOK, N. Am. Herpet., 2 ed., III, p. 17 (1842).—DE KAY, Zool. New York, III, p. 57 (1842).—BAIRD and GIRARD, Cat. N. Am. Serp., p. 3 (1853).—LE CONTE, South. Med. Surg. Journ., IX, 1853 (p. 664).—BAIRD, Pac. R. R. Rep., X, Reptiles, p. 14, pl. XXIV, fig. 2 (1859).—JAN, Rev. Mag. Zool., 1859, extr. p. 28.—JAN, Elenc. Sist. Ofid., p. 123 (1863).—COPE, in Wheeler's Surv. W. 100 Mer., V, p. 534 (1875).—COPE, Proc. Am. Philos. Soc., 1867 (p. 64).—COPE, Proc. U. S. Nat. Mus. XIV, 1891, p. 689 (1892).—TRUE, in Hammond's South Carolina, p. 235 (1883).—GARMAN, Rept. Batr. N. Am., I, Ophid., pp. 112, 171 (1883).—GARMAN, Bull. Essex. Inst., XIX, 1887, p. 122.—YARROW, in Buck's Ref. Handb. Med. Sc., VI, p. 166 (1888).—JORDAN, Man. Vert. North. U. S., 5 ed., p. 199 (1888).—BARRINGER, Ven. Rept. U. S., p. 4 (1891).—WILLIAMS, Science, XX, Dec. 16, 1892, p. 345.—LŒNNBERG, Proc. U. S. Nat. Mus., XVII, 1894, p. 335.—H. GARMAN, Bull. Essex. Inst., XXVI, 1894, p. 36.—*Caudisona adamantea*, COPE, in Mitchell's Res. Ven, Rattlesn., p. 121 (1861).—COPE, Proc. Phila. Acad., 1866, p. 309.

1802.—*Crotalus rhombifer*, LATREILLE, Hist. Nat. Rept., III, p. 197.—DAUDIN, Hist. Nat, Rept., V, p. 323 (1803).—DUMÉRIL et BIBRON, Erpét. Génér., VII, p. 1470 (1854).—DUGÈS, Naturaleza, IV, 1879 (p. 22).

1802.—*Crotalus horridus*, LATREILLE, Hist. Nat. Rept., III, p. 199 (but not p. 186; nor of Linn. 1758).—HARLAN, Journ. Phila. Acad., V, 1827, p. 370.—HARLAN, Med. Phys. Res. (p. 133) (1835).

1802.—*Crotalus durissus*, SHAW, Gen. Zoöl., III, p. 333 (not of Linn. 1758).

1853.—*Crotalus terrificus*, LE CONTE, Proc. Phila. Acad., 1853 (p. 419) (not of Laur. 1768).—COPE, Proc. Phila. Acad., 1859, p. 337.

1875.—*Crotalus adamanteus*, subsp. *adamanteus*, COPE, Bull. U. S. Nat. Mus. No. 1, Check-list, pp. 33, 79.—COPE, Proc. U. S. Nat. Mus., XI, 1888, p. 393.—COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 690 (1892).—YARROW, Bull. U. S. Nat. Mus. No. 24, pp. 12, 75 (1883).

Figures.—BEAUVOIS, Trans. Am. Philos. Soc., IV, pl. facing p. 380, upper figure (1799).—SHAW, Gen. Zool., III, pl. LXXXIX (1802).—DAUDIN, Hist. Nat. Rept. V pl. LX, figs. 22, 23; pl. LXIX, fig. 2 (1803).—HOLBROOK, N. Am. Herpet., 1 ed., II, pl. XVI (1838); 2 ed., III, pl. II (1842).—DUMÉRIL et BIBRON, Erpét. Gen., Atlas, pl. LXXXIV, fig. 3 (1854).—BAIRD, Pac. R. R. Rep., X, Reptiles, pl. XXIV, fig. 2 (1859).—JAN, Icon. Ophid., livr. 46, pl. II, fig. 2 (but not fig. 1) (1874).—YARROW, in Buck's Ref. Handb. Med. Sc., VI, pl. XXVII (1888).

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* See Forest and Stream, XXXVII, Aug. 6, 1891, p. 44.

† From the Latin *adamanteus*, Diamond-shaped; lozenge-shaped.

*Description.**—Head triangular. Two anterior frontals (internasals), connected with superciliaries (supraoculars) on each side by two large plates; inside of these a second row; included space filled by small scales. Scales margining superciliaries (supraoculars) small; scattered larger ones toward the center of the intermediate space. Three rows of scales between the suborbitals and labials. Suborbitals extending to the middle of the orbit. Labials 15 or 16 above; first, fifth, and seventh largest, and vertical; below, 18; first, fourth, and fifth largest. Dorsal rows, 27; outer rows obsoletely carinated. Three or 4 dark rings on tail. Three series of well-defined perfect rhombs, 1 dorsal, 2 lateral, separated by narrow lines. Light stripe from superciliary to the angle of the mouth.

Scales on the cheek smooth. Three rather large plates on the edge of the upper part of the head, between the superciliaries (supraoculars) and rostral, inside of which is a second row of 3, also larger than the rest.

The two lower rows of lateral scales smooth. Third and fourth very faintly carinated. Scales on the back and sides not conspicuously different in size except the lower two or three rows. Posteriorly, near the tail, all the scales are carinated except the lowest.

General color, yellowish gray, with rhomboidal black blotches, lighter in the center, and with all the angles perfect. Or rather there is a series of dull yellowish lines crossing obliquely from one side of the abdomen to the other over the back, following the oblique series of scales, and occupying generally the posterior half of each scale, the basal portion being black. These lines, of which there are about 36 crossing from each side, from head to tail (9 on tail), decussate first on the fifth or sixth lateral row, and then on the back, where they are more or less confluent three or four rows. The rhomboids thus inclosed and crossing the back are generally black for 1½ or 2 scales within the yellowish brown, mottled with darker. The intervals on the sides between the lines are mostly dark yellowish brown, minutely mottled with dark brown. These intervals constitute a lateral series of transverse rhomboids, sometimes with the lower angle truncated. Opposite to the dorsal rhomboids is a series of small triangles in the angles of the first decussation. The distance between two parallel transverse stripes generally consists of five rows of scales, occasionally of six.

On the sides and posteriorly these markings are more or less indistinct, though generally recognizable. The tail usually exhibits a good deal of black. The under parts are dull yellowish white, or greenish white, clouded toward the sides with brown; no regular spots visible. The black on the tail does not constitute complete rings, but is interrupted in the middle of the lower surface, and in fact the black patches alternate with each other, and are not opposite.

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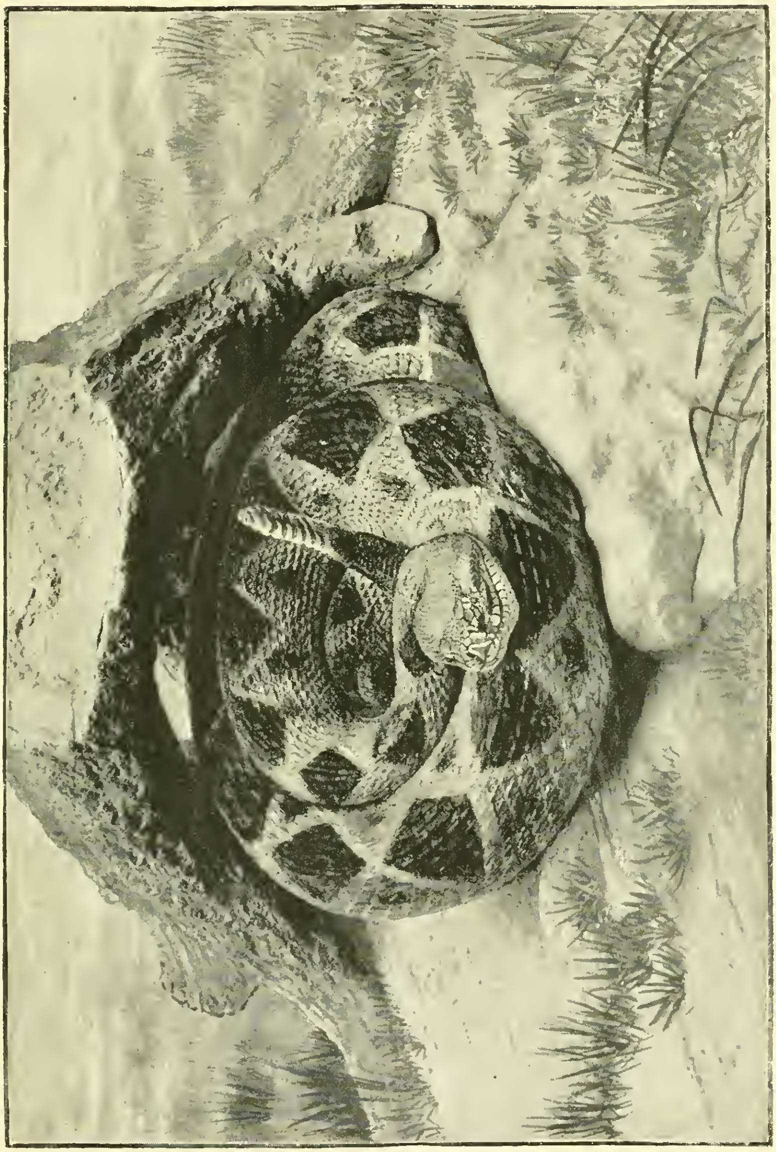
* By S. F. Baird, in Baird and Girard's, N. Am. Serp., p. 3, from a South Carolina specimen, U. S. Nat. Mus., No. 250.



DIAMOND RATTLESNAKE.—CROTALUS ADAMANTEUS.

From a cast in the U. S. National Museum.

The top of head is light brown, with occasional black scales. A dull yellowish streak starts at the posterior edge of the superciliary plate, and passing obliquely backward, through two rows of scales, extends to angle of the mouth (fig. 58). A second band starts on the plate in advance of the superciliary, and crossing the anterior orbitals, expands till it involves the seventh, eighth, and ninth upper labials. Interval between the first two stripes dark brown. There are also indications of a second vertical light bar in front of the nostril, and two below the pit. Rostral dark yellowish, lighter in the margin.

Number of ventrals (gastrosteges), 169; of subcaudals (urosteges), 32; scale rows across body, 27.

Variation.—With the exception of the usual variation of the ground color through the various tinges of grayish and brownish, the color and pattern of this species is unusually constant. The characteristic whitish stripes on rostral, nasals, and on the sides of the head are well marked, even in the largest specimens, and the dorsal pattern is also nearly always very distinct.

Geographical distribution.—The diamond rattler inhabits a comparatively small area in the southeastern corner of our country. Florida seems to be the center of its distribution, and from that State it extends along the coast northward into the southern portion of North Carolina at about the thirty-fifth parallel, Mr. H. H. Brimley having in letter advised me of a specimen, presumably of this species, having been taken in 1885 at the Neuse River, across from New Berne. Along the gulf coast it extends at least as far west as the Mississippi River, being still found not far from New Orleans, as Dr. Gustave Kohn informs me, although very scarce. It also ascends the Mississippi River some distance, exactly how far I do not know, but a specimen is in the National Museum (No. 4393) which is said to have been collected by Col. Kearney in Arkansas.

In Florida the species is found everywhere, including the Keys.

Habits.—The Diamond Rattler, or Diamond-backed Rattlesnake, is usually called the Water Rattler in localities where the Banded Rattlesnake also occurs in order to distinguish it from the latter, which is then known as the Timber-Rattler. As the name indicates, this species is rather partial to the neighborhood of water, although it is not a water snake to the extent of pursuing its prey into the water. Yet it is said to be a good swimmer and not even afraid to cross over from Key to Key (*Lœnnberg*, *l. c.*).

Although rather common, and probably the Rattlesnake most frequently seen in captivity, at least in this country, but little detailed and reliable information concerning its habits can be found in the literature. The observers who have had anything to say about it are often much at variance. Some regard it as very slow and clumsy, others again insist that it is much more active than the Banded Rattlesnake and much fiercer. Some report their inability to induce this species to eat in confinement, while others again claim that it takes food without trouble. Equally defective is our knowledge in regard to its breeding habits.

The Diamond Rattler is our largest species, and in fact one of the largest of the whole family. The largest specimen in the National Museum collection (No. 10947) is only 6 feet 5¼ inches long, but much larger specimens are on record. Dr. C. S. Allen has recorded 1 specimen 8 feet 5 inches, with a circumference of 15 inches, which was shot near Oak Lodge, Fla., by Chas. F. Latham, in November, 1890, while Mr. Frank M. Chapman mentions one 8 feet 9 inches long, and killed by J. H. Norton, of Jacksonville.*

We often enough hear of Florida Rattlers 9 feet or more long, but in all cases I have investigated it was found that the measurements were taken from skins, or mounted specimens, which of course may be stretched almost to any desired length.

With a supply of venom proportionate to its size the dangerous nature of a stroke of one of these large brutes, if well delivered, may well be imagined. Nevertheless, fatalities are comparatively rare, and even cases of bites are not heard of nearly as often as one might be led to suppose from the number of specimens which are still found in many places.

The Texas Rattlesnake.

Crotalus atrox,† Baird and Girard.

Plate 11.

1853.—*Crotalus atrox*, Baird and Girard, N. Am. Serp., pp. 5, 156.—Duméril et Bibron, Erpét, Génér., vii, ii, p. 1482 (1854).—Hallowell, Proc. Phila. Acad., 1856, p. 307.—Baird, Pac. R. R. Rep., x, Whipple's Route, p. 39 (1859).—Baird, Mex. Bound. Surv. ii, Rept. p. 14 (1859).—Cope, Proc. Phila. Acad., 1859, p. 337.—Cope, in Wheeler's Surv. W. 100 Mer., v, p. 534 (1875).—Cooper, Proc. Calif. Acad. Nat. Sc., iv, p. 66 (1870).—*Caudisona atrox*, Cope, in Mitchell's Res. Ven. Rattlesn. (p. 121) (1861).—Cope, Proc. Phila. Acad. 1866, p. 309.

1859.—*Crotalus adamantens*, var. *atrox*, Jan, Rev. Mag. Zool., 1859, Extr. p. 28.—Jan, Elenc. Sist. Ofid., p. 123 (1863).—Cope, Bull. U. S. Nat. Mus. No. 1, p. 33 (1875).—Cope, Bull. U. S. Nat. Mus. No. 17, p. 24 (1880).—Cope, Proc. U. S. Nat. Mus., xi, 1888, p. 398.—Cope, Proc. U. S. Nat. Mus., xiv, 1891, p. 690 (1892).—Cope, Proc. Phila. Acad., 1892, p. 336.—Yarrow, Bull. U. S. Nat. Mus. No. 24, pp. 12, 76 (1883).—Garman, Rept. Batr. N. Am., i, Ophid., pp. 113, 172 (1883).—*Caudisona adamantea atrox*, Coues, in Wheeler's Surv. W. 100 Mer., v, p. 607 (1875).

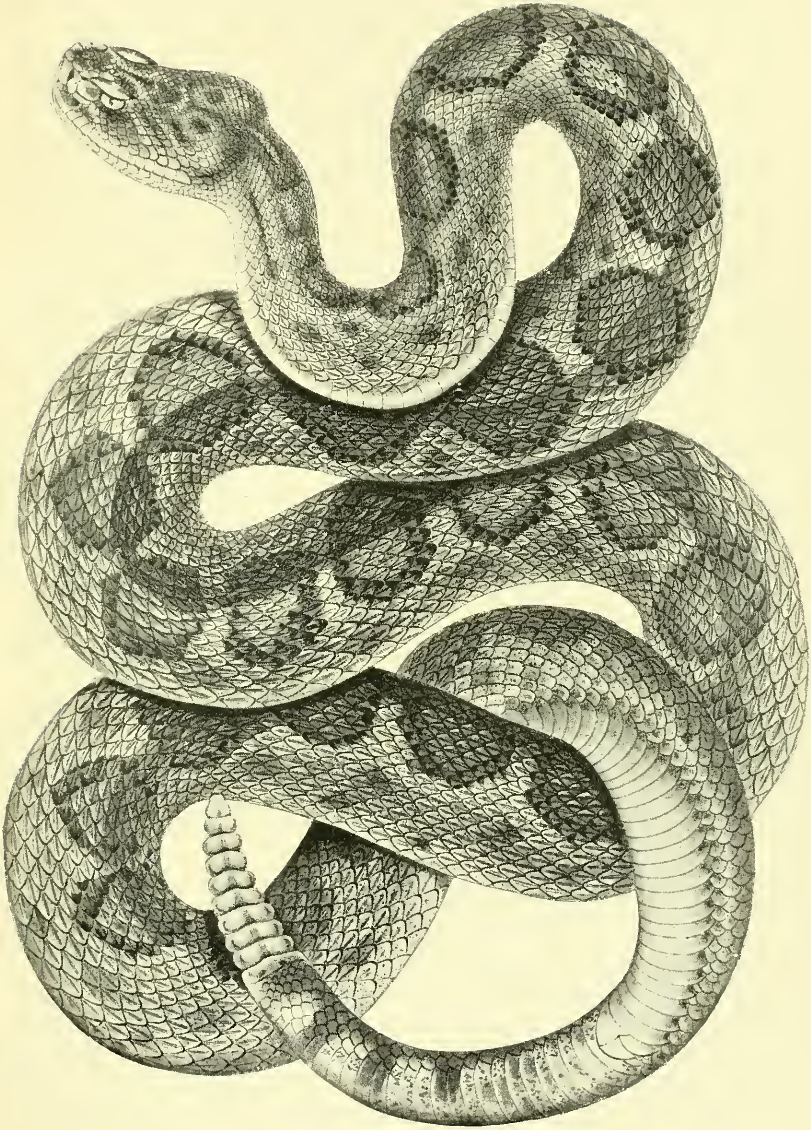
1861.—*Caudisona atrox*, var. *sonoraensis*, Kennicott, Proc. Phila. Acad., xiii, 1861, p. 206.—Cope, Proc. Phila. Acad., xiii, 1861, p. 292.

1861.—*Caudisona scutulata*, Kennicott, Proc. Phila. Acad., xiii, 1861, p. 207.—Cope, Proc. Phila. Acad., 1866, p. 309.—*Crotalus scutulatus* Cope, in Wheeler's Surv. W. 100 Mer., v, p. 533 (1875).

1863.—*Crotalus adamanteus*, var. *sonoriensis*, Jan, Elenc. Sist. Ofid., p. 124.

*Abstr. Proc. Linn. Soc. New York, year end. Mch. 2, 1892, p. 4.

† From the Latin *atrox*, terrible, cruel.



TEXAS RATTLESNAKE,—CROTALUS ATROX.

From Baird, Rep. Mex. Bound. Surv.

1874.—*Crotalus adamanteus*, JAN, Icon. Ophid., livr. 46, pl. II, fig. 1 (not of Beauvois).

1875.—*Crotalus adamanteus*, var. *scutulatus*, COPE, Bull. U. S. Nat. Mus., No. 1, p. 33.—COPE, Proc. U. S. Nat. Mus. XIV, 1891, p. 690 (1892).—*Caudisona adamantea scutulata*, COUES, in Wheeler's Surv. W. 100 Mer., V, p. 607.

Figures.—BAIRD, Mex. Bound. Surv., II, Rept., pl. I (1859).—BAIRD, Pac. R. R. Rep., X, Rept., pl. XXIV, fig. 3 (1859).—JAN, Icon. Ophid., livr. 46, pl. II, fig. 1 (1874).

*Description.**—Head subtriangular; plates on head; 2 anterior frontals (internasals) in contact; between these and superciliaries (supraoculars), on side of the crown, 2 imbricated plates; space inclosed occupied by smaller scales; superciliaries (supraoculars) bordered by a row of larger scales; the anterior much largest. Three rows of scales between labials and suborbitals; labials 16 above, first, fifth, and seventh, largest; 15 below, first and third largest; dorsal rows 25–27; 2 exterior rows smooth; on the tail 3–6 half rings. Color yellowish brown, with a continuous succession of dorsal lozenges, sometimes truncate before and behind; intervals all narrow. A single transverse light line; superciliary stripe from superciliary directly to the angle of the mouth.

General style of coloration somewhat as in *C. adamanteus*. Ground color above, dull yellowish brown, with a series of subhexagonal patches from the head nearly to the tail, in an uninterrupted series, separated throughout by narrow lines. We may refer the markings to the intersection of two series of light yellowish lines, about 40 in number, crossing obliquely from each side across to the other, along the anterior half of as many oblique series of scales. The lateral decussation is along the sixth row of dorsal scales; on the back, where they cross, the lines are confluent for a breadth of 5 or 6 scales, making a series of transverse lines across the back, truncating the obtuse angles of the rhomboids, which would otherwise be produced. Sometimes the acute lateral angles of the rhomboids are also truncated. Laterally, the yellowish lines are more or less obsolete, leaving a more or less distinct chain pattern. The rhomboids or subrhomboids inclosed have a narrow margin of dark brown, lighter toward the center. In all cases the interval between the successive rhomboids is but 1 or 2 half scales in width. The lateral rhomboids and triangles referred to in *C. adamanteus* are indicated by two alternating series of dark brown blotches, the first along the third and fourth lateral row, opposite the apices of the rhomboids; the second along the sixth and seventh, and alternating with the same; the spots occupy 1 scale, or part of 4 contiguous ones. Space between these rhomboids and the yellowish lines, dull yellowish brown. Beneath nearly uniform yellowish, slightly clouded on the sides of the scales. On the tail the blotches are confluent into 3 or 6 dark brown half rings, interrupted on the surface. General distribution of lines on the head much as in

* Original description by S. F. Baird, in Baird and Girard, N. Am. Serp., p. 5, from the type specimens from Texas.

C. adamanteus; a narrow light line from the posterior end of superciliary backward directly to the angle of the mouth; a second from the anterior extremity, nearly parallel with the first, the two inclosing an indistinct patch and separated on the labials by 4½ scales. There is also a single narrow light line across the superciliary perpendicular to its length, obsolete in old specimens.

It may readily be distinguished from *C. adamanteus* by its light color and the truncations of the rhomboids, as well as the general obsoleteness of the lateral markings. The rhomboids are longer in proportion and more rounded. The 2 lateral rows of scales are smooth, the next 2 more strongly carinated than in *C. adamanteus.* The fifth upper labial is largest, and transverse, the rest nearly uniform. The stripes on the side of the head are less distinct.

From *C. confluentus* it may be distinguished by the greater comparative size of the interval between the dorsal blotches, especially posteriorly. In *C. confluentus* there are two light lines across the superciliary plate, dividing it into three sections, the central rather narrower. Here, too, the posterior facial stripe, instead of passing to the angle of the mouth, goes back of it on the second row above the labials, in *C. atrox*, passing directly to the angle of the mouth. Other important distinctions are seen in the narrower scales of *C. confluentus*, etc.

From *C. lucifer*, the more narrow head, fewer and larger intersuperciliary scales, lighter color, arrangement of color along the head, will at once distinguish it.

Number of ventrals (gastrosteges), 177 to 187; number of subcaudals (urosteges), 23 to 28; number of scale rows across the body, 25 to 27.

Variation.—This species exhibits a considerable variation in the scutellation, less so in coloration. The ground color is usually more or less grayish, with a varying amount of brownish, olive, or yellowish admixture, while on the Pacific coast there seems to be a reddish form, geographically limited, which will be considered separately as a race. The head pattern is fairly constant and will at once serve to distinguish this species from *C. adamanteus*, the nasals and anterior labials being unicolor, densely dusted over with minute black dots.

As for the scutellation, the greatest variation is shown in the presence, or absence, of an upper loreal, as well as in the size of the scales or scutes covering the upper surface of the snout. In a number of specimens the upper head scales are more or less enlarged, in some forming on the snout a series of paired scutes reaching to between the orbits, very much after fashion of *C. molossus* and its nearest allies. This character, however, is shared by specimens belonging to other species, for instance *C. horridus*, and notably in *C. confluentus*, so much so, in fact, that the so-called *C. scutulatus*, which is based upon such specimens, is composed of specimens of both species. The character is mostly exhibited in specimens from the Mexican tableland and its extension into Arizona, but it is apparently not constant enough to warrant us in recognizing it as a geographic subspecies even. The character is an ancestral one, and its appearance may probably be attributed to reversion.

Geographical distribution.—*Crotalus atrox* covers a considerable area, embracing the arid portion of Texas, parts of southern New Mexico, Arizona, and California, southward into Mexico. In western and southern Texas, west of about the ninety-seventh meridian this species appear to be *the* Rattlesnake, being apparently common in all suitable localities. It does not appear to occur in the moist region of eastern Texas, and as a matter of fact we do not know which form occupies that region at all, whether *C. adamanteus* extends so far west as to meet its western representative, *C. atrox*, or whether there is an actual gap between the two species, occupied by neither. Toward the north, Prof. Cope (Proc. Phila. Acad., 1892, p. 336), has found it at the eastern foot of the Staked Plain, about the head of the Colorado River, but he did not meet with it on the Plain itself, nor north of the region mentioned. That it extends considerably farther north is proven, however, by a specimen (No. 4225) in the National Museum, collected near the western boundary of Texas, just south of the Canadian River and at the northern foot of the Llano Estacado.

Habits.—Very little has been written concerning the habits of *C. atrox*, but in a general way they may be considered to be similar to those of *C. adamanteus*, except that the former is apparently less partial to water. Being a large and powerful snake, though not quite so large as the Diamond Rattlesnake, it is capable of inflicting very dangerous bites.

The Red Diamond Rattlesnake.

Crotalus atrox ruber,* Cope.

1892.—*Crotalus adamanteus ruber*, Cope, Proc. U. S. Nat. Mus., xiv, 1891, p. 690.

Description.†—Rostral plate a little wider than high; plates of upper side of canthers rostralis smaller than in other subspecies, the posterior especially smaller than the anterior, and partly decurved laterally. One loreal. Five rows of scales between orbit and labial; eight rows between superciliary plates. Second pair of inferior labials with the marginal portion cut off from the postsymphyseal portion. (Perhaps an abnormality.)

The color is light red, marked above with deep red spots. These are of a longitudinal oval form anteriorly, but posteriorly they have a diamond-shaped form. They have no distinct lateral borders, either light or dark, but they are separated on the median line of the back by a single row of yellow-tipped scales. Traces of brownish red indefinite

* From the Latin *ruber*, red, ruddy.

† Original description by E. D. Cope, in Proc. U. S. Nat. Mus.; xiv, 1891, p. 690, from U. S. Nat. Mus., No. 9209; locality unknown.

spots opposite their lateral angles as well as their intervals. Head without marking, except a faint trace of a pale line from the eye to the border of the mouth below it. Inferior surfaces yellow. Tail white, with five black cross bands, of which all but the first are complete rings.

Gastrosteges (ventrals), 186; urosteges (subcaudals), 26; scale rows, 27; total length, 1.245 mm.

Variation.—The characters upon which this form were originally based, viz, the small size of the scales on canthus rostralis and the absence of either light or dark borders to the dorsal rhombs do not seem to hold in a larger series, for of the additional specimens which I have seen some have the canthal scales of normal size, while in nearly all the specimens there are traces at least of the borders to the dorsal spots, these borders becoming apparently less distinct as the snakes grow larger. The only character which seems to fairly distinguish this form as a subspecies is the bright cinnamon red color of its upper surface, at least in the large specimens.

Geographical distribution.—This subspecies was originally described from a specimen the habitat of which was not known. Since then I have seen, thanks to Dr. C. Hart Merriam, several large specimens from Twin Oaks, San Diego County, on the Pacific slope of the coast ranges, which fixes the range of the form. A young specimen in the National Museum (No. 8856), somewhat darker and less bright red than the others, probably either on account of its age or the long time it has been in alcohol, is recorded as collected by A. W. Chase at San Francisco, November, 1875, but it is probably very doubtful if the specimen really came from the immediate vicinity of that city.

Habits.—Nothing special is known of the life history of this form.

THE PRAIRIE RATTLESNAKE.

Crotalus confluentus,* Say.

Plate 12.

1818.—?*Crotalinus viridis*, RAFINESQUE, Am. Month. Mag., IV, 1818, p. 41.

1823.—*Crotalus confluentus*, SAY, in Long's Exped. Rocky Mts., II, p. 48.—BAIRD and GIRARD, N. Am. Serp., p. 8 (1853).—BAIRD and GIRARD, in Marcy's Expl. Red River, p. 214, Zool., pl. I (1853).—HALLOWELL, Proc. Phila. Acad., 1856, p. 250.—BAIRD, Pac. R. R. Rep., X, Whipple's Route, p. 40 (1859).—BAIRD, Mex. Bound. Surv., II, Rept., p. 14 (1859).—COOPER, Pac. R. R., Rep., XII, pt. III, p. 295 (1860).—COOPER, Amer. Natural, 1869, p. 124.—COPE, Proc. Phil. Acad., 1859, p. 337 (1860).—COPE, Bull. U. S. Nat. Mus., No. 1, p. 33 (1875).—COPE, Amer. Natural., XIII, 1879, p. 435.—COPE, Bull. U. S. Nat. Mus., No. 17, p. 24 (1880).—YARROW, in Wheeler's Surv. W. 100 Mer., V, p. 530 (part) (1875).—COUES and YARROW, Bull. Geol. Surv. Terr. (Hayden's), IV, No. 1, Feb., 1878, p. 262.—CRAGIN, Trans. Kansas Acad. Sc., VII, p. 121 (1881).—GARMAN, Rept. Batr. N. Am. Ophid., pp. 114, 172 (1883).—GARMAN, List N. Am. Rept. Batr., p. 34 (1884).—STEJNEGER,

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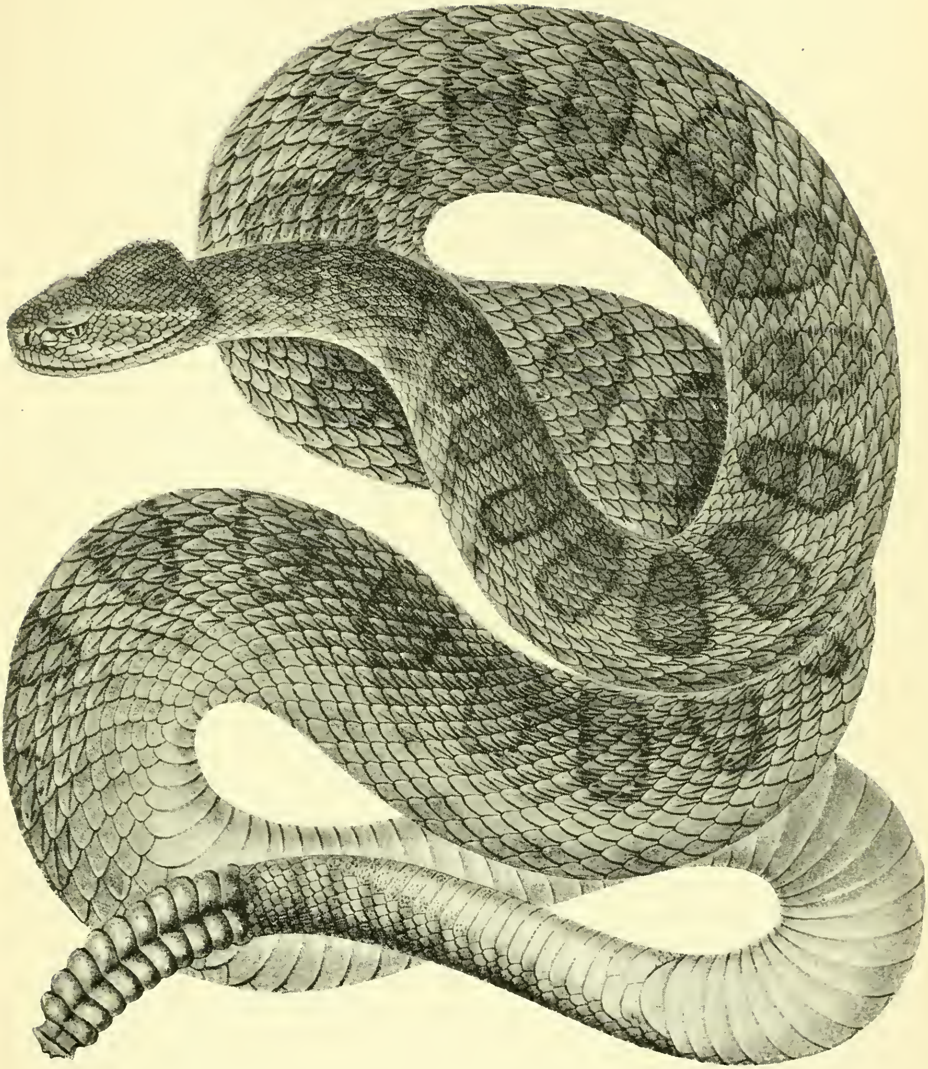
* From the Latin *confluens*, flowing together; with reference to the spots on the neck of the type specimen running together into a longitudinal mark.



PRAIRIE RATTLESNAKE,—CROTALUS CONFLUENTUS.
From Baird, Pacific R. R. Rep.

N. Amer. Fauna, No. 5, p. 111 (1891).—TAYLOR, Ann. Rep. Nebraska State Board Agric., 1891, p. 354 (1892).—HAY, Proc. U. S. Nat. Mus., xv, 1892, p. 387.—COUES, Hist. Exp. Lewis and Clark, I, p. 313; II, p. 373 (1893).—*Candisona confluenta* COPE, in Mitchell's Res. Ven. Rattlesn., p. 122 (1861).—COPE, Proc. Phila. Acad., 1866, p. 309.—ALLEN, Proc. Boston Soc. N. H., XVII, 1874, p. 69, extr. p. 39.—COUES, in Wheeler's Surv. West 100 Mer., V, p. 604 (1875).

1852.—*Crotalus lecontei*, HALLOWELL, Proc. Phila. Acad., VI, 1852, p. 180.—HALLOWELL, in Sitgreave's Exp. Zuñi and Colo. Riv., p. 139 (in part only) (1854).—*Candisona lecontei*, COPE, in Mitchell's Res. Ven. Rattlesn. (p. 121) (1861).—HAYDEN, Geol. Nat. Hist. Upp. Missouri, p. 177 (1862).

859.—*Crotalus adamanteus*, var. *confluentus*, JAN, Rev. et Mag. Zool., 1859, No. 12, extr. p. 28.—JAN, Elenc. Sist. Ofid., p. 124 (1863).

1865.—*Crotalus durissus*, MAX VON WIED, Verz. Rept. Reise Nord. Amer., p. 65, pl. VII, figs. 1–3 (not of LINN.).

1866.—*Candisona confluenta*, var. *lecontei*, COPE, Proc. Phila. Acad., 1866, p. 307 (not of 1883).

1875.—*Crotalus adamanteus*, subsp. *atrox*, YARROW, in Wheeler's Surv. West 100 Mer., V, p. 529 (not of B. & G.).

1875.—*Crotalus lucifer*, YARROW, in Wheeler's Surv. West 100 Mer., V, p. 529 (not of B. & G.).

1875.—?*Candisona lucifer*, var. *cerberus*, COUES, in Wheeler's Surv. West 100 Mer., V, p. 607.

1883.—*Crotalus confluentus*, var. *confluentus*, COPE, Proc. Phila. Acad., 1883, p. 11.—COPE, Proc. Phila. Acad., 1892, p. 336.—COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 692 (1892).—TAYLOR, Amer. Natural., XXVI, Sept. 1892, p. 752.

1883.—*Crotalus confluentus*, var. *pulverulentus*, COPE, Proc. Phila. Acad., 1883, p. 11.—*Crotalus confluentus pulverulentus*, COPE, Proc. U.S. Nat. Mus., XIV, 1891, p. 692 (1892).

Figures.—BAIRD and GIRARD, in Marcy's Expl. Red River, Zool., pl. I (1854).—COOPER, Pac. R. R. Rep., XII, pt. iii, pl. XII (1859).—DUMÉRIL et BIBRON, Erpét. Génér., Atlas, pl. LXXXIV bis, fig. 4 (1854).

*Description.**—Head subtriangular. Plates on top of head squamiform, irregular, angulated, and imbricated; scales between superciliaries (supraoculars) small, numerous, uniform. Four rows of scales between the suborbital series (which only extends to the center of the orbit) and the labials. Labials 15 or 18, nearly uniform. Dorsal series 27–29. Dorsal blotches quadrate, concave before and behind; intervals greater behind. Spots transversely quadrate posteriorly, ultimately becoming 10 or 12 half rings. Two transverse lines on superciliaries, inclosing about one-third. Stripe from superciliary to angle of jaws crosses angle of the mouth on the second row above labial. Rostral margined with lighter.

This species bears a considerable resemblance to *C. atrox*, but the body is more slender and compact. Scales on the top of the head anterior to the superciliaries nearly uniform in size. Line of scales across from one nostril to the other consists of 6, not 4 as in *C. atrox*. Superciliaries more prominent. Labial series much smaller. Upper anterior orbitals (preoculars) much smaller, as also is the anterior nasal.

* From S. F. Baird's description of specimens from Wichita Mts. and Texas, in Baird and Girard's N. Am. Serp., p. 8.

Scales on the top of the head less carinated. Scales between superciliaries smaller and more numerous, 5 or 6 in number instead of 4. Two lateral rows of scales smooth, first, second, and third gradually increasing in size. Scales more linear than in *C. atrox.*

General color yellowish brown with a series of subquadrate dark blotches, with the corners rounded and the anterior and posterior sides frequently concave, the exterior convex (fig. 53). These blotches are 10 or 11 scales wide and 4 or 5 long, lighter in the center, and margined for one-third of a scale with light yellowish. The intervals along the back light brown, darker than the margins of the blotches. Anteriorly the interval between the dark spots is but a single scale; posteriorly it is more, becoming sometimes 2 scales, where also the spots are more rhomboidal or lozenge-shaped; nearer the tail, however, they become transversely quadrate. The fundamental theory of coloration might be likened to that of *Crotalus adamanteus*, viz, of 40 or 50 light lines decussating each other from opposite sides; but the angles of decussating, instead of being acute, are obtuse, and truncated or rounded off throughout. Along the third, fourth, and fifth lateral rows of scales is a series of indistinct brown blotches covering a space of about 4 scales and falling opposite to the dorsal blotches; between these blotches, and opposite to the intervals of the dorsal blotches, are others less distinct. Along the fifth, sixth, seventh, and eighth rows is a second series of obsolete blotches, each covering a space of about 4 scales, and just opposite the intervals between the dorsal spots. The dorsal and lower series are separated by an interval of 3 scales, this interval light brown. Beneath the color is dull yellowish, and 10 or 12 darker half rings are visible on the tail.

In point of coloration the principal features, as compared with *C. atrox*, lie in the dorsal blotches, being disposed in subquadrate spots instead of subrhomboids; the intervals thus forming bands across the back perpendicular to the longitudinal axis. This tendency to assume the subquadrangular pattern has broken up the chainwork into isolated portions, as in *Coluber eximius* or *Crotalophorus tergeminus* (*Sistrurus catenatus*). The intervals of the dorsal blotches are wide and darker in the middle, while in *C. atrox* they are narrow, not linear, and unicolor. The sides of the head (fig. 59) present the usual light stripe from the posterior extremity of the superciliary; it passes, however, to the angle of the jaw on the neck, along the second row of scales above the labials. A second stripe passes in front of the eye to the labials, widening there. A small, light vertical bar is seen below the pit and another on the outer edge of the rostral. On the superciliaries are seen two light transverse lines inclosing a space nearly one-third of the whole surface. In *C. atrox* there is a single median line. Sometimes, as in *C. atrox*, the single blotches on the nape are replaced by two elongated ones parallel to each other.

Variation.—There is some slight variation in the size of the scales covering the top of the head, which is, in a general way, correlated with the latitude of the locality, but the character is so exceedingly unstable and apparently unsupported by any other character that it would be unprofitable and misleading to adopt any subspecies at the present stage of our knowledge, at least. This instability in the size of the head scales sometimes goes so far as to fuse them into nearly regular shields on the snout and between the eyes, exactly in the same manner as in certain specimens of *Crotalus atrox*, which have been called *Crotalus scutulatus*, the result being that this so called species or subspecies is a mixture of *atrox* and *confluentus*. Such scutulated specimens have been found both in Arizona and in Montana, the two extremes of its geographical distribution. A specimen from Fort Hayes is recorded by Garman as having the outer edge of the supraocular produced into a horn, as in *C. cerastes*.

The color varies also greatly being sometimes duller, sometimes brighter, lighter or darker, depending upon age, season, condition of skin, climate, and the predominating color of the surroundings, but I have seen no differences of such a character or stability as to render the recognition of geographical races possible or profitable.

Geographical distribution.—Broadly speaking, the Prairie Rattlesnake occupies the area bounded in the East by the ninety-sixth meridian and the Upper Missouri Valley; by the main divide of the Rocky Mountains in the West; by the thirty-third parallel in Texas and the Mexican boundary further west in the South; and by the fiftieth parallel in the North. In the Northeast its distribution appears to be limited by the watershed between Missouri and the Red River of the North, according to Dr. Coues (Bull. Geol. Surv. Terr. IV, 1878, p. 267), who collected numerous specimens along the Canadian border between this watershed and the crest of the Rockies. He also states that it is to be considered fairly common in the region of the Upper Missouri and Milk River and some of their northern tributaries; its range thus extending some distance into the British Possessions, where Mr. James M. Macoun informs me that it is most abundant from Medicine Hat, on the Saskatchewan, to the boundary. In the region just south of the above, Dr. J. A. Allen, while attached to the Union Pacific Railroad expedition, found it common, especially in the bad lands of the Little Missouri and along the Yellowstone, outnumbering all the other ophidians together, and on the expedition of 1872 not less than 2,000 were killed (Proc. Boston Soc. Nat. Hist., XVII, 1874, p. 69). In Nebraska, Taylor (Amer. Natural., XXVI, Sept. 1892, p. 752) observes that it was formerly abundant all over the State, but that it is now confined almost wholly to the middle and western part, where it is by no means rare. The distribution in Kansas, Oklahoma, and Indian Territory is very similar, while in northwestern Texas it is recorded from between the main forks of the Brazos River and on the Llano Estacado as far south as Cañon Blanco (Cope, Zool. Pos. Texas, p. 24; Proc. Phila. Acad. 1892, p. 336). Further west Capt. Pope collected specimens at the Pecos River near the thirty-second parallel. As we leave the plains in going west we find this species ascend higher into the mountains, as it is not uncommon in New Mexico and Arizona and Colorado above 5,000 feet altitude. Even in Montana and Idaho it reaches this elevation, at least in places, though it probably does not occur much higher. Although the main divide of the Rocky Mountains in this northern region seems to be the limit of its extension to the west, yet in at least one place where there is no high crest to obstruct its passage across, has it been found on the western slope, viz; at Lemhi, Idaho, in which locality it was collected by parties of Dr. Merriam's Idaho exploration party, as recorded by me in North American Fauna, No. 5, p. 111 (1891).

Habits.—The Prairie Rattlesnake being one of the smaller species, as it seldom reaches a length of over 4 feet with a proportionately slender body, does not seem to be a very dangerous snake. Dr. Allen, as referred to above, found it so common in the region visited by the expedition that several hundred were killed by the different members, yet the only casualty resulting from it was one horse bitten. On the expedition of 1872 not less than *two thousand* were killed and not a man nor an animal was bitten. Allen also comments upon the fact that they were found abroad quite late in the season, as they were met with quite frequently after several severe frosts had occurred. During July two pairs were found *in coitu*, indicating the season at which they pair. Dr. O. P. Hay (Proc. U. S. Nat. Mus., xv, 1892, p. 387), on the other hand, quotes Prof. S. W. Williston as stating that the sexes pair in May.

Taylor (*l. c.*) found its food habits similar to those of the Massasauga. It is the species often found in or around the homes of the prairie dogs, where they are most abundantly found during the breeding season of the dogs.

Professor Cope records a similar observation (Proc. Phila. Acad., 1892, p. 336) and remarks that the snake protects itself by retreating quickly into the holes of the prairie dogs. The popular belief that these rodents and the rattlesnakes live together because of any special friendship is certainly erroneous, as there can be no doubt that the latter to a great extent feed upon the offspring of the former.

In addition to the hibernation, which, according to Dr. Coues, lasts about six months, terminating with the loosening of the ground from frost, Dr. Suckley (Pac. R. R. Rep., XII, Pt. iii, p. 296) observed these snakes in a more or less sluggish and stupid condition during the drought of summer, a condition which he calls "æstivation."

THE PACIFIC RATTLESNAKE.

Crotalus lucifer,* Baird and Girard

Plate 13.

1842.—? *Crotalus oregonus*, HOLBROOK, N. Am. Herpet., 2 ed., III, p. 21, pl. III.—DE KAY, Zool. N. Y., III, p. 57 (1842).—BAIRD and GIRARD, N. Am. Serp., p. 145 (1853).—BAIRD, Pac. R. R. Rept. X, p. 14, pl. XXIV, fig. 6 (1859).—COPE, Proc. Phila. Ac., 1859 (p. 337).

1852.—*Crotalus lucifer*. BAIRD and GIRARD, Proc. Phila. Acad., VI, p. 177.—BAIRD and GIRARD, Cat. N. Am. Serp., p. 6 (1853).—GIRARD, U. S. Expl. Exp., Herpet., p. 187, pl. XV, figs. 1–6 (1858).—BAIRD, Pac. R. R. Rep., X, Williamson's R. in 1855, p. 10 (1859).—Cope, Proc. Phila. Acad., 1859, p. 337.—Cope in Wheeler's Surv. West 100 Mer., V, p. 533 (1875).—Cope Bull. U. S. Nat. Mus., No. 1, p. 33, (1875).—COOPER, Pac. R. R. Rep., XII, Pt. iii, p. 295 (1860).—LORD, Natural. Vancouv. Isl., II, p. 303 (1866)—LOCKINGTON, Amer. Natural., 1880, p. 295.—GARMAN, Rept. Batr. N. Am., I, Ophid., p. 114 (1883).—YARROW, Bull. U. S. Nat. Mus., No. 24, Check List, pp. 12, 76 (1883).—TOWNSEND, Proc., U. S. Nat. Mus., X, 1887, p. 239.—BEHR, Proc. Calif. Acad. Sc. (2) I, June 1888, p. 94.—STEJNEGER, N. Amer. Fauna, No. 5, p. 111 (1891).—STEJNEGER, N. Amer. Fauna, No. 7, p. 218 (1893.)—COUES, Hist. Exp. Lewis and Clark, III, pp. 898, 968 (1893).—DENBURGH, Bull. U. S. Fish Comm., 1894, p. 57.—*Caudisona lucifer*, COPE, in Mitchell's Res. Ven. Rattlesn., p. 121 (1861).—COPE, Proc. Phila. Acad., 1866, p. 309.—COUES, in Wheeler's Surv. West 100 Mer., V (p. 606) (1875).

1875.—*Crotalus confluentus*, (part) YARROW, in Wheeler's Surv. West 100 Mer., V, p. 530.

1877.—*Crotalus adamanteus atrox*, STREETS, Bull. U. S. Nat. Mus. No. 7, p. 40 (not of B. & G.)

1883.—*Crotalus confluentus lucifer*, COPE, Proc. Phila. Acad., 1883. pp. 11, 19, 22.—COPE, Proc. U. S. Nat. Mus., XIV, 1891, p. 692 (1892).—COPE, Proc. Phila. Acad., 1893, p. 183.

1859.—*Crotalus lecontei*, HALLOWELL, Rep. Pac. R. R., X, Williamson's Route in 1853, p. 18 (not of 1852).

1863.—*Crotalus adamanteus*, var *lucifer*, JAN, Elenc. Sist. Ofid., p. 124.

1883.—*Crotalus oregonus*, var *lucifer*, GARMAN, Rept. Batr. N. Am., I, Ophid., p. 173.

1892.—*Crotalus confluentus lecontei*, COPE, Proc. U. S. Nat. Mus., XIV, p. 692 (not of Hallow.).

1868.—?*Crotalus hallowelli*, COOPER, in Cronise, Nat. Wealth Calif., p. 483 (nom. nud.).—COOPER, Proc. Calif. Acad. Nat. Sc., IV, 1870, p. 68 (nom. nud.).

Figures.—GIRARD, U. S. Expl. Exp., Herpet., Atlas, pl. XV, figs. 1–6 (1858).—BAIRD, Pac. R. R. Rep., X, Williamson's Route in 1855, pl. XI (1859).—HALLOWELL, Pac. R. R. Rep., X, Williamson's Route in 1853, pl. III (1859).—Standard Natural History, III, pl. facing, p. 398 (1885).

Description.†—Muzzle broad. Scales between the superciliaries (supraoculars) numerous, small, and uniform. Plates on the top of head, 4 prefrontal, (internasals) 4 postfrontal (prefontals), or else irregular. Three rows scales between the suborbitals and labials. Labials 16 above; first and fifth largest; 15 below. Dorsal rows 25, exterior

* Probably so named with reference to its supposed diabolical appearance or nature.

† The original description by S. F. Baird, in Baird and Girard's N. Am. Serp., p. 6.

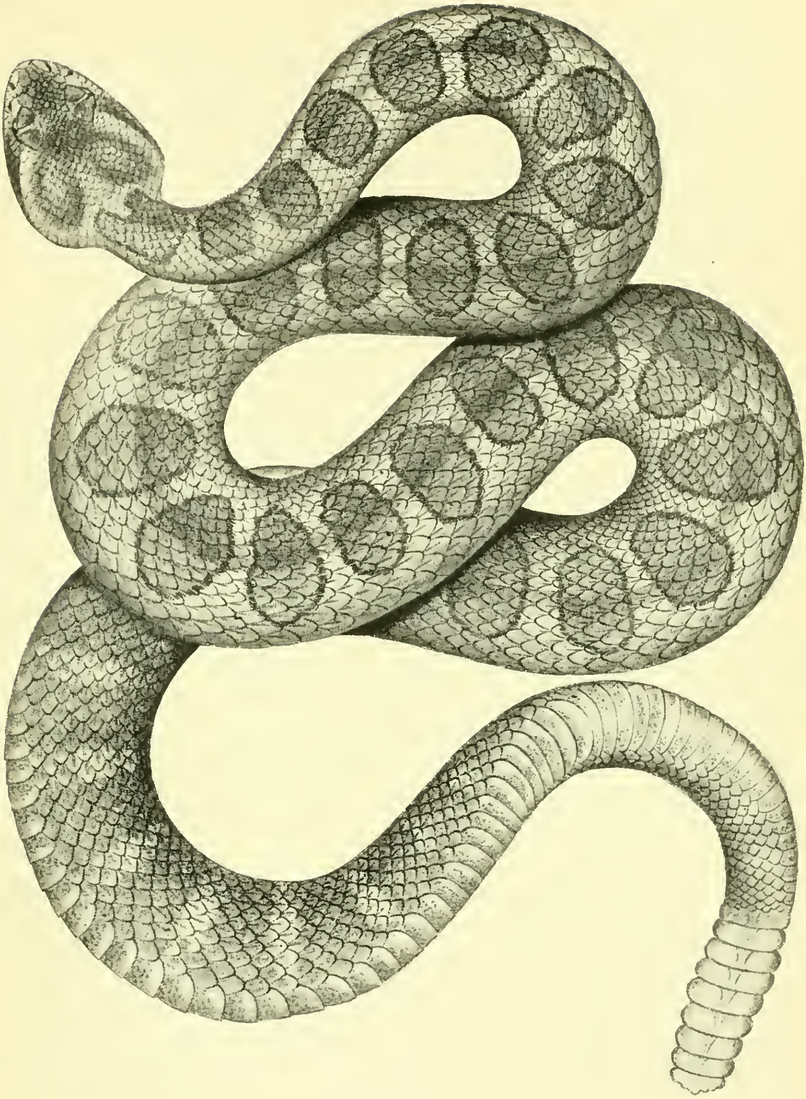
smooth, second and third with absolute carination. Tail and posterior portion of body with 16 or 17 half rings. A succession of brown dorsal hexagons or octagons, separated throughout by a narrow lighter line. Light stripe from superciliary crosses the angle of the mouth on the third and fourth row above labial.

Head very broad anteriorly, outline little tapering. Head above covered with many small tuberculiform scales, showing a substelliform radiation. Interval between superciliary plates filled with small scales, nearly uniform in size; row bordering the superciliaries very small. Scales in front of the superciliaries variable; in one specimen there are two rows of four each, of considerable size; in another they are larger than the rest, but irregular. Scales on the cheeks large, flat, smooth.

Ground color, light brown above. Along the back a series of sub-hexagonal or octagonal blotches, formed by a skeleton of dull yellowish, constituting a dorsal chain. The space thus inclosed of the ground color is margined faintly with dark brown; the width of the interval between the successive blotches is from one-half to 1½ scales. These spots are frequently confluent, two and three running together. Where most distinct the spots are 4 scales long and 11 wide. On each side of this dorsal series is a second, separated by a single row of scales, the blotches extending from the abdominal scutellæ to the fifth or sixth row. These are smaller than the dorsal, and subcircular. Opposite the transverse light bands, and in the open space between four contiguous blotches on the sides, smaller blotches are indistinctly visible. Posteriorly, the spots on the back and sides are confluent and darker; in one specimen forming 17 half rings, encircling the back, leaving about 24 dorsal blotches. Abdomen greenish yellow, more or less clouded with brown at the bases of the scales. Head dark brown; a light line from posterior portion of the superciliaries along the fourth row of supralabial scales back to the angle of the jaws, on the occiput, where it expands into the color of the under part. Upper labials of the same light color behind, rapidly widening anteriorly so as to include whole front and side of the face, leaving only the top of the head dark. The space about the facial pit darker. (See fig. 60).

The theory of coloration is that of decussating lines, which, when they intersect, unite so as to have the angles of intersection truncated.

The species has a general resemblance to *C. atrox* in the arrangement of the blotches, but is darker, and has about 17 dark half rings posteriorly instead of 4 or 5. In *C. atrox* the head is narrower and more triangular, the space between the superciliaries narrow and occupied by angulated larger scales, instead of small tuberculous ones. In *C. atrox* the row bordering the superciliaries is much larger than the rest, and the scales on the top of the head generally more angulated. In *C. lucifer* the line on the side of the head (fig. 60), instead of going directly from the posterior end of the superciliary to the commissures, passes back nearly parallel to the mouth, crossing along the fourth row



PACIFIC RATTLESNAKE,—CROTALUS LUCIFER.
From Baird. Pacific R. R. Rep.

of scales above the labial. The second line in front of the eye is much wider below in *C. lucifer*, and the face generally shows more of white, while the dark portions are much darker.

Variation.—There is a great deal of variation observable in the various specimens before us, particularly in the shape of the head, as well as in the general coloration. As with most of these snakes, the characteristic head pattern becomes obsolete as the individuals grow large, and this character, which is otherwise so constant and reliable in the young, is sometimes difficult of application in very large and old ones. However, I have yet to see a specimen in which the essential parts of it can not be made out if care be exercised. The ground color also varies greatly according to climatic and other local conditions, very dark, nearly black specimens with strongly contrasted color pattern in whitish being frequently found near the coast, or in mountain regions with a very moist climate, while, on the other hand, specimens living in the arid region among light-colored surroundings are often greatly faded, as shown by various specimens from Utah and other portions of the great basin. Upon an examination of a large series, however, I can not find any more reliable or stable color difference than is usual in most species covering a large area and subject to varying, often very restricted, local influences, and I can not see my way clear to recognize any subspecies of *C. lucifer* on this account.

The difference in the outline of the snout and the proportionate width of the head varies apparently greatly, as stated, though hardly more than in several other species. These differences depend greatly upon the general condition of the snake, upon the amount of venom in the gland, and, in alcoholic specimens, upon their state of preservation, specimens dried and hardened in too strong alcohol showing a much more pointed snout than those preserved in a moderately strong solution, while in soft examples kept in a too weak fluid the face is often swollen and rounded.

It appears probable that Holbrook's *C. oregonus* is based upon such a hardened specimen, but as I have not been able to examine it I have refrained for the present from exchanging the well-known name *lucifer* for the older appellation. The material at my disposal is not sufficiently extensive, nor is its quality sufficiently satisfactory to allow me to pass a final judgment upon the question whether there really occurs one or two subspecies or forms on the Pacific province, a question which therefore must be considered still open.

Geographical distribution.—*Crotalus lucifer* is the characteristic snake of the Pacific province as well as the northern portion of the Great Basin. In southern California it occurs on the west slope of the coast ranges of San Diego and Los Angeles counties from the sea level high up into the mountains. It is even found on at least some of the islands off the coast, as, for instance, Santa Catalina Island and Los Coronados. In the southern part of the great interior valley of California this

Rattlesnake is equally at home in the foothills and on the higher slopes of the Sierra Nevada, at least up to an altitude of 8,600 feet above the level of the sea. In the lower cultivated country it is rapidly becoming extinct in some places, while on the other hand there are records of its increase in other localities. Dr. Behr (Proc. Calif. Acad. Sc. (2), I, 1888, p. 94) has called attention to this curious circumstance with regard to its occurrence in various localities around San Francisco Bay. Our records for northern California are less complete, but it is undoubtedly equally widely distributed in all suitable localities, though probably not so high up in the mountains. Townsend (Proc. U. S. Nat. Mus., X, 1887, p. 239) found it "pretty generally distributed, but more numerous in the foothills of Shasta County than elsewhere. Very few snakes were met with in the elevated coniferous forests, and none high up on the mountains." In Oregon and Washington this species is still common in places. In the early days of these states Dr. Suckley (Pac. R. R. Rep., XII, Pt. iii, p. 295) found them to be so numerous at the Dalles as to be very annoying, having been known to enter dwelling houses. Dr. Cooper (*l. c.*) states that they are much less numerous north of the Columbia River than south, and also that none are found west of the Cascade Range, except an occasional straggler carried down the Columbia River. However that may be in Washington, it certainly does not hold for Oregon, as the National Museum possesses a specimen from Fort Umpqua (No. 4234). Lord (Naturalist in Vancouver Island, 1866, p. 303) says that at the Dalles, the Snake, Pelouse, and Spokane rivers, indeed along the entire boundary line between the British Possessions and the United States west of the continental divide, and high up in the Rocky Mountains "its name is *legion*." The exact northern boundary of the species in British Columbia is not recorded, but Mr. James M. Macoun, of the Geological Survey of Canada, writes me that it is confined to a small area in the interior of British Columbia, bounded on the west by Lytton, on the North Thompson River, being found in that latitude as far east as Shuswap Lake. The farthest eastern record is about 10 miles east of Okanagan Lake, in the vicinity of which they are very abundant.

This species evidently follows up the tributaries of the Columbia into the interior, for a number of specimens were collected in Idaho, at Big Butte and Little Lost River, by parties of Dr. Merriam's Idaho exploration party (N. Am. Fauna, No. 5, 1891, p. 111).

Whether the distribution of this species into Nevada is continuous to the north with the Oregon and Idaho localities remains yet to be seen, though it seems probable. It is also continuous into the eastern portion of northern California. Robert Ridgway, during King's exploration of the fortieth parallel, found it excessively abundant on the little island in the Pyramid Lake, and also collected it at the Truckeé River, and later explorers have also recorded it as common from that neighborhood. Farther east it has been obtained in Nevada and Utah by the various Government exploring parties at altitudes of 5,000 feet and upwards, and in the southern portion of these States this Rattlesnake almost certainly does not descend below 5,000 feet. Dr. Merriam's various parties, which in 1891 were scouring the mountain ranges and deserts of Nevada and Utah south of the thirty-eighth parallel, failed to find a single specimen, so that it seems almost certain that it does not occur there. The records of this species from Arizona are very dubious, as the specimens so recorded which I have had an opportunity to examine have either been misidentified, or else the locality was very doubtful.

Habits.—The Pacific Rattlesnake undoubtedly in a general way shares in the habits of its congeners, but is perhaps even less offensive than most of them in spite of the fact that it often reaches dimensions which might make it dangerous enough. It seems to prefer rocky places, whether timbered or not, but it does not invade the desert proper.

The Tiger Rattlesnake.

Crotalus tigris,* Kenn.

Plate 14.

1859.—*Crotalus tigris*, KENNICOTT, U. S. and Mex. Bound. Surv., II, Rept., p. 14.—BAIRD, Pac. R. R. Rep., X, Reptiles, p. 16 (1859).—COPE, Proc. Phila. Acad., 1859, p. 338.—COPE, in Wheeler's Surv. W. 100 Mer., V, p. 534 (1875).—COPE, Bull. U. S. Nat. Mus., No. 1, Check-list, pp. 33, 90 (1875).—COPE, Proc. U. S. Nat. Mus., XIV, 1891, No. 882, p. 693 (1892).—COOPER, in Cronise, Nat. Wealth Calif., p. 483 (1868).—COOPER, Proc. Calif. Acad. Nat. Sc., IV, p. 66 (1870).—GARMAN, Rept. Batr. N. Am., I, Ophid., pp. 117, 175 (1883).—GARMAN, List Rept. Batr. N. Am., p. 35 (1884).—YARROW, Bull. U. S. Nat. Mus., No. 24, Check-list, pp. 12, 74 (1883).—YARROW, in Buck's Ref. Handb. Med. Sc., VI, p. 166 (1888).—STEJNEGER, N. Am. Fauna, No. 7. Death Vall. Exp., p. 214 (1893).—MERRIAM, N. Am. Fauna, No. 7, p. 215 (1893).—*Caudisona tigris*, COPE, in Mitchell's Res. Ven. Rattlesn., p. 122 (1861).—COPE, Proc. Phila. Acad., 1866, p. 309.—COUES, in Wheeler's Surv. W. 100 Mer., V, p. 608 (1875).

Figures.—BAIRD, Mex. Bound. Surv., II, Rept., pl. IV (1859).—BAIRD, Pac. R. R. Rep., X, Rept., pl. XXX, fig. 1 (1859).

Description.†—Body slender; head small, very much depressed, narrow behind; nose remarkably broad and obtuse; whole outline of head nearly quadrangular. Superciliaries (supraorbitals) and frontals smooth; space between superciliaries very wide; 4 frontal plates (internasals), 6 post-frontals (pre-frontals). Two rows of scales between suborbital chain (which is complete) and labials. Labials 14 above, 13 to 14 below. Dorsal rows 21 to 23; very slightly carinated. Dorsal scales broad, rounded behind. Color, yellowish ash above, with rather small, indistinct dorsal brown blotches anteriorly; 2 posterior thirds of body banded with brown.

* From the Latin *tigris*, a tiger, with reference to its yellowish color and tiger-like cross streaks.

† Original description by R. Kennicott in Mex. Bound. Surv., II, Rept., p. 14, from type specimen, U. S. Nat. Mus., No. 471.

Variation.—Beyond the usual individual variation in number of scale rows, loreals, labials, size of scales on top of head, etc., nothing special has been noticed in the material examined. The color varies from whitish to tawny. The head markings are rather indistinct, especially the postocular stripe, which is often lost in the dense sprinkling of minute black dots covering the sides of the head.

Geographical distribution.—This rare snake was formerly only known from a few localities in southern Arizona near the Mexican boundary, until in 1891 the Death Valley exploration under Dr. Merriam extended its range very materially into the desert mountains of southern California and Nevada south of the thirty-seventh parallel, from Owens Valley to the Great Bend of the Colorado, where these snakes were found to be quite common, as Dr. A. K. Fisher and his party killed no less than nineteen in or near Shepherd Canyon, Argus Range, California, during the latter part of April and first week of May, 1891 The vertical range is considerable, as Dr. Merriam's party collected specimens at altitudes varying between about 2,000 and 6,500 feet above the sea.

Habits.—The Tiger Rattler which has received its name, not from any extreme degree of bloodthirstiness or fatal aggressiveness, but from its tawny color and marked cross stripes, seems partial to the barren mountain ranges with their rocks and crevices in preference to the desert valleys surrounding them. It is one of the smaller species and comparatively harmless, though, of course, a bite when inflicted might be serious enough.

During the Death Valley expedition under Dr. C. Hart Merriam, a specimen was found in a wood rat's nest that was dug open. Its stomach contained a kangaroo rat (*Dipodomys*) and a pocket mouse (*Perognathus*), indicating nocturnal habits.

Mr. Stephens, of the same party, on April 15, 1891, killed a pair of these snakes which were on a ledge of rock, standing erect with their heads near together, "apparently playing." They were probably pursuing their amours, and the time would thus indicate the pairing season of the species.

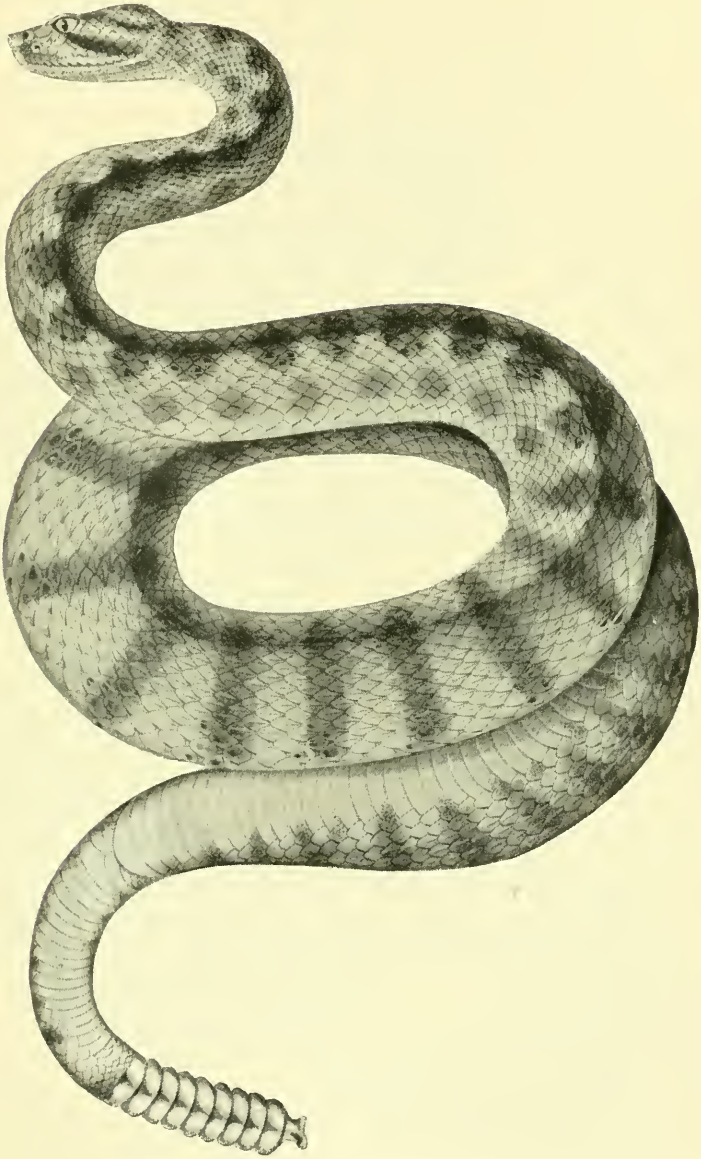
THE HORNED RATTLESNAKE.

*Crotalus cerastes,** Hallowell.

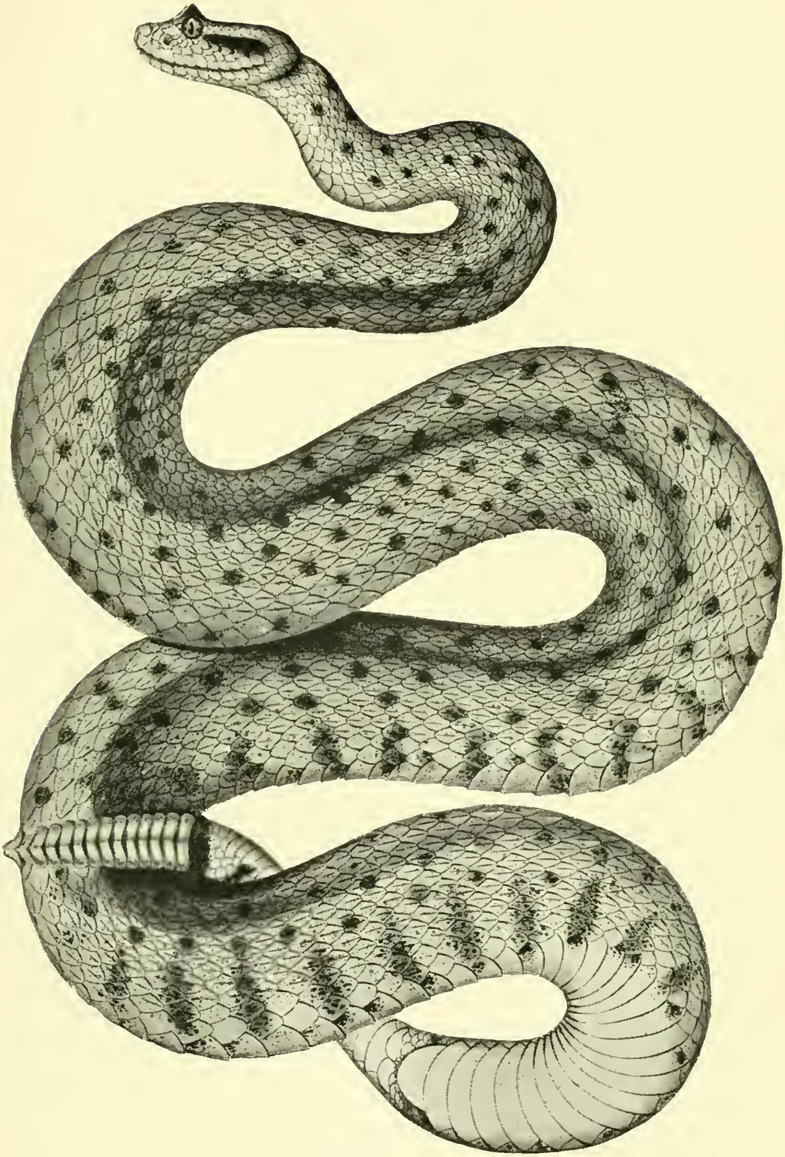
Plate 15.

1854.—*Crotalus cerastes*, HALLOWELL, Proc. Phila. Acad., 1854 (p. 95).—HALLOWELL, Pac. R. R. Rep., x, Williamson's Route (p. 17) (1859).—BAIRD, U. S. Mex. Bound. Surv., II, Rept., p. 14 (1859).—BAIRD Pac. R. R. Rep., x, Reptiles, p. 16 (1859).—COPE, Proc. Phila. Acad., 1859, p. 337.—COPE, Bull. U. S. Nat. Mus., No. 1, Check-list, p. 33 (1875).—COPE, in Wheeler's Surv. W. 100 Mer., v, p. 534 (1875).—COPE, Proc. U. S. Nat. Mus., XIV, 1891, No. 882, p. 694 (1892).—JAN, Elenco Sist. Ofid., p. 124 (1863).—

*From the Greek κεράστης (kerastes) in allusion to the cerastes, or horned serpent of the deserts of Northern Africa.



TIGER RATTLESNAKE,—CROTALUS TIGRIS.
From Baird, Rep. Mex. Bound. Surv



HORNED RATTLESNAKE,—CROTALUS CERASTES.

From Baird, Rep. Mex. Bound. Surv.

COOPER, Proc. Calif. Acad. Nat. Hist., IV, p. 67 (1874).—YARROW, Bull. U. S. Nat. Mus., No. 24, Check-list, pp. 12, 73 (1883).—YARROW, in Buck's Ref. Handb. Med. Sc., VI, p. 166 (1888).—GARMAN, Rept. Batr. N. Am., I, Ophid., pp. 116, 175 (1883).—GARMAN, List N. Am. Rept. Batr., p. 35 (1884).—STEJNEGER, N. Am. Fauna, No. 7, Death Vall. Exp., p. 216 (1893).—MERRIAM, N. Am. Fauna, No. 7, p. 217 (1893).—*Caudisona cerastes* COPE, in Mitchell's Res. Ven. Rattlesn., p. 124 (1861).—COPE, Proc. Phila. Acad., 1866, p. 309.—COPE, Proc. Phila. Acad., 1867, p. 85.—*Echmophrys cerastes* COUES, in Wheeler's Surv. W. 100 Mer., V, p. 609 (1875).

Figures: HALLOWELL, Pac. R. R. Rep., X, Williamson's Route, pl. IV, fig. 1 (1859).—BAIRD, Pac. R. R. Rep., X, Reptiles, pl. XXXV, fig. 4 (1859).—BAIRD, U. S. Mex. Bound. Surv., II, Rept., pl. III (1859).—JAN, Icon. Ophid., livr. 46, pl. III, fig. 5 (1874).

*Description.**—Head small, angles rounded; nose obtuse, much depressed; rostral as broad as high; nostril in the middle of a single large plate (figs. 66, 67). Lateral edge of superciliary plate (supraocular) elongated into a horn-like process directed upward over the eye. Two

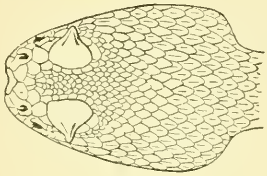


Fig. 66.
HEAD OF CROTALUS CERASTES, TOP VIEW.
Cat. No. 482, U. S. N. M.

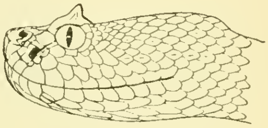


Fig. 67.
HEAD OF CROTALUS CERASTES, SIDE VIEW.
Cat. No. 482, U. S. N. M.

rows of scales between the suborbital series (which is complete of large scales) and the labials. Upper labials 11 to 13, lower 12 to 13. Dorsal rows of scales 21, slightly carinated; each scale along the middle of the back with a tubercular swelling toward the center. Crown tubercular. Entire head and upper parts of a slight yellowish, with a dorsal series of small, indistinct blotches, below which are several irregular rows of isolated brown dots. A narrow, brown stripe extends from the orbit back over the angle of the mouth.

Geographical distribution.—In a general way the horned rattlesnake inhabits the same region as *C. tigris*, viz, southern Arizona, California, and Nevada, but while the latter inhabits the mountain ranges of this area the former is more confined to the desert plains and valleys.

The type locality is Mojave Desert, whence Dr. Merriam, in 1891, rediscovered it and secured specimens. His Death Valley expedition brought home numerous specimens from nearly all the suitable localities visited, and he found it to be "the characteristic snake of the Lower Sonoran deserts of the Great Basin, from southern California easterly across southern Nevada to Arizona and southwestern Utah." We have received specimens from Mr. R. C. Orcutt, who obtained them

*Description by R. Kennicott, in Mex. Bound. Surv., II, Rept., p. 14, from specimen in U. S. Nat. Mus., No. 482.

in the Colorado Desert, San Diego County, Cal., near Salton, from Chrystoval, Ariz., and other places in the Gila and Colorado deserts. It occurs at least as far east as Tempe, where we have specimens from Dr. Wortman, and I myself have collected it at Vulture, Ariz.

Habits.—The Horned Rattlesnake is known locally as the "sidewinder" throughout its range, as Dr. Merriam explains, on account of its peculiar mode of progression:

When disturbed it moves away sideways, keeping its broadside towards the observer instead of proceeding in the usual serpentine manner.

Its feeding habits seems to be similar to those of the Tiger Rattler, as a specimen collected by the Death Valley expedition contained a kangaroo rat and 2 pocket mice. As it is a small snake it is probably comparatively harmless, though it has a very bad reputation, but there is nothing to indicate that its venom is more virulent than that of the other Rattlesnakes. Dr. Merriam's parties brought home 15 specimens and killed a good many more, but no one was bitten.

As to the breeding habits we have the following observation by Dr. Merriam:

During the latter part of April and the early part of May these Rattlesnakes were often found in pairs and were doubtless mating. At such times they remained out in plain sight over night, instead of retreating to holes or shelter under desert brush, and on two occasions they were found by us on cold mornings so early that they were too chilled to move until considerably disturbed. I stepped on one of these by accident as it lay in a compact coil with its head in the center, but it was held so firmly by my weight that it was unable to strike. A moment before I had killed its mate.

The Green Rattlesnake.

Crotalus lepidus,* Kennicott.

Plate 16.

1861.—*Caudisona lepida*, Kennicott, Proc. Phila. Acad., XIII, 1861, p. 206.—Cope, in Mitchell's Res. Ven. Rattlesn., p. 124 (1861).—*Aploaspis lepida*, Cope, Proc. Phila. Acad., 1866 p. 310.—Cope, in Wheeler's Surv. W. 100 Mer., V, p. 535 (1875).—Cope, Bull. U. S. Nat. Mus., No. 1, Check-list, p. 33 (1875).—Yarrow, Bull. U. S. Nat. Mus., No. 24, Check-list, pp. 12, 189 (1883).—*Crotalus lepidus*, Cope, Proc. Phila. Acad., 1883, p. 13.—Cope, Proc. U. S. Nat. Mus., XIV, 1891, No. 882, p. 692 (1892).—Garman, Rept. Batr. N. Am., I, Ophid., pp. 117, 175 (1883).

Figures.—None.

*Description.**—The top of the muzzle is covered by 8 smooth scuta; the rostral plate is rather low, and is in contact with the prenasal; there are 2 preoculars and 2 loreals; and but 2 scales separate the orbit from the superior labial scuta. Of the latter there are 12 occipital scales smooth. Scales of body in 23 rows, the 2 external on each side smooth. Gastrosteges (ventrals), 153; urosteges (subcaudals), 27. The rattle consists of 7 segments and a button, and narrows gradually towards the extremity (fig. 68).

* From the Latin *lepidus*, pleasant, nice, smooth.

GREEN RATTLESNAKE.—CROTALUS LEPIDUS.
From a specimen in the U. S. National Museum.

The color above is greenish gray, which is crossed by 19 jet-black rings on the body (fig. 54), which do not extend on the abdomen. These rings are 2½ scales wide on the middle line, and narrow downwards on each side so as to cover but 1 scale in width. The scales which border the annuli are half black and half green, the effect of which is to give the edge of the ring a turreted outline. The edges of the ground-color are paler than any other part of the scales, thus throwing the black into greater relief. A large black spot, shaped like 2 hearts side by side with the apices posterior, marks the nape, and there is an irregular small black spot on each side of the occiput. Some black specks between the orbits. No other marks on the head. Near the middle of the gray spaces of the body some of the scales of many of the rows have black tips. The tail is light brown above and has a basal broad black, and 2 other narrow brown annuli. Below, dirty white with closely placed shades of brown.

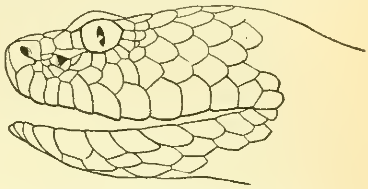


Fig. 68.
HEAD OF CROTALUS LEPIDUS, SIDE VIEW.
Cat. No. 21057, U. S. N. M

Variation.—Prof. Snow, in 1884, in a letter to the reptile department of the National Museum, describes the fresh color of the specimen just described, taken by him at the head of Water Canyon, New Mexico, in August of 1881, from memory, as being of "an unmistakable glaucous or grayish green" which contrasted beautifully with the jet-black bands. In the specimens in the National Museum the bands are brown in the center, black at the edges.

In the scutellation of the head there is some variation, but nothing out of the unusual. The nostrils are comparatively small, and Kennicott originally described the species as having them situated in an undivided nasal, which afterwards led Cope to institute the genus *Aploaspis*. The two heads upon which the species was originally based do not seem to be in existence any more, but in the specimens which I have examined there is certainly a division of the nasal at least below the nostril. The upper preocular appears always to be divided vertically.

In 3 specimens examined by me the scale rows varied from 21 to 23; the ventrals (gastrosteges), from 160 to 163; subcaudals (urosteges), from 24 to 25.

Geographical distribution.—This species, although apparently extremely rare, seems to occur all along our Mexican border, at least from Eagle Pass on the Rio Grande to Yuma on the Colorado. Since the two heads collected by the Mexican Boundary Survey parties at Eagle Pass and Presidio del Norte, no specimens have been recorded from Texas. Prof. Frank Snow, however, in August, 1881, obtained a specimen at the head of Water Canyon, just west of Socorro, N. Mex. Shortly

* Description by E. D. Cope, in Proc. Phila. Acad., 1883, p. 13, from a New Mexican specimen collected by Prof. Frank Snow.

after, Mr. E. W. Nelson sent a specimen to the National Museum from Tucson, Ariz., the one figured, and recently Dr. Thimothy E. Wilcox obtained it at Fort Huachuca in the same Territory. How far it extends south into Mexico we do not know.

Habits.—Nothing is known about its habits except that it is a mountain species, and as it is our smallest crotalus, its bite is probably proportionately less dangerous than that of the others.

THE WHITE RATTLESNAKE.

Crotalus Mitchellii,* Cope.

Plate 17.

1861.—*Caudisona Mitchellii*, COPE, Proc. Phila. Acad., 1861, p. 293.—COPE, Proc. Phila. Acad., 1866, p. 310.—*Crotalus Mitchellii* COPE, in Wheeler's Surv. West 100 Mer., v, p. 535, (1875).—COPE, Bull. U. S. Nat. Mus., No. 1, Check-list, p. 33 (1875).—COPE, Bull. U. S. Nat. Mus., No. 32, p. 90 (1887).—COPE, Proc. U. S. Nat. Mus., XIV, 1891 (No. 882), p. 694 (1892).—DENBURGH, Proc. Cal. Acad. Sc. (2) IV, 1894, p. 450.

1883.—*Crotalus Mitchelli*, YARROW, Bull. U. S. Nat. Mus., No. 24, Check-list, pp. 12, 73, 189.

1883.—*Crotalus oregonus*, var. *Mitchellii*, GARMAN, Rept. Batr. N. Am., I, Ophid., p. 173.

1891.—*Crotalus pyrrhus*, STEJNEGER, W. Amer. Scient., VII, April, 1891 (publ. June), p. 165 (in part).

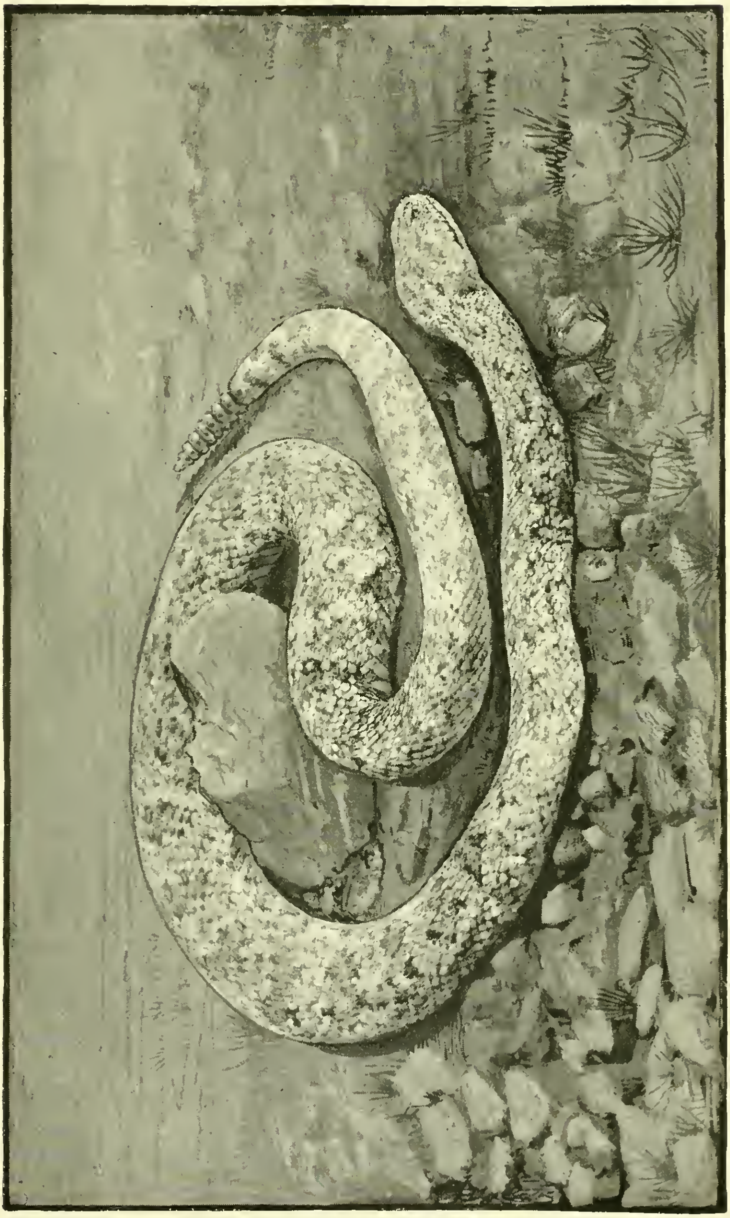
Figures.—None.

Description.†—Head depressed (figs. 69, 70), covered with small, irregular scales, posteriorly keeled; anteriorly, and upon the obtuse muzzle, rugged, free at the lateral or hinder edges. Superciliaries (supraoculars) prominent, striate rugose. One loreal; nostril large, prenasal small, higher than long, separated from the rostral and superior labials by small scales. Rostral low, an equilateral triangle. Sixteen superior labials, the last large, 3 rows between them and the orbit; temporals large, smooth. Superior labials, 16. Scales elongate, striate rugose, in 25 rows, all strongly keeled except the first. Crepitaculum (rattle) well developed, of the *C. atrox* type i. e., strongly compressed, having the terminal complete segments as broad as the basal. Gastrosteges (ventrals), 198; urosteges (subcaudals), 26. Total length (excl. crepitaculum), 44 inches; tail, 3 inches 6 l. (Figs. 69, 70.)

The color above and below is grayish yellow. The upper surface of the head is shaded, that of the body coarsely and densely punctulated with brown. The regular aggregation and deepness of these punctulations form a series of about 42 dorsal spots. These are transverse, with produced lateral angles, extending across 12 rows of scales from angle to angle, separated from the adjacent ones by a bright band of

* Named in honor of Dr. S. Weir Mitchell, of Philadelphia.

† Original description, by E. D. Cope, in Proc. Phila. Acad., 1861, p. 293, from a Cape St. Lucas specimen in Smithsonian Institution.



WHITE RATTLESNAKE,—CROTALUS MITCHELLII.
From a specimen in the U. S. National Museum.

ground color, 1½ scales wide. On the posterior fourth of the total length they form brown cross bands; 5 upon the tail are black on a very light ground, as in *C. atrox.* Anteriorly there is an ill-defined series of spots which are opposite those of the dorsal line. A yellow band extends from the nasal plates anterior to the eye, involving from the ninth to the last superior labial. Superior to this is a brown band extending from the eye and ceasing on a line with the angle of the mouth. Some indistinct brown marks on the top of the head are arranged as follows: One on the inner border of each superciliary; 3 posterior to these, the median short and broad; 4 further posterior, the median pair longer, diverging, reaching the neck.

Variation.—The characters of scutellation hitherto relied upon for distinction between *C. mitchellii* and *C. pyrrhus*, viz, the breaking up of the large horizontal preocular of the former into 2 or more "loreals," does not hold, as shown by specimens more recently received. Mr. Charles Orcutt has sent us a specimen from the Colorado Desert, San Diego

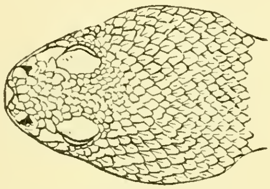


Fig. 69.
HEAD OF CROTALUS MITCHELLII, TOP VIEW.
Cat. No. 12625, U. S. N. M.

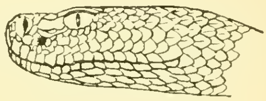


Fig. 70.
HEAD OF CROTALUS MITCHELLII, SIDE VIEW.
Cat. No. 12625, U. S. N. M.

County, Cal. (U. S. Nat. Mus., No. 16353), which is in all other respects almost identical with Belding's specimen from La Paz, Lower California, (No. 12625), but with the preocular on one side divided completely; on the other side, however, only with a faint indication of a division, while another from the same locality has it divided on both sides. These specimens I formerly identified as *C. pyrrhus* on this account, especially as the specimen of so-called *C. pyrrhus* from the Mojave Desert, California, (No. 8669), has the preocular divided on both sides exactly as No. 16501 and the left side of No. 16353. This specimen is, therefore, also a true *C. mitchellii.* The face scutellation of the type of *C. pyrrhus* (No. 6606) is practically identical with that of Dr. Loew's specimen, from the Mojave Desert, and the only difference which I can see consists in the deep reddish color, a difference which can not be regarded as more than subspecific, if indeed it is more than an individual variation. In the California and Lower California specimens the ground color is pale yellowish, almost white.

While reading the proofs of this article I received a paper by Mr. John van Denburgh (Proc. Cal. Acad. Sc. (2) IV, pp. 450–455), who, from an examination of 10 specimens in the California Academy from Lower California, comes to the same conclusion. In these the granules between the nasal and the rostral occur indiscriminately, in one or two series, and he shows conclusively that there is no difference between *C. mitchellii* and *C. pyrrhus* in so far as scutellation is concerned. He even goes so far as to assert that there is no color difference either, as two of his specimens were "decidedly red." I have myself seen specimens more or less suffused with vinaceous-cinnamon or ochraceous-rufous, but the color is essentially different from the red of the type of *C. pyrrhus*, the status of which I, therefore, consider still unsettled.

Geographical distribution.—Originally described from the Cape region of Lower California from a specimen collected by Xantus and later found in the same locality by Belding, it has but recently been discovered in the Colorado and Mojave deserts of Southern California, those from Colorado Desert being due to Mr. R. C. Orcutt's zeal.

Habits.—This species seems to be a distinctive desert form, but beyond this nothing is known of its habits.

THE RED RATTLESNAKE.

Crotalus Mitchellii pyrrhus,* Cope.

1866.—*Caudisona pyrrha*, COPE, Proc. Phila. Acad., XVIII, 1866, pp. 308, 310.—COPE, in Wheeler's Surv. West 100 Mer., V, p. 535 (1875).—COUES, in Wheeler's Surv. West 100 Mer., V, p. 608 (1875).—*Crotalus pyrrhus*, COPE, Bull. U. S. Nat. Mus., No. 1, Check-list, p. 33 (1875).—COPE, Wheeler's Surv. West 100 Mer., V, pl. XXII (1875).—COPE, Proc. U. S. Nat. Mus., XIV, 1891 (No. 882), p. 694 (1892).—YARROW, Bull. U. S. Nat. Mus., No. 24, Check-list, p. 73 (1883).—GARMAN, N. Am. Rept., I, Ophid., p. 114 (1883).—STEJNEGER, W. Amer. Scient., VII, April, 1891 (publ. June), p. 165 (in part).

1883.—*Crotalus confluentus*, var. *pyrrhus*, GARMAN, N. Am. Rept., I, Ophid., p. 173.

1884.—*Crotalus confluentus* (B), GARMAN, List, N. Am. Rept. Batr., p. 34.

Figures.—Wheeler's Survey West 100 Mer., V, pl. XXII.

The status of this form has been discussed under the head of *C. mitchellii*. It may be well to remark that so far only one specimen of this highly colored form has been obtained, and that the suspicion seems well founded that it is but little more than an individual variation.

Description.†—Scales in 25 series, broad and rounded, the 2 inferior rows smooth. Head short and very obtuse, the nostrils opening subvertically. Superior labials higher than long, 3 rows of temporals smooth; scales of vertex small, keeled; those more anterior, striate. Superciliaries (supraoculars) broad oval, striate. Canthus rostralis none. Inferior labials 15, the first and second margining a plate which meets its fellow in front of the geneials (chin-shields), and is in other species a continuation of the first. Gastrosteges (ventrals), 178; urosteges (subcaudals), 24; joints of rattle, 9. The general tint of this

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* From the Greek πυῤῥός (pyrrhos), flame-colored, reddish.

† Original description by E. D. Cope in Proc. Phila. Acad., 1866, pp. 308, 310 from type specimen, U. S. Nat. Mus., No. 6606.

species is a bright salmon red, the scales of the inferior rows punctulate with brown.

Rostral broad as long; 7 [scales] between superciliaries, 3 below orbits; labials, 14; 2 very small preorbitals and 4 loreals. Pale vermillion varied with yellow on the sides of the belly, with numerous arge reddish-bay transverse hexagons, which become transverse bands on posterior two-thirds of length; yellow below.

Geographical distribution.—Only one specimen is known, viz: the type which Dr. E. Coues obtained in Canyon Prieto, not far from Fort Whipple, Arizona.

Habits.—Appears to be a desert form.

THE POISON OF THE POISONOUS SNAKES.

The deadly fluid which from time immemorial has inspired dread and wonder in the human mind, not only by its fatal results but also by its mysterious apparent variability, early became a subject of study and speculation. More than two hundred years ago a Redi and a Charras published their observations on the European vipers and their poison, and all through the eighteenth century experiments with various venoms and their supposed antidotes were common. Some of the investigators of those early dates did good work, notably the Italian savant, Felix Fontana, who arrived at some results which, though contradicted and unheeded by many authors who ought to have known better, have been fully corroborated by the latest investigations.

Very little was discovered as to the real nature of the poison, however, the definite constituency of which the older experimentors had no means of ascertaining. They could only know its grosser physical characteristics, for chemistry, and especially organic chemistry, had not yet reached such a development that it could tackle the intricate problems involved in such investigations. All that was gained was a prodigious number of so-called antidotes, most of which, in their turn, were declared infallible, though very few of them ever gained a general acceptance. In nearly all instances miraculous cures and surprisingly sudden recoveries were recorded, but, sad to say, in other cases even the best reputed remedies failed. It has remained for the last decades to ruthlessly annihilate the claims of most of these "antidotes."

Prince Lucien Bonaparte, in 1843, seems to have been the first to make a chemical analysis of the viper poison, the result of his research being that it is albuminoid or proteid in its nature. The supposed active principle he called echidnine, or viperine. Less than twenty years after, Dr. S. Weir Mitchell, of Philadelphia, commenced a series of analyses and experiments on the poison of the rattlesnake, giving a result similar to Bonaparte's, the corroboration of the albuminoid nature of the venomous substance, which in this case received the name crotaline.

In the meantime organic chemistry, physiology, and bacteriology made immense strides forward. The deadly work of the microbes began gradually to be understood, and their action in the process of putrefaction, as well as their rôle in many of the diseases which in their symptoms recalled those of snake poisoning, became known or suspected; the ptomaïnes and the leucomaïnes were discovered; and the chemists in their improved laboratories became enabled to deal with the proteids, to separate them, and to classify them.

New theories as to the nature of the powerful poison were the necessary result; some thought the toxic property due to the presence of leucomaïnes, or alcaloid bodies; others preferred to regard the fatal results as due to the work of some bacillus; others maintained its albuminoid origin; while others again regarded a combination of all these causes as the true solution of the question.

While works dealing rationally and scientifically with this theme were few formerly and far between, one important discovery has followed closely upon another during the last ten years, and, even at the moment of publishing this, the writer is anxiously scanning each new number of the various journals, magazines, and proceedings, for fear that the latest mail may bring some important information that might make it necessary to modify or even rewrite this account, lest it should become antiquated even before it reaches the hand of the reader.

Before giving a résumé of these late discoveries, the methods of work by which they have been obtained will be briefly discussed.

Attention is directed at the very outset to the fact that the poison of the various kinds of snakes (we speak only of that of the elapoid and viperoid snakes, as the poison of the opisthoglyph snakes has not yet been investigated in the same manner) differs a great deal both in external or physical qualities as well as in chemical composition, and that the poisoning occasioned by its injection often shows very marked symptomatic differences. Within certain limits these differences are only those of degree, and it will be possible in the following to make the statements somewhat general, though in the details there may be slighter deviations according to the kind of snake we have to deal with.

The first thing, of course, is to obtain the poison. The investigators prefer the fresh secretion, if it can be had, for although dried or kept in alcohol the venom is not made innocuous, yet even a slight modification of its properties is to be avoided if possible. A sufficient number of live snakes is therefore highly desirable (Weir Mitchell at one time had at least one hundred in his laboratory), for the quantity of the fluid which each snake yields at any one time is comparatively small.

The methods for obtaining the venom are somewhat various. To kill the snake in order to extract it from the glands directly is a waste of material well to be avoided. The process of allowing it to bite into a soft material from which it is afterwards extracted is open to the objection that some of the fluid is lost, that it is unnecessarily brought into contact with substances which may affect its nature more or less, and that it is not obtained in a concentrated state, as it must be washed out with distilled water. Dr. Weir Mitchell, after having seized the snake by the neck with the tongs or loop, forced a saucer between the jaws, into which the enraged animal would then bite vigorously, leaving a quantity of the poison on the saucer. Prof. Kaufman having experienced that the snake often breaks its teeth on such a hard substance, or even refuses to bite, used a stick covered with rubber. The late Dr. C. S. Allen, of New York, for the same reasons covered the mouth of a wineglass or similar vessel with an animal membrane through which he induced the snake to strike the hollow teeth, the fluid being squirted into the glass. Dr. Paul Barringer, of the University of Virginia, has, it seems to me, improved upon this method by using several thicknesses of filtering paper, the object being to clean the fangs of possibly adhering saliva, and thus prevent the venom from coming in contact with foreign substances and the microbes inhabiting them.

The substance thus obtained is a more or less yellowish, exceptionally colorless, transparent, sticky fluid, without any appreciable smell or taste, easily soluble in water, insoluble in absolute alcohol or ether. If vigorously shaken it becomes frothy. Examined under the microscope, epithelial cells and other impurities are found, as well certain albuminoid bodies resembling micro-organisms, but they do not respond to the dye tests for bacteria, nor are they multiplied by cultures. Drs. Mitchell and Reichert have demonstrated the presence of bacteria (*l. c.* pp. 6–7), but their own researches, as well as those of others, also show that they form no constant or essential accompaniment.

Mitchell and Reichert (*l. c.* p. 137) injected large quantities of the pure micrococci from a sixth generation, in various manners, into rabbits, cats, pigeons, etc., but no signs of any lesions resembling those of venom poisoning were observed.

Drs. Wolfenden and Dawson Williams* endeavored to grow cobra venom in gelatine, "but without the slightest success;" Dr. A. Viaud-Grand-Marais† states that "bacteria and other protoorganisms are seen to make their appearance when the solutions of the venom commence to undergo alterations, but only then."

Fredet is said to have made similar observations, and Kaufmann‡ corroborates these statements from his own experiments.

Another essential point is, that even boiling, unless continued for a long time, does not altogether destroy the poisonous qualities of the fluid. Mitchell found that the rattlesnake poison suffers a gradual impairment of the toxicity of the venom increasing with the increase

* Journ. Physiol., Cambr., VII, 1886, p. 331.
† Dict. Encycl. Médec., Paris (3 ser.), IX, 1881, p. 388.
‡ Ven. Vip., 1889, p. 4; Vip. France, 1893, p. 23.

of temperature, but that it is still toxic even when boiled; Dr. Wall's experiments,* as quoted by Wolfenden, seem to show that cobra poison resists the heat even better, for it is stated that prolonged application of heat (for two hours) at a high temperature at last destroys the toxicity of cobra venom, and that a dilute solution is more easily destroyed by heating than a strong, such a toxic dilute solution being destroyed after heating at 106° C. for half an hour.

When exposed to the air, even for a short time, the fluid poison takes up bacteria, and putrefaction proceeds particularly rapid if the venom be diluted with water. Continued alteration of this kind finally appears to destroy its toxicity.

Excluded from the air, however, or preserved in pure alcohol or glycerine, the venom retains its properties for almost any length of time, as shown by the fact that a glycerine solution in the possession of Dr. Mitchell for twenty years was still toxic.

Dried and kept from atmospheric humidity it is equally permanent, twenty-two years not being able to alter it in the least. It is therefore advisable to handle the dried isolated fangs of the large venomous snakes with caution. It dries somewhat like a gum or varnish, and will crack and scale off in a similar manner.

In discussing the chemical characteristics of snake poison, it is hardly necessary at the present day to refer to the now thoroughly refuted theories of the crystalline nature of any of its active toxic constituents. The last attempt (that of A. Wynter Blyth) † to prove the poisonous quality of the cobra venom to be due to a certain "cobric acid" was effectually disposed of by Dr. R. Norris Wolfenden, ‡ and need not detain us here.

There are, on the other hand, still some physiologists who are not satisfied that the negative results obtained by Prof. Wolcott Gibbs at the request of Drs. Mitchell and Reichert in their search for alkaloids in the venom of the rattlesnake are absolute conclusive, in view of Dr. Armand Gautier's positive determination of leucomaïnes or alkaloids derived from living protoplasm in snake poison. In his much discussed article, "Sur les alcaloïdes dérivés de la destruction bactérienne ou physiologique des tissus animaux,"§ Gautier positively affirmed his assertion of 1881 (Bull. Ac. Méd., Paris (2 ser.), x, 1881, pp. 947–953, and discussion following, pp. 953–958) that from the venom of a *Trigonocephalus*, and particularly from that of the cobra, he had been able to extract a small quantity of matter belonging to the organic alkalis. From the cobra poison he prepared two new alkaloids, which, among

*Indian Snake Poisons, 1883 (pp. 120–124).

† The Poison of the Cobra de Capello. Analyst, I, London, 1877, pp. 204–207.

‡ On 'Cobric Acid,' a so-called constituent of cobra venom. Journ. Physiol., Cambridge, VII, 1886, pp. 365–370.

§ Bulletin de l'Académie de Médecine, Paris (2 ser.), XV, 1886, pp. 65–97: I part. Alcaloïdes bactériennes ou ptomaïnes; pp. 115–139: II part. Alcaloïdes physiologiques ou leucomaïnes.

other peculiarities, possessed the property of immediately precipitating Prussian blue when treated successively with ferrocyanide of potassium and the ferric salts. He expressly remarks, however, that these alkaloids do not constitute the most dangerous part of the venom, which he asserts is of a nitrogenous nature. They seem chiefly to stupify, but are not necessarily fatal. In the course of the discussion he further emphasized the fact that these leucomaïnes in the normal state of the tissues only occur in minimal proportions (*tom. cit.* p. 431).

Other careful investigations simultaneous with and later than those of Prof. Gibbs have fully substantiated the claim that the leucomaines play no rôle in the poisoning, and that, if present, they form no essential part of the venom. Dr. Wolfenden (*loc. cit.* p. 335) made examinations of cobra venom by the Stas-Otto method for ptomaine, or alkaloid, in three different instances, but did not succeed in finding the slightest trace of any such body. There was neither trace of fixed nor volatile alkaloid, the residues were noncrystalline and, moreover, nontoxic, and gave none of the alkaloidal test reactions.

Prof. Gautier, as I have already intimated, insisted that the toxic constituent of the venom is of a different nature. The researches of the last ten years have proved beyond a shadow of doubt their proteid nature, and that Bonaparte was correct when, in 1843, he referred to it as an albuminoid.

The achievements during the last decade in the study of the chemistry of snake venoms have been of such a nature, are so recent, and even now progressing, that the best way to record them is to treat them historically and chronologically.

The first progressive step was taken when, in 1883, Dr. S. Weir Mitchell and E. T. Reichert, of Philadelphia, laid before the National Academy a preliminary report on the results of studies, which, after a lapse of twenty years, Dr. Mitchell had resumed. He had in some way become convinced that the complexity of the symptoms in snake poisoning could not be the result of a single simple constituent, but that they might be explained by the assumption of a similarly complex nature of the albuminoid body, the crotaline, previously thought to be simple. Dr. Mitchell, in a later popular article,* has given a clear and interesting insight in the mental process which led to the important discovery and the laboratory processes by which it was demonstrated, from which we make the following abstracts:

> When I first studied this strange poison I thought of it as a single albuminous body. As such it had always been regarded since it had been proved by Prince Bonaparte to belong to the albumens. When once I chanced to think that venom might be a complex fluid, holding in solution more than one poison, reasons for such a belief multiplied, and so excited my interest that, in 1882, with Prof. Reichert's aid, I began to put my theory to the sharp test of experiment. To prove in the outside laboratory what the inside mental laboratory has comfortably settled is not always easy, and many months of careful research were required before the answer

* Century Magazine, N. York, XXXVIII, Aug. 1889, pp. 503–514.

came to us. I will try to make clear our methods and results. When a little of the venom is placed in sufficient water it dissolves readily. If now we heat the solution a coagulation takes place, just such as happens when white of egg hardens on boiling. If by means of a filter we separate this substance, clotted by heat, it is found to be innocuous. The clear fluid which passes through the filter is, however, poisonous, but does not cause much *local* effect. As a whole the poison has been damaged by heat, presumably because one or more of its ingredients had been injured by heat. The next step is to learn if the substance made solid and inert by boiling can not be separated in some other way and in such a form as will leave it also poisonous.

All soluble substances are divisible into two classes, one of which will pass through an animal membrane into a current of pure water, and one of which will not. Those which can so pass are said to be dialysable, and the filter is known as a dialyser, and the process is called "dialysis." We disolve some of the poison in water and put it in an inverted funnel, the wide mouth of which, being covered with a thin animal membrane is placed in distilled water. Under these circumstances the water goes through the membrane, and dilutes the fluid above it and certain substances pass out to the water.

The matter which thus finds its way out to the water is said to be dialysable. When examined it proves to be poisonous—to be uncoagulable by heat, and to be the same as the matter left unaltered when we boil the diluted poison for a few moments. This substance resembles the albuminous matter which is formed when gastric juice digests white of egg, and as the material so obtained is called peptone, we name our product which passed through the dialyser to water *venom peptone*.

As the thinner water enters the dialyser and the peptone goes out within the vessel there falls down a white substance, which is easily redissolved if we add a little common salt. It falls out of solution because the salts belonging to venom and which keep the white matter dissolved are, like all saline substances, dialysable and pass out along with the peptone. This white precipitate has certain likenesses to the albuminous bodies known as globulin, and of which there are several kinds in our bodies. That which falls out of the solution of venom we named *venom globulin*.

The final results of Mitchell's and Reichert's investigations were embodied in a fine quarto volume published by the Smithsonian Institution in 1886 as one of its "Contributions to Knowledge" under the title "Researches upon the Venoms of Poisonous Serpents," to which we must refer the reader for details.

There are in those results, with regard to the chemical nature of the venom, two points, however, to which I will call particular attention as being of a fundamental nature, and which the reader must keep steadily in mind if he wishes to understand the present status of the question, viz. first that the crotalus poison, as well as the cobra venom, consists of several proteids, two of which are preponderating, although present in a varying degree. One of these, the *globulin*, is not dialysable; the other proteid, which passes through the membrane of the diaylser, Mitchell referred to the peptones, though possibly it belongs to another class, as will be seen later on.

The second point is that these two chief constituents are present in different proportions in the various poisons, the globulin occurring mostly in the crotalid snakes, but only in a minimal quantity in the cobra. This difference in the composition of the venoms corresponds markedly with the difference in the symptoms accompanying poisoning by the *Crotalidæ* (and the nearly related *Viperidæ*) on the one hand, and by the *Najidæ* or cobras (and the nearly related *Elapidæ*) on the other, as will be shown further on.

Simultaneously with Mitchell and Reichert's report there appeared in England a couple of articles by Dr. R. Norris Wolfenden of a scarcely less import, he, however, having had the benefit of the preliminary report by his American precursors. He published them in the Cambridge Journal of Physiology under the common title "On the nature and action of the venom of poisonous snakes," the first one being a treatise on "The Venom of the Indian Cobra, *Naja tripudians*," the second "A Note upon the Venom of the Indian Viper, *Daboia russelii*."

Wolfenden's results are in the main the same as those of Mitchell and Reichert. Pursuing a different method of subdividing the proteids there are some differences in detail, which mean very little so far as the general result is concerned, but there is also one disagreement as to the nature and the nomenclature of the dialyzable portion. Mitchell referred it, as we have seen, to the peptones, but Wolfenden maintains that it can not possibly be a peptone since it is precipitated by acetic acid and potassic ferrocyanide. He, on the other hand, refers it to the albumoses, and in his analysis of the daboia poison he names it "*albumose* or *syntonin*." This is therefore practically the same as Mitchell's *venom peptone*.

Wolfenden found in the cobra an overwhelming quantity of the globulin, but scarcely any albumose; in the daboia, on the other hand besides the globulin, a certain quantity, proportions not given, of "albumose or syntonin," which seems to be more difficult to dialyze than the crotalus proteid of the same class. As will be seen, Mitchell's conclusions were amply and independently confirmed.

The very latest studies of the chemical nature of the venom are those of Dr. C. J. Martin and Mr. J. M'Garvie Smith, of Sydney, Australia, who have successfully investigated the poison of the Australian black snake, *Pseudechis porphyriacus*, a very dangerous snake related to the Indian cobra.* Their results corroborate in the main those of their predecessors, and in their endeavor to identify the various proteids which constitute the venom, they successfully separated three proteids, viz., "one an albumin, and the other two albumoses. The albumin is not virulent, but the two albumoses (corresponding to proto and hetero-albumoses of Kühne) are extremely poisonous. They each have the same physiological action and this is the same as that produced by the venom itself."

It is one of the great merits of Mitchell and Reichert's work that they undertook to test directly upon the venom the numerous chemical antidotes which from time to time have been suggested or from their known action on similar substances seemed to give promise of favorable results. It was found that many are worthless, that in fact only a few

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* Proc. Roy. Soc. U. S. Wales, Aug. 3, 1892, and Journal of Physiology, xv, 1893, (p. 380). See also W. D. Halliburton's paper on "Snake Poison" in Science Progress, II, Sep. 1894, pp. 1–9.

exert such an influence upon the venom as to make them available as *local* antidotes. We emphasize *local*, because from the very nature of the poison as an albuminoid and consequently chemically closely related to normal constituents of the blood, there can be no chemical antidote which after the introduction of the venom into the circulation would be able to destroy the poison without also destroying the blood itself.

I wish to call attention here to the fact that Mitchell repeatedly makes distinction between the poisoning resulting in death within a few hours and when it is slower in coming. He found that in the most rapid poisoning there is frequently nothing appreciable to the naked eye beyond the slight local lesion, or here and there minute capillary hemorrhages, when death has been delayed beyond a minute; while in examples of chronic poisoning, both the local and the systemic changes are enormously more extensive. This distinction between local and systemic changes is one of considerable importance, since the rational treatment of any given case hinges upon the full understanding of this point.

Only two years pass, and another very important contribution to our knowledge of the intricate question of snake poison was published, this time by a Russian, Dr. E. A. Feoktistow, the same whose work on the rattle of the rattlesnake we have already had the occasion to quote In 1888 he issued a doctor dissertation with the following title: Experimentelle Untersuchungen über Schlangengift,* based upon about 400 experiments with the fresh venom from about 200 specimens belonging to several species of vipers and *Crotalus durissus*. His researches cover to a great extent those of Mitchell and Reichert. In some cases the disagreement between the results of these eminent students is highly perplexing; for instance, in regard to the effect of the venom upon the blood and the blood vessels. The disagreement as to the causes of death as formulated by Mitchell and Reichert, on one hand, and Feoktistow on the other, also seems startling at first, for the former conclude that death occurs through paralysis of the respiratory centers, paralysis of the heart, hemorrhages in the medulla, or possibly through the inability of the profoundly altered red corpuscles to perform their functions, and they positively assert that the direct action of the venom upon the nervous system, save as concerns the paralysis of the respiratory centers, is of but little importance, while Feoktistow with equal positiveness concludes that the snake venom is a nerve poison *par excellence*, which paralyzes the vaso-motor center, and in large doses the respiratory center as well. It is impossible for us here to carry out a comparative analysis of the two works, but I think it will be found that the disagreement between these authors is more apparent than real, and that it consists more in the interpretation of

* St. Petersburg, 8vo., 47 pp.; a preliminary article in Mém Ac. Sc. St.-Pétersb. (7e, sér.) XXXVI, No. 4, 22 pp., under title: Eine Vorläufige Mittheilung über die Wirkung des Schlangengiftes auf den thierischen Organismus.

the phenomena than in the results of the experiments themselves. But it would be a thankful task for an experienced physiologist to correlate all the facts, to eliminate possible errors, to reexperiment where there may be doubt as to the facts, and to weigh the evidence impartially for and against the various explanations. His work would not have to be confined to the works already mentioned, for the very next year there appeared another independent treatise of considerable importance.

In 1889 the French Academy of Medicine, in Paris, awarded the Orfila prize for 1888 to M. Kaufmann, professor of physiology at the veterinary school at Alfort, in recognition of his studies of the venom of the common viper of France, *Vipera aspis*.* Kaufmann's work is for the greater part a study of the action of the poison of the viper upon the nerves, the circulation, and the tissues, and of certain chemical antidotes upon the venom. It corroborates that of his predecessors, and shows the similarity of action of the viper venom to the crotalus venom, but it also contains several valuable new observations and new discoveries.

I have said that Mitchell has already called attention to the difference between the rapid and slow poisoning. Feoktistow made similar observations, but Kaufmann has emphasized it still more, and in part based his study upon this difference. His experiments, to a greater extent than his predecessors', were separately directed upon ascertaining the results of the injection of the venom directly into the circulation and those following only its hypodermic application to the tissues. The results deserve a closer examination here.

Injected directly into the veins of the animals experimented upon, the venom produces its effects with almost lightning rapidity, consisting in nervous, circulatory, respiratory, and digestive disturbances. The nervous disturbances consist of a primary excitation of very short duration, followed by a drowsiness, which lasts until death; the intellectual faculties are not impaired for a long while, but the general sensibility, as well as the voluntary and reflex movements, are rapidly affected. The circulatory disturbances consist in an enormous lowering of the arterial tension, due to a considerable vascular dilatation, principally in the abdominal digestive viscera; in a considerable acceleration of the pulse, and in a very great feebleness of the blood waves propelled by the heart. The respiration and calorification do not undergo profound alterations, only a slight diminution of their activity being observed. The conclusion is reached that the death which follows the introduction of the venom into the circulation must be attributed to gastro-intestinal apoplexy and the stupefying action exercised directly upon the nervous system. This is in confirmation of Feoktistow's views.

The hypodermic injections produce both general systemic effects identical with the above, due to the absorption of the poison into the

* Du venin de la vipère. Mém. Acad. Méd., XXXVI, 1889, and separate.

circulation, and local effects which develop at the point of injection and in the adjoining tissues. These local lesions consist in a more or less intense swelling, and in a purple or black discoloration produced by extravasation of blood and serum in the tissues affected by the venom. The death, which is due to the direct absorption of the venom, arrives very rapidly, and the characteristic internal hemorrhages are observed; the death, however, which is the consequence of the infection of local origin is slower, and the ordinary internal lesions are not found, but, on the contrary, considerable local alterations. The danger from the injection varies with the part of the body inoculated; thus injections of venom made on the inner side of the thighs or on the nose are very dangerous; those practiced on the side of the thorax muscles less so. The micro-organisms accompanying the local lesions are only accidental and secondary productions; they find excellent conditions for their propagation and multiplication in the altered or mortified tissue, but inoculated into healthy animals they do not produce the specific effects of the venom. After the injection under the skin, the poison is slowly diffused in the adjoining tissues and determines their progressive alteration without itself being altered in any way, for the venom can be traced in its full activity in the local lesions, and serum taken from the altered tissues, if injected into healthy animals, develops the ordinary effects of the venom; this serum, consequently, contains a certain quantity of active venom. On the other hand, venom does not accumulate in an appreciable quantity neither in the liver, the kidneys, nor the nervous centers, as serum taken from these tissues has remained inactive in animals inoculated with it.

Mitchell and Reichert had confirmed the destructive action of certain chemicals upon the venom and discovered others of similar action, notably permanganate of potassium, ferric chloride, iodine and bromine. To these Kaufmann adds chromic acid, which he highly recommends as a remedy for the local lesions.

The fact that chromic acid in a solution of 1 to 100 is one of the reagents which produces the greatest precipitate in the venom, besides being an energetic oxidizer, led Prof. Kaufmann to institute a series of very interesting experiments with it, which only lack of space prevents me from reproducing here in their entirety. Suffice it to say that they prove conclusively the potent and beneficent action of the chromic acid, not only when it is injected mixed with the venom, but also when introduced some time after the poisoning. The last experiment of the series (No. XXXV) is very instructive. Four dogs of about equal size were inoculated on the inner side of the thigh with two drops of fresh viper venom obtained immediately before the injection. One was left without further treatment, the others had injected in the puncture, five minutes after, respectively 1:100 solutions of chromic acid, permanganate of potassium, and bichoride of mercury. The following morning all showed local congestions, and in the evening of that day the dog which had received no remediary injection died. On the third day, in the one treated with chromic acid the local congestion was red, in the other two œdematous and blackish. On the fourth day the reddening had almost disappeared in the former and no ulceration was to be observed; in the dog treated with permanganate the discoloration had also nearly disappeared, but there was a large ulcer, while the one treated with bichloride of mercury had not even improved so much. They afterwards all fully recovered. Kaufmann sums up the result of this experiment as follows: This experiment demonstrates that the three agents employed have preserved the animals from death; the bichloride has the inconvenience of producing a caustic action, forming a scar and a wound long to heal; the permanganate, although less destructive, also leaves a wound which takes long time in scarifying, while the chromic acid most completely checked the action of venom without occasioning any cauterization or ulceration.

The point essentially proved by the above experiment is the relative superiority of the chromic acid over the permanganate and the bichloride of mercury.

Three years later, Dr. Albert Calmette, surgeon of the first class of the colonial medical staff and director of the bacteriological institute at Saigon, Cochin China, published a similar series of experiments* with a solution of chloride of gold, upon the venom of the cobra. He claims to have secured quite a success in saving the animals experimented upon, the experiments being conducted very much like those of Kaufmann, by injection of the venom mixed with the chemical, and by injecting them separately, the latter as late as five minutes after the former. Very little can be gathered from his experiments as to the efficacy of the chloride of gold in counteracting the local disturbances as compared with that of chromic acid, because of the slight local effects of the cobra venom. Whether the chloride of gold in this respect is the equal of the chromic acid is therefore doubtful, although from the facts that it forms an insoluble precipitate with the venom and that its cauterizing effect is but slight, it may probably be inferred that there is but little difference between them.

Dr. Calmette has recently † recommended a solution (1:11) of chloride of lime as superior to the chloride of gold, it being effective up to fifty minutes with rabbits which would otherwise have died in two hours.

Unfortunately for Dr. Calmette's claim for the efficacy of chloride of gold, an English physiologist,‡ undertook a series of similar experiments with an entirely different result. From his criticism it would appear as if the whole treatment of local neutralization of the venom

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* Étude expérimentale du venin de Naja tripudians, etc. Ann. de l'Inst. Pasteur, Paris, VI, 1892, pp. 160–183; also, Arch de Méd. Nav., Paris, LVIII, 1892 (pp. 161–190); see also Brit. Med. Jour., Weekly Epitome, 1892, April 23 (p. 67).

† See McClure's Magazine, III, October, 1894, p. 466.

‡ Chloride of Gold as a Remedy for Cobra Poison, by A. A. Kanthack. Lancet, London, 1892, I, pp. 1296–1297.

by injection of a chemical destroyer at the wound is chimerical, but such a conclusion, it seems to me, would be premature to say the least. It is true that the introduction and non-efficacy of the venom mixed with the chemical proves nothing as being practically no venom; it is also true that the introduction of the chemical five minutes after the bite would be of but little practical use if five minutes were the extreme limit for its beneficial action. It is also undoubtedly true that even within this time it is not always capable of, alone and unassisted, to save the life of the patient. On the other hand, it must not be forgotten that the above experiments had been chiefly theoretical, and that no means were taken to assist the remedy experimented with. It is rather singular that the experimenters should not have extended their experiments somewhat, and it is particularly surprising that those testing the efficacy of the local treatment should not have introduced the use of ligatures to a greater extent. By thus confining the action of the poison to the neighborhood of the point of inoculation the experimenter would probably have been able to extend the period within which the chemical agent showed itself beneficent considerably beyond the five minutes. I think this is a point worthy of consideration by those contemplating future experiments with local chemical remedies.

After the important discoveries of Mitchell and Reichert as to the multiple chemical composition of the snake poisons, it was but natural that the attention of the searchers for remedies was principally drawn in the direction of looking for local chemical destroyers. It was also natural that these researches should prevail in those countries in which the crotalids and the vipers predominate, because of the local destructiveness of the poison of these snakes. But the other side was, fortunately, not lost sight of, and the search for remedies to counteract the poison after it has reached the circulation, was naturally carried on most vigorously in the home of the najid and elapid snakes, in India and Australia.

Mitchell had already pointed out the hopelessness of finding a chemical which, introduced into the veins, would be able to destroy the poison without also destroying the blood. The only rational line of research would be to discover such remedies as would, to use Mitchell's words, "oppose the actions of venom upon the most vulnerable parts of the system," or, as he calls them, "physiological antagonists." It will be remembered that Mitchell and Reichert came to the conclusion that "there can be no question, however, that the respiratory centers are the parts of the system most vulnerable to venom, and that death is most commonly due to their paralysis." Although, according to them, paralysis of the heart generally only plays a secondary rôle in the case of snake poisoning, yet the cardiac power is sensibly enfeebled, especially in the early stage. The kind of remedies to be looked for would consequently be such as will stimulate the vital functions of respiration and circulation.

The remedy which to them seemed to hold forth the greatest promise of success was alcohol, a stimulant the effects of which are well known; which is, moreover, usually readily at hand, and which has been extensively tried for the purpose. It has been used both by the layman and the practitioner, often with apparent success, and its application has undoubtedly saved many a life. On the other hand, reports are numerous of patients having died which were under the influence of liquor when bitten, or to whom whisky was afterwards administered. But it is safe to say that in most of these cases the alcohol had been taken in excess so as to depress instead of stimulate the vital functions. It can not be emphasized too much, or too often, that intoxication, so far from helping the cure, helps the poison, and that persons having been made intoxicated beyond excitement, when under treatment for snake bite, and yet recovered, have so recovered not from the treatment but in spite of it. It should also be remembered that the alcohol has no beneficent direct action upon the venom; on the contrary, applied locally or intravenously, it seems to add to the virulence of the poison.

Notwithstanding all that has been written about the utter uselessness of ammonia, we see still occasionally in medical literature reports from physicians who have obtained cures in spite of its application. Injected directly, it is worse than useless. It should not at this late date be necessary to fill pages in order to emphasize this fact, which has been conclusively demonstrated by all rational experiments from the time of Fontana to that of Mitchell and the other physiologists of to-day. Internally, as a stimulant, it has also been shown to be much inferior to alcohol. The radical defect of ammonia in severe cases consists in the fact that it increases the arterial pressure, thus aiding the poison in producing the internal hemorrhages.

The remedy which has come prominently to the front during the last five years, however, and which really seems to come up to all reasonable expectation, is a poison scarcely less terrible than the snake venom itself, viz, *strychnine.* The theory upon which the application of this drug has been based is, on the one hand, that the snake poison acts as a specific nerve poison, depressing and more or less suspending the function of the motor nerve centers throughout the body without interfering with the structure of the nerve cells, and, on the other, that the physiological action of strychnine upon the same organs is diametrically opposed to the action of the venom, or, in brief, that "strychnine is the exact antithesis of snake poison in its action." To use the words of the main advocate of strychnine as an antidote:

Whilst snake poison turns off the motor batteries and reduces the volume and force of motor-nerve currents, strychnine, when following it as an antidote, turns them on again, acting with the unerring certainty of a chemical test, *if administered in sufficient quantity.* Purely physiological in its action, it neutralizes the effects of the snake poison, and announces, by unmistakable symptoms, when it has accomplished this task, and would, if continued, become a poison itself. Previous to this announcement its poisonous action is completely neutralized by the snake poison, and the latter would therefore be equally as efficacious in strychnine poisoning as strychnine is in snake poisoning.*

I am not aware that this test has been applied, but I may here call attention to the fact that Dr. A. O. Ameden, of Glens Falls, N. Y., by a similar train of reasoning, was led to apply rattlesnake poison to a case of tetanus apparently with most signal success.†

It seems that the great discovery of strychnine as the antidote par excellence was barely missed by Dr. Louis Lanszweert, who in 1871 published a short article, "Arseniate of Strychnia: New Antidote to the Poison of Snakes,"‡ in which he somewhat vaguely refers to five cases successfully treated by him in San Francisco, as well as to some equally successful experiments made by him in Paris upon rabbits. It is evident that he regarded the arsenic as the antidote, and it is not at all clear why he added the strychnine, except that by this addition he obtained "a more readily soluble substance than arsenious acid." It is now well known that arsenic is no specific antidote, and it seems almost certain that the success of Dr. Lanszweert's treatment was due to the strychnine. From what I have shown above, Dr. Ameden, in 1883, came also dangerously near making the same discovery.

It has recently been claimed that Dr. John Shortt, of India, as early as 1868 experimented with strychnine, but that it was given up on account of the failure of experiments upon animals. Dr. Shortt's efforts may possibly have been published in the unprofessional local press; but in 1868 as well as in 1870 he recommended liquor potassæ as an antidote, without mentioning strychnine. The honor of the discovery can, therefore, not be claimed for him.

This was reserved, however, to a then obscure Australian practitioner, Dr. A. Mueller, of Yackandandah, Victoria, who in 1888, in the most positive manner, claimed that he had practically proved strychnine to be the specific antidote by the success of his cures, and to have demonstrated the scientific correctness of the theory by accounting satisfactorily for all the phenomena observable in connection with the subject.

Dr. Mueller's discovery, which was published in a series of articles in the Australasian Medical Gazette, in Sydney,§ at once started a vigorous, sometimes even acrimonious, discussion in Australia, and the

* On Snake Poison, by A. Mueller, 1893, p. 42.

† Serpent Venom as a Remedial Agent in Tetanus. Medic. News, Phila., 1883, XLIII, p. 339. Also, Crotaline as a Remedy in Tetanus. Med. and Surg. Rep., Phila., 1883, XLIX (p. 642). Also, Rattlesnake Venom in a Case of Tetanus. Albany Med. Ann., 1885, VI (p. 91).

‡ Pacif. Med. and Surg. Journ., San Francisco, Aug. 1871 (n. s.), V. pp. 108–115.

§ On the Pathology and Cure of Snake Bite. Australas. Med. Gaz., 1888, 1889, VIII, pp. 41–42 (I); pp. 68–69 (II); pp. 124–126 (III); pp. 179–182 (IV); pp. 209–210 (V).

strychnine was most earnestly tested and enthusiastically indorsed by Dr. Mueller's followers, while his antagonists of the old school went to the other extreme of denouncing the subcutaneous injection of the drug in snake venom cases as being of equal value to so much water. The medical journals of the colonies from that time on are full of the controversy, which soon spread to India.

The opposition gleefully recorded several cases of death in spite of the administration of strychnine. In addition they clamored for a series of experiments upon animals by which the theory could be "scientifically" tested, at the same time pointing out that the experiments which had so far been undertaken did not seem to support Dr. Mueller's contention.

These criticisms Dr. Mueller has met by explaining in an apparently satisfactory manner why in the fatal cases reported the treatment had failed, it being mostly due to the fact that not enough strychnine had been administered. As to the experiments on animals, it was contended that the physiological effects of strychnine upon man and the various kind of test animals is so different that no safe conclusions can be drawn, and that, moreover, the numerous tests afforded by the cases of human beings having been bitten and saved from death by the administration of the strychnine is the best possible proof of its efficiency.

From an article recently published (Australas. Med. Gaz., Sydney, XII, December 15, 1893, pp. 401–403) it will be seen that the opposition to the strychnine treatment is on the wane and that the Governments of Australia and India are alive to the importance of Dr. Mueller's discovery. The latter, in his recent book,* furthermore states that he knows from good authority that Sir Joseph Fayer, the president of the medical board at the India office, the celebrated authority on snake poison, and author of the monumental work "The Thanatophidia of India," has recommended to the English Government the adoption of the strychnine treatment of snake bite in India. It is but fair in a case like this to render the results of Dr. Mueller's discovery in his own words. Hence the following quotations from his book, which I have deemed it essential, should be as full as practicable, especially since his work has so far received but little attention in this country:

> It is self-evident from preceding statements that in the treatment of snake bite with strychnine the ordinary doses must be greatly exceeded, and that its administration must be continued, even if the total quantity injected within an hour or two amounts to what in the absence of snake poison would be a dangerous, if not a fatal, dose. Timidity in handling the drug is fraught with far more danger than a bold and fearless use of it. The few failures among its numerous successes recorded during the last four years in Australia were nearly all traceable to the antidote not having been injected in sufficient quantity. Even slight tetanic convulsions, which were noticed in a few cases, invariably passed off quickly. It should be borne in mind that of the two poisons warring with each other, that of the snake is by far

*Snake Poison and its Action. Sydney, 1893, p. 70.

the most insidious and dangerous one, more especially in its effects on the vaso-motor centers. The latter are wrought very insidiously and where they predominate require the most energetic use of the antidote; for whilst the timid practitioner, after injecting as much strychnine as he deems safe, stands idly by waiting for its effects, the snake virus, not checked by a sufficient quantity of it, continues its baneful work, drawing the blood mass into the paralyzed abdominal veins, and finally, by arrested heart action, bringing on sudden collapse. In such cases even some tetanic convulsions are of little danger and may actually be necessary to overcome the paralysis of the splanchnicus and with it that of the other vaso-motor centers.

Whilst then it must be laid down as a principle that the antidote should be administered freely and without regard to the quantity that may be required to develop symptoms of its own physiological action, the doses in which it is injected and the intervals between them must be left to the practitioner's judgment, as they depend in every case on the quantity of snake poison absorbed, the time elapsed since its inception and the corresponding greater or lesser urgency of the symptoms. If the latter denote a large dose to have been imparted and it has been in the system for hours, delay is dangerous and nothing less than 16 minims of liq. strychniæ P. B., in very urgent cases even 20 to 25 minims, should be injected to any person over 15 years of age. Even children may require these large doses, as they are determined by the quantity of the poison they have to counteract and are kept in check by it. The action of the antidote is so prompt and decisive that not more than fifteen to twenty minutes need to elapse after the first injection before further measures can be decided on. If the poisoning symptoms show no abatement by that time, a second injection of the same strength should be made promptly, and unless after it a decided improvement is preceptible, a third one after the same interval. As the action of strychnine when applied as antidote is not cumulative, no fear need to be entertained of violent effects breaking out after these doses repeated at short intervals. * * *

If under the influence of these large doses the symptoms abate, or if the latter are comparatively mild from the first, smaller doses of strychnine should be injected, say from one-fifteenth to one-tenth of a grain, but under all circumstances the rule that distinct strychnia symptoms must be produced before the injections are discontinued should never be departed from. This rule is a perfectly safe one for its observance entails no danger, a few muscular spasms or even slight tetanic convulsions being easily subdued and harmless as compared with that most insidious condition exemplified in case No. 1, cited below, the first one treated with strychnine by the writer, who, having no experience in the treatment, did not administer quite enough strychnine. The patient, after apparently recovering from a moribund condition and being able to walk and even to mount a horse, remained partly under the influences of the poison and succumbed to it during sleep, when, according to subsequent experience, one more injection would have saved him.

The tendency to relapses is always great when much snake poison has been absorbed. Apparently yielding to the antidote for a time, the insidious venom, after a shorter or longer interval during which it appears to have been conquered, all at once reasserts its presence, and has to be met by such fresh injections, regardless of the quantity of strychnine previously administered, but the amount required in most relapses is not a large one.

In speaking of the applicability of the treatment to bites of snakes with longer fangs and more powerful venom than those of Australia, he concludes as follows:

In those cases only where the long fangs of these snakes perforate into a vein and a large quantity of venom injected into the blood stream overpowers the nerve centers so as make death imminent, if not almost instantaneous, the subcutaneous injections may be found of little use. Here intravenous injections of half a grain and even 1 grain doses would appear to be indicated, and might yet fan the flame of life afresh, even when respiration and pulse at wrist have already ceased. We have seen both these functions extinct in Australia and restored by comparatively small doses of the antidote, and can see no reason why a more energetic use of it should not restore them in India.

Dr. Mueller next enumerates in detail 50 cases, only 2 from his own practice, some of them very remarkable and several, as it seems, quite conclusive, but as none of these cases were caused by snakes directly related to our American poisonous serpents, except to the *Elapidæ*, it is not thought necessary to reprint any of them here. The first case reported is the one alluded to above, the first case treated by Dr. Mueller with strychnine. The case ended fatally.

The death of the unfortunate lad, however, has saved some lives since. It taught the writer the lesson never to trust to the apparent success of the antidote until it shows distinct signs of its own physiological action, and even then to watch his patients carefully for the first twenty-four hours, and let them sleep for short periods only.

The cases from India reported by Dr. Banerjee, also reprinted in the book, have been assailed as unreliable, but since the publication of the book others have been recorded in the Indian Medical Gazette, for 1893, and reprinted in the Australasian Medical Gazette (see, for instance, two in Vol. XIII, January 15, 1894), which seem to indicate a success for the treatment in India as great as in Australia.

An entire chapter is devoted to the unsuccessful cases, which are analyzed and explained. The last one Dr. Mueller finds to convey a new lesson even to him, as he draws from it the conclusion that the antidote can only be relied on within the first twenty-four hours after the bite.

It can not for a moment be supposed that the discovery of the strychnine treatment will be accepted as the final settlement of the question of a physiological antidote. As a matter of fact, our knowledge of the physiological action of the various venoms is as yet but imperfect, and the physiological properties of many of the drugs which may be called to play a rôle are not better known. Experiments are still carried on, but as no definite results have as yet been obtained we shall only mention them very briefly.

In 1888, Dr. H. C. Yarrow published a series of articles in Forest and Stream concerning "Snake bite and its Antidote."* In the introduction he gives an interesting historical sketch of the search for antidotes, and then submits in detail a series of experiments of his own, among which I wish to call special attention to those with *jaborandi*, or its alkaloids pilocarpine and jaborine, the use of which was first

* Forest and Stream, N. Y., XXX; Pt. I, May 10, 1888, p. 307; Pt. II, May 17, pp. 327, 328; Pt. III, May 24, pp. 349, 350, and May 31, pp. 369, 370; Pt. IV, June 7, pp. 386–388; Chapters II and III also reprinted in Albany Medical Annals, 1888, IX, pp. 204–212.

introduced, it seems, by the French physician, Dr. Josso.* Rabbits and fowls were inoculated with crotalus poison and treated with extr. jaborandi, both hypodermically and in the stomach. It appears that the rabbits recovered even from a fourfold lethal dose of the venom, while in the fowls the effect of the antidote was less marked, as it was only capable of prolonging but not saving life.

Another drug which it might possibly pay to experiment with is *strophanthus*, as suggested by Dr. T. L. Bancroft, of Australia. In short, there is yet a wide field open for the investigators.

The beneficial effects of the jaborandi are probably to be ascribed to the influence of this drug both upon the skin and the liver, and this fact opens up another question which must be taken into consideration before we conclude this chapter, viz, the question as to the way in which the poison is eliminated by the system; for it is plain from all that we now know of the physiology of the case that when the poison has once entered into the circulation all that can be done in this direction is to counteract its immediate effect upon the nerve centers, thus prolonging life and enabling the system to throw off the poison. Any remedy that would assist in doing so would be a distinct help. But in order to find such a remedy it is necessary to know exactly how the poison is finally got rid of. Unfortunately, this is a point upon which no conclusive studies have been made. As already mentioned, experiments have been made which go to show the presence of the venom in the liver, kidneys, etc., although in but small quantity. I am not aware that there has been made any extended experiments to ascertain the presence of the poison in the perspiration, a point well worth investigation in view of the fact that there are cases of severe systemic poisoning which have been reported † cured simply by means of profuse perspiration. Inoculation of urine of the bitten subject has been occasionally undertaken to test the presence of venom, and fatal results have been reported, but the experiments have not been conducted in such a way as to satisfy us that death was not due to the ptomaines contained in the urine.

However, Feoktistow found, in addition, gross anatomical changes in the kidneys of poisoned cats, and Dr. Mueller has recently ‡ called attention to the probability that the snake poison is eliminated through the kidneys.

Quite recently Dr. Konrad Alt, of Germany, in a paper read before the Natural History Society of Halle on the Saale, on July 23, 1892, § has demonstrated that a portion of the venom, at least, is eliminated by

* Gaz. Hebdom. de Médec. et Chir., Paris (2 ser.), 1882, XIX (p. 835).

† For instance: W. H. Wooster, New Treatment for Snake Bite and other Poisons. Science, XX, Nov. 4, 1892, pp. 255, 256.

‡ On Hæmaturia in Snakebite Poisoning. Australas. Med. Gaz., Sydney, XII, Aug. 15, 1893, pp. 247-249.

§ Untersuchungen über die Ausscheidung des Schlangengiftes durch den Magen. Münch. Medic. Wochenschr., XXXIX, Oct. 11, 1892, pp. 724-728.

the stomach. Two sets of experiments were made upon dogs. In the one set the stomach was washed out carefully, the result being that the animals so treated showed a distinctly less degree of poisoning than the control animals. In the other set, the contents of the stomach with proper precautions were inoculated into other dogs, the result being symptoms of poisoning identical with those of the control animals. Moreover, the presence of the unaltered venom was demonstrated by chemical tests.

The conclusion seems justified that a washing out of the patient's stomach ought to be part of the treatment of a case of snake bite.

This entire question seems a promising field for future investigation, which we earnestly recommend to physiologists having the opportunity and wishing to advance our knowledge of snake poison and its treatment.

TREATMENT.

It is not for the present writer to recommend any one special treatment of cases of snake-bite poisoning; but he is willing to state what would seem to be a rational treatment, in view of our present knowledge of the subject. He will, however, confine himself to such cases as may arise from poisoning by snakes occurring in this country only.

Evidently the first thing to ascertain is whether the case is really that of a bite by a poisonous snake, leaving here out of consideration the *opisthoglyphs*, the bite of which probably is too rare and too insignificant to need special mention. If consisting of one or of two isolated punctures, the wound is almost certain to be caused by a poisonous bite, and the distance between the two punctures will usually give a clew to the size of the snake and consequently to the presumable degree of the poisoning. If the snake or its head are secured, the identification may be comparatively easy, as all our poisonous snakes, with the exception of the *Elaps*, or harlequin snake, of the Southern and Southwestern States, are readily recognized by the pit between the eye and the nostril, as before stated (p. 365, fig. 9). The characters of the *Elaps* have also been given in this work (p. 356, figs. 5, 7, 8), and no difficulty should be found in making a correct identification. As will be plain from what has been said above concerning the difference in the action of the crotalid and the elapid snakes, this distinction may be of some importance in selecting the correct treatment.

In very severe acute cases, in which the venom has been injected directly into the circulation, no matter by what kind of snake, the chances for recovery are very slight indeed. The only chance in such cases seems to be to stimulate the nervous centers as speedily as possible, the best known means to this end being injection of large doses of strychnine, if necessary, intravenously, until tetanic effects are obtained and the patient roused from the coma which has probably seized him. This result obtained, other systematic or local remedies, as the case may require, can then be applied.

A similar treatment also seems advisable in such cases of slow poisoning in which the patient has already reached a stage of collapse, or coma, before assistance can be rendered, provided not more than twenty-four hours have elapsed since the bite was inflicted, in which case injections of strychnine seem inapplicable.

If in case of slow poisoning help can be administered very soon after the infliction of the wound and the venom has been localized by ligatures and minimized by incision of the wound, sucking, or, better, cupping of the blood, the treatment next to be applied depends upon whether the offending snake is a Pit Viper (Crotalid) or an *Elaps*, for if it was a rattlesnake, a copperhead, or a water moccasin, attention should at once be directed to the local lesion, unless the state of the patient imperatively demands an immediate stimulant, in which case *small* doses of alcohol may be useful. Apparently the best treatment of the local lesion is an 1 to 100 solution of chromic acid injected into the incised wound, the punctures of the fangs, and into the surrounding swelling, as quickly as the circumstances will allow, since the success of this treatment depends upon the chemical reaching and destroying the venom before it is absorbed into the circulation. Kneading of the tissues surrounding the wound in order to bring the venom and chemical in close contact may be useful. If chromic acid is not at hand, chloride of gold, permanganate of potassa, etc., may be substituted.

There does not seem to be any necessity for amputation in a case where hypodermic injection of any of these chemicals can be applied. It can only be recommended in such extreme cases in which these remedies are not to be had, and the danger great. But even in this case the amputation must follow quickly or not at all.

The local lesion having been attended to, the general systemic treatment may commence, as by this time the venom has probably already entered the circulation, it being necessary occasionally to loosen the ligatures for a moment to prevent mortification. Alcohol in small doses and washing out of the stomach may now be in order, as well as the administration of sudorific and diuretic remedies, preferably extract of jaborandi. Hypodermic injections of 15 to 20 minims of liqu. strychniæ repeated every twenty minutes until slight tetanic spasms appear, seem to be warranted. Constant watching for relapses and attention to the local lesion will do the rest.

The action of the venom of the elapid snakes being so much more rapid and the local changes so insignificant as not to cause any great alarm, the chances are that when the patient asks for help and treatment the venom has already entered the circulation, and that attempt to destroy any appreciable quantity of the poison in the wound would be futile. However, whenever possible this should not be neglected. The usual first treatment would nevertheless be general, viz, the administration of stimulants, sudorifics and diuretics as instanced above, since the danger from a quick paralysis of the nerve centers is so much greater in these cases.

It may be well to emphasize here, that in the case of children the amount of the antidotal remedy to be administered must not be judged by the age of the child, but by the amount of venom to be counteracted as well as by the character of the snake, and it is worth remembering in this connection—besides the different action of the crotalid and the elapid snakes—that the degree of danger chiefly depends upon the size of the snake; that of our pit vipers the rattlesnake is the most dangerous, the copperhead less so, and the water moccasin the least so, although in itself not to be trifled with.

As for the preliminary treatment before medical assistance can be obtained or rational remedies applied, but little can be added to the old methods employed. The first thing to be done is to tie a strong ligature or two, a string or a handkerchief, between the wound and the heart, whenever practicable; next, cutting deeply into the punctures so as to make the blood flow freely; sucking out of the blood from the wound, a procedure perfectly harmless, unless the person doing it has an open wound in the mouth; next, careful loosening of the ligature so as to admit a small quantity of fresh blood to the ligated member in order to prevent mortification; next, administration of a stimulant; if at hand, small doses of an alcoholic liquor being given internally at frequent intervals; if alcohol is not at hand, and a stimulant appears imperative, a small dose of ammonia might be given, but *only* very shortly after the bite, not on a later stage when it will certainly do harm, at least in cases of poisoning by rattlesnake, copperhead, or water moccasin; if the patient has to wait for the arrival of a doctor, now is the time to try all reliable means to produce a profuse perspiration.

There may occasionally be such extreme cases in which amputation and cauterization by heat or otherwise would be the only available remedies, but as a rule such barbaric treatment need not be resorted to, and in most cases would probably be a cure worse than the disease.

There has been placed on the market several specially constructed contrivances for use in cases of snake bite, to which I wish to call attention.

A cupping instrument specially constructed for snake bite so as to be easily applicable to small surfaces or the extremities was made several years ago by William Hume, instrument maker, Lothian street, street, Edinburgh, Scotland, at a price of 10*s.* 6*d.*

In France, MM. Pelliot & Delon, 26 Rue du Roi-de-Sicile, Paris, at the instance of Prof. Kaufmann, have arranged a pocket case containing hypodermic syringe, chemicals, directions for use, etc., for the local treatment by chromic acid. Price, 6 francs.

Kaufmann's own directions for the injection of this fluid are as follows:

Two or three drops of an aqueous solution (1 to 100) of chromic acid or permanganate of potash are injected with a Pravaz syringe exactly into the puncture of each fang. It is necessary to let the liquid penetrate into the tissues to the same depth as the venom; the injection must, therefore, be more or less deep according to the size of the snake. To make absolutely sure, three or four more similar injections are made a little distance around the point bitten.

If, at the time of treatment, the swelling has already obtained a certain size it may be necessary to make injections into various points of the tumor. After the injections the part is pressed gently with the hand so as to distribute the injected fluid in all directions and facilitate its mixture with the venom. Next, some punctures are made with the point of a knife. Usually a rather large quantity of yellowish serosity flows from the wound, mixed with a part of the injected fluid. In order to facilitate this discharge the swelling should be kneeded repeatedly with the hand. Then the surface should be washed with the permanganate or the chromic solution, and a small piece of lint soaked with one or the other of these liquids applied. If, after some time, the swelling continues to grow, additional injections into the parts must be made as well as punctures. With this treatment the tissues preserve their vitality; the skin does not turn black but remains red. The microbes are destroyed by the injected agents, which act as antiseptics as well as antidotes.

For the strychnine treatment the Australians have also constructed a pocket case containing patent poison sucker, hypodermic syringe with two needles, glass mortar and pestle, two tubes of strychnine tabloids, and directions for use. The manufacturer is L. Bruck, 13 Castlereagh street, Sydney, and it sells for £1.

It seems as if a combination of these two cases would be the thing for this country, and ought to be of great service not only to physicians residing in those parts ot the States in which poisoning by snake bite is not unusual, but also to such persons who from their occupation are particularly exposed to dangers of this kind.

PREVENTIVE INOCULATION—THE IMMUNITY OF SNAKES AGAINST SNAKE VENOM.

It has been noticed from time to time by various experimenters that animals which had recovered from snake-venom injections showed a certain amount of resistance afterwards, so as to make them useless for future experiments. It naturally suggested itself to investigators that by continued inoculation of small doses of the pure or modified venom, immunity from the poison, even in otherwise fatal doses, might finally be obtained.

Such a preventive inoculation, although of doubtful use in this country, with its comparatively small number of fatalities from snake bites, might be highly beneficial in India and Australia, or to travelers or others in tropical countries, who might be specially exposed to such dangers.

As early as 1887 Prof. Henry Sewall, of the University of Michigan, undertook and reported* upon a series of experiments with massasauga venom on pigeons. The conclusions drawn were that repeated inoculation with sublethal doses produced a continually increasing resistance toward the injurious effects of the poison without apparent influence on the general health of the animals. It was also shown, however, that the efficiency of resistance against the venom gradually fails in absence of fresh inoculation, although at least one of the pigeons retained its immunity over an interval of five months.

There is another class of observations which have a certain bearing on this question.

It has been long known, although occasionally doubted or contradicted, that the poisonous snakes are proof against their own venom. Big doses of snake venom have repeatedly been inoculated into the bodies of the producers themselves absolutely without effect. The current stories of "suicides" of rattlesnakes are easily explained, and in none of the many cases reported is there any conclusive proof that death resulted from a self-inflicted wound. It is also well known that a number of the so-called harmless snakes remain unaffected whether bitten by a venomous snake, or inoculated in the laboratory with enormous doses.

Considerable light has very recently been thrown upon this curious immunity, as well as the question of preventive inoculation, by the studies and experiments of two French physiologists, C. Phisalix and G. Bertrand, who are at the present moment, I believe, still engaged in further work along the same lines. They have published a series of articles in the Comptes Rendus of the French Academy of Sciences, describing their experiments with the venom of the viper. Having previously found that the blood of the toad and the salamander contain the same toxic principles they turned their attention to the viper. Guinea pigs were injected with the blood of the viper and died within two hours under the ordinary symptoms of Viper-bite poisoning; the post mortem examination gave the same result; and an examination of the poison in the viper blood showed it to be insoluble in alcohol. The authors conclude that there exists in the blood of the viper some agent similar to the venom; that it is due to an internal secretion of the glands, and that the presence of this toxic principle in the gland must be considered as the true cause of the immunity of the viper from its own venom.†

The next step was to examine the blood of some of the poison-proof harmless snakes, the two French species of *Natrix* being selected for the purpose. Guinea pigs injected in a similar manner as in the experiments with the viper blood gave similar results—they died in two

*Experiments on the Preventive Inoculation of Rattlesnake Venom. Jour. Physiol., Cambr., 1887, VIII, pp. 203–210.

†Toxicité du sang de la vipère (*Vipera aspis*, L.). Compt. Rend. Ac. Sc. Paris, CXVII, No. 26, Dec. 26, 1893, pp. 1099–1102. Extr. in Rev. Scientif. (4), I, No. 1, p. 23 (1894).

hours with all the symptoms of viper-bite poisoning. Having thus determined that there exists in the blood of the *Natrix* a poisonous agent in at least as great a quantity as in the viper and that the immunity of these snakes also is due to this cause, the question naturally arose as to the origin of the venom in the "harmless" snakes—in other words, by which organs is the venom furnished to the blood. Successive inoculation of organic extracts of the principal intestines, liver, pancreas, spleen, thymus, thyroid body, and salivary glands gave the result that only those of the latter had any effect at all and that this effect showed the characteristics of viper-venom poisoning. The natural conclusion is that the presence of venom in the blood of the harmless snakes is due to internal secretion of the salivary glands.*

The authors referred to had now reached the stage when they could look around for a suitable attenuation of the venom in order to secure a proper "vaccine," and they found that heat had this effect. Some of the results obtained by them by heating are not new—for instance, that boiling the viper venom for a few seconds affects it in such a way as to disassociate from it the local phenomena, the undestroyed portion left being practically elapid, or cobra, poison. When the authors therefore heated a lethal dose of viper venom and, after cooling, inoculated it into a guinea pig, they did practically nothing but inoculate the animal with a much reduced, nonfatal dose of cobra venom. The result of their experiments shows that this vaccination with the thus attenuated venom results in a certain amount ot immunity. †

Naturally the authors next experimented with a view to ascertain the effects of the blood of the animals thus vaccinated. The experiments demonstrated the presence of the venom in the blood serum after three days (21st to 24th of January), and that this blood serum also possesses vaccinating properties. ‡ Of course, the results having been published on February 12, sufficient time had not lapsed to determine if the immunity thus obtained is lasting. The authors seem to be hopeful of obtaining such modifications of the blood as will enable them to utilize it as a therapeutic agent. Experiments and time alone will show.

It is but fair to add that Dr. Calmette claims priority for the discovery of the "serum" vaccine treatment. §

* Sur la présence de glandes venimeuses chez les Couleuvres, et la toxicité du sang de ces animaux. Compt. Rend. Ac. Sc. Paris, CXVIII, No. 2, Jan. 8, 1894, pp. 76–79.

† Atténuation du venin de la vipère par la chaleur et vaccination du cobaye contre ce venin. Compt. Rend. Ac. Sc. Paris, CVIII, No. 6, Feb. 5, 1894, pp. 288–291.

‡ Sur la propriété antitoxique du sang des animaux vaccinés contre le venin de la vipère. (Compt. Rend., Ac. Sc., Paris, CXVIII, No. 7, Feb. 12, 1894, pp. 356–358.)

§ See Henry J. W. Dam. Inoculation against Snake Poison. Dr. Calmette's Experiments at the Pasteur Institute, Paris. McClure's Magazine, III, October, 1894, pp. 460–468.

EXTERMINATION OF POISONOUS SNAKES.

It can be stated as a general rule that our poisonous snakes are decreasing rapidly in numbers, and that consequently the danger from their bites is constantly diminishing. In many localities where rattlesnakes were formerly numerous they have now become entirely exterminated, while in others they are extremely rare. The causes that have led to this are various, but the commonest cause is undoubtedly the increasing cultivation of the country. In other places the decrease in the number of the snakes can be traced directly to their being killed off by the hog, an animal certainly not proof against the venom if it enters the circulation, but usually well protected by its fat, which is in most cases sufficiently thick to prevent the fangs of the serpent from penetrating to the underlying tissues.

From other localities there is reported a similar decrease without it having been possible to offer a satisfactory explanation. As a striking illustration of this, I may cite the experience of an exploring party under Dr. C. Hart Merriam, camping for several months at the base of the San Francisco Mountain, Arizona, in 1889. The party consisted of a number of naturalists, specialists in mammalogy, ornithology, herpetology, and botany, who were busily engaged in studying the fauna and flora of that mountain for several months during the summer. Yet not a single rattlesnake was collected or seen by the party in that locality where twenty-five years previously Dr. E. Coues had collected quite a series of them, belonging to several species, during a comparatively short stay, notwithstanding the fact that the character of the country has apparently not changed in any essential particular. It has not been brought under cultivation; there are no hogs running about, only herds of cattle; no regular burning over of the ground takes place; no special enemies could be discovered; a few people pass occasionally through the district, and fewer still live there permanently.

On the other hand, there are instances on record of localities in which certain species of poisonous snakes have actually increased. This may occur in places, for instance, where the land was formerly burned over regularly every year, thus destroying the snakes in great numbers. Dr. H. H. Behr* attributes the increase in the number of rattlesnakes in some localities not far from San Francisco to the killing off of the enemies of the snake, notably birds of prey and other snakes, and probably correctly, while Mr. Hurter (Trans. Acad. St. Louis, vi, 1893, p. 258) reports a similar increase in western Illinois as due to the new stock law compelling swine to be penned up.

The poisonous snakes have a great many natural enemies which keep them in check, but there does not seem to exist in this country any animal which makes a specialty of the business and is particularly

* Proc. Calif., Acad. Sci. (2), i, 1888, pp. 94–99.

adapted for it, with the possible exception of some of the harmless snakes. We have seen that the latter, at least a great many of them, are poison-proof, and thus have but little to fear from the bite, and it is a well known fact that some of them are able to kill and eat a poisonous snake at least equaling them in size. Among the most redoubted enemies of the rattlesnake is quoted the common king snake or chain snake, *Lampropeltis getulus*, and the remnants of poisonous snakes are often found in the stomachs of other species.

This fact emphasizes the desirability of a correct discrimination between the poisonous kinds and the harmless snakes. The former ought to be killed and, if possible, exterminated wherever found; the latter should not only be spared, but protected and their multiplication encouraged, as they rank among the best friends of the farmer and the gardener.

I do not know whether it has ever been tried anywhere in this country to pay a bounty or a premium per head, or rattle, for the extermination of the dangerous snakes, but it is occasionally suggested, and may deserve a moment's reflection in this connection, notwithstanding the fact that there are but few localities in North America in which the really dangerous snakes are numerous enough to render even an experiment with bounty desirable. It would be different, of course, if the system should have proved to possess any merit or to have been followed by success in countries where it has already been tried. A brief mention of some of the more noteworthy attempts in this line will show, however, that such has not been the case.

It has been tried and is still in vogue in India, where large sums are paid annually for the purpose. But it does not seem to do much good, except perhaps the moral effect in a country in which the dreaded cobra* is considered sacred by a great portion of the population. Even in the little island of Martinique, it appears to have had but scant effect in diminishing the number of the deadly "fer-de-lance."†

Prof. Kaufmann, in his book so often referred to, on the other hand, indorses the system as having been instrumental in diminishing the number of vipers in France, and submits that if it has not always given good results where it might be expected, the reason is solely that the system has not been applied in a thorough manner, in other words, that it has not been adopted over the whole country. In defense of this he appends a table showing the number of vipers killed in three "departments" (counties) since the beginning of the system. The table is very interesting, but as the results are very similar in all three (Haute-Saone, Doubs, Jura), I shall not weary the reader with more columns of figures than those from the department of Haute Saone as being most characteristic.

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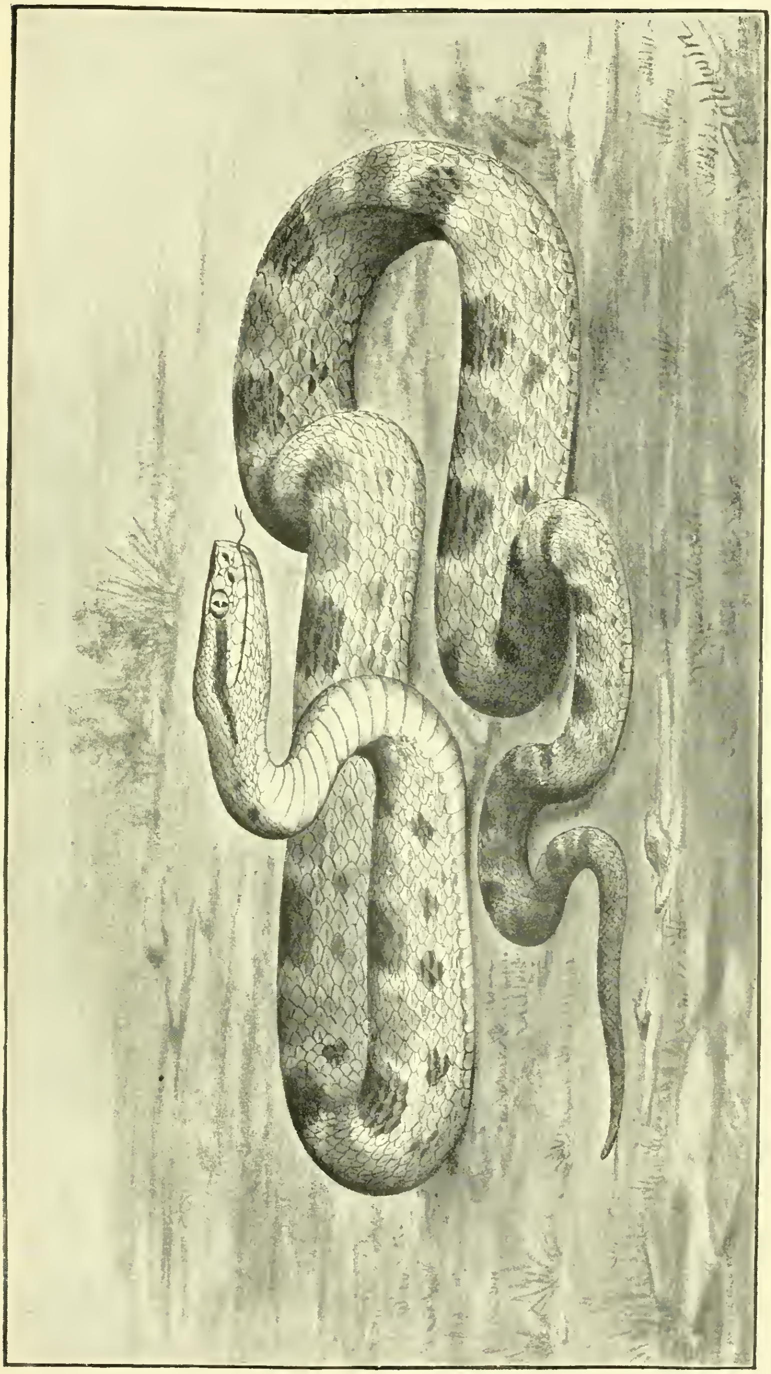
* For an illustration of this dangerous snake see pl. 18.
† See pl. 19.

INDIAN COBRA,—NAJA NAIA.
After Fayrer's "Thanatophidia of India."



WEST INDIAN "FER-DE-LANCE", BOTHROPS LANCEOLATUS.
From a specimen in the U. S. National Museum.

Year.	Premium per viper.	Number of vipers killed.
	Francs.	
1864	0.25	1,934
1865	0.25	3,790
1866	0.25	4,354
1867	0.25	2,678
1868	0.25	2,147
1869	0.25	2,809
1870	0.25	877
1871	0.25	539
1872	0.25	243
1873	0.25	1,929
1874	0.25	1,636
1875	0.25	1,622
1876	0.25	2,505
1877	0.25	2,183
1878	0.25	5,394
1879	0.25	5,071
1880	0.25	15,130
1881	0.25	18,398
1882	{0.25 / 0.15}	13,874
1883	0.15	1,058
1884	0.25	4,870
1885	0.25	18,084
1886	0.25	22,083
1887	0.25	27,053
1888	0.25	27,665
1889	0.25	39,031
1890	0.25	67,620
Grand total	....	294,577

Let us look at this table for a moment. Nearly 300,000 vipers killed during twenty-seven years in a department of France almost the exact size of the State of Delaware (Haute-Saone, 2,028 square miles; Delaware, 2,050 square miles)! Haute-Saone, in 1876, about the middle of the period covered by the table, had a population of 304,052 souls; consequently there is said to have been killed in one generation one viper for each human inhabitant! But let us analyze the table a little closer.

We observe first that in the years of the Franco-German war and those next following there was a great drop in the number of vipers killed, for the people naturally had other things to attend to. We also notice that when, in 1882, the authorities reduced the premium from 25 centimes to 15 centimes per viper the people evidently lost interest in the business, which must have become unprofitable, since the number killed suddenly dropped from nearly 14,000, in 1882, to a little more than 1,000, in 1883. The result evidently was that the authorities became alarmed at the possible increase of the dreaded reptile and again raised the premium to the old figure, undoubtedly to the great satisfaction of the snake hunters and a corresponding depletion of the county treasury. Furthermore, if we average the number of snakes killed during the six years before the war we will find that the annual average of vipers killed was 2,952, or nearly 3,000. The corresponding figure for the six years following the excessive drop caused by the war is 2,544, or somewhat less than the average of the first six years. Two conclusions seem warranted by these figures, first, that the average of these twelve years, viz, 2,748, represents the normal number which a diligent search throughout the department might yield; second that the decrease in the number of vipers killed during the years 1870–1872 did not materially increase the number of vipers during the period following, unless it might be assumed that the premium had already effected a diminution of the vipers as early as 1867, which is, of course, barely possible. We would now be prepared for a constant decrease in the number of vipers killed yearly from 1879 on, but on the contrary, in 1880 the figures jump to 15,000, and with the exception of the years affected by the reduction of the premium, the number of alleged vipers killed is steadily increasing, until in 1880 it reaches the astounding number of 67,620!

At what rate must the vipers of Haute-Saone have been multiplying since 1880! And this is what Prof. Kaufmann considers a successful system.

The conclusion seems irresistible that the functionaries paying the bounty have either made false returns and pocketed the money, or else that they have paid for every snake brought in whether poisonous or not. The latter supposition would be the more disastrous one to the county, because of the enormous number of useful species that must have perished. One only wonders if a single snake is left in Haute-Saone.

But whichever of the two suppositions is the correct one, this case corroborates only the experience which has been had everywhere that bounties, as a rule, are failures where a nice discrimination has to be made by the premium-paying functionary, and that it very often leads to fraud both on the side of this official and on that of the bounty hunter.

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CHINESE GAMES WITH DICE AND DOMINOES.

BY

STEWART CULIN,
*Director of the Museum of Archæology and Palæontology,
University of Pennsylvania.*

CHINESE GAMES WITH DICE AND DOMINOES.

By Stewart Culin.

"The earth hath bubbles, as the water has, and these are of them."

This paper,* of which a preliminary study was printed in 1889,† is the first of a series on Chinese games, to be continued by similar accounts of playing cards and chess. It has been considerably extended, through recent studies in connection especially with the collection gathered by the author in the Anthropological Building in Chicago, and that in the National Museum.‡

The games described are chiefly those of the Chinese laborers in America, a limitation found as acceptable as it is necessary, since even among these people, who all came from a comparatively small area, there exist variations in the methods of gambling, as well as in the terminology of their games. The latter is made up largely of slang and colloquial words and presents many difficulties. The gamblers are usually men of the most ignorant class, and those most familiar with the games are often the least able to furnish correct Chinese transcriptions of the terms employed in them, so that the task of interpretation would have been extremely difficult but for the assistance received from Chinese and Japanese scholars.§

* This paper has been prepared at the request of the authorities of the U. S. National Museum, to illustrate a portion of its extensive collection of games.

† Chinese Games with Dice. | By Stewart Culin.—Read before The Oriental Club of Philadelphia. | March 14, 1889. | Philadelphia. | 1889. 8°. pp. 1–21.

‡ This collection, though the author modestly refrains from mentioning the fact, owes much of its completeness to Mr. Culin's own generous contributions.

G. Brown Goode.

§ The Chinese words printed in italics are transliterated according to Dr. Williams' "Tonic Dictionary of the Chinese Language in the Canton Dialect," Canton, 1856. Dr. Hepburn's Japanese-English Dictionary has been followed for Japanese, and the Korean words, in the absence of any native standard of orthography, and for the purpose of convenient reference, have been made to accord with that admirable work, the *Dictionnaire Coréen-Français*, Yokohama, 1880.

GAMES WITH DICE.

Chinese dice* are small cubes of bone marked on each side with incised spots from 1 to 6 in number, (fig. 1) which are arranged in the same manner as the spots on modern European dice, as well as those of Greece and Rome of classical antiquity;† the "six" and "one," "five" and "two," and "four" and "three" being on opposite sides.

The "four" and "one" spots on Chinese dice are painted red, and the "six," "five," "three," and "two" are painted black. The "one" is always much larger and more deeply incised than the other spots, possibly to compensate for its opposite, the "six."

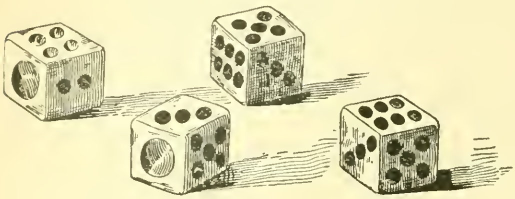

Fig. 1.

CHINESE DICE.

The origin of the custom of painting the "fours" red is accounted for, according to the *Wa Kan san sai dzu e*,‡ by the following story:

An emperor of the Ming dynasty (A. D. 1368–1643) played at *sugoroku* with his queen. He was almost defeated by her, but had one way of winning through the dice turning "fours." He cried and threw the dice, and they came as he desired, whereupon he was exceedingly glad, and ordered that the "fours" thereafter be painted red, in remembrance of his winning.

A similar story was related to me as a common tradition among the Cantonese, by an intelligent Chinese, who gave the emperor's name as *Lò Ling Wong*,§ who reigned under the title of *Chung Tsung* (A. D.

* The common name for dice among the Cantonese is *shik tsz'*, composed of *shik*, "colors," and *tsz'*, "seed," "dice."

In Medhurst's English and Chinese Dictionary, Shanghai, 1847, three other names for dice are given: *t'au tsz'* composed of *t'au*, written with a character compounded of the radicals, *kwat*, "bone," and *shü*, "a weapon," "to strike," and the auxiliary *tsz'*; *shéung luk*, "double sixes," from what is regarded as the highest throw with 2 dice, and *luk ch'ik*, literally "six carnation." The last name may be considered as a compound of the terms for the most important throws: "six" and carnation or red; the "four," to which, as will be seen, an especial significance is attached, as well as the "one," the lowest throw with a die, being painted red. In Japanese dice are called *sai*, a word written with a Chinese character, *ts'oi*, "variegated," "lucky."

† About the only dotted cubical dice which depart from this arrangement are those of the ancient Etruscans, which are regarded as having the "one" and the "three," "two" and "four," and "five" and "six" opposite, a system which does not appear, according to the writer's observation, to have been constant.

‡ "Japanese Chinese Three Powers' (Heaven, Earth, Man) picture collection." Osaka, 1714; vol. 17, fol. 4.

§ Whence a vulgar name for dice among the Cantonese, *hot lò*, composed of *hot*, "to call out loud," and *lò*, for *Lò Ling Wong*.

Modern Indian dice are usually marked with black and red spots. In the Māhābharata (IV, 1, 25) reference is made to "dice, dotted black and red." (Prof. E. W. Hopkins, J. A. O. S., vol. 13, p. 123.)

684, 701–710). Mr. Herbert A. Giles* tells me that this story is mentioned by a Chinese author, but I am inclined to regard the account as fanciful, and think that it is probable that the color of the "fours" was derived, with the dice themselves, from India.

Several sizes of dice are used by the Chinese, varying from a cube of two-tenths to one of seven-tenths of an inch. Different sizes are employed in different games, according to custom.

Dice are usually thrown by hand into a porcelain bowl, the players throwing around in turn from right to left, and accompanying their efforts with cries of *loi!* "come!"

The Chinese laborers in the United States play several games with dice, but they are not a popular mode of gambling, and are generally neglected for *fán t'án*, and Chinese dominoes.

SZ' 'NG LUK.

The best known of these games is called *sz' 'ng luk*, "four, five, six," commonly contracted to *sing luk*, and is played with 3 dice of the largest size. The throws in it in the order of their rank are: "Three alike from three "sixes" down, called *wai.*† "Four, five, six," called *sing luk* or *chün fá.*‡ Two alike, the odd die counting from "six" down to ace, the last throw being called *yat fat*, "ace negative." One, two, three, called *mò lung*, "dancing dragon," or *shé tsai*, "little snake."

The first player is determined, on throwing around, to be the one who throws the highest number of red spots. The other players lay their wagers, usually in sums divisible by 3, before them. The first player throws until he makes one of the above mentioned casts. If he throws *sing luk* ("four, five, six"); 3 alike; or 2 alike, "six" high, each of the players at once pay him the full amount of their stakes; but if he throws *mò lung* or *yat fat*, he pays them the full amount of their stakes. If he throws 2 alike, "five," "four," "three," or "two" high, the next player on his left throws. If the latter makes a higher cast, the first player must pay him, but if a lower cast, he must pay the first player. The amounts thus paid are usually proportionate to the difference between the throws with the odd die. If it is 4 or 3, the full amount; if 2, two-thirds, or if 1, one-third of the stakes must be paid.

The third player throws in the same way, and the game is continued until the first player is out-thrown.

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* Chinese dice are the exact counterpart of our own except that the ace and four are colored red; the ace because the combination of black and white would be unlucky and the "four" because this number once turned up in response to the call of an Emperor of the T'ang dynasty, who particularly wanted a "four" to win him the *partie*. (Strange stories from a Chinese Studio, Vol. II, p. 145.)

† *Wai* means "to inclose," and is a term that is also employed in Chinese games of chess and cards.

‡ Literally, "strung flowers."

KON MÍN YÉUNG.

Kon mín yéung, "pursuing sheep," is played with 6 dice of the largest size. It is a game played for small stakes, usually for something to eat, and is seldom resorted to by professional gamblers.

In it the player throws until he gets 3 alike, when the sum of the spots on the other dice is counted.

The throws in the order of their rank are: Six "sixes," called *tái mín yéung*, "large sheep." Six "fives," "fours," "threes," "twos," or "ones," called *mín yéung kung*, "rams." Three alike and "six, six, five," called *mín yéung ná*, "ewes." Three alike and the other throws than the above. These are designated by the number representing the sum of the throws with the 3 odd dice.

The throws, *tái mín yéung* and *mín yéung kung*, take all the stakes. If *mín yéung ná*, or any other cast of 3 alike, is made, the next player throws until he gets 3 alike, when he pays if his throw is lower, or is paid if it is higher, as in *sing luk*.

The throw of 3 "fours" is called *wong p'ang fúi*, concerning the origin of which name the following story is related:

A boy and girl were betrothed by their parents. The girl's father died, and the family having been reduced to poverty, her brother sold the girl to become a prostitute. This she resented, and anxious to find her betrothed, whose face she well remembered, she caused it to be advertised that she would yield herself to the man who could throw 3 "fours" with the dice. Many, attracted by her beauty, tried and failed, until her husband, Wong p'ang-fúi, who had obtained the rank of *kái ün*, or senior wrangler at the provincial examination, presented himself. For him she substituted loaded dice, with which he threw 3 "fours," whereupon she disclosed herself, and they were happily united.

CHÁK T'ÍN KAU.

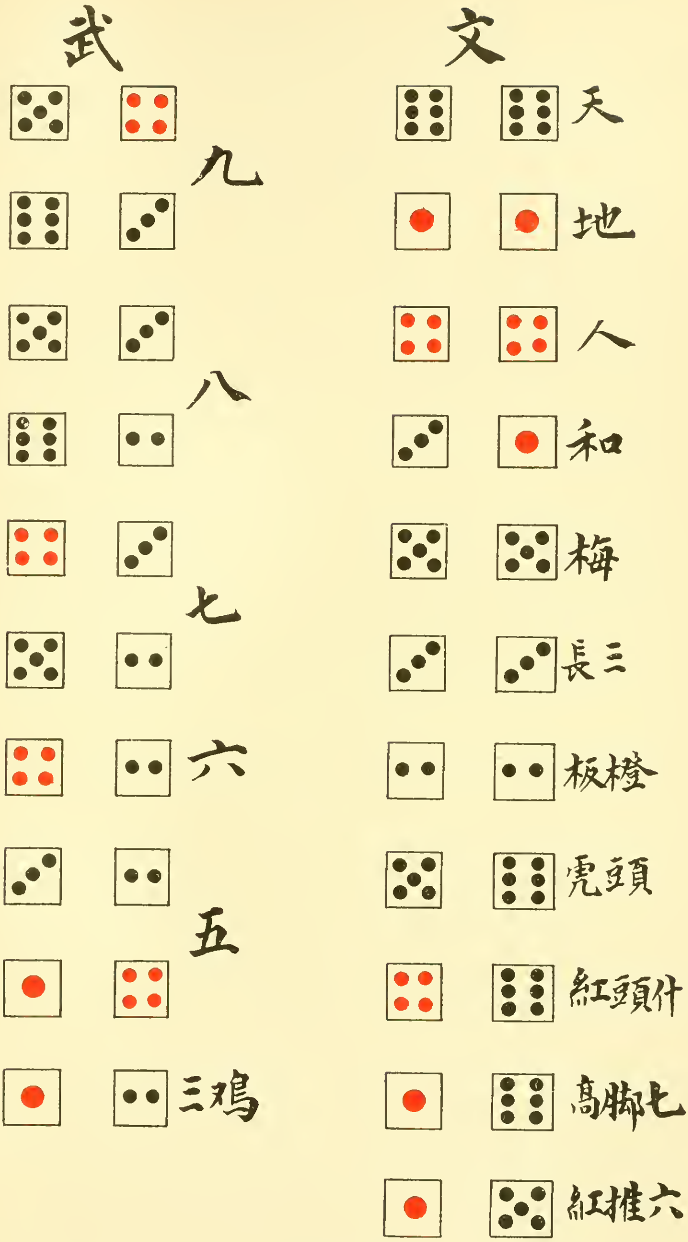
Chák t'ín kau, "throwing heaven and nine," is played with 2 dice. In this game the 21 throws that can be made with 2 dice receive different names, and are divided into two series, or suits, called *man*, "civil," and *mò*, "military."

The 11 *man* throws, in the order of their rank, are figured on the right of Plate 1. They are:

"Double six," called *t'ín*, "heaven."
"Double one," called *tí*, "earth."
"Double four," called *yan*, "man."
"One, three" called *wo*,* "harmony."
"Double five," called *múi*, "plum (flower)."†

*This throw is called by some *ngo*, a "goose," a name, like those of the throws that follow it in this series, evidently derived from a fancied resemblance of the spots on the dice.

†The 5 spot is also called by the name of *mume* or "plum (flower)," in Japan. In Korea the same name, *mai-hoa*, "plum flower," is given to the sequence "five, one;" "five, two;" "five, three;" "five, four;" "five, five;" "five, six" in the game of *Ho-hpai*, with dominoes.



CHINESE DICE.

"Double three," called *ch'éung sám,* "long threes."
"Double two," called *pán táng,* "bench."
"Five, six," called *fú t'au,* "tiger's head."
"Four, six," called *hung t'au shap,* "red head ten."
"One, six," called *kò kéuk ts'at,* "long leg seven."
"One, five," called *hung ch'ui luk,* "red mallet six."

The 10 *mò* throws in the order of their rank are figured on the left of Plate I. They are:

"Five, four," and "six, three," called *kau,* "nines."
"Five, three," and "six, two," called *pát,* "eights."
"Five, two," and "four, three," called *ts'at,* "sevens."
"Four, two," called *luk,* "six."
"Three, two," and "four, one," called *'ng,* "fives."
"One, two," called *sám,* "three," or *sám kai,* "three final."

The first player determined, the other players lay their wagers on the table. The first player then throws and his cast determines the suit, whether *man* or *mò,* for that round. No other throws count and

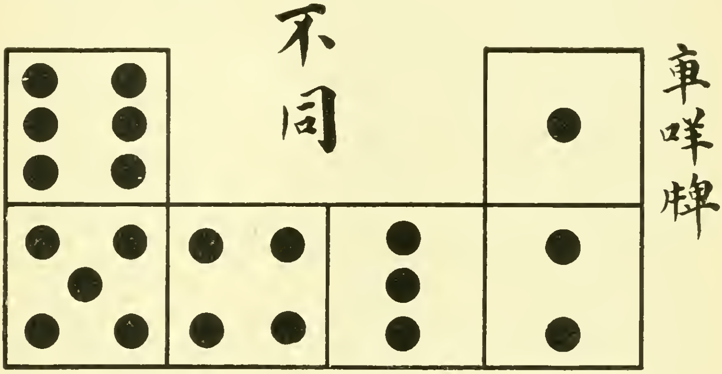


Fig. 2.
PÁT CHÁ BOARD: CHINA.

the players throw again, if necessary, until they make a cast of the suit led. If the first player throws the highest pair of either series, that is the "double six" of the *man,* or one of the "nines" of the *mò,* each player at once pays him, but if he leads the lowest of either suit, that is, the "five, one," or "one, two," he pays them the amount of their stakes.

If he throws any other pair than the highest or lowest of either suit the second player throws, and is paid his stakes, if he throws higher, by the first player, or pays him if he throws lower. The game is continued until the first player is outthrown, when he is succeeded by the second player, and the others lay their wagers as before.

PÁT CHÁ.

Pát chá, "grasping eight," is played with 8 dice, preferably of the smallest size. In this game the banker is provided with a diagram (fig. 2) numbered or dotted, like the 6 faces of a die, upon which the players place their stakes. It bears the legend *pat t'ung*, "unlike," which expresses the desire of the banker as to the manner in which the dice shall fall. A player throws 8 dice. If at least 3 fall like the number bet on, the gamekeeper pays him 8 times, or if 6 or more are like the number bet on, 16 times the amount of his stakes. In any other event, the player loses. A similarly marked tablet is used in playing with the *ch'é mé*, or teetotum (fig. 3). This implement is made with 6 dotted sides. The players lay their stakes upon the numbers on the tablet, and win 4 times the amount of their stakes if the one played on turns uppermost, or lose, if another number comes up. The *ch'é mé* is said to have its sides decorated sometimes with pictures of fish and animals instead of numbers or spots, and the diagram, which is called the *ch'é mé p'ái*, or the "tablet for the teetotum," is then similarly inscribed (fig. 3).*

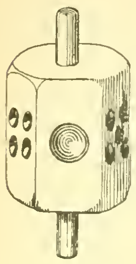


Fig. 3.

CHINESE TEETOTUM.

(From specimen in the museum of the University of Pennsylvania.)

CHONG ÜN CH'AU.

Chong ün ch'au is a game played with tallies, *ch'au*, the highest of which is called *chong ün*, the name given the *Optimus* at the examinations for the degree of Hanlin, whence I have styled it "The Game of the Chief of the Literati." (pl. 3.) Two or more persons may play, using 6 dice and 63 bamboo tallies. The latter receive the following names:

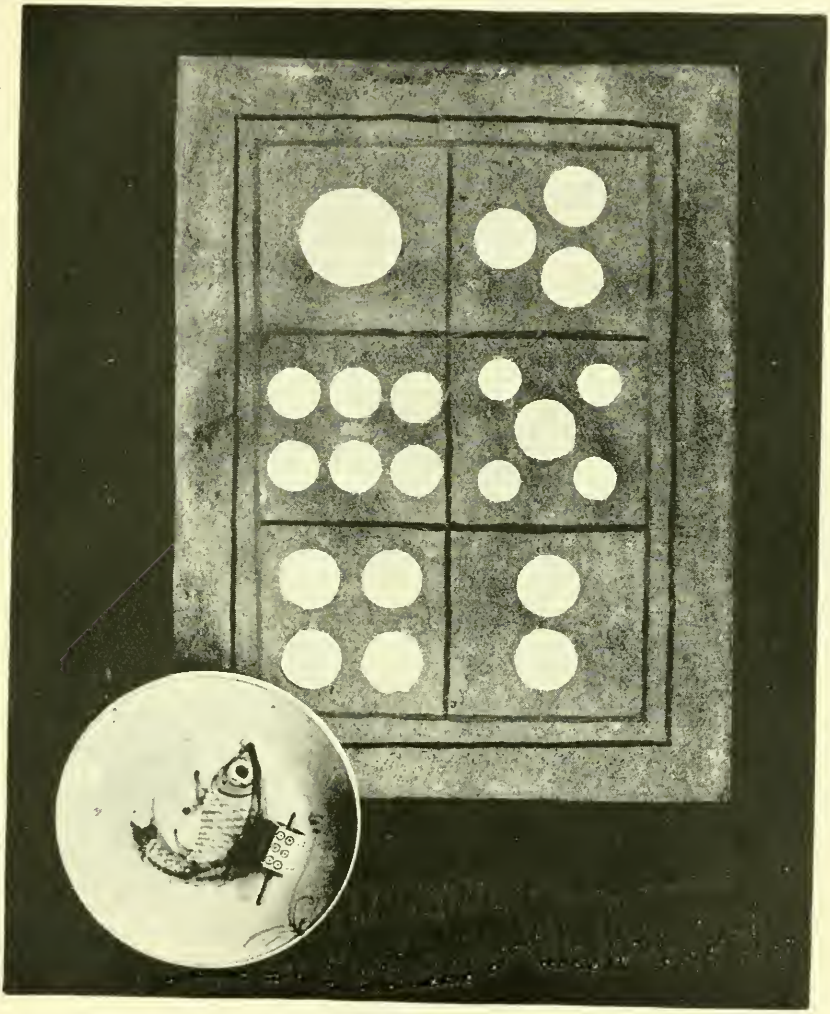
First. One piece about 6 inches in length, called *chong ün*, the first of the Hanlin doctors. This counts as 32.

Second. Two shorter pieces called *pong ngán*, second of the Hanlin, *t' ám fá*, third of the Hanlin. Each count as 16.

Third. Four shorter pieces called *úi ün*, the First of the *tsun sz'*, or literary graduates of the third degree. Each count as 8.

Fourth. Eight shorter pieces called *tsun zs'*, literary graduates of the third degree. Each count as 4.

*A similar game from Manila, Philippine Islands, in the United States National Museum (Plate 2), consists of a cardboard with 6 equal divisions, with numbers, represented by disks of colored paper, from 1 to 6; a hexagon-shaped top with numbers from 1 to 6, and a saucer in which to spin it. It is described by the collector, Hon. Alex. R. Webb, United States Consul, under the name of *prinola*, as a popular game in the market places with the native women. "Bets are placed on the spots on the board, the top is spun rapidly in the saucer, and the winners are paid double the amount of their bets. Only one number can win, of course the one corresponding to that which turns up when the top stops turning, and the chances are therefore quite largely in favor of the dealer." The name is evidently the Portuguese *pirinola*, but the game is probably of Chinese or Indian origin. In India a 6-sided teetotum, *chukree*, identical with the Chinese, is used, and is turned like a top on a wooden or china plate. "The stakes are placed on a board with 6 partitions, and the game is decided on the settling of the die with a particular number uppermost. The play of this game is allowed only during the Diwali festival, when gambling is sanctioned as a religious observance." (Ms. catalogue of Indian games and toys procured for the Chicago exhibition. Provincial Museum, Lucknow, India.)



THE GAME OF PRINOLA.

Cat. No. 154193, U. S. N. M. Manila, Philippine Islands.

TALLIES FOR "CHONG ÜN CHAU."
Cat. No. 153605, U. S. N. M. Kwangtung, China.

Fifth. Sixteen shorter pieces called *kü yan*, graduates of the second degree. Each count as 2.

Sixth. Thirty-two shorter pieces called *sau ts'oi*, graduates of the first degree. Each count as 1.

The first, second, and third classes bear rude pictures and names, but the others are usually distinguished only by their size.

Two or more persons can play. The players throw in turn from right to left, and after throwing each draws the tallies he is entitled to according to the appended table. If the tally called for by a throw has been drawn, its value may be made up from the remaining ones: but the winner of the *chong ün* must surrender it without compensation if another player makes a higher throw than that by which he won it. The one who counts highest becomes the winner.

The game is said to be played by women and children, and is not played by the Chinese laborers in the eastern United States, although they are generally acquainted with it.

A set of implements for this game from Johore in the collection of His Highness the Sultan at the Columbian Exposition was similar to that above described, and was evidently of Chinese workmanship. It was catalogued under the name *chong wan chiam* (*chong ün ch'au*), the tallies being called *buah-buah bertulis.*

The throws in *chong ün ch'au*, in the order of their rank, are:

6 "fours."	6 "fives."	6 "twos."
6 "sixes."	6 "threes."	6 "ones."

These throws are called *ts'un shik*, and take all the tallies:

5 "fours" and 1 "six," or 1 "five," or 1 "three," or 1 "two," or 1 "one."
5 "sixes" and 1 "four," or 1 "five," or 1 "three," or 1 "two," or 1 "one."
5 "fives" and 1 "four," or 1 "six," or 1 "three," or 1 "two," or 1 "one."
5 "threes" and 1 "four," or 1 "six," or 1 "five," or 1 "two," or 1 "one."
5 "twos" and 1 "four," or 1 "six," or 1 "five," or 1 "three," or 1 "one."
5 "ones" and 1 "four," or 1 "six," or 1 "five," or 1 "three," or 1 "two."
4 "fours" and 1 "three" and 1 "one."
4 "fours" and 1 "twos."
4 "sixes" and 1 "four" and 1 "two."
4 "sixes" and 1 "five" and 1 "one."
4 "sixes" and 2 "threes."
4 "fives" and 1 "four" and 1 "one."
4 "fives" and 1 "three" and 1 "two."
4 "threes" and 1 "two" and 1 "one."
4 "twos" and 2 "ones."
4 "fours" and 2 "sixes."
4 "fours" and 1 "six" and 1 "five."
4 "fours" and 2 "fives."
4 "fours" and 1 "six" and 1 "three," or 1 "six" and 1 "two."
4 "fours" and 1 "five" and 1 "three," or 1 "six" and 1 "two."
4 "fours" and 1 "five" and 1 "two," or 1 "five" and 1 "one."
4 "fours" and 2 "threes," or 1 "three" and 1 "two."
4 "fours" and 1 "two" and 1 "one," or 2 "ones."

Each of the above throws counts as thirty-two, and takes the *chong ün*.

2 "fours," 2 "fives," and 2 "sixes."
2 "ones," 2 "twos," and 2 "threes."
3 "fours" and 3 "sixes," or "fives," or "threes," or "twos," or "ones."
3 "sixes" and 3 "fives," or "threes," or "twos," or "ones."
3 "fives" and 3 "threes," or "twos," or "ones."
3 "threes" and 3 "twos" or "ones."
A sequence from "one" to "six."

Each count as 16, and takes either the *pong ngán* or *t'ám fá*. Three "fours" with any combination except those mentioned count as 8, and take one of the *úi ün*. Four "sixes," 4 "fives," 4 "threes," 4 "twos," or 4 "ones," with any combination of 2 dice except those already mentioned count as 4, and take one of the *tsun sz'*. Two "fours" count as 2 and take one of the *kü yan*. One "four" counts as 1, and takes one of the *sau ts'oi*.

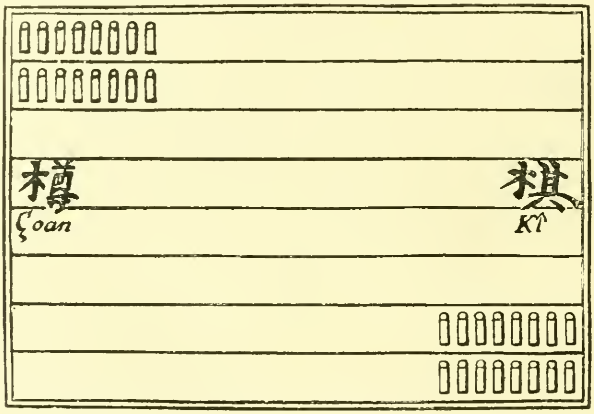


Fig. 4.

CHINESE BACKGAMMON.

(From De Ludis Orientalibus. 1694.)

The Chinese game similar to backgammon, which that accomplished scholar, Dr. Thomas Hyde, described in his work on Oriental games under the name of Chinensium Nerdiludium (The Nerd Game of the Chinese)* is not played by the Chinese laborers in America, nor do any I have met appear to be acquainted with it (fig. 4.)

According to Dr. Hyde, it is called by Chinese *Çoan Kî*, which he translates as *erectus ludus*, or *erectorum ludus*, but which might be rendered as "the bottle game" or "bottle chess" *Çoan* (*tsun*), meaning a vase or bottle, and *Kî* (*k'í*) being a generic name for games played with men as chess.

This game is played with dice and small upright pillars, from which the name is derived. The board is divided into eight equal parts by transverse lines, and the pieces, which are from 2 to 3 inches high and number 16 on each side, are arranged upon it when the playing commences, as seen in the figure.

The pieces are moved line by line, according to the throws with the dice, from the places on the left to the eighth place on the right, and from thence ascending to the

*De Ludis Orientalibus. Oxford, 1694, p. 65.

opposite side and back to the starting place, the player who first gets all his pieces there winning the game.

Two dice are thrown, and the pieces are moved to the places which the number of the throws directs. One may move whatever piece or pieces one chooses, according to the number, either pieces which have been moved before or those which have not yet been moved. If, instead of upright pieces, one plays with small flat discs, which is also permitted, they may be placed side by side or piled on top of each other, as seems most convenient.

A throw of 2 "ones" causes a piece to be set aside and delivered up as lost, or, if the game is played for money, it loses the player the tenth part of his stakes. Whoever throws "twos" or "threes" begins moving to the second or third lines, and so on. If doublets are thrown, one may move to the place corresponding to the half number of such doublets; and this may be done by moving 1 piece once to such half number, or 2 pieces at the same time to the place corresponding with such whole number, for in this case either 1 or 2 pieces together may be moved. If "five" and "six," which make 11, are thrown, one may move 1 piece to the fifth place and another to the eleventh, or else move 2 pieces at the same time to the tenth line or place, and then 1 of them to the next line, which is the eleventh. And thus with respect to other throws: If single (as "two" and "four"), for the single numbers move as many places, but if joined (as "five" and "six"), then otherwise, as already stated.

The game of backgammon, played upon a board of 24 stations similar to the boards in common use in Spain at the present day, exists along the entire eastern coast of Asia, from Korea to the Malay Peninsula.

SSANG-RYOUK.

In Korea the game of backgammon is known as ssang-ryouk (Chinese *shéung luk*), double sixes. It is played with wooden pins or men (fig. 5), called *mal* (Chinese *má*), "horses," upon a hollowed board, *ssang-ryouk-hpan** according to the throws with two dice.

The throws receive the following names:

1–1, *syo-syo* (Chinese *siú siú*), "smallest."
1–2, *tjoui-hko* (Chinese *shü pí*), "rat nose."
1–3, *syo sám* (Chinese *siú sám*), "small and three."
1–4, *păik să* (Chinese *pák sz'*), "white and four."
1–5, *păik i* (Chinese *pák 'ng*), "white and five."
1–6, *păik ryouk* (Chinese *pák luk*), "white and six."
2–2, *tjoun-a* (Chinese *tsun á*), "superior two."

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* *Hpan*, the word used for "board" in *ssang-ryouk*, as well as Korean chess and other Korean games, is written with the Chinese character meaning "an order," "rank," which the Cantonese call *kuk*. The men are about 3½ inches in height. Fifteen are employed on each side, one set being painted red and the other left the natural color of the wood. They are usually made of boxwood, but some softer wood is employed for the cheaper sets.

Dice are called in Korean *tjyou-să-ă* (Chinese *chü shá*, "vermillion," *ă?*), and are identical in every respect with those of China. The only other Korean games with dice than *ssang-ryouk* with which I am acquainted are as follows: One which my informant tells me has no particular name, but which might be called *tjyou-sa-ă-nol-ki* Three or four boys sit around, and one puts a peanut or pine nut on the floor and the die is thrown, the nut going to the one throwing the highest. The other, consists in the substitution of a cubical die for the four staves used in the prevailing Korean game of *nyout-nol-ki*.

2–3, *a sam* (Chinese *á sám*), "two and three."
2–4, *a să* (Chinese *á sz'*), "two and four."
2–5, *koan-a* (Chinese *kún á*), "sovereign two."
2–6, *a ryouk* (Chinese *á luk*), "two and six."
3–3, *tjyang-sam* (Chinese *ch'éung sám*), "long three."
3–4, *sam să* (Chinese *sám sz'*), "three and four."
3–5, *sam o* (Chinese *sám 'ng*), "three and five."
3–6, *sam ryouk* (Chinese *sám luk*), "three and six."
4–4, *tjoun-hong* (Chinese *tsun hung*), "superior red."
4–5, *să o* (Chinese *sz' 'ng*), "four and five."
4–6, *să ryouk* (Chinese *sz' luk*), "four and six."
5–5, *tjoun-o* (Chinese *tsun 'ng*), "superior five."
5–6, *o ryouk* (Chinese *'ng luk*), "five and six."
6–6, *tjoun-ryouk* (Chinese *tsun luk*) "superior six."

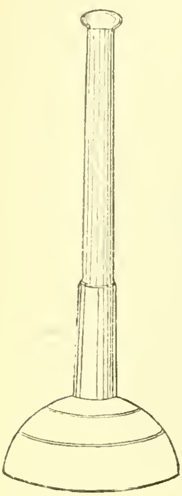

Fig. 5.
KOREAN PIECE FOR BACKGAMMON.

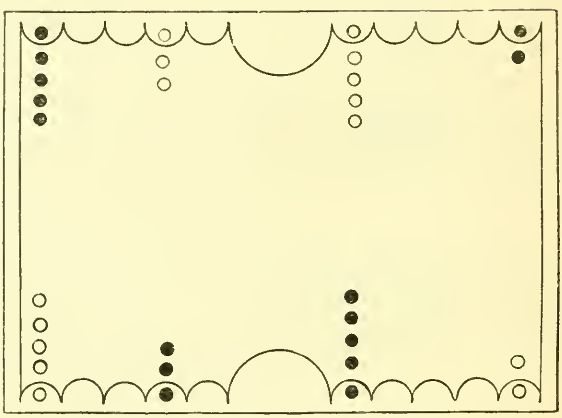

Fig. 6.
SSANG-RYOUK (BACKGAMMON) BOARD: KOREA.

A diagram of the board, set as at the commencement of the game, is shown in fig. 6.

The board has mortised sides, which extend about 2 inches above the surface. The divisions on either side, called *pat* (Chinese *t' ín*, "fields"), are simply outlined in black. The larger ones in the middle are not counted in moving, and are used to throw the dice in. The first player is determined by the highest throw with 1 die. The pieces are moved around according to the throws, as in the English game of backgammon; but it is customary to move 2 pieces when doublets are thrown, and doublets do not entitle the player to another throw, nor to any additional count than if the dice were dissimilar.

A player may take an opponent's piece, which must be again entered, as in the English game. This is called *tjap-ta*, "to catch." When a player gets all his men around into his home place he bears them off according to his subsequent throws.

SAKA.

In Siam the game of backgammon is known as *saka*, and is played upon a board, represented in fig. 7, with 2 dice.* Sixteen discs of ivory,

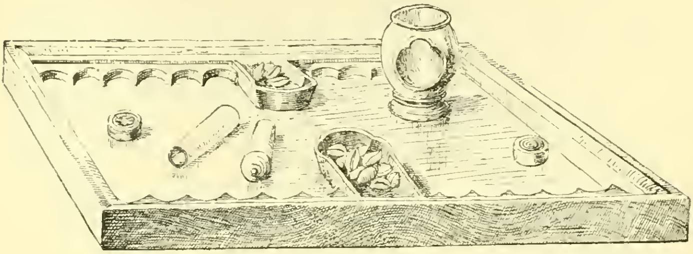

Fig. 7.

SAKA (BACKGAMMON) BOARD: SIAM.

like draftsmen, are used on each side, one set being white and the other, red. The small compartments on either side of the board are

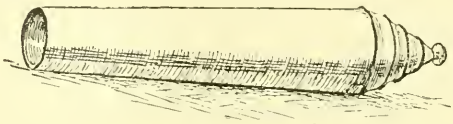

Fig. 8.

KRABOK: CYLINDER FROM WHICH DICE ARE THROWN.

(Siamese Backgammon.)

said to be intended for cowries (*bia*), which are used as counters. The pieces are entered, according to the throws, in the right-hand side of the board opposite the player, and are moved around, as in our game, to the side directly opposite, where they are thrown off. A player does not take his opponent's pieces. The dice are not thrown directly with the hand, but are loaded into a tube (*krabok*) of ivory, about 3 inches in length (fig. 8), called *krabok saka*, and shot obliquely through another cylinder of ivory, 2½ inches high (fig. 9), called by the same name, placed upon the board. These implements correspond with the Roman *fritillus* or dicebox, and the *pyrgus*, the latter being defined as "a little wooden tower on the side of a gaming board, hollow, and having steps inside, through which the dice were thrown upon the board.†

Fig. 9.

CYLINDER INTO WHICH DICE ARE THROWN.

(Siamese Backgammon.)

* Dice are called in Siamese *lok bat*. They are identical with those of China.

† Andrews's Latin-English Lexicon.

TABAL.

A backgammon board from Johore, exhibited by His Highness the Sultan in the collection of games at the Columbian Exposition under the name of *tabal*, is represented in fig. 10. It is played with 2 dice, *dadu*, those exhibited being marked in black and red, like those of

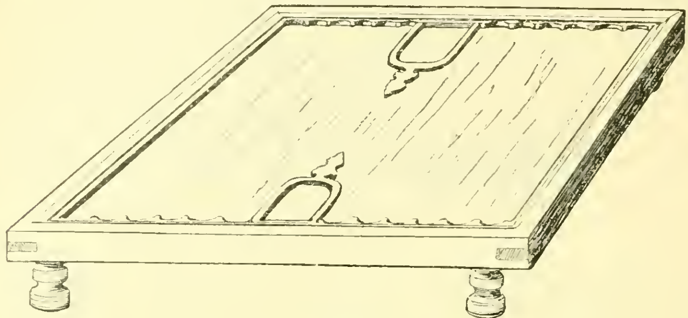

Fig. 10.

TABAL (BACKGAMMON) BOARD: JOHORE, MALAY PENINSULA.

(From specimen in the Museum of the University of Pennsylvania.)

China. The name of the game, *tabal*, is doubtless from the Portuguese *tabola* or Spanish *tabla*, and *dadu* from the Portuguese or Spanish *dado*, "a die."

SUGOROKU.

The game described by Dr. Hyde agrees in some respects with the Japanese game of *sugoroku*, as illustrated in native encyclopedias. In fig. 11, reproduced from the *Kum mō dzu e tais ei*,* the board is

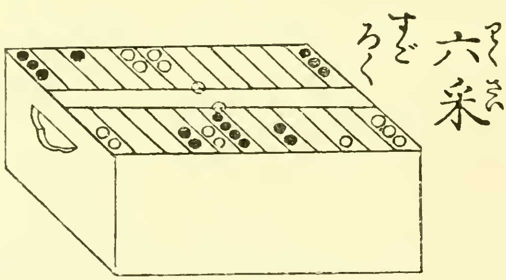

Fig. 11.

SUGOROKU BOARD: JAPAN.

represented as being divided into 12 parts by longitudinal lines, which are broken in the middle by an open space similar to the *ho kái*, or "dividing river," of the Chinese chessboard. According to the same work the 12 compartments, called in Japanese *me*, or "eyes," symbolize the 12 months, and the black and white stones, with which the game is played, day and night.

* "Very Complete Collection of Pictures to Teach the Unenlightened." Kiyoto, 1789, vol. 4, part 8, fol. 5.

The moves are made according to the throws of the dice, the name being derived from that of the highest throw, *sugoroku* (Chinese, *shéung luk*), or "double sixes."*

Sugoroku appears to be of great antiquity in Japan. The *Wa Kan sán sai* states that it is recorded in the Japanese Annals that *sugoroku* was forbidden in the time of Jitō Tennō (A. D. 687–692), and that it is probable that it was played in Japan before the game of *go*† was brought to that country. The same encyclopedia, in the careful manner usual in such works, makes a number of citations from Chinese authors with reference to the origin of the game. It says it is recorded in the Suh sz' ch'í‡ that Ts'ao Chih§ of Wei invented *sugoroku*, and used 2 dice for it, but at the end of the Tang dynasty (A. D. 618–913), the number of dice was increased to 6.

It is written in the Wú tsáh tsú that *sugoroku* is a game that was originally played in Hú (Japanese, *Ko*), the country of the Tartars. It relates that the King of Hú had a brother who was put to death for a crime. While in prison he made the game of *sugoroku* and sent it to his father, writing with it a few words in order to make known how men are oppressed by others when they are single and weak.

The Ngán lui yáu states that *sugoroku* came from the T'ien Chuh, "India."

The name of *sugoroku* is applied at the present day in Japan to various games played upon boards or diagrams, in which the moves are made by throwing dice.|| Of these there are many kinds, among

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* *Sugoroku* is also called *rokusai*, as will be seen from the names appended to fig. 11.

† Chess, by which the game of 360 men, half black and half white, called by the Chinese *wai k'í* is meant.

‡ I am unable to identify either this or the two following works quoted in the *Wa Kan san sai*.

§ Ts'ao Chih (A. D. 192–232) was the third son of the great usurper, Ts'au Ts'au, who overthrew the Han dynasty. He was distinguished by precocious talent and poetical genius, and devoted himself wholly to literary diversions. (The Chinese Reader's Manual, No. 759.)

|| The name is also applied to at least one simple dice game in which no board or diagram is used. Mr. Kajiwara informs me that in the Province of Aomori, a common game with 2 dice is called *ichi-san sugoroku;* so called from the name of the highest throw, *ichi san*, "one, three."

Japanese dice at the present day usually have their 6 faces marked with black dots. Those used by gamblers are said to be larger than the kind employed in popular amusements. The dice games are said to vary in different parts of the Empire. Japanese sailors in New York City play a game with 2 dice called *chō han*, "even and odd." They throw 2 dice under a cup. The even throws are called *chō* and the odd *han*. The players, two or more in number, bet on the even or odd by calling out and laying their wagers before them while the cup remains inverted over the dice. They use foreign playing cards cut lengthwise in strips and tied in bundles of 10 as counters, instead of money; a custom that they say has its origin in the use of the narrow Japanese playing cards, or bamboo tallies at home for this purpose. The same game, under the same name, called by the Chinese *chéung pun*, is known to the Cantonese laborers in the United States as a common game in China.

which the most popular is called *dô chiu*, or "traveling" *sugoroku*. It is played upon a large sheet of paper, on which are represented the various stopping places upon a journey; as, for example, the 53 post stations between Tokio and Kiyoto, and resembles the games of "snake" and "steeplechase," familiar to English and American children.* Such games are much played by the Japanese at the season of the the New Year, when new ones are usually published. In 1889, Japanese newspapers reported that two new games of *sugoroku* found much favor in Tokio.

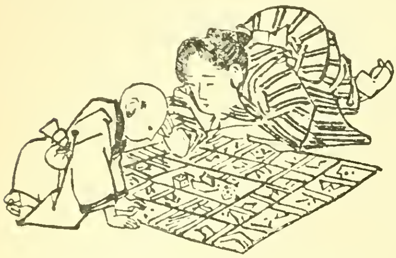

Fig. 12.
JAPANESE CHILDREN PLAYING SUGOROKU.

The same general name would be given by the Japanese to the following Chinese game, which I have occasionally seen played by the clerks in Chinese stores in our cities.

SHING KÚN T'O.

Shing kún t'o, the "table of the promotion of the officials," is the celebrated game which is best known through Dr. Hyde's account as "the game of the promotion of Mandarins."†

It is played by two or more persons upon a large paper diagram, on which are printed the titles of the different officials and dignitaries of the Chinese Government. The movements are made by throwing dice, and the players, whose positions upon the diagram are indicated by notched or colored splints, are advanced or set back, according to their throws.‡

The following story was related to me concerning the invention of the game:

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* A paper diagram for a game of *sugoroku* is entitled, according to the characters on the sheet, *Hokkaidô shin dô ichi ran sugoroku*, or "A glance at the Hókkaidô new road *sugoroku*." This game was published in 1873 on the occasion of the opening of a new road through the southern part of the island of Yesso, from Hakodate to Sapporo, the capital.

The diagram consists of an impression in colors, 32½ by 20 inches, and is divided into 38 parts, exclusive of the goal and starting place. These contain pictures of the scenery at the different stations on the road, each division having a tablet beside it on which the name of the place is written, with the distance to the next stopping place. The game is played with 1 die, the players throwing in turn, and advancing from the lower right-hand corner to the goal at the center. Each spot of the throw counts as one station on the diagram. If a player's move leaves him upon a division having the character *tomare*, "stop over," he loses his next throw. When a player near the goal makes a higher throw than is just necessary to take him to the central space, he is set back; if he has an excess of 1, to the fifth place from the goal; 2, to the fourth place, and so on.

† De Ludis Orientalibus, p. 70.

‡ A similar but much simpler game, with the titles of Japanese instead of Chinese officials, is played in Japan under the name of *kuwanroku*.

The Emperor Kienlung (A. D. 1736–1796) was in the habit of walking at nightfall among the houses occupied by the candidates for the degree of Hanlin, who came up to Peking for the triennial examination; and hearing, night after night, the song of the dice issuing from one of them, he summoned the offender before him to explain his conduct. In excuse, fearing punishment, he told the Emperor that he had constructed a chart, on which were written the names of all the official positions in the Government, and that he and his friends threw dice, and according to their throws traversed the board, and were thus impressed with a knowledge of the various ranks and steps leading to official advancement. The Emperor commanded him to bring the chart for his inspection. That night the unfortunate graduate, whose excuse was a fiction created at the moment, sat until daybreak, pencil in hand, and made a chart according to his story, which he carried to the Emperor. That august prince professed to be much pleased with the diligence of the scholar who improved his mind, even while amusing himself, and dismissed him with many commendations.

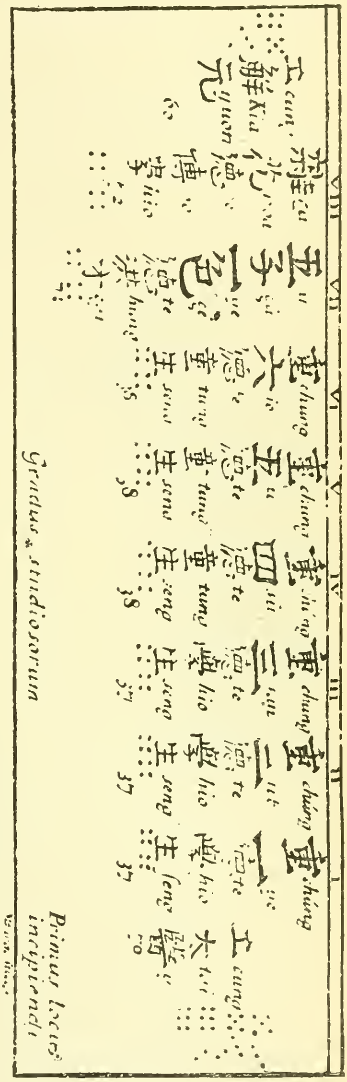


Fig. 13.

FIRST PLACES FOR ENTERING IN THE GAME OF "PROMOTION OF MANDARINS."

(From De Ludis Orientalibus, 1694.)

This familiar sounding story can not be accepted without question, especially since it will be seen that Dr. Hyde published his account many years before the period mentioned; but my informant, a clerk in a Chinese shop in Philadelphia, may not have stated the date correctly.

The paper charts for the game may be purchased at the Chinese stores in New York and San Francisco. The names of the different offices are arranged upon them in rectangular divisions, alongside of each of which is a tablet with the name of the board or class under which those within it are included. They ascend from the lowest to the highest in successive stages, arranged in order around the chart from right to left, and from the outer division, which is devoted to provincial officials, to the innermost, which has the titles of the members of the metropolitan administration. The center is occupied with rules for playing. Four dice are thrown in turn by each player, instead of 6, as formerly recorded by Dr. Hyde. Entrance is obtained by making a cast, either of 4 alike, by which the player is at once advanced to an "hereditary rank;" of "three, four, five, six," called *ch'ün fá*; of 3 alike or 2 alike. All of these throws, in descending order, enable the player to enter one of the positions from which advancement may be obtained. Subsequent promotion depends upon the throws, doublets enabling the player to move once; 3 alike, twice; and 4 alike, 3 times. "Double fours" count highest, "double sixes" next, and so on down to "ones," through which the player is set back. The appropriate move for each throw is indicated in small characters beneath each of the titles on the chart.

A curious contrast is presented between the little sheet reproduced by Dr. Hyde (fig. 13), upon which only the principal officials of the Ming dynasty are represented, and that now current, whereon may be seen the innumerable ramifications of the Chinese "civil service" under the present Tartar domination.

The charts such as I have seen used in the United States are printed in Canton, and bear an impression about 23 inches square. They are divided into 63 compartments, exclusive of the central one and the place for entering at the lower right-hand corner. The latter contains the names of 13 different starting places from *yau shang*, or "honorary licentiate," down to *t'ung shang*, or "student," between which are included the positions of *t'in man shang*, "astrologer," and *í shang*, "physician." These are entered at the commencement of the game by the throws of "three, four, five, six," 3 "fours," 3 "sixes," 3 "fives," 3 "threes," 3 "twos," and 3 "ones;" and then in the same manner double "fours," and so on down to double "ones."

The 63 compartments, representing as many classes of officials or degrees of rank, comprise 397 separate titles, of which the highest, and the highest goal of the game, is that of *man fá tín tái hok sz'*, or "grand secretary." This, however, under favorable conditions, can only be reached by a player who starts from a favorable point, advancement in the game being regulated by rules similar to those which actually regulate promotion under the Government. Thus a player whose fortune it is to enter as a physician or astrologer can only obtain promotion in the line of his service, and must be content with a minor goal, as he is ineligible to the high civil office of "grand secretary."

The dice are thrown into a bowl placed in the center of the sheet, the players throwing in turn, and each continuing to throw until he has made a cast of doublets or higher. It is noticeable that "fours," as in Dr. Hyde's account, constitute the highest throw. A pair of "fours," according to the rules, is to be reckoned as *tak*, "virtue," and leads to a higher place than those of other numbers. "Sixes" are next highest, and are to be reckoned as *ts'oi*, "genius;" and in the same manner, in descending degree, "fives" are to be reckoned as *kung*, "skill;" "threes" as *léung*, "forethought;" "twos" as *yau*, "tractability;" and "ones," *chong*, "stupidity."

The game is much complicated by being played for money or counters, which is necessary under the rules. By this means advancement may be purchased, degradation compounded for, and the winner of a high position rewarded.

The main point of difference in the game as it exists to-day and as described by Dr. Hyde is in the number of dice employed. The enlarged form of the diagram is of minor importance, as he himself says that the names of the officials written on the tablet are many or few, according to the pleasure of the players.

The game of *shing kún t'o* and the Japanese game of many stations, described under the name of *sugoroku*, I regard as having been derived from the ancient Tartar game played with staves, which exists at the

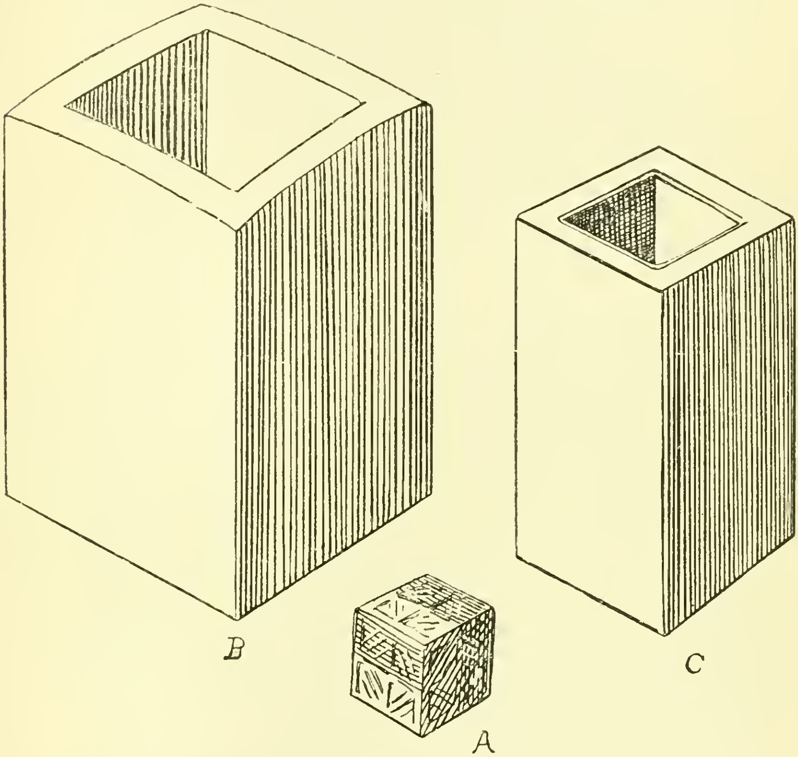


Fig. 14.

PÒ TSZ' (CHINESE).

(From specimen in the Museum of the University of Pennsylvania.)

present day in Korea under the name of *nyout-nol-ki*. As to the backgammon game, which I consider to be a development of the same game, and which I have described as existing in Korea, China, Japan, Siam, and the Malay Peninsula, I am uncertain whether it is indigenous, has come over from India, or been acquired from the Portuguese or Spaniards in the fifteenth or sixteenth century.

PÒ TSZ'.

The *pò tsz'*, or covered die, is not, properly, a die at all. It consists of a small wooden cube (fig. 14 *a*), which is placed in a square receptacle in the top of a brass prism (fig. 14 *c*), over which a brass cover (fig. 14 *b*) fits very closely. A specimen exhibited by His Highness, the Sultan of Johore in the section of games at the Columbian Exposition consisted of a wooden cube about one-half an inch square, having one-half of each face painted red and one-half white. The prism in which the cube fitted was slightly convex on the bottom, and, when placed upon a smooth surface, could be twirled rapidly. The game is played by placing the box containing the *pò* in the center of a square crossed by diagonal lines, which is drawn upon a mat. One of the four divisions of the square is painted red. The players lay their bets upon the other divisions, and the box is spun rapidly by the gamekeeper, who repeats the operation until it comes to rest squarely with the corners corresponding with the intersecting lines. The cover is then lifted, and those who have staked opposite the red side of the die win. The banker wins when the red side comes opposite the side of the square painted red.* There is said to be a current notion, amounting to a superstition among the Chinese in Johore, that if a player stops the box as it is spinning the luck will surely go against him.

KONG POH.

Another specimen in the Sultan's collection, called at Johore, *kong poh* (Chinese *t'ung pò*), "current treasure," furnishes an explanation of the name *pò*. It consists of a wooden die (fig. 15 *a*), with a face $1\frac{3}{8}$ inches square, and three-fourths inch thick, which fits into a brass box with a broad base (fig. 15 *b*). A wooden cover (fig. 15 *c*) fits over the box. This die is not spun, but is concealed in a bag which accompanies it, and there adjusted by the gamekeeper. The face of the wooden die is carved with the characters *t'ung pò* (fig. 15 *á*), on one side in the ordinary, and on the reverse in seal characters, the character *t'ung* being painted red, and *pò* white. The inscription *t'ung pò*, "current treasure," occurs on the face of all modern Chinese coins (fig. 15 *d*), and the common name of the game is evidently derived from the character *pò*, which occurs on this block.

GAMES WITH DOMINOES.†

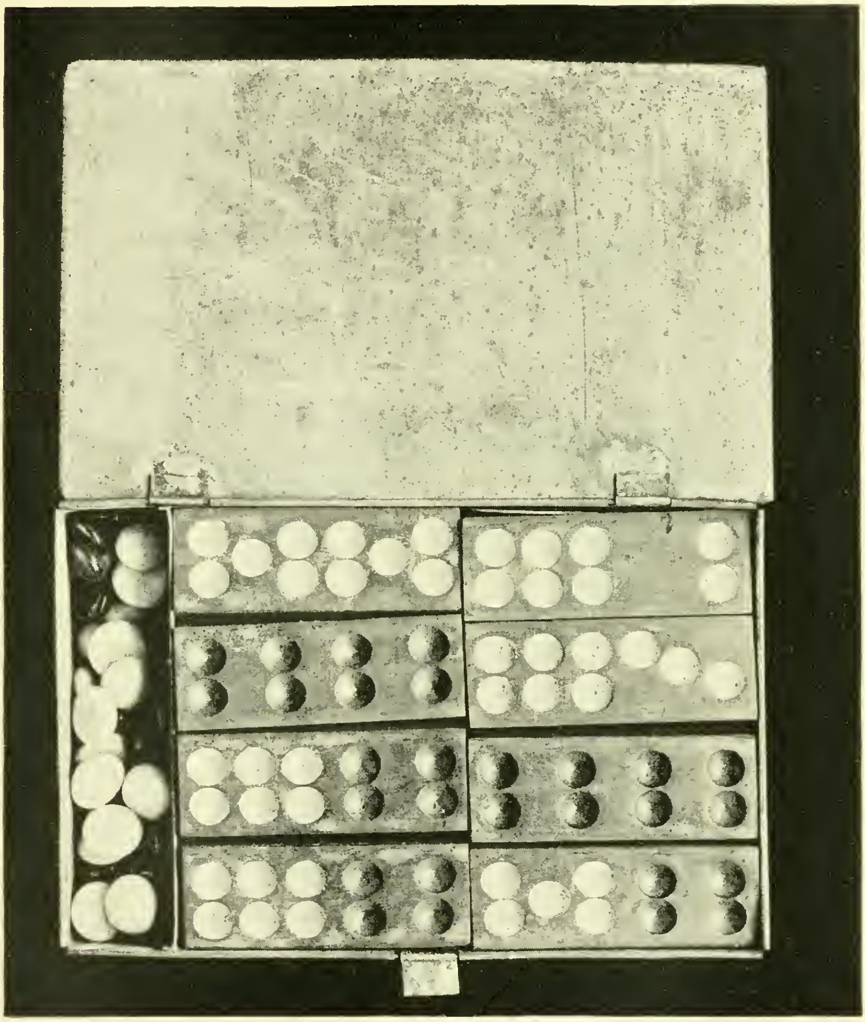
Chinese dominoes, commonly called *kwat p'ái*,‡ "bone tablets," consist of 32 rectangular pieces of wood, bone, or ivory, similar to those used in Europe and America (pl. 4).

They differ, in the absence of the "blank" in the Chinese series (fig.

* The Manners and Customs of the Chinese of the Straits Settlements, Singapore, 1879, p. 63. The Chinese laborers in the United States are generally unfamiliar with the game.

† Read in part before The Numismatic and Antiquarian Society of Philadelphia, November 4, 1886.

‡ This is the common name among the Cantonese. Medhurst's English and Chinese Dictionary, Shanghai, 1847, gives in addition two other names—*ngá p'ái*, "ivory tablets," and *tím tsz' p'ái*, "dotted tablets."



CHINESE DOMINOES WITH COUNTERS, IN TIN BOX.
Cat. No. 168208, U. S. N. M. Kwangtung, China.

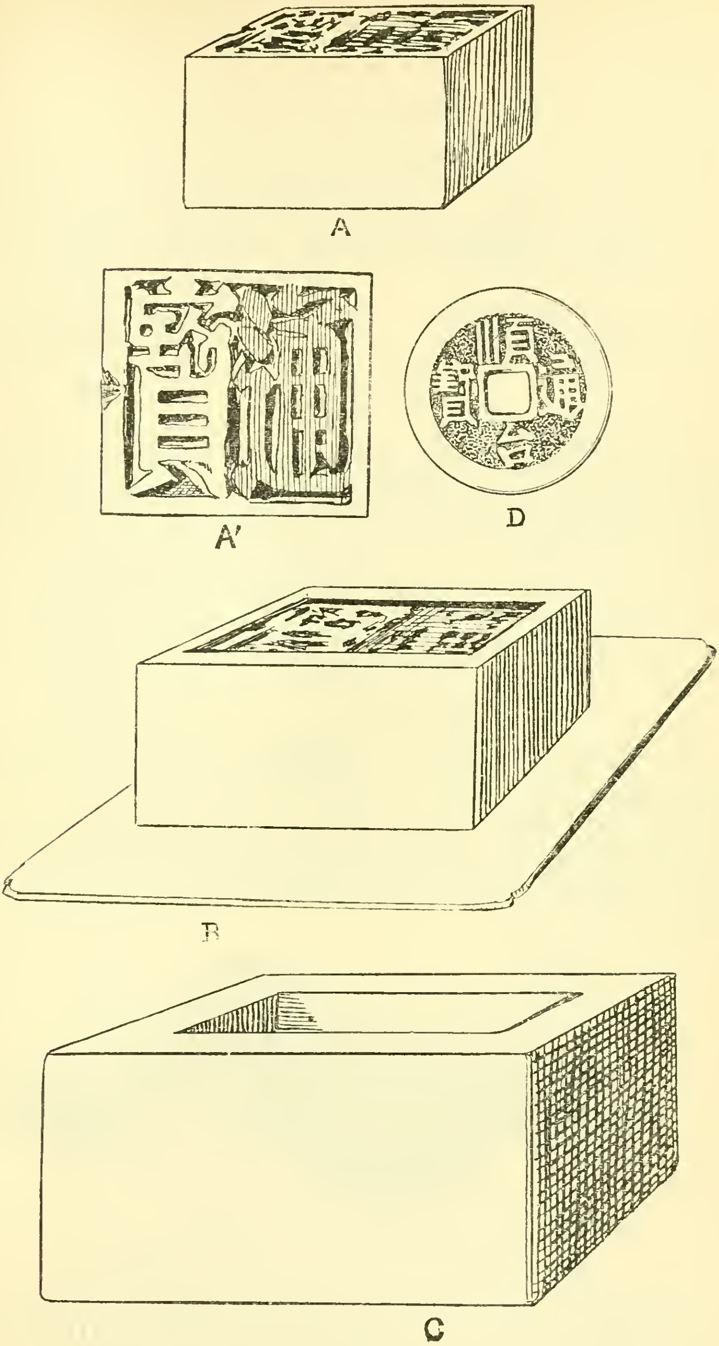


Fig. 15.

KONG POH: JOHORE, MALAY PENINSULA.

(From specimen in the Museum of the University of Pennsylvania.)

16), which commences with "double one" instead of "double blank," and contains 21 different pieces instead of 28 as in the European game (fig. 17). Eleven of the 21 pieces are duplicated, making 32 pieces in a set.

The "one" and "four" marks and the alternate "threes," which com-

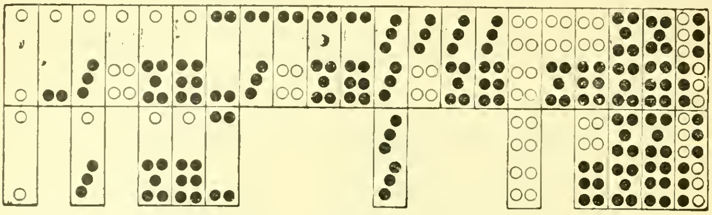


Fig. 16.

CHINESE GAME OF DOMINOES.

prise the "sixes," are usually painted red, while the other marks are painted black or white, depending upon the material of the dominoes.

The dominoes in common use in the Province of Kwangtung and among the Chinese in the United States are made of Chinese ebony

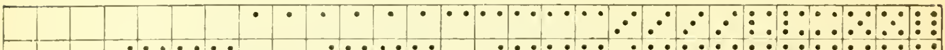


Fig. 17.

EUROPEAN GAME OF DOMINOES.

and are about $2\frac{5}{8}$ inches long, seven-eighths of an inch in width, and three-eighths of an inch in thickness, with incised spots, which are painted red and white. The ends of each piece are usually ornamented with a single incised red spot, while the backs are sometimes uniformly marked with three spots, one red between two white, arranged diagonally across (fig. 18).

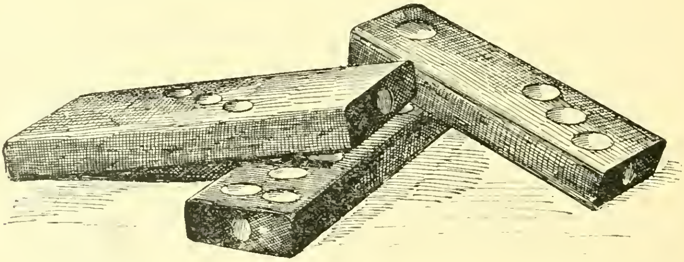
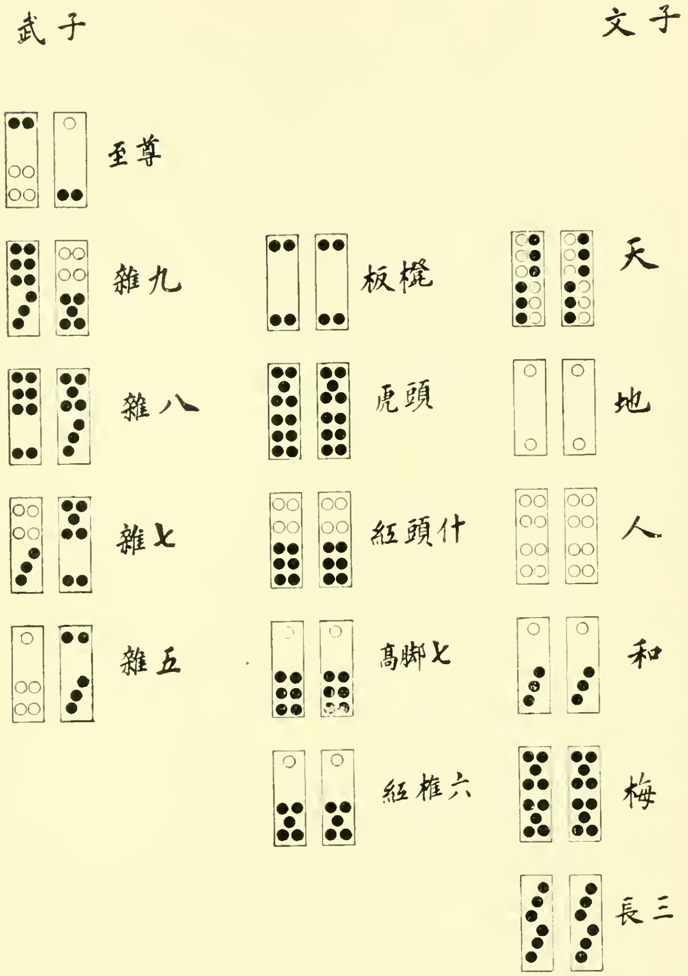


Fig. 18.

CHINESE DOMINOES: PROVINCE OF KWANGTUNG AND UNITED STATES.

The following Chinese games are those of the Chinese laborers in the United States, among whom they are the commonest gambling implements. They call each piece by name, and in certain games pair them according to the arrangements shown in plate 5. The 11 pieces that



METHOD OF PAIRING CHINESE DOMINOES

are duplicated are paired with their doubles, and form a series or suite, to which they give the name of *man*, "civil," while the remaining 10 pieces are paired with each other, in accordance with the sum of their spots, and from a suite called *mò*, "military."

The *man* pieces, in the order of their rank, are:

6–6, called *t'in*, "heaven."
1–1, called *tí*, "earth."
4–4, called *yan*, "man."
1–3, called *wo*, "harmony."
5–5, called *múi*, "plum" (flower).
3–3, called *ch'éung sám*, "long three."
2–2, called *pán tang*, "bench."
5–6, called *fú t'au*, "tiger's head."
4–6, called *hung t'au shap*, "red head ten."
1–6, called *kò kéuk ts'at*, "long leg seven."
1–5, called *hung ch'ui luk*, "red mallet six."

The *mò* pieces are:

2–4 and 1–2, called *chí tsün*, "supreme."
6–3 and 4–5, called *tsáp kau*, "heterogeneous nines."
6–2 and 5–3, called *tsáp pat*, "heterogeneous eights."
4–3 and 5–2, called *tsáp ts'at*, "heterogeneous sevens."
1–4 and 2–3, called *tsáp 'ng' luk* "heterogeneous sixes."

Both pieces in all the pairs are of equal value and rank in their suits

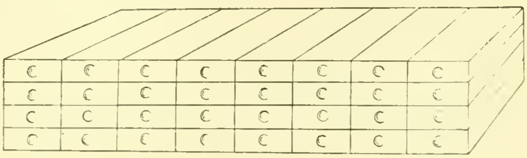


Fig. 19.
STACK OF DOMINOES AT OPENING OF GAMES

in the order given, except those which compose the pair called *chí tsün*, which together form the highest pair, but separately are the lowest of the *mò* series.

The arrangement of the dominoes called *shéung tung*, or "stack," at the opening of games, is shown in fig. 19.

TIÚ Ü.

A simple game called *tiú ü*, "to angle," is played by 2 or 3 persons with 2 sets of dominoes. The pieces are well mixed and piled face down, side by side, in a stack 4 high. Four piles of 4 each are now drawn from one end of the stack and placed face up on the table. When 2 play, both players draw 3 piles (12 dominoes), or if 3 play, 2 piles (8 dominoes) from the same end of the stack. The players then examine their pieces, and the first player endeavors to mate one of his pieces with one having the same number of spots among those turned up on the table. If successful, he places the mated pair, face up, before him. In either case he draws the bottom piece of the pile at the end of the stack from which the last piles were drawn and endeavors to mate it with one of those on the table. If successful, he takes the pair, but if not, he places the piece drawn among those on the table. The second player then tries to mate one of his pieces, and also draws one from the stack, and the game is continued in this manner until the stack is exhausted. A pair of double "sixes" in a player's hand is at once laid out. If a player holds a piece in his hand, identical with 2 pieces on the table, and the fourth piece of the same kind has not been played, he may, at his turn, pile the 3 pieces that are alike one upon the other, with the uppermost face up, at the opposite end of the stack to that drawn from, and the player who first lays out the fourth piece may take the 3 pieces. The 2 pieces composing the *chí tsün* mate with each other, and form an exception in this game to the rule by which all pieces having the same number of spots mate with each other without reference to their belonging either to the *man* or *mò* series. When the last domino is drawn, the players examine those they have taken. The pieces on which the spots number 8 or more are called *tái ü*, "large fish," and count 2 points for each spot. The pieces below 8 are called *sai ü*, "small fish," and count 1 point for each red spot. If this latter sum is between 2 decades, the highest decade is counted. The player counting the highest becomes the winner, and is paid by each of the players for each point he has in excess.

TS'UNG SHAP.

Ts'ung shap, "to dispute for tens," is played by 2 persons with 1 set of dominoes. The pieces are piled face down, side by side, in a stack 4 pieces high, which the players divide between them, each player taking 8 of the 16 piles. The first player draws the top piece from the end pile towards the right of his pile, and lays it face up on the table. The second player, in turn, draws a piece and lays it face up alongside of the piece played by the first player. The players continue to draw and place the pieces on the table in this manner either on the right or left of the row thus formed. If a player lays down a piece which is a duplicate of one of the pieces at either end of the row, he takes both pieces, called *tái*, a "pair," and they count 10 for each spot on them at the end of the game. Or, if a player lays down a piece on which the spots, added to those on 2 pieces at one end of the row, or on the pieces at each end, form a sum that is a multiple of 10, the player takes the 3 pieces, and they count 1 for each spot on them at the end of the game. If there are but 2 pieces on the table, and a player takes them, he piles them upon each other to mark the play, called *táp tí*, literally "to tread on earth," i. e. a "sweep," which counts 40. The winner draws and lays out another piece. Should he fail to take up a winning combination of

2 or 3 pieces, his opponent may take it, and follow by laying out a piece and continuing the game. The game proceeds until one of the players has laid out all of his pieces, when the one who counts highest wins.

K'AP TÁI SHAP.

Kim tái shap, "to grasp many tens;" *Ch'i tái shap*, "to grasp many tens;" *K'ap tái shap*, "to complete many tens;" is played by any number of persons from 2 to 20 and upward, and is the favorite game with dominoes in the Chinese gambling houses in the United States. In many of these houses a large table covered with matting to deaden the sound is kept apart for this game. As there played, many sets of dominoes are used which are well mixed by the players and piled faces down, side by side, in piles 5 pieces high in a long stack upon the table. The croupier, or one of the players, shakes 4 dice under a cup, and counts around to the right, commencing with the player on his right, up to the number thrown. The one at whom he stops becomes the first player. The top piece on the third pile from one end of the stack, with each alternate piece on the top up to the number of persons playing, less-one, is now removed and placed in a pile at the other end of the stack. The first player takes 2 piles at the end and gets 10 pieces; the second player on his right takes the 2 next piles and gets 9 pieces, and so on, each player except the first getting 9 pieces.

In this game each piece in a set of dominoes may be mated with a duplicate piece to form a pair called *ngán*, "eye." The *ngán* or eyes thus formed by the pieces on the left (pl. 6) are called *ün ngán* or "weak eyes," while those formed by the pieces on the right are called *ngáng ngán*, or "strong eyes." The object of the game is to get 10 pieces in each of which 2 are the same and form either an *ün* or *ngáng ngán*, and the others form 4 pairs, in each of which the sum of the spots is 10 or a multiple of 10, whence the name of the game. The piece 2–4 is only counted as 3 in making up tens.

The players examine their pieces, and the first player if he has not drawn a winning hand, discards a piece which he throws face up on the table. The next player to the right may take this piece to complete a winning hand, or in exchange for a piece from his hand, which he places face up on the table. He also draws a piece from the bottom of the exposed pile of the stack. If it does not complete a winning hand he may either throw it face up on the table, or keep it and discard a piece from his hand. The third player may now take one of the pieces on the table and draw one from the bottom of the exposed pile. The game proceeds in this way until one of the players gets 10 pieces, of which 2 form a *ngán*, and the others pairs on which the sum of the spots is 10 or a multiple of 10 and wins the game.

In gambling houses the stakes are placed in a box on the table at the commencement of each game, the players all contributing the same amount. Five per cent is at once taken from the box for the gambling house, and the remainder goes to the successful player.

K'AP SHAP.

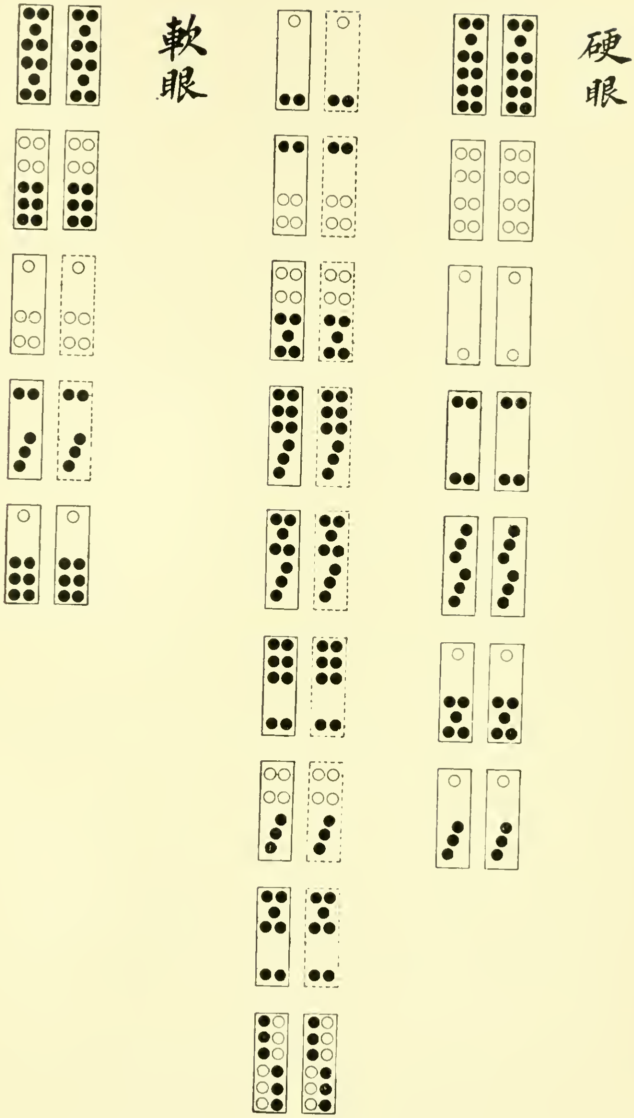
K'ap shap, "to complete tens;" *K'ím shap*, "to grasp tens;" *Shap tsai*, "little tens." *K'ap shap* corresponds with the preceding game and is the name given to it when played by 2 persons. One set of dominoes are used and the pieces are arranged in a stack 4 high. The first player takes 8 and the second 7 pieces. The object of the game is to get 8 pieces, 2 of which form a *ngán*, or pair, and the others pairs on which the sum of the spots is 10 or a multiple of 10. In this game, as in *K'ap t'áí shap*, a winning hand is required to contain 1 *ngán*, or "eye." Slight variations from the manner here described occur in playing these games. The first player is frequently determined by drawing a domino and counting around, instead of by throwing dice.

NAÚ T'ÍN KAU.

Naú t'ín kau, literally "turning heavens and nines," from the names of the highest pieces of the 2 suits, is played by 2 persons. One set of dominoes are used, which are piled face down in a stack 4 high. The first player draws the top domino from the end of the stack toward his right, and the second player the one beneath it. The second player must draw a higher domino of the same suit, either *man* or *mò*, or the first player takes both pieces and places them on the table before him, with the face of the winning piece exposed on top. The winner continues drawing first until the other player draws a higher piece, when the latter takes both pieces and has the lead. The game is continued in this way until the stack is exhausted. Each of the players then counts the red spots on the exposed faces of the dominoes before him and the one having the highest total becomes the winner, and is paid for each red spot he has in excess by the loser.

TÁ T'ÍN KAU.

Tá t'ín kau, "to play heavens and nines," called, like the preceding game from the names of the highest pieces of the two suits, is the best and most highly developed of the Chinese games with dominoes. It is played by 4 persons with 1 set of dominoes. The 32 pieces are arranged face down in a stack 4 high to form 8 piles of 4 pieces each. One of the players throws 2 dice, and counts around to determine who shall be the first player. He is called *tsò chong*, "builder of the barn," or *chong ká*, and usually places some object on the table before him to indicate his position. A disk of wood inscribed with the character *chong* frequently accompanies sets of dominoes for this purpose. The first player takes 2 piles of dominoes. If the dice fall near one end of the stack of dominoes, the first player takes the 2 piles at that end.



METHOD OF PAIRING CHINESE DOMINOES IN THE GAME OF KAP T'ÁI SHAP.

the player on his right the next 2 piles; the third player to the right, the next two, and the fourth player the remaining rows. But if the dice fall near the middle of the stack, the first player takes the 2 middle rows; the player on his right the piles on the right and left of the middle ones, the third player the piles outside of these, and the fourth player the piles at the ends. The first player leads by placing 1, 2, 3, or 4 pieces face up on the table. One piece of either suit may be thus led, and a higher piece of the same suit will be required to take it; or a pair of either suit may be led, and a higher pair of the same suit will be required to take it; or one or both pieces of the first, second, third, or fourth pair of one suit (see pl. 5) may be led with one or both pieces of the corresponding pair of the other suit, and 2 3, or 4 pieces of corresponding higher pairs will be required to take them. That is, one or both of the 6–6 may be led with one or both of the pair 6–3, 4–5, and the pair of 1–1 with one or both of the pair 6–2, 5–3, and vice versa.

The other players follow from right to left, by playing as many pieces as are led, putting them on top of those on the table if they are higher, or beneath if they are lower than those already played. They are not required to follow suit. The winner leads again, and the game is continued until all the dominoes have been played. The player who takes the last round wins the game. He becomes the *tsò chong* for the next game. It is required of the winner, however, to take at least 2 tricks, so that if only 1 piece is led on the last round a player who has not won a trick is not allowed to take the trick, and the game goes to the next higher player. *Tá t'ín kau* is invariably played for money. A trick counts 1 point, for which any sum may be agreed upon. At the end of the game the players each pay the winner according to the number of tricks they have taken. The holder of 4 or more tricks pays nothing; of 2 tricks, for 2 points; of 1 trick, for 3 points, and a player who does not take a trick for 5 points. The first player, or *tsò chong*, however, always pays twice the amount when he loses, and is paid double when he wins, and so on throughout the game, paying and receiving in every case twice as much as the other players. Should the *tsò chong*, through winning the last round, hold his position over into the next game, his gains and losses are then in the ratio of 3 to 1 to those of the other players. In the third game they would be as 4 to 1, and so on.

If any player except the first player wins a round with the pair 2–4 1–2, called *chí tsün*, the first player must pay him 4 times, and the other players twice the sum agreed upon for 1 point; but if the first player takes a round with the *chí tsün*, the other players must pay him 4 times the value of a point.

If any player except the first takes a round with 4 pieces of 2 corresponding pairs, the first player pays him 8 times and the other players 4 times the value of a point, but if the first player takes the round the other players pay him 8 times the value of a point.

If a player takes 2 rounds with the *chí tsün* or 2 rounds with 2 corresponding pairs in 2 successive games, the amounts that must be paid him by the other players are doubled, and if he takes 3 such rounds in succession they are trebled. In gambling houses the winner of a round with the *chí tsün* must put the value of 1 point and the winner with 2 corresponding pairs of 2 points in a box for the house. This constitutes the only revenue derived by gambling houses from the game.

It is said that the custom of requiring the winner to take at least 2

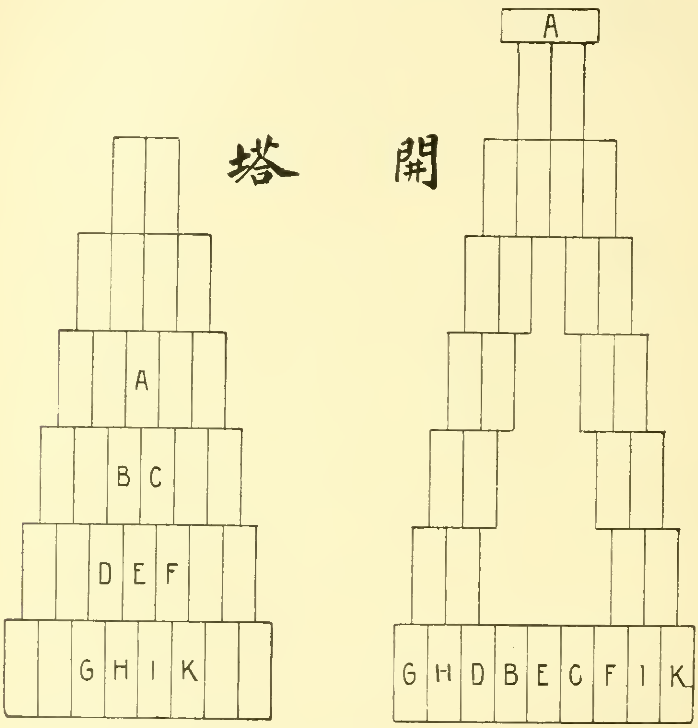


Fig. 20.

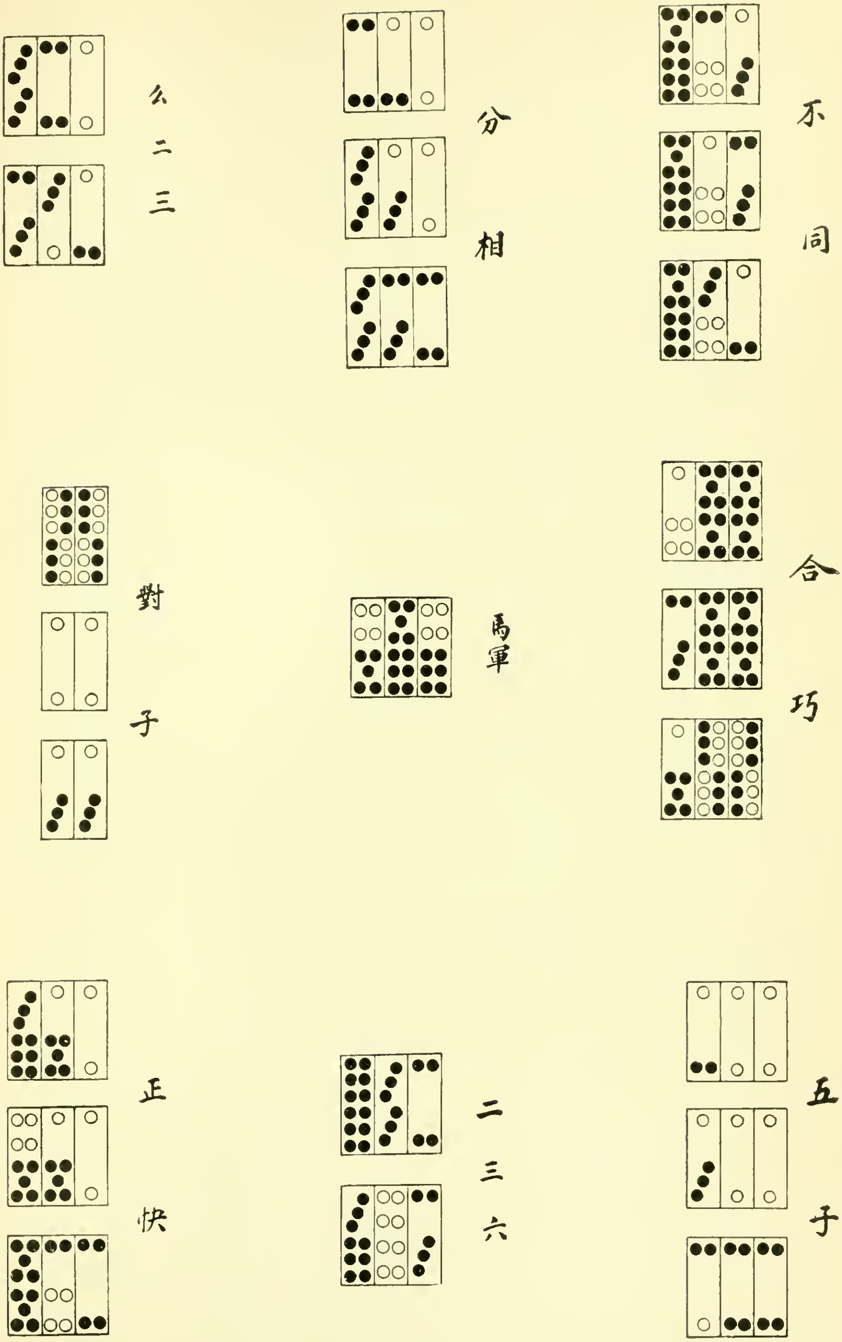
ARRANGEMENT OF DOMINOES IN GAME OF HOI T'ÁP.

tricks is an innovation of the last hundred years. Formerly the person taking the last trick became the winner, although it was the only trick taken by him during the game.

HOI T'ÁP.

Hoi t'áp, "to open the pagoda," is a game of solitaire played with dominoes. One set of dominoes are placed face down and arranged in the form of a pyramid, with 2 pieces at the apex and 4, 5, 6, 7, and 8, in the successive rows beneath, as shown in the diagram on the left of fig. 20.

The center domino, A, in the third row from the top, is then pushed down, taking with it the small pyramid composed of the pieces B, C of



COMBINATIONS OF DOMINOES, SIGNIFICANT IN FORTUNE TELLING.

the fourth row, D, E, F of the fifth row, and G, H, I, K of the sixth row. The piece A is then placed transversely, face up, across the top of the original pyramid, and the other pieces that were withdrawn formed into a line, face up, at its base; the pairs G–H and I–K being put at the ends, D and F within them, B, C next within and E in the middle, as in the diagram on the right of fig. 20. The players then proceed to mate the pieces that are face up, according to the arrangement found on pl. 5. When no more pairs can be made with the exposed pieces the outside piece on the right of the second row from the top may be reversed. If it can not be paired it is left in its place, but if mated the outside piece on the third row is liberated, and may be reversed, and so on. When the right-hand side is blocked, the piece on the left of the second row may be reversed, and the same plan followed as before. When the piece A is mated the two pieces beneath it may be reversed; and the removal of the two pieces at the ends of the lowest row, as G H, permits the pieces directly above them to be reversed. The process is continued until the game is blocked, or the player has mated all the pieces comprising the pyramid.

This game is said to be used in divination, the success or failure in mating all the pieces being regarded as furnishing a clew to the determination of the event under consideration.

FORTUNE TELLING WITH DOMINOES.

Dominoes are regularly used in fortune telling in China at the present day, and their use for this purpose is generally known to the laborers who come to America. I have before me a book entitled *Ngá p'ái shan shò t'ò chü ts'éung kái*, "a chart for finding out the numbers by divine aid and with ivory dominoes, with an explanation and commentary." This work was printed in Canton in 1865, the name of the author being given as Ch'ing Ngok. The preface, which professes to explain the attributes and astrological significance of the dominoes, is followed by a series of diagrams illustrating different combinations formed with dominoes taken three, or in one class, two at a time. Specimens of the different classes are represented in pl. 7.

The following names and numerical values are given to them:

pat t'ung, "unlike," counts 6.
hòp háu, "ingeniously divided," counts 4.
'ng tsz', "five spots," counts 5.
fan shéung, "divided reciprocally," counts 3.
má kwan, "cavalry," counts 3.
í sám luk, "two, three, six," counts 3.
iú í sám, "ace, two, three," counts 3.
túi tsz', "corresponding spots," counts 3.
ching fái, "correctly satisfied," counts 1.

In telling fortunes an entire set of dominoes is placed face down upon a table and well mixed. The dominoes are then all placed side by side in a row and reversed. The manipulator selects from this row as many combinations as possible, formed by adjacent pieces, according to the diagrams, and adds together the numbers corresponding with them. This sum is referred to the following table and result noted:

1 to 4 is to be esteemed *há há*, "lowest."
5 to 7 is to be esteemed *chung há*, "below the middle."
8 to 9 is to be esteemed *chung p'ing*, "even middle."
10 to 11 is to be esteemed *shéung shéung*, "highest."

The dominoes are then reversed again and mixed, and the preceding operations twice repeated, and 3 sets of terms from the above series obtained. Reference is then made to the text of the book. This consists of 125 pages, arranged in order under all the different combinations that may be formed with the 5 pairs of terms given above, taken 3 pairs at a time, commencing with *shéung shéung*, *shéung shêung*, *shéung shéung*. An oracular verse, apparently of original composition, is found on each page, referring to some well-known personage or incident, with a short text to aid the diviner in applying the prognostication to the various affairs of life.

DOMINOES FROM FUHCHAU.

Before proceeding to discuss the origin and antiquity of the Chinese game, an account will be given of dominoes used in other parts of China, and among the people of the adjacent countries.

A set of dominoes from Fuhchau* in the Oriental Section of the Museum of Archæology and Palæontology of the University of Pennsylvania is made of bamboo and numbers 32 pieces. They measure $\frac{31}{32}$ by $\frac{27}{32}$ by $\frac{15}{32}$ inch, and have slightly curved faces that follow the natural curve of the reed. The concave faces are marked with incised spots that are painted red and green, and are arranged in the Chinese series (fig. 17), green taking the place of black spots. These dominoes are accompanied with 16 wooden disks resembling draughtsmen, an inch in diameter, the faces of which are reproduced in plate 8. They each bear a Chinese character referring to one of the 16 pairs formed with the 32 dominoes.† Four of these, *t'ín*, *tí*, *yan*, and *wo*, are the same

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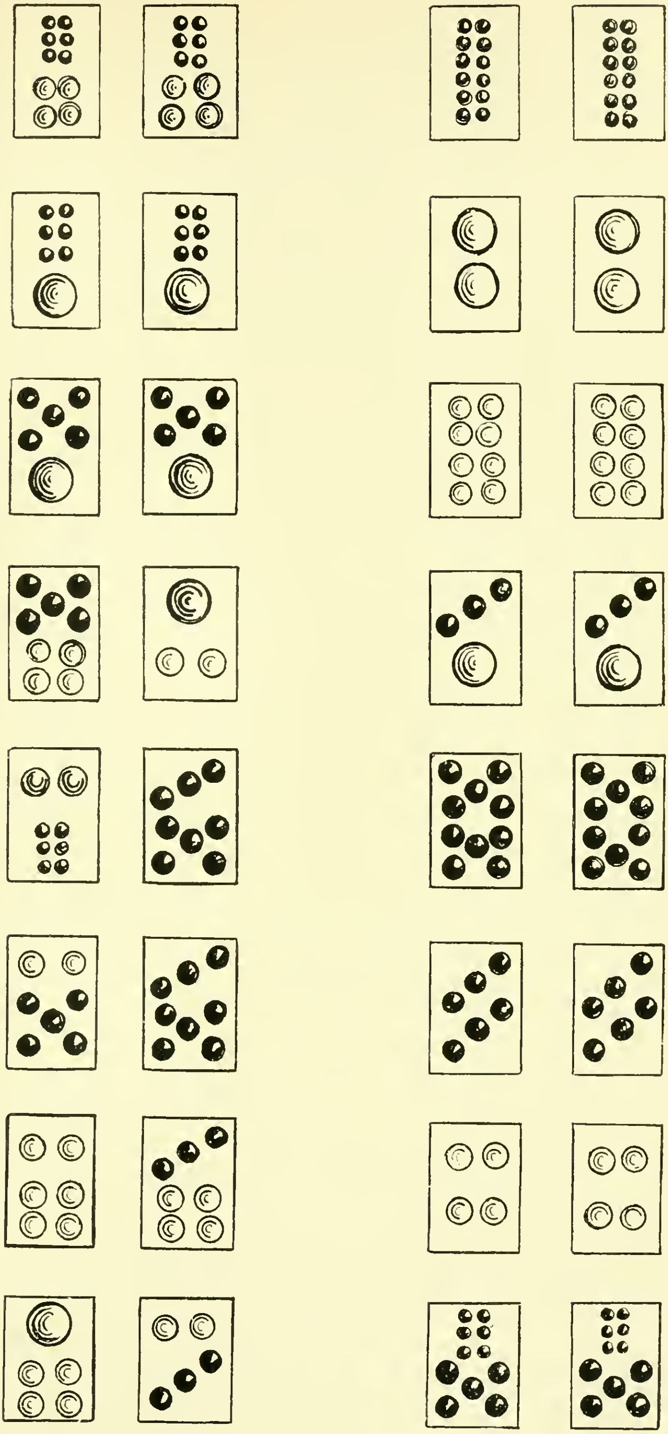
* Received through the courtesy of J. P. Cowles, esq., U. S. vice-consul, Fuhchau.

† Prof. Rudolfo Lanciani, in the Athenæum, January 7, 1888, gave an account of the discovery of a tomb in Perugia twenty-one centuries old, in which an inveterate gambler had been buried together with his gambling apparatus. Among other remarkable sets were "16 *tesseræ*, or labels, cut in bone, 4 inches long, with a word engraved on one side and a number on the other." The importance of the discovery is concentrated on the words and numbers engraved on the bone labels. The ancients used to give a special name to a certain number, or addition of numbers, which they obtained by throwing the dice. * * * As regards the newly discovered labels, it appears that any number from 1 to 12 was considered a very bad throw, and consequently the corresponding words or names were very objectionable indeed (*Mœchus Vappa*, ect.). The "13" is neither good nor bad; hence its name, *vix rides*, "you hardly smile." The names corresponding to higher numbers are all of good omen, such as *benignus* (25), *amator* (30), and *felix* (60), which seems to be the maximum of the game discovered at Perugia." While the agreement of number of tablets in this Etruscan series with those in the Chinese is probably a mere coincidence, it is curious to note the occurrence of such similar usages in ages and countries so widely separated.

FACES OF WOODEN DISCS ACCOMPANYING DOMINOES FROM FUHCHAU.
From specimens in the Museum of the University of Pennsylvania.



KOREAN DOMINOES

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as those used to designate the four highest pieces in the *mán* series, plate 5, but the remainder, in place of the vulgar names usually given to the other pairs, have the characters *shü*, *ngau*, *fú*, *tò*, *lung*, *shé*, *má*, *yéung*, *hau*, *kai*, *hün*, and *chü*, which represent the names "rat," "ox," "tiger," "hare," "dragon," "serpent," "horse," "goat," "monkey," "cock," "dog," and "pig," the 12 animals of the duodenary cycle.* I understand these discs are used in connection with a kind of lottery.

I am informed that bamboo dominoes, similar to the above, are used at Shanghai, and at all the Chinese ports from Fuhchau northward.

There are several very interesting sets of Chinese dominoes from Fuhchau in the museum of the Long Island Historical Society, Brooklyn, N. Y. † One of these sets (A) consists of 126 marked pieces and 2 blanks. They are made of bamboo, faced with bone or ivory, which is attached to the wood with glue, or, in the case of one of the sets, with small brass pins. The pieces measure about $\frac{7}{8}$ by $\frac{5}{8}$ by $\frac{3}{8}$ inch. This set is composed: first, of 3 suits of 21 pieces marked with black and red dots, each comprising the Chinese series without the duplicates; second, of 2 suits of 21 pieces, similarly marked with black and red dots with the addition of ornamental devices of flowers in red and green; third, of 1 suit of 21 pieces, each with double sets of dots, 1 set being placed at each end of the pieces, and between certain devices in red and green, comprising the emblems of the Eight Genii, the characters for "sun" and "moon," a tiger, and various flowers.

A similar set was exhibited by W. H. Wilkinson, esq., Her British Majesty's consul-general, Seoul, Korea, in his collection in the section of games at the Columbian Exposition, Chicago, 1893. They were from Shanghai, and designated as Hua ho (*fá ho*) "flower harmony." ‡

Another set (B) in the museum of the Long Island Historical Society comprises 141 marked pieces and 2 blanks. They are made of bamboo with a bone or ivory face, which is skillfully mortised to the wood, and measure $\frac{7}{8}$ by $\frac{5}{8}$ by $\frac{3}{8}$ inch. This set is composed:

First, of 4 suits of 9 pieces each, marked in red, green, and blue, with from 1 to 9 circles.

Second, of 4 suits of 9 pieces each, marked in red and green, with from 1 to 9 narrow rectangles.

Third, of 4 suits of 9 pieces each, marked with the characters *yat mán*, "one ten thousand," to *kau mán*, or "nine ten thousand." The characters for "one" to "nine" are in blue, and that for *mán*, "ten thousand," is in red.

Fourth, of 4 pieces marked *pak*, "north," in blue; of 4 pieces marked *nám*, "south," in blue; of 4 pieces marked *tung*, "east," in blue; of 4

* Chinese Reader's Manual, part 2, No. 301.

† The gift of the Hon. George Glover, formerly U. S. consul at Fuhchau. There is a similar collection given by him in the American Museum of Natural History, Central Park, New York.

‡ Cf. Descriptive Catalogue World's Columbian Exposition, Department M, revised edition, p. 87.

pieces marked *sai*, "west," in blue; of 4 pieces marked *chung*, "middle," in blue; 1 piece marked *pak wong*, "northern ruler," in red and blue; 1 piece marked *nám wong*, "southern ruler," in red and blue; 1 piece marked *tung wong*, "eastern ruler," in red and blue; 1 piece marked *sai wong*, "western ruler," in red and blue; 1 piece marked *chung wong*, "middle ruler," in red and blue; 1 piece marked *t'ín wong*, "heavenly ruler," in red and blue; 1 piece marked *tí wong*, "earthly ruler," in red and blue; 1 piece marked *yan wong*, "human ruler," in red and blue; 1 piece marked *wo wong*, "harmony ruler," in red and blue; 1 piece marked *ch'un*, "spring," in red; 1 piece marked *há*, "summer," in red; 1 piece marked *ts'au*, "autumn," in red; 1 piece marked *tung*, "winter."

Fifth, of 8 blank pieces.

A set nearly identical with this was also exhibited by Mr. Wilkinson. It lacked the pieces designated as "rulers of the five directions," the *t'ín*, *tí*, *yan*, and *wo wong*, and the 4 pieces with the names of the seasons. It had, however, 4 pieces bearing the character *fát*. This set was from Ningpo, and was designated by Mr. Wilkinson as chung fa (*chung fát*). "The coloring," he states, "whether in red, green, or blue, is purely ornamental, and has nothing to do with the play of the game.*

Another set (C), from Fuhchau, in the museum of the Long Island Historical Society, is made entirely of bamboo. This set is composed of 32 pieces, measuring $\frac{7}{8}$ by $\frac{9}{16}$ by $\frac{5}{16}$ inch. They are inscribed on one face with the usual dots and the characters that represent the names of the pieces of the Chinese game of chess, *tséung k'í*.

These marks are arranged as follows:

6–6 6–6, *kü*, "chariot," in red.
1–1 1–1, *tséung*, "elephant," in green.
4–4 4–4, *kü*, "chariot," in red.
1–3 1–3, *séung*, "elephant," in red.
5–5 5–5, *tsut*, "soldier," in red.
3–3 3–3, *ping*, "soldier," in green.
2–2 2–2, *sz'*, "secretary," in green.
5–6 5–6, *má*, "horse," in green.
4–6 4–6, *má*, "horse," in red.
1–6 1–6, *tsut*, "soldier," in red.
1–5 1–5, *tsut*, "soldier," in red.
6–3 4–5, *sz'*, "secretary," in red.
6–2 5–3, *p'áu*, "cannon," in red.
4–3 5–2, *p'áu*, "cannon," in green.
1–4, *ping*, "soldier," in red.
2–3, *tsut*, "soldier," in red.
2–4, *tséung*, "general," in green.
1–2, *shui*, "general," in red.

Mr. Himly† describes a set of Chinese bamboo dominoes, 32 in the set, with the characters of the chessmen, which is identical with the

* Descriptive Catalogue, p. 87.

† Zeitschrift des deutscher Morgenländischer Gesellschaft, Band 43, p. 453.

preceding, except for slight variations in the association of the names of the chessmen on the dotted pieces. He offers it in explanation of the number, 32, of the domino game, and says that it could only have been made to save space while traveling. As in the preceding, the 32 dominoes do correspond, piece for piece, with the 32 men in the Chinese game of chess. It is clear that the devices on some, at least, of the other decorated dominoes were copied from playing cards, those on the set A being identical in number as well as in devices with a set of the dotted cards from Fuhchau in the same collection, while the set B has the names of the familiar suit marks, *ping*, *sok*, and *mán*, of the cards: hence it is possible that the "chess dominoes" were imitated from the corresponding "chess cards," and that the true explanation of the number of the domino pieces must be found elsewhere.

Mr. W. H. Wilkinson also exhibited at the Columbian Exposition a set of dominoes from Wenchow, called hua tang chiu, "flowery tang chiu." They consist of 5 suits of 21 pieces each and 17 extra pieces (total, 122) and 4 blanks. The extra pieces are (1) 6–6 6–3, (2) 1–1 1–3, (3) 4–4 1–3, (4) 2–4 4–4, (5) 3–3 5–6, (6) 1–2 2–2, (7) 1–2 2–4, (8) 4–5 5–5, (9), (10), (11) 3 pieces marked with the sequence 1–6—that is, 1–4 2–6 3–5; 1–6 2–5 3–4; 1–5 2–3 4–6, and 6 pieces bearing the characters (*a*) wen, "civilian;" (*b*) wu, "military;" (*c*) tsung, "universal;" (*d*) t'ai, "highness;" (*e*) ho, "lily;" (*f*) p'ei, "heap up." "The blanks are used only to replace cards lost." The material was wood, stained black, with incised spots, painted white and red. "The coloring of the cards is immaterial." They measured 1 by $\frac{14}{16}$ by $\frac{8}{16}$ inch, and the inner face was slightly concave, like the dominoes from Fuhchau, mentioned on page 518.*

CH'IÚ P'ÁI.

Another form of Chinese dominoes remains to be described which are current at Tientsin. There are the *ch'iú p'ái*, "leaping dominoes,"† which consist of 32 slips of bamboo about 14 inches in length, with the domino spots marked at one end, contained in a cylindrical bamboo box. This game is carried on by cake, candy, and fruit sellers. The player draws 3 of the bamboo slips, and if the 3 marks form what is described under the following account of Korean dominoes, pages 523, 524, as *yat p'ái*, "perfect tablets," the player wins; if not he loses.

KOREAN DOMINOES.

A set of Korean dominoes from Seoul (pl. 9) in the National Museum is made of ivory and numbers 32 pieces. They measure $\frac{3}{4}$ by $\frac{7}{16}$ by $\frac{3}{16}$ inches, and are marked with incised spots arranged according to the Chinese system. The "one" and "four" spots are painted red and all the others black, and the "one" spots are much larger than the others and very deeply incised.

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* Cf. Descriptive Catalogue, p. 88.

† There is a set from Fuhchau in the museum of the Long Island Historical Society.

The Koreans call dominoes *kŏl-hpai* (Chinese *kwat p'ái*), "bone tablets." A more correct name is said to be *ho-hpai*, (Chinese *Ŭ p'ái*), "barbarian tablets." This latter name is also applied to a special game. The 32 dominoes are paired as shown in pl. 6, those of which there are two being mated with each other, and those of which there are but one with reference to the sum of the spots, but not in the manner of the Chinese series (Pl. 5).

The pieces receive the same names as those of the dice throws of the Korean game *Ssang-ryouk*, "backgammon," viz:

1-1, *syo-syo* (Chinese *siú siú*), "smallest."
1-2, *tjoui-hko* (Chinese *shü pí*), "rat nose."
1-3, *syo sam* (Chinese *siú sám*), "small and three."
1-4, *păik să* (Chinese *pák sz'*), "white and four."
1-5, *păik i* (Chinese *pák 'ng*), "white and five."
1-6, *păik ryouk* (Chinese *pák luk*), "white and six."
2-2, *tjoun-a* (Chinese *tsun á*), "superior two."
2-3, *a sam* (Chinese *á sam*), "two and three."
2-4, *a să* (Chinese *á sz'*), "two and four."
2-5, *koan-a* (Chinese *kun á*), "sovereign two."
2-6, *a ryouk* (Chinese *á luk*), "two and six."
3-3, *tjyang-sam* (Chinese *ch'éung sám*), "long three."
3-4, *sam să* (Chinese *sám sz'*), "three four."
3-5, *sam o* (Chinese *sám 'ng*), "three and five."
3-6, *sam ryouk* (Chinese *sám luk*), "three and six."
4-4, *tjoun-hong* (Chinese *tsun hung*), "superior red."
4-5, *să o* (Chinese *sz' 'ng*), "four and five."
4-6, *să ryouk* (Chinese *sz' luk*), "four and six."
5-5, *tjoun o* (Chinese *tsun 'ng*), "superior five."
5-6, *o ryouk* (Chinese *'ng luk*), "five and six."
6-6, *tjoun-ryouk* (Chinese *tsun luk*), "superior six."

Dominoes are regarded as a vulgar game in Korea. They are used in gambling houses and are not much played as a social game by the higher classes.

HO-HPAI.

The commonest Korean game of dominoes is called *Ho-hpai*, i. e., "Barbarian tablets." It is played by 3 or 4 persons. When 4 persons play an entire set of dominoes are used. When 3 play the following pieces are withdrawn: 6-6, 5-5, 4-4, and 3-3. The dominoes are turned face down and shuffled. On commencing to play, the players all draw 1 piece to decide who shall play first. The one who gets the piece with the highest number of spots becomes the *Tjyang-ouen* (Chinese, *Chong ün*).* The pieces are again shuffled and the *Tjyang-ouen* draws 7 pieces and each of the other players 6. The *Tjyang-ouen* then whirls his 7 pieces about between his fingers in the right hand until 1 piece slips out. This piece he turns face up. Should the piece turned up be either 5-4, 1-2, 1-4 or 2-3 he keeps the pieces he has drawn. If it should be either 6-6, 5-5, 4-4, 3-3, 2-2, 1-1, 6-5, 6-4, 6-1, 5-1, or 3-1, that is to

* This title is that of the first of the literary graduates in Korea. The same name is applied to the first of the Hanlin doctors in China.

say one of the pieces of which there are duplicates, he hands his 6 pieces that are yet undisclosed to the player on his right who in turn gives his pieces to the player next to him, and so on until the *Tjyang-ouen* receives those of the fourth player. If on the other hand, he turns up either 6–3, 6–2, 5–3, 5–2, 4–3, or 4–2, he hands his 6 pieces to the player on the left who in turn gives his pieces to his immediate neighbor until the *Tjyang-ouen* receives those from the player on the right. The seventh piece that was turned up is now turned down and mixed with the remaining pieces, which are placed side by side in a line, and covered with a slip of paper, or a strip of bamboo made for the purpose. If the *Tjyang-ouen* keeps his pieces, he becomes the first player, but if he exchanges them, the one on the right or left to whom he gave his pieces becomes the first player. In this game certain combinations of 3 pieces are called *han-hpai* (Chinese *yat p' ái*), "perfect tablets," and the object of the game is to get 2 such combinations. The game is then spoken of as *hte-tjye-ta*, "broken". *Ho-hpai* is played for money and a certain stake agreed upon, the player winning once, twice, thrice, four or five times this amount for each player, according to the combination which composes his winning hand. These combinations and the numbers they count are as follows:

(1) A sequence, as 1–3, 2–4, 5–6, called *ssang-syo-han-hpai* (Chinese, *shéung tsü yat p'ái*), counts 3 in combination with another *ssang-syo*, and 1, in combination with any other *han-hpai*. A *ssang-syo* composed of 6 pieces, which pair according to the Korean system, is called *tăi-să-ttai* (Chinese, *túi sz' tai*), literally, "corresponding four times," and counts 4, the name referring to the count.

(2) The sequence 1–1, 1–2, 1–3, 1–4, 1–5, 1–6, and the corresponding sequences in which 6, 5, 4, 3 and 2 replace the ones in this example, are called *pou-tong* (Chinese, *pat t'ung*), "unlike," and count as follows:

1–1, 1–2, 1–3, 1–4, 1–5, 1–6 counts 3.
2–1, 2–2, 2–3, 2–4, 2–5, 2–6 counts 5.
3–1, 3–2, 3–3, 3–4, 3–5, 3–6 counts 3.
4–1, 4–2, 4–3, 4–4, 4–5, 4–6 counts 3.
5–1, 5–2, 5–3, 5–4, 5–5, 5–6 counts 4.
6–1, 6–2, 6–3, 6–4, 6–5, 6–6 counts 3.

(3) The sequence 1–2, 3–6, 4–5, 1–4, 2–6, 3–5, called *hol-ssang-syo* (Chinese, *tuk shéung tsú*), "solitary double sequence," counts 5.

(4) Two doublets, and 1 piece upon which the sum of the spots, or 1 of the 2 sets of spots is equal to the single number of the doublets, as 1–4, 5–5, 5–5, or 4–2, 4–4, 4–4, called *sok* (Chinese, *noi*), "inclosed," counts 1, both when paired with another *sok* or any other *han-hpai*. A *han-hpai* composed of sixes is called *ryouk-sok;* of fives, *o-sok;* of fours, *hong-sok;* of threes, *sam-sok;* of twos, *a-sok*, and of ones, *păik-sok*.

(5) Three pieces upon which the spots are equally divided between 2 numbers, as 4–4, 2–4, 2–2, called *tai-sam-tong* (Chinese, *túi sám t'ung*), "three alike, opposite," count 1.

(6) The combination 6–6, 5–5, 4–4, called *ro-in* (Chinese, *lò yan*), "old man," counts 3 when combined with itself and 1 with any other *han-hpai*. The combination 3–3, 2–2, 1–1, called *a-ki* (Chinese, *á chí*), "child," counts 3 when combined with itself and 1 with any other *han-hpai*.

(7) The combination 6–6, 3–3, 2–2, called *ssang-pyen* (Chinese, *shéung pín*), "doublets," counts 3 when combined with itself and 1 with any other *han-hpai*. The combinations 2–3, 3–1, 1–2, and 4–5, 5–6, 4–6, called *Yo-Soun*, count 3 when combined with each other and 1 in combination with any other *han-hpai*.

As the *sok* are combinations which may be formed very easily, it is sometimes agreed to play without them. If the first player has not drawn a winning hand he puts down a piece from his hand at the end that is nearest to him of the concealed row and takes up the piece at the other end, at the same time sliding the row of pieces along, so that the piece he puts down is concealed, and the piece he takes up is exposed. If he then does not make a winning combination, the next player, if he has not already a winning combination, puts down a piece and takes up another as before, and this is continued until some one obtains a winning combination, and so wins the game. He then becomes the *Tjyang-ouen* in the next game.

TJAK-MA-TCHI-KI.

Tjak-ma-tchi-ki, "pair making," is played by 2, 3, or 4 persons. The pieces are reversed and shuffled and covered with paper. The first player draws 6 and the other players each draw 5 dominoes. The first player endeavors to play out a pair from those he has drawn, but if he is unsuccessful he lays out 1 piece face up on the table. The second player takes up the piece discarded if he can combine it with a domino in his hand to form a pair. If not, he draws a piece from those left under the paper, and discards a domino, which he lays out face up. This process is continued around until 1 player gets 3 pairs in his hand, and becomes the winner. When 2 or 3 play, the 6–6 can not be played to complete the third pair, but when 4 play it may thus be played and the winner must be paid alone by the player who discarded the corresponding piece.

If the pair is completed by a piece drawn from the unused pile, all the other players pay the winner, but if it is completed by a piece which has been discarded, the player who discarded that piece alone pays the winner. It is sometimes agreed that the third pair by which a player wins must be completed with a piece drawn from the unused pile.

KKO-RI-POUT-TCHI-KI.

Kko-ri-pout-tchi-ki, "tail joining," is played by 2, 3, or 4 persons; 3 or 4 usually play. The set of dominoes are reversed and shuffled and each player draws 8 dominoes. When 3 play, the pieces 6–6, 5–5, 4–4, and

3–3 are first withdrawn. The game is begun by someone asking who has the *koan a* ? The holder of this piece, the 5–2, lays down any piece he may select from his hand, face up, at the same time crying out a number on one side of it, which number must be paired. The next player must mate the side designated with one of his pieces, but if unable to do so, must lay a piece from his hand, face down on the table. The game is continued around until all have been paired or all have laid down their pieces. Then each counts the spots on the pieces they have been compelled to lay down, which naturally have been selected from those with the fewest spots in their hands, and the one who has the highest number of spots pays the one who has the lowest number of spots. When 4 play, all players who count more than 30 must pay.

KŌL-YE-SI.*

Kōl-ye-si is played by two or more persons, not exceeding ten. The set of dominoes is placed face down and shuffled, and part, if not all of the set, are placed end to end in an irregular line. One of the players acts as banker, *Moul-tjyou* (Chinese, *Mat chü* "things' ruler"). The other players each draw 1 piece in turn from the line. They examine this piece and each put whatever stake they choose on the piece drawn. The *Moul-tjyou* puts down the same amount, whatever it may be, beside each player's stake and takes the next 2 pieces. If his pieces are identical, a perfect pair, he at once wins all that has been staked. Otherwise the other players draw in turn either 1 or 2 pieces from the line. This done, they and the *Moul-tjyou* turn their pieces face up. They all count the spots on their dominoes. The remainders, after deducting the tens, count, and if the *Moul-tjyou* has an excess over that of any player, he takes the stakes, but if a player has an excess over that of the *Moul-tjyou* when the tens are deducted from the sum of the spots, that player wins the amount of the stake he has staked.

This is a common game in gambling houses. It is customary to keep a water jar there, in which the players voluntarily put a portion of their stakes before the result is disclosed, or, if unmindful, at the suggestion of some one interested in the house.

RYONG-HPAI.

Dominoes are used in Korea as in China in playing solitaire, which, as in China, is a favorite kind of sortilage, not regarded seriously, but often played at the beginning of the day, the player wishing for a happy omen. The solitaire game described under the name of *hoi t'áp*, page 516, is known under the name of *Ryong-hpai* (Chinese, *lung p'ái*), "Dragon tablets," while another arrangement is shown in fig. 20.

**Kōl-ye-si* means *kōl* (*hpai*) or "domino" *ye-si*, the latter being the name of a game played with cards.

KE-POUK-HPAI.

In this system, called *ke-pouk-hpai* (Chinese, *kwai p'ái*), "Tortoise tablets," the 32 dominoes are laid face down to form a representation of a tortoise (fig. 21), with 2 pieces at head and tail and 2 for legs at each of the 4 corners. The pieces at these extremities are turned face up, followed by those marked A, B, C, D, and mated according to the Korean system, (pl. 9). The player loses when he fails to mate all the pieces.

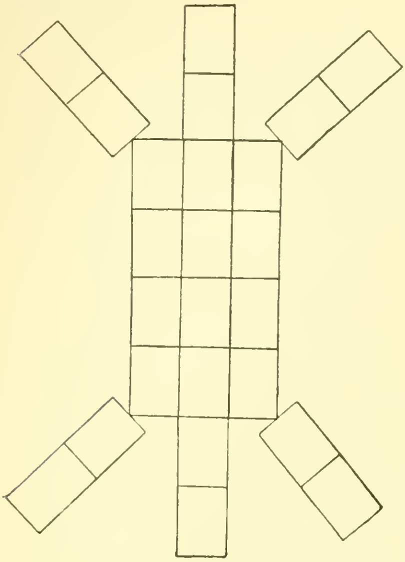

Fig. 21.

ARRANGEMENT OF DOMINOES IN KE-POUK-HPAI, "TORTOISE TABLETS;" KOREA.

SIN-SYO-TYEN.

Sin-syo-tyen (Chinese, *shan shò chím*), "personally counting divination," is a kind of fortune telling practiced with dominoes. The inquirer shuffles a set of dominoes face down and arranges them side by side in a line. He then turns them face up, preserving the arrangement, and selects as many of the combinations referred to on pages 523, 524, as can be formed by contiguous pieces. The sum of the numbers there given, in connection with the combinations thus formed is noted, and the operation twice repeated. The three results are added together, and if their sum amounts to 32, the number of the domino pieces, the augury is very good; more or less being estimated proportionally good or indifferent.

O-KOAN.

Another popular method of divination with dominoes is called *o-koan* (Chinese, *'ng kwán*), "5 gateways."

An entire set of 8 dominoes is reversed and shuffled and 20 pieces are then arranged face down in 5 rows of 4 pieces each (fig. 22). The player then turns these pieces face up and commencing at the bottom row endeavors to form combinations of 3 pieces each, *han-hpai* such as have been described under *ho-hpai* In addition to the *han-hpai* already enumerated, pages 523, 524, the following additional ones are permitted in *o-koan:* Three pieces upon which 3 of the spots are alike and the sum of the other 3

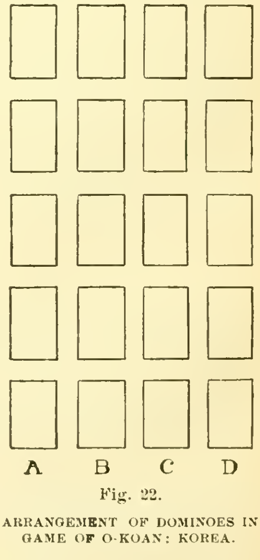

Fig. 22.

ARRANGEMENT OF DOMINOES IN GAME OF O-KOAN: KOREA.

spots is equal to 5, called *sam-tong-tan-o-tyem* (Chinese *sám t'ung tán 'ng tím*), "three alike and only five spots," and 3 pieces upon which 3 of the spots are alike and the sum of the other 3 spots is equal to or more than 14, called *sam-tong-sip-sá-tyem* (Chinese *sám t'ung shap sz' tím*), "three alike and fourteen spots."

In forming these combinations, 3 contiguous pieces in a row may be taken, or 1 or 2 pieces at one end of a row may be used in combination with 2 pieces or 1 piece at the other end, the pieces thus taken being always placed on the inner side. Thus the piece A may be mated with C D to form a combination A C D, or B A may be mated with D to form a combination A B D. The combinations thus formed are removed and placed in a line face up above the 5 rows, the one found nearest the bottom being placed to the left and successive ones to the right of the line thus started. When no more combinations can be discovered, 5 pieces are drawn from the unused pile of 12 pieces which have been left with their faces down, and one of them placed face down to the right of each of the 5 rows. These 5 pieces are then turned face up, and an attempt made to form combinations of threes with their aid. The results are successively placed to the right of the line at the top and this process is continued until the 12 extra pieces are exhausted. When this happens, 5 pieces are withdrawn from the left of the top line and added in succession to right of the 5 rows. If, by chance, but 4 or a less number of rows remain, only a corresponding number of pieces are drawn. This process is continued over and over until all the pieces are combined in sets of threes in a long row at the top, or the top row is exhausted and a block ensues, determining success or failure. The name of the game is said to have been taken from a well-known episode in the life of *Koan Ou** (Chinese, *Kwán Ŭ*), the

* Kwan Yü (*Kwán Ŭ*) *D.* A. D. 219. Designated Kwan Chwáng Miú and deified as Kwan Ti or Wu Ti, the God of War. A native of Kiai Chow, in Shan-si, who rose to celebrity toward the close of the second century through his alliance with Liu Pei and Chang Fei in the struggles which ushered in the period of the Three Kingdoms. He is reputed to have been, in early life, a seller of bean-curd, but to have subsequently applied himself to study until, in A. D. 184, he casually encountered Liu Pei at a time when the latter was about to take up arms in defense of the house of Han against the rebellion of the Yellow Turbans. He joined Liu Pei and his confederate, Chang Fei, in a solemn oath, which was sworn in a peach-orchard belonging to the latter, that they would fight henceforth side by side and live and die together. The fidelity of Kwan Yü to his adopted leaders remained unshaken during a long series of years in spite of many trials; and similarly his attachment to Chang Fei continued throughout his life. At an early period of his career he was created a t'ing how (baron) by the regent Ts'ao Ts'ao, with the title of Hán shu t'ing hau. * * * His martial powers shone conspicuously in many campaigns which were waged by Liu Pei before his throne as sovereign of Shu became assured, but he fell a victim at last to the superior force and strategy of Sun K'üan, who took him prisoner and caused him to be beheaded. Long celebrated as one of the most renowned among China's heroes, he was at length canonized by the superstitious Hwei T'sung, of the Sung dynasty, early in the Twelfth century, with the title Chung hwui Kung. In 1128 he received the still higher title of Chwáng miú wu ngán wáng, and after many subsequent alterations and additions he was at length raised in 1594 by Ming Wan Li to the rank of Ti, or God, since which date, and especially since the accession of the Manchow dynasty, his worship as the God of War has been firmly established. (Chinese Reader's Manual, No. 297.)

celebrated Chinese general, now universally worshiped in China as the God of War, and one of the heroes of the famous historical romance, the *Sám Kwok chí*, or "Annals of Three States." In escaping from Ts'ao Ts'ao,* it is recorded that he killed six generals at "five frontier passes," *o-koan* (Chinese *'ng kwán*). The vicissitudes of his life at this time are typified in the varying fortunes of the game, which at one moment approaches a successful termination, only for the player to be unexpectedly set back to overcome its obstacles anew. The conquest of the "five *koan*," which *Koan Ou* achieved, finds it analogue in the 5 rows of the dominoes which the player struggles to overcome. Many educated people play this game every morning, and scholars who have nothing to do play it all day long, finding intellectual pastime in its elusive permutations.

BURMESE AND SHAN DOMINOES.

A set of Burmese dominoes in the National Museum are of teak wood and measure 2 by 1 by $\frac{3}{8}$ inches (pl. 10). The spots are marked with incised circles. They number 24 pieces, marked as follows: 6–6, 1–1, 4–4, 1–3, 5–5, 3–3, and 2–2 duplicated, and one each of the following pieces: 6–3, 4–5, 6–2, 5–3, 4–3, 5–2, 2–4, 1–4, 2–3, and 1–2, the last having 2 smaller spots adjoining the "1."

They are accompanied by a cubical die about three-fourths inch square, with 2 opposite faces marked with 1 spot, 2 opposite faces marked with 2 spots, and 2 opposite faces marked with 3 spots. This is used to decide who shall play first.

A set of Burmese dominoes, from Rangoon, sent to the writer by the Hon. Sir C. H. T. Crosthwaite, lieutenant-general Northwest Provinces, British India, are identical with the preceding, except that the spots are marked with small brass disks.

A set of Burmese dominoes in the British Museum are made of black horn, and number 32 pieces. They measure $1\frac{3}{8}$ inches in length by three-fourths of an inch in width and have incised spots, which are painted red and yellow and arranged according to the Chinese system. The backs are uniformly marked with "1" and "3" spots composed of concentric circles, and the ends each bear 1 spot similarly inscribed. Another set of Burmese dominoes in the same collection are made of black wood, with the spots painted red and white.

Dice are called *anzamiā* (singular *anzâ*) in Burmese. The Burmese dice in the museum of the University of Pennsylvania are small ivory cubes, regularly marked and having the fours in red, and are identical with the Chinese.

A set of Shan dominoes in the British Museum, presented by Maj. E. B. Gladen, are identical in every respect with the horn dominoes from Burma in the same museum.

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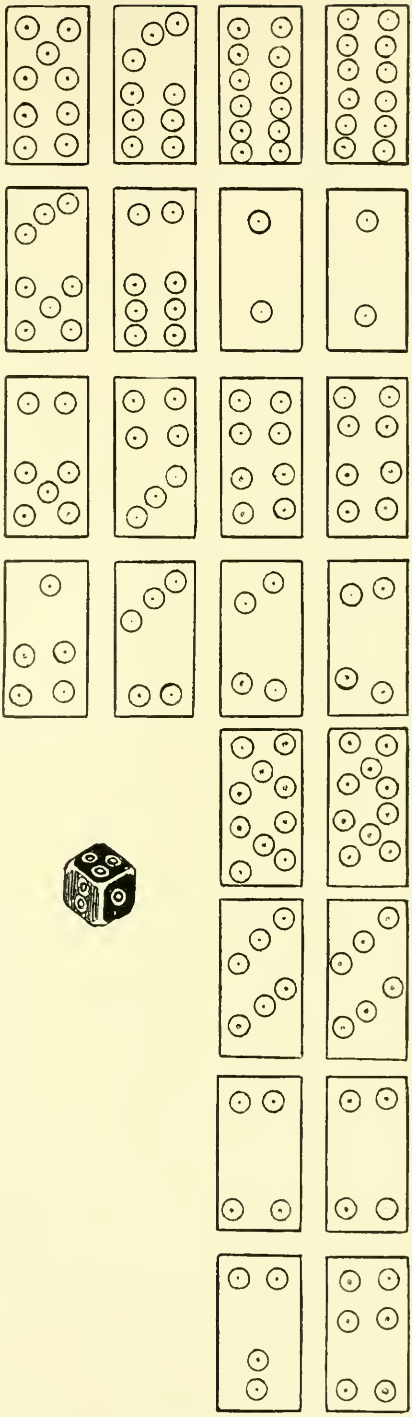
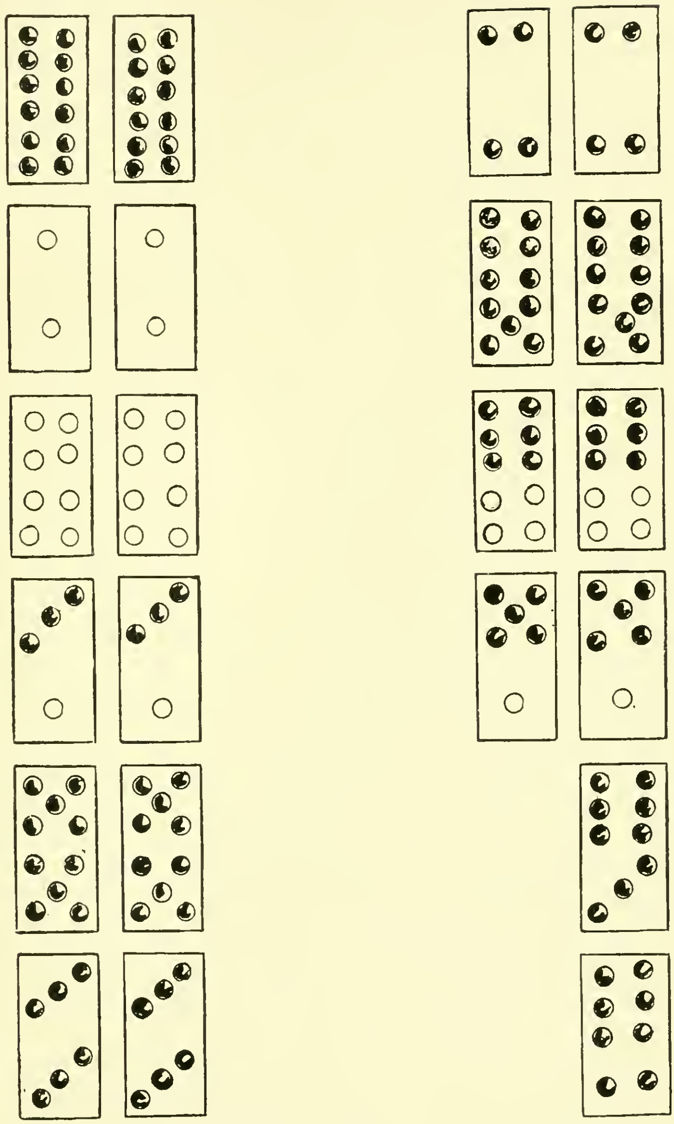
* Ts'ao Ts'ao *D.*, A. D. 220. Chinese Reader's Manual, No. 768.



BURMESE DOMINOES.
Cat. No. 166540, U. S. N. M.



SIAMESE DOMINOES.

SIAMESE DOMINOES.

Dominoes are called in Siamese *tau tem* (Chinese *tá tím*) "arranging or connecting spots." Two sets of dominoes exhibited by the Government of Siam in the Section of Games at the Columbian Exposition consist of 24 thin rectangular tablets of ivory, one with face of $\frac{12}{16}$ by $\frac{6}{16}$, and the other $1\frac{11}{16}$ by $\frac{13}{16}$ inches (pl. 11). The "ones" and "fours" are marked with red and the others with black spots, in the following series: The pieces 6–6, 1–1. 4–4, 1–3, 5–5, 3–3, 2–2, 5–6, 4–6, 1–6, and 1–5 duplicated, and one of each of the pieces 6–3 and 6–2.

ESKIMO DOMINOES.

A set of Innuit dominoes in the U. S. National Museum, Washington, (pl. 12), is described by Mr. Lucien Turner, who conducted the expedition for the Smithsonian Institution in 1884.*

"The Innuit," Mr. Turner says, "who come from the western end of Hudson Strait, the so-called Northerners, have a game which they play with sets of pieces of ivory cut into irregular shapes, and marked on one face with spots arranged in different patterns. The number of pieces in a set varies from 60 to 148. The name of a set is *Á ma zú a lát*, and somewhat resembles our game of dominoes.

"The game is played in the following manner: Two or more persons, according to the number of pieces in the set, sit down and pile the pieces before them. One of the players mixes the pieces together in plain view of the others. When this is done he calls them to take the pieces. Each person endeavors to obtain a half or third of the number, if there be two or three players. The one who mixed up the pieces lays down a piece and calls his opponent to match it with a piece having a similar design. If this can not be done by any of the players the first has to match it, and the game continues until one of the players has exhausted all of the pieces taken by him. The pieces are designated by pairs, having names such as *ka múi tik* (sled), *kaiak* (canoe), *kalé sak* (navel), *á ma zut* (many), *a taú sĭk* (1), *má kok* (2), *pĭng a sut* (3), *si tá mût* (4), and *tá li mat* (5). Each of the names above must be matched with a piece of similar kind, although the other end of the piece may be of a different design. A *kamutik* may be matched with an *amazut*, if the latter has not a line or bar cut across it; if it has a bar it must be matched with an *amazut*.

"This game is known to the people of the Ungava district, but those only who learn it from the Northerners are able to play it. The northern Eskimo stake the last article they possess on the issue of the game. Their wives are disposed of temporarily, and often are totally relinquished to the victor. I have heard of wives so disposed of often sit down and win themselves back to their former owners."

Dr. Franz Boas informs me that the Eskimo name for dominoes means "standing upright side by side."

MISCELLANEOUS GAMES.

Several fanciful games have come to my notice which have been suggested by the European domino game. In the Section of Games in the Department of Anthropology at the Columbian Exposition, Chicago, 1893, a modern French game was exhibited under the name of *Le Magister Dominoes Geographique*, consisting of oblong pieces of cardboard, each bearing on its face a portion of the map of the Valley of the Seine. It was intended to be used for teaching geography. Another game,

* Eleventh Annual Report of the Bureau of Ethnology, 1889–'90, pp. 257–258.

entitled "Evan's Baseball Dominoes," consisted of wooden domino-shaped blocks marked on one face at the ends with the names of the scoring points in the American game of baseball.

INTRODUCTION OF DOMINOES INTO EUROPE.

From the foregoing accounts it will be seen how widely the peculiar Chinese game of dominoes is distributed, from Korea to Burma and Siam. Dr. Gustav Schlegel states that the European game of dominoes is without doubt borrowed from the Chinese, only that in it the philosophic-astronomic elements have been done away with and only the arithmetical retained. I have been unable to discover the connecting links between the two games. The Levant may furnish a clew to the relationship if any such now exists, but I am without information on the subject.

The game seems to date from a recent period in Europe. According to Brockhaus' Conversations-Lexicon, Art "Domino," it was introduced into Germany through France from Italy about the middle of the last century. In England it appears from a writer in Notes and Queries * to have been introduced by French prisoners about the close of the last century.

INVENTION OF THE GAME.

According to a tradition current among the Chinese laborers in the United States, dominoes were invented by *Hung Ming*,† a hero of that popular romance, the *Sám Kwok chí*,‡ for the amusement of his soldiers to keep them awake during the watches of the night in their camp before the enemy. Others attribute them to the ingenuity of *Kéung t'ái Kung*,§ and give a similar reason for their discovery. A Chinese physician, the most scholarly of my informants among his class, insisted that they were invented by *Fán Lai*,‖ whose picture, from a popular illustrated edition of the *Tung chau lit kwok*,¶ is reproduced in fig. 23. Little importance need be attached to these stories, which are given as illustrations of the conflicting statements made by the comparatively uneducated Chinese regarding things which are a matter of record.

Dr. Gustav Schlegel,** quoting from the Chi sz yin kan (*Chü sz' yám káu*),†† states that dominoes were invented in 1120 A. D. by a statesman

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* January 23, 1869.

† Chu-ko Liang (*Hung Ming*), A. D. 181–234. The great counselor of Liu Pei, who owed to the sagacity and military skill of Chu-ko Liang his success in establishing himself upon the throne. (The Chinese Reader's Manual, No. 88.)

‡ Wylie, A., Notes on Chinese Literature, Shanghai, 1867, p. 161.

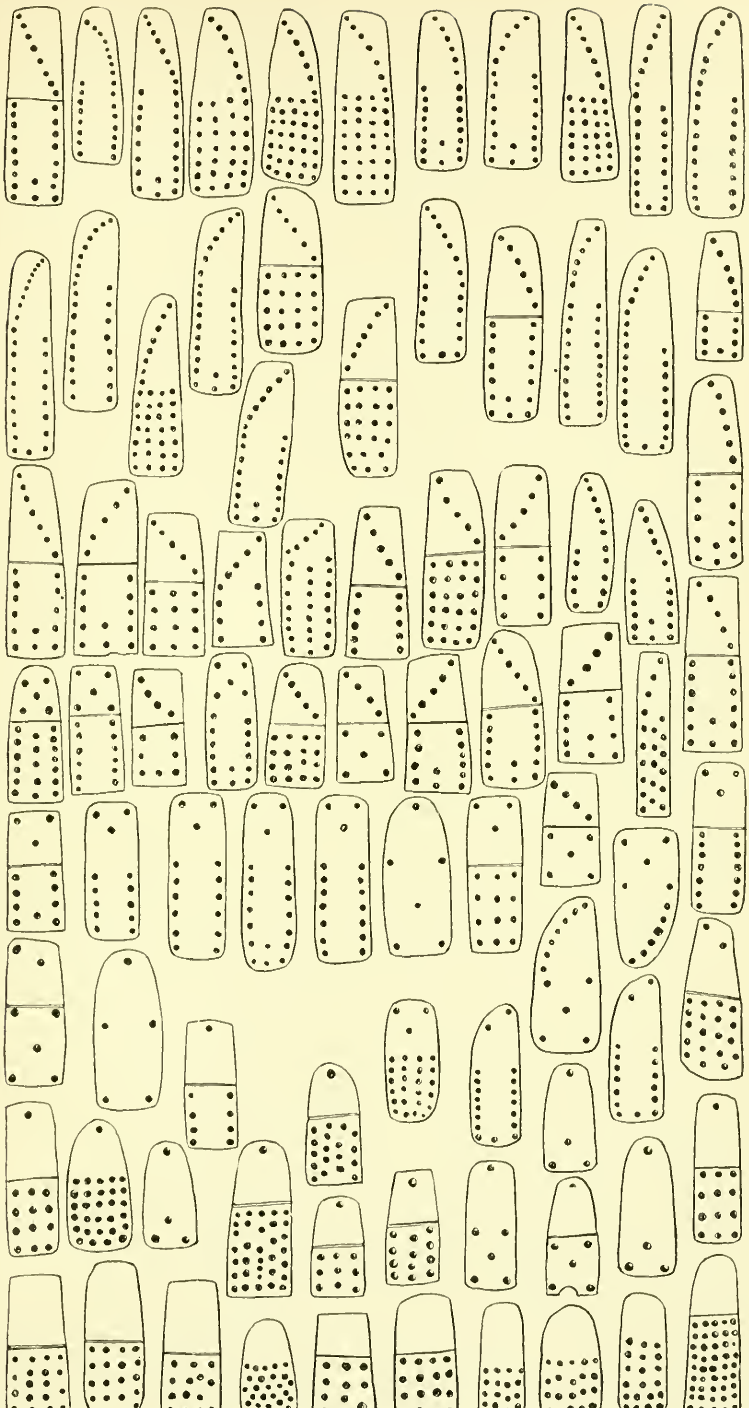
§ Kiang Tsze-ya (*Kéung t'ái kung*) is reported to have been a counselor of Si Peh, twelfth century B. C. (The Chinese Reader's Manual, No. 257.)

‖ Fan Li (*Fán Lai*), minister of Kow Tsien, Prince of Yüeh, whom he aided to overthrow the rival kingdom of Wu, the final victory of which, after twenty years' warfare, was achieved B. C. 473. (The Chinese Reader's Manual, No. 127.)

¶ Notes on Chinese Literature, p. 162.

** Chinesische Bräuch und Spiele in Europa, Breslau, 1869, p. 18.

†† Investigations on the traditions of all things.



ESKIMO DOMINOES.

Cat. No. 76880, U. S. N. M.

who presented them to the Emperor Hwui-tsung, and that the game with its explanation was locked in the imperial treasury and first came into general use in the reign of Hwui-tsung's son, Kao-tsung (1127–1163 A. D.).

Mr. Karl Himly* cites Kánghí's Dictionary as saying that according to general tradition dominos were invented in the second year of Siuen-ho (1120) and circulated abroad by imperial order at the time of Kao-tsung.

Mr. Chatto† quotes the other great Chinese dictionary of the last century, the Ching tsz' t'ung, on the authority of Mr. Samuel Birch, as saying that the cards now known in China as "Teen-tsze-pae" (*tím tsz' p'ái*), or "dotted cards," were invented in the reign of Sinen-ho, 1120, and that they began to be common in the reign of Kao-tsung.

Mr. W. H. Wilkinson has recently shown‡ that in the citation made by Chatto from the Ching tsz' tung, he omits the concluding and most important sentence: "It does *not* follow that this class of games originated in the period Hsüan-ho," and says that the passage, adduced again and again by European writers to prove that cards (dominoes) were first invented in the reign of Siuen-ho, when carefully examined, distinctly declares that such a conclusion would be unsound.

Fig. 23.
FÁN LAI.

"It is perfectly clear," Mr. Wilkinson says, "that all that was done or asked for in 1120 was an imperial decision as to which of several forms of T'ien-kin (Heavens and Nines) was to be considered orthodox. The game and the cards must have been in existence long before. The passage from the Cheng-tză-t'ung runs thus: 'Also ya p'ai, now the instruments of a game. A common legend states that in the second year of the Hsüan-ho, in the Sung dynasty (1120 A. D.), a certain official memorialized the throne, praying that the ya p'ai (ivory cards) might be fixed as a pack of 32, comprising 127 pips (sic, it should be 227, but Chinese printers are careless), in order to accord with the expanse of the stars and constellations. The combination, 'Heaven,' (6—6, 6—6) consisted of two pieces, containing 24 pips, figures of the 24 solar periods; 'earth' (1—1, 1—1) also composed of two pieces, but contained 4 pips, the four points of the compass—east, west, south and north; 'man' (4—4, 4—4) two pieces, containing 16 pips, the virtues of humanity, benevolence, propriety and wisdom, fourfold; 'harmony' (1—3, 1—3) two pieces of eight pips, figuring the breath of 'Harmony' which pervades the eight divisions of the year. The other combinations had each their names. There were four players having 8 cards apiece for their hand, and the cards won or lost according as the number of the pips was less or more, the winner being rewarded with counters. In the time of Kao-tsung

* Zeitschrift der deutscher Morgenländischen Gesellschaft, Band 43, p. 451.

† Facts and Speculations on the History of Playing Cards. London, 1848, p. 55.

‡ The American Anthropologist, Jan., 1895, vol. viii., No. 1, p. 66.

(1127-1163) pattern packs were issued by imperial edict. They are now known throughout the empire as ku p'ai, 'bone pai;' but it does not follow that this class of games, po-sai, ko-wu, and the rest originated in the reign Hsüan-ho."

As the foregoing shows that the historical evidence is inconclusive as to the actual invention of dominoes, and as the Chinese accounts of the invention of other games are not particularly trustworthy, and especially as the history of all games seems to be one of gradual evolution, rather than direct invention, the following pages are devoted

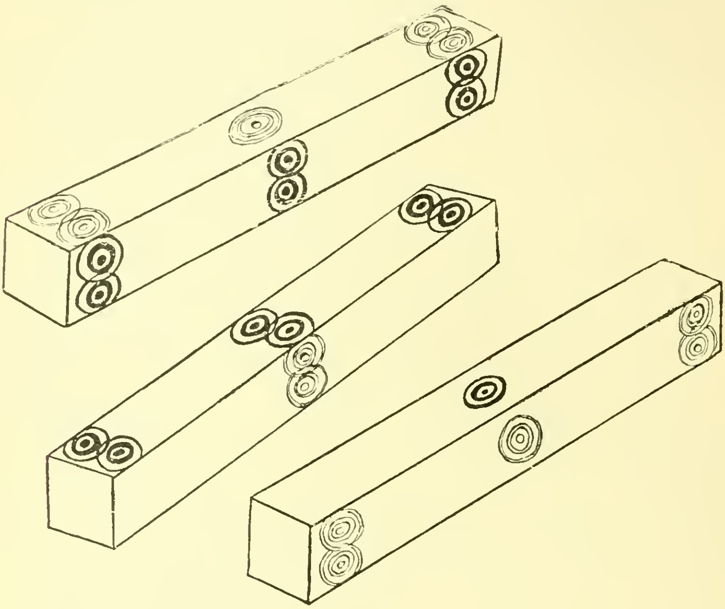


Fig. 24.

PASE (DICE). SET OF THREE FOR CHAUSAR, LUCKNOW, INDIA.

(From specimens in Museum of University of Pennsylvania.)

to an examination into the origin of the game from internal evidences rather than an historical point of view.

DOMINOES A FORM OF DICE.

It is readily apparent that the 21 individual domino pieces represent the possible throws with 2 dice, and that the domino pieces may be regarded as conjoined dice. Of this the Korean dominoes furnish the best material evidence. Consonant with many other Korean objects, they are typical of an earlier age of Chinese culture than that now existing in China.

Their material, color of spots, and the manner in which the "one" spots are incised and made larger than the other spots, complete their resemblance to 2 conjoined dice. If we accept this theory the bone-faced bamboo dominoes may be regarded as directly related to the preceding, the wooden backs being substituted as a matter of economy. Dominoes made entirely of wood would naturally follow, and the long dominoes used in the south of China might be regarded as a later type. Even they bear a suggestion of their origin in the spots with which their ends and tops are decorated.

The names of the dominoes are the same as those of the corresponding throws with the 2 dice, and the pieces are divided, like the dice-throws, into the series of *man* and *mò*, in which they rank in the same order as the dice. The correspondence extends to the game as well, the most characteristic domino game, *tá t'ín kau*, closely resembling the most characteristic dice game, *chák t'ín kau*. Indeed, if dominoes were invented for the purpose of a game, they doubtless had their origin in the game with 2 dice. This game with 2 dice, *shéung luk*, which, according to one Chinese authority, is said to have come from India, finds a parallel in an Indian dice game.

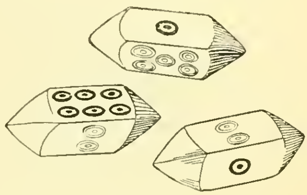


Fig. 25.

PASE (DICE), SET OF THREE FOR CHAUSAR, LUCKNOW, INDIA.

(From specimens in Museum of University of Pennsylvania.)

Several kinds of dice are employed in games in India. One (fig. 24) called *pase* (plural of *pasa*) are used in the game called *chausar*, and consist of rectangular bone or ivory prisms, marked on 4 sides with 1, 2, 5, and 6 spots. These dice are sometimes made shorter and pointed at the ends (fig. 25). Their origin I assign to the staves referred to on page 507. Another kind of Indian dice, called by the Arabic name of *k'ab*, or *kabat*, from *k'ab*, "ankle," "ankle bone," are used in the game of *k'abatain*, 2 dice being thrown. Either natural astragali, consisting of the knuckle bones of a goat, or dice marked on 4 sides with "three," "four," "one," and "six" spots, or cubical dice regularly marked on the 6 sides (fig. 27) are employed. The "four" spots on these dice are usually marked in red, and often both the "three" and "four" are marked in this color.* Thus cubical dice appear to be

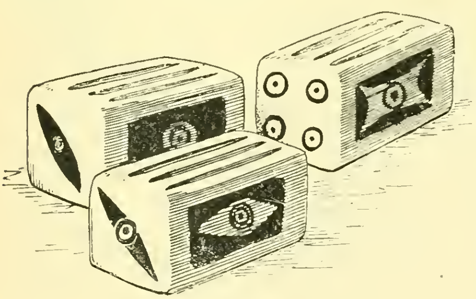


Fig. 26.

SET OF LONG DICE: CELEBES.

* This account of *k'ab* was communicated to the writer by the Hon. Syad Mohammed Hadi, of Sultanpur, India. Two sets of ivory dice, received by the writer from Lucknow, are cubical, and marked on their 6 sides with from 1 to 6 spots, in the same manner as our common dice. The "fours" alone are in red.

directly connected with the knuckle bones. The Arabic name for the knuckle bone and the die is the same, *k'ab*, and, like the knuckle bones, which are commonly thrown in pairs, natural pairs from the right and left leg being used, cubical dice are also thrown in pairs. Carrying out the resemblance, cubical dice in India are sold in pairs, and by varying the arrangement of the "threes" and "fours"* are actually made in pairs, rights and lefts, like the knuckle bones. If this is the true history of the descent of the cubical dotted die, its evolution must have occurred at a very early time, as the regularly marked stone die from the Greek colony of Naucratis, Egypt (fig. 28), assigned by the discoverer, Mr. Flinders Petrie, to 600 B. C., bears witness.

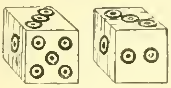


Fig. 27.

KABATAIN—PAIR OF IVORY DICE: LUCKNOW, INDIA.

(From specimens in Museum of University of Pennsylvania.)

Now, the 4 sides of the knuckle bone (*talus*) (fig. 30), which were designated among the Romans as *supinum*, *pronum*, *planum*, and *tortuosum*, and correspond with the numbers "three," "four," "one," and "six," receive in the Mohammedan East the names of ranks and conditions of men. The Persians, according to Dr. Hyde,† name them, respectively, "*duzd*," "slave," "*dihban*," "peasant," "*vezir*," "viceroy," and *shah*, or *padi-shah*, "king." Similar names are given by the same author as applied to them by the Arabs, Turks, and Armenians. From this it appears that the names and rank given to the significant throws, "three," "four," "one," and "six," with knuckle bones and dice in Western Asia find their counterparts in the names and rank of the same throws in China, the names of the classes of human society found among the Arabs being replaced in China with the terms for the cosmic powers: "Heaven" ("six"), "Earth" ("one"), and "Man" ("four"), and the "Harmony" ("three-one"), that unites them. It will also be observed that the use of 2 dice, which appears to follow that of the natural pair of knuckle bones, and is displayed in the Indian *k'abatain*, and the ancient and widely diffused game of backgammon, is paralleled by the use of 2 dice in China, where *shéung luk* (Japanese, *sugoroku*)

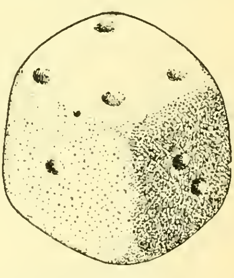


Fig. 28.

STONE DIE: NAUCRATIS, EGYPT.

From specimen in Museum of University of Pennsylvania.

* If a Chinese die be turned ace up and revolved toward the person holding it so that the "two," "five," and "six" are disclosed in succession, it will be found that the "three" is usually to the left and the "four" to the right, while the opposite is more usually the case on European dice. In the Indian dice here referred to, this arrangement is alternated, one having the "three" on the right and the other on the left.

† De Ludis Orientalibus, p. 147.

is a common name for dice play. It has been observed that the "threes" and "fours" are marked in red on Indian dice, while in China the "ones" and "fours" are so marked. The *Wak kan san*

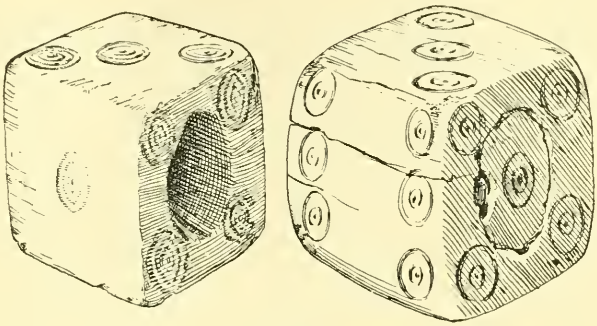


Fig. 29.

ANCIENT ROMAN DICE OF IVORY.

(From specimens in Museum of University of Pennsylvania.)

sai relates that in the game of *Sugoroku* the throws receive the following names:

Chio ichi, "double one."	*Shiu shí*, "vermilion four."
Chio ni, "double two."	*Chio go*, "double five."
Shiu san, "vermilion three."	*Chio roku*, "double six."

From this it would appear that the dice anciently used in Japan and China had the "three" and "four" marked in red* like the Indian

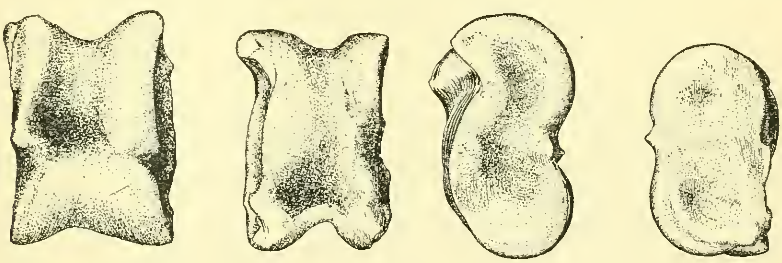


Fig. 30.

THE FOUR SIDES OF A KNUCKLE BONE.

After Hyde.

k'abat, instead of the "one" and "four," as is the present custom—an additional argument in favor of the Indian origin of the Chinese dice. Two questions remain to be answered:

*A pair of miniature Japanese ivory dice, presented to the writer by Prof. Henry H. Giglioli, of Florence, Italy, have the "threes" and "fours" marked in red.

Where and for what purpose were the dice-throws united in the domino form, and why was the number of the domino pieces increased from 21 to 32? Dominoes are unknown in India as a native game, but as it seemed possible that they might have had their origin there for use in fortune telling, the writer made a careful examination of the principal East Indian systems of fortune telling with dice, but the results did not throw any light upon the origin of dominoes.* The Thibetan astrologers, according to Schlagintweit,† use dice which are either cubes like European ones, or rectangular parallelopipedons, sometimes comparatively very long; the latter, in consequence of their form, having two sides blank. This description agrees with the preceding Indian dice used in fortune telling, which I regard as derived from the game with staves, but the faces of a die (fig. 32), which Schlagintweit figures as used by the Thibetans for astrological purposes, suggests a domino in the duplication of its spots.‡

Fig. 31.

ANCIENT GLASS ASTRAGALI: SYRIA.

(From specimens in Museum of University of Pennsylvania.)

The astrological associations of the domino game have not thrown

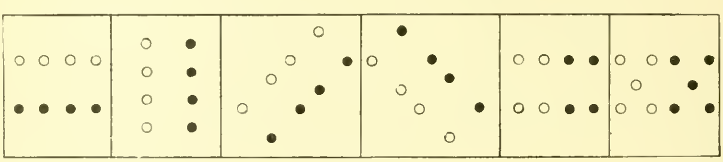


Fig. 32.

FACES OF TIBETAN DIE USED FOR ASTROLOGICAL PURPOSES.

From Schlagintweit.

light as yet upon the question of its origin. They have been referred to in connection with the method of telling fortunes, and it has been observed that the disks accompanying the bamboo dominoes from Fuhchau bear the names of the cyclical animals. It will also be noticed that the terms *ün* and *ngáng*, "weak" and "strong," applied to the pairs in the game of *k'ap t'ái shap*, p. 513, are the same as those used to designate the broken and undivided lines in the *Yik King*, and that

* Report of the Proceedings of the Numismatic and Antiquarian Society of Philadelphia, 1890–91, p. 65.

† Buddhism in Thibet, London, 1863, p. 315.

‡ Col. W. W. Rockhill informs me that he never saw dice used in Thibet except for fortune telling. According to Col. Rockhill, the Thibetan name for dice is *sho*, and a person who throws dice, *mo jyab ken*. He tells me that he always saw four dice used in Thibet and North China. These dice have no "six." There is a picture of the god *Pal-dan-hlamo* holding a bag of dominoes or dice in the superb Thibetan collection deposited by him in the U. S. National Museum.

the diagram (fig. 33)* which is given by Legge † as the accepted form of the *Lok Shü*, or "Lo writing," which is referred to in the *Yik King* as one of the sources of inspiration for its broken and undivided lines, ‡ is composed of light and dark circles similar to the domino dots.

I may suggest, in conclusion, that dominoes may have been first used as counters or tallies in a dice game or in a method of fortune telling with dice. They existed in their present form in China in the year 1120 A. D., according to the Chinese records, with similar astrological associations as at the present day. They are clearly descended from dice, and particularly from that game with two dice which appears to have been introduced into China from western Asia.

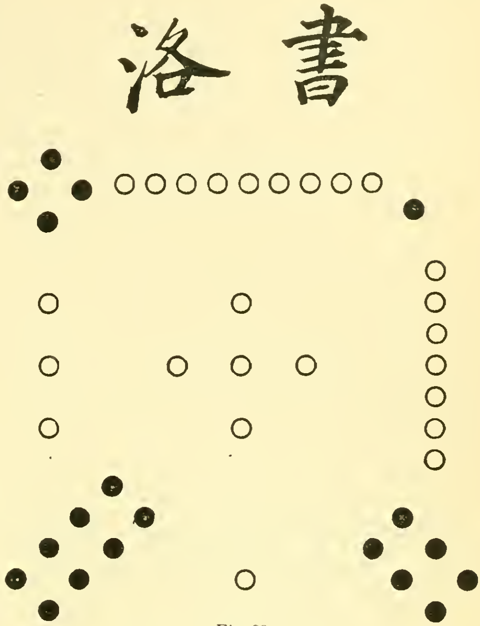


Fig. 33.

LOK SHU, OR "LO WRITING."

* This diagram coincides with the most renowned of the arithmetical squares which are used as charms both by Hindus and Mohammedans in India. It is usually written as below, an inversion of the Chinese arrangement.

6	1	8
7	5	3
2	9	4

This square appears in its numerical form on the Thibetan charts, reproduced by Schlagintweit, where it is arranged in the Chinese order.

It is believed in India, said one of my Mohammedan informants, that to write this charm will bring good look and money by honest means. The object for which it is used is always written beneath it. He told me that his grandfather wrote it every day after prayers and would place beneath it the words *rizk*, "bread," or *chardj*, "expenses." Such numbered diagrams are cut in squares, each containing a number. These are made into pills with wheaten bread and thrown into a pond or river to be eaten by fish.

Another Indian, a Hindu, says that this magic square is called in Hindustani *Pundra no yuntra*, or the "15 yuntra."

It is written both with numerals and with dots. In the latter case the set of dots from 1 to 9 frequently are made each of a different color and certain names are given to them.

It is not improbable that this diagram was borrowed by the Chinese from India, and that, too, at a much later period than is usually assigned to it by the Chinese. The writer found a copy of it—in Arabic numerals, among the written charms in a soldier's kit captured in Tonquin—in the Municipal Museum of the city of Havre.

The spots, like those on the dice, are doubtless survivals of a primitive system of notation, like that which existed in Mexico at the time of the Conquest.

† Legge, Rev. Dr. James, The Yê King, Oxford, 1882. Introduction, p. 18.

‡ *Ibid.*, Appendix III, Sec. 1, par. 73.

THE ONYX MARBLES: THEIR ORIGIN, COMPOSITION, AND USES, BOTH ANCIENT AND MODERN.

BY

GEORGE P. MERRILL,

Curator, Department of Geology, U. S. National Museum.

THE ONYX MARBLES: THEIR ORIGIN, COMPOSITION, AND USES, BOTH ANCIENT AND MODERN.

By George P. Merrill.
Curator, Department of Geology, U. S. National Museum.

"It now remains for us to speak of stones, or in other words, the leading folly of the day; to say nothing at all of our taste for gems and amber, crystal and murrhine vases. For everything of which we have previously treated (down to the present book) may by some possibility or other have the appearance of having been created for the sake of man; but as to the mountains, nature made these for herself, as a kind of bulwark for keeping together the bowels of the earth; as also for the purpose of curbing the violence of rivers, of breaking the waves of the sea, and so, by opposing to them the very hardest of her materials, putting a check upon those elements which are never at rest. And yet, we must hew down these mountains, forsooth, and carry them off; and this for no other reason than to gratify our luxurious inclinations."—Pliny.

Since very early times civilized man has shown an ever increasing tendency to decorate his home and his temples with objects beautiful and rare. With but a limited knowledge of metallurgy, with methods of manufacture crude in the extreme, the scope of his means was at first limited to such materials as nature had already prepared for his use or as could be wrought into objects of beauty by the few arts at his command. It is but natural, therefore, that the gems and precious stones early came into demand for household as well as personal adornment, while the marbles and alabasters, the granites, porphyries, and more vulgar lime and sandstones became equally desirable for purposes of interior decoration and for the rougher exteriors of houses and palaces, temples and tombs, wherever civilization had gained sufficient foothold to render them objects of admiration, or where a desire for immortality had spurred the builder to seek a less perishable material than wood.

Hence it is that the onyx and sardonyx, the diamond, the opal, and the pearl, as well as marbles and alabasters were thousands of years ago as well known and—among the wealthier classes—even more universally used than to-day. It is indeed a singular fact that in all these years that have elapsed since history began, scarcely a gem or ornamental stone of more than local importance has been discovered but was known, in at least some of its varieties, and utilized by a people so ancient that we can read their history only in their ruins.

Among the most beautiful of the many stones thus used for both building and for interior decoration, were certain travertines and cave deposits, the so-called onyx marbles, or oriental alabasters, the *lapis oniscus*, or *onychites*, of the Romans. It is the purpose of the writer to present herewith in considerable detail the results of his own researches and observations on this class of rocks, together with so much additional information as can be gleaned from available sources.

It is unfortunate in our discussion of the subject in hand, that both the popular names by which these stones are known are erroneous and misleading. The term onyx as properly used, includes a banded variety of chalcedony—a purely siliceous rock—the name being derived from the Greek ονυξ or ονυχιον, a nail, in allusion to the wavy bands by which the stone is traversed, and its translucency, both of which are characteristics of the nails upon the hand. That such a name should have become applied to this particular variety of travertine is by no means strange, since both the characteristics of banding and translucency are often as pronounced as in the true onyx. And, inasmuch as the name has become too firmly engrafted upon the literature to ever become wholly eradicated, it is the name used here, but in its adjective form only, as descriptive of a kind of marble.

The term alabaster as applied to the stone is even more misleading than onyx, since both stones are used for much the same purposes, and when reading published accounts we are not infrequently at a loss, unless descriptive qualities are mentioned, to know at all times whether the material under discussion is a true alabaster (gypsum) or an onyx marble. Thus Chateau * states that the alabasters are translucent, of a greater hardness than the marbles proper, and are hence more expensive to work. Finally he says the alabasters "présentent des veines festonnées et onduleuses, que l' on ne remarque jamais dans les marbres avec cette même irrégularité." It is obvious that this is a travertine and not a true alabaster. Again (on p. 453) he speaks of "*L'alabatre dur*," or "*calcaire*," having a yellow or variegated tint, and which is found in grottos and caverns in calcareous rocks. The "*alabatre tendre*" or "*gypseux*" of this writer is the true alabaster.

Pliny, the elder, from whom we quoted at the beginning of this article, wrote with an equal lack of perspicuity, though this perhaps is to be little wondered at. He says: "Our forefathers imagined that onyx was to be found only in the mountains of Arabia, and nowhere else, but Sundines was aware that it is also found in Carmania. Drinking vessels were made of it at first, and then the feet of beds and chairs. Cornelius Nepos relates that great was the astonishment when P. Lentulus Spinther exhibited amphoræ made of this material, as large as Chian wine vessels in size, 'and yet five years after,' says he, 'I saw columns of this material, no less than 2 and 30 feet in height.' At a more recent period again some change took place with reference to this stone,

* Technologie du Batiment, Vol. II, p. 448.

for four small pillars of it were erected by Cornelius Balbus in his theater as something quite marvelous. Ajassen, however, thinks these were of yellow jasper or sardonyx, and I myself have seen 30 columns of larger size in the banqueting room which Callistres erected."

Again, "this stone is called 'alabastrites' by some, and is hollowed out into vessels for holding unguents, it having the reputation of preserving them from corruption better than anything else. In a calcined state it is a good ingredient for plasters. That which is of a honey color is the most esteemed, covered with spots curling in whirls and not transparent. Alabastrite is considered defective when it is of a white or horn color, or approaching to glass in appearance."*

"Alabastrites is a stone which comes from Alabastron in Egypt and Damascus in Syria. It is of a white color, spotted with various tints. Calcined with fossil salt and pulverized, it is a cure for affections of the mouth and teeth, it is said."†

"Ajassen remarks that under this name (alabaster) the ancients meant, first, yellow, calcareous alabaster, and, secondly, chalcedony, unclassified."‡

It seems most probable that the drinking vessels and feet of chairs and beds referred to in these quotations were of the true onyx (chalcedony). The amphoræ and large columns, on the other hand, were most likely of the onyx marble (travertine or stalagmite). The alabastrites, which on being calcined is good for plasters, would seem at first thought to be a true alabaster (calcium sulphate) since this when thus treated yields the well-known plaster of paris. I have as yet, however, to learn with absolute certainty of the use of the sulphate by the Egyptians for the purpose he mentions—that of making vessels for holding unguents; and, inasmuch as the calcium carbonate would yield quicklime on calcining, it seems most probable that the material referred to in the second and third quotations from Pliny's work was of the last-named material.

In the descriptions of St. Marks Cathedral at Venice, as given by Baedecker and others, mention is made of an altar with "four spiral columns of alabaster, said to have once belonged to the temple of Solomon, of which the two white ones in the middle are semitransparent." To one at all acquainted with the physical properties of the true alabaster it seems impossible that the material can be other than an onyx marble or perhaps chalcedony.

The above illustrations together with the references which follow will serve to show the confusion existing in the literature on the subject.

The derivation of the name is interesting, and may well be dwelt upon briefly here. The original Greek word from which our word

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* Pliny, Natural History, Book XXXVI, chap. 12.

† *Ibid.*, Book XXXVII, chap. 54.

‡ *Ibid.*, Vol. VI., p. 399.

alabaster was derived was *αλαβαστρος*, or *αλάβαστρον*, and is said to have been derived from *α*, not, and *λαβή*, a handle, or *λαβεῖν*, to hold, in allusion to the little handleless, phial-like, or amphora-shaped perfume vessels constructed from it. But the word after a time passed from the thing made to the substance of which it was made, though Pliny mentions an Egyptian town called Alabastron, where the manufacture of the vessels was carried on. The ancient Roman name of the stone was alabastrites.* Be this as it may, the name alabaster, as now used by all authorities, applies only to a white, though sometimes variously veined and mottled variety of gypsum, a calcium sulphate, while the onyx marbles with which we have to do in this work, are of calcium carbonate and mineralogically either aragonite or calcite, principally the latter.

ORIGIN AND MODE OF OCCURRENCE.

The origin of these stones is purely chemical, and of interest on account of the very simplicity of the process. Simple and well known though it may be, we are apparently not yet able to account in a manner entirely satisfactory for the varying physical conditions, as texture and hardness or form of crystallization, under which the material occurs. Pure water, although an almost universal solvent, nevertheless acts so slowly upon most substances belonging to the mineral kingdom that the results are quite inappreciable to the ordinary observer. When, however, holding minute quantities of carbonic acid, and especially when, as deep in the surface of the earth, it is under considerable pressure, its solvent property is very considerably augmented, and results are produced both in the way of solution and redeposition which are readily noticeable, even to the most casual observer.

One of the most common mineral substances found in aqueous solution is carbonate of lime, the essential constituent of ordinary limestones and marbles, as well as of the beautiful onyx marbles, as we shall notice later. It is to be found in the water of all springs, streams, lakes, and seas, and furnishes the means whereby the multitudinous shellfish and corals build up their calcareous shells and skeleton-like supports. Pure water will dissolve only 1 part in 10,800 when cold and 1 part in 8,875 when boiling. When the water is saturated with carbonic acid gas at ordinary atmospheric pressure and a temperature of 10° C., its capacity for solution is increased to nearly 1 part by weight in 1,000 (0.88 grams per liter of water). With an increase in pressure the amount of carbonic acid that can be held by water is also increased, and there is as a natural result an augmentation in its solvent power. The maximum amount of lime which can be dissolved, even under the most favorable circumstances, is stated by Roscoe and

*JONES, T. RUPERT. Demonstration on the marbles and other monumental stones in the British Museum.—(Proceedings Geologists Association, Vol. VIII.)

Schorlemmer to be about 3 grams per liter of water, or 3 parts by weight to 1,000.

As has long been known, it is to the escape from solution of half the combined carbonic acid, aided in some cases by the secreting power of algous vegetation, that is due the deposition of the lime carbonate in the form of sinters and tufas about the orifices of springs, in that of scale in steam boilers and other vessels, or in the form of stalagmitic and stalactitic deposits in caves. With its solvent power diminished by the loss of the acid gas, the water deposits its load as rapidly as the gas escapes.

Now, although we know this to be the process by which the calcareous deposition takes place, we do not know absolutely just what are the conditions which control the character of the deposit as regards compactness and condition of crystallization. Why in some cases the deposit should be so compact as to be susceptible of an enamel-like polish, and of such colors as to make a beautiful marble, or again light and tufaceous like those now forming at the Mammoth Hot Springs in the Yellowstone National Park, or the more compact *lapis Tiburtinus* of Tivoli, Italy. Such synthetic work as has been done fails to throw much light upon the subject. G. Rose* has shown that by humid methods it is possible to produce out of the same solution crystals of both aragonite and calcite, the one or the other forming according to the temperature of the solution. Aragonite was formed exclusively by a rapid evaporation of hot solutions, while calcite was produced from similar solutions, both hot and cold. As the investigations here chronicled have shown the onyx marbles to be almost invariably of calcite, it is at once evident that we must look for other controlling conditions than those of temperature for a satisfactory solution. Such literature as bears upon the subject enables us, however, to draw, from analogy, certain conclusions, and it may not be without interest to refer here briefly to the expressed opinions of others. Thus Dr. Edward Hitchcock, writing half a century ago, says:†

"I have alluded to the deposition of marble, or alabaster, by certain springs in the vicinity of Lake Oroomiah (Persia). What is called the Tabrez marble has been repeatedly described by travelers; but I doubt whether definite geological ideas have yet been entertained respecting the mode of its formation. With the exception, perhaps, of a deposit of travertine around Rome, in Italy, resembling statuary marble, I am not aware of any case besides those around Oroomiah in which the most beautiful marble is produced by springs. The Tabrez marble is usually of a yellowish or light blue color, perfectly compact, and so translucent that it is used in thin slices for the windows of baths and other places, like the phengites of the ancients. * * * The common opinion is that the springs now deposit it; but one or two facts have led me to suspect that this may not be the case. Above the marble there lies a deposit, several feet thick, of common tufa, or travertine. Now, my suspicion is that this tufa is all the deposit which has been formed since the springs

* Fouque and Levy, Synthèse des Mineraux et des Roches.

† Transactions of the Association of American Geologists and Naturalists, 1840–'42, pp. 414–415.

assumed their present state, and that the alabaster was deposited when their temperature was higher, and when, perhaps, they were beneath deep waters. However, this opinion is little better than conjecture."

Bischoff,* in discussing similar phenomena, says:

"It is interesting to know that mineral springs can deposit granular limestone. I doubt whether hot springs are better suited to this than cold, from which the deposition takes place slower than from the former; but the slower the $CaCO_3$ is deposited, the more likely is it to assume a crystalline form."

J. L. Smith, writing of the thermal waters of Hierapolis, says: †

"The amount of water is very great, and it is so highly charged with carbonate of lime as to incrust all bodies that it comes in contact with, and it takes place so rapidly that the concretion does not possess great solidity, and frequently has a granular form, resembling driven snow."

W. H. Weed, in writing on the deposition of calcareous matter by the waters of the hot springs of the Yellowstone National Park, says: ‡

"Another variety * * * is that which forms the lining of hot-spring ventholes. This is deposited comparatively slowly, and occurs in shelly layers half an inch to 3 inches thick, with a smooth, rounded, and globular surface. It is crystalline and marble-like and pure white. This travertine is a crystallization out of a supersaturated solution of carbonate of lime, due to the relief of pressure as the waters approach the surface. A similar deposit lines the ventholes of the Orange and other springs, and is analogous to the deposit so quickly formed in the conduit pipes leading the hot water to the hotel baths, also due to supersaturation, experiments showing that such solutions do not deposit their excess of lime at once, but in the course of a short time."

Bearing in mind that these onyx marbles are of calcite, and so compact as to acquire under proper manipulation an enamel-like polish, and further that, as noted later, they are all superficial deposits, it remains to formulate our own opinions regarding their origin and to note how far they differ, if at all, from those above given. It is well to note, at the very outset, that while there is no apparent doubt but that, with the exception of the deposits in caves (see p. 550), the onyx marbles are the result of spring action, I have been able to learn of no single instance in which material of this nature is now forming, the recent deposits invariably taking a tufaceous structure. It is singular, to say the least, that widespread phenomena due to purely local causes should be so nearly synchronous in action and that we should be living in an age of cellular deposition only.

It is evident that, so far as their mineralogical nature is concerned, the onyx marbles may be products of deposition from water of any ordinary temperature, hot or cold. Accepting the fact that such deposition would take place more slowly from a cold than from a hot solution, and that the more slowly deposition takes place the more likely is

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* Chemical and Physical Geology, Vol. I, p. 152.

† Original Researches, p. 64.

‡ Formation of Travertine and Siliceous Sinter by the Vegetation of Hot Springs. Ninth Ann. Rep., U. S. Geological Survey, 1887-'88.

the deposit to assume a crystalline structure, we might at first thought conclude these to be cold rather than hot water deposits. Bearing in mind, however, that they bear evidence of comparatively rapid growth, such as would indicate deposition from waters of a high degree of saturation, it would seem more probable that at the time of issuing the waters were comparatively hot, and perhaps under conditions of considerable pressure as well as saturation.* The tendency of such to immediately lose their excess of carbonic acid and deposit a light tufaceous travertine or sinter, as upon the immediate surface at the Mammoth Hot Springs, would be checked provided the discharge took place in pools of quiet water. We know that deposits sufficiently compact to receive a polish are sometimes formed in steam boilers, where, however, more than ordinary degree of saturation prevails and under unnatural conditions of pressure.† The onyx deposits being, however, purely superficial, no such conditions of pressure could exist, and we must apparently fall back upon such conditions as should retard the loss of carbonic acid and thus cause the deposit to take place more slowly. Such conditions, we may fairly assume, would exist at the bottom of pools of water, and it is under such conditions, in the writer's opinion, based upon observation as well as on theoretical grounds, that the onyx marbles have been formed. To account, then, for the alternating tufaceous and compact character of the beds which everywhere exists, we have to make only the natural assumption that the temperature of the water and its degree of saturation periodically varied, the variation being accompanied perhaps by a difference in volume or place of discharge, whereby the water hitherto accumulating in pools, ran off almost immediately, permitting a rapid loss of carbonic acid and an equal rapid diminution in temperature. This intermittent character of the deposition, and in fact the general history of onyx formation is, so far as my own experience goes, best shown in a region rather difficult of access known locally as the Tule Arroyo, a deep cañon or ravine on the peninsula of Lower California, some 150 miles south from San Diego, and 15 to 20 miles from the gulf coast. The country rocks here are nearly black mica schists and blue gray silicified limestones and quartzites standing nearly vertical with a strike some 20° west of north, the whole being cut by the ravine, or arroyo, as it is called by the Mexicans. On the steep slopes of the hills on either side, and before the ravine had assumed anything like its present depth, springs have from time to time gushed out and deposited their calcareous load upon the surface over which they flowed. As a rule the first material

*The fact that nearly every deposit of this nature of which I have thus far found trace is in a region of comparatively recent volcanic activity increases the probability of their being hot-spring deposits.

†The writer has in his possession such a crust some 5 c. m. in thickness, taken from the boiler of an ocean steamer plying between New York and Portland, Me. In this case, however, the mineral is anhydrite (anhydrous sulphate of lime) rather than a carbonate.

thus deposited was a dull-colored cellular travertine which cemented together the angular fragments of older rocks with which the slopes were strewn, giving rise to a coarse conglomerate, or breccia. After this had gone on for some time and the travertine layer had grown, it may be, to several feet in thickness, the conditions changed as I have attempted to outline above, and the deposit took the form of the compact and beautifully veined and tinted stone to which the name onyx is commonly applied. In time the onyx-forming action ceased in its turn, and for a period no calcareous deposition whatever took place, the slopes becoming once more covered with angular particles of older rocks from higher up, these in their turn becoming cemented into breccias when the springs resumed their work. In this way were built up the alternating layers of breccia, tufa, and onyx, until finally all deposition practically ceased, and spasmodic but fiercely rushing streams cut the arroyo to its present depth, exposing in either wall the irregularly alternating beds described. In the bottom of the cañon still exist two diminutive springs, each building up in its feeble way small beds of tufaceous material. The water still flowing is so highly carbonated as to bubble like a glass of Vichy fresh from the fountain, and leaves, when drank immediately, a pleasant prickly sensation in the mouth and throat.

In discussing the origin of the onyx marbles, it is perhaps but fair to question the possibility of their having been originally deposited as tufaceous materials, and subsequently compacted and crystallized by pressure, heat, and percolating solutions, or other of the ordinary agents of metamorphism. This can be best answered by pointing out the alternating character of tufaceous and compact layers. It is difficult to conceive of conditions such as should have metamorphosed any one bed without affecting, in the least, those either above or below, or both. The wavy, undulating lines of deposition, comparable with the rings of growth upon a tree, are well defined and unbroken, and though differing frequently from one another in color and crystallization preserve their parallelism and individuality throughout. (See pls. 1 and 3.) There are apparently good reasons for supposing the material to have been deposited as we now find it, the crystallization being contemporaneous with deposition, as is the case with the stalagmitic material in caves.* The wonderful variations in color, even in the same block or slab, are, however, in part due to changes subsequent to their deposition, and it may be well to dwell upon this branch of the subject in considerable detail. Few rocks possess so wide a range of colors or shades of the same color. Pure white, opaque, milk or chalk white to almost colorless, gray, brown in hues from light ochre to deep mahogany, buff, amber, ochre yellow, pink, red, and green are all common; the

*These latter deposits do, however, in some cases undergo a recrystallization whereby the whole internal structure is modified without change of external form, as I have mentioned elsewhere.

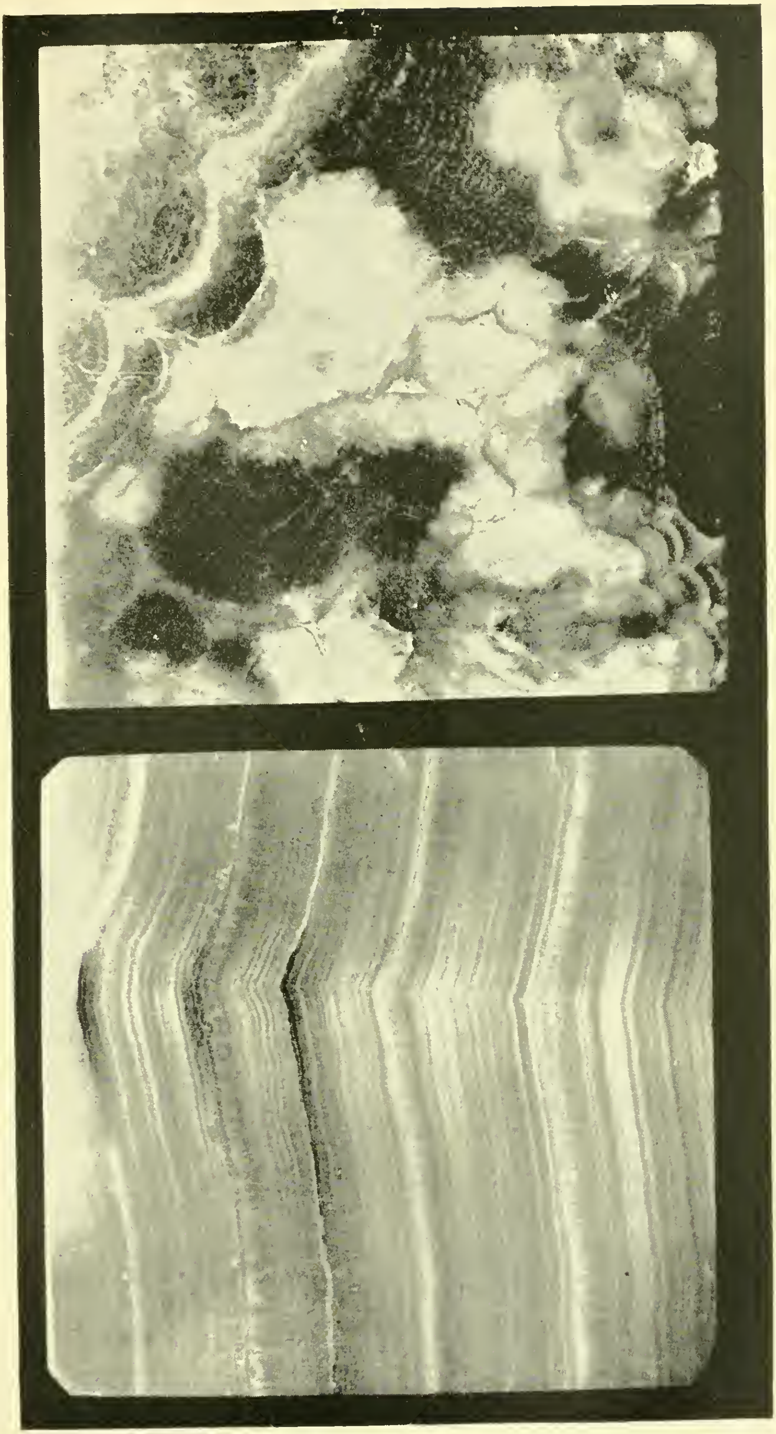
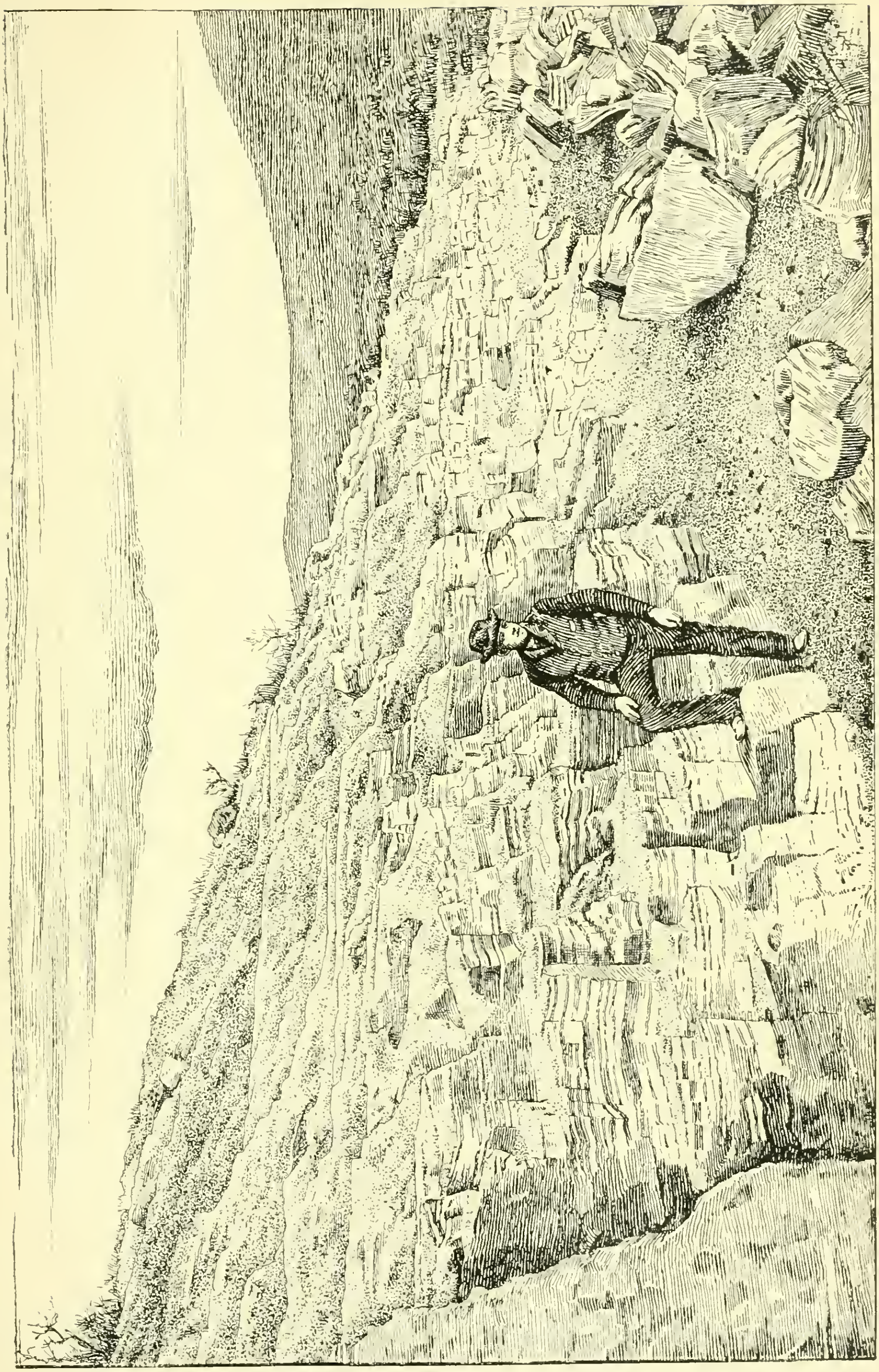


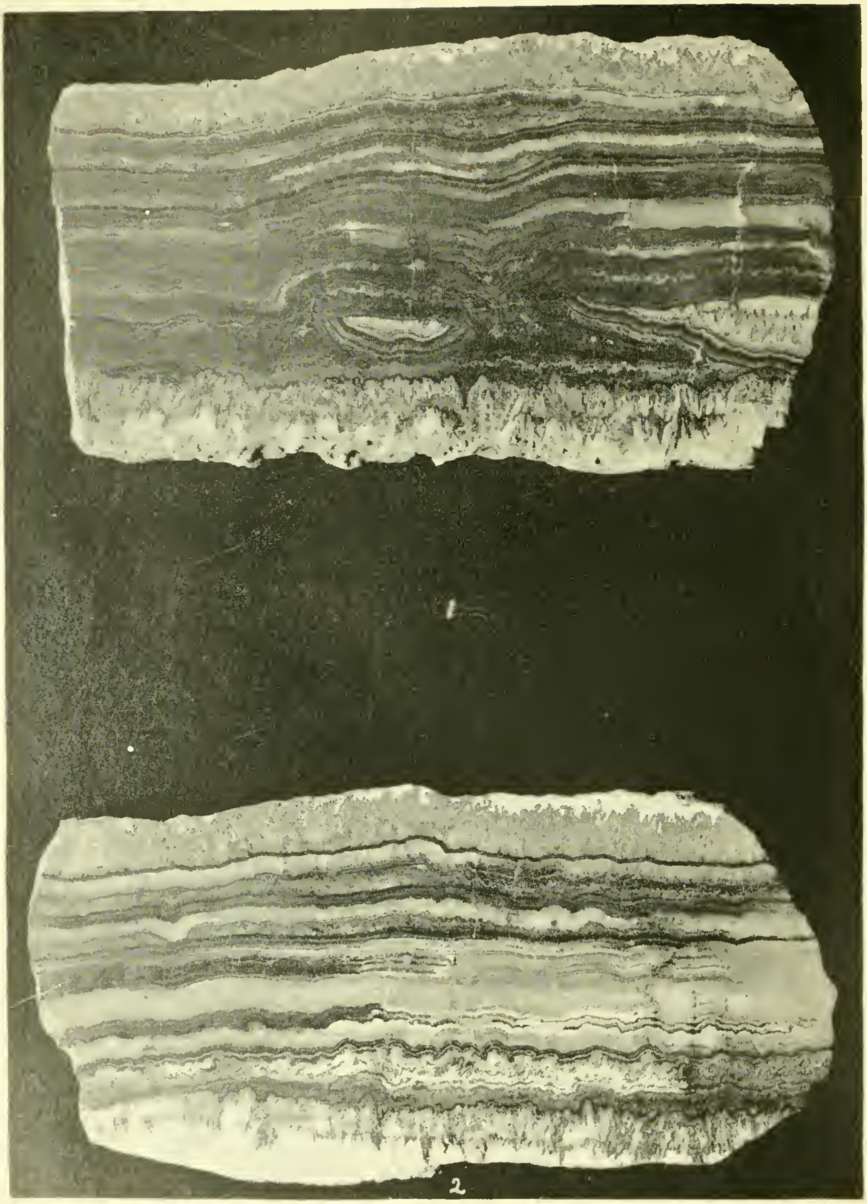
Fig. 1. Section across plane of deposition. Cat. No. 37640, U. S. N. M. Mexico.
Fig. 2. Section parallel to plane of deposition. Cat. No. 28638, U. S. N. M. Italy.

ONYX MARBLES.
Natural size.



CUT IN HILLSIDE SHOWING LAYERS OF TRAVERTINE, MAYERS STATION, ARIZONA.

Drawn from a photograph.



SLABS OF ONYX MARBLE CUT ACROSS PLANE OF DEPOSITION TO SHOW BANDING.
Cat. No. 67000, U. S. N. M. Mayers Station, Arizona.
The colors are white, greenish, and brown.

various hues being sometimes constant throughout large masses, sometimes intermixed and blended, sometimes occurring in alternating parallel bands, and sometimes in distinct veins and spasmodic dashes. In the majority of cases the coloring matter is supposedly iron in some of its forms, aided in part by manganese; in any case the apparent color may be modified by conditions of crystallization and structure, a clear translucent stone, by transmitted light, appearing much lighter and of more delicate tints than one that is opaque.* Assuming that the color constituents are only the two metals named, it yet remains to account for their presence and explain the conditions under which they give rise to such a variety of hues. It is easy and presumably correct to assume that the coloring matters were deposited contemporaneously with the calcite, but we must not in accepting this overlook the fact that these substances are unequally soluble, and under proper conditions would not be deposited together at all, but would undergo a process of natural separation. As is stated by Bischof,† water which contains carbonate of lime and protoxide of iron "may, when it passes for long distances in contact with the air, finally deposit pure carbonate of lime." This, for the reason that the iron early becomes converted into the condition of sesquioxide and is deposited almost at the start. We can here account for their intimate association only on the supposition that at the time of deposition the water was not flowing, but lying in quiet pools where oxidation as well as loss of carbonic acid was retarded. The variation in color of the bands might thus be in part accounted for on the supposition that the waters, as they issued, contained at times varying amounts of the oxides mentioned. (See pl. 3). ‡

In fact, however, the varying hues are by no means due wholly to the proportion of metallic oxides, but rather to the conditions under which these oxides exist and to organic matter. In certain cases, as in the slabs shown in pl. 3, the bands are of alternating white, green, and brown color, though all show practically the same percentages of iron when calculated as protoxide carbonate. As a matter of fact, however, the iron exists in this state only in the white and faintly

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* A good illustration of the popular ideas regarding the cause of the color in these rocks is given in the accompanying paragraph from the Engineering and Mining Journal (New York), vol. 49, p. 678. "Mexican onyx is a form of stalagmite, and its colors are formed by oxides of metal in the earth over the caves through which calcareous water passes. Gold is represented by purple, silver by yellow, iron by red, copper by green, and arsenic and zinc by white." It is difficult to conceive of any wording by which more errors could be comprised within the limits of a single paragraph.

† Chemical and Physical Geology, p. 146.

‡ The higher or the lower the temperature of the water, the more or less rapid its cooling, the greater or less abundance of bicarbonate of lime and protoxide of iron, and the different proportions in which these compounds occur—all these circumstances may give rise to the most varied deposits of these substances as regards their relative quality.—(*Bischof*, p. 147.)

greenish layers, the brown layers containing it in the form of both protoxide and more or less hydrated sesquioxides. Bischoff, in speaking of a like condition in the so-called sprudelstein of Carlsbad, says: *

The brown contains a considerably larger quantity of peroxide of iron than the white, which is sometimes quite free from it. This difference presupposes either that there is a difference in the quantity of iron contained in the water, or that sometimes the atmospheric air has a greater influence than at others, and that in those cases a larger quantity of protoxide of iron is peroxidized.

In the case of the stones here described the percentage of iron in the green and brown and red varieties is nearly the same, the varying hues depending mainly upon its chemical condition. While it is possible that a part of the change from protoxide carbonate to sesquioxide took place at the time of deposition, a large part is due to oxidation which has taken place since the beds were in substantially their present condition, and is due to percolating solutions. That this is the case is abundantly proven by the fact that the oxidation in most cases can be readily seen to have progressed along lines of jointing and fracture and along the more porous layers. In many cases the oxidation is accompanied by a partial removal of the lime carbonate, whereby the stone is rendered cellular and unfit for use. Such, however, is not always the case, and many of the oxidized varieties are beautiful in the extreme, as well as unique. (*See* under chemical and physical properties, p. 558.)

The cave marbles differ from the travertines mainly in method of deposition, being cold-water deposits upon the walls and floors of limestone caves. Rain water passing through the atmosphere and soaking through the layer of soil by which the earth is covered becomes charged with a varying amount of carbonic acid, which gives it the power of dissolving slowly the lime carbonate forming the essential constituent of the rock limestone, as already noted. Filtering downward through cracks and fissures or between the laminæ composing the beds, it thus gradually enlarges them until what are popularly known as caves or caverns are produced. But after this cave-forming process has gone on for awhile another process sets in, whereby the cavern may be wholly or in part refilled. The water from the surface percolating down through the roof of the cave dissolves out a portion of the lime carbonate, just as when running through a crack or fissure, but in this case the water comes through the overlying rock and remains for a time suspended, in the form of a drop, from the ceiling. Here it evaporates or loses a part of its carbonic acid, and, unable longer to hold the lime in solution, begins to deposit it in the form of a ring around the outer margin of the drop. As time goes on this ring becomes prolonged into a quill-like tube, growing in length always from its lower end. After a time, as a rule, this frail tube becomes partially or wholly closed, when the water flows down over the outside, the growth now being wholly

* Op. cit. p. 148.

external. In this way are formed the elongated pendant cones from the roofs of caves, and to which the name stalactite is given.* Such on being cut and polished show a beautiful zonal structure, not wholly unlike the rings of growth upon the trunk of a tree. (Pl. 13.)

But it rarely happens that all the water evaporates upon the ceiling; a portion usually falls upon the floor, where by a similar process it builds up a deposit chemically the same as the stalactites, but differing in that owing to the spreading out of the water as it falls, the floor deposits are more massive in form. To these floor deposits the name stalagmite is given. In some cases they rise in the form of blunt trunks or cones to meet their corresponding stalactites above until there are formed continuous pillars from floor to ceiling, as shown in plate 4. If this process goes on for a sufficient time the entire cave may be refilled, and since the water in percolating through the roof dissolved only the pure lime carbonate, or with but a trace of impurity, leaving nearly all the carbonaceous, siliceous, and clayey constituents behind, so these stalactitic and stalagmitic deposits are of purer lime, refined by nature's methods and recrystallized under new conditions. The form of crystallization, it should be stated, is sometimes that of aragonite, but so far as the writer's experience goes, more commonly that of calcite. It is sometimes, though not always, possible to distinguish between the two forms of crystallization by the unaided eye, stalactites (or stalagmites) of aragonite showing interiorly a radiating fibrous structure, the fibers being not infrequently beautifully curved and of a silky luster, while those of calcite are more granular. It sometimes happens that deposits of both kinds are to be found in the same cave, though so far as my own observation goes they belong in such cases, as at Wyandotte, Indiana, to different periods of growth. What the conditions are upon which these varying forms of crystallization depend is not now apparent.

It follows almost from necessity from their mode of origin, as above given, that the beds of onyx marbles, both spring and cave deposits, are as a rule far less extensive and regular in their arrangement than are the ordinary stratified and bedded limestones and marbles. Spring action is more or less intermittent, and the place of discharge, as well as the character of the deposit, variable. The latter usually take the form of a comparatively thin crust, conforming to the contours of the surfaces on which it lies. The various layers thicken and thin out irregularly, and are often lenticular in cross section. Sound and homogeneous layers of more than 20 inches thickness are not common. Where two or more layers, of sound and merchantable material occur they are not infrequently separated by tufaceous material, foreign débris, or by impure and porous onyx of little value. This condition of affairs will become more apparent as particular occurrences are

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*On the Formation of Stalactites and Gypsum Incrustations in Caves. Proc. U. S. Nat. Museum, XVII, 1894, p. 77.

described. The cave marbles vary even more irregularly, both in extent and quality. The deposit may be a mere veneering over the face of the rock, and although there is apparently an abundance, judging from appearances alone, the actual amount of available stone may be extremely small.* Moreover, such deposits are rarely uniform for any great distance, either in texture or color. Owing to coarse crystallization, they fracture easily, and, moreover, are more than likely to contain numerous cavities, large and small, known popularly as "thumb holes" and "pin holes." The small amounts of metallic oxides and organic matter they contain render the colors light and usually dull. White, yellowish, amber, and reddish, with a resinous luster, are common. The rock as a rule is less translucent than the true onyx marbles, and when polished appears "muddy" and unsatisfactory. Nevertheless, such deposits do not infrequently yield comparatively small blocks of beautiful material and material that is doubly desirable because it is unique.

Properly managed such can be worked up to good advantage, but too much has been expected from them, and it is this fact that has led to the disastrous failures following every attempt that has thus far been made to work the cave marbles in America. If the material as taken from the ledge could be assorted by some competent person and worked up, each block for such a purpose of ornamentation as it seemed best adapted, then we might hope for some interesting results. But at best the cave marbles of America must rank as "uniques" rather than objects of commercial value. They will never become regular sources of supply. There is too much waste and too much uncertainty regarding amount and quality.

A marked and very beautiful feature of the onyx marbles in general, and particularly of those which originate as spring deposits, is the fine, undulating, parallel bands of growth or lines of accretion shown on a cross section, and which are of course due to its mode of origin through successive depositions upon the surface (see pl. 1). The stone owes its chief value for decorative purposes to its translucency, fine veination, and color. In many instances the original hues have become enhanced by oxidation and through the development of reticulating veins of small size, due to incipient fracture, into which percolating waters have introduced new coloring solutions or locally oxidized the protoxide carbonates, which seem to form the chief coloring constituent, as already noted.

The localities from which the finer grades of stone of this type have in times past or present been obtained are few and widely scattered,

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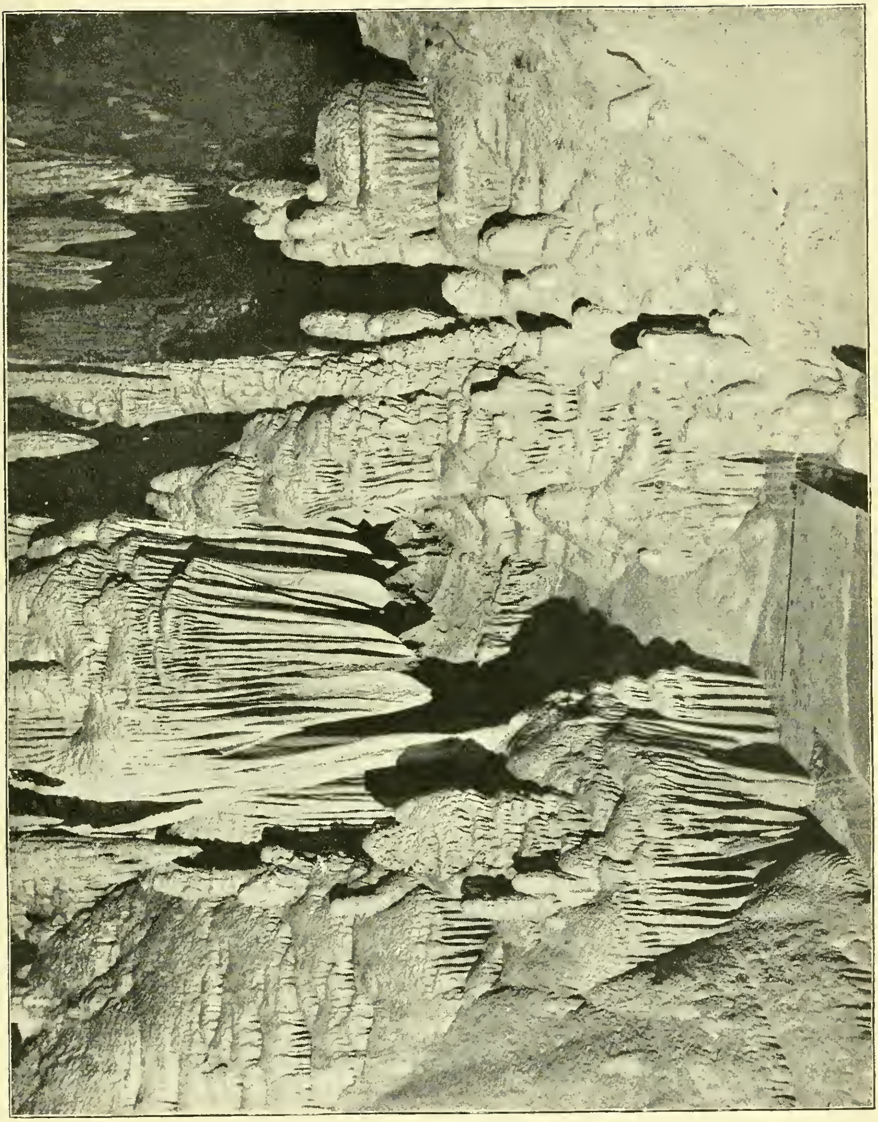
* The writer has met with just such cases in his experience. A certain deposit was represented as a solid mass of merchantable stone, showing a quarry face 100 or more feet in length by some 20 or 30 feet in height. On inspection it was shown that the "quarry face" was but a thin coating of stalactitic matter over the sloping wall of an old cavern. Not a cubic yard of merchantable stone could have been obtained in the entire outcrop.



VIEW IN A LIMESTONE CAVERN SHOWING STALACTITIC AND STALAGMITIC MASSES.

and it is interesting to note that, with the exception of the cave deposit, all that have thus far come under the writer's notice which are of such color as to make them preeminently desirable for ornamental purposes, occur in hot and arid countries and regions not far distant from recent volcanic activity. This is as true of foreign as of American occurrences. It is to be noted that all the deposits known are of slight geological antiquity, belonging to late Tertiary and early Quarternary periods. If materials of like nature were earlier deposited they would seem to have so far lost their identity as to be no longer recognizable. Contrary to the general belief, as indicated in the literature of the subject, or by the labeling of samples in museums, the onyx marbles, as shown by the investigations here chronicled, are almost without exception of calcite and not aragonite. It is true that the basis for such a statement is founded mainly upon specific gravities, the results of which may in certain cases seemingly be open to doubt. While, however, it is possible that certain of these stones may be made up of finely alternating bands of calcite and aragonite, there would seem no legitimate reason for doubting the main mass of the material to be calcite, particularly when microscopic examinations have borne out the results obtained by gravity methods.

USES, ANCIENT AND MODERN.

As already noted, the onyx marbles were used in Egypt during very early times for making small articles, as jugs, bowls, canopic vases, and amphoræ, employed to hold offerings to the gods, the ashes of the dead, and for other religious and domestic purposes. We find them thus utilized as early as the second dynasty. It is worthy of note that few, if any, of these articles were polished, though many of them show great skill in workmanship. In the Abbott collection of Egyptian antiquities of the New York Historical Society are several fine examples of this nature, one of which is shown in pl. 9, fig. 2.

According to the guide book to the fourth Egyptian room of the British Museum (1892, p. 117) the vases, bowls, saucers, spoons, and other vessels, which were placed in the tombs to hold the wine, oil, honey, sweetmeats, perfumes, and cosmetics offered to the dead, were, during the first six dynasties, commonly made from plain white "alabaster" (whatever that may be). Afterwards, variegated marbles and stones were frequently employed, including aragonite, granite and diorite, steatite and schist. Mr. G. F. Harris states* that the oynx thus used during the earlier periods—the fifth and sixth dynasties—was plain and of one uniform layer, but about the time of the twenty-fifth dynasty a zoned variety of a yellow color came into use. This authority further states that the principal shapes shown in the British Museum are "hemispherical vases with wide open mouths, for holding wines; basins, cylindrical vases, with wide rims for unguents or oils; vases in the shape of wine jugs, two-handled amphoræ, and drop-shaped

* The Builder, London, vol. 61, 1891, p. 14.

alabasters." These latter forms were held in such high esteem that they were exported from Egypt, and it is stated that "the names of Persian monarchs have been found in hieroglyphic and cuneiform characters upon them, whilst vases apparently of Egyptian material, if not of Egyptian fabric, have been discovered in the early tombs of Asia Minor, Greece, and the isles of the Archipelago." According to other authorities,* the first mention of articles of this nature by Greek writers is that of Herodotus (born 484 B. C.), who speaks of a *μυρου αλβαστρον* as one of the presents sent by Cambyses to the Ethiopian king. "Some of these vessels," it is stated, "had a long and narrow neck, which was sealed; so that when the woman in the gospel is said to break the box of ointment, it appears probable that she only broke the extremity of the neck, which was thus closed." The Egyptians did not, however, confine their use of the stone to these small articles, but at a very early period began utilizing it for the interior decoration of their tombs and temples. According to Dr. J. W. Dawson,† the magnificent granite temple of Kephren at Gizeh was lined with this stone in the early age of the pyramid-building kings.

"Some of the very old tombs in the Memphite cemetery at Sakkarah are lined with alabaster, or partially so lined. A curious example of the latter may be seen in the tomb called that of Unas. The inner sepulchral chamber of this tomb is lined with slabs of alabaster. The work is then continued in common limestone, and the entrance of the tomb is lined with the stronger and more enduring red granite. At Abydos are the remains of a magnificent monolithic shrine of this stone, and at Karnak a similar shrine is built of alabaster slabs, some of them 20 feet in length. In this and other cases one is astonished that so fine work and material should be lavished on places enshrouded in darkness; and the question is raised, but can not be answered, What means of illumination had the ancient Egyptians, beyond the smoky oil lamps and torches, which would scarcely suffice adequately to illuminate the interior of tombs and temples, and would soon have destroyed their beautiful workmanship."

"The finest work in Egyptian alabaster that I have seen [says the writer] is the sarcophagus of Seti I, father of Rameses II,‡ found in his tomb in the 'valley of the kings,' by Belzoni, and now in Sir John Soane's Museum in London. It is 9 feet 4 inches in length, 3 feet 8 inches wide, and from 2 feet 8 inches to 2 feet 3 inches deep; and is hollowed out of a single block so delicately that its general thickness is only 2½ inches, and that a lamp placed within shines through the translucent sides. On the bottom of the coffin is a figure of Netpe, or Athor, the mother goddess, with arms extended to receive the body of the King; and the whole surface is covered with inscriptions and professional figures representing the liturgy of the dead. The lid was of similar character, but has been broken to pieces.§ By a singular combination of accidents, the mummy of this great King, which had been transferred by its guardian priests for greater security to Deir el Bahari, is now in the Boulak Museum. The noble sarcophagus prepared for it is in London, and his vast and beautifully decorated tomb stands open for the inspection of travelers in the 'valley of the kings.'"

* Smith, Dictionary of Greek and Roman Antiquities, 1890, p. 96.

† Modern Science in Bible Lands, pp. 283–286.

‡ Nineteenth dynasty. According to Mariette, 1462 B. C.; Prof. Lepsius, 1443 B. C. Still others give dates from 1350 B. C. to 1600 B. C.

§ A very complete account and a figure of this sarcophagus is given in the General Description of Sir John Soane's Museum, sixth edition, 1893, pp. 43–47.

The materials employed in the Temple of the Sphinx in Egypt are rose granite and "alabaster." The supporting piers are of granite, the lining slabs of the walls and the ceiling of "alabaster" without carving or any form of relief.

Onyx was also employed for statuettes, some few of which are preserved in the museums of to-day. The statue of Rameses, now in the Musee du Louvre, in Paris, is stated by Chateau to be of Egyptian alabaster, while in the Boulak Museum at Cairo are "alabaster" statues of Queen Ameneritis, mounted on a base of gray granite; also of Osiris, the scribes Neferhotep and Awi.

According to Hull,* a beautifully iridescent variety of the Egyptian stone was used in constructing the four columns, each about 8 feet in height, which adorn the Sala containing the cabinets of gems in the Galleria degli Uffizi at Florence. He also describes large cinerary urns formed from this material, one of the finest being in the museum of the Vatican at Rome, which measures 9 feet in length and 4 feet in depth. Also tables in the Galleria Pitti at Florence.

During the reign of Mohamed Ali, the founder of the present dynasty, onyx from the Beni-Souef quarries was largely utilized in the embellishment of the celebrated "Alabaster Mosque" at Cairo. This, it will be remembered, was partly completed in its present form by Said Pasha in 1857. The alabaster used for the incrustation of the masonry consists partly of blocks and partly of slabs. The beautiful yellow tint of the stone fades on prolonged exposure to the sun.† I am informed by Mr. H. A. Ward that the stone here used is so translucent that when the sun is shining upon it, shadows of passers-by upon the street are distinctly noticeable from within, even where the wall is 18 inches in thickness.

Following the Egyptians, the Romans, with their characteristic luxuriousness, did not fail to overlook so promising a material, and early adopted it for similar purposes. A portion of the vessels found in Grecian and Roman ruins are of undoubted Egyptian materials and manufacture. The quarries at Ain Tembalek were worked with great activity at a very early period by the Romans. This is proven not merely by the abundance of works of art in this stone among the Roman ruins, but also by the finding of actual quarry sites. In all the Arabian monuments found in the region, especially at Tlemcen, there has been frequent use made of the onyx. In the grand mosque D'jama-Kebir, built during the twelfth century, may be seen the remains of an old court flagged with onyx, in the center of which is a fountain of the same material. In the mosque Djama-Aboul'l Hassen, the numerous columns supporting the arcade are also of onyx. Beautiful examples of the character of the quarry product are also to be seen at Sidi Bou Medin and at the museum at Tlemcen. The onyx columns of the

* Building and Ornamental Stones, page 150.

† Baedeker, Guide to Lower Egypt.

ancient mosque of Mansourah are said to be particularly fine. Chateau states that the tunic of the statue of Diana in the Louvre is of the Algerian onyx. Material of the same nature, derived either from Algeria or the numerous caverns of Italy, was extensively utilized for sarcophagi by Romans, Etruscans, and Greeks, the body and cover in such cases being each of a single piece, and in many instances elaborately carved. The Etruscan sarcophagus in the Boston Museum of Fine Arts is of material of this nature.

Onyx from deposits near Lake Oroomia and Yezd was extensively used in the balmy days of the Persian Empire by the native nobles. I am informed by the Rev. Benj. Labaree that it has been used in the form of slabs to face the elegant fountains or to pave their baths. Small blocks were also used in the doors and windows of their baths in place of glass. "The most beautiful slab I know of," he writes, "is one some 8 by 4 feet, as near as I recall, serving as a table or sideboard in the English consulate at Tabreez. It must be some 4 inches thick. It is of a charming yellow tinge with darker reddish lines shading through it."

Writing on the same subject, the Rev. P. Z. Easton states that the grand staircase of the new palace of the Crown Prince at Tabriz is paved with this marble. In the bazaars one finds it employed by the lithographers. Small ornaments, such as saltcellars, vases, etc., are cut from it, and sometimes slabs for table tops. "In cemeteries it is used to some extent, but generally only where the cemetery is inclosed, as otherwise it is likely to be broken and carried off. In Moslem cemeteries, however, this is not so apt to be the case. I remember seeing a fine block at Marand, about 40 miles from Tabriz, which had not been disturbed." Mr. Easton further states that there must be some variation in quality, as in some cases stones which have been exposed even for a comparatively short period change in color and become comparatively valuless, "while in other cases, as in those of the magnificent slabs at the back of the Blue Mosque, which have stood for four centuries, and for a century or more have been more or less exposed to the action of the weather, there is comparatively little change." In ancient times, when there was more wealth in Persia, this stone was probably much more extensively used, and larger pieces were hewn out. A Persian prince of to-day would hardly incur the expense of moving such masses as the blocks in the Blue Mosque. Morier states* that the tomb of the Persian Poet Hafiz is also of this stone. He describes this as "a parallelogram with a projecting base, and its superfices carved in the most exquisite manner. One of the odes of the poet is engraved upon it, and the artist has succeeded so well that the letters seem rather to have been formed with the finest pen than sculptured by a hard chisel. The whole is of the diaphanous marble of Tabriz, in color a combination of light green, with here and there

* First Journey Through Persia, 1812, p. 104.

veins of red and sometimes of blue." Curzon, however, writing in 1892,* describes the tomb of Hafiz as having once had a lid of marble, but which was carried away by Kerwin Khan and built into the tank in Jehan Nemak, replacing it by the present sarcophagus made of yellow Yezd marble. Morier further says that the Haft-ten, a Persian pleasure house erected by Kerwin Kahn at Shiraz, is wainscoted with the Tabriz marble, one of the largest slabs being 9 feet long and 5 feet wide, such wainscotings being often inlaid with gold. The college called *Medresse Shah Sultan Hassein*, at Ispahan, also contains some of the same material.

Many Italian churches, ancient and modern, contain numberless illustrations of the extensive use of these materials, and which, in many cases, have been taken for their present use from the ruins of still more ancient structures. The Cathedral of S. Paolo le Mura, at Rome (rebuilt in 1853), contains two beautiful columns of the Egyptian "alabaster" near the entrance, and four others in the canopy of the high altar. These were presented, it is stated,† by the present viceroy of Egypt, and hence came, without doubt, from the valley of the Nile.

The use of the onyx in thin slabs for window panes in cathedrals has often been reported in Mexico as well as in Europe. I am informed by Dr. G. Brown Goode that a portion of the windows in the Cathedral of Orvieto (Italy) are of a yellow-brown banded stone, which is doubtless a lime carbonate from cave or spring deposits in Italy, Algeria, or Egypt. The Church of San Miniato, in Florence, has likewise five windows of similar material. The adaptability of the Mexican onyx for certain forms of interior decoration is well shown in the columns and arch about the entrance of the ark containing the manuscripts of the pentateuch in the new Jewish Synagogue on Fifth avenue, New York City.

In modern times the Algerian onyx has been largely used by the French for interior decoration, as in the grand staircase of the Parisian opera house, and in the manufacture of tops for small stands, turned columns, tables, lampstands, clocks, and similar articles for household use and adornment. The same may be said regarding those of Mexico and the United States. The native Mexicans utilize small pieces in the manufacture of paper weights and knives, penholders, inkstands, card receivers, and plaques, which are sold to tourists. In the United States the material has been utilized, in addition, in the construction of mantels and fireplaces, some of which are very elaborate. In some of our modern hotels there is a lavish display, but in only too many cases, as in the Auditorium at Chicago, most astonishingly poor taste has been shown. The walls are simply sheathed with slabs, apparently without any attempt at selection as to quality, color, or veination, but one laid on

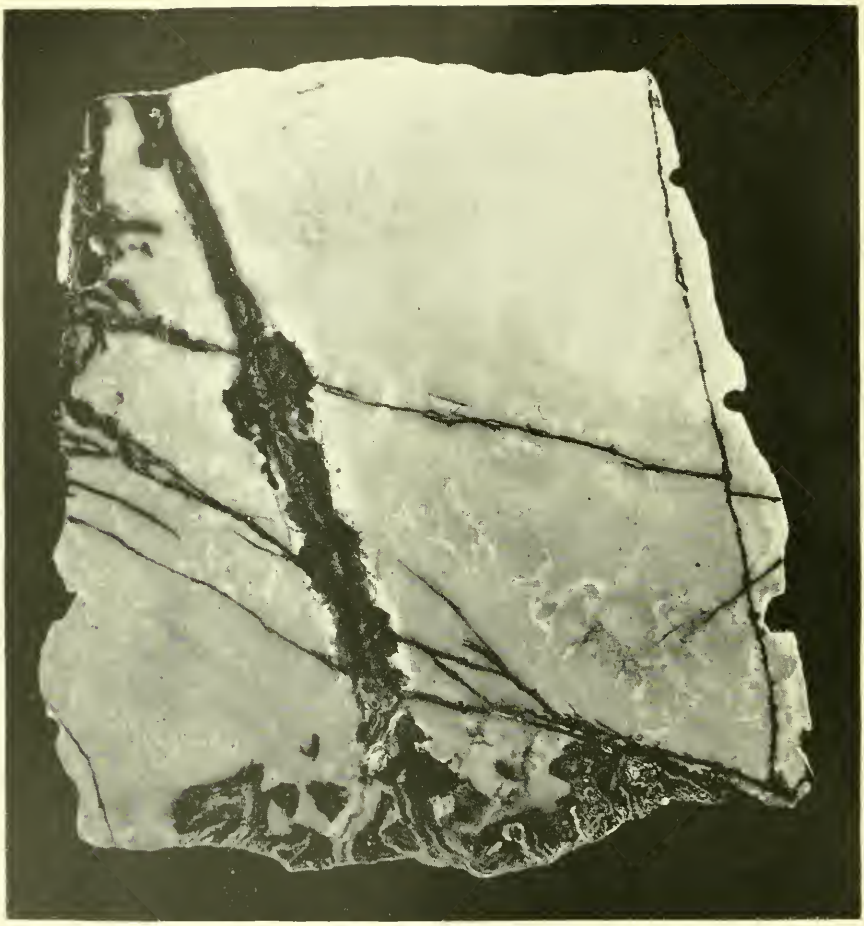
* Persia and the Persian Question.

† Baedeker, Guide to Rome.

after another as carelessly as bricks in a wall. One-half of the amount of material might have been more effective had proper taste been exercised. It is worthy of remark that our architects, decorators, and artisans of to-day seem to rely for effect wholly upon perfection of surface and color, beauty of design and excellence of execution being almost wholly overlooked. Everywhere are flat surfaces, moldings, and machine-made columns, all brilliantly polished, but nothing more. Yet the stone will cut to as sharp an edge as the finest Carrara marble, and is eminently adapted for bas-relief, small statues, busts, and objects of like nature. Its translucency and ever varying shades of color, so far from being defects, are, under proper treatment, actual merits, and it seems almost unaccountable that they have so long been overlooked. Modern manufacturers are not infrequently guilty of the utterly reprehensible custom of seeking to improve the paler hues by paint or other coloring materials applied to the back or unexposed side of the thin slabs, the translucency of the stone being just sufficient to transmit the colors, without permitting its cause to be discovered. This is especially the case with much of the Parisian work now brought into America, but unfortunately the practice is not confined to the French.

CHEMICAL AND PHYSICAL PROPERTIES.

As has been noted, the onyx marbles consist essentially of carbonate of lime crystallized in the form of calcite; very rarely as aragonite. The results of quantitative chemical analyses of some of the principal varieties are given in the accompanying table. As will be noted, the percentage of lime carbonate rarely falls below 90. Next to the lime, iron as carbonate or oxide forms the most prominent constituent, and is apparently the main cause of color variation, the tints depending upon its state of combination, whether as carbonate or sesquioxide. The small amounts of manganese may have some effect, but this could not be ascertained with any degree of certainty. It is interesting to note that the almost milk-white varieties from San Luis Obispo, California (25571), and Lower California (68246) carry, respectively, 3.93 and 2.79 per cent. of iron, calculated as carbonate ($FeCO_3$). The most pronounced green and brown varieties carry but from 4.19 to 5.51 per cent. of the carbonate, while the faintly tinted greens from Lower California run as high as 7.49 per cent. As a rule, it seems safe to say that the green and red-brown colors are due to this ferruginous constituent, the green colors containing the iron as a carbonate, and the ocher red, yellow, and browns being derived, therefore, by a process of oxidation, as noted on p. 548. Certain amber browns and yellows, (and in one case a bright flesh-pink color), as exemplified in the stones from Suisin City and Sulphur Creek, California, and in all the stalagmitic marbles, both American and Egyptian, are, however, due to organic matter, all burning white, giving off the characteristic empyreumatic odor, and showing but the merest traces, if any, of metallic oxides. It may further be said



SLAB OF GREEN ONYX MARBLE WITH VEINS OF OCHREOUS BROWN.

Cat. No. 67549, U. S. N. M. Mayers Station, Arizona.

This specimen and those shown in plates 6 and 7 were cut from the same block, to show various stages of oxidation.

SLAB FROM SAME BLOCK AS SHOWN ON PLATE 5, BUT SHOWING A MORE ADVANCED STAGE OF OXIDATION.

Cat. No. 67549, U. S. N. M.

The percolating solutions permeated along the line extending from the upper left side diagonally downwards toward the right side.

SLAB FROM SAME BLOCK AS SHOWN IN PLATES 5 AND 6.

Cat. No. 67549, U. S. N. M.

The polished face was toward the surface shown in plate 6 and separated by a thickness of not more than two inches.

ristics of onyx marbles.

	Crystalline structure.	H_2O.	Total.	Analyst.
		Per cent.	Per cent.	
......	Finely columnar; radiating....	0.47	100.29	R. L. Packard.
ter....	Granular	....	....	
......	Microgranular and columnar ..	0.29	100.18	Do.
......	Microcolumnar	0.57	99.80	Do.
......	Micrigranular and columnar ..	(*)	100.04	W. D. Bigelow.
		0.40	99.41	G. P. Merrill.
......	.....do	(*)	100.19	W. D. Bigelow.
......	.....do	(*)	99.78	Do.
......	Granular and columnar........	0.37	99.75	R. L. Packard.
......	Finely columnar; radiating....	....	....	
......	Microcolumnar in cross section	....	99.35	Do.
or....	Microcolumnar; radiating......	....	....	
......	Finely columnar; radiating....	....	....	
......	Microcolumnar	0.38	99.93	Do.
......	.....do	0.68	100.29	Do.
......	.....do	(*)	100.56	W. D. Bigelow.
......	.....do	....	99.20	Do.
little	.....do	....	....	G. P. Merrill.
......	....	....	100.00	Dr. Edw. Hitchcock.
brecci-	Finely columnar; radiating....	....	99.93	R. L. Packard.

s: Green variety, Fe CO_3 4.27 per cent

R

that the most constant distinction between those of the onyx marbles which are spring deposits and those which are formed in caves is the absence, in the latter, of appreciable quantities of metallic oxides. This is presumably to be accounted for on the supposition that the cave marbles result from the solvent action of cold carbonated water on limestone containing, aside from the iron oxides, only mechanically included impurities which do not enter at all into solution, but remain in the form of the ochreous residual clays which are so characteristic of limestone caverns the world over. The travertines, on the other hand, result from the solvent action of heated solutions on deep-seated siliceous rock, and which as a result carry not merely lime, but a considerable proportion of rarer constituents as well. That these rarer constituents are not more abundant in the deposits themselves is due to their unequal solubility and the consequent fractional separation which takes place on evaporation. This separation has already been alluded to, on p. 549. The reverse of the above-stated rule does not always hold good, since, as above noted, the Suisin City deposit, which is a travertine, contains scarcely a trace of iron. The percentage of manganese, as will be noticed, is, with but two exceptions less than one-half of one per cent. These exceptions are (1) a faintly greenish stone from Lower California, and (2) a pure milk white variety from Lake Oroomiah, the latter yielding 4.34 per cent. of this material calculated as a carbonate, ($MnCO_3$) or 2.68 per cent. when calculated as oxide (MnO). The magnesium carbonate is almost invariably present in small amounts, and singularly enough is highest in the cold-water (cave) deposit from Syout, Egypt (61336), where it reaches 6.88 per cent. Careful tests were made for the rarer elements, but with negative results in the most cases, the Suisin City stone showing 1.59 per cent. of strontium carbonate; that from the Hacienda del Carmen, Mexico (61337), 1.34 per cent. of calcium sulphate, and that from San Luis Obispo 0.25 per cent. of tricalcic phosphate, $Ca_3(PO_4)_2$. The milk white stone from Lake Oroomiah yielded 2.30 per cent. of calcium sulphate and 0.24 per cent. of tricalcic phosphate.

In order to illustrate the possible changes in color from secondary oxidation, pls. 5, 6, and 7. are given. The slabs were all sawn from the same block, not above 10 inches in thickness, and which was at first supposed to be nearly uniform throughout. In pl. 5, it will be observed, there is a wide vein of ocherous brown extending somewhat diagonally from top to bottom, with smaller veins cutting it from left to right. In the second slab the vein has extended so as to include the whole upper left section, while in the third the original green has been almost wholly obliterated. It is easy to perceive that this change in color has been brought about wholly through the oxidizing influence of percolating solutions which followed the lines of existing flaws. In no case that has thus far come under my observation am I inclined to regard these veins and dashes of red and brown as original, but as results of secondary oxidation.

Table showing composition and physical characteristics of onyx marbles.

Source.	Catalogue number.	Hardness.	Specific gravity.	Weight per cubic foot.	Color.	Behavior: Before blowpipe.	Behavior: In closed tube.	Crystalline structure.	Mineral nature.	$CaCO_3$	$MgCO_3$	$FeCO_3$	$MnCO_3$	Misc.	SiO_2	H_2O	Total.	Analyst.
				Pounds						*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
Syout, Egypt	61336	3.5	2.75	171.87	Faint straw	Burns quietly to quicklime, scarcely crumbles.	No appreciable change till it passes into quicklime	Finely columnar; radiating	Calcite	92.04	6.88					0.47	100.29	R. L. Packard.
Beni Souef, Egypt		3	2.64	165	Nearly white	Decrepitates vigorously	Decrepitates vigorously, becomes brownish and gives off water	Granular	do									
Algeria	61328	3.5	2.77	173	Faint straw	Burns quietly to quicklime	Blackens	Microgranular and columnar	do	95.20	1.97	2.5	0.11			0.29	100.18	Do.
Hacienda del Carmen, Mexico	61337	3.5	2.75	171.87	Light green	do	Blackens, gives off a little water and faint odor	Microcolumnar	do	89.36	3.00	5.24	0.20	1.34 $CaSO_4$		0.57	99.80	Do.
Mayers Station, Arizona (green)	67825	3.5	2.75	171.87	Light green	do	do	Microgranular and columnar	do	93.93	0.50	5.9			0.05	(*)	100.04	W. D. Bigelow.
										93.50		5.31				0.40	99.41	G. P. Merrill.
Mayers Station, Arizona (brown)	67825	3.4	2.67	166.87	Red brown	Decrepitates energetically.	Turns dark, gives off water, and decrepitates vigorously	do	do	93.82	0.53	4.06		1.73 Fe_2O_3 †	0.05	(*)	100.19	W. D. Bigelow.
Cave Creek, Arizona (green)	68251	3.5	2.75	171.87	Light green	Burns quietly to quicklime	Blackens but gives only a trace of water and no odor	do	do	93.48	1.07	5.10			0.04	(*)	99.78	Do.
Suisin City, California	38445	3.25	2.70	170.62	Dark amber	do	Blackens, and gives oily distillate with empyreumatic odor	Granular and columnar	do	95.48	2.20			1.59 $SrCO_3$, 0.11 $BaCO_3$		0.37	99.75	R. L. Packard.
Sulphur Creek, California	68451	3.5	2.68	167.5	do	do	Blackens, decrepitates, and gives off water with slight odor	Finely columnar, radiating	do									
San Luis Obispo, California	25571	3.5	2.72	170	White	Decrepitates energetically	Becomes dark, and decrepitates at a red heat	Microcolumnar in cross sections	do	93.68	1.43	3.91	0.06	0.25 $Ca_3(PO_4)_2$			99.35	Do.
Siskiyou County, California	36586	3.5	2.73	170.62	Light green	Burns quietly	Becomes dark and decrepitates slightly at red heat, faint odor	Microcolumnar, radiating	do									
Rio Puerco, Valencia County, New Mexico	60631	4	2.87	179.37		Decrepitates vigorously	Gives off water and slight empyreumatic odor	Finely columnar, radiating	Aragonite									
New Pedrara, Lower California	68246	3.5	2.79	174.37	Faintly green	Turns dark, then burns quietly to quicklime	Blackens and decrepitates	Microcolumnar	Calcite	90.16	1.66	6.97	0.76			0.38	99.93	Do.
Do	68246	3.5	2.77	173	White, rose tinted	do	Blackens and gives off faint empyreumatic odor	do	do	93.48	1.68	4.1	0.26			0.68	100.29	Do.
Do	68246		2.78		White	do	do	do	do	96.86	0.24	2.7		0.61 Fe_2O_3	0.06	(*)	100.56	W. D. Bigelow.
Do	68246		2.79		Faintly green	do	do	do	do	91.09	0.64	7.4					99.20	Do.
Near Lehi, Utah			2.72	170	Yellow	do	Blackens, and turns white without decrepitation, yields little water, and faint empyreumatic odor	do	do	97.61	0.23							O. P. Merrill.
Near Lake Oroomiah, Persia										95.74	1.34	2.8					100.00	Dr. Edw. Hitchcock.
Do	62609	3.5	2.75	170.87	Milk white	Burns quietly to quicklime	Decrepitates energetically and becomes brown, yields no appreciable moisture and but faint odor	Finely columnar, radiating	Calcite	90.93	0.75	1.37	4.34	2.30 $CaSO_4$, 0.24 $Ca_3(PO_4)_2$			99.93	R. L. Packard.

* Not determined.

† Other samples from same locality yielded R. L. Packard results as follows: Green variety, $FeCO_3$ 4.27 per cent; brown red (oxidized) variety, $FeCO_3$ 1.22 per cent, Fe_2O_3 3.53 per cent.

An intermediate stage in the process is shown in the small block figured on pl. 8, where oxidation has gone on from all sides until only a nucleal mass of green remains, into which the oxidizing process was extending along the lines of deposition, much as the process of serpentinization extends along the curvilinear cracks of an olivine granule.

Two independent analyses of the green and oxidized portions from this specimen (67825) yielded in the one case 5.51 per cent. of iron carbonate ($FeCO_3$) for the green variety, and 4.06 per cent. of the carbonate, and 1.73 per cent. of sesquioxide (Fe_2O_3) for the brown. In the second case 4.27 per cent. of $FeCO_3$ in the green variety, and but 1.22 per cent. of the same salt in the brown, with 3.53 per cent. of the sesquioxide. In both cases the total amount of iron calculated as Fe seems a trifle the largest in the oxidized portion (2.65 per cent. in the green as against 3.06 per cent. in the brown).

The completed stage of oxidation is shown in pl. 15. The original green color is wholly effaced, and the block, when cut across the grain, gives a unique combination of red-brown colors which, together with the original lines of deposition, give an appearance so like that of certain tapestries that I have given it the name of *tapestry* onyx.

In a few instances the shades of color are produced by mechanically included impurities, as in pl. 12, from a specimen from San Luis Obispo, California. Visitors to the California pavilion in the mines building during the Exposition at Chicago in 1893 will recall the beautiful and unique pictures in stone there shown. This coloring matter, in its various shades of smoky brown, is due to inclusions of clay parallel to the plane of deposition. It would appear that during the time the stone was being deposited the waters became temporarily charged with silt, which settled in thin films over the uneven, often botryoidal surfaces already formed, to become entombed in the mass of the stone when the onyx-forming stage was resumed.

In structure the onyx marbles are invariably holocrystalline, sometimes granular, but much more commonly with a fibrous or radiating columnar structure, the fibers or columns being composed of calcite crystals elongated in the direction of their principal axes and standing at approximately right angles to the plane of deposition, as noted by Sorby* in deposits of similar origin.

Twin forms so characteristic of the calcite of metamorphosed sedimentary deposit, or even the secondary calcite in veins and cavities of eruptive rocks, are quite lacking. Mechanical inclosures of any kind are almost wholly wanting, as may be inferred from the analyses. The banded aragonite from New Mexico (60631) shows the dark color to be due to included particles of a coal-black color, which give reactions for manganese oxide.

The characteristic banding or "grain" of the stone is due to lines of accretion comparable with the lines of growth upon the trunk of a tree,

*Quarterly Journal of the Geological Society of London, Vol. xxxv, 1879, p. 73.

BLOCK OF GREEN ONYX MARBLE WITH EXTERIOR ZONE OF RED BROWN OXIDIZED MATERIAL.
Cat. No. 67825, U. S. N. M. Mayers Station, Arizona.

each layer representing successive surfaces over and upon which the lime-holding solutions have deposited new materials. In some instances the successive layers vary more or less in character of crystallization and color, due to a slight change in contents of organic matter or metallic oxides, or physical conditions, whereby the material is rendered more or less opaque. The characteristic feature which above all others adds beauty to the stone is its translucency, which is a purely physical quality. As a rule the crystallization, in sound blocks, continues uninterruptedly upward through the successive layers for a distance of several millimeters, so that there is no tendency toward separation along these layers until a point is reached where, owing to impurities in the water, or it may be a temporary cessation of deposition, crystallization ceased. On beginning once more, such lines not infrequently form lines of weakness. A not uncommon structure is that shown in fig. 1 of pl. 9. Crystallization starts from a series of points on a preexisting surface and progresses upward and outward forming a series of inverted cones. This structure is evident only on close inspection and in slabs sufficiently thin to be translucent.

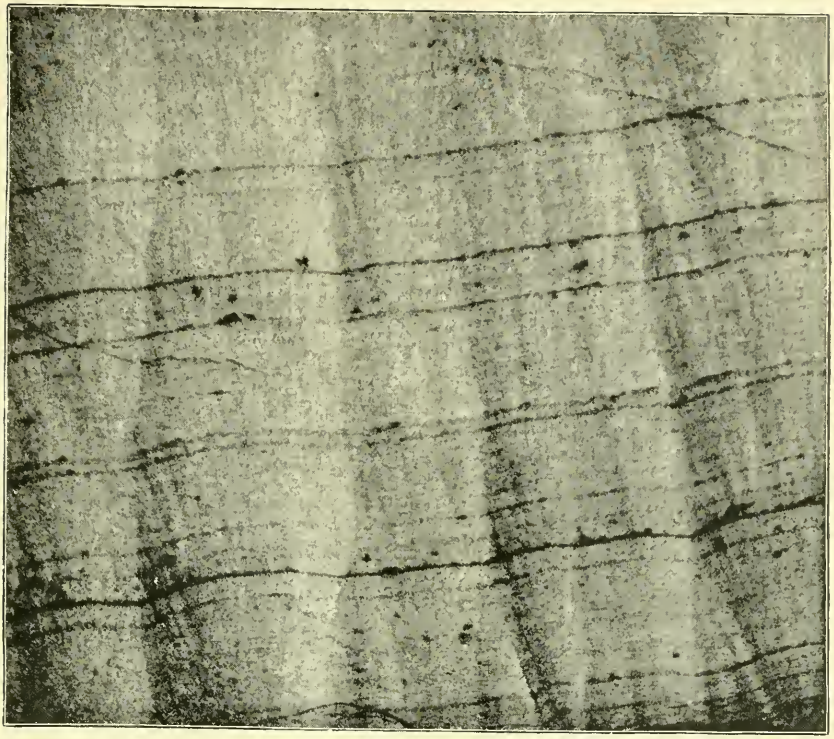
As a natural consequence of its mode of deposition the surface structure is usually botryoidal. Cut across the plane of deposition the structure is then as shown in fig. 1 of pl. 1. Cut at right angles to this, the structure, owing to the wavy, botryoidal nature of the original surfaces, is often wonderfully beautiful and always interesting. The colors continually appear and reappear in varying degrees of intensity accordingly as they lie upon the immediate surface or are subdued by intervening layers of colorless material. One sees in fact not merely the colors which lie upon the surface, but those beneath as well, subdued, enhanced, enriched it may be, by those which overlie or lie beneath. It is in this characteristic that lies the chief claim for beauty, and its entire separation from marbles of the common, sedimentary type. The figures given on the pls. 14, 17 and 18 will serve to show, so far as is possible by photograph, the varying structure described.

The cave marbles are as a rule much less translucent than the travertines, coarser in crystallization, and hence more liable to fracture. They are, moreover, less homogeneous, containing many cavities and interspaces which have never been filled. In the columnar forms a pronounced zonal structure is common, as shown in the cross and longitudinal sections in figs. 3 and 4 on pl. 13. In the more massive forms we find the bandings as in the travertines, but without the delicate crystallization.

LOCALITIES: DOMESTIC AND FOREIGN.

Arizona.—Several deposits of onyx have within a few years been located in Arizona, though so far as at present known to the writer, but two are of such extent as to be of any commercial value. These two are both in Yavapai County, and possess many characters in common.

The first to be described lies at Mayers Station, on the stage road leading from Prescott to Phœnix, and some 28 miles southeast of the first-named town, which at time of writing, is the nearest accessible point by rail. What stone has thus far been shipped is hauled by wagon to Prescott, and by the Prescott and Arizona Central Railroad 70 miles north to the Atlantic and Pacific Railroad, which affords an outlet both east and west, as occasion demands. At time of writing there is, however, in process of construction a new line connecting the Santa Fe system on the north with the Southern Pacific, and which will pass sufficiently near the deposits to greatly diminish the hauling distance, as well as afford the benefit of competing freight rates furnished by the two lines. The deposits occur on the western side of what for a considerable portion of the year is a dry ravine, but which in the winter and rainy season carries a variable and often turbulent body of water, and rejoices in the name of Big Bug Creek. The country rock is highly metamorphic schist standing nearly on edge with occasional dikes of basic eruptives. The onyx proper occurs interbedded with a coarse breccia formed of schistose and dioritic fragments embedded in a sandy and calcareous matrix, the entire formation occupying a low range of hills, of which an area of 200 acres is estimated by the company to comprise all the quarryable material. Standing at the stage station and looking westward across the creek, one sees the low bluffs of onyx where the edges of the bed have been exposed in the work of exploitation. At first glance the outlook is not inspiring. The rock weathers gray and rusty brown, breaks down under the prolonged exposure to which it has been subjected, and appears like anything but the beautiful stone it really is. Closer inspection is, however, more assuring. At the shallow openings that had been made in the bluffs and on the top of the hill, at the time of the writer's visit (1891), the onyx occurred in irregular somewhat concentric layers, (pl. 2), from the fraction of an inch to 2 or more feet in thickness, and which are traversed parallel with the plane of deposition by wavy bands of color in all shades of amber, white, ocher yellow, brown, deep ocherous red, and green of a most beautiful emerald shade. The sound layers of stone are separated from one another by porous cellular layers, so that slabs of large size can be obtained only by cutting parallel with the banding; *i. e.*, with the plane of deposition. This in itself is no drawback, since the colors blend much better and the general effect is vastly richer than when cut across the grain. No two of the openings show material of exactly the same nature as to color and markings, or as to size and thickness of the blocks. In all, the stone lies in layers readily separable from one another, and which, as a rule, thicken and thin out irregularly. The more highly colored varieties carry, as shown by analysis, nearly 5 per cent. of carbonate of iron. Through the oxidizing effect of percolating solutions this carbonate has in many instances been converted into a more or less hydrated oxide, whereby the green is changed to red, brown, or amber-yellow colors in



1

2

Fig. 1. Microscopic structure of onyx marble showing fibrous structure extending upward across the plane of deposition.
Fig. 2. Vase of "Egyptian Alabaster" (stalagmitic marble), from Sakkarati. From the Abbott collection of Egyptian antiquities in the possession of the New York Historical Society.

all shades. This oxidation has naturally followed along the lines of jointing and penetrated the more porous layers, so that what were once large blocks of homogeneous green are now surrounded by a crust of varying thickness of the oxidation product. All stages of the process are seen at the various openings, from those in which the green stone is covered with a mere crust, and scarcely sufficiently veined to give a desired variety, to those in which scarcely a trace of the original green remains, but the whole block is of a red-brown color in varying shades. At times the oxidation has been accompanied with a removal of so large a proportion of the lime carbonate that the texture is destroyed; the stone becomes somewhat cellular or spongy, and does not acquire a good surface and polish. In other cases, the stone still retains its compact structure and susceptibility to a high polish, though necessarily it loses its translucency and becomes quite opaque. Nevertheless, the stone is by no means undesirable for either furniture toppings or for decorative purposes. The colors are rich but not gaudy, and, when properly prepared, are capable of effects both unique and beautiful. There is in the National Museum a slab of the oxidized stone (60845) of brown and red color so cut with the grain as to resemble in a wonderful degree a piece of antique tapestry. (pl. 15.) The details of its structure are intricate in the extreme, and since what is to be seen by a careful study of them depends almost wholly on the vividness of one's imagination, the writer drops the subject to be taken up, it may be, by those more gifted, either in imagination or in the faculty of expression. This type of onyx, I may say, differs from anything I have seen elsewhere, and, while the present workers regard it as valueless, and it is doubtful if the quarries can be relied upon to produce any large supply, or even two blocks alike, I still regard it as a beautiful stone, and one well worthy of consideration. In certain of the outcrops no green at all appears, but the stone lies in somewhat wavy layers of from 1 or 2 to 12 or 15 inches in thickness, and which are traversed by narrow alternating bands of brown, white, yellow, and sometimes pink. This variety of onyx is more granular in structure—due to coarse crystallization—than the green onyx, less translucent, and, on the whole, much less desirable. It is, nevertheless, a fine marble. Owing to the wavy nature of the bands, they appear and disappear in the form of veins, blotches, streaks, and clouds of varying intensity in color when the stone is sawn into slabs. The compact, highly lustrous green stone, with a surface almost as close as enamel, and with its veins and dashes of red and brown, is, however, the most desirable of all.

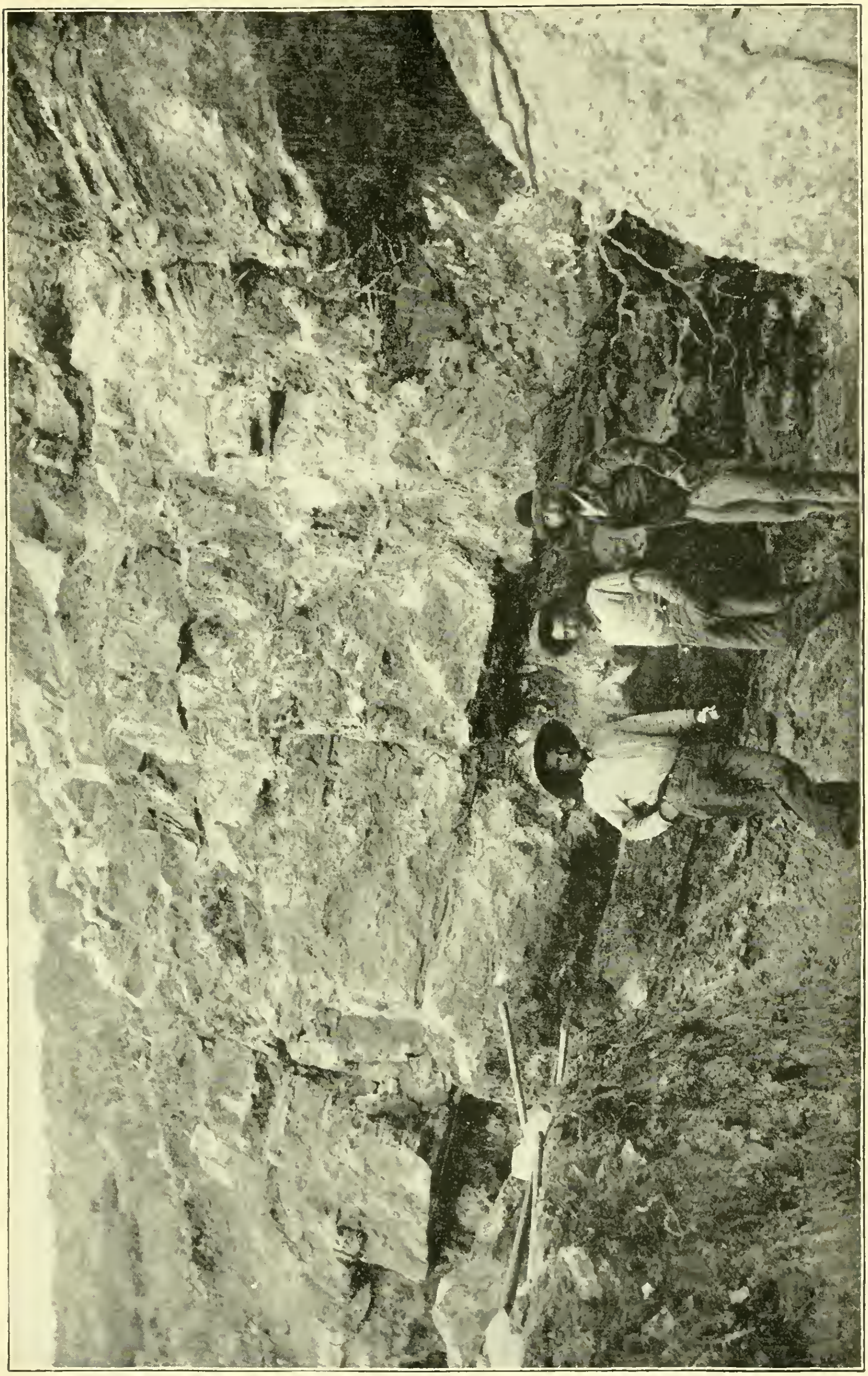
The so-called Cave Creek quarries of Arizona are also in Yavapai County, but in the extreme southern part, near the Mariposa County line. At present they are accessible only from Phœnix, and over a road the latter 12 to 20 miles of which is hilly in the extreme. In riding over it one can but be reminded of a saying in reference to the Territory to the effect that "if Arizona 'd been laid flat it would be bigger'n any two States in the Union." But to reach the market the quarried stone must be dragged on wagons over this 50 miles of roadway to Phœnix, and thence shipped by rail. With this great drawback, coupled with high freight imposed by a railroad free from competition, the quarries labor under great disadvantage.

The country rock here is a slaty schist injected with quartz porphyries and diorites, all sporadically overlaid by basalt, the diorite cropping out in the rounded foothills, and weathering reddish. The main onyx ledge lies on the western slope of a low basalt-capped hill. The lowest underlying rock. as exposed in the creek bed a few rods below the quarry, is also basalt, but of a coarse texture and gray color. In the quarry opening the lowest rock exposed is a calcareous breccia, formed of fragments of slate and pebbles of basic eruptive rocks cemented by a friable travertine. At the time of the writer's visit (August, 1892) the outcrop, as exposed by digging, was some 200 yards in length and presented some remarkable features. The maximum thickness of the bed was about 10 feet. As exposed, it was not, however, continuous, but evidently had been thrown out of place and more or less shattered and broken by the extrusion of the basalt, the face of the quarry having the appearance shown in pl. 10.

The prevailing colors here, as at Mayers Station, are green and yellowish, with veins of ocherous brown and red. The tints are beautiful in the extreme, and the best quality of the stone is certainly very fine. Clear uniformly green stone is not to be had in blocks of any size, but all are filled with reticulating veins. There is a large amount of waste material in the stone thus far removed, owing to the oxidation which has gone on in the same manner as at Big Bug Creek. There are also occasional small masses of chalcedonic quartz. The deposit is unique, in that the largest blocks thus far obtained have their greatest dimensions at right angles with the plane of deposition. Slabs 4 feet wide could thus be cut across the grain, and while by this method the beautiful blending of the colors is lost, still the wood-like grain, or onyx-like banding, is thus brought out, and is greatly preferred by some. At date of writing nearly all the material thus far quarried has been literally dug out of the tufaceous material, in the form of corroded, irregular blocks of all shapes, and in sizes including at most but a few cubic feet. What the large bed will yield, and how far it extends into the hill, is yet to be ascertained. (See pl. 11.)

California.—Within the State limits of California are several deposits of onyx marble, which may, with the increasing wealth of the country, become important sources of supply. At present but one is actively worked, difficulty of access and cost of transportation, together with a limited market on the Pacific Coast, operating against an extensive development. The most noted of these deposits, and indeed the only one that has yet proven of any commercial importance, is located near the town of Musick, San Luis Obispo County, in the heart of the Santa Lucia Mountains. According to the report of the State mineralogist*

*Tenth Ann. Rep. State Mineralogist of California, 1890, p. 584–85.



QUARRY OPENING AT CAVE CREEK, ARIZONA, SHOWING THICKNESS OF DEPOSIT.

CUT IN HILLSIDE AT CAVE CREEK, ARIZONA, SHOWING DETACHED MASSES OF CORRODED ONYX.

there are two openings or outcroppings, some half a mile apart, lying in sections 9 and 16 of township 31 south, range 15 east, Mount Diablo meridian. The inclosing rock is a slaty sandstone, the ledges standing nearly on edge and having a thickness of about 16 feet. The outcroppings lie one on the northern slope of the ridge and the other on the southern, the hill rising about 80 feet between them. Whether the two are parts of the same vein or bed is as yet unknown. The strike of the more northern croppings is directly toward the southern, though that of the southern is diagonal to the course of the others. The stone is very close in texture, acquires a high lustrous polish, and shows when cut across the grain a beautiful wood-like banding. The colors are quite variable, but not so pronounced as those of Arizona. White, translucent, with a pearly luster, is the prevailing type, but pinkish and purple shades, with tinges of blue, orange, red, and olive, are not uncommon, the colors being sometimes in blotches and sometimes in veins. A peculiar translucent, smoky variety is not uncommon, resembling some varieties of true alabaster. A pair of columns prepared some time ago excited considerable admiration from showing two apparent geode-like cavities lined with crystals of burnished gold set in a dark olive and purple ground. In reality no cavities existed, the stone being solid and sound throughout.

One of the most remarkable and unique varieties, but which occurs only sporadically, is of a translucent white, but so injected parallel with the bedding with argillaceous matter as to give most wonderful cloud-like effects, such as words can not satisfactorily describe. Visitors to the California pavilion at the World's Columbian Exposition at Chicago in 1893 will recall the unique pictures in stone there displayed by the Kesseler Brothers, of San Francisco. In some slabs the dark coloring matter was so distributed as to give the effects of precipitous mountains, with tops in the clouds and lakes and valleys at their feet. In others the effect was as if the surface were roughly mammillated with smoky clouds of varying degrees of density. In all these forms the slabs must be cut moderately thin and parallel to the bedding and viewed by transmitted light in order to bring out the best effects. (Pl. 12.) The coloring matter in these cases was found to be mechanically included clay, which remained as a muddy sediment in the bottom of the beaker when the stone was dissolved in hydrochloric acid, as already noted.

It is stated in the report above referred to that the stone could be taken out in blocks 10 feet square (thickness not stated) without a flaw. The material is hauled by wagon from the quarries to Musick, and shipped thence by rail to San Francisco, where it is worked up. Active and systematic quarrying was begun here in the summer of 1890.

Several years ago a resinous travertine occurring as superficial deposits on a bare hillside near Suisun City, in Solano County, was worked somewhat spasmodically, but was soon abandoned, owing in part, it is said, to the damage done by injudicious blasting. It is probable, however, that but little could have been done under the most favorable of circumstances, owing to color and textural qualifications. The stone varies in color from light amber to deep resinous brown, and often shows most beautifully the peculiar wavy, undulatory bands of color so characteristic of rocks of this class. Both color and texture are, however, variable, and it is impossible to obtain slabs of any size that are not rendered undesirable through porous layers, or monotonous and even objectionable from their dull resinous hues. Some beautiful material was here obtained, and doubtless more might yet be found, but Americans, and those who call themselves such, have yet to learn how to conduct such an enterprise profitably. Another small deposit that was worked to some extent exists on Sulphur Creek, in Colusa County This is a very beautiful stone, of a rich deep-brown color, with bedding veins of lighter yellowish-brown. The quantity is said to be quite limited and to be obtained only in blocks of small size. The coloring matter in both these cases is wholly organic, analyses showing scarcely a trace of metallic oxides or other impurities. In the reports of the State mineralogist the Sulphur Creek stone is described as occurring in the form of a vein consisting of two seams, each about 5 inches thick. A quantity of the rough stone was at one time sent to England, where it found a ready market. Some onyx of a light-brown color, beautifully veined, occurs in the quarries of the Colton Marble Company, in San Bernardino County. It is said to have been used only to a slight extent. The writer never having seen samples, can express no opinion regarding its qualities. Near Crescent Falls, on the Sacramento River, 6 miles below Sisson, in Siskiyou County, is still another deposit, yielding material of a beautiful emerald-green color. I am informed by Mr. J. S. Diller, of the U. S. Geological Survey, that the stone occurs only in the form of a vein 4 to 6 inches wide in granite, the vein being open in the middle and allowing the escape of an excellent spring of soda sulphur water. The deposit is very irregular and of limited extent along the strike, and probably also limited in depth. It is too irregular to furnish large slabs and of too small extent to afford any considerable quantity of material. Onyx marbles have also been reported at Gold Run, in Placer County; Las Penas-qintos Creek, San Diego County; Oro Grande, San Bernardino County; Vacaville, Solano County; Geyserville, Sonoma County; Tuscan Springs, Tehama County; Three Rivers, in Tulare County; near the head waters of Eel River, in Lake County; Bridgeport, Mono County; Little Castaca Cañon, Los Angeles County, and on Santa Catalina Island. None of these have, however, as yet been shown to be of sufficient extent to have any commercial value, nor has the writer seen any of the material.

Eastern Appalachian Region.—The valley of Virginia, extending throughout the entire length of the State, running in a southwesterly direction from Harpers Ferry on the north, is underlaid by limestones of Silurian or Cambrian age. Percolating waters, acting through untold years, have dissolved out, in these, numerous caverns in the manner

SLAB OF SAN LUIS OBISPO ONYX MARBLE, CUT PARALLEL WITH PLANE OF DEPOSITION AND SHOWING CLOUD-LIKE EFFECT FROM INCLUSIONS OF CLAY.

Cat. No. 61306, U. S. N. M.

STALAGMITIC MARBLES.

Fig. 1. Cross-section of block. Cat. No. 67366, U. S. N. M. Marion County, Virginia.
Fig. 2. Cross-section of block. Cat. No. 67617, U. S. N. M. El Paso, Texas.
Fig. 3. Longitudinal section of stalagmite. Cat. No. 67981, U. S. N. M. Luray, Virginia.
Fig. 4. Cross-section of stalagmite. Cat. No. 67981, U. S. N. M. Luray, Virginia.

already described. The Luray Caves, in Page County, and Weyers Cave, in Augusta County, are among the most widely known of these. There are, however, hundreds of smaller and less interesting ones, which may have become wholly or partially refilled by stalactitic and stalagmitic matter. Very many instances present themselves in which portions of the roofs or sides of these caves have been removed by erosion, leaving the white, creamy, or amber yellow stalagmitic material exposed on the surface, where it shows up in strong contrast with the dull gray limestone which forms the prevailing country rock. It has not infrequently happened that these deposits are of sufficient extent to warrant the opening of small quarries, though the stone is rarely of sufficient beauty to enter into active competition with the onyx marbles of Mexico, Arizona, California, or Algeria, with which they are chemically almost identical. Nevertheless fine blocks are frequently obtainable, showing a pronounced banded structure when cut across the plane of deposition (pl. 13), and it is rather to be regretted that no more successful attempts have been made toward keeping them upon the market. Such attempts as have been made have almost uniformly failed, partly owing to a lack of definite knowledge as to the character of the deposits on the part of those in control, and partly from the fact that the work was undertaken on too extensive a scale. The average American has yet to learn that a small business, carefully conducted, may be a surer source of income than many of the gigantic schemes which flood the country to-day. The managers of the caverns above alluded to might add materially to their incomes, as well as to the satisfaction of their visitors, by exposing for sale small objects made from such blocks of stalactite or stalagmite as could be spared without defacement of the cave. So far as the writer is aware it is only at Mammoth Cave, in Kentucky, that any attempt is made in this line, and here one finds only a few small charms and paper weights manufactured at odd moments by the natives. Near Harrisonburg, in Owen County, are considerable deposits of stalagmitic material which have yielded small pieces of great beauty. An attempt was made not long ago to work the quarries, but with little success. The marble dealers, knowing they could not be relied upon as constant sources of material, ignored them utterly, and it will not be until our wealthier classes learn to more fully appreciate home products that we may hope to see these marbles receive the attention they deserve.* Nevertheless it is not

*It must be acknowledged, however, that the difficulty lies not wholly with the wealthier classes, who can scarcely be expected to admire or demand any article concerning the existence of which they are ignorant. Americans abroad pay fancy prices for small articles of ornament and art simply for the reason that these are everywhere exposed for sale, and the attention is at once attracted. Let but the American exert equal taste and patience in working up our native materials, and it is possible we might be able to tell quite another story. Brazilian agates, colored and polished in Germany, are sold to the tourists of Colorado and other Western resorts as local products, and I have seen the so-called "tiger-eye" (Crocidolite) from South Africa sold by dealers in Montana to the unsuspecting tourist as fossil wood from Arizona.

uncommon to find mantels and chimney pieces of the stone in the houses of people living in the vicinity. Such, as a rule, are the work of local stone dealers, and cut from blocks found loose in the fields. Fine blocks of stone from caves that have been almost completely refilled have been found near Lexington, in Rockbridge County, a slab some 18 inches square of which is among the collections of the National Museum. In one of the extreme southwestern counties deposits of this nature were worked some thirty years ago by a local stonecutter, but who, it needs scarcely be said, was a foreigner. The material, singularly enough, was utilized mainly for tombstones. As a result the churchyards of the region present an appearance quite unique, and wholly unlike anything I ever saw elsewhere. In place of the white marbles, gray granite, or dull slate of the ordinary churchyard, we find here rows of white, amber, and resinous stalagmitic marbles, some of which are translucent and still beautiful in spite of their years of exposure, though naturally roughened and in some cases badly flawed and seamed.

Quarries in the broken-down caves of eastern Tennessee, southwestern Missouri, and Arkansas have also been opened and worked for a limited period, some of them furnishing a fair grade of material, but for which there proved only a limited market. The attempt is invariably made to utilize the product mainly for furniture tops and wainscotings, in which line it must be brought into competition with the more desirable travertines and high-grade decorative colored marbles, as those of Siena and Algeria. For small ornaments, vases, columns, and certain forms of bas-relief the material is best adapted, and it is of little use to seek a market elsewhere.

Colorado, Utah, and New Mexico.—Deposits in every way similar to those noted above have been reported from Colorado, and, indeed, are likely to occur in any limestone country. Dark and light amber varieties were exhibited as from Pelican Point, Utah County, in the Utah exhibit at the World's Columbian Exposition in 1893. A much more striking variety was in the form of bright lemon and orange, dark buff, and chrome yellow and white slabs from deposits near Lehi, in the same Territory. The stone was beautifully translucent and the colors of astonishing depth and brilliancy—so much so that it at first seemed scarcely possible that they could be natural. The writer was informed by Mr. F. T. Millis that the material occurs in the form of a vein some 4 feet in width in limestone. Near Rio Puerco Station of the Atlantic and Pacific Railroad, in Valencia County, New Mexico, are deposits of travertine, or stalagmitic matter, which have been exploited thus far only in a preliminary way. The stone varies from whitish to deep smoky, almost black, and from translucent to opaque. The better varieties show on a polished surface a silky luster and a radiating fibrous structure. It is distinctly banded parallel with the plane of deposition, the bands varying from faintly whitish to nearly black, the dark bands being mere lines of inclosures. The stone, while lacking in richness of color, is, owing to its luster and fibrous structure, very attractive. The specific gravity is 2.88; before the blowpipe it turns white and crumbles away, agreeing in these as well as its fibrous structure with the properties of aragonite.

Mexico.—To the average American the name onyx is inseparable from that of Mexico, since from this source has, until within a few years, been brought the almost entire commercial supply, though small quantities are imported from Algeria and Egypt.

There are many small, sporadic occurrences of onyx throughout the volcanic areas south of the city of Mexico, and doubtless in other parts of the republic as well, but which are as yet unknown or unworked owing to lack of facilities for transportation. Until quite recently the principal source has been the region southeast of Puebla, between Tecali, Tzicatlacoya, and Tepene. Recently deposits have been found near San Antonio.* The underlying rock, so far as I am able to glean, is in most cases a Cretaceous limestone, though frequently associated with recent lavas. Those deposits now worked are naturally along or near the lines of railway leading to Vera Cruz and the city of Mexico.

The stone of these localities has been worked from a very early period of American history, perhaps even before the advent of the Spaniards and the blotting out of Aztec civilization. The best modern account of the quarries, if such they can be called, that I am able to find is that given by an unknown writer in the Engineering and Mining Journal for December 26, 1891. On this I have drawn very largely in the descriptions given below, although I cannot vouch for its accuracy.

Among the Aztecs the stone was so highly prized for its beauties that it was deemed too sacred to be given to the ordinary uses of common mortality, and was devoted almost solely to the ornamentation of religious edifices or the manufacture of sacrificial vessels. So strict and arbitrary was this limitation on its use that its Indian name, "tecali," is merely a corruption of the Aztec word "teocall" (Lord's mansion), a name given by the Indians to their temples.† With Cortez and his freebooting followers the stone found as high favor, while with that peculiarity that always distinguished them of picking out the best under all circumstances, the padres regarded it as a most meet and proper offering to the church from the devout. Altars and baptismal fonts were always made of it when it could be obtained, and among the most

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* Beiträge zur Geologie und Paleontologie der Republik Mexico. Von Drs. Felix und Lenk, III. Theil., p. 129.

† Teocaltzinco, Teocal-tzinco, Teocalcino. Un templo sobre medio cuerpo humano, signos, uno figurativo de *teo calli* (casa de Dios) y el otro fonético, terminal y diminutivo, tzinto, significan; "en el lugar del pequeño templo" ó en pequeño Teocaltepec.

Catalogo Alfabetico de los Nombres de Lugar Pertencientes al Idioma "Nahuatl" Estudio Jeroglifico de la Matricula de los Tributos, etc., por el Dr. Antonio Peñafiel. 1885.

From this it would appear that the derivation of the word as given in my "Stones for Building and Decoration" (Wiley & Sons, New York) is erroneous.

notable sights connected with a tour of Mexico are the magnificent collections of articles of this marble which are to be found in many churches, particularly that in the cathedrals of the cities of Mexico and Puebla, and in the churches of Leon, Queretaro, and Guadalajara, several of which contain perfect slabs 3 and 4 feet square, an extraordinary size on account of the small and irregular shape in which the stone is found.

During recent years fashion has taken up what the priests of these two religions thus marked with their approval, and the stone under the name of Mexican onyx, with its capricious markings, has become so well known as to make a detailed description of its different varieties unnecessary. To those who have made its acquaintance, though only through the medium of the ordinary onyx table top, clock, or the interior ornamentations of public buildings, beautiful as such are, it would be hard to convey a correct idea of the exquisite beauties of the finer grades of the marble. While the ordinary grades commonly encountered probably surpass in elegance any similar material, it is only in the light and dark green, the ivory-colored, the brilliantly banded, and the dark-red varieties that a full realization of the stone at its best is had.

In the quarries the stone is found in the form of detached masses, ranging in size from a few inches up to 10 or 12 cubic feet. Larger sizes are occasionally found, but so rarely that the event is a notable one, while the value per cubic foot is correspondingly increased. For example, the value of a piece containing 1 or 2 cubic feet would be estimated to be ordinarily $3 per cubic foot in Mexican money, but were the piece to contain 25 or 30 cubic feet, the valuation would be about $15 per cubic foot. This is for ordinary stock; with green and the other finer grades it would be very difficult to form any estimate whatever. This smallness of available sizes is one of the principal defects of the stone, and one with which the best skill has battled in vain. With its other defects, that of occasional flaws or holes, ranging from a tenth of an inch to 2 or 3 inches in diameter, more success has been had in remedying the negligence of nature by filling the smaller with a cement mixed with powdered portions of the stone, while in the larger a piece of the onyx is very often boldly inlaid with such skill as to defy detection on a cursory inspection. With the growing inability to supply the demand for onyx, this last method of making the most out of what remains of the stone has been pursued to a great extent, and with very good success except where the article so "improved" is subjected to sudden changes of temperature, in which case the effect of our northern climate at once becomes apparent, and the best of work under the irregular processes of expansion and contraction soon becomes unsightly. Almost as common but a more questionable method of "improving" the stone is that of sawing the inferior qualities that lack color into very thin slabs, so thin as to be almost translucent. These are then operated on by an "artist," who adorns

ONYX MARBLE CUT PARALLEL WITH PLANE OF DEPOSITION.
Cat. No. 26011, U. S. N. M. Pueblo, Mexico.
Colors, green and red.

one side with a variety of colors and pencilings that make a very fair counterfeit of the real first-class article, after which the side that is painted is covered with a coating of very fine cement, which gives it the appearance of having been merely sawed and left unpolished. This class of work is often done so well that when first finished it will deceive any but the sharpest of experts, but under a year or two of use, the swindle becomes apparent, and soon nothing remains but a thin, transparent slab of stone.

The formation in which the marble or onyx is found is a tough, reddish or dark-brown clay, overlying a closely cemented conglomerate. This is the usual form, but in one instance—that of the Antigua Salines, on the Rancho del Carmen—it is found in a hard, flint-like country rock which appears to be more of a bastard jasper than anything else. In this instance the onyx appears as a regular vein formation, the veins varying from 1 to 12 inches in width.

Of the quarries themselves all are small. The most famous—*La Pedrara*, in the district of Tecali, 21 miles from the city of Puebla—does not cover more than 3 acres, while the average depth of the quarrying is not over 7 feet. The value of the onyx taken from this small area, though, is hard to realize. The high reputation of the stone is recognized the world over, but it is very doubtful if one-tenth of what has been sold as "La Pedrara" during the last quarter of a century ever came from it. At present no attempt is made to work the quarry, in fact no indication of onyx in the place is to be seen; the only effort made in obtaining onyx from it being by sorting over the old dumps or refuse places which have accumulated during its active existence. From these is taken every piece of onyx that will square 6 inches or over. The process is slow, while the yield is seemingly very small in return for the labor. The onyx obtained is of a very fine quality of green, ranging from a very light to a very dark tint, and, as a rule, showing a slight dash of red or pink. Occasional pieces of variegated colors are found which are very fine, while the texture is very good.

Next in importance to La Pedrara is *Antigua Salines*, in the district of Tehaucan, and which has already been briefly mentioned on account of its peculiar geological formation. The quarry covers over an area not exceeding two acres, and forms the face of a hill about 250 feet high. In working it, the system has been simply a process of gouging out the onyx and the rock which encases it, until into the side of the hill there has been excavated a hole 100 feet in width by 50 feet in height and 60 feet deep, looking very much as if an immense shovelful had been taken out. The onyx is variegated in colors, and is ranked next to La Pedrara.

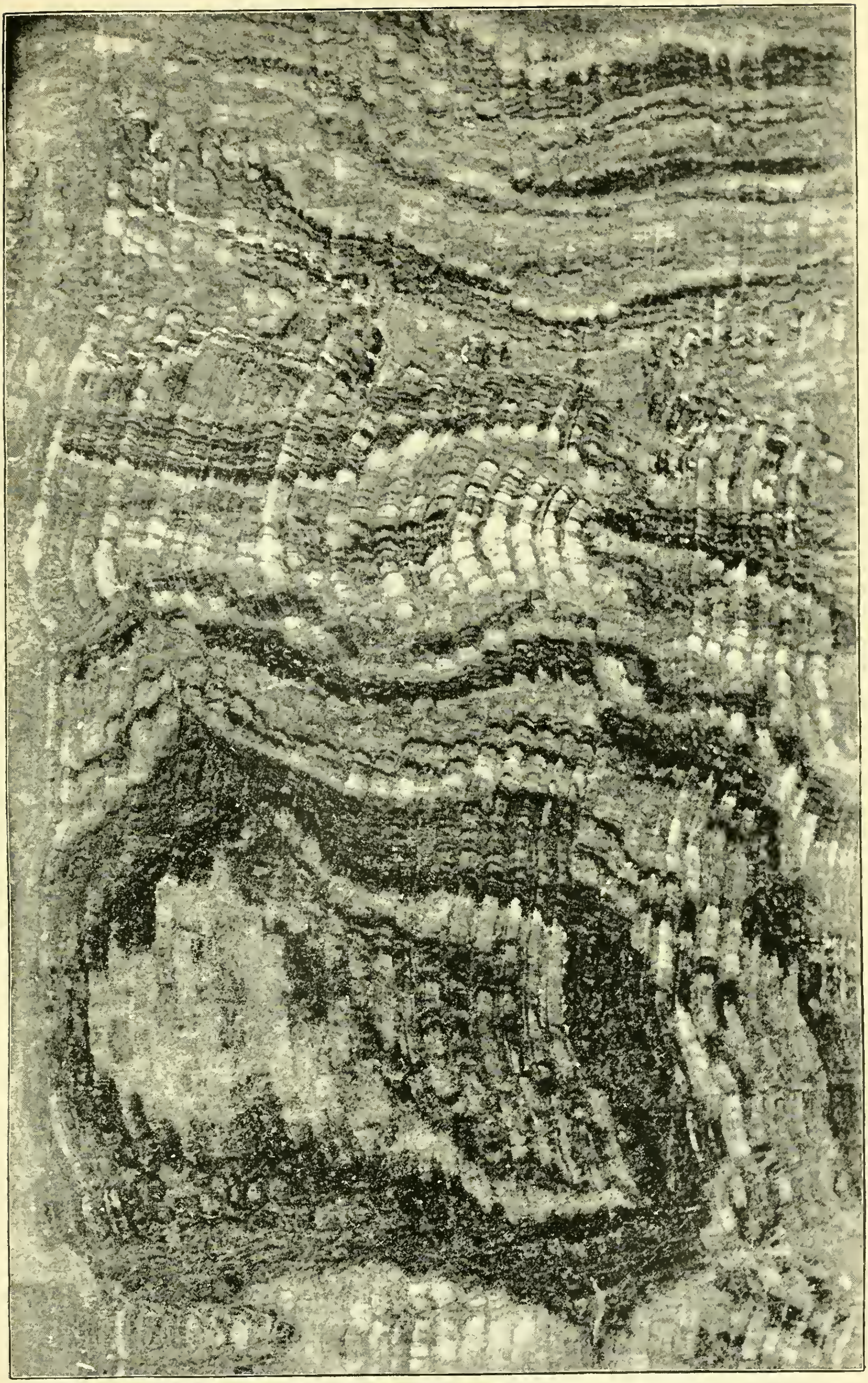
Ranking third, probably, in importance is *La Sopresa*, which covers an area of about 5 acres, and is located about 35 miles west of Antigua Salines, in the same district. The onyx from this quarry is semitranslucent, white, totally devoid of colors, save where an occasional mass of green is found. The quarry has been worked for the last fifteen years only, and is at present the largest producer of onyx in Mexico. Sizes ranging as large as from 2 to 3 feet square can be obtained, which is something extraordinary in Mexican onyx deposits, and the supply in "sight" seems to be sufficient for several years. The total absence of any color to set off the pure white is to be regretted, but as it is, the demand for the stone is sufficient to tax the quarry to its utmost to supply it.

Directly east from Sopresa, about 4 miles, is found the quarry of *La Mesa*, lying, as its name indicates, on a level table-topped mountain. The quarry shows quite extensive working, the product being a variegated onyx, which, however, lacks the brilliancy shown in the stone of Antigua Salines. It covers an area of nearly 30 acres, being the largest quarry in Mexico. Occasionally quite large pieces are obtained, but the average sizes prepared for shipment will not exceed 15 by 10 by 6 inches, while pieces as small as 10 by 6 by 10 inches are also shipped, both to Europe and America. This, however, is the case with all the quarries, and it is the exception when pieces larger than the first mentioned are exported.

In addition to the quarries here mentioned there are many others of less importance, either by reason of their small output or from having been worked out. Among these the most interesting, on account of historical associations or past records, are those known as El Mogote, Lajas, Agua Esconda, Desamparo, Mehauntepec, Tepeyac, Tecoluco, La Paoma, and La Reforma.

Baja California.—The last, and perhaps most important of the American deposits to be described are also on Mexican territory, but on the peninsula of Lower or Baja California, near the Gulf Coast, and some 150 miles south from San Diego. One of these, that at the Tule Arroyo, has been already sufficiently described on p. 547. The second deposit, or rather series of deposits, lies in the open desert some 3 to 5 miles to the southwest of the arroyo. The region is one of low rolling hills and flat-topped mesas, with shallow valleys and dry water courses. The prevailing rock, a friable sandstone, with alternating layers of calcareous conglomerate and onyx in isolated patches. The surface is everywhere covered with irregularly rounded and angular fragments of eruptive rocks from the hills in the near vicinity.* Aside from the onyx and the characteristic lake bed deposits all traces of spring and lake action have long since disappeared, and the region is an arid waste with only cacti, "sirios" (*Fouquieria splendens*) and the *agave shawi* in the immediate vicinity, with the *mesquite*, *paolo verdes*, stout, low-branching elephant wood (*veatchi Cedrocensis*) and pole-like *fouquieria columnaris*, or giant cactus (*cereus pringlei* (?)) like clustered mill logs along the dry water courses or extending for dreary miles along the flat-topped

*For a detailed account of the geology of the peninsula, see "Geological Sketch of Lower California," by S. F. Emmons and G. P. Merrill, published in Bulletin Geological Society of America, April, 1894.



TAPESTR ONYX.

Cat. No. 60845, U. S. N. M. Yavapai County, Arizona.

Natural size.

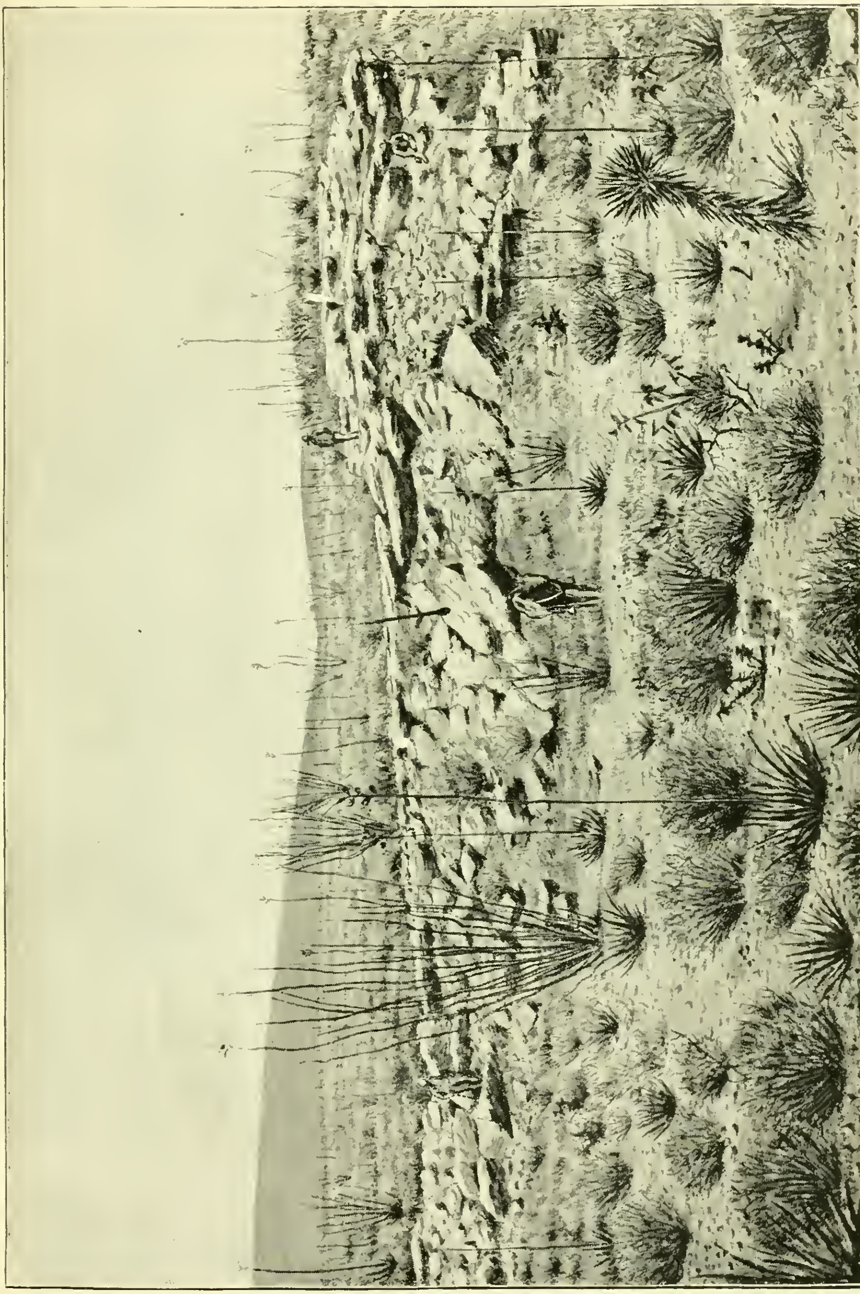
plateaux. The agave, the refreshing plumpness of whose virgin leaves stands out in marked contrast with the dried and shrunken forms of the flower-bearing adults, forms, together with the thorny *Fouquieria splendens*, the most striking floral feature of the waterless land. The onyx occurs in the form of spasmodic and isolated patches, sometimes forming apparently a superficial pavement upon the surface, or again, where the beds have been cut by the winding course of the now dry ravine in the form of three distinct layers, from 20 inches to 3 or more feet in thickness, interstratified with tufaceous and lake bed material. (Pl. 16).

Nothing can be more fascinating to the lover of the beautiful in stones than this occurrence, where huge blocks of material of almost ideal soundness, with ever varying shades of color and veination lie everywhere exposed in countless numbers. Under the blistering sun of an almost tropic climate the exposed blocks have become to some extent corroded, and covered upon their immediate surface with a thin film of oxidation products which just sufficiently disguise the true color and translucency to keep one running here and there, ever cracking off new fragments in the vain attempt to collect a fairly typical series. The colors are peculiarly delicate, and there is a wonderful uniformity in quality. Pearl white (the virgin onyx), delicate rose tints, and light greens are the more common, all variegated by a network of fine sharp veins of a rose-red color, as shown in Plates 17 and 18 The rose color is, so far as my present knowledge goes, quite unique and wonderfully beautiful.

The analyses given in the table show this to be the most dense of any of the onyx marbles thus far examined. Although less highly colored than some of the Mexican varieties, it is nevertheless one of the most beautiful, owing to its uniform translucency, freedom from flaws, and fine veination.

Algeria.—The celebrated deposits from whence the ancient Romans drew their supplies of onyx, alabaster, calcareous onyx, or oriental alabaster are situated in the northern part of Algeria, in the province of Oran. The deposits as now worked are two in number, one some 65 miles from Oran, on the route to Tlemeen, and the second a few miles to the west, both lying to the right of the Isser. The first of these, known by the name of Bled Bekham, is divided into three parts by two ravines, the Oued Abdallah on the east and the Oued Calkra on the west. M. Comynet estimates the area occupied here by the onyx as about 12 acres, and gives the following section: (1) A bed of about 4 feet thickness, under which lies compact travertine of no value; (2) a second bed of onyx 3 feet 4 inches thick, separated by impure travertine from a third bed of onyx 2 feet in thickness, and lastly, several thinner beds from 6 to 16 inches in thickness, alternating with impure travertine, making in all a mean thickness of some 10 feet of quarryable material. It was stated at the time that blocks of extraordinary size could be quarried for shafts, columns, or friezes, even up to 20 feet in length by 4 feet square. At this date it is stated blocks may be had 10 feet in length by 3 feet in width and thickness. The second deposit noted, called Ardja-el-Beida, lies some 3 kilometers to the west of Bled Bekham, upon a plateau with steep north, west, and south escarpments. It was once continuous with a bed called El Cellon, but from which it has become separated by a ravine called the Chabbat-Karouba. The onyx of this locality is said to be inferior to that of the first, both as regards quality and size of blocks obtainable. The beds vary in thickness from 30 inches with a total of some 10 feet, and cover an area of about 20 acres. All the deposits are Quaternary, and lie unconformably upon lime and sandstones of Tertiary (Middle Miocene) age. The stone, as is usually the case, varies greatly in color and shade, from pure white to rose-colored and bright red, golden yellow, and, more rarely, green. The present quarriers (Sauville & Co., Paris) divide the output into four classes, *le Blanc*, *le Rubauné* or *Veiné*, *le Cachemire* and *le Cachemire bois*. The white (blanc) variety is the more abundant, and is found in nearly all the quarries, occurring in layers sometimes upward of a meter in thickness, and blocks have been removed containing upwards of 5 cubic meters. It varies from translucent to opaque, sometimes milk white or veined with fine ribbons of pale yellow. The milk-white variety is employed for columns, articles used in religious ceremonies, and in place of ordinary white marble in furniture. The translucent variety is employed in statuary, and has, besides, many other applications, as for the glazing of church windows and for shades. The ribboned or veined onyx is also abundant, and there are many places for its extraction. The ribbons are parallel with the plane of deposition, and of a clear deep yellow, sometimes rose or violet tint. Other irregular veins traverse the stone in all directions, giving very beautiful effects. This variety is also obtainable in blocks of good size, and is used for buildings, columns, pilasters, balustrades, stairways, panels, or for furniture tops. A green variety also occurs, though now somewhat sparingly. The prevailing color is paler than the better varieties of the Mexican or American stone. A rose variety, said to have been especially admired by the Romans, is found in small blocks, scarcely larger than a paving stone. White translucent varieties with irregular veins of lively red or orange yellow also occur, though sporadically and in small masses.*

*In a publication entitled "Notice Mineralogique par la Service des Mines" (Algeria, 1889) I find references to onyx quarries as below: In the province of Oran, at Ain Seboa, some 17.5 kilometers south 32° west from Nemours, an onyx of yellow, gray, and vermilion tint, apparently belonging to the Quaternary period and resting upon Oxfordian beds; at Sidi Brahim, 10 kilometers south 4° west of Nemours, a similar stone, but of poorer quality, and at Tekbalet, 26 kilometers north 21° east from Tlemcen, a very beautiful variety of diverse hues intercalated in isolated Quaternary areas resting upon Miocene; in the province of Constantine, in Oued Zergua, some 40 kilometers southeast of Souk-Ahras, a marble approximating onyx occurring in veins in Cenomanien beds. This doubtless a stalagmitic or stalactitic deposit.



DEPOSITS OF ONYX MARBLE IN DESERT SOUTH OF SAN QUENTIN, LOWER CALIFORNIA.

BLOCK OF ONYX MARBLE FROM LOWER CALIFORNIA.

Natural size.

Colors greenish-white and rose tinted with red-brown veins.

SLAB OF ONYX MARBLE SHOWING SHARP RETICULATING VEINS.
Cat. No. 61388, U. S. N. M. Peninsula of Lower California.
Natural size.
Colors whitish, rose tinted, with red and brown veins.

Although not described in the published accounts, it is evident that a process of oxidation has gone on in certain layers of the Algerian stone, as in that of Arizona, for such material is found in the shape of turned columns and stands for statues and other ornaments in the art and furnishing shops. The colors are quiet ocher and mahogany brown, clouded and veined, and though not as translucent and highly lustrous as objects of the unoxidized stone, such are by no means lacking in beauty. The dealers, in their ignorance of the nature of the materials they handle, will almost invariably assure a customer that such are not of onyx, but "marble," even though as the writer has shown them, there may still be veins or layers of unoxidized material running through them.

Egypt.—Unlike the onyx of Algeria, that of Egypt, at least so far as the better known locality is concerned, is stalagmitic, that is to say, a cave deposit.

According to various authorities* there are two known sources of stone, the first near Beni-Souef, some 25 leagues south of Cairo, and the other at Syout, farther to the south, but also in the Nile Valley. The writer is informed by Dr. Ernest Sickenberger, of Cairo, that the stone of the first-named locality is found in cavities and clefts in Eocene limestone at Gebel Oorakem (Wady Sanoor) east of Beni-Souef, and in smaller amounts east of Assioot. That used in the mosque of Mehemet Ali, as already noted, was taken from the Gebel Oorakam quarries, as was also the material for the beautiful monolithic columns of the Church of S. Paolo fuori le Murs, at Rome. Samples of this stone kindly sent to Washington by Dr. Sickenberger were of a nearly white or only faint straw color, of a granular texture, and in no way remarkable for their beauty, but such as might be duplicated by the hundreds of tons from the broken-down caves in the Silurio-Cambrian limestones of the Shenandoah Valley of Virginia. Mineralogically the stone is calcite and carries only a trace of organic matter in the way of impurities. According to Delesse this deposit was worked by the Egyptians at a very early date, and later by the Romans. As, however, published accounts speak of the stone only as "Egyptian alabaster," we have in most cases no means of ascertaining the exact locality from whence it was derived. The Syout stone differs from that of Beni-Souef in having a micro-radiating instead of granular structure, and in being of a light yellowish or straw color. It is translucent and close in texture, and has a beautifully mellow and pleasing tint either when carved or polished. The date at which these latter deposits were first opened can not be ascertained from available literature. Delesse states, and after him Chateau,† that they were discovered by Selim Pacha, to

*See Delesse, Materiaux de Construction de L'Exposition Universelle de 1855; Zittel, in Baedeker's Guide to Lower Egypt; Sir J. W. Dawson's Notes on Useful and Ornamental Stones in Ancient Egypt.

† *Op Cit.*

whom they were conceded by the vice roi. Boscawen,* however, gives us to understand that they were worked at a much earlier period by kings of the sixth dynasty (3703 B. C. according to Mariette; 2744 B. C. according to Prof. Lepsius). He describes the quarry as situated in the hills to the east of the Syout road, some 10 miles southeast of the plain of Tel-el Amarna, and as being about 250 feet long by 50 feet in width, cut into the face of the hill. It was worked, he says, upon a most regular system, layer after layer being cut away, the product being both "alabaster" and ordinary limestone. The detailed description of this author is as follows:

"Starting from the quarry is a broad roadway, from 15 to 20 feet wide, crossing the hills into the line of the Siout road, and thence across the plain of Tel-el-Amarna to the Nile. This roadway is a wonderful piece of engineering work. In one place a ravine some 40 or 50 feet is crossed, the roadway being carried across by a solid causeway built by bowlders so arranged on a road basis as to support very heavy weights. The gradients are regulated with great care.

"This quarry does not seem to have been worked much during the later dynasties of the Middle Empire. The other day the Arabs brought us news of a large magharah, or quarry, with inscriptions, situated one day's journey into the desert. So Mr. Newberry and myself started on camels. It was a long, dreary ride across the plain of Tel-el-Amarna, along the Siout road, and across the hills, slightly to the south of Hat-Nub. Here we crossed a number of barren wadies and reached the slopes of a low limestone range, probably the northern portion of the Jebel-Kaiwleh, and after a hard climb reached the entrance to a large quarry, which was partially blocked with drift and rubbish. It required but a very casual inspection to find that we had struck a very ancient quarry, for on the lintel of the door were a number of inscriptions of King Teta, the founder of the sixth dynasty. The inscriptions on the doorway were very archaic in type, especially the rudely-drawn figures of a dog and a hawk and the portrait of Teta wearing a crown. The entrance chamber of the quarry ran due south for a distance of about 80 feet and then struck a broad isle running slightly southeast for a distance of about 110 feet. All around were fragments of beautiful alabaster, of a type not used for building purposes, but the fine, rich, yellow, close-grained sort, often with brown veins, used for statues, vases, and toilet and sacrificial pots. The walls were covered in many places by rude votive inscriptions, usually painted panels representing a sacrificial scene, with the table of offerings. Some of these are grotesque almost to caricature. The face and limbs are the dark Egyptian red, the robe white, while the grotesque nose of the figure and the green palm branch seem to quite burlesque the scenes near Over the figure is a short hieratic inscription. On other walls are dated inscriptions in the reign of Amenemhat II, of the twelfth dynasty, and a fine rock-cut tablet of Usertesen III. The king is here represented seated on his throne, with his hunting dog by his side.

"The quarry does not seem to have been worked after the period of the twelfth dynasty. We slept in the quarry that night, and it was indeed about as old and as weird a bedchamber as was ever my fortune to occupy. Bats flew over our heads and blinked at the lamp, and about midnight two foxes, whose home we had usurped, came to the top of the neighboring hills and barked defiance. * * * The morning was devoted to examining the quarry, and with some interesting results. The alabaster vein was not very thick, but very rich in color, and the method of working seemed to have been to cut out blocks about 4 or 6 feet long and 3 feet in depth and width These were hewn out and roughly dressed with stone hammers and chisels made

* See Stone, Indianapolis, Indiana, Sept., 1893, pp. 362–365.

from hard bowlders. * * * The hands were protected by hide bands wound around the chisel, and several strips were found in the débris. That the alabaster from this mine was only transported in small portions is shown by the fact that there is no made roadway for sledge transport.

"Another alabaster quarry remains to be mentioned, situated to the east of the Tel-el-Amarna plain, behind the northern tombs. This was worked by Rameses II and his son Meneptah, the Pharoahs of the Oppression and the Exodus, and its steep sides may have echoed to the blows of the picks of the toiling Israelites."

Persia.—The onyx found in the vicinity of Lake Oroomiah has already been referred to in discussing the origin of this class of rocks. For a description of its mode of occurrence we have to rely mainly upon the accounts of travelers who are neither chemists or geologists. The writer is informed by Mr. P. Z. Easton that the quarries, if such they can be called, lie not far from the main road from Tabriz to Maragha, about 44 miles from the former place and 28 miles from the latter. I find two somewhat detailed accounts of the occurrence in the literature at hand, and venture to give both in full, though the first more as a curiosity than as a contribution to scientific knowledge. This is by Morier * and is as follows:

"On the 24th we proceeded to Shirameen, a village near the lake, and distant 3 fursungs from the preceding stage. At the distance of 1 fursung on the right of the road is a spring of chalybeate water, and 2 fursungs farther on, after having discovered the expanse of the lake, we diverged from the road to visit the petrifactions.

"This natural curiosity consists of certain extraordinary ponds or plashes whose indolent waters, by a slow and regular process, stagnate, concrete, and petrify, and produce that beautiful transparent stone commonly called Tabriz marble, which is so remarkable in most of the burial places in Persia, and which forms a chief ornament in all the buildings of note throughout the country. These ponds, which are situated close to one another, are contained in a circumference of about half a mile, and their position is marked by confused heaps and mounds of the stone, which have accumulated as the excavations have increased. We had seen nothing in Persia yet which was more worthy of the attention of the naturalists than this; and I never so much regretted my ignorance of subjects of this nature, because I felt that it is of consequence they should be brought into notice by scientific observation. However, rather than omit all description of a spot which perhaps no Europeans but ourselves have had the opportunity of examining, and on which, therefore, we are bound (in justice to those opportunities) not to withhold the information which we obtained, I will venture to give the following notes of our visit, relying upon the candor and the science of my reader to fill up my imperfect outline.

"On approaching the spot the ground has a hollow sound, with a particularly dreary and calcined appearance, and when upon it a strong mineral smell arises from the ponds. The process of petrifaction is to be traced from its first beginning to its termination. In one part the water is clear, in a second it appears thicker and stagnant, in a third quite black, and in its last stage is white, like a hoar frost. Indeed, a petrified pond looks like frozen water, and before the operation is quite finished a stone slightly thrown upon it breaks the outer coating, and causes the black water underneath to exude. Where the operation is complete a stone makes no impression, and a man may walk upon it without wetting his shoes. Whenever the petrifaction has been hewn into the curious progress of the concretion is clearly seen, and shows itself like sheets of rough paper one over the other in accumulated layers. Such is the constant tendency of this water to become stone

* Morier, Second Journey through Persia, May 18, 1818, pp. 284–286.

that where it exudes from the ground in bubbles the petrifaction assumes a globular shape, as if the bubbles of a spring, by a stroke of magic, had been arrested in their play, and metamorphosed into marble. These stony bubbles, which form the most curious specimens of this extraordinary quarry, frequently contain within them portions of the earth through which the water has oozed.

"The substance thus produced is brittle, transparent, and sometimes most richly streaked with green, red, and copper-colored veins. It admits of being cut into immense slabs, and takes a good polish. We did not remark that any plant except rushes grew in the water. The shortest and best definition that can be given of the ponds is that which Quintus Curtius gives of the Lake Ascanius, "Aqua sponte concrescens" (Lib., XI., c. 12). The present royal family of Persia, whose princes do not spend large sums in the construction of public buildings, have not carried away much of the stone; but some immense slabs which were cut by Nadir Shah, and now lie neglected amongst innumerable fragments, show the objects which he had in view. So much is this stone looked upon as an article of luxury that none but the king, his sons, and persons privileged by special firman are permitted to excavate; and such is the ascendancy of pride over avarice that the scheme of farming it to the highest bidder does not seem to have ever come within the calculations of its present possessors."

The second account, that of Curzon,* is apparently the more accurate, though he also refers to the stone as a "petrifaction," and is quite in error in stating that the springs in the Yellowstone Park have deposited "gleaming blocks of snow-white marble." He says:

"Near the eastern shore of the lake (Oroomiah), and at about 6 miles from the village of Dehkharegan, are the pits or springs from which is extracted the famous semitransparent marble, sometimes called after the neighboring town of Maragha, sometimes after Tabriz. A number of springs, clustered within an area of half a mile in circumference, are constantly bubbling up and precipitating the limestone which they hold in solution. This is deposited in the form of horizontal layers, which are like a thin crust to start with, and can be cracked or broken, but which gradually solidify into hard blocks, with an average thickness of 7 or 8 inches, the best of which are believed to have been formed when the springs had a much higher temperature than the present (65° F.). When quarried this petrifaction can be sawn either in the thinnest plates, when it is nearly transparent, and is sometimes used for windows, or in more substantial slabs, in which form it is much used for pavements and mural wainscotings. It is a singularly beautiful substance, being of a pink or greenish or milk-white color, streaked with reddish or copper-colored veins (from the oxide which it contains); and I have seen beautiful samples of it in the palaces and mosques of the East. I have very little doubt that the wainscoting of the Gur Amir, or Tomb of Timur, at Samarkand, which I have described in my former work, and which has puzzled all travelers, is composed of this marble, which there is nothing more natural than the great conquerer should have carried home with him at the close of his Persian campaign.† The process of petrifaction bears a marked resemblance to that which was in existence till the great eruption of a few years ago at the pink and white terraces in New Zealand, and to that which may still be seen at the Mammoth Hot Springs in the Yellowstone Park, in North America, where the induration may be observed through all its stages, from a filmlike frosted sugar to gleaming blocks of snow-white marble."

The Tabriz stone seems to have formerly been quite extensively used

*Curzon, G. N., Persia and the Persian Question, etc., Vol. I. 1892, p. 264, *et seq.*

†In footnote to above statement he says: "Since writing the above I have come across the statement as a matter of fact that Timur took back with him to Samarkand a large supply of the marble of Azerbaijar."

by the wealthier classes, as already noted (p. 556), and is still utilized to some extent, though mainly in the manufacture of small ornaments.

The Museum collections contain but a few small pieces of material from this source, and which are either pure milk white in color and very translucent (62609), or of a dull red brown color and opaque (62610), the latter being apparently an oxidation product from the white. The stone is interesting from a chemical standpoint, as already noted (p. 559).

Other localities than those mentioned above are known. Thus Blanford* says:

"Mount Kuh Hazar,† lying between Bam and Karman, consists mainly if not wholly of volcanic rocks and ash beds. At the base of the mountain, near Rayin, there is much calcareous tuffa in horizontal beds, apparently deposited by springs, some of which are seen a short distance up the side of the mountain, forming calcareous deposits. Large blocks of massive carbonate of lime of a slightly greenish tint, and apparently formed in stalagmitic masses, are found in the neighborhood, and are used for ornamental purposes. A similar stone is said to be brought from Yezd and other places, and it is generally known in Persia as Yezd marble. It closely resembles the Egyptian stone known as oriental alabaster, except that the color is greenish white instead of yellow."

This is doubtless the stone described by Curzon as—

"An excellent yellow, semitransparent marble, quarried in the mountains near Yezd, the actual spot being Turun Pusht, 40 miles from Taft and 56 miles from Yezd. As already noted, it is from the Yezd stone, according to Curzon, that was constructed the tomb of the poet Hafiz. From this stone, too, according to the same authority, were constructed the superb marble throne and the twisted marble pillars that now adorn the throne room or talar in the royal palace at Teheran."

Still another locality for this stone or one answering well its description is near the village of Tauris, in Susiane. Chardin‡ describes it as—

"transparent presque comme le cristal de roche, et on voit a travers de tables qui ont un pouce d' epassier et meme plus. Ce marbre est blanc, mele de verd, pale comme une maniere de jadde. Il est si tendre que le couteau l' entame: ce qui fait penser a plusiers que ce n'est pas un vrai mineral, ni qui ait la consistance d' une vraie pierre."

ITALY.—The writer is informed by Chevalier Jervis that very many localities exist in different parts of Italy where natural caverns in limestones of varying geological age are to be met with, and which are capable of affording much fine marble for decorative purposes. A very complete list of these is given in Mr. Jervis's treatise on the economic geology of Italy,§ and we will here mention only the more important and widely known. Singularly enough the ancient Romans, with all their love for lavish display in articles beautiful and rare, seem to have

*Eastern Persia, an account of the Journeys of the Persian Boundary Commission, 1870–1872, Vol. II, p. 486.

†Kuh Hazar is a mountain 14,550 feet in height, lying between Bam and Karman, in the central southern portion of the Empire.

‡ Voyages du Chevalier Chardin en Perse, etc., Vol. III, 1811.

§ See I Tesori Sotterranei dell' Italia, vol. 3, p. 340, and vol. 4, p. 504.

worked but little these deposits, but to have preferred bringing their materials from more distant sources. A rich honey-yellow marble of this class occurs in caverns in Archean limestone at Busca, Cuneo province, and may be seen worked up in the royal palace at Turin, and in some of the private houses. It is stated to be very beautiful. A banded dark yellow and white variety, forming a handsome ornamental stone, is found at Indiano Olona, in the province of Como. The stone occurs in caves in Mesozoic limestone not far from the Swiss frontier. At Albino, in the Val Setiana, province of Bergamo, stones of this class may be quarried in slabs of considerable superficial area but limited thickness. It is used for making mantels and other articles of ornament as well as for inlaid work. There are two localities of the stone in the province of Brescia which may be mentioned. One at Pisogne, on the eastern side of the lake of Iseo, where a yellow-brown material is obtained from stalactites in Triassic limestone, and the other at Rezzato, a few miles to the east of Brescia. The stone here is dark brown, and occurs in caverns in the Liassian limestone.

In the Appennine range a large number of localities may be specified where stalactitic and stalagmitic marbles of great variety and beauty are to be found. Special mention must be made of the stone known as *alabastro del Gazzo*, from the fact of its coming from Monte Gazzo, at San Giovanni Battista, province of Genoa, overlooking the Mediterranean Sea. The cave is in a Triassic limestone. The stone is described by Chevalier Jervis as a beautiful and gorgeous material, and as having been largely used in former centuries for internal decoration in the churches of Genoa. A great number of stalactites from the same part of Liguria were employed with wonderfully artistic effect in making the artificial cave in the celebrated gardens of the Marquis Pallaricini, at Pegli, near Genoa. In the province of Siena there is a cavern in Liassian limestone whence large masses of cave marble have been procured for decorative purposes, while at Castelnuova dell' Abbate, in the commune of Monte Alcino, considerable quantities are found underlying a Quatenary travertine. Stones of this same class are found also at Terracina, province of Rome, and at Gesualdo (principato Utteriore), near the central chain of the southern Appennines. This last locality furnished the architect Vanvitelli 32 monolithic shafts or columns for the royal palace at Caserta. The same stone, together with other marbles, was used by the King of Naples for the internal decoration of the royal palace at Portici, now the higher school of agriculture.

Miscellaneous localities.—According to D'Orbigny and Gente,* France has an abundance of beautiful "calcareous alabasters" in grottoes and caves, but the material is less esteemed than that of Italy, whence the commercial supply was largely obtained.

They also state that a veined, undulated "alabaster" of a beautiful

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* Geologie Appliquee aux Arts et a l'Agriculture.

wax yellow color is found in caverns at Malaga, in Spain. When cut across the bedding it shows veins of two very pleasing tints, but when cut parallel it shows only large, confused, cloudy areas (*taches embrouellies*), and is not nearly as beautiful. The Palais at Madrid is decorated with this stone. C. P. Brard, in his Mineralogic Appliquee aux Arts, 1821 (p. 396), describes the onyx marbles as cave deposits, and seems never to have heard of their occurrence as hot-spring deposits. Under this head he describes, very briefly, clouded white, limpid to opaque varieties, sometimes of a beautiful green tint, from Arcena, in Andalusia, Spain. The translucent varieties were the soundest and most esteemed by the ancients (whoever they may have been). He also speaks (p. 402) of a honey yellow, almost transparent variety from the isle of Malta, and which was used in making statues of large size. Other varieties are also found on this island, one of a clear yellow color, veined with white, or white variegated with black, or brown and white. This same authority further states that a brown "alabaster" with clearer veins, and which receives a beautiful polish, is found in the territory of Saguna, in Sicily, and near Montreal and Caputa other varieties, with lively red and yellowish veins or clear yellow and white. A white variety with yellow and red veins is found at Mount Pellegrino and a yellowish one at Bactia, in Corsica. Unfortunately, this author's descriptions are meager, and the use of the name alabaster, as already noted, is so misleading that we can not in all cases discriminate, and it is possible some of the stones here mentioned may be true alabaster (gypsum).

Pliny* writes of a white alabaster, which is presumably a true carbonate, as occurring at Damascus, in Syria. He compares it with that found near Thebes (Syout?), in Egypt, but of a white color. The most next esteemed variety, he states, is that of Carmania (Carmona, in Spain?), and the least that of Cappadocia, in Asia Minor. Next to that of Carmania he considers a product of a locality, not mentioned, in India, as of greatest value, and places that of Syria as third in the list.

CATALOGUE OF ONYX MARBLES IN THE COLLECTION OF THE DEPARTMENT OF GEOLOGY IN THE U. S. NATIONAL MUSEUM.

No. 67549. A series of five slabs, varying from 8 by 10 inches to 28 by 34 inches, cut parallel and across the plane of deposition. Original colors green, but individual slabs showing various stages of oxidation. Three large slabs, 28 by 34 inches, were all cut from the same block, originally some 10 inches thick and supposed to be nearly uniform throughout, but proving to be so thoroughly oxidized in certain portions as to yield slabs with but a few square inches of green still showing on the polished surface. (See pls. 5, 6, and 7). From the Big Bug Quarries, Mayers Station, Yavapai County, Arizona. Collected by George P. Merrill. 1891.

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* Pliny, Natural History, Book XXXVI, chap. 12.

No. 62382. Three slabs, of a thin-bedded granular, scarcely translucent variety of travertine of a white, amber, ochreous brown, and red mottled color. Largest an irregular oval some 24 by 38 inches. From Big Bug Quarries, Mayers Station, Yavapai County, Arizona. Collected by George P. Merrill. 1892.

No. 60845. Slab of opaque oxidized variety "tapestry onyx." Cut across the grain on plane of deposition. Size, 15 by 21 inches. Locality as above. (See Pl. xv.)

No. 66999. Irregular slab of green and oxidized travertine, some 12 by 36 inches. Cut across the grain. Locality as above. Gift of William O. O'Neill. 1891

No. 68364. Slab of a pink granular, scarcely translucent variety, 17 by 36 inches, Locality as above. Received from G. S. Fellows. 1892.

No. 68365. Irregular slab, 12 by 15 inches, of light green and brownish material Locality as above. Received from G. S. Fellows. 1892.

No. 67825. Small irregular block about 5 by 9 by 2 inches. Selected to show nucleal mass of unchanged green onyx surrounded by a shell of oxidized material. (See Pl. 8.) Locality as above. Collected by George P. Merrill. 1892.

No. 60846. Three irregular slabs, the largest some 22 by 26 inches, of opaque oxidized travertine, of ochreous yellow, brown, and red colors. Cut parallel with plane of deposition. Locality as above.

No. 67000. Three slabs, 5 by 13, 7 by 13, and 5 by 18 inches. Cut across the plane of deposition to show alternating bands of oxidized and unchanged material. Locality as above. Gift of William O. O'Neill. 1891.

No. 67821. Block about 3 by 4 inches of oxidized onyx, illustrating the completed stage of the process. Locality as above. Collected by George P. Merrill.

No. 68251. Three blocks, 4 by 7, 8 by 7, and 5 by 7 inches, of green and brown travertine, from the so-called Cave Creek Quarries, in the southern part of Yavapai County, near the Maricopa County line, and some 50 miles north of Phœnix, Arizona. Collected by George P. Merrill. 1892.

No. 61306 and No. 61307. Seven small slabs of white, pink tinted, and smoky clouded varieties, from San Luis Obispo, California. (Pl. 12.) Highly translucent. Received from J. and F. Kesseler. 1893.

No. 36759. Two small thin slabs, 1¾ by 3¾ inches, of white onyx, cut across the grain. Nearly transparent. Locality as above.

No. 25571. Two cubes, 4 by 4 inches, of white and white-brown veined travertine, from locality as above. Received from the Tenth Census. 1881.

No. 27301. Small slab, 3½ by 4 by 1 inches, marked only as from California. Received from Mrs. L. J. Wilkins. 1882.

No. 36886. Small slab, some 5 by 11 inches, of bright emerald green, highly translucent travertine, from near Crescent Falls of Sacramento River, 5 miles south of Berryville, Siskiyou County, California. Received from J. S. Diller and L. J. Griffin. 1884.

No. 67665. Two small pieces similar material from Shasta Springs, Shasta County, California. Received from F. W. Crosby. 1892.

No. 68451. Small irregular fragments of a dark amber variety, cut across the grain. From Sulphur Creek, Colusa County, California. Received from Henry S. Durden. 1892.

No. 25255. Slab of dark amber variegated travertine, 5 by 10 inches, from Suisun City, Solano County, California. Received from Centennial Commission. 1876.

No. 25256. Slab of dark amber variegated travertine, 5 by 10 inches Locality as above. Received from Centennial Commission. 1876.

No. 38445. Five small irregular pieces of dark amber variegated travertine, cut across the grain and polished. Locality as above. Received from B. K. Emerson. 1886.

No. 25645. One small piece of dark amber variegated travertine, 6 by 6½ by 2 inches cut across the grain and polished. Locality as above. Received from the Tenth Census. 1881.

No. 16054. One small piece of dark amber variegated stone, 5 by 7½ inches, cut across the grain and polished. Locality as above. Received from Thomas Donaldson.

No. 25374. Block of translucent stalagmitic marble, 3½ by 4 by 5 inches. From the Luray Caverns, Page County, Virginia. Received from R. R. Corson. 1881.

No. 67981. Massive stalagmite cut in half and polished to show structure. Locality as above. Received from J. H. Morrison.

No. 60693. Irregular slab of translucent stalagmitic marble, of light, amber color, about 12 by 14 inches. Suisin, Solano County, California. Received from H. A. Ward. 1893.

No. 60694. Irregular slab about 3 by 2 feet by 1½ inches of dark amber variegated travertine, cut with the grain and polished. Locality as above. Obtained from H. A. Ward.

No. 25637. Block of translucent stalagmitic marble, coarsely crystalline, almost granular, light amber yellow, 7½ by 10½ by 14¾ inches. Luray, Virginia. Received from R. R. Corson. 1881.

No. 62072. Slab of nearly white, faintly translucent stalagmitic marble, from broken-down cave near Marion, Smyth County, Virginia; 15 by 16 inches. Received from Dr. John S. Apperson. 1893.

No. 67366 and No. 67366*a*. Two slabs and large block of dark amber and brown, scarcely translucent stalagmitic material, cut across the grain, and showing concentric structure, from farm of G. H. Killinger, Marion, Smyth County, Virginia. About 12 by 18 inches and 18 by 18 inches. Received from F. V. Z. Carachristi. 1891.

No. 68131. Slab of nearly white stalagmitic material, from cave near Andersonville, Tennessee. Cut across the grain. Received from W. H. Evans & Sons. 1892.

No. 60624. Cross section of stalagmite, some 7 inches in diameter, translucent, from Wyandotte Cave, Wyandotte, Indiana. Collected by George P. Merrill. 1893.

No. 68144. Two massive stalagmites cut and polished to show structure. Locality as above. Collected by George P. Merrill.

No. 60625. Turned ornament of stalagmite, some 7 by 11 inches; light, amber colored; translucent. Locality as above.

No. 68126. Irregular blocks, polished on one side, of stalagmitic material, from broken-down caves near Harrisonburg, Rockingham County, Virginia. White and amber. Received from F. Staling.

No. 67583. Slab of stalagmitic material, cut across the grain; 10 by 12 inches. Locality as above. Gift of J. S. Moffett. 1892.

No. 68188. Conical block, about 8 inches at base and 9 inches in height, of red, brown, and white stalagmite, from cave at West Plains, Howell County, Missouri. Gift of W. P. Davis. 1892.

No. 60699. Slab of opaque, dark amber brown stalagmite, from cave in Crawford County, Missouri; 25 by 27 inches. Received from J. F. Leighton. 1893.

No. 67913. Irregular blocks of faintly greenish stalagmitic material, from caves in the Stevenson-Bennett mines, west slope of Organ Mountains, near Las Cruces, New Mexico. Collected by George P. Merrill. 1892.

No. 61404. Large rough block of white, scarcely translucent stalagmitic material, from Marion County, Arkansas. Received from State Commissioner World's Columbian Exposition. 1893.

No. 67617. Finely banded irregular travertine of white color, from about 12 miles southwest of El Paso, Texas; 8 by 3 inches. Received from F. W. Crosby. 1892.

No. 67618. Small block of finely banded pearl white travertine (?), with ocherous veins, from near El Paso, Texas; 3 by 5 by 1½ inches. Received from F. W. Crosby. 1892.

No. 61405. Polished slab, 24 by 36 by 2 inches, of dark amber and whitish material, from near Las Vegas, Valencia County, New Mexico. Received from T. B. Mills. 1894.

No. 60631. Irregular block, some 4 by 4 by 6 inches, of finely banded aragonite. Quarries near Rio Puerco Station, Valencia County, New Mexico. Received from T. R. Gabell. 1893.

No. 37642. Block of variegated white and brown opaque material, cut across the grain; 6 by 12 by 2 inches. Aguas Calientes, Mexico. Received from New Orleans Exposition. 1885.

No. 26011. Polished slab, 11 by 8 inches by 1 inch, of dark green translucent travertine, from Puebla, Mexico. Received from Mexican Centennial Commission. 1876.

No. 37640. Polished blocks and thin slabs of white and green highly translucent travertine, 4 by 4 inches and 7 by 7 inches, from Tecali, Puebla, Mexico. Received from New Orleans Exposition 1885.

No. 37593 and No. 37594. Paper weights of onyx marble, as manufactured by the native Mexicans. State of Puebla, Mexico.

No. 37595. Paper cutter of onyx marble, as manufactured by the native Mexicans. State of Puebla, Mexico.

No. 37596. Thin slab of nearly transparent white travertine, from State of Tecali, Puebla, Mexico; 3 by 4 inches. Received from New Orleans Exposition. 1885.

No. 60695. Slab of a pearl-white, highly translucent variety, cut across the grain; 17 by 15 inches by ½ inch. Puebla, Mexico. 1893.

No. 61059. Broken table top of fibrous, mottled, white and yellowish onyx marble. Locality uncertain, probably Mexico. Leidy collection. 1893.

No. 60696. Polished slab of white variegated travertine; 9½ by 11½ inches. From Puebla, Mexico. 1893.

No. 36757. Polished slab, nearly white, variegated variety; 6 by 7½ inches by ½ inch. Locality as above.

No. 68246. Nine irregular polished blocks of pearl-white, greenish, and rose-tinted varieties of travertine, from New Pedrara quarries, on Peninsula of Lower California. Collected by George P. Merrill. 1892.

No. 61388. Two fine slabs, of white, rose-tinted travertine, highly translucent, 32 by 42 inches and about 18 by 42 inches, from the above locality. Gift of New Pedrara Onyx Company 1894.

No. 38564. Slab of light amber and white material, highly translucent, supposed to be from Mexico. Gift of Hugh Sisson Sons, Baltimore, Maryland. 1886.

No. 60680. Small yellowish slab, from the Desert of Atacama, Chili, 1893.

No. 36774. Small block and slabs of white and faintly amber stalagmitic material, from Egypt; 3½ by 3½ and 2 by 9½ inches. Gift of Bowker, Torrey & Co. 1884.

No. 25343. Polished block of brownish, finely banded translucent stone, from Blad Recam, near Oued Abdallah, Algeria; 7 by 7 by 8½ inches. Gift of H. A. Ward. 1881.

No. 25344. Block of highly translucent, beautifully yellowish and white banded onyx marble, from Beni Souef, near Cairo, Egypt; 7 by 8½ by 18 inches. Received from H. A. Ward. 1881.

No. 25027. Irregularly rounded mass of dark opaque stalagmitic material, from Gibraltar. Received from Centennial Commission. 1876.

No. 28638. Slab 4 by 4 inches by ⅞ inch of light, yellow and white stalagmitic material from Italy. Received from W. W. Story. 1883.

No. 69702. Slab, 2⅝ by 2⅝ inches by ¼ inch of white, very translucent, coarsely crystalline material, marked as from Stuttgart. From Museum of Natural History Paris, France. 1888.

No. 69735. Slab, 3⅞ by 5 inches by ¼ inch, of dull, almost opaque material, from Algeria. Received from Museum of Natural History, Paris, France. 1888.

No. 69682. Slab, 5½ by 7 inches by 1 inch, of dull white opaque and porous material, from Algeria. Received from Museum of Natural History, Paris, France. 1888.

No. 69687. Slab, 5½ by 7 by 3 inches, of dark, resinous, scarcely translucent material, from Algeria. Received from Museum of Natural History, Paris, France. 1888.

No. 69629. Slab, 3½ by 3½ inches by ¼ inch, of dark, resinous, stalagmitic material, from Montauto, Tuscany, Italy. Received from Museum of Natural History, Paris, France. 1888.

No. 69738. Slab, 3¾ by 3¾ inches by ½ inch, of a granular dull brownish red and white variety, from Ima, France. Received from Museum of Natural History, Paris, France. 1888.

No. 69734. Slab, 3¾ by 6 inches by ¾ inch, similar to last, from same locality. Received from Museum of Natural History, Paris, France. 1888.

No. 61350. Three pieces stalagmitic marble. One block, 13 by 10 by 8 inches, translucent, yellow, streaked with white; slab 13 by 10 inches by 1 inch, cut across the grain; slab 13 by 7 inches by 1 inch, white and buff mottled, cut parallel with plane of deposition. From near Lehi, Utah. Received from F. T. Millis. 1893.

No. 62388. One slab onyx, 15 by 4 inches, white and ocherous brown, mottled, from Puebla, Mexico. Received from C. M. Manning. 1894.

No. 62389. Slab 10 by 5 inches, red and brownish angular fragments, in a dull cream groundmass. Locality as above. Received from C. M. Manning. 1894.

No. 62609 and 62610. Small blocks of milk white and red brown oxydized travertine, from near Lake Oroomiah, Persia. Gift of Rev. S. G. Wilson. 1891.

No. 67538. Irregular block of banded stalagmite, about 4 by 4 by 6 inches, from Franklin Mountain, El Paso County, Texas. Received from Mr. Morehead.

No. 27268. Small piece of dark amber stalagmitic marble, about 2 by 5 by 1¼ inches, from Rockbridge County, Virginia. Received from the U. S. General Land Office.

No. 61323. Irregular block of pale brown, banded stalagmite, from Virginia. Received from J. C. McGuire.

No. 35746. Small fragment, about 3 by 3 inches, of light green travertine, from Falls of Sacramento River, Siskiyou County, California. Received from Charles H. Townsend.

No. 62575. Irregular slab, about 4 by 7 inches, of dark green and ocherous brown and red travertine, from Brazil. Received from G. S. Fellows and Wm. Grace.

No. 62634. Block of light, porous travertine, 4 by 6 inches, from Tivoli, Italy. Received from W. O. Crosby.

No. 61343. Slab, 4 by 5 inches, of light amber stalagmitic marble from Eureka Springs, Arkansas. Gift of S. E. Meek.

No. 61245. Small slab, 3 by 5½ inches, of dark amber variegated stalagmitic marble, from Province of Cuner, Italy. Received from G. Jervis.

No. 28637. Small slab, 4 by 4 by ¾ inches, of light amber and brown variegated stalagmitic marble, from Civita Vechia, Italy. Gift of W. W. Story.

THE COWBIRDS.

BY

MAJOR CHARLES BENDIRE,

Honorary Curator of the Oological Collections, U. S. National Museum.

THE COWBIRDS.

By Maj. Charles Bendire,
Honorary Curator of the Oological Collections, U. S. National Museum.

Among our American birds comparatively few present such an interesting field for systematic investigation and study of their habits and mode of reproduction as the Cowbirds or Cow Buntings.

The family to which they belong, the *Icteridæ*, containing such familiar birds as the Bobolink, the Oriole, Blackbirds, etc., is confined to the American continent, and the genus *Molothrus* (with its subgenus *Callothrus*) is represented by 12 species and subspecies. Of these, three are found in the United States, namely: *Molothrus ater*, *Molothrus ater obscurus*, and *Callothrus robustus;* and a fourth, *Callothrus æneus*, is a resident of western Mexico and portions of Central America. The remaining species are confined to South America. *Callothrus armenti* is found on the coast of Colombia and Venezuela; *Molothrus atronitens* in Guiana, Venezuela, and Trinidad; *M. purpurasceus* in western Peru; *M. cassini* in Venezuela and Colombia; *M. fringillarius* in Brazil; *M. bonariensis* in Argentina, Paraguay, Bolivia, and Brazil; *M. rufoaxillaris* in Argentina and Uruguay, and *M. badius* in Argentina, Paraguay, and Bolivia.

Respecting the general habits of some of the species, comparatively little is as yet known excepting those found in the United States (but even here a great deal remains to be learned) and the three last, which have been pretty fully described in Sclater and Hudson's excellent work on Argentine ornithology.

It is probable that nearly all these species are parasitic to a greater or less degree, laying their eggs in the nests of other birds and letting them perform the duties of incubation and rearing the young, with the exception of *Molothrus badius*, the Baywinged Cowbird, which occasionally builds a nest of its own or appropriates nests of other species, but incubates its own eggs or cares for its young like other respectable members of the Avian family.

This same parasitic instinct is also found among members of the more cosmopolitan family of the Cuckoos, notably with *Cuculus canorus*, the European Cuckoo, about which a great deal of interesting literature has already been published, and the same traits, only in a much more modified degree, are also said to be occasionally observed in at least one of our North American species, the Blackbilled Cuckoo, *Coccyzus erythrophthalmus*, but no such instance has as yet come under my own observation, and I consider it of rare occurrence.

On the whole, our Cowbirds present a far wider and more interesting field for careful observation and study than does the European Cuckoo, as their habits differ greatly in many respects; for instance, they are among the few, if they are not the only birds, which practice polyandry, which is probably caused for the reason that the males generally outnumber the females about 3 to 1.

In order to give the reader some idea of these disreputable but nevertheless interesting birds, my articles written for Life Histories of North American Birds, Part II, are printed from advance sheets without alteration, excepting the addition of a concise description of each species, taken from Mr. R. Ridgway's Manual of North American Birds.

Fgures of an adult male and female Cowbird, *Molothrus ater*, are here given (pls. 2 and 3) as well as a nest of the Yellow Warbler, *Dendroica aestiva*, (pl. 1) containing three eggs of its own and one of this parasite.

The articles on the Cowbirds found in the Argentine Republic are copied from Messrs. P. L. Sclater and W. H. Hudson's work on Argentine ornithology, the notes on their habits being based on observations made by the latter gentleman. The two series of articles combined will enable the reader to arrive at a better understanding of the general habits of some of the members of this interesting genus.

MOLOTHRUS ATER (Boddaert) Cowbird. (Plates 2 and 3).

Oriolus ater, BODDAERT, Tables des planches enluminées d'histoire naturelle, 1783, 37.

Molothrus ater, GRAY, Hand List of Birds, II, 1870, 36.
(B 400, C 211, R 258, C 313, U 495.)

Description.—Adult males: Head, neck, and chest uniform brownish (varying greatly in tint); rest of plumage glossy black, with a greenish reflection, changing to purplish next to the brown of the neck, especially on the upper back. Adult females: Plain brownish gray, darker on upper parts, paler on chin and throat; the feathers, especially on back and breast, with indistinct darker shaft streaks. Young: Above dull brownish gray, the feathers bordered with pale buffy; lower parts dull light buffy, broadly but rather indistinctly streaked with dull brownish gray.

Length (male), about 7.75–8.25; wing, 4–4.60 (4.31); tail, 2.90–3.35 (3.08); culmen, 0.61–0.72 (0.66): tarsus, 98–1.12 (1.05); female considerably smaller.

Geographical range.—United States and the southern parts of the Dominion of Canada, in the eastern portions to about latitude 49° north; in the interior to Little Slave Lake, southern Athabasca, latitude 55° 30′, and probably still farther north: west to British Columbia, eastern Washington, eastern Oregon, Nevada, and southeastern California; south in winter to southern Mexico.

The breeding range of the Cowbird, also known as Cow Bunting,

NEST OF YELLOW WARBLER, DENDROICA ÆSTIVA, BAIRD, WITH THREE EGGS, TOGETHER WITH ONE EGG OF THE COWBIRD, MOLOTHRUS PECORIS.

THE COWBIRD, MOLOTHRUS PECORIS, BODDAERT.
Male. Natural size.

THE COWBIRD, MOLOTHRUS PECORIS, BODDAERT.
Female. Natural size.

Cow Blackbird, Shinyeye, Blackbird, Lazy Bird, Clodhopper, and in former years on the plains as Buffalo Bird, extends from our southern States, excepting Florida, southern and western Texas, north into the southern parts of the Dominion of Canada, as already indicated. Westward its breeding range extends to eastern British Columbia, eastern Washington, eastern Oregon, Nevada, and probably southeastern California, where Dr. A. K. Fisher shot an adult male at Furnace Creek, in Death Valley, June 20, 1891. East of the Rocky Mountains the Cowbird is pretty generally distributed over the greater part of its range, excepting the extensive forest regions and some of the more southern States, where it appears to occur only sparingly. Its center of abundance is found in the States bordering the Upper Mississippi River and its numerous tributaries. West of the one hundred and thirteenth meridian (Greenwich), in the United States at least, it must be considered as a rare summer visitor, and as far as I have been able to ascertain it has not yet been found anywhere on the Pacific Coast, west of the Cascade and the Sierra Nevada mountains, except as a straggler. In the southern portions of the provinces of Alberta and Assiniboia, Dominion of Canada, as far west as Calgary, I found this species remarkably abundant in the latter part of May, 1894, along the line of the Canadian Pacific Railway, small parties from 6 to 12 being almost constantly in sight, evidently on their way to their breeding grounds.

The most northern point where its eggs have been taken appears to be in the vicinity of Little Slave Lake, in southern Athabasca, in latitude 55° 30′ north. Mr. S. Jones, of the Hudson Bay Company, forwarded specimens from there to the Smithsonian Institution in 1868, but it is quite probable that this species ranges farther north.

Although I have traveled extensively over our westernmost States and Territories I noticed the Cowbird on but very few occasions, and only found its eggs there twice; once on June 21, 1871, near Fort Lapwai, Idaho, in the nest of the Long-tailed Chat, *Icteria virens longicauda*, and again near Palouse Falls, in southeastern Washington, on June 18, 1878, in a nest of the Slate-colored Sparrow, *Passerella iliaca schistacea*, and which I believe is the most western breeding record known.

Both of these specimens are now in the United States National Museum collection.

The most southern breeding records I have knowledge of, are from Wayne and McIntosh counties, Ga., Petite Anse Island, Louisiana, and Harris County, Tex. It does not appear to breed anywhere in the immediate vicinity of the gulf coast in Texas, where it is replaced by its smaller relative, the Dwarf Cowbird. While the majority of these birds pass beyond our borders in the late fall and winter, mainly to southern Mexico, still a good many remain in our Southern States, and a few even winter occasionally as far north as New England, Michigan, etc.

Dr. G. Brown Goode tells me that while on the German Lloyd steamer

Neckar, in April, 1880, a Cowbird flew on board, fully 1,000 miles east of Newfoundland, and was captured.

The Cowbird ordinarily arrives in good-sized flocks in the middle States from its winter home in the south, during the last half of March; in the more northern States, rarely before the first week in April, more frequently after the middle of this month, the males predominating in numbers over the more plainly colored females, and generally preceding them several days. Soon after, these flocks commence to break up and scatter in small companies of from 6 to 12 individuals and disperse generally over the country. It prefers more or less cultivated districts, river valleys, etc., where other birds are abundant, and rarely penetrates far into heavily timbered sections in mountainous regions, excepting in Colorado, where it has been met with at altitudes up to 8,000 feet.

The food of the Cowbird consists principally of vegetable matter, such as seeds of different kinds of noxious weeds, like ragweed, smartweed, foxtail or pigeon grass, wild rice and the smaller species of grains, berries of different kinds, as well as of grasshoppers, beetles, ticks, flies, and other insects, worms, etc., and in this respect it does perhaps more good than harm.

While the Cowbird is fairly common in most of the States east of the Mississippi River, it is far more noticeable in the regions west of this stream, although perhaps not much more abundant. In the prairie States this is especially the case, and one will rarely see a bunch of cattle there without an attending flock of Cowbirds, who perch on their backs searching for parasites, or follow them along on the ground hunting for suitable food among their droppings. They generally act in concert; when one settles on the ground the others follow shortly afterwards, and let one start to fly the remainder take wing also. Their flight resembles that of the Red-winged Blackbird. When the nesting season approaches the males become very demonstrative in their actions toward the females, but do not appear to mind the attentions paid by other males to the same female, as other birds usually do, and rarely fight for her possession. Free lovers as they are, they do not object to such trifles.

At this time of the year several males may frequently be seen, while perched on some fence rail, or the limb of a tree, with the feathers of their throats raised, tails spread, and wings trailing, each endeavoring to pour out his choicest song to one of his protective mates, which consists of various unreproducable guttural sounds uttered while all the feathers are puffed out, the head lowered, and evidently produced only by considerable effort on the part of the performer. One of their call notes sounds somewhat like "spreele," others resemble the various squeaks of the Red-winged Blackbird, and all are difficult to reproduce on paper.

It is a well-known fact that the Cowbird is a parasite, building no nest, but inflicting its eggs usually on smaller birds, leaving to them the labor and care of rearing its young. It appears to be entirely devoid of conjugal affection, and practices polyandry, the small flocks in which it is found during the season of reproduction generally containing several more males than females.

It is at all times more or less gregarious, especially so in fall and winter, when it often forms large flocks, and associates then with the other blackbirds, like Brewer's and the Red-winged.

The laying season rarely begins before May 15, and continues for about two months. During this time probably from 8 to 12 eggs are laid by each female, or the equivalent of two broods, and I believe that several days elapse between the laying of each egg. It is not likely, and this is very fortunate indeed, that more than half of these eggs are hatched, as some are occasionally dropped in old and abandoned nests, or, when the female is hard pressed, even on the ground; others in just completed nests in which the rightful owner had not yet laid, and, seeing the parasitic egg in its nest, either abandons it entirely or constructs another over the first, burying the stranger egg among the building material.

When the Cowbird is ready to lay she quietly leaves her associates and begins her search for a suitable nest, usually selecting one of a species smaller than herself, but if such a one is not readily found a nest of a larger bird will answer equally well, especially if the full complement of eggs has not been deposited in it. She does not forcibly drive the owner from her nest, but watches her opportunity to drop her egg in it when it is unguarded. In rare instances only will a fresh Cowbird's egg be found among incubated ones of the rightful owner. I have only observed this on a single occasion. From 1 to 7 of these parasitic eggs have been found in a nest, the larger numbers usually in those of ground-building species, especially in that of the Ovenbird, where from 3 to 5 eggs, with perhaps 2 or 3 of the owner, are not especially uncommon. I know of one instance where not less than 7 Cowbirds' eggs were found in a nest of this species with a single one of its own. Not unfrequently 2 or more eggs, in all probability laid by the same bird, will be found in one nest. There is so much variation in their eggs, both in size and markings, that the close resemblance of any 2 eggs at once attracts attention. It is not unusual to find some of the eggs of the species imposed on thrown out of the nest to make room for those of the parasite, nor to find minute punctures in the shells of some of the remaining eggs. This is possibly done on purpose by the Cowbird with her beak, to keep the eggs from hatching, or with her sharp claws while sitting on the nest and depositing her own egg. I am inclined to attribute this puncturing to the latter cause, but there is no doubt that the Cowbird sometimes throws the rightful owner's eggs out of the nest purposely to enhance the chances of its offspring coming to maturity. I have yet to see a punctured Cowbird's egg. It is astonishing how many different species are thus imposed upon by the

Cowbird. One would naturally suppose that birds breeding in holes in trees or under rocks would be exempt from this infliction, but this is not the case. Perhaps among the strangest and most unlikely of foster parents selected are the Red-headed Woodpecker and the Rock Wren.

Mr. William G. Smith, formerly of Loveland, Colo., writes me that he found a Cowbird's egg in a Rock Wren's nest which was placed under a ledge of rock fully 2 feet from the entrance, and which was barely large enough for the wren to squeeze through. It seems almost impossible that a bird of this size would be able to enter the small pendent nest of the Parula Warbler and deposit its egg therein in the usual way; still this species is occasionally imposed on, and it is possible that the egg is dropped in the nest with the beak. The following is a list of species in whose nests eggs of the Cowbird have been found, and undoubtedly a number of others yet remain to be added to it:

Zenaidura macroura, Mourning Dove.
Coccyzus americanus, Yellow-billed Cuckoo.
Melanerpes erythrocephalus, Red-headed Woodpecker.
Tyrannus tyrannus, Kingbird.
Sayornis phœbe, Phœbe.
Contopus virens, Wood Pewee.
Empidonax acadicus, Acadian Flycatcher.
Empidonax pusillus, Little Flycatcher.
Empidonax pusillus traillii, Traill's Flycatcher.
Empidonax minimus, Least Flycatcher.
Otocoris alpestris praticola, Prairie Horned Lark.
Dolichonyx oryzivorus, Bobolink.
Xanthocephalus xanthocephalus, Yellow-headed Blackbird.
Agelaius phœniceus, Red-winged Blackbird.
Sturnella magna, Meadow Lark.
Sturnella magna neglecta, Western Meadow Lark.
Icterus spurius, Orchard Oriole.
Icterus galbula, Baltimore Oriole.
Icterus bullocki, Bullock's Oriole.
Scolecophagus cyanocephalus, Brewer's Blackbird.
Carpodacus purpureus, Purple Finch.
Spinus tristis, American Goldfinch.
Calcarius ornatus, Chestnut-collared Longspur.
Rhynchophanes mccownii, McCown's Longspur.
Poocætes gramineus, Vesper Sparrow.
Poocætes gramineus confinis, Western Vesper Sparrow.
Chondestes grammacus, Lark Sparrow.
Chondestes grammacus strigatus, Western Lark Sparrow.
Zonotrichia leucophrys, White-crowned Sparrow.
Spizella socialis, Chipping Sparrow.
Spizella pusilla, Field Sparrow.
Spizella pallida, Clay-colored Sparrow.
Junco hyemalis, Slate-colored Junco.
Melospiza fasciata, Song Sparrow.
Melospiza fasciata montana, Mountain Song Sparrow.
Melospiza georgiana, Swamp Sparrow.
Passerella iliaca schistacea, Slate-colored Sparrow.
Pipilo erythrophthalmus, Towhee.
Cardinalis cardinalis, Cardinal.
Habia ludoviciana, Rose-breasted Grosbeak.
Guiraca cærulea, Blue Grosbeak.
Passerina cyanea, Indigo Bunting.
Passerina amœna, Lazuli Bunting.
Passerina ciris, Painted Bunting.
Spiza americana, Dickcissel.
Calamospiza melanocorys, Lark Bunting.
Piranga erythromelas, Scarlet Tanager.
Prianga rubra, Summer Tanager.
Petrochelidon lunifrons, Cliff Swallow.
Ampelis cedrorum, Cedar Waxwing.
Vireo olivaceus, Red-eyed Vireo.
Vireo gilvus, Warbling Vireo.
Vireo flavifrons, Yellow-throated Vireo.
Vireo solitarius, Blue-headed Vireo.
Vireo noveboracensis, White-eyed Vireo.
Mniotilta varia, Black and White Warbler.
Protonotaria citrea, Prothonotary Warbler.
Helmitherus vermivorus, Worm-eating Warbler

Helminthophila pinus, Blue-winged Warbler.
Helminthophila chrysoptera, Golden-winged Warbler.
Helminthophila ruficapilla, Nashville Warbler.
Compsothlypis americana, Parula Warbler.
Dendroica æstiva, Yellow Warbler.
Dendroica cærulescens, Black-throated Blue Warbler.
Dendroica cærulea, Cerulean Warbler.
Dendroica blackburniæ, Blackburnian Warbler.
Dendroica virens, Black-throated Green Warbler.
Dendroica discolor, Prairie Warbler.
Seiurus aurocapillus, Ovenbird.
Seiurus noveboracensis, Water Thrush.
Seiurus motacilla, Louisiana Water Thrush
Geothlypis formosa, Kentucky Warbler.
Geothylpis trichas, Maryland Yellow-throat.
Geothylpis trichas occidentalis, Western Yellow-throat.
Icteria virens, Yellow-breasted Chat.
Icteria virens longicauda, Long-tailed Chat.
Sylvania mitrata, Hooded Warbler.
Setophaga ruticilla, American Redstart.
Galeoscoptes carolinensis, Catbird.
Harporhynchus rufus, Brown Thrasher.
Salpinctes obsoletus, Rock Wren.
Troglodytes ædon, House Wren.
Parus bicolor, Tufted Titmouse.
Polioptila cærulea, Blue-gray Gnat-catcher.
Turdus mustelinus, Wood Thrush.
Turdus fuscescens, Wilson's Thrush.
Turdus ustulatus swainsonii, Olive-backed Thrush.
Turdus aonalaschkae auduboni, Audubon's Hermit Thrush.
Merula migratoria, American Robin.
Sialia sialis, Bluebird.

Among these the nests of the Phoebe, Song Sparrow, Towhee, Indigo Bunting, Ovenbird, and Yellow-breasted Chat seem to be most frequently selected, and these usually contain also more of the parasitic eggs than the majority of the others.

The egg of the Cowbird usually hatches in from ten to eleven days, generally in advance of those of the foster parent, and the growth of the young interloper is rapid. Mr. M. A. White, of Mathews, Va., writes on this subject as follows, and his observations correspond fairly well with my own:

It was on the 9th of June, 1891, that I placed a fresh egg of the Cowbird in the nest of a Chipping Sparrow containing two of her own that had an advance of one and a half days' incubation over the first. I watched results. About the 19th, Mr. Cowbird emerged from his prison walls, large and vigorous. A day later a little sparrow came forth from his delicate shell, but much smaller, and exhibiting less strength than his fosterbrother. The other egg failed to hatch.

The daily increase in dimension of the Cowbird was something immense, while that of his younger companion seemed rather to diminish than enlarge, until finally, at the end of three days, he died—evidently for want of food, as the Cowbird, being larger, greedily devoured everything that came in contact with his capacious mouth. The untimely end of the rightful heir was but gain to this usurper, as he now received the whole attention of the parent birds. Nature having now, at the early age of seven days, provided him with a respectable dress, he was no longer contented to remain within the small compass which the nest furnished, whereupon he betook himself to the branches of the tree in which the nest had been placed. But soon this area became too limited for his ambitious spirit, for at the end of his second week he was flitting from bush to bush, exploring the fields and hedges, his foster parents providing for him all the while. Two weeks more and he was a full-fledged bird. About July 20 I saw him for the last time.*

* The Oologist, Vol. x, Aug., 1893, pp. 230, 231.

Such seems to be the fate of nearly all the young which have the misfortune to be hatched with a Cowbird for a companion. I have yet to see a nest containing young birds of both species more than a few days old; by that time the rightful offspring are either smothered or crowded out of the nest by their stronger foster brother, or starved, and he then absorbs the entire attention of the parents. Only in such cases where these are as large or larger than the imposter is there any likelihood to be an occasional exception to this rule. It can readily be seen what an immense amount of harm a Cowbird causes in the economy of nature, granting that only a single one of its eggs is hatched in a season; to accomplish this a brood of insectivorous and useful birds is almost invariably sacrificed for every Cowbird raised, and they are certainly not diminishing in numbers.

While a few of the selected foster parents resent the addition of a parasitic egg in their nest, either by abandoning it entirely or by building a new one over it, and occasionally even a third one, the majority do not appear to be much disturbed by such an event, and after a short time go on as if nothing had happened. A few species, like the Indigo Bunting, for instance, will sometimes abandon their own eggs should the stranger egg be removed, but apparently do not mind the loss of one or two of their own, and continue incubating just the same.

Almost invariably the nests in which one or more of these parasitic eggs have been deposited contain only incomplete sets of their rightful owners. Where the Cowbird drops an egg in the nests of species considerably smaller than itself, as the Gnat-catcher, etc., its much larger size seems to be a positive advantage to the more rapid development of the embryo, as the egg must necessarily receive more animal heat than the smaller ones, which can scarcely come much in contact with the body of the sitting bird, and the development of the embryos in these must be more or less retarded thereby.

It is ludicrous to see a fat, fully fledged young Cowbird following a pair of Chipping Sparrows, or some small Warbler clamoring incessantly for food and uttering its begging call of *seerr-seerr* most persistently, only keeping quiet while its gaping beak is filled with some suitable morsel, and stranger still to note how devoted the diminutive nurses are to their foster child. One would think that they might see through the fraud, at least after the young interloper left the nest, if not before, and abandon him to his fate, but the greatest attachment seems to exist between them until the Cowbird is able to shift for himself, when he leaves and joins his own kind.

It has been asserted that, in the West, Cowbirds occasionally build nests and rear their own young, but this is undoubtedly incorrect, and on proper investigation it will be found that the supposed Cowbird is really Brewer's Blackbird.

When the laying season is over they collect again in larger flocks and frequent the marshes in company with the Blackbirds, where they find an abundance of food at that time of the year, and the return migration to their winter homes begins usually in the latter half of October.

The eggshell of the Cowbird is compact, granulated, moderately glossy, and relatively much stronger than in the eggs of its near allies the *Icteridæ*. The ground color varies from an almost pure white to grayish white, and less often to pale bluish or milky white, and this is usually profusely covered over its entire surface with specks and blotches varying in color from chocolate to claret brown, tawny and cinnamon-rufous. In an occasional specimen the markings are confluent and the ground color is almost entirely hidden by them; in the majority, however, it is distinctly visible. These markings are usually heaviest about the larger end of the egg, and in rare instances they form an irregular wreath. The eggs vary greatly in shape, ranging from ovate to short, rounded, and elongate-ovate, the first predominating.

The average measurement of 127 specimens in the U. S. National Museum collection is 21.45 by 16.42 millimeters, or 0.84 by 0.65 inch; the largest egg measures 25.40 by 16.76 millimeters, or 1 by 0.66 inch; the smallest 18.03 by 15.49 millimeters, or 0.71 by 0.61 inch.

MOLOTHRUS ATER OBSCURUS (Gmelin). Dwarf Cowbird.

Sturnus obscurus, GMELIN, Systema Naturæ, I, II, 1788, 804.
M[olothrus] ater var. obscurus, COUES, Birds of the Northwest, 1874, 180, in text (B — C 211 *a*, R 258 *a*, C 314, U 495 *a*).

Similar to preceding, only smaller. Length (male), about 7–7.50; wing, 3.70–4.15 (3.93); tail, 2.85–3 (2.91); culmen, 0.57–0.63 (0.60); tarsus, 0.93–1 (0.96); female smaller.

Geographical range.—Mexico and adjoining portions of the United States from southern Texas to southwestern Arizona and Lower California.

The breeding range of the Dwarf Cowbird in the United States is coincident with its geographical distribution. It can only be considered as a summer resident, although a few appear to winter in southern Arizona, as I shot an adult male on Rillito Creek, near Tucson, on January 24, 1873. It usually arrives from its winter home in southern Mexico about the middle of March, and is then found associating with different species of Blackbirds, especially Brewer's Blackbird, and frequenting the vicinity of cattle ranches, roads, and cultivated fields. By April 15 the flocks have scattered, and small parties of from 5 to 12 may now be seen in suitable localities, such as the shrubbery along water courses, springs, etc., where other small birds are abundant. The character of its food and its general habits as well, are similar to those of the common Cowbird, which it closely resembles, being only a trifle smaller. In middle Texas the two races intergrade to some extent, and it is claimed both breed there. In the lower Rio Grande valley, Texas, the typical Dwarf Cowbird is common, and I found it equally so in the vicinity of Tucson, Ariz., where I have taken quite a number of its eggs.

Mr. F. Stephens writes me that it is a common summer resident as far west as the Colorado River, beyond the immediate vicinity of which he has never seen it. Mr. L. Belding found it common in the streets of San Jose del Carbo, Lower California, associating with Brewer's Blackbirds during April, but rarely saw it later. It is questionable if it breeds there.

Like its eastern relative, the Dwarf Cowbird drops its eggs in the nests of other birds, principally in those of species which are smaller than itself. The following is a list of those in which they have thus far been found:

Contopus richardsoni, Western Wood Pewee.
Pyrocephalus rubineus mexicanus, Vermilion Flycatcher.
Agelaius phœniceus, Red-winged Blackbird.
Icterus cucullatus, Hooded Oriole.
Icterus cucullatus nelsoni, Arizona Hooded Oriole.
Icterus spurius, Orchard Oriole.
Icterus bullocki, Bullock's Oriole.
Chondestes grammacus strigatus, Western Lark Sparrow.
Amphispiza bilineata, Black-throated Sparrow.
Peucæa carpalis, Rufous-winged Sparrow.
Melospiza fasciata fallax, Desert Song Sparrow.
Embernagra rufivirgata, Texas Sparrow.
Cardinalis cardinalis canicaudus, Gray-tailed Cardinal.
Sporophila morelleti sharpii, Sharpe's Seed-eater.
Piranga rubra cooperi, Cooper's Tanager.
Vireo noveboracensis, White-eyed Vireo.
Vireo bellii, Bell's Vireo.
Vireo bellii pusillus, Least Vireo.
Helminthophila luciæ, Lucy's Warbler.
Dendroica æstiva sonorona, Sonora Yellow Warbler.
Geothlypis trichas occidentalis, Western Maryland Yellow-throat.
Icteria virens longicauda, Long-tailed Chat.
Mimus polyglottus, Mockingbird.
Polioptila plumbea, Plumbeous Gnatcatcher.
Sialia mexicana, Western Bluebird.

Doubtless a number of others still remain to be added.

According to my observations the Least Vireo seems to be oftener imposed upon, in southern Arizona at least, than any other bird; the Desert Song Sparrow, Black-throated Sparrow, and Vermilion Flycatcher following in the order named.

The earliest date known by me on which an egg of this subspecies was found is April 18, the latest August 2, showing that the laying season lasts considerably longer than with *Molothrus ater*, and it appears to be at its height during the month of June.

I found it almost impossible to obtain a full set of the Least Vireo's eggs; nearly every nest found contained 1 or 2 eggs of this parasite, and usually only 1 or 2 of its own, and the latter were frequently punctured. In fact, this was so often the case that I am inclined to believe that it is done purposely and not by accident; but whether made by the beak or claws of the bird I will not venture to say, but believe it is done with the latter. In many nests I found 1 or 2 of the owner's eggs thrown out and broken, and occasionally every one, the foster parent sitting on the parasite's eggs alone. Among other instances I found this to be the case in a nest of the Plumbeous Gnatcatcher placed in a thick mistletoe bunch growing from a limb of a mesquite tree about 15 feet from the ground, and well hidden. I first observed the nest on June 10, 1872, when it contained a single egg; on visiting it again on the 17th, the female was sitting on a couple of Dwarf Cowbird's eggs alone, and on looking on the ground I found the remnants of 3 eggs, which evidently had been thrown out. Bullock's Oriole may occasionally rid herself of the parasitic egg; at any rate I noticed the remains of such a one lying under a nest of this species with portions of one of her own. This nest contained only 3 eggs of the rightful owner, and the bird was sitting on these. The largest number of Dwarf Cowbird's eggs found by me in one nest was 3, that of a Desert Song Sparrow, and all its own eggs were missing. I several times found nests containing single eggs of this parasite abandoned, and also picked up 2 uninjured from the ground where they evidently had been dropped by the bird, not finding a suitable nest in time to deposit them. None of the young of the foster parents seem to survive the advent of a young Cowbird in their nest longer than two or three days; they are starved by that time by their more vigorous and voracious foster brother. After the young Dwarf Cowbird is old enough to care for itself it abandons its foster parents and seeks the company of its own kind, gathering in small bands and roving from place to place. Later in the season, about the latter part of October, these gather into larger flocks, associate at this time with other congenial species, and shortly after return to their winter homes in Mexico.

In general appearance and shape the eggs of the Dwarf Cowbird resemble those of the former, and the same description will answer for both, but they appear on an average to be somewhat less heavily spotted, which gives them a lighter appearance; and they are also considerably smaller.

The average measurement of 37 specimens in the U. S. National Museum collection is 19.30 by 14.99 millimeters, or 0.76 by 0.59 inch; the largest egg in this series measures 20.57 by 15.49 millimeters, or 0.81 by 0.61 inch; the smallest 18.03 by 13.74 millimeters, or 0.71 by 0.54 inch.

CALLOTHRUS ROBUSTUS (Cabanis). Red-eyed Cowbird.

Psarocolinus æneus, WAGLER, Isis, 1829, 758.
Callothrus robustus, RIDGWAY, Manual of North American Birds, 1887, 589.
(B —, C —, R 259, C 315, U 496.)

Adult males: Head, neck, back, and lower parts uniform glossy black, with a soft, bronzy luster, duller on head; lesser and middle wing coverts, outermost scapulars, and rump glossed with violet; wings in general, upper tail coverts, and tail glossy blue-black, changing to greenish; iris bright red. Length about 9–9.50, wing 4.60–4.80, tail

3.70–3.80, culmen 0.85–0.90, tarsus 1.15–1.25. Young male entirely blackish, with distinct gloss only on wings, etc.; the lower parts, back, etc., without bronzy luster. Adult female: Above dark brownish gray, the feathers sometimes showing distinct dusky shaft streaks. Length about 8–8.50, wing about 4.10, tail 3.25, culmen 0.75, tarsus 1.05.

Geographical range.—Mexico and Central America, north to southern Texas, south to Panama.

The breeding range of the Red-eyed or Bronzed Cowbird, a larger and darker colored species than the two preceding, coincides with its geographical distribution in the United States, and extends, as far as known, north and eastward only to Bexar County, Tex., where Mr. H. P. Attwater reports it as a rare summer resident near San Antonio, and found one of its eggs in the nest of a Bullock's Oriole in that vicinity.

We are indebted to Dr. James C. Merrill, U. S. Army, for the addition of this interesting species to our fauna, who first recorded it in the Bulletin of the Nuttall Ornithological Club, Vol. I, 1876, p. 88, as an abundant summer resident in the vicinity of Fort Brown, Tex. A full account of the breeding habits of this species by Dr. Merrill may be found in the above-mentioned bulletin, Vol. II, 1877, pp. 85–87, from which I extract the most interesting notes:

My first specimens were taken at Hidalgo, on the Rio Grande, 70 miles northwest of Fort Brown, where, however, they are not so abundant as lower down the river. Here they are common throughout the year, a small proportion going south in winter Those that remain gather in large flocks with the Long-tailed Grackles, common Cowbirds, and Brewer's, Red-winged, and Yellow-headed Blackbirds; they become very tame, and the abundance of food about the picket lines attracts them for miles around. *C. robustus* is readily distinguishable in these mixed gatherings from the other species by its blood-red iris and its peculiar top-heavy appearance, caused by its habit of puffing out the feathers of the head and neck.

This habit is most marked during the breeding season and in the male, but is seen throughout the year.

About the middle of April the common Cowbird, Brewer's, and Yellow-headed Blackbirds leave for the north; the Long-tailed Grackles have formed their colonies in favorite clumps of mesquite trees; the Redwings that remain to breed have selected sites for their nests; the Dwarf Cowbirds, *Molothrus pecoris obscurus*, arrive from the south, and *Callothrus robustus* gather in flocks by themselves and wait for their victims to build. The males have now a variety of notes, somewhat resembling those of the common Cowbird *Molothrus pecoris*, but more harsh. During the day they scatter over the surrounding country in little companies of one or two females and half a dozen males, returning at nightfall to the vicinity of the picket lines. While the females are feeding or resting in the shade of a bush the males are eagerly paying their addresses by puffing out their feathers, as above noted, strutting up and down, and nodding and bowing in a very odd manner. Every now and then one of the males rises in the air, and poising himself 2 or 3 feet above the female, flutters for a minute or two, following her if she moves away, and then descends to resume his puffing and bowing. This habit of fluttering in the air was what first attracted my attention to the species. In other respects their habits seem to be like those of the eastern Cowbird (*M. pecoris*).

My first egg of *C. robustus* was taken on May 14, 1876, in a Cardinal's nest. A few days before this a soldier brought me a similar egg, saying he found it in a Scissors-tail's (*Milvulus*) nest. Not recognizing it at the time, I paid little attention to him, and did not keep the egg. I soon found several others, and have taken in all 22 specimens the past season. All but 2 of these were found in nests of the Bullock's, Hooded, and Orchard Orioles. It is a curious fact that although Yellow-breasted Chats and Redwinged Blackbirds breed abundantly in places most frequented by these Cowbirds, I have but once found the latter's egg in a Chat's nest, and never in a Redwing's, though I have looked in very many of them. Perhaps they feel that the line should be drawn somewhere, and select their cousins, the Blackbirds, as coming within it. The Dwarf Cowbirds are not troubled by this scruple, however. Several of these parasitic eggs were found under interesting conditions. On six occasions I have found an egg of both Cowbirds in the same nest. In four of these there were eggs of the rightful owner,* who was sitting. In the other two the Cowbird's eggs were alone in the nests, which were deserted. But I have known the Hooded Oriole to set on an egg of *C. robustus*, which was on the point of hatching when found. How its own disappeared I can not say. Once 2 eggs of *C. robustus* were found in a nest of the small Orchard Oriole (var. *affinis*). Twice I have seen a broken egg of *C. robustus* under nests of Bullock's Oriole on which the owner was sitting. Early in June a nest of the Hooded Oriole was found, with 4 eggs, and one of *C. robustus*, all of which I removed, leaving the nest. Happening to pass by it a few days later, I looked in, and to my surprise found 2 eggs of *robustus*, which were broken. These were so unlike that they were probably laid by different birds. Still another egg, and the last, was laid in the same nest within ten days. But the most remarkable instance was a nest of the small Orchard Oriole, found June 20, containing 3 eggs of *C. robustus*, while just beneath it was a whole egg of this parasite; also a broken one of this and of the Dwarf Cowbird *M. obscurus*. Two of the eggs in the nest were rotten. The third, strange to say, contained a living embryo. As the nest was certainly deserted, I can only account for this by supposing that the 2 rotten ones were laid about the first week of June, when there was considerable rain, and that the other was deposited soon after, since which time the weather had been clear and very hot. On one occasion I found a female *C. robustus* hanging with a stout thread around its neck to a nest of the Bullock's Oriole. The nest contained one young of this Cowbird, and it is probable that its parent after depositing the egg was entangled in the thread on hurriedly leaving the nest, and there died. It had apparently been dead about two weeks. This case supports the view that the eggs or young of the owner are thrown out by the young parasite and not removed by its parent, though I could find no trace of them beneath the nest.

Among the species imposed on by the Bronzed Cowbird are the following:

Milvulus forficatus, Scissors-tailed Flycatcher.
Icterus auduboni, Audubon's Oriole.
Icterus cucullatus, Hooded Oriole.
Icterus spurius, Orchard Oriole.
Icterus bullocki, Bullock's Oriole.
Cardinalis cardinalis canicaudus, Gray-tailed Cardinal.
Guiraca cœrulea eurhyncha, Western Blue Grosbeak.
Icterus virens longicauda, Long-tailed Chat.

Other species undoubtedly will have to be added to this list.

The Orioles appear to be the especial victims of the Bronzed Cowbird, and among these Audubon's seem to be the worst sufferer. In nine sets of this species in the U. S. National Museum collection there are only two which contain the normal number of eggs, 4. The other seven all contain from 1 to 3 of these parasitic eggs, with 1 or 2 of

*It would be interesting to know what would have become of the three species in one nest, and had the latter been near the fort where I could have visited them daily I should not have taken the eggs. It is probable, however, that *C. robustus* would have disposed of the young Dwarf Cowbird as easily as of the young Orioles.

their own, and some of these are usually punctured. In none of these nests were eggs of the Dwarf Cowbird found in addition to those of the *Callothrus robustus*. The former appears to confine itself to the smaller Orioles only.

The eggs of the Bronzed Cowbird are rather glossy; the shell is finely granulated and strong. Their shape varies from ovate to short and rounded ovate. They are pale bluish green in color and unspotted, resembling the eggs of the Black-throated Sparrow and Blue Grosbeak in this respect, but are much larger.

The average measurement of 38 specimens in the U. S. National Museum collection is 23.11 by 18.29 millimeters, or 0.91 by 0.72 inch. The largest egg of the series measures 24.64 by 18.80 millimeters, or 0.97 by 0.74 inch; the smallest, 21.84 by 16.76 millimeters, or 0.86 by 0.66 inch.

MOLOTHRUS BONARIENSIS (Gm.). Argentine Cowbird.

Molothrus bonariensis, SCL. et SALV., *Nomencl.*, p. 37; HUDSON, *P. Z. S.*, 1872, p. 809, 1874, p. 153 (Buenos Ayres); DURNFORD, *Ibis*, 1877, pp. 33, 174 (Chupat); WHITE, *P. Z. S.*, 1882, p. 601 (Buenos Ayres); DÖRING, *Exp. al Rio Negro, Zool.*, p. 41 (*Carhue*); BARROWS, *Bull. Nutt. Orn. Cl.* VIII, p. 133 (Entrerios); SCL., *Cat. B.*, XI, p. 335.—*Molothrus sericeus*, BURM., *La Plata Reise*, II, p. 494.

Description.—Uniform shining purplish black; less lustrous on wings and tail; bill and feet black; total length, 7.5 inches; wing, 4.5; tail, 3. Female, dark ashy brown; beneath paler; slightly smaller in size.

Hab.—Argentina, Paraguay, Bolivia, and Brazil. This species is the *Tordo Comun* of Azara, and is usually called "*Tordo*" or "*Pajaro Negro*" by the Spanish, and "*Blackbird*" by the English-speaking Argentines. A more suitable name, I think, is the Argentine Cowbird, which has been given to it by some writers on ornithology, Cowbird being the name of the closely allied North American species, *Molothrus pecoris*.

This Cowbird is widely distributed in South America, and is common throughout the Argentine country, including Patagonia, as far south as Chupat. In Buenos Ayres it is very numerous, especially in cultivated districts where there are plantations of trees. The male is clothed in a glossy plumage of deep violaceous purple, the wings and tail being dark metallic green; but seen at a distance or in the shade the bird looks black. The female is inferior in size and has a dull, mouse-colored plumage and black beak and legs. The males are much more numerous than the females. Azara says that nine birds in ten are males, but I am not sure that the disparity is so great as that. It seems strange and contrary to nature's usual rule that the smaller, shyer, inconspicuous individuals should be in such a minority; but the reason is perhaps that the male eggs of the Cowbird are harder shelled than the female eggs, and escape destruction oftener when the parent bird exercises its disorderly and destructive habit of pecking holes in all the eggs it finds in the nests into which it intrudes.

The Cowbirds are sociable to a greater degree than most species, their companies not breaking up during the laying season; for, as they are parasitical, the female merely steals away to drop her egg in any nest she can find, after which she returns to the flock. They feed on the ground, where, in their movements and in the habit the male has in craning out its neck when disturbed, they resemble Starlings. The male has also a curious habit of carrying his tail raised vertically while feeding. They follow the domestic cattle about the pastures, and frequently a dozen or more birds may be seen perched along the back of a cow or horse. When the animal is grazing they group themselves close to its mouth like chickens round a hen when she scratches up the ground, eager to snatch up the small insects exposed where the grass is cropped close. In spring they also follow the plow to pick up worms and grubs.

The song of the male, particularly when making love, is accompanied with gestures and actions somewhat like those of the domestic pigeon. He swells himself out, beating the ground with his wings, and uttering a series of deep internal notes, followed by others loud and clear; and occasionally when uttering them he suddenly takes wing and flies directly away from the female to a distance of 50 yards, and performs a wide circuit about her in the air, singing all the time.

The homely object of his short-lived passion always appears utterly indifferent to this curious and pretty performance; yet she must be even more impressionable than most female birds, since she continues scattering about her parasitical and often wasted eggs during four months in every year. Her language consists of a long note with a spluttering sound, to express alarm or curiosity, and she occasionally chatters in a low tone as if trying to sing. In the evening when the birds congregate on the trees to roost they often continue singing in concert until it is quite dark; and when disturbed at night the females frequently utter their song while taking flight, reminding one of the *Icterus pyrrhopterus*, which has only its usual melody to express fear and other painful emotions. On rainy days, when they are driven to the shelter of trees, they will often sing together for hours without intermission, the blending of innumerable voices producing a rushing sound as of a high wind. At the end of summer they congregate in flocks of tens of thousands so that the ground where they are feeding seems carpeted with black, and the trees when they alight appear to have a black foliage. At such times one wonders that many small species on which they are parasites do not become extinct by means of their pernicious habit. In Buenos Ayres, where they are most numerous, they have a migration, which is only partial, however. It is noticeable chiefly in the autumn, and varies greatly in different years. In some seasons it is very marked, when for many days in February and March the birds are seen traveling northward, flocks succeeding flocks all day long, passing by with a swift, low, undulating flight, their wings producing a soft musical sound; and this humming flight of the migrating Cowbirds is as familiar to every one acquainted with nature in Buenos Ayres as the whistling of the wind or the distant lowing of cattle.

The procreant instinct of this *Molothrus* has always seemed so important to me, for many reasons, that I have paid a great deal of attention to it; and the facts, or, at all events, the most salient of them, which I have collected during several years of observation, I propose to append here, classified under different headings so as to avoid confusion, and to make it easy for other observers to see at a glance just how much I have learned.

Though I have been familiar with this species from childhood, when I used to hunt every day for their wasted eggs on the broad, clean walks of the plantation, and removed them in pity from the nests of little birds where I found them, I have never ceased to wonder at their strange instinct, which in its wasteful, destructive character, so unlike the parasitical habit in other species, seems to strike a discordant note in the midst of the general harmony of nature.

MISTAKES AND IMPERFECTIONS OF THE PROCREANT INSTINCT OF MOLOTHRUS BONARIENSIS.

1. The Cowbirds, as we have seen, frequently waste their eggs by dropping them on the ground.

2. They also occasionally lay in old forsaken nests. This I have often observed, and to make very sure I took several old nests and placed them in trees and bushes, and found that eggs were laid in them.

3. They also frequently lay in nests where incubation has actually begun. When this happens the Cowbird's egg is lost, if incubation is far advanced; but if the eggs have been sat on three or four days only, then it has a good chance of being hatched and the young bird reared along with its foster brothers.

4. One female often lays several eggs in the same nest, instead of laying only one, as does, according to Wilson, the *Molothrus pecoris* of North America. I conclude that this is so from the fact that in cases where the eggs of a species vary considerably in form, size, and markings, each individual of the species lays eggs precisely or nearly alike. So when I find 2, 3, or 4 eggs of the Cowbird in one nest all alike in color and other particulars, and yet in half a hundred eggs from other nests can not find one to match with them, it is impossible not to believe that the eggs found together, and possessing a family likeness, were laid by the same bird.

5. Several females often lay in one nest, so that the number of eggs in it frequently makes incubation impossible. One December I collected ten nests of the Scissortail, *Milvulus tyrannus*, from my trees; they contained a total of 47 eggs, 12 of the Scissortails and 35 of the Cowbirds. It is worthy of remark that the *Milvulus* breeds in October

or early in November, rearing only one brood; so that these ten nests found late in December were of birds that had lost their first nests. Probably three-fourths of the lost nests of *Milvulus* are abandoned in consequence of the confusion caused in them by the Cowbirds.

6. The Cowbirds, male and female, destroy many of the eggs in the nests they visit, by pecking holes in the shells, breaking, devouring, and stealing them. This is the most destructive habit of the bird, and is probably possessed by individuals in different degrees. I have often carefully examined all the parasitical eggs in a nest, and after three or four days found that these eggs had disappeared, others, newly laid, being in their places. I have seen the female Cowbird strike her beak into an egg and fly away with it; and I have often watched the male bird perched close by while the female was on the nest, and when she quitted it seen him drop down and begin pecking holes in the eggs. In some nests found full of parasitical eggs every egg has holes pecked in the shell, for the bird destroys indiscriminately eggs of its own and of other species.

ADVANTAGES POSSESSED BY M. BONARIENSIS OVER ITS DUPES.

After reading the preceding notes one might ask, if there is so much that is defective and irregular in the reproductive instinct of *M. bonariensis*, how does the species maintain its existence, and even increase to such an amazing extent, for it certainly is very much more numerous, over an equal area, than other parasitical species. For its greater abundance there may be many reasons unknown to us. The rarer species may be less hardy, have more enemies, be exposed to more perils in their long migrations, etc. That it is able to maintain its existence in spite of irregularities in its instinct is no doubt due to the fact that its eggs and young possess many advantages over the eggs and young of the species upon which it is parasitical. Some of these advantages are due to those very habits of the parent bird which at first sight appear most defective; others to the character of the egg and embryo, time of evolution, etc.

1. The egg of the Cowbird is usually larger, and almost invariably harder shelled than are the eggs it is placed with; those of the Yellow-breast, *Pseudoleistes virescens*, being the one exception I am acquainted with. The harder shell of its own egg, considered in relation to the destructive egg-breaking habit of the bird, gives it the best chance of being preserved; for though the Cowbird never distinguishes its own eggs, of which indeed it destroys a great many, a larger proportion escape in a nest where many eggs are indiscriminately broken.

2. The vitality or tenacity of life appears greater in the embryo Cowbird than in other species; this circumstance also, in relation to the egg-breaking habit and to the habit of laying many eggs in a nest, gives it a further advantage. I have examined nests of the Scissor-tail, containing many eggs, after incubation had begun, and have been surprised at finding those of the Scissortail addled, even when placed

most advantageously in the nest for receiving heat from the parent bird, while those of the Cowbird contained living embryos, even when under all the other eggs, and as frequently happens, glued immovably to the nest by the matter from broken eggs spilt over them.

The following instance of extraordinary vitality in an embryo *Molothrus* seems to show incidentally that in some species protective habits, which will act as a check on the parasitical instinct, may be in the course of formation.

Though birds do not, as a rule, seem able to distinguish parasitical eggs from their own, however different in size and color they may be, they often do seem to know that eggs dropped in their nest before they themselves have began to lay ought not to be there; and the nest, even after its completion, is not infrequently abandoned on account of these premature eggs. Some species, however, do not forsake their nests; and though they do not throw the parasitical eggs out, which would seem the simplest plan, they have discovered how to get rid of them and so save themselves the labor of making a fresh nest. Their method is to add a new deep lining, under which the strange eggs are buried out of sight and give no more trouble. The *Sisopygis icterophrys*, a common Tyrant Bird in Buenos Ayres, frequently has recourse to this expedient, and the nest it makes being rather shallow the layer of fresh material, under which the strange eggs are buried, is built upward above the rim of the original nest, so that this supplementary nest is like one saucer placed within another, and the observer is generally able to tell from the thickness of the whole structure whether any parasitical eggs have been entombed in it or not. Finding a very thick nest one day, containing 2 half-fledged young birds besides 3 addled eggs, I opened it, removing the upper portion, or additional nest, intact, and discovered beneath it three buried *Molothrus* eggs, their shells encrusted with dirt and glued together with broken egg-matter spilt over them. In trying to get them out without pulling the nest to pieces I broke them all. Two were quite rotten, but the third contained a living embryo, ready to be hatched, and very lively and hungry when I took it in my hand. The young Tyrant Birds were about a fortnight old, and as they hatch out only about twenty days after the parent bird begins laying, this parasitical egg with a living chick in it must have been deeply buried in the nest for five or six weeks. Probably after the young Tyrant Birds came out of their shells and began to grow, the little heat from their bodies penetrating to the buried egg, served to bring the embryo in it to maturity; but when I saw it I felt (like a person who sees a ghost) strongly inclined to doubt the evidence of my own senses.

3. The comparatively short time the embryo takes to hatch gives it another and a great advantage; for, whereas the eggs of other small birds require from fourteen to sixteen days to mature, that of the Cowbird hatches in eleven days and a half from the moment incubation commences; so that when the female Cowbird makes so great a mistake

as to drop an egg with others that have already been sat on, unless incubation be very far advanced, it still has a chance of being hatched before or contemporaneously with the others; but even if the others hatch first, the extreme hardiness of the embryo serves to keep it alive with the modicum of heat it receives.

4. Whenever the *Molothrus* is hatched together with the young of its foster parents, if these are smaller than the parasite, as usually is the case, soon after exclusion from the shell they disappear, and the young Cowbird remains sole occupant of the nest. How it succeeds in expelling or destroying them, if it indeed does destroy them, I have not been able to learn.

5. To all these circumstances favorable to the *Molothrus* may be added another of equal or even greater importance. It is never engaged with the dilatory and exhaustive process of rearing its own young, and for this reason continues in better condition than other species; and, moreover, being gregarious and practising promiscuously sexual intercourse, must lay a much greater number of eggs than other species. In our domestic fowls we see that hens that never become broody lay a great deal more than others. Some of our small birds rear two, others only one brood in the season, building, incubation, and tending the young taking up much time, so that they are usually from two to three months and a half employed. But the Cowbird is like the fowl that never incubates, and continues dropping eggs during four months and a half. From the beginning of September until the end of January the males are seen incessantly wooing the females, and during most of this time eggs are found. I find that small birds will, if deprived repeatedly of their nests, lay and even hatch four times in the season, thus laying, if the full complement be 4, 16 eggs. No doubt the Cowbird lays a much larger number than that; my belief is that every female lays from 60 to 100 eggs every season, though I have nothing but the extraordinary number of wasted eggs one finds to judge from.

Before dismissing the subject of the advantages the *Molothrus* possesses over its dupes, and of the real or apparent defects of its instinct, some attention should be given to another circumstance, viz, the new conditions introduced by land cultivation and their effect on the species. The altered conditions have in various ways served to remove many extraneous checks on the parasitical instinct, and the more the birds multiply the more irregular and disordered does the instinct necessarily become. In wild districts where it was formed, and where birds building accessible nests are proportionately fewer, the instinct seems different from what it does in cultivated districts. Parasitical eggs are not common in the desert, and even the most exposed nests there are probably never overburdened with them. But in cultivated places, where their food abounds, the birds congregate in the orchards and plantations in great numbers, and avail themselves of all the nests, ill-concealed as they must always be in the clean, open-foliaged trees planted by man.

Diversity in Color of Eggs.

There is an extraordinary diversity in the color, form, and disposition of markings, etc., of the eggs of *M. bonariensis;* and I doubt whether any other species exists laying eggs so varied. About half the eggs one finds, or nearly half, are pure unspotted white, like the eggs of birds that breed in dark holes. Others are sparsely sprinkled with such exceedingly minute specks of pale pink or gray as to appear quite spotless until closely examined. After the pure white, the most common variety is an egg with a white ground, densely and uniformly spotted or blotched with red. Another not uncommon variety has a very pale, flesh-colored ground, uniformly marked with fine characters, that look as if inscribed on the shell with a pen. A much rarer variety has a pure white shell with a few large or variously sized chocolate spots. Perhaps the rarest variety is an egg entirely of a fine deep red; but between this lovely marbled egg and the white one with almost imperceptible specks there are varieties without number, for there is no such thing as characteristic markings in the eggs of this species, although, as I have said before, the eggs of the same individual show a family resemblance.

Habits of the Young of M. Bonariensis.

Small birds of all species, when first hatched, closely resemble each other. After they are fledged the resemblance is less, but still comparatively great. Gray, interspersed with brown, is the color of most of them, or at least of the upper exposed plumage. There is also a great similarity in their cries of hunger and fear—shrill, querulous, prolonged, and usually tremulous notes. It is not, then, to be wondered at that the foster parents of the young *Molothrus* so readily respond to its cries, understanding the various expressions denoting hunger, fear, pain, as well as when uttered by their own offspring. But the young *Molothrus* never understands the language of its foster parents as other young birds understand the language of their real parents, rising to receive food when summoned, and concealing themselves or trying to escape when the warning note is given. How does the young *Molothrus* learn to distinguish, even by sight, its foster parent from any other bird approaching the nest? It generally manifests no fear even at a large object. On thrusting my fingers into any nest I find the young birds, if still blind or but recently hatched, will hold up and open their mouths, expecting food; but in a very few days they learn to distinguish between their parents and other objects approaching them, and to show alarm even when not warned of danger. Consider the different behavior of three species that seldom or never warn their offspring of danger: The young of *Synallaxis spixi*, though in a deep, domed nest, will throw itself to the ground, attempting thus to make its escape; the young of *Mimus patagonicus* sits close and motionless, with closed eyes, mimicking death; the young of our common

Zenaida, even before it is fledged, will swell itself up and strike angrily at the intruder with beak and wings, and by making so brave a show of its inefficient weapons it probably often saves itself from destruction. But anything approaching the young *Molothrus* is welcomed with fluttering wings and clamorous cries, as if all creatures were expected to minister to its necessities.

December 21.—To-day I found a young *Molothrus* in the nest of *Spermophila cærulescens.* He cried for food on seeing my hand approach the nest. I took him out and dropped him down, when, finding himself on the ground, he immediately made off, half flying. After a hard chase I succeeded in recapturing him, and began to twirl him about, making him scream, so as to inform his foster parents of his situation, for they were not by at the moment. I then put him back in, or rather upon, the little cradle of a nest, and plucked half a dozen large measure worms from an adjacent twig. The worms I handed to the bird as I drew them from the cases, and with great greediness he devoured them all, notwithstanding the ill treatment he had just received, and utterly disregarding the wild, excited cries of his foster parents, just arrived and hovering within 3 or 4 feet of the nest.

Last summer I noticed a young Cowbird in a stubble field, perched on the top of a slender, dry stalk. As it was clamoring at short intervals, I waited to see what bird would come to it. It proved to be the diminutive *Hapalocercus flaviventris*, and I was much amused to see the little thing fly directly to its large foster offspring and, alighting on its back, drop a worm into the upturned open mouth. After remaining a moment on its singular perch, the Flycatcher flew away, but in less than half a minute returned and perched again on the young bird's back. I continued watching them until the *Molothrus* flew off, but not before I had seen him fed seven or eight times in the same manner.

In the two foregoing anecdotes may be seen the peculiar habits of the young *Molothrus*. As the nests in which it is hatched, from those of the little *Serpophaga* and Wren to those of *Mimus*, vary so much in size and materials, and are placed in such different situations, the young *Molothrus* must have in most of them a somewhat incongruous appearance. But in the habits of the young bird is the greatest incongruity or inadaptation. When the nest is in a close thicket or forest, though much too small for the bird, and although the bird itself can not understand its foster parents and welcomes all things that, whether with good or evil design, come near it, the unfitness is not so apparent as when the nest is in open fields and plains.

The young *Molothrus* differs from the true offspring of its foster parents in its habit of quitting the nest as soon as it is able, trying to follow the old bird, and placing itself in the most conspicuous place it can find, such as the summit of a stalk or weed, and there demanding food with frequent and importunate cries. Thus the little Flycatcher had acquired the habit of perching on the back of its charge to feed it, because parent birds invariably perch above their young to feed them, and the young Cowbird prevented this by always sitting on the summit of the stalk it perched on. The habit is most fatal on the open and closely cropped pampas inhabited by the Cachila, *Anthus correndera*. In December, when the Cachila Pipit rears its second brood, the *Milvago chimango* also has young, and feeds them almost exclusively on the young of various species of small birds. At this season the Chimango destroys great numbers of the young of the *Cachila* and of *Synallaxis hudsoni*. Yet these birds are beautifully adapted, in structure, coloration, and habits, to their station. It thus happens that in districts where the *Molothrus* is abundant their eggs are found in a majority of the *Cachilas's* nests; and yet to find a young Cowbird out of the nest is a rare thing here, for as soon as the young birds are able to quit the nest and expose themselves they are all or nearly all carried off by the *Chimangos*.

Conjectures as to the Origin of the Parasitic Instinct in M. Bonariensis.

Darwin's opinion that the "immediate and final cause of the Cuckoo's instinct is that she lays her eggs not daily, but at intervals of two or three days" (Origin of Species), carries no great appearance of probability with it; for might it not just as reasonably be said that the parasitic instinct is the immediate and final cause of her laying her eggs at long intervals? If it is favorable to a species with the instinct of the Cuckoo (and it probably is favorable) to lay eggs at longer intervals than other species, then natural selection would avail itself of every modification in the reproductive organs that tended to produce such a result, and make the improved structure permanent. It is said (Origin of Species, Chap. VII) that the American Cuckoo lays also at long intervals, and has eggs and young at the same time in its nest, a circumstance manifestly disadvantageous. Of the *Coccyzus melanocoryphus*, the only one of our three *Coccyzi* whose nesting habits I am acquainted with, I can say that it never begins to incubate till the full complement of eggs are laid—that its young are hatched simultaneously. But if it is sought to trace the origin of the European Cuckoo's instinct in the nesting habits of American *Coccyzi*, it might be attributed not to the aberrant habit of perhaps a single species, but to another and more disadvantageous habit common to the entire genus, viz, their habit of building exceedingly frail platform nests, from which the eggs and young very frequently fall. By occasionally dropping an egg in the deep, secure nest of some other bird an advantage would be possessed by the birds hatched in them, and in them the habit would perhaps become hereditary. Be this as it may (and the one guess is perhaps as wide of the truth as the other), there are many genera intermediate between *Cuculus* and *Molothrus* in which no trace of a parasitic habit appears; and it seems more than probable that the analogous instincts originated in different ways in the two genera. As regards the origin of the instinct in *Molothrus*, it will perhaps seem premature to found speculations on the few facts here recorded and before we are acquainted with the habits of other members of the genus. That a species should totally lose so universal an instinct as the maternal one, and yet avail itself of that affection in other species to propagate itself, seems a great mystery. Nevertheless, I can not refrain from all conjecture on the subject, and will go so far as to suggest what may have been at least one of the many concurrent causes that have produced the parasitic instinct. The apparently transitional nesting habits of several species, and one remarkable habit of *M. bonariensis*, seem to me to throw some light on a point bearing intimately on the subject, viz, the loss of the nest-making instinct in this species.

Habits vary greatly; were it not so, they would never seem so well adapted to the conditions of life as we find them, since the conditions themselves are not unchangeable. Thus it happens that while a species seems well adapted to its state in its habits, it frequently seems not so well adapted in its relatively immutable structure. For example, without going away from the pampas, we find a Tringa with the habits of an upland Plover, a Tyrant Bird, *Pitangus bellicosus*, preying on mice and snakes, another Tyrant Bird, *Myiotheretes rufiventris*, Plover-like in its habits, and finally a Woodpecker, *Colaptes campestris*, that seeks its food on the ground like a Starling; yet in none of these—and the list might be greatly lengthened—has there been anything like a modification of structure to keep pace with the altered manner of life. But, however much the original or generic habits of a species may have become altered—the habits of a species being widely different from those of its congeners, also a want of correspondence between structure and habits (the last being always more suited to conditions than the first) being taken as evidence of such alteration—traces of ancient and disused habits frequently reappear. Seemingly capricious actions, too numerous, too vague, or too insignificant to be recorded, improvised definite actions that are not habitual, apparent imitations of the actions of other species, a perpetual inclination to attempt something that is never attempted, and attempts to do that which is never done—these and other like motions are, I believe, in many cases to be attributed to the faint promptings of obsolete instincts. To the same cause many of the occasional aberrant habits of individuals may possibly be due—such as of a bird that builds in trees occasionally laying on the ground. If recurrence to an ancestral type be traceable in structure, coloration, language, it is reasonable to expect something analogous to occur in instincts. But even if such casual and often aimless motions as I have mentioned should guide us unerringly to the knowledge of the old and disused instincts of a species, this knowledge of itself would not enable us to discover the origin of present ones. But, assuming it as a fact that the conditions of existence and the changes going on in them are in every case the fundamental cause of alterations in habits, I believe that in many cases a knowledge of the disused instincts will assist us very materially in the inquiry. I will illustrate my meaning with a suppositious case. Should all or many species of *Columbidæ* manifest an inclination for haunting rocks and banks, and for entering or peering into holes in them, such vague and purposeless actions, connected with the facts that all doves build simple platform nests (like *Columba liria* and others that build on a flat surface), also lay white eggs (the rule being that eggs laid in dark holes are white, exposed eggs colored), also that one species, *C. liria*, does lay in holes in rocks, would lead us to believe that the habit of this species was once common to the genus. We should conclude that an insufficiency of proper breeding places, i. e., new external conditions, first induced doves to build in trees. Thus *C. liria* also builds in trees where there are no rocks; but, when able, returns to its ancestral habits. In the other species we should believe the primitive habit to be totally lost from disuse, or only to manifest itself in a faint, uncertain manner.

Now, in *Molothrus bonariensis* we see just such a vague, purposeless habit as the imaginary one I have described. Before and during the breeding season the females, sometimes accompanied by the males, are seen continually haunting and examining the domed nests of some of the *Dendrocolaptidæ*. This does not seem like a mere freak of curiosity, but their persistence in their investigations is precisely like that of birds that habitually make choice of such breeding places. It is surprising that they never do actually lay in such nests, except when the side or dome has been accidentally broken enough to admit the light into the interior. Whenever I set boxes up in my trees the female Cowbirds were the first to visit them. Sometimes one will spend half a day loitering about and inspecting a box, repeatedly climbing round and over it and always ending at the entrance, into which she peers curiously, and when about to enter starting back as if scared at the obscurity within; but after retiring a little space she will return again and again, as if fascinated with the comfort and security of such an abode. It is amusing to see how pertinaciously they hang about the ovens of the Ovenbirds, apparently determined to take possession of them, flying back after a hundred repulses, and yet not entering them even when they have the opportunity. Sometimes one is seen following a wren or a swallow to its nest beneath the eaves, and then clinging to the wall beneath the hole into which it disappeared. I could fill many pages with instances of this habit of *M. bonariensis*, which, useless though it be, is as strong an affection as the bird possesses. That it is a recurrence to a long disused habit I can scarcely doubt; at least, to no other cause that I can imagine can it be attributed; and, besides, it seems to me that if *M. bonariensis*, when once a nest builder, had acquired the semiparasitical habit of breeding in domed nests of other birds, such a habit might conduce to the formation of the instinct which it now possesses.

I may mention that twice I have seen birds of this species attempting to build nests, and that on both occasions they failed to complete the work. So universal is the nest-making instinct that one might safely say the *M. bonariensis* had once possessed it, and that in the cases I have mentioned it was a recurrence, too weak to be efficient, to the ancestral habit. Another interesting circumstance may be adduced as strong presumptive evidence that *M. bonariensis* once made itself an open exposed nest as *M. badius* occasionally does, viz, the difference in color of the male and female, for while the former is rich purple the latter possesses an adaptive resemblance in color to nests and to the shaded interior twigs and branches on which nests are usually built. How could such an instinct have been lost? To say that the Cowbird occasionally dropped an egg in another bird's nest, and that the young hatched from these occasional eggs possessed some (hypothetical) advantage over those hatched in the usual way, and that the parasitical habit so became hereditary, supplanting the original one, is an assertion without anything to support it, and seems to exclude the agency of external conditions. Again, the want of correspondence in the habits of the young parasite and its foster parents would in reality be a disadvantage to the former; the unfitness would be as great in the eggs and other circumstances, for all the advantages the parasite actually possesses in the comparative hardness of the eggshell, rapid evolution of the young, etc., already mentioned, must have been acquired little by little through the slowly accumulating process of natural selection, but subsequently to the formation of the original parasitical inclination and habit. I am inclined to believe that *M. bonariensis* lost the nest-making instinct by acquiring that semiparasitical habit common to so many South American birds of breeding in the large covered nests of the *Dendrocolaptidæ*. We have evidence that this semiparasitical habit does tend to eradicate the nest-making one. The *Synallaxes* build great elaborate domed nests, yet we have one species (*S. ægithaloides*) that never builds for itself, but breeds in the nests of other birds of the same genus. In some species the nest-making habit is in a transitional state. *Machetornis rixosa* sometimes makes an elaborate nest in the angle formed by twigs and the bough of a tree, but prefers, and almost invariably makes choice of, the covered nest of some other species or of a hole in the tree. It is precisely the same with our Wren, *Troglodytes furvus*. The Yellow House Sparrow, *Sycalis pelzelni*, invariably breeds in a dark hole or covered nest. The fact that these three species lay colored eggs, and the first and last very darkly colored eggs, inclines one to belive that they once invariably built exposed nests, as *M. rixosa* still occasionally does. It may be added that those species that lay colored eggs in dark places construct and line their nests far more neatly than do the species that breed in such places but lay white eggs. As with *M. rixosa* and the Wren, so it is with the Bay-winged *Molothrus;* it lays mottled eggs, and occasionally builds a neat, exposed nest; yet so great is the partiality it has acquired for large domed nests, that whenever it can possess itself of one by dint of fighting it will not build one for itself. Let us suppose that the Cowbird also once acquired the habit of breeding in domed nests, and that through this habit its original nest-making instinct was completely eradicated. It is not difficult to imagine how in its turn this instinct was also lost. A diminution in the number of birds that built domed nests would involve *M. bonariensis* in a struggle for nests, in which it would probably be defeated. In Buenos Ayres the White-rumped Swallow, the Wren, and the Yellow Seed-finch prefer the ovens of the *Furnarius* to any other breeding place, but to obtain them are obliged to struggle with *Progne tapera*, for this species has acquired the habit of breeding exclusively in the ovens. They can not, however, compete with the *Progne*, and thus the increase of one species has, to a great extent, deprived three other species of their favorite building place. Again, *Machetornis rixosa* prefers the great nest of the *Anumbius*, and when other species compete with it for the nest they are invariably defeated. I have seen a pair of *Machetornis*, after they had seized a nest, attacked in their turn by a flock of 6 or 8 Bay-wings, but, in spite of the superior numbers, the fury of the *Machetornis* compelled them to raise the siege.

Thus some events in the history of our common *Molothrus* have perhaps been accounted for, if not the most essential one—the loss of the nest-making instinct from the acquisition of the habit of breeding in the covered nests of other birds, a habit that has left a strong trace in the manners of the species, and perhaps in the pure white unmarked eggs of so many individuals; finally, we have seen how this habit may also have been lost. But the parasitical habit of the *M. bonariensis* may have originated when the bird was still a nest builder. The origin of the instinct may have been in the occasional habit, common to so many species, of two or more females laying together; the progenitors of all the species of *Molothrus* may have been early infected with this habit, and inherited with it a facility for acquiring their present one. *M. pecoris* and *M. bonariensis*, though their instincts differ, are both parasitic on a great number of species; *M. rufoaxillaris* on *M. badius*; and in this last species two or more females frequently lay together. If we suppose that the *M. bonariensis*, when it was a nest builder or reared its own young in the nests it seized, possessed this habit of two or more females frequently laying together, the young of those birds that oftenest abandoned their eggs to the care of another would probably inherit a weakened maternal instinct. The continual intercrossing of individuals with weaker and stronger instincts would prevent the formation of two races differing in habit; but the whole race would degenerate, and would only be saved from final extinction by some individuals occasionally dropping their eggs in the nests of other species, perhaps of a *Molothrus*, as *M. rufoaxillaris* still does, rather than of birds of other genera. Certainly in this way the parasitic instinct may have originated in *M. bonariensis* without that species ever having acquired the habit of breeding in the covered dark nests of other birds. I have supposed that they once possessed it only to account for the strange attraction such nests have for them, which seems like a recurrence to an ancestral habit.

MOLOTHRUS RUFOAXILLARIS, Cassin. Screaming Cowbird.

Molothrus rufoaxillaris, SCL. et SALV., *Nomencl.* p. 37; HUDSON, *P. Z. S.* 1874, p. 161 (Buenos Ayres); DURNFORD, *Ibis*, 1877, p. 174 (Buenos Ayres); WHITE, *P. Z. S.* 1882, p. 601 (Catamarca); BARROWS, *Bull. Nutt. Orn. Cl.* VIII, p. 134 (Entrerios); *Scl. Cat. B.* XI. p. 338.

Description.—Silky black, washed with purple; wings and tail with a slight greenish gloss; a chestnut spot on the axillaries; bill and feet black; whole length 8 inches, wing 4.5, tail 3.3. Female similar, but somewhat smaller.

Habitat.—Argentina and Uruguay.

This bird has no vulgar name, not being distinguished from the common Cowbird by the country people. The English name of Screaming Cowbird, which I have bestowed on it, will, I think, commend itself as appropriate to those who observe this bird, for they will always and at any distance be able to distinguish it from the species it resembles so nearly by listening to its impetuous screaming notes, so unlike anything in the language of the common Cowbird.

The Screaming Cowbird is larger than the allied species. The female is less than the male in size, but in color they are alike, the entire plumage being deep blue-black, glossy, and with purple reflections; and under the wing at the joint there is a small rufous spot. The beak is very stout, the plumage loose, and with a strong, musky smell; the œsophagus remarkably wide.

It is far less common than the other species of *Molothrus*, but is not rare, and ranges south to the Buenos-Ayrean pampas, where a few individuals are usually found in every large plantation; and, like the *M. badius*, it remains with us the whole year. It is not strictly gregarious, but in winter goes in parties, never exceeding five or six individuals, and in the breeding season in pairs. One of its most noteworthy traits is an exaggerated hurry and bustle thrown into all its movements. When passing from one branch to another, it goes by a series of violent jerks, smiting its wings loudly together, and when a party of them return from the fields they rush wildly and loudly screaming to the trees, as if pursued by a bird of prey. They are not singing birds, but the male sometimes, though rarely, attempts a song, and utters, with considerable effort, a series of chattering unmelodious notes. The chirp with which he invites his mate to fly has the sound of a loud and smartly-given kiss. His warning or alarm note when approached in the breeding season has a soft and pleasing sound; it is, curiously enough, his only mellow expression. But his most common and remarkable vocal performance is a cry beginning with a hollow-sounding internal note, and swelling into a sharp metallic ring; this is uttered with tail and wings spread and depressed, the whole plumage raised like that of a strutting turkey cock, whilst the bird hops briskly up and down on its perch as if dancing. From its puffed-out appearance, and from the peculiar character of the sound it emits, I believe that, like the pigeon and some other species, it has the faculty of filling its crop with air, to use it as a "chamber of resonance." The note I have described is quickly and invariably followed by a scream, harsh and impetuous, uttered by the female, though both notes always sound as if proceeding from one bird. When on the wing the birds all scream together in concert.

The food of this species is chiefly minute seeds and tender buds; they also swallow large caterpillars and spiders, but do not, like their congeners, eat hard insects.

I became familiar, even as a small boy, with the habits of the Screaming Cowbird, and before this species was known to naturalists, but could never find its nest, though I sought diligently for it. I could never see the birds collecting materials for a nest, or feeding their grown-up young like other species, and this might have made me suspect that they did not hatch their own eggs; but it never occurred to me that the bird was parasitical, I suppose because in summer they are always seen in pairs, the male and female being inseparable. Probably this is the only parasitical species in which there is conjugal fidelity. I also noticed that, when approached in the breeding season, the pair always displayed great excitement and anxiety, like birds that have a nest, or that have selected a site on which to build one. But year after year the end of the summer would arrive, the birds reunite in parties of half a dozen, and the mystery remain unsolved. At length, after many years, fortune favored me, and while observing the habits of another species (*Molothrus badius*), I discovered by chance the procreant habits of the Screaming Cowbirds, and as these observations throw some light on the habits of *M. badius*, I think it best to transcribe my notes here in full.

A pair of *Leñateros* (*Anumbius acuticaudatus*) have been nearly all the winter building a nest on an acacia tree 60 yards from the house; it is about 27 inches deep, and 16 or 18 inches in circumference and appears now nearly finished. I am sure that this nest will be attacked before long, and I have resolved to watch it closely.

September 28.—To-day I saw a Bay-wing (*M. badius*) on the nest; it climbed over it, deliberately inspecting every part with the critical air of a proprietor who had ordered its construction, taking up and rearranging some sticks and throwing others away from the nest. While thus engaged two common Cowbirds (*M. bonariensis*), male and female, came to the tree. The female dropped on to the nest and began also to examine it, peering curiously into the entrance and quarreling with the first bird. After a few minutes she flew away, followed by her glossy escort. The Bay-wing continued its strange, futile work until the owners of the nest appeared, whereupon it hopped aside in its usual slow leisurely manner, sang for a few moments, then flew away. The similarity in the behavior of the two birds struck me very forcibly. In the great interest they take in the nests of other birds, especially in large covered nests, the two species are identical. But when the breeding season comes their habits begin to diverge; then the common Cowbird lays in nests of other species, abandoning its eggs to their care, while the Bay-wings usually seize on the nests of other birds and rear their own young. Yet, as they do occasionally build a neat, elaborate nest for themselves, the habit of taking possession of the nests of other birds is, most likely, a recently acquired one, and probably its tendency is to eradicate the original building instinct.

October 8.—This morning, while reading under a tree, my attention was aroused by a shrill note as of a bird in distress issuing from the neighborhood of the *Leñatero's* nest; after hearing it repeated at intervals for over twenty minutes I went to ascertain the cause. Two Bay-wings flew up from the ground under the nest, and on searching in the rank clover growing under the tree I discovered the female *Leñatero*, with plumage wet and draggled, trembling and appearing half dead with the rough treatment she had experienced. I put her in the sun, and after half an hour, hearing her mate calling, she managed to flutter feebly away to join him. The persecutors had dragged her out of the nest and would, no doubt, have killed her, had I not come so opportunely to the rescue.

Since writing the above, I have continued to watch the nest. Both the Bay-wings and *Leñateros* left it for some days. Six days after picking up the ill-treated female, the *Leñateros* came back and resumed possession. Four days later the Bay-wings also came back; but on finding the nest still occupied, they took possession of an unfinished oven of an Ovenbird on another tree within 20 yards of the first, and immediately began carrying in materials with which to line it. When they had finished laying I took their 5 eggs, at the same time throwing down the oven, and waited to see what their next move would be. They remained on the spot singing incessantly, and still manifesting anxiety when approached. I observed them four days, and then was absent from home as many more; on returning I found that the *Leñateros* had once more disappeared and that the nest was now held by the Bay-wings. I also noticed that they had opened an entrance very low down at the side of the nest which they were using; no doubt they had killed and thrown out the young *Leñateros*.

It was now early in November, the height of the breeding season, and numbers of common Cowbirds constantly visited the nest; but I was particularly interested in a pair of Screaming Cowbirds that had also begun to grow fond of it, and I resolved to watch them closely. As they spent so much of their time near the nest, showing great solicitude when I approached it, I strongly hoped to see them breed in it, if the Bay-wings could only be got rid of. The Screaming Cowbirds would not, or dared not, attack them; and, as I always think that the worst possible use one can put a little bird to is to shoot it, I could not help them by destroying the Bay-wings. I therefore resolved to take their eggs, hoping that that would cause them to leave in disgust.

When I was satisfied from their movements that they had finished laying, I got up to the nest and was astonished to find 10 eggs instead of 5 as I had confidently expected: for, though the common Cowbirds had paid a great deal of attention to the nest, I knew the Bay-wings would not allow them to lay in it.

The 10 eggs in the nest were all unmistakably Bay-wings' eggs, and having observed before that several females do occasionally lay together, I concluded that in this case two females had laid in the nest, though I had only seen two birds—male and female. After taking the 10 eggs the Bay-wings still remained, and in a very short time they appeared to be laying again. When I had reason to think that the full complement was laid, I visited the nest and found 5 eggs in it; these I also took and concluded that the second female had probably gone away, after having been deprived of her first clutch. During all this time the Screaming Cowbirds remained in the neighborhood and occasionally visited the tree; but to my very great surprise the Bay-wings still stubbornly remained, and by-and-by I found that they were going to ay again—the fourth time! When I next visited the nest there were 2 eggs in it; I left them and returned three days later, expecting to find 5 eggs, but found 7—certainly more than one female had laid in the nest on this occasion. After taking these last 7 eggs the Bay-wings left, and though the Screaming Cowbirds continued to make occasional visits to the nest, to my great disappointment they did not lay in it.

April 12.—To-day I have made a discovery, and am as pleased with it as if I had found a new planet in the sky. The mystery of the Bay-wings' nest twice found containing over the usual complement of eggs is cleared up, and I have now suddenly become acquainted with the procreant instinct of the Screaming Cowbird. I look on this as a great piece of good fortune, for I had thought that the season for making any such discovery was already over, as we are so near to winter.

The Bay-wings are so social in their habits that they always appear reluctant to break up their companies in the breeding season. No sooner is this over, and while the young birds are still fed by the parents, all the families about a plantation unite into one flock. About a month ago all the birds about my home had associated in this way together and went in a scattered flock, frequenting one favorite feeding spot very much, a meadow about fifteen minutes' walk from the house. The flock was composed, I believe, of 3 families, 16 or 18 birds in all. The young birds are indistinguishable from the adults, but I knew that most of these birds were young, hatched late in the season, from their incessant strident hunger notes. I first observed them about the middle of March. A week ago, while riding past the meadow where they were feeding, I noticed among them 3 individuals with purple spots on their plumage. They were at a distance from me, and I naturally concluded that they were young common Cowbirds (*M. bonariensis*) casually associating with the Bay-wings. I was surprised to see them, for the young male *M. bonariensis* always acquires the purple plumage before March, so that these individuals were changing color five weeks after the usual time. To-day, while out with my gun, I came upon the flock, and noticed 4 of the birds assuming the purple plumage, 2 of them being almost entirely that color; but I also noticed with astonishment that they had bay or chestnut-colored wings, also that those with least purple on them were marvelously like the Bay-wings in the mouse-colored plumage of the body and the dark tail. I had seen these birds before the purple plumage was acquired, and there was then not the slightest difference amongst them, the adults and their supposed offspring being alike; now some of them appeared to be undergoing the process of a transmutation into another species. I at once shot the 4 spotted birds, along with 2 genuine Bay-wings, and was delighted to find that the first were young Screaming Cowbirds.

I must now believe that the extra eggs twice found in the nest of the Bay-wings were those of the Screaming Cowbird; that the latter species lays chiefly in the nests of the former; that the eggs of the two species are identical in form, size, and color, each bird also laying 5; and that, stranger still, the similarity is as perfect in the young birds as it is in the eggs.

April 15.—This morning I started in quest of the Bay-wings, and observed 1 individual, that had somehow escaped detection the day before, assuming the purple dress. This bird I shot; and after the flock had resettled a short distance off I crept close up to them, under the shelter of a hedge, to observe them more narrowly. One of the adults was closely attended by 3 young birds; and these all, while I watched them, fluttered their wings and clamored for food every time the old bird stirred on its perch. The 3 young birds seemed precisely alike; but presently I noticed that 1 of them had a few minute purple spots, and on shooting this one I found it to be a young *M. rufoaxillaris*, while the other 2 were true young Bay-wings.

The hungry cry of the young *M. badius* (Bay-wing) is quite different from that of the young *M. bonariensis.* The cry of the latter is a long, shrill, two-syllabled note, the last syllable being prolonged into a continuous squeal when the foster parent approaches with food. The cry of the young *M. badius* is short, reedy, tremulous, and uninflected. The resemblance of the young *M. rufoaxillaris* to its foster brothers in language and plumage is the more remarkable when we reflect that the adult bird in its habits, gestures, guttural notes, also in its deep purple plumage, comes much nearer to *M. bonariensis* than to *M. badius.* It seems impossible for mimicry to go further than this. A slight difference in size is quite imperceptible when the birds are flying about, while in language and plumage the keenest ornithologist would not be able to detect a difference. But it may be questioned whether this is really a case of an external resemblance of one species to another acquired by natural selection for its better preservation. Possibly the young *M. rufoaxillaris* in the first stage of its plumage exhibits the ancestral type—that of the progenitor of both species. If *M. badius* belonged to some other group—*Sturnella* or *Pseudoleistes*, for instance—it would scarcely be possible to doubt that the resemblance of the young *M. rufoaxillaris* to its foster brothers resulted from mimicry; but as both species belong to the limited, well-defined group *Molothrus*, the resemblance may be ascribed to community of descent.

Formerly I believed that, though *M. badius* is constantly seen rearing its own young, they also occasionally dropped their eggs in the nests of other birds. I could not doubt that this was the case after having witnessed a couple of their young following a Yellowbreast and being fed by it. I must now alter my opinion, for what then appeared to be proof positive is now no proof at all, for those two birds were probably the young of *M. rufoaxillaris*. There are, however, good reasons for believing that *M. rufoaxillaris* is parasitical almost exclusively on *M. badius*. I have spoken of the many varieties of eggs *M. bonariensis* lays. Those of *M. badius* are a trifle less in size, in form elliptical, densely and uniformly marked with small spots and blotches of dark reddish color, varying to dusky brown; the ground color is white, but sometimes, though rarely, pale blue. It is not possible to confound the eggs of the two species. Now, ever since I saw, many years ago, the Yellow breast feeding the supposed young Bay-wings, I have looked out for the eggs of the latter in other birds' nests. I have found hundreds of nests containing eggs of *M. bonariensis*, but never one with an egg of *M. badius*, and, I may now add, never one with an egg of *M. rufoaxillaris*. It is wonderful that *M. rufoaxillaris* should lay only in the nests of *M. badius*, but the most mysterious thing is that *M. bonariensis*, indiscriminately parasitical on a host of species, never, to my knowledge, drops an egg in the nest of *M. badius*, unless it be in a forsaken nest. Perhaps it will be difficult for naturalists to believe this, for if the *M. badius* is so excessively vigilant and jealous of other birds approaching its nest as to succeed in keeping out the subtle, silent, gray-plumaged, omnipresent female *M. bonariensis*, why does it not also keep off the far rarer, noisy, bustling, conspicuously colored *M. rufoaxillaris?* I cannot say. The only explanation that has occurred to me is that *M. badius* is sagacious enough to distinguish the eggs of the common parasite, and throws them out of its nest. But this is scarcely probable, for I have hunted in vain under the trees for the ejected eggs, and I have never found the eggs of *M. badius* with holes pecked in the shells, which would have been the case had *M. bonariensis* intruded into the nest.

With the results just recorded I felt more than satisfied, though so much still remained to be known, and I looked forward to the next summer to work out the rich mine on which I had stumbled by chance. Unhappily, when spring came around again ill health kept me a prisoner in the city, and finding no improvement in my condition, I eventually left Buenos Ayres at the close of the warm season to try whether change of climate would benefit me. Before leaving, however, I spent a few days at home and saw enough then to satisfy me that my conclusions were correct. Most of the birds had finished breeding, but while examining some nests of *Anumbius* I found one which Bay-wings had tenanted, and which for some reason they had forsaken, leaving 10 unincubated eggs. They were all like Bay-wings' eggs, but I have no doubt that 5 of them were eggs of *M. rufoaxillaris.* During my rides in the neighborhood I also found two flocks of Bay-wings, each composed of several families, and among the young birds I noticed several individuals beginning to assume the purple plumage, like those of the previous autumn. I did not think it necessary to shoot more specimens.

The question why *M. badius* permits *M. rufoaxillaris* to use its nest, while excluding the allied parasite, *M. bonariensis*, must be answered by future observers; but before passing from this very interesting group (*Molothrus*), I wish to make some general remarks on their habits and their anomalous relations to other species.

It is with a considerable degree of repugnance that we regard the parasitical instincts in birds. The reason it excites such a feeling is manifestly because it presents itself to the mind as—to use the words of a naturalist of the last century, who was also a theologian, and believed the Cuckoo had been created with such a habit—"a monstrous outrage on the maternal affection, one of the first great dictates of nature." An *outrage*, since each creature has been endowed with this all-powerful affection for the preservation of its own, and not another, species; and here we see it, by a subtle process, an unconscious iniquity, turned from its purpose, perverted and made subservient to the very opposing agency against which it was intended as a safeguard. The formation of such an instinct seems, indeed, like an unforseen contingency in the system of nature, a malady strengthened, if not induced, by the very laws established for the preservation of health, and which the *vis medicatrix* of nature is incapable of eliminating. Again, the egg of a parasitical species is generally so much larger, differing also in coloration from the eggs it is placed with, while there is such an unvarying dissimilarity between the young bird and its living or murdered foster brothers, that, unreasoning as we know instinct, and especially the maternal instinct, is, we are shocked at so glaring and flagrant an instance of its blind stupidity.

In the competition for place, the struggle for its existence, said with reason to be most deadly between such species as are most nearly allied, the operations are imperceptible, and the changes are so gradual that the diminution and final disappearance of one species is never attributed to a corresponding increase in another more favored species over the same region. It is not as if the regnant species had invaded and seized on the province of another, but appears rather as if they had quietly entered on the possession of an inheritance that was theirs by right. Mighty as are the results worked out by such a process, it is only by a somewhat strained metaphor that it can be called a *struggle*. But even when the war is open and declared, as between a raptorial species and its victims, the former is manifestly driven by necessity. And in this case the species preyed on are endowed with peculiar sagacity to escape its persecutions, so that the war is not one of extermination, but, as in a border war, the invader is satisfied with carrying off the weak and unwary stragglers. Thus the open, declared enmity is in reality beneficial to a species, for it is sure to cut off all such individuals as might cause its degeneration. But we can conceive no necessity for such a fatal instinct as that of the Cuckoo and Cowbird destructive to such myriads of lives in their beginning. And inasmuch as their preservation is inimical to the species on which they are parasitical, there must also here be a struggle. But what kind of a struggle? Not as in other species, where one perishes in the combat that gives greater strength to the victor, but an anomalous struggle in which one of the combatants has made his adversary turn his weapons against himself, and so seems to have an infinite advantage. It is impossible for him to suffer defeat; and yet, to follow out the metaphor, he has so wormed about and interlaced himself with his opponent that as soon as he succeeds in overcoming him he also must inevitably perish. Such a result is, perhaps, impossible, as there are so many causes operating to check the undue increase of any one species; consequently the struggle, unequal as it appears, must continue forever. Thus, in whatever way we view the parasitical habit, it appears cruel, treacherous, and vicious in the highest degree. But should we attempt to mentally create a perfect parasitical instinct (that is, one that would be thoroughly efficient with the least possible prejudice to or injustice toward another species—for the preservation of the species on which the parasite is dependent is necessary to its own) by combining in imagination all known parasitical habits, eliminating every offensive quality or circumstance, and attributing such others in their place as we should think fit, our conception would probably still fall short in simplicity, beauty, and completeness of the actual instinct of *M. rufoaxillaris*. Instead of laying its eggs promiscuously in every receptacle that offers, it selects the nest of a single species; so that its selective instinct is related to the adaptive resemblance in its eggs and young to those of the species on which it is parasitical. Such an adaptive resemblance could not, of course, exist if it laid its eggs in the nests of more than one species, and it is certainly a circumstance eminently favorable to preservation. Then, there not being any such incongruity and unfitness as we find in nests into which other parasites intrude, there is no reason here to regard the foster parents' affection as blind and stupid, the similarity being close enough to baffle the keenest sagacity. Nor can the instinct here appear in the light of an outrage on the maternal affection, for the young *M. rufoaxillaris* possesses no advantage over its foster brothers. It is not endowed with greater strength and voracity to monopolize the attentions of the foster parent or to eject the real offspring; but being in every particular precisely like them, it has only an equal chance of being preserved. To this wonderful parasitical instinct we may well apply Darwin's words, when speaking of the architecture of the hive bee, "Beyond this stage of perfection natural selection could not lead."

MOLOTHRUS BADIUS, Vieill. Bay-winged Cowbird.

Molothrus badius, BURM., *La-Plata Reise*, II, p. 495 (Parana and Tucuman). SCL. et SALV., *Nomencl.*, p. 37; HUDSON, *P. Z. S.*, 1874, p. 163 (Buenos Ayres); DURNFORD, *Ibis*, 1877, p. 174 (Buenos Ayres); SCL., *Cat. B.*, XI., p. 338.

Description.—Dull gray, beneath rather paler; wings chestnut; tips of primaries, inner portions of secondaries, and tail blackish; bill and feet black; total length, 7.5 inches; wing, 3.5; tail, 3. Female similar.

Habitat.—Argentina, Paraguay, and Bolivia.

In this species the sexes are alike; the plumage of the body is gray-drab color, with a black spot between the eye and beak; tail dark, the quills cinnamon color; beak and legs black. Azara, describing it under the name of *Tordo pardo roxiso*, says it is a rare bird, so that it has probably increased since his time, as it is now quite common in the Plata district.

The Bay-wings usually go in small flocks, numbering from 10 to 30 individuals, and are not migratory, but in winter they travel about a great deal from place to place without extending their journeys more than a few miles in any direction. They are fond of coming about houses, and are frequently seen pecking at the fresh meat hanging out of doors; and, like other birds of the same tribe, feed chiefly on the ground. They spend a great portion of their time on trees, are familiar with man, and inactive, and in their motions singularly slow and deliberate. Their language is varied. Curiosity or alarm is expressed by trilling notes, and before quitting a tree all the birds of a flock ceremoniously invite each other to fly with long clear notes, powerful enough to be heard a quarter of a mile away.

They also sing a great deal in all seasons, the song being composed of soft, clear, rather sweet notes, variously modulated, uttered in a leisurely manner, and seeming to express a composed frame of mind, all the birds in a flock singing in concert. During the cold season the flock always finds some sheltered sunny spot on the north side of a wood pile or hedge, where they spend several hours every day, sitting still and singing in their usual quiet, soft style.

Their extreme sociability affects their breeding habits, for sometimes the flock does not break up in spring, and several females lay in one nest together; but whether the birds are paired or practice a promiscuous intercourse, I have not been able to discover. They have a great partiality for the large domed nests made by the *Anumbius acuticaudatus*, called *Leñatero* in the vernacular. One summer a flock of about 10 Bay-wings took possession of a *Leñatero's* nest on one of my trees, and after a few days I took 14 eggs from it. Though the birds hopped, chirping around me, manifesting great solicitude, the eggs were quite cold, and had I left them many more would have been laid no doubt; but as they were piled up 3 or 4 deep in the nest they could never have been hatched.

As a rule, however, the flock breaks up into pairs, and then a neat, well-made nest is built in the fork of a branch, lined with horsehair; or, oftener still, a *Leñatero's* nest is seized, the Bay-wings fighting with great spirit to get possession, and in it, or on it, their own nest is made. Like their relations, the common Cowbird, they seem strongly attracted by domed nests, and yet shrink from laying in the dark interior. As a rule, when they have captured a *Leñatero's* nest they break a hole in the side and so admit the light and form an easy entrance One summer a pair of Bay-wings attacked a *Leñatero's* nest on one of my trees, the fighting was kept up for three or four days, and then at the foot of the tree I found 5 young *Leñateros*, fully fledged, which had been pecked to death and thrown out of the nest.

The eggs of the Bay-wing are 5 in number, nearly round, and densely marked with dusky reddish brown.

Once I observed 2 young Bay-wings following a Yellow-breast, *Pseudoleistes virescens*, with their usual peculiar hungry cry, and while I watched them they were fed several times by their foster parents Naturally I concluded that the Bay-winged Cowbird is sometimes parasitical on other species, but I never saw anything afterward to confirm me in that belief, and I believe now that I was mistaken, and that the young Bay-wings were not real Bay-wings, but the young of *Molothrus rufoaxillaris*.

PRIMITIVE AMERICAN ARMOR.

BY

WALTER HOUGH, PH. D.
Department of Ethnology, U. S. National Museum.

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"Cornelius Tacitus doth pleasantly quip and jest at the men of war of our ancient Gaules, so armed, only to maintaine themselves, as they that have no means either to be offended or to raise themselves being overthrowne." Montaigne, Of The Parthian Armes.

In the U. S. National Museum there are many examples of primitive American armor. These defensive weapons may be classed as parrying armor, or the shield, and body armor, for the defense of the head, trunk, legs, and arms. The subject will be treated under form, material, structure, decoration, function, mythology, and distribution.

I. Shield.

The shield is the first defensive weapon both in point of time and of usefulness. While the shield on first thought may seem merely intended as a covering for the vulnerable points of the body, its importance is far greater in parrying. Therefore, with this idea in view, the shield may be as simple as the plain parrying stick of the Australians, which begins the classic series of Lane Fox.

If one bears in mind that defensive weapons are the concomitants of offensive weapons, the development of the shield becomes clear. Thus, where missile weapons are used, the parrying stick is a natural and adequate defense. Where missiles are given greater velocity with the throwing strap, the throwing stick, or the bow, the shield must cover the body better. It would seem that the broad shield is the countergrowth of the bow.

The circular shield characterizes the Western Hemisphere. The North American shield is convex and from 12 to 26 inches in diameter. The Mexican area is perhaps an exception, though the Codices almost invariably depict the round shield, and the surviving Mexican shields, on which Mrs. Zelia Nuttall is authority, are circular.* The Nahua shield was "sometimes rounded and sometimes oval, sometimes rounded on the lower side." Some shields were of an ordinary size; others were intended to cover the entire body and were constructed so that when not in use they could be folded up and carried under the arm.† Lafitau conveys the idea that the Iroquois had shields of different shapes.‡

As to material, nearly all American shields are made of thick rawhide, that of the buffalo and elk being most available. Shields worked

*Nuttall, Zelia, on Ancient Mexican Shields. Internat. Archiv. fur Ethnologie, Leiden, Vol. v, pt. i, 1892, pp. 34–53.

† Bancroft, H. H., Native Races of the Pacific, Vol. ii, p. 407.

‡ Lafitau, Mœurs des Sauvages Amériquains, Vol. ii, p. 197, Paris, 1724.

out from a single piece of wood, like those of the Dyaks are found on the Rio Marañon in South America (fig. 1).*

The Virginia Indians used "targets made of barcks."† The Navajoes made a shield of cedar rods twined together with cord (Cat. No. 8401, U.S.N.M.), which may be connected with the rod armor of the Athapascans and the similar cane shields of the Nahuas of Mexico.

Among the Ceris and Chicoratos of New Mexico, "Another kind of shield was made of small laths closely interwoven with cords, in such a manner that, when not required for use, it could be shut up like a fan, and was carried under the arm." ‡

"In Tobasco and along the coast, tortoise shells inlaid with gold,

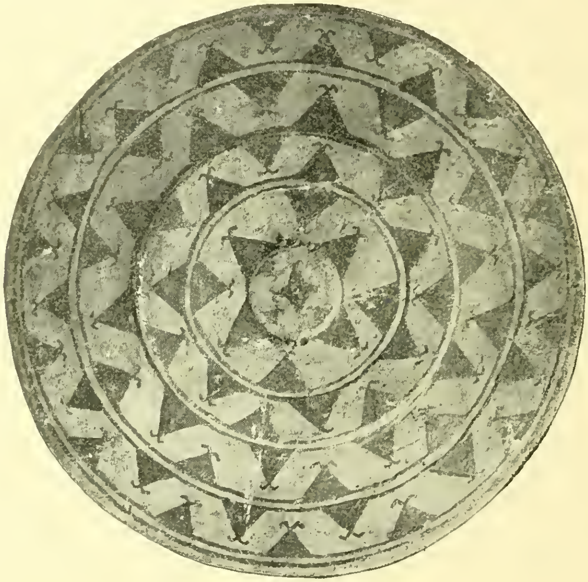

Fig. 1.

WOODEN SHIELD.

Cat. No. 75881 U. S. N. M. Peru. Gift of the Trocadero Museum, Paris

silver, or copper were commonly used as shields,"§ as the Malay specimen from Singapore. Reeds, grass, hides, or 'nequen-cloth coated with India rubber served to protect an Aztec common soldier.|| The Pueblo tribes "carried round shields of basketry, of heavily and closely netted cotton, or of thick rawhide, symbolically painted."¶

* *Wooden shield.*—Flat disk of light wood, thicker in the center, forming a step. Two bent wood handles wrapped with bark are sprung into holes in the rear of the shield. Decorated with triangular figures in red and yellow, resembling tents. Diameter, 33 inches. (Cat. No. 75881, U. S. N. M. Indians of the Upper Amazon (Rio Marañon) Peru. Gift of the Trocadero Museum, Paris).

† Hariot, Thomas, Virginia, p. 24.

‡ Bancroft, *op. cit.*, Vol. I, p. 579.

§ Bancroft, H. H., *op. cit.*, Vol. II, p. 407.

|| Bancroft, *loc. cit.*

¶ Cushing, F. H., article "Pueblos," in Johnson's Cyclopedia, from advanced sheets in new edition, now in press.

The construction of the North American shield is given in detail by George Catlin. The ingenious process of contracting and hardening the hide by fire was common.

Sioux shield made of the skin of the buffalo's neck, hardened with glue extracted from the hoofs and joints of the same animal. The process of "smoking the shield" is a very curious as well as important one, in their estimation. For this purpose a young man about to construct for him a shield digs a hole of 2 feet in depth in the ground, and as large in diameter as he designs to make his shield. In this he builds a fire, and over it, a few inches higher than the ground, he stretches the rawhide horizontally over the fire, with little pegs driven through holes made near the edges of the skin. The skin is at first twice as large as the size of the required shield; but having got his particular and best friends (who are invited on this occasion) into a ring to dance and sing about it and solicit the Great Spirit to instill into it the power to protect him harmless against his enemies, he spreads over it the glue which is rubbed and dried in, as the skin is heated; and a second busily drives other and other pegs, inside of those in the ground, as they are gradually giving away and being pulled up by the contraction of the skin. By this curious process, which is most dexterously done, the skin is kept tight whilst it contracts to one-half of its size, taking up the glue and increasing in thickness until it is rendered as thick and hard as required (and his friends have pleaded long enough to make it arrow, and almost ball, proof), when the dance ceases and the fire is put out. When it is cooled and cut into the shape that he desires, it is often painted with his medicine or totem upon it, the figure of an eagle, an owl, a buffalo, or other animal, as the case may be, which he trusts will guard and protect him from harm. It is then fringed with eagles' quills or other ornaments he

Fig 2.

ARAPAHOE SHIELD.

Cat. No. 129871, U. S. N. M. Dakota. Collected by H. M. Creel.

may have chosen and slung with a broad leather strap that crosses his breast. These shields are carried by all the warriors in these regions, for their protection in battles, which are almost invariably fought from their horses' backs.*

The shield was invariably held on the left arm,† usually by a simple thong of buckskin attached to the interior. Wooden handles, believed to have belonged to Pima Indian shields, were found in a cave with war clubs on Superstition Mountain in Arizona, by Dr. E. Palmer. (Cat. No. 76028, U. S. N. M.)

It is the custom of most tribes to put one or more covers of dressed buckskin over the shield, the covers being decorated.‡ (See. pl. I and fig. 2.)

The decoration of the North American shield forms one of the most fruitful sources for the religious beliefs and practices of the Indians.§

The decoration was inspired by a revelation through a dream, following among the Crows the terrible initiation ceremony and among all tribes following an ordeal. The protection of the shield has largely become fetichistic and in many cases the survival of this ancient means of defense has been brought about by its cult relations.

The warrior fraternities of the Moki and Zuñi tribes have an elaborate ceremonial of the shield.‖ In the Moki ceremony, held at the

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* Catlin, George, North American Indians, 7th ed. Lond., 1848. Vol. I, p. 241.

† See the paper by Mr. Cushing on Manual Concepts., American Anthropologist, V, 1892, p. 290.

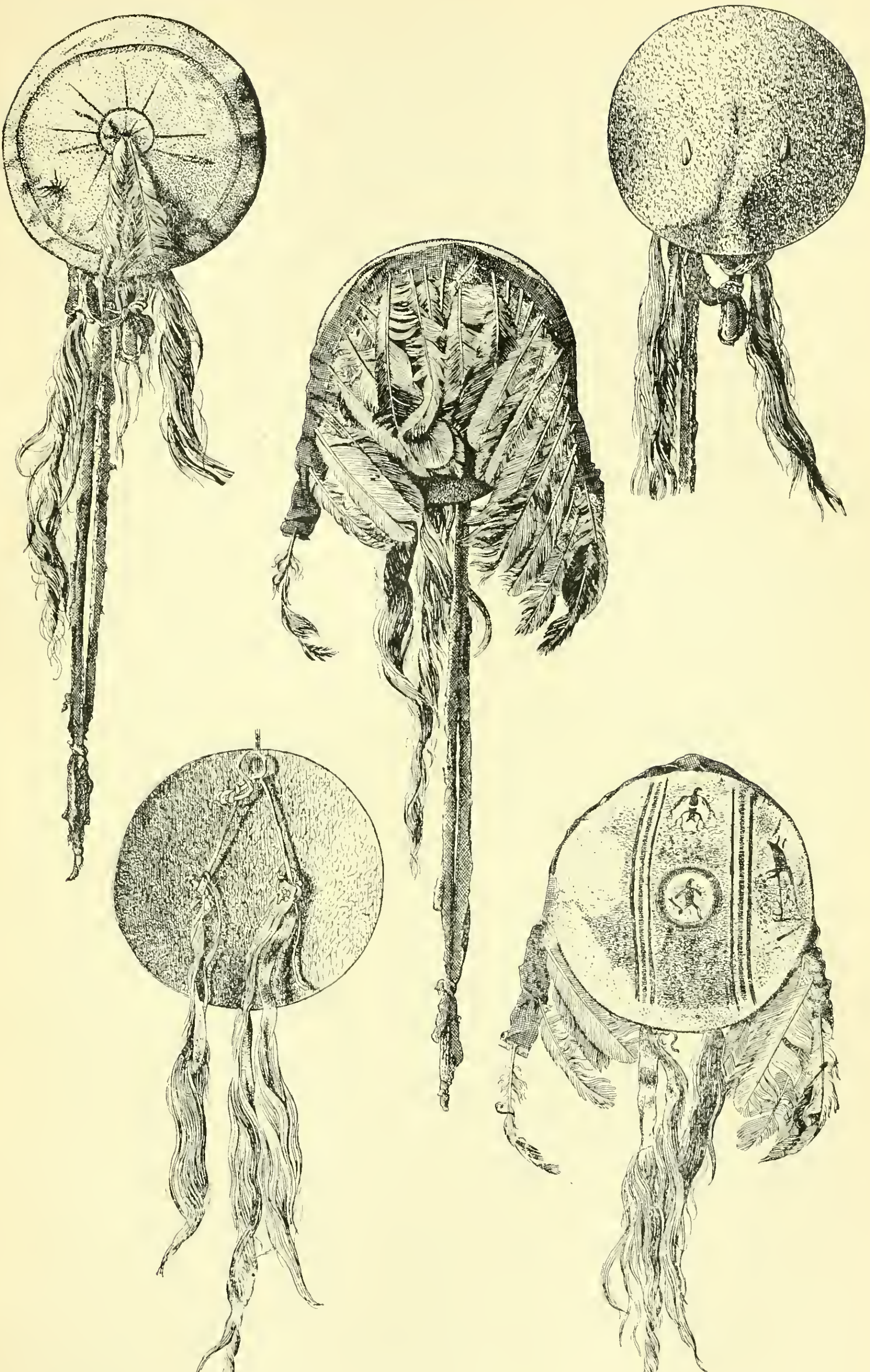
‡ DESCRIPTION OF FIGURE 2 AND PLATE I.

Fig. 2, shield.—Made of rawhide with cover of muslin symbolically painted in green, yellow, red, and black. The background above is yellow and below green. The figures are on the yellow portion and represents two dragon flies, the sun and moon, an owl, and a circle in red outlined with green. Two eagle claws are fastened at opposite sides. A bunch of eagle feathers is fastened at the upper edge, and from it depends a flannel band with rows of large eagle feathers having horsehair cemented to their ends. The thongs for holding have disappeared; there remains a thong for suspension. Diameter 18 inches (Cat. No. 129871, U. S. N. M. Arapahoe Indians, Dakota. Collected by H. M. Creel.)

Plate I, shield with 2 covers.—The shield proper is of hardened buffalo hide of convex form, plain in front with four perforations through which the thong forming the handle is passed, (lower figure). To the triangular handle are attached long cow tails, (figure to right). The inner cover is of buckskin, gaudily decorated, and edged with a band of flannel bordered with eagle feathers and having a woven band hanging down, (figure to left; back view of same, upper figure to the right). The outer cover, which is to protect the inner cover and the feathers are also painted and whitened with pipeclay. Four charms are attached to it, viz, a curl of cow's tail, an eagle feather, and two tufts of shredded cloth with a bit of brass chain. The covers are gashed around the edge and supplied with a gathering string for securing the cover tightly over the shield. The complete shield is shown in the upper figure to the left. A third painted cover for this shield has been discovered. Diameter of shield proper, 15½ inches; of shield with covers, 17½ inches. (Cat. No. 8443, U. S. N. M. Comanche Indians, Fort Griffin, Texas. Collected by Dr. H. McElderry, U. S. A.)

§ Mr. James Mooney is preparing a paper upon this branch of the subject. Mrs. Nuttall has treated on this aspect of the Mexican shield; *loc. cit.*, ante, p. 1.

‖ *See* Zuñi Fetiches, Cushing, 2d An. Rept. Bu. Ethnol., Pls. X, XI, p. 40.



RAWHIDE SHIELD WITH COVERS.

Cat. No. 8443, U. S. N. M.

winter solstice by the warrior societies, the sun is represented by a shield, and attack and defense is graphically dramatized. The shields of the sun warrior fraternities are decorated with the totems of the individual societies. A description of this ceremony will soon be published by Dr. J. Walter Fewkes.

The various feathers, hoofs and horns, and skins of animals, etc., hung to shields, are also personal fetiches.

The distribution of the shield shows that most of the American tribes possessed the shield, and a majority appear to have had no other weapon of defense. There is strong presumption, however, that the use of body and shield armor was widespread in America, as historical notices show.

Charlevoix, writing of the Iroquois, observes that while the western tribes use bucklers of buffalo hide, "it is pretty surprising that other Indian nations never use them."* Lafitau and the earlier missionaries, however, credit the Iroquoian people with the shield in the following words:

> Their shields were of ozier or bark covered with one or many *peaux passées;* there are some made of very thick skin. They had them of all sizes and all sorts of figures.†

Some South American tribes who use body armor are said to be unacquainted with the shield. Likewise the Eskimo seem to be destitute of this weapon.

There are probably fifty American shields in the National Museum, some collected as early as 1830. Several have been handed down from father to son for a period of sixty-five years.

These shields are from the tribes of the western portion of the continent and include the Crows, Sioux, Comanches, Kiowas, Navajoes, Utes, Apaches, Pimas, Zuñis, Mokis, etc.

II. Body Armor.

The aboriginal armor of North America was intended to protect the vital organs and to allow free movement of the limbs. The form assumes that of a sleeveless jacket, coat, or wide band going around the trunk, suspended from the shoulders. The selection of defensive materials and their adaptation to defensive covering for the body form an interesting study in native invention, while the evidence in North America of the migration of inventions awakens no less interest. Thus we find that at the period of the disuse of armor by the aborigines there were six types of body armor found on the North American Continent and contiguous regions, viz:

Plate armor.—Rows of overlapping plates, perforated and lashed. Eskimo and Chukchis.

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* Charlevoix, F. X. de, Journal of a Voyage to North America. Vol. I, p. 338. Lond., 1761.

† Lafitau, *loc. cit.*, II, p. 197.

Slat armor.—Wooden slats twined together. Sitkans, Shastas, Iroquois, Virginia Indians.

Rod armor.—Wooden rods twined together. Aleuts, Sitkans, Columbia River tribes, Klamaths, Hupas, Iroquois, Virginia Indians, etc.

Band armor.—Bands of skin arranged in telescoping fashion. Chukchis.

Skin armor.—Coats of hardened hide. Tlingits, Haidas, Hupas, Chinooks, Navajoes, Mohawks, Shoshones, Pawnees, Comanches, etc.

Cotton-padded armor.—Mexicans, Isthmians, and Peruvians.

Three well-defined areas, including the above-mentioned types of North American body armor, will be now considered, viz:

(1) *Bering Strait area*, the American shore of Bering Sea, and the islands as far north as Cape Prince of Wales, inhabited by the Eskimo, and the Asiatic side, inhabited by the Coast Chukchis. (Plate armor.)

(2) *Western area*, extending from Sitka through northern California and the central basin to Mexico. (Slat, rod, and skin armor.)

(3) *Eastern area*, extending from southeastern Canada to Virginia, inhabited by Algonkian and Iroquoian tribes. (Slat, or rod, and skin armor.)

The first two areas are known by actual specimens, while the third area is historical. In the interior of the continent, according to historical notices, several stocks used armor. There is, therefore, sufficient testimony to show that if not universal the use of armor was at least general among the North American tribes.

1. BERING STRAIT AREA.

The National Museum possesses a number of examples of Eskimo-Chukchis plate armor from Cape Prince of Wales, Diomede Island, St. Lawrence Island, Alaska, and Cape Wankarem, Siberia.

The most perfect specimens are from Cape Prince of Wales and Diomede Island. (See pls. 2 and 3.) *

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* DESCRIPTION OF PLATE 2.

Fig. 1, plate armor.—Made of three rows of walrus-ivory plates, averaging 1 inch in width and 6 inches in length. Each plate contains 6 holes, through which pass rawhide thongs, thus lashing the plates together. These plates are slightly imbricated, as are also the different rows, so as to ward off more effectually the weapons of the enemy. The lower row contains 43 plates, and the middle 38. The upper row consists of two sections; one containing 10 plates, protecting the breast, the other 8 plates, protecting the upper part of the back. A rawhide strap passes over the shoulders and supports the armor. This armor very closely resembles that of Japan. Length when spread out, 44 inches. (Cat. No. 153491, U.S.N.M. Eskimo of Cape Prince of Wales, Alaska. Collected by H. R. Thornton).

Fig. 2, plate armor.—Fragment consisting of 9 iron plates similar to those on Japanese armor, and bound with three lashings of rawhide. This speciman was

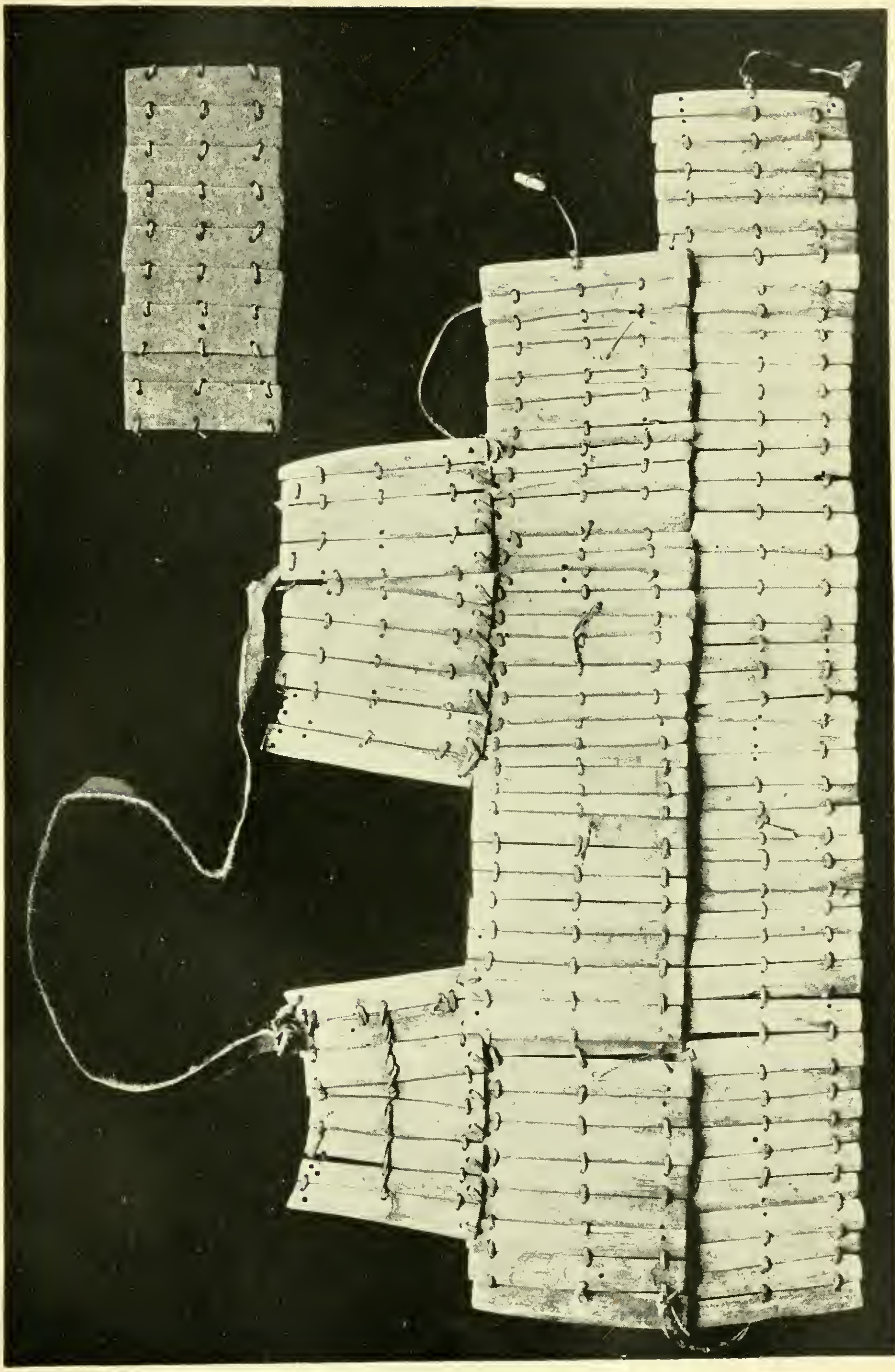

Fig. 1. Eskimo ivory plate armor.
Cat. No. 153491, U. S. N. M.

Fig. 2. Iron armor plates.
Cat. No. 153492, U. S. N. M.

ESKIMO PLATE ARMOR.

This type of armor consists of small, flat, oblong plates of ivory or bone pierced near the edges with from 4 to 6 or more holes. They are lashed in series with rawhide thongs passing through the holes, forming what is known as the "clove hitch." The longer edges of the plates are chamfered to admit of overlapping and curving the armor around the body; it could thus be rolled up in small compass when not in use.

The coat would be formed of from 3 to 5 imbricating rows of plates so constructed, having offsets under the armpits and straps for the shoulders. Sometimes a yoke of skin fitting the neck and shoulders formed a support for the rows of plates, as in specimens from St. Lawrence Island. The coat is fastened at the back, being tied with thongs or having a toggle and loop.

Iron armor plates were dug up in a marsh at Cape Prince of Wales (see pl. 3), and plates of iron and copper were found on St. Lawrence Island.

There is an interesting statement from Lisiansky, who wrote his voyages in 1805, that the Tlingits,on the introduction of iron and firearms, adopted a new form of protection, consisting of a buckskin strip around the neck with iron plates attached pendant down the breast.

Nordenskkjöld figures a suit of armor like that of the Eskimo from the Chukchis.* In the Museum there are 4 plates of fossil ivory from the Chukchis of Cape Wankarem.

The hoop or band armor mentioned as type 4 (pl. 4, fig. 2) is found only on the Siberian side of this area and, as well as the plate armor, recalls well-known forms in Japan. This hoop armor is interesting as showing the reproduction of plate armor types in skin, being made of horizontal bands of sealskin instead of rows of ivory plates, the rings telescoping together when the armor is not in use. This type may be compared with the banded mail of the Middle Ages, about which there

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dug up in a bog near where the ivory armor on this plate was found. Length of each plate, 4⅝ inches; width, 1½ inches. (Cat. No. 153492, U.S.N.M. Eskimo of Cape Prince of Wales, Alaska. Collected by H. R. Thornton).

DESCRIPTION OF PLATE 3.

Plate armor.—Made of five imbricating rows of plates of walrus ivory of unequal size in the different rows, pierced with from 6 to 13 holes, lashed with sealskin thongs. The vertical edges of the plates are chamfered. The upper row has 40, 3 by 1¼ inches; second row, 49 plates, 5 by 1 inch; third row, 28 plates, 3½ by 1⅝ inches; fourth row, 31 plates, 6 by 1½ inches; fifth row, 16 plates, 6 by 1¼ inches. Two pointed plates cut from a tusk are lashed to one side, forming a clasp. This armor was wrapped around the body after the manner of a cuirass and is said to have been an efficacious protection against arrows. In the form, lashing, and adjustment of the plates it is identical with certain types of Japanese armor. Width extended, 49 inches; height, 24 inches. (Cat. No. 64290, U.S.N.M. Eskimo of Diomede Island, Alaska. Collected by E. W. Nelson).

* Nordenskjöld, A. E., Voyage of the *Vega*, II, p. 478.

has been much discussion.* The upper portion of this war panoply (pl. 4,† fig. 1) is unique.

It serves as a shield and resembles the neck fender of the Kingsmill Island armor; designed, without doubt, to protect the warrior from attack in the rear, a common occurrence in all savage warfare.

The whole armor is very heavy and clumsy. The method of wearing the suit is shown in plate 5.‡ Captain Hooper says:

> Their war spears and those used in hunting bears are made of steel, with a handle about 6 feet long. The blade is kept very sharp and highly polished. These weapons are often beautifully inlaid with brass ornamented figures, and are purchased from the Russian traders at Gazhaga.§

The Chukchis of Plover Bay formerly wore a cuirass made of long strips of baleen, reaching from the neck to the middle of the thigh. The thickest baleen was not selected for making the armor. The strips were arranged vertically, *en echelon*, and tied through perforations on the edges. Over the joints were applied other strips of whalebone, as in a thatch fastened by thongs, passing through perforations at their edges and in the middle of the foundation strips. Owing to the material and construction this armor was somewhat elastic. When spread out it was in shape of a band with cuts below the armpits and having suspending straps going over the shoulders, resembling the Hupa armor. (See pl. 15.) The coat was tied at the back with cords, requiring the assistance of another person.

The Chukchis told my informant, Capt. E. P. Herendeen, that this

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* Hewitt, John, Ancient armor, p. 270; also hoop armor, *id.* p. 256.

† DESCRIPTION OF PLATE 4.

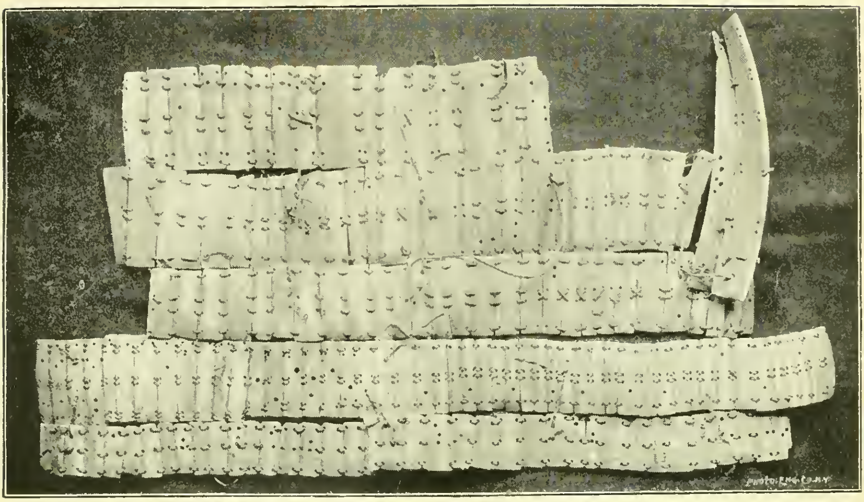
Fig. 1, armor.—Upper portion of 2437. Made of sea-lion skin stretched over plates of wood. Back, shield shaped, formed of 2 vertical pieces of three-eighth inch board lashed together with whalebone and covered with hide, which extends continuously over the wings, being a very large skin turned over and sewed on the upper edge. The wings consist of 4 wooden plates on one side and 5 on the other, growing shorter toward the front and terminating on the left side in a section without wooden lining. The plates are movable, the hide being creased at the joints and in the crease is laid a rounded thong which is held at intervals by loops of whalebone passing through the edges of the plates. On the back are two whalebone toggles for attachment to the lower portion. A more clumsy contrivance than this fender can scarcely be imagined. Width, 72 inches; height, 28 inches. (Cat. No. 2436, U.S.N.M. Chukchis, Eastern Siberia. Collected by Commodore John Rogers, U. S. N.

Fig. 2, hoop armor.—Made of seven bands of sea-lion skin, 5½ inches wide, doubled and whipped together at the edges. These bands are connected by heavy thongs and hang in an enlarging series, like an inverted telescope drinking cup, from a frame of whalebone covered with hide. The free ends of the bands overlap in front. A square breastplate of doubled hide protects the neck. This armor is the lower portion of No. 2436. Diameter, 36 inches; height, 20 inches. (Cat, No. 2437, U.S.N.M. Chukchis, Eastern Siberia. Collected by Commodore John Rogers, U. S. N.

‡ DESCRIPTION OF PLATE 5.

Chukchis warrior and family.—From an aquarelle made by W. Alexander in 1797, showing, after the interpretation of the artist, the method of wearing the armor figured in pl. 4.

§ Cruise of the *Corwin*, 1881, Washington, 1884, p. 31.



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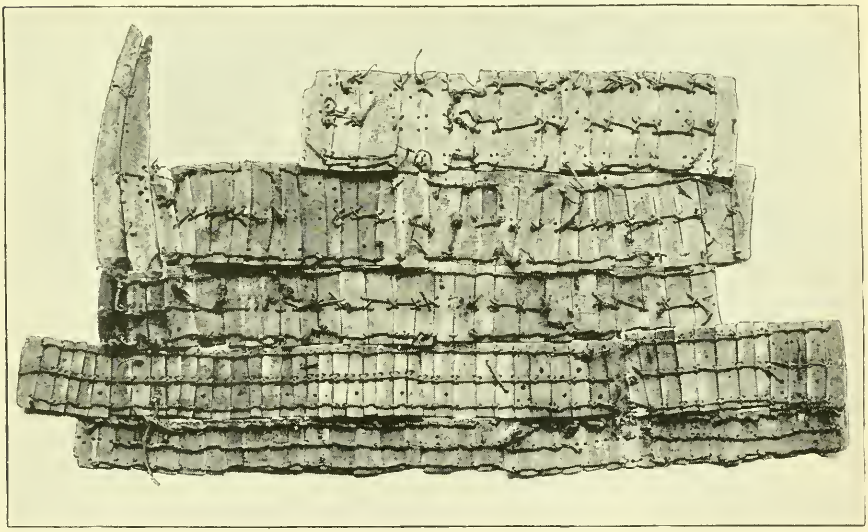
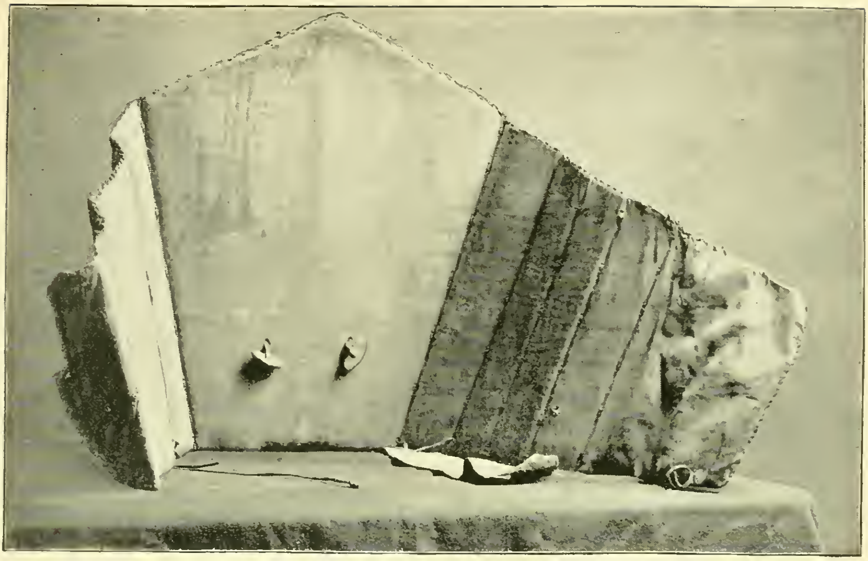


2

ESKIMO PLATE ARMOR.

Fig. 1. Front view.
Fig. 2. Back view.



1

2

CHUKCHIS HOOP ARMOR.

Fig. 1. Upper portion. Cat. No. 2436, U. S. N. M.
Fig. 2. Lower portion. Cat. No. 2437, U. S. N. M.

CHUKCHIS WEARING HOOP ARMOR. PLOVER BAY.

armor was used in going over to trade with the hostile Eskimo of St. Lawrence Island, which was dangerous and compelled sleepless caution. Capt. Herendeen also saw the band armor (pl. 4) among the Chukchis. Ivory was not observed by Capt. Herendeen, as that material is very scarce on the Asiatic side; but, no doubt, the materials for plate armor were procured by barter with Eskimo. In any event, fossil ivory plate armor was made by the Chukchis.

Driftwood is also very rare on the Siberian coast, while on the islands and American shore it is abundant. The quest for this indispensable material must have been a strong incentive for the Asiatic migrants to cross the straits.

As far as known the Chukchis did not use either helmets or shields.

Of interest in comparison with the Eskimo-Chukchis armor is that used by the Giliaks of Siberia. This is composed of plates of iron lashed together (fig. 3).*

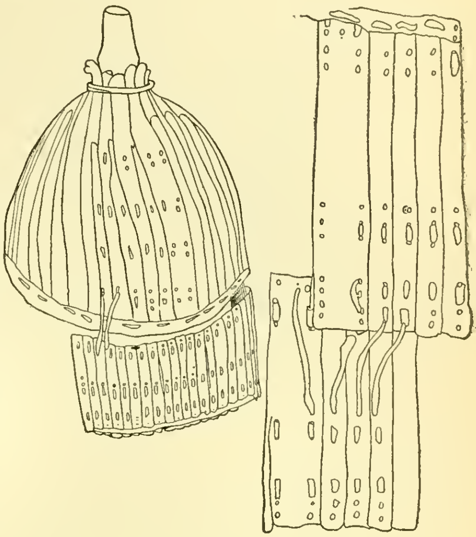


Fig. 3.

GILIAK HELMET AND BODY ARMOR. SIBERIA.

After Schrenck.

They also wear an ingeniously constructed conical helmet with a neck cover. The Giliak coat of plaited thongs, figured in the same work, does not occur in America, but has its counterpart in the cocoanut-fiber armor of the Polynesians and the plaited armor of the Malays.

The Kamtschadales have bows, arrows, spears, and a coat of mail made of mats or plaited thongs.†

The Kalmucks have coats of mail bought from their neighbors.‡ They use lances.

Descending the coast toward Japan, which seems to be the origin of the plate armor ranging from that country into the American continent, we notice that the Colletske make use of a leather coat covered with plates of iron about 6 inches long and a pot-shaped helmet of smaller plates having neck covers.

*Schrenck, L. V., Reisen und Forschungen im Amur-Lande, 1854–'56. St. Petersburg, 1891. Pl. XLIV.

Description of fig. 3.—Helmet and detail of armor of the Giliaks of the Amoor, Siberia. In the perforations and arrangement this armor resembles the armor of the Eskimo.

Drawing from *Reisen und Forschungen im Amur-Lande*, 1854–'56, by Dr. Leopold V. Schrenck. St. Petersburg, 1891.

† Grieve, Hist. of Kamtschatka, Gloucester, 1764, p. 202

‡ Pallas, 1, p. 143.

2. WESTERN AREA.

In the western area the slat type of wooden armor seems to be central among the Koluschans in the north, while the rod type runs southward and is central among the Tinné of British Columbia.

The slat armor has some resemblances to the Eskimo coat, and might be regarded as the working out of the plate-armor idea in a region where wood is abundant and twined weaving common.

The slat coat or coat of slats and rods combined is always made in two sections, one for the front and the other for the back, while the rod coat is in a single piece.

Plate 6* shows the front and back of the slat coat, and Plates 7 and 8* show the combined rod and slat armor. These specimens are very old. The woodwork shows great skill, especially the interlocking joinery at the edges. The hardest wood procurable was selected, and usually sinew cord was employed to join the slats. Plate 9,* taken from Niblack after Lisiansky, shows the parts and method of wearing the slat armor.

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* DESCRIPTIONS OF PLATES 6–9.

Plate 6, slat armor.—Made of 32 slats of cedar and other wood woven together by fine weaving of fine sinew and other cord. A band of weaving of 3 inches width is carried along the front at the top and the weaving is continued downward in two places, meeting a band crossing the bottom and forming a geometrical figure. The middle series of slats, 8 in number, extends below the other 4 inches, 3 of which are intact, while 2 on either side are united, forming a swallowtail and allowing the free bending of the thighs.

The front and back are distinct, joined by elk-skin cords at the sides. A section of short slats, 8 in number, is placed in front of the throat, and a similar row, 7 in number, protects the back of the neck. The armor is held in place by a broad band of elk skin over the right shoulder, and fastened on the left side by a loop and thong. A toggle on the left side of the collar in front was probably for suspension of the quiver. Height, 21½ inches; width, 20 inches. (Cat. No. 9243, U.S.N.M. Tlingit Indians, Sitka, Alaska. Collected by Dr. A. H. Hoff, U. S. A.)

Plates 7 and 8, slat armor (back and front).—Made of slats and rods of hard wood 1¼ to 1½ inches wide, five-sixteenths inch thick, woven together by means of fine sinew cord so as to admit of considerable flexibility. The rods and slats are pared down to form channels for the reception of the cord weaving. The front and back portions are woven separately, being connected by cords of leather on the left side and on the right side by a loop and toggle. The rods on the border of the rear of armor are neatly "toed in." The neck portions are made up of short slats and sewed on by means of a strip of rawhide 1½ inches wide. The shoulder supports are of very thick elk hide, the one on the right being fastened by a slash and toggle. Width of rear portion, 24 inches; height, 20 inches; width of front portion, 18 inches; height, 19 inches. (Cat. No. 74437, U. S. N. M. Tlingit Indians, Sitka, Alaska. Collected by J. J. McLean.)

Plate 9.—Wooden helmet secured to the head by straps fastened under the chin (figure in upper left corner); wooden mask or visor, side view, showing holes for eyes (middle figure); body armor (lower left-hand figure); mask or visor, showing buckle, which is held in the teeth to keep the visor in place (Cat. No. 74343, U.S.N.M.), Tlingit, (lower right-hand figure); sketch showing the method of wearing the armor; (upper right-hand corner).

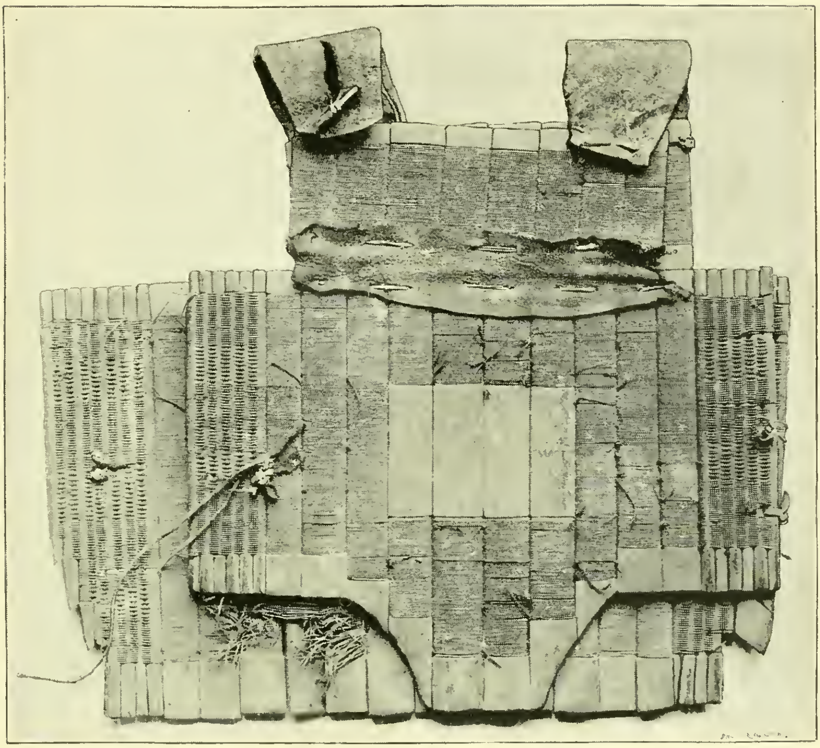
1

2

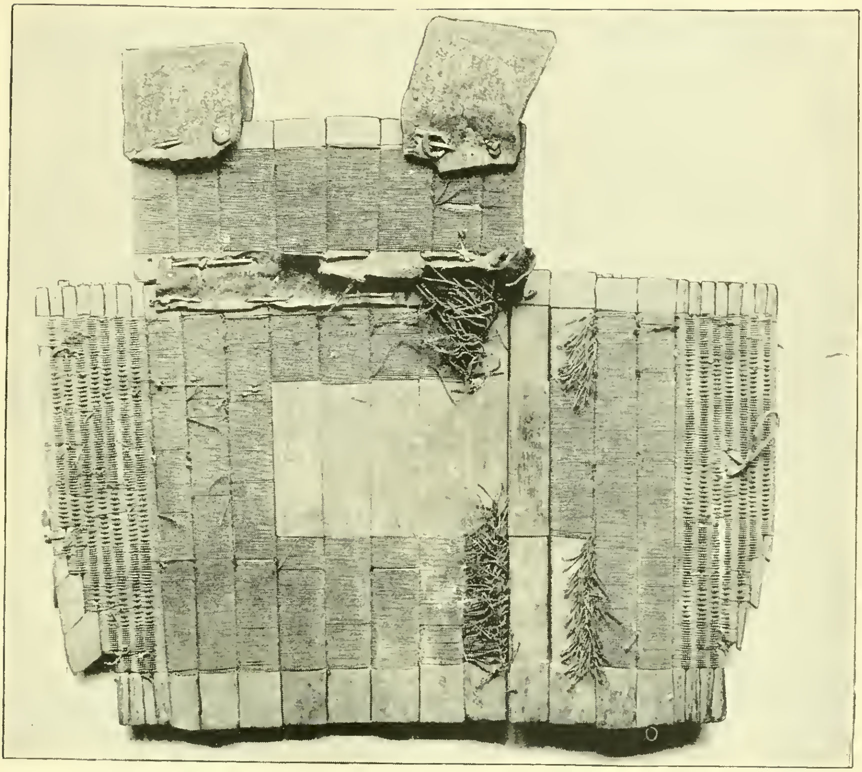
TLINGIT SLAT ARMOR.

Cat. No. 9243, U. S. N. M.

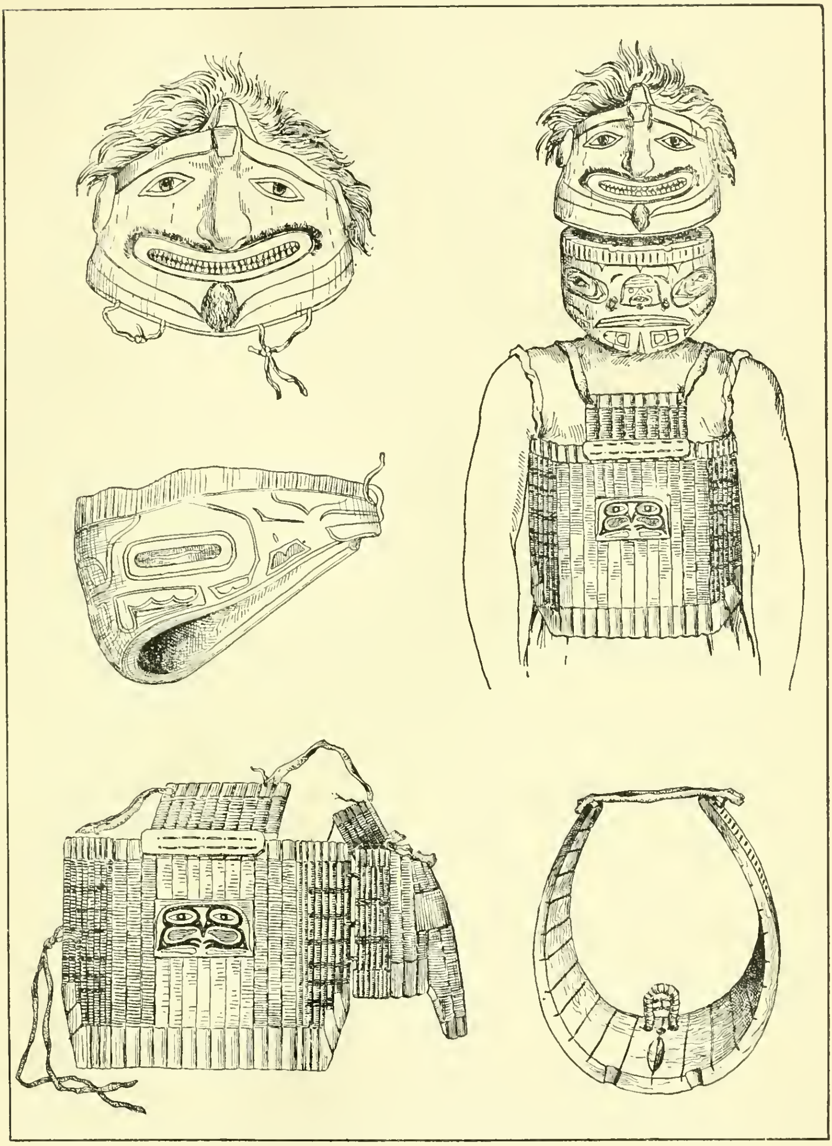
Fig. 1. Front view.
Fig. 2. Back view.



TLINGIT SLAT AND ROD ARMOR.
Cat. No. 74437, U. S. N. M.
Front view.



TLINGIT SLAT AND ROD ARMOR.
Cat. No. 74437, U. S. N. M.
Back view.



TLINGIT HELMETS AND SLAT ARMOR.

As representative of the northwestern coast culture the Tlingits and Haidas are most prominent. Captain Cook noticed that—

They incase almost the entire body in a wooden or leathern armor. They make a breast plate of wood and an arrow-proof coat of thin flexible strips bound with strings like a woman's stays. They wear helmets with curiously carved visors.*

A kind of jacket, or coat of mail, made of thin laths bound together with sinews which makes it quite flexible, though so close as not to admit an arrow or dart.†

It seems, therefore, necessary to treat the Northwest Coast as one culture area, where the arts of the ethnic units can scarcely be differentiated. A close study as marked out by Niblack and shown in the careful collections of Lieut. G. T. Emmons, U. S. Navy, may disentangle the borrowings of the stocks of this area.

There are 4 suits of this type in the Museo Arqueologico in Madrid. They were collected by the Malespina Expedition of 1791. The exact locality is not stated and an account of Malespina's exploration was not published, as far as I can learn.

If one may judge by the Spanish names which have remained on the map, such as Malespina Island, Cape Muzon, Cordova Bay, and others, the Malespina Expedition explored the north side of Dixon Entrance and came in contact with the Haidas as well as the Tlingits. Although there is some probability of these armors being Haidan, I incline to believe them to be Tlingit.

During the course of this study, one piece of armor of unknown function in the National collection was found to be a *greave*, or armor for the lower leg (pl. 10).‡ This unique piece discloses the hitherto unnoticed fact that the Northwest Coast warriors were more completely armed than had been imagined. This greave leads to the inference that a similar protection was extended to the upper legs and the arms. With heavy wooden helmet, the slat coat and armor for the limbs, we have a picture of an Alaskan warrior armed cap-a-pie. In no way was this armor inferior to that employed in ancient or feudal times or at a late period among the Japanese. The resemblance of the specimen in question to the Japanese greave is striking.

It is made up of 12 slightly tapering hard wood slats and 8 rods woven together with sinew cord. The portion not covered with weaving bears a totemic painting. When curved around the leg,

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* Bancroft, *op. cit.* 1, p. 105.

† Cook, Capt. James, Third Voyage, Vol. II, p. 372.

‡ *Description of Plate 10.*—Greave made up of 12 slightly tapering hard wood slats and 8 rods woven together with twisted sinew cord. The weaving is diversified in the central portion by carrying the threads in pairs alternately over the rods. The portion not covered with weaving bears a totemic painting. When the greave is curved around the calf of the leg, the hollowed out portions, which are also beveled, accommodate the instep and knee joint. Tied at the front with thongs. The holes along the upper edge are probably for attaching the greave to the armor for the upper leg. Length, 15 inches; width of upper edge, 17½ inches; width of lower edge, 16¼ inches. (Cat. No. 74438, U. S. N. M. Tlingit Indians, Alaska. Collected by J. J. McLean.

the hollowed-out portions accommodate the instep and knee joint. It was secured by thongs and probably with a band or garter. The holes along the upper edge are probably for attaching the greave to the cuissard.

Charlevoix, in speaking of the Iroquois, says:

They had even formerly a kind of mail for the arms and thighs made of the same material,* *i. e.*, small pliable sticks pretty well wrought.†

The resemblance between the culture of the west and east coasts of North America is striking in other instances.

Many of the figures in the Mexican codices and sculptures wear a covering around the calf of the leg, which may be the greave. In the sculptures from Yucatan this greave or legging seems to be of horizontal bands and square plates.

The rod type of armor of the western area is well represented by specimens in the National Museum. All the examples extant range from Sitka to northern California in a region comparatively lately explored.

The rod and slat types are mixed; in the method of twining together the elements they are identical. In some localities the broad band of rods is alone found, while among the Tlingits, or around Sitka, occur rod armor, slat armor, and a combination of both types in the same piece, as well as skin armor.

In form the Aleut armor, instead of following the Eskimo type, belongs with the rod type of the Indians. The perforation of the rods, however, and the method of lashing, show Eskimo handiwork. D'Orbigny says: "Les armes défensives consistaient en une cotte de joncs tressés qui leur couvrait tout le corps."‡

Dr. W. H. Dall, during his exploration of the caves of the Aleutian Islands, found the armor figured in pls. 11 and 12.§ "Under the

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* Charlevoix, F. X. de, Vol. I, p. 338, Lond., 1761.

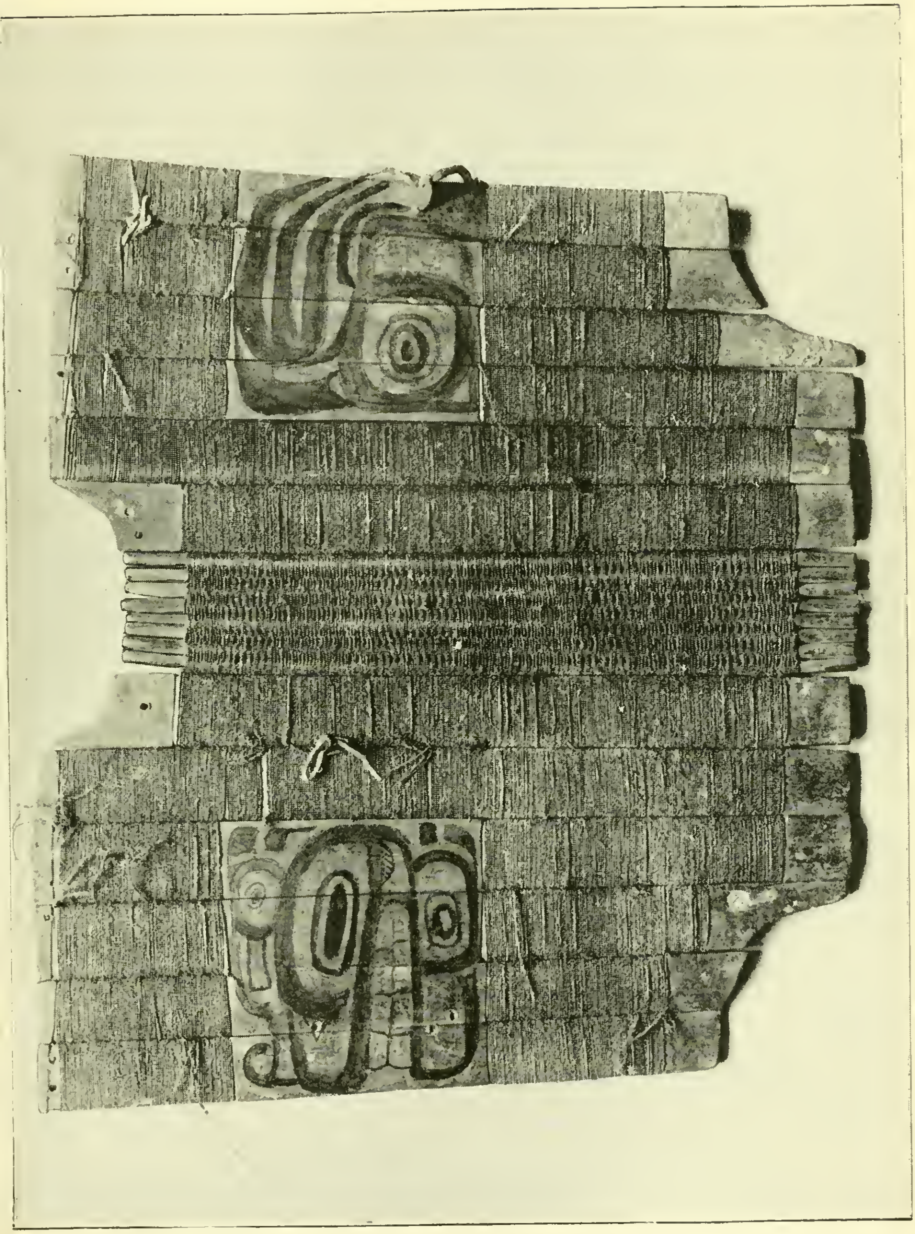
† *Id.*, Letters to the Duchess of Lesdiguières, p. 143, Lond., 1763.

‡ D'Orbigny, Voyages, p. 579.

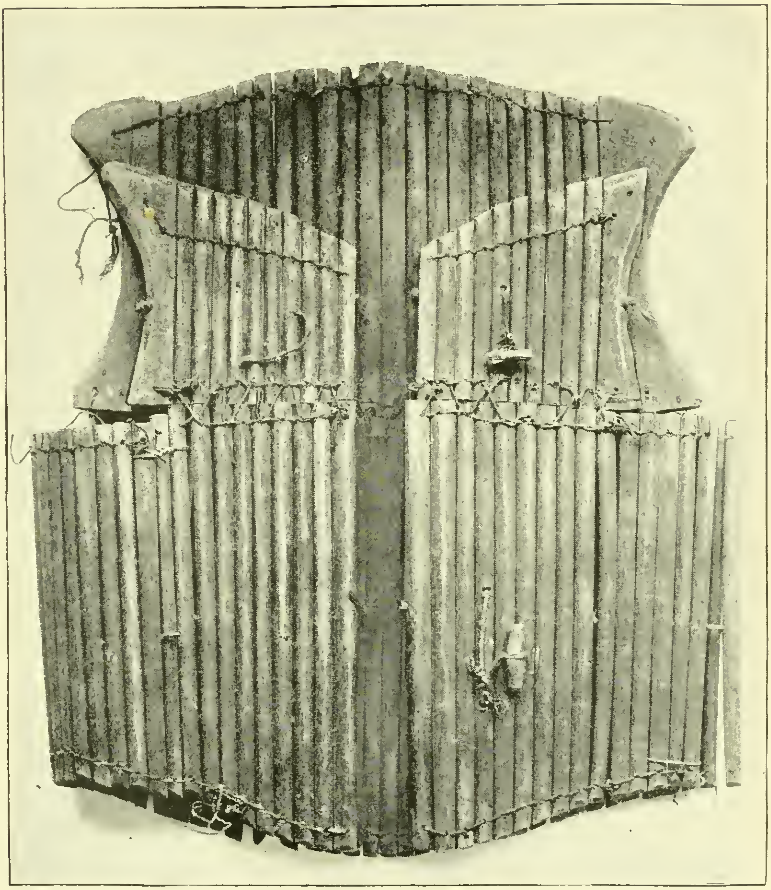
§ DESCRIPTION OF PLATES 11 AND 12.

Plate 11, rod armor.—Made up of two series of cedar rods, one-half inch in diameter and different lengths, painted red. The lower series containing 68 rods; the upper series, two side sections of 10 rods and a curved piece each, and a central section containing 22 rods with curved side pieces. The rods are perforated through either end and held in series by a sewing of finely plaited sinew cord, the cord being brought through the hole in the first rod, leaving two long ends. These are brought past each other from opposite sides through the hole in the next rod, and so forth. The sections are joined by a rickrack lashing, engaging with the horizontal sewing. The rods are perforated from side to side and a thin rod of whalebone drawn through, rendering the armor flexible. At the lower and upper edges of the armor the ends of the rods are chamfered. There are two wooden toggles on the right side.

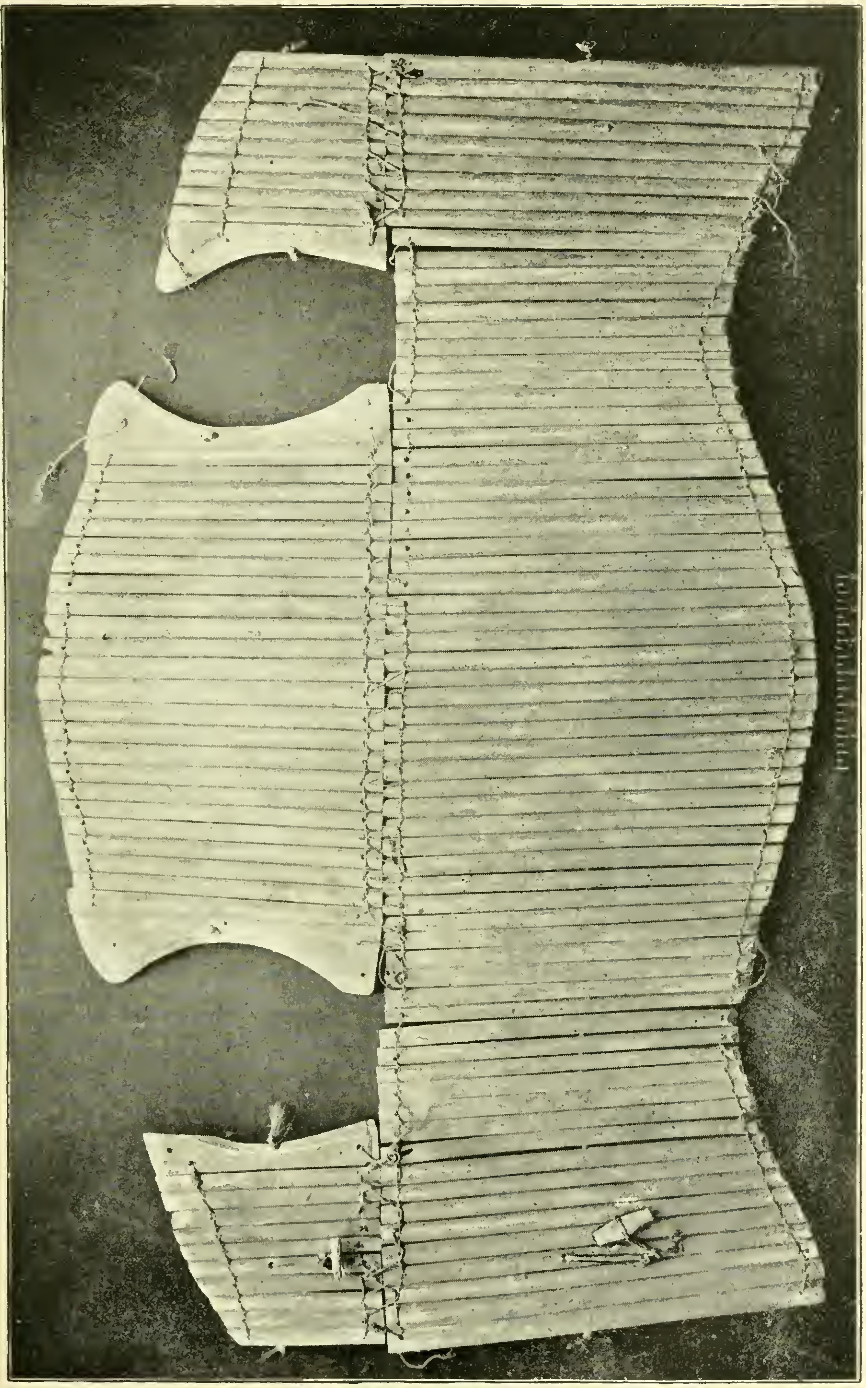
Plate 12, rod armor.—Same coat as shown in pl. 11, doubled together, showing the position upon the body in wearing the armor. This view shows also a portion of the inner side and the projecting ends of the whalebone binding strip which has been broken. Width, 40 inches; height, 25 inches. (Cat. No. 17249, U.S.N.M. From a burial cave in the Island of Amaknak. Collected by E. Hennig.)



TLINGIT SLAT GREAVE.
Cat. No. 74438, U. S. N. M.



PREHISTORIC ALEUTIAN ROD ARMOR.
Cat. No. 17249, U. S. N. M.



PREHISTORIC ALEUTIAN ROD ARMOR.

Cat. No. 17249, U. S. N. M.

Figured in Plate 11 so as to show position on the body.

net was inserted a piece of wooden body armor (17249) composed of small, round rods of proper size, united by sinew cords and with nicely carved wooden pieces about the armholes. This is the only piece of this aboriginal armor known to be in existence. It was fastened behind with two loops of sinew, into which wooden buttons were inserted. The small rods of which it is composed were about three-fourths of an inch in diameter, painted red.

"The armor, slight as it was, must have been a tolerably good protection against the bone and stone arrowheads of the natives."*

In the northern portion of this area, except in the Aleutian Islands,

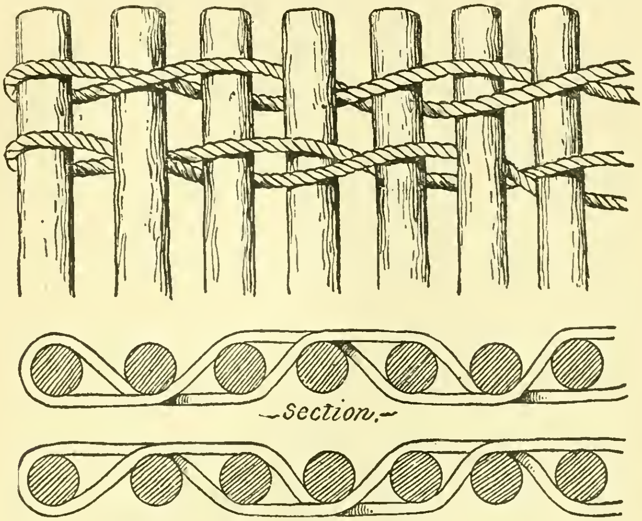


Fig. 4.

SHOWING DETAIL OF WEAVING ROD AND SLAT ARMOR OF THE NORTHWEST COAST.

the rod armor is an oblong band composed of peeled rods of uniform length and diameter held in series by bands of weaving (pl. 13).†

Lieut. Niblack says, in describing this armor, that—

The threads are sometimes single and sometimes in pairs, and are made to pass over and under the rods in pairs, but in such manner that the overlappings alternate from one row to the next. This is shown in detail in fig. 4, where 1*a* and

*Dall. W. H., Remains of Later Prehistoric Man in the Caves of the Aleutian Islands, p. 18, Smithsonian Contrib. to Knowledge, No. 318.

†DESCRIPTION OF PLATE 13.

Rod armor.—Composed of 72 peeled rods of uniform length and diameter, held in vertical series by alternate bands of weaving of woolen and sinew cord. The rods are bunched in the middle of the band. The ends of the rods are neatly hollowed out, forming cup cavities, and there are 4 equidistant vertical bands of red paint. This band was probably worn with a skin coat, both specimens having been secured from the same native. There appears to be no device to prevent the rod band slipping down. Width, 30 inches; height, 23½ inches. (Cat. No. 168158, U.S.N.M. Taku Indians, southeastern Alaska. Collected by Herbert G. Ogden.)

1*b* represent the part of one cord, and 2*a* and 2*b* represent those of another. The view represents the upper left-hand corner of the weaving and two upper threads, showing 7 rods in both plan and section. As stated, this method of running the cords or twine is varied by occasionally running them in pairs.*

Bands of rods of this character are intended to be worn under or over the skin armor, encircling the body below the armpits, and there are no shoulder straps to prevent the armor slipping down over the hips.

To the southward the rod band assumes a more effective form. It is cut out for the arms and has shoulder straps. Just where this form begins it is not possible to say with exactness, probably with the Tinné. The specimens are from the Shastas, Hupas, and Klamaths of Oregon and California (pls. 14 and 15).†

The following references may be of interest:

Western Tinné: "While on the warpath they also wore a kind of armor or cuirass consisting of dried sticks of the same kind of wood, *Amelanchier alnifolia*, arranged in parallel order and kept together with babiche lines interlaced in several places.‡

The Chinooks wear "a kind of vest, made of small round sticks of the size and shape of arrows 12 inches long; they are laid side by side, and then sewed together and fixed on the body like a waistcoat."§

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* The Indians of the Northwest Coast, Niblack, A. P. Report of Smithsonian Inst., Part II, 1888, p. 269.

† DESCRIPTION OF PLATES 14 AND 15.

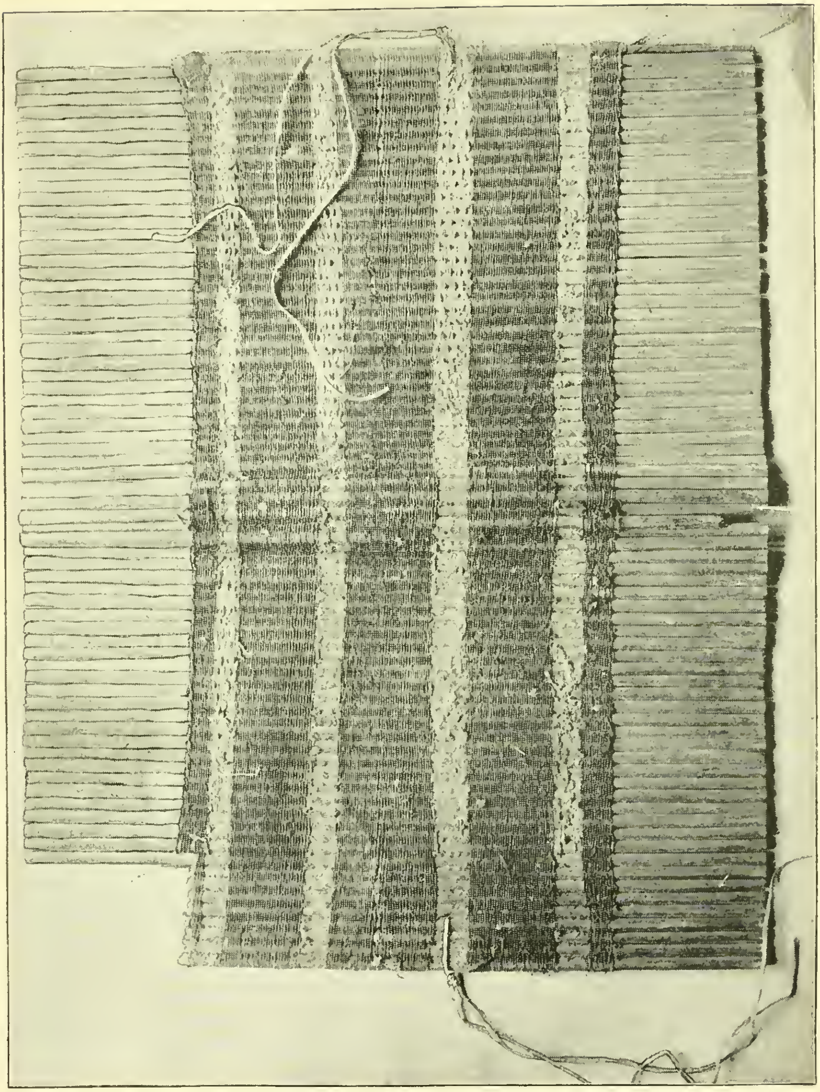
Plate 14, rod armor.—Made of 74 strips of wood formed by splitting branches, woven with native cord of wild hemp. The checkered portion in black is woven with cord made of human hair. Short rods are worked in below the armpits. All the rods are split at either end, the finishing cords drawn into the split to secure the weaving. In addition the armor is bound on the upper and lower edges with skin sewed with sinew. The shoulder straps are of otter (?) fur. The surface of the armor shows 4 horizontal bands of red paint. Width, 38 inches; height, 30 inches. (Cat. No. 2928, U. S. N. M. Shasta Indians, northern California and Oregon. Collected by Lieut. G. T. Emmons, U. S. N.)

Plate 15, fig. 1, rod armor (*Klnig-klicyst-e-cue-it-wul*).—Made of 118 peeled rods, woven together with native twine, bound with buckskin on upper and lower edges and armholes. Shoulder straps of leather; 6 horizontal stripes of red cord cross the front of the coat. "It is tied across the breast from left to right. The red lines denote the number of enemies slain or captives taken; also the rank of the wearer. This class of armor was in common use among the Natanos and Kennucks before the introduction of firearms, but it is now obsolete, nearly. This is the only complete suit that Lieut. Ray could obtain." (The Ray Collection, Smithson. Rept., 1886, 1, p. 230.) Width, 41 inches; height, 21 inches. (Cat. No. 126909, U. S. N. M. Huap Indians, California. Collected by Capt. P. H. Ray, U. S. A.)

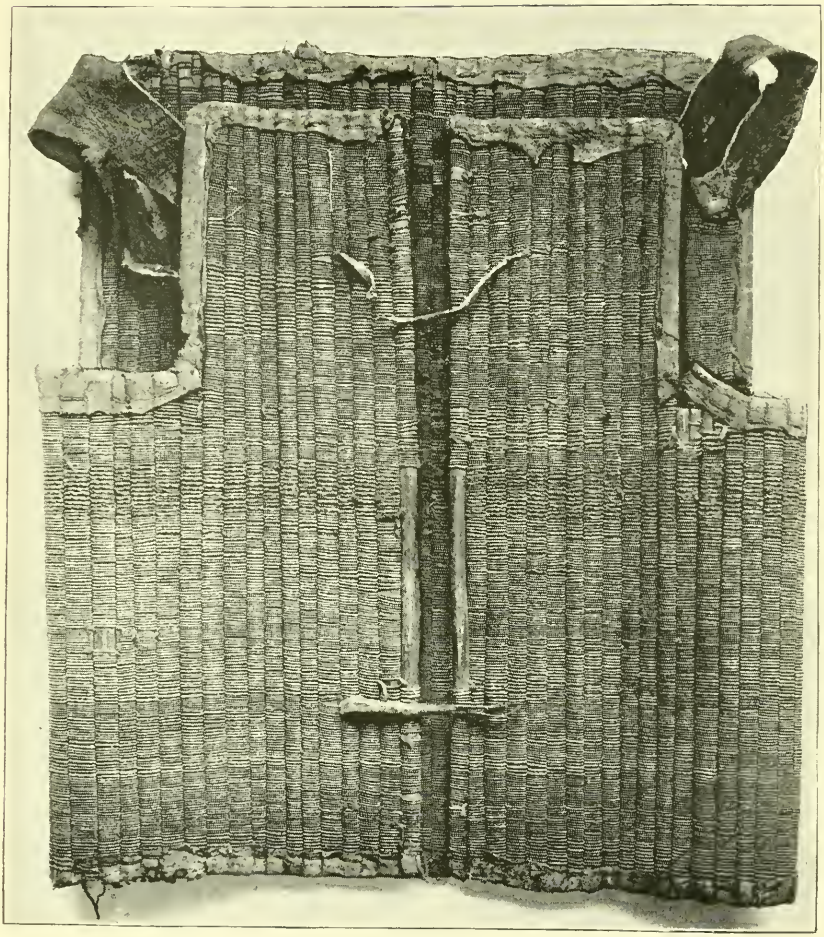
Plate 15, fig. 2, rod armor (*Tal-luck*).—Modern. Made up of 44 oval rods of pine wood. The cord is of native hemp and cords made from sisal, the latter probably derived from ropes. The weaving is diversified by using cords colored red and yellow; bound with buckskin painted red; shoulder straps of buckskin; tying straps at the sides. Width, 38 inches; height, 21 inches. (Cat. No. 2094, U. S. N. M. Klamath Indians, Oregon. Collected by L. S. Dyar.)

‡ Morice, A. G., the Western Dénés. Proc. Canad. Inst., Vol. XXV, 1889, p. 140.

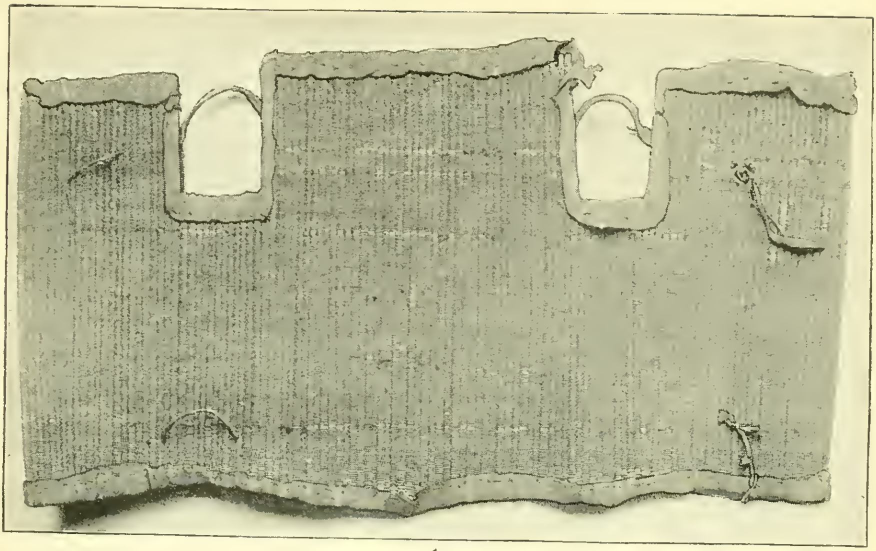
§ Ross, Alexander, adventures, etc., on the Oregon and Columbia rivers, Lond., 1849, p. 89.



TAKU ROD ARMOR.
Cat. No. 168158, U. S. N. M.



SHASTA ROD COAT.
Cat. No. 2928, U. S. N. M.



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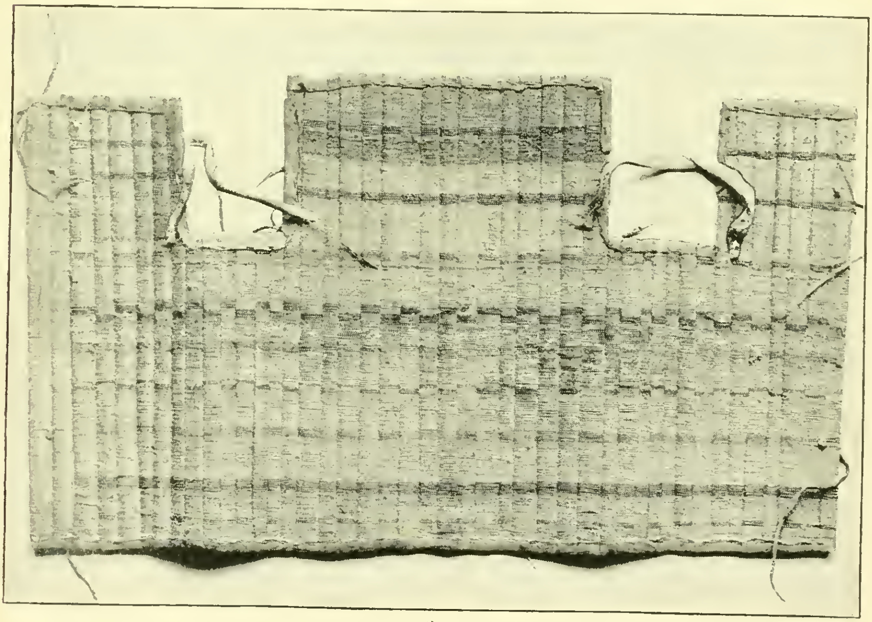

2

ROD COATS.

Fig. 1. Hupa rod armor. Cat. No. 126909, U. S. N. M.
Fig. 2. Klamath rod armor. Cat. No. 2094, U. S. N. M.

Among the Hupas "there is another kind of armor made of wattles and twine, woven and bound with buckskin. This is worn in battle to protect the body; it is tied across the breast from left to right. The red lines denote the number of enemies slain or captives taken; also the rank of the wearer. This class of armor was in common use among the Natano and Kenuck Indians before the introduction of firearms, but it is now nearly obsolete."*

The rod coats were put on like a vest and were tied in front. The rear portion, being a little longer, protected the back of the neck.

On the western slopes of the Rocky Mountains and on the Great Plains the natural defensive protection of the great land and sea mammals, transferred by man to his own body, becomes, in turn, his efficient armor.

The skins of the elk and moose on the northwest coast and the bison in the interior to the south furnish excellent material for defensive clothing. These skins are invariably tanned to render them flexible, and are often coated with glue and sand over certain portions.

Father Morice, in his clear description of the process, says:

> Another sort of armor, indigenous to the Déné nation, was the *peoesta* (wherein one sits). This had the form of a sleeveless tunic falling to the knees, so that it afforded protection to the whole body save the head—in hard fights the Dénés invariably shot kneeling. The armor or cuirass was of moose skin, which, when sewed according to the proper pattern, was soaked in water, then repeatedly rubbed on the sandy shores of a stream or lake and dried with the sand and small pebbles adhering thereto, after which it was thoroughly coated with a species of very tenacious glue, the principal ingredient of which was boiled isinglass, obtained from the sturgeon. Being again, before drying, subjected to a thorough rubbing over sand, it received a new coating of the aforesaid glue. When this process had been repeated three or four times, it formed an armor perfectly invulnerable to arrows over the parts which were thus protected.†

The skin coats were always made in one piece folded over, sewed above the shoulders, leaving an orifice for the head and with a hole cut out of the left side for the left arm, the right side of the garment remaining open. The skin was often doubled, but more frequently the coat was reinforced with pieces of thick hide. Sometimes shoulder guards were added.

It will be seen that the leather coats from Sitka are short and follow the type of slat armor. This will be noticed in the "swallowtail" for the protection of the pubic region, or which assumes this shape by the cutting away of portions of the skirt over the groins (pls. 16 and 17).‡ Sometimes a slash was made over the thigh and in front of the throat.

* Mason, O. T., The Ray Collection, Rep. Smithsonian Institution, 1886, p. 230.

† Morice, A. G., The Western Dénés, Proc. Canad. Inst., Vol. XXV (Oct., 1889), p. 140.

‡ DESCRIPTION OF PLATES 16 AND 17.

Plate 16, Fig 1, skin armor.—Made of two thicknesses of caribou hide, scarfed rregularly to secure flexibility. Sewed around the border with rawhide. Padded in the truncated portion with heavy pieces of hide. The garment has been patched at the edges eaten away by rats. Formerly worn as an undergarment for protection against daggers, spears, and arrows. Outside was worn a rod band as a further protection. This specimen is very ancient and primitive, worn before the introduction

The shoulder guards were worked out of the hide at the left armhole, or added over one or both shoulders. On the front are one or two loops of buckskin, probably for the attachment of the bow and quiver or dagger.

On the right side the armor was usually fringed, and in some cases a band of lighter skin was sewed along the same side. This band was often decorated.

To the southward the coat seems to become longer and simpler in outline (pls. 18, 19).*

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of fire arms. Width, 21 inches; length, 28 inches. (Cat. No. 130587, U.S.N.M. Tlingit Indians, Alaska. Lent by Max B. Richardson.)

Fig 2, skin armor.—Made of tanned hide; two thicknesses; sewed along the upper edge. The "swallowtail" portion is reinforced with two extra thicknesses, making four in all. The coat is very heavy. The sewing is done with sinew. Width, 25 inches; height, 33 inches. (Cat. No. 60239, U.S.N.M. Tlingit Indians, Alaska. Collected by J. J. McLean.)

Plate 17, skin armor.—Made of one piece of heavy elk skin apparently smoke-tanned, lined inside with another piece sewed around the lower portion. Ample cuts for arm holes. Over the left shoulder is fastened an *epauliere,* made of a heavy piece of folded hide. For convenience in putting on or off the armor, the band over the right shoulder is buttoned over a wooden toggle. Fastened with thongs on the right side. Two loops in front are probably for the bow. Width, 20½ inches; height, 29 inches. (Cat. No. 60240, U.S.N.M. Tlingit Indians, Alaska. Collected by J. J. McLean.)

*DESCRIPTION OF PLATES 18 AND 19.

Plate 18, Fig. 1, skin armor.—Front view. Made of very heavy hide, with corrugated appearance, single thickness. A strip of lighter leather, cut from a painted garment, has been sewed to the left side. A double shoulder protector has been sewed to the left side of the neck opening, and the skin has been cut and enlarged by gussets to protect the right shoulder. A slit cut in the skirt of the coat admits of free movement of the knee. The fringe is wrapped with strips of grass, tied, by thongs, on the left side.

Fig. 2, skin armor.—Rear view of armor. Curiously, this armor must have been worn by a left-handed man, as it is put on in the reverse of the other coats described. Width, 30 inches; height, 37½ inches. (Cat. No. 130588, U.S.N.M. Alaska. Lent by Max B. Richardson.)

Plate 19, Fig. 1, skin armor.—Made of tanned caribou skin folded in the usual way and reinforced. Fringed on the right side. The coat is longer than those worn to the North. The leather has apparently been stiffened with glue. The feature of this coat is that two very heavy pieces of hide go over the shoulders and form a slit in front of the neck. The buckskin loops in front are for the attachment of the quiver. Width, 32 inches; height, 37 inches. (Cat. No. 46464, U.S.N.M. Chilcat Indians, Alaska. Collected by Dr. T. H. Bean.)

Fig. 2, skin armor.—Made of thick tanned elk or moose skin folded twice into oblong form like a sheet of note paper. Sewed over the shoulders and strengthened inside by hinge pieces. Open along right side the edges cut into coarse fringe. A short slit down left side below the shoulder leaves a passage for the left arm. About midway near the right side is fastened a wooden toggle, by which, probably, was suspended the dagger. The front of the coat is discolored and dented as though an attempt had been made to render the leather more dense by hammering. The leather has perhaps also been treated with glue, as described by Father Morice among the Tinné. Inside the armor at the back is a finely drawn and painted totem in a circle 10½ inches in diameter. Width, 26 inches; height, 36 inches. (Cat. No. 168159, U.S.N.M. Taku Indians, Southeastern Alaska. Collected by Herbert G. Ogden.)

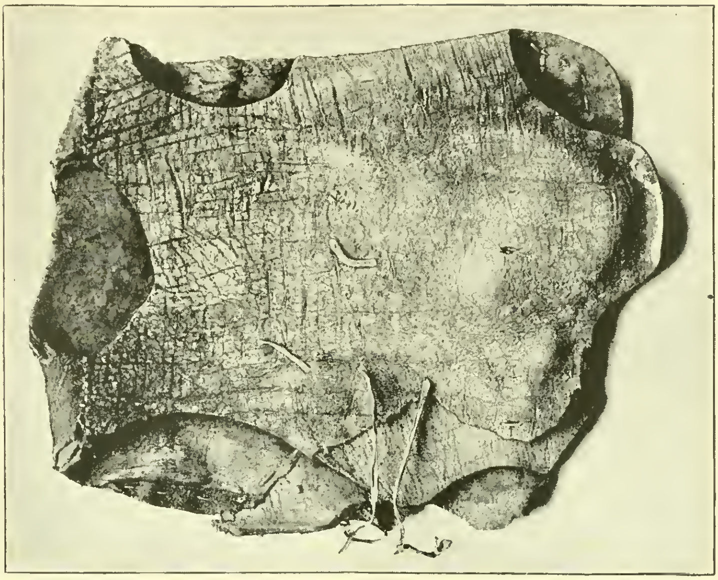


Fig. 2. Coat of tanned hide.
Cat. No. 60239, U. S. N. M.

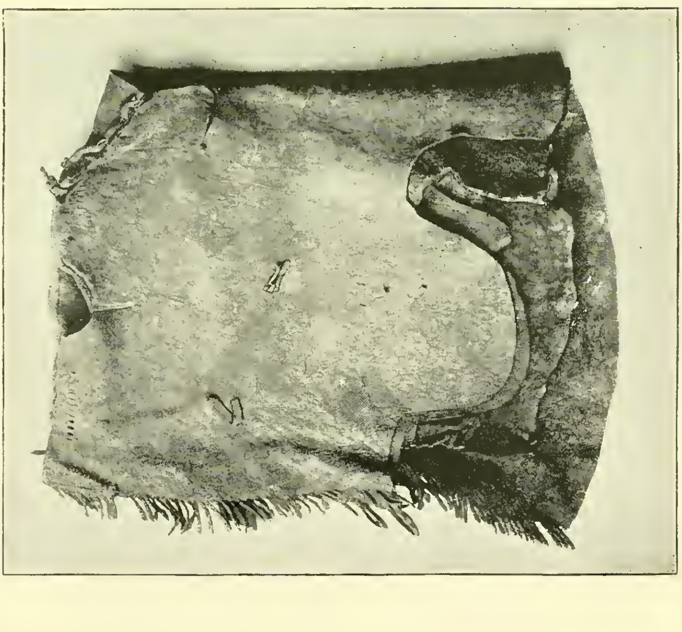
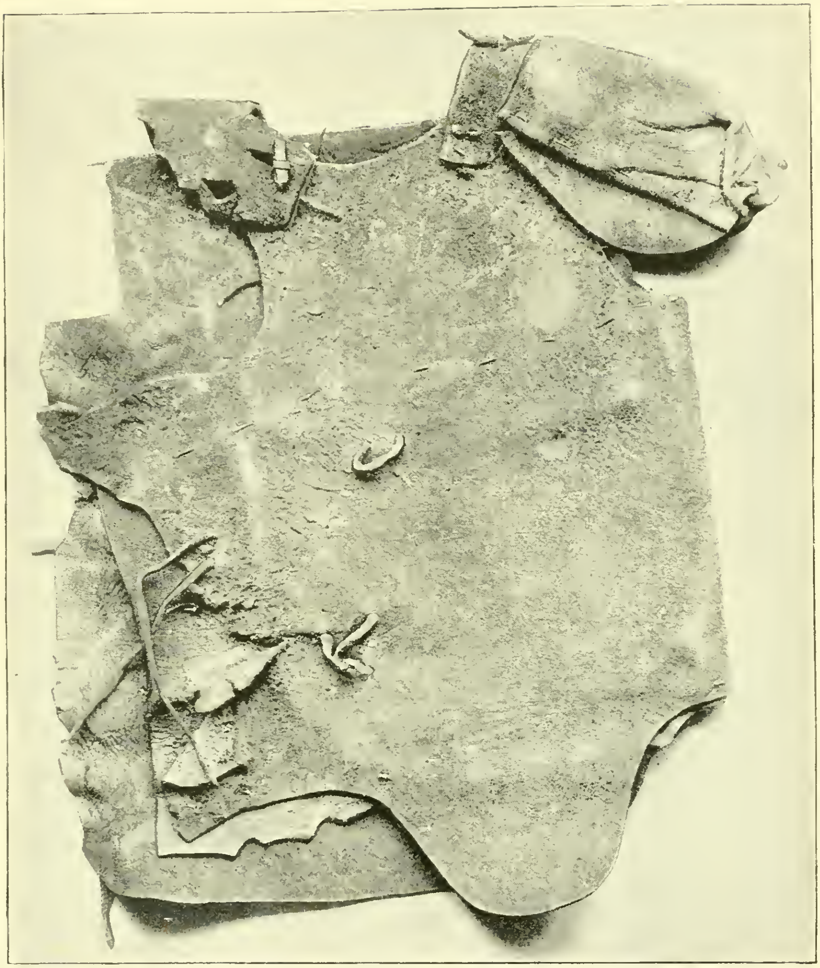


Fig. 1. Coat of caribou hide.
Cat. No. 130587, U. S. N. M.

TLINGIT SKIN ARMOR.



ALASKAN SKIN ARMOR WITH SHOULDER GUARDS.

Cat. No. 60240, U. S. N. M.

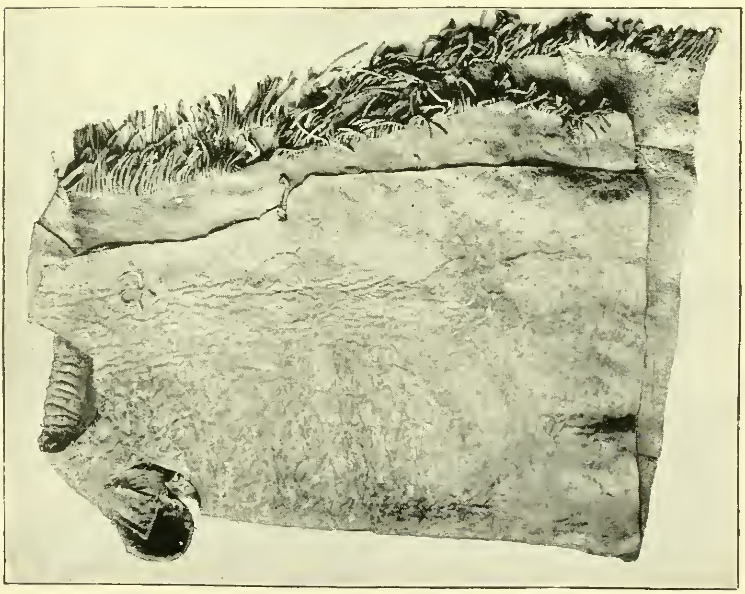


Fig. 1. Front view.

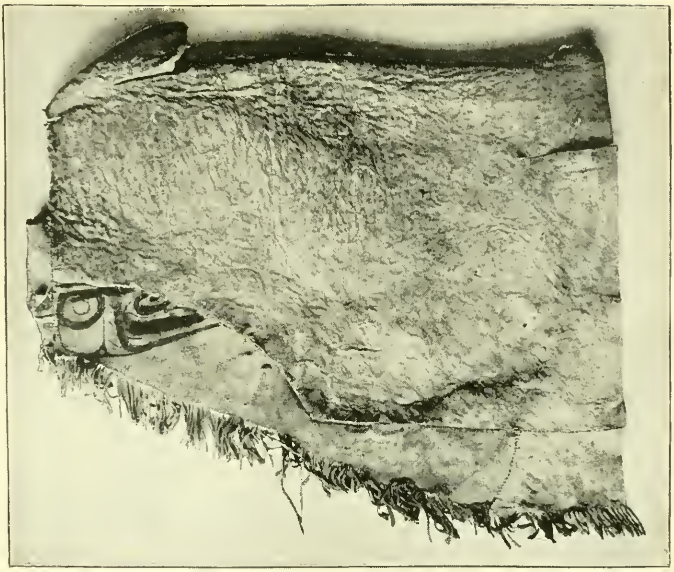


Fig. 2. Back view.

ALASKAN SKIN ARMOR.

Cat No. 130588, U. S. N. M.

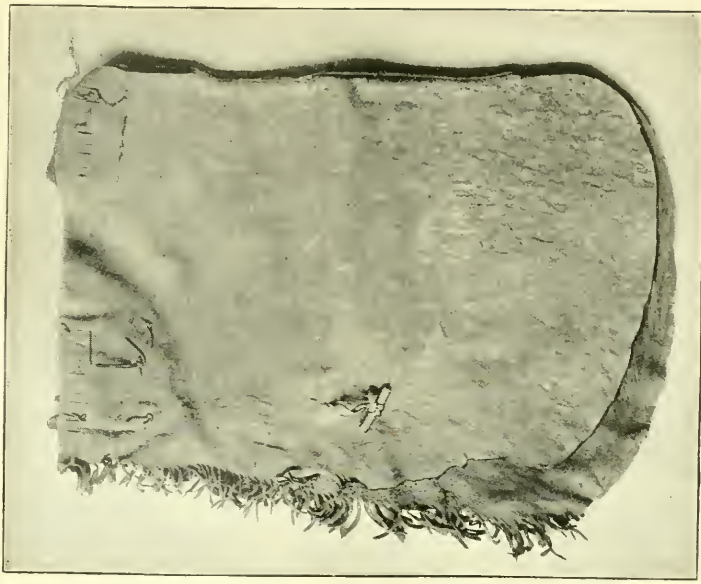


Fig. 2. Taku skin armor. Cat. No. 168159, U. S. N. M.

Fig. 1. Chilcat skin armor. Cat. No. 16161, U. S. N. M.

SKIN ARMOR.

The long coat culminates among the Hupas and Klamaths, although some Alaskan tribes wore long coats identical with the ceremonial coats (pl. 20).*

Two modern armors from Sitka, in form of a waistcoat, are curious. Both open in front and are fastened by lappets and brass buttons of English manufacture. One is plated over the entire front and a portion of the back with Chinese coins, like the penny armor of Europe; the other is plain. The derivation of these coins is not known, but the collector supposes the work to be that of Chukchis. These are current Chinese coins like those brought to this country by the Chinese to be used in gambling. There are a few Japanese coins on this coat. The armor was collected in 1870 (pl. 21). †

Decoration of the war armor was infrequent. The fringe has been mentioned. Applied bands of quill work on leather fringe have been observed. The slat armor often bore totemic devices, and the rod armor was diversified by bands of weaving of different colored cords or by painted bands. In the interior of two coats from southern Alaska (Takus and Tlingits) are elaborate colored totemic paintings. Since the painting is not seen, it can not be for ornament. Perhaps it is a fetichistic protection.

Two very heavy, long, wide skin coats from the Northwest Coast in

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* DESCRIPTION OF PLATE 20.

Skin armor (Cue it wul).—Made of a large elk skin, tanned, folded on itself. The outer portion falls as a skirt to the ankles, while the inner portion reaches only to the knees, and the hard neck portion of the hide comes in front and acts as a plastron to protect the belly and thighs. Joined over the shoulders by leather straps worked through a series of slashes. Zigzag cut for the left arm. Fringed at the side and tying thongs on the right. The front and back decorated with cusps, dots, circles, and lines in red and blue paint. It is worn so as to cover the left side, with the left arm through the slit, the head through the opening. The suit has been worn by several generations and in some of the modern battles with the whites, in which the bullet marks were received. There are also arrow cuts which were received in battle. The cusps and triangular figures are intended to denote the number of enemies slain and captives taken. (See "The Ray Collection," Report of the Smithsonian Institution, 1886, 1, p. 205.) Width, 26 inches; height, 47 inches (Cat. No. 126908, U.S.N.M. Hupa Indians, California. Collected by Capt. P. H. Ray, U. S. A.)

† DESCRIPTION OF PLATE 21.

Fig. 1, skin armor.—Made of three layers of tanned hide, hardened. Two layers are formed by folding and the third is inserted between them. In general shape it is that of a waistcoat, with collar sewed on with thongs, but not formed of pieces like the similar armor. Fastened in front with 4 lappets and sailors' buttons of brass. On the right side is a loop of buckskin, probably for the dagger. Height, 23 inches. (Cat. No. 18927, U.S.N.M. Sitka, Alaska. Collected by James G. Swan.)

Fig. 2, skin armor.—Made of thick tanned hide in imitation of an old-fashioned waistcoat, the resemblance being exact in particulars of cut and sewing. Plated over the front and shoulder of the back with Chinese coins sewed on with sinew cord. Four lappets for fastening in front with brass buttons of English manufacture. Dr. Hoff believes this coat to be the work of Chukchis. Height, 25½ inches. (Cat. No. 9284, U.S.N.M. Sitka, Alaska. Collected by Dr. A. H. Hoff, U. S. A.)

the national collection are of problematic purpose. They were sent in as armor by the collector, and from the thickness, weight, and other points are evidently defensive. There is, however, no armhole on the left side nor projection for the shoulder. In one suit the neck opening is large and is surrounded with a leather-covered collar made of short wooden slats, slightly interlocking, held together with a cord twining. In the other suit the collar is of hide (pl. 22).*

Fig. 5.

ANCIENT KOREAN COTTON ARMOR.

Cat. No. 128344, U.S.N.M. Korea. Deposited by Dr. G. Brown Goode.

If these objects are defensive they could scarcely be used by a man on all fours for stalking, as they are too wide and long, and the arms would be completely hampered. They would be most useful as armor for some animal. While one tribe at least (the Shoshones of the Upper Missouri) is known to have protected their horses with armor,† the Northwest Coast tribes did not have horses. A further suggestion is that they were ceremonial.

These objects are noticed here with the view of ascertaining their function.

Padded armor, which was used in Mexico and Central America, is the remaining type. No specimens of Mexican padded armor are extant. In some of the sculptures quilted armor is perhaps represented by a groundwork of small squares. A search of the codices and an examination of the sculptures will doubtless throw much light upon this subject.

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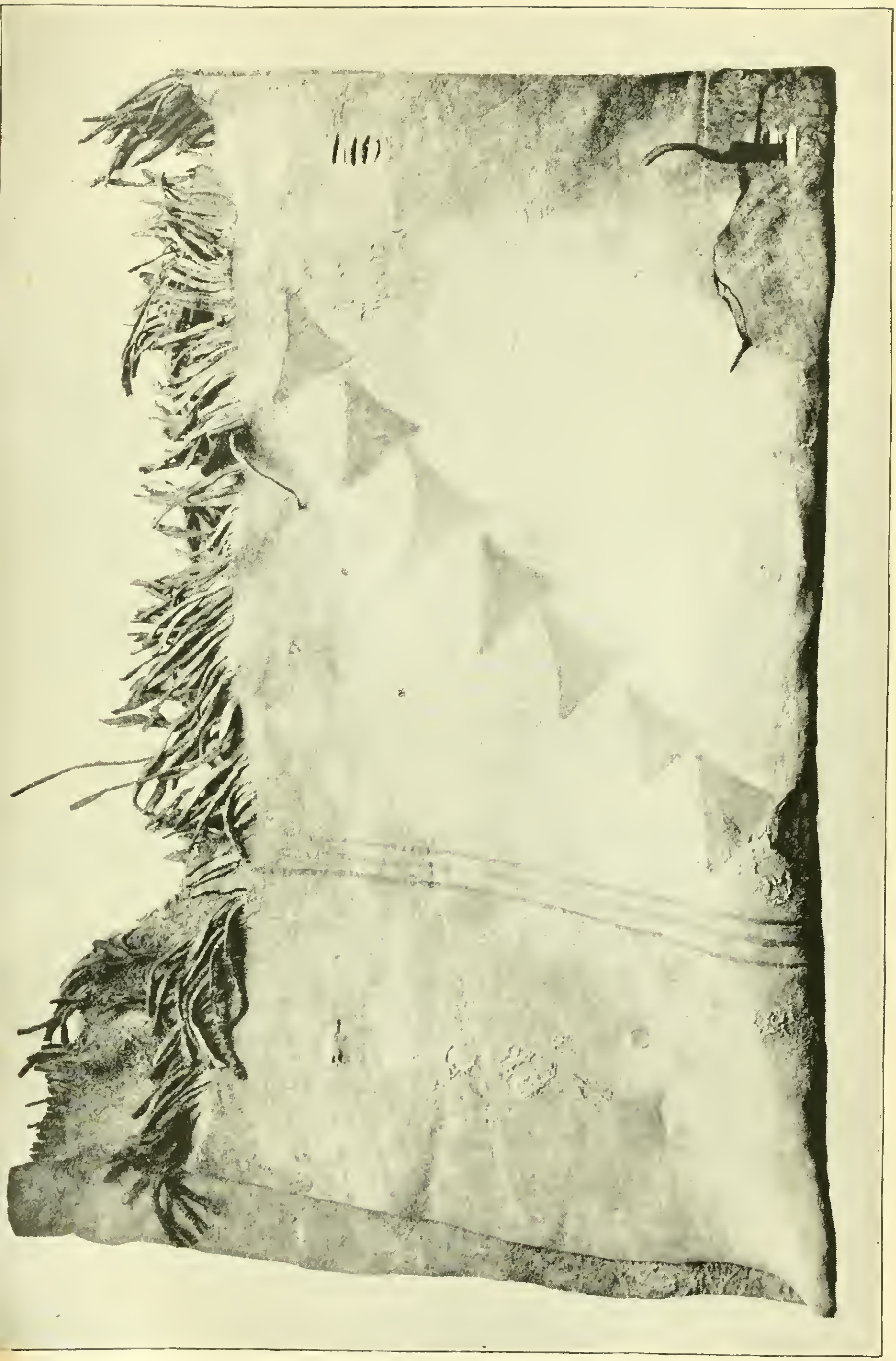
* DESCRIPTION OF PLATE 22.

Fig 1, skin robe.—Of hide, roughly curried in tanning. The collar is a slight cut on the left side which does not penetrate the inner fold. A painted, fringed band has been neatly sewn to the right side. On the inside is an elaborate totemic painting. Length, 52 inches; width, 36 inches. Northwest coast.

Fig 2, skin robe.—Made of a large tanned elk, or caribou, hide, doubled, the short fold being inside. A collar composed of short interlocking slats of wood, woven together with cord in the manner of the slat armor and covered with leather, is sewed to the neck. Fringed at the sides. Four bands of fringed buckskin decorated with colored grass are sewed on one side. Length, 54 inches; width, 32 inches. (Cat. No. 71440, U.S.N.M. Alaska. Collected by J. J. McLean.)

† See page 646.



HUPA ELK-SKIN ARMOR.

Cat. No. 126908, U. S. N. M.

Fig. 1. Skin armor plated with Chinese coin.
Cat. No. 1892? U. S. N. M.

Fig. 2. Tlingit armor.
Cat. No. 9284, U. S. N. M.

SKIN ARMOR.

Fig. 1. Alaskan skin coat.

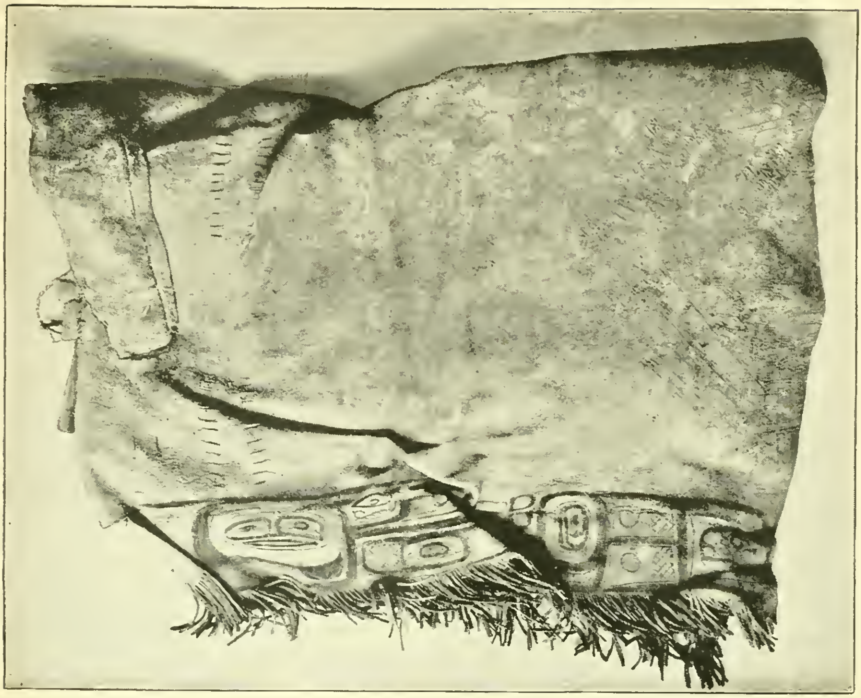


Fig. 2. Alaskan skin coat.
Cat. No. 74440, U. S. N. M.

COATS RESEMBLING ARMOR.

Padded armor has been of widespread adoption. In Mongolian countries it survived to a recent date. The Korean armor (fig. 5*) will give an idea of this type.

Prescott says, in reference to the Peruvian armor:

Men's bodies were protected by casques made either of wood or the skins of wild animals, and sometimes richly decorated with metal and with precious stones surmounted by the brilliant plumage of the tropical birds. * * * Men's defensive armor consisted of a shield, or buckler, and a close tunic of quilted cotton, in the same manner as with the Mexicans.†

Probably not very different from the cuirass of hide of the northern tribes.

Hansard tells us the Spaniards invented felt covering for their horses as a protection against Floridan arrows.‡ He also states that—

The Spaniards, who fight on horseback with the Indians of those provinces, carry a doublet well lined with cotton wool.§

It may be surmised that the Spaniards introduced this style of armor both into Mexico and Peru.

Dr. Brinton, in his "American Race," says of the Tarascos of Michoacan:

Nowhere else do we find such complete defensive armor. It consisted of helmet, body pieces, and greaves for the legs and arms, all of wood, covered neatly with copper or gold plates, so well done that the pieces looked as if they were of solid metal.

The following excerpts, arranged geographically, describing armor from other tribes not represented by extant specimens, are introduced here to show the range of armor in America.

The Nass Indians of the Tsimshian stock follow the other stocks on the Northwest Coast in that—

Their war garments were formed of 2, 3, or more folds of the strongest hides of the land animals they were able to procure. In the center was a hole sufficient to admit the head and left arm to pass through, the mode of wearing them being over the right shoulder and under the left arm. The left side of the garment is sewed up, but the right side remains open; the body is, however, tolerably well protected,

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* This consists of a coat, helmet, and wide belt made up of many thicknesses of coarse cotton cloth covered with yellow stuff. The coat is made up of two wide flaps connected by a band which passes over the left shoulder. These flaps are cut out to fit the neck, and are tied at either side. A plastron of cloth is hung over the chest. The surface of portions of the coat is printed with Sanscrit dharani, or prayers for victory. A belt resembling those worn by Korean women at the present time, but much thicker, is tied around the waist. The helmet is padded, and is stiffened by four perpendicular bands of iron riveted through the cloth and terminating in a brass ball at the apex. Visor, small; wide and heavy épaules, one at either side at the back. The helmet has also Sanscrit dharani written upon it. Length of coat, 34 inches; width, 30 inches; length of belt, 54 inches; width, 11 inches; height of helmet, 12 inches. (Cat. No. 128344 U. S. N. M. Korea. Deposited by Dr. G. Brown Goode.)

† Prescott, Conquest of Peru, 1, p. 67.

‡ Hansard, History of Archery, p. 23.

§ Benzoni, History of the New World, Hakluyt Soc., p. 8.

and both arms are left at liberty for action. As a further security, on the part which covers the breast they sometimes fix on the inside thin laths of wood.*

On Vancouver Island the Nootkas make use of—

A thick tanned leather mantle, doubled, and appears to be the skin of an elk or buffalo. This is so contrived as to cover the breast quite up to the throat, part of it falling down to the heels. This garment is sometimes very curiously painted, and is not only strong enough to resist, but, as we understand from them, spears could not penetrate it. So it may be considered their complete defensive armor.†

The Chinooks of the Columbia River use skin and rod armor. Ross says, in reference to the former, their war garments are of two kinds; one is termed *clemal*, of elk skin, dressed and worked to the thickness of nearly half an inch, and arrow proof. The clemal nearly covers the whole body, with an opening left on the right side to allow the arm free action in combat. (Ross, Alex., Advent., etc., on the Oregon or Columbia River. Lond., 1849, p. 89.)

Franchere says of the Columbian River tribes:

For defensive armor they wear a cassock or tunic of elk skin, double, descending to the ankles, with holes for the arms. It is impenetrable for their arrows, which can not pierce two thicknesses of leather; and as their heads are also covered with a sort of helmet, the neck is almost the only part in which they can be wounded. They have another kind of corselet made like the corsets of our ladies, of splinters of hard wood interlaced with nettle twine. The warriors who wear this curious dress do not use the tunic of elk skin. He is consequently less protected, but a good deal more free, the said tunic being very heavy and very stiff.‡

Passing eastward, Lewis and Clarke, when speaking of the Shoshoni of the Rocky Mountains, at the head of the Missouri River, remark:

They have a kind of armor, something like a coat of mail, which is formed by a great many folds of dressed antelope skins, united by means of a mixture of glue and sand. With this they cover their own bodies and those of their horses, and find it impervious to the arrow.§

Mr. Dorsey informs me that there is reason to believe that the Pawni formerly employed a kind of hide cuirass and a defensive helmet, and as Du Pratz states that the Padoucas (Comanches) "cover their horses with dressed leather (probably bison hide), hanging down quite round, which secures them from darts," it is perhaps permissible to infer that their riders were protected in the same way.

In that wonderful origin-epic of the Navajoes the Indian singer chants to Dr. Matthews of "suits of armor made of several layers of buckskin. The warriors in those days wore such armor, but they wear it no longer." ||

* Vancouver, Voyage, Vol. II., p. 339.

† Cook's Voy., Vol. II., p. 246.

‡ Franchere, Gabriel, Narrative of a Voyage to the Northwest Coast of America. New York, 1854, p. 253.

§ Lewis and Clarke, Allen ed., Vol. I, 425, 1814.

|| Matthews, Washington, The Mountain Chant. Annual Report of the Bureau of Ethnology, 1883-'84, p. 73.

Among the Pueblo tribes "they also wore cuirasses of elk or bison skin, or of padded cotton and yucca, and carried round shields of basketry of heavily and closely netted cotton, or of thick rawhide, symbolically painted." *

Coming to the great civilizations of ancient Mexico, Bancroft says of the Nahua Indians of Mexico:

The *chimalli*, or Mexican shield, was made of various materials and of divers forms, sometimes rounded and sometimes oval; sometimes rounded on the lower side. It was commonly constructed of flexible bamboo canes bound firmly together and covered with hide. The face of the shield was ornamented according to the rank and taste of the wearer; that of a noble was generally covered with thin plates of gold, with a heavy boss in the center. In Tabasco and along the coast tortoise shells inlaid with gold, silver, or copper were commonly used as shields. Reeds, grass, hides, or 'nequen cloth, coated with india rubber, served to protect an Aztec common soldier. Some shields were of an ordinary size; others were intended to cover the entire body, and were constructed so that when not in use they could be folded up and carried under the arm. The body armor of the nobles and higher grades of warriors consisted of a breastplate made of quilted cotton, one or two fingers in thickness, called "ichcahuipilli." Over this was a thick cotton coat which covered part of the arms and thighs, made in one piece, fastened behind and decorated with feathers of the color of the company's uniform. The cotton armor was completely arrow proof. Arm and leg guards made of wood, covered with leather or gold plates and trimmed with feathers, and of the same material, shaped and painted to represent the head of a tiger, serpent, or monster with mouth open and teeth bared, complete the defensive armor.†

Again, in treating of the Toltecs, Veytia relates:

The body armor worn by the principal warriors was made of double cloth padded with cotton. It differed from that of the Aztecs, reaching down the ankles, and was worn over a thin white tunic. The private soldier painted the upper part of the body to represent armor, but from the waist to the thighs they wore short drawers, and over them fastened around the waist a kind of kilt that reached to the knee, and availed them somewhat for defense. Across the body was a sash made of feathers that passed from the right shoulder to the left side of the waist.‡

Cotton-padded armor seems to have been the principal type used in Mexico. Among the Mayas of Mexico—

In addition to shields the Mayas had for defensive armor garments of thickly-quilted cotton, called *escaupiles*, which covered the body down to the lower part of the thigh, and were considered impervious to arrows.§

There are a few references among the Isthmian tribes of the use of armor where the skin and rod types persist. Gabb says that the Bri Bris and Tiribis, Costa Rica, use "an iron-headed lance with shaft barely 4 feet long. Round shields were carried on the arm, made of the thickest part of the hide of the tapir."||

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*Extract from article "Pueblos," by F. H. Cushing, to be published in Johnson's Cyclopædia.

† Bancroft, H. H., Native Races of the Pacific States, Vol. II., p. 407.

‡ Veytia, Hist. Ant. Mej., Tom. I, pp. 289–90.

§ Bancroft, *op. cit.*, I, p. 655.

|| Gabb, A. M., Indians of Costa Rica, p. 516, Proc. Am. Philos. Soc., Aug. 20, 1875.

The Mosquito Indians of Honduras also employed armor. Bancroft says:

Armor is made of plaited reeds covered with tiger skins and ornamented with feathers; besides this they employ a breastplate of twisted cotton.*

Entering the continent of South America we find that—

The Abipones are unacquainted with shields and targets, but they cover greatest part of their bodies with a sort of defense made of an undressed anta's hide, a tiger skin being sewed either in the in or out side; it is open in the middle, that the head may come through, and extended on each side as far as the elbows and middle; it is impenetrable to common arrows, but not to spears and bullets.†

In the vast continent of South America there are only scattering references to the use of armor. In the southern extremity, where the phase of life assumes a resemblance to that of our North American tribes, we find well-known forms of armor. The cavalry of the Araucanians is "armed with swords and lances; formerly used bows and slings. The soldiers are not clothed in uniform, according to the European custom, but all wear beneath their usual dress cuirasses of leather, hardened by a peculiar mode of dressing; their shields and helmets are also made of the same material."‡

The Patagonians also wear a helmet with coat of mail, made of several folds of hide, and have a shield of bull's hide for use on foot.§ Their weapons are bows, lances, bolas, and clubs.

3. EASTERN AREA.

There is sufficient historical evidence that the defensive weapons of the east coast were similar to those of the west coast. The lakes and rivers with short portages rendered communication easy across this vast distance, and points out a great line of migration both of peoples and inventions. This is shown by the following reference:

Some sixty or seventy years ago a party of Iroquois, having crossed the Rocky Mountains, reached L. Tathá in two wooden canoes, which at once excited the covetousness of a band of Carriers, who killed the strangers for the sake of their canoes. These having been brought here (Stuart's Lake) served as models for the building of the first home-made "dugouts."‖

On the Atlantic slope there is abundant evidence to show that the Iroquois used body armor. Cartier (Hakluyt Voy., Vol. III, London, 1810), speaking of the Toudamani (Iroquois, probably Onondaga and Seneca) says:

Also they showed us the manner and making of their armor; they are made of cordes and wood, finely and cunningly wrought together.

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* Bancroft, *op. cit.*, I, p. 723.

† Waitz. Anthropologie, Vol. II, p. 361.

‡ Thompson, G. A. Alcedo's Geogr. and Hist. Dict. of America. Lond., 1812, Vol. I, p. 407.

§ Falkner. Description of Patagonia, p. 129.

‖ Morice, A. G. Proc. Canadian Inst., Oct., 1889, p. 131. The Carriers previously had birch-bark canoes.

Lafitan, whose famous work "Moeurs des Sauvages Ameriquains," was published in 1724, gives a more detailed account of the defensive armor of the tribes of the northeastern part of the present United States and of Canada, probably referring chiefly to the Iroquois and Huron, with whom he was most familiar. He says (Vol. II, p. 197):

Their cuirasses were a tissue of wood, or of small sticks of reed cut of proportionate lengths, strongly pressed against each other, woven and enlaced very neatly with small cords made of deer skin. They had cuissards and brassards (defensive coverings for the thighs and arms) of the same material. These cuirasses were proof against arrows armed with bone or stone, but not against those mounted with iron.

Charlevoix says of the Iroquois:

Most had no defensive weapon, but when they attacked any intrenchment, they covered their whole body with small, light boards. Some have a sort of cuirass or breastplate of small, pliable rings, very neatly worked. They had even formerly a kind of mail for the arms and thighs, made of the same materials. But as this kind of armor was found not to be proof against firearms, they have renounced them without putting anything in their place.*

Sagard says that the Hurons (Iroquois) had armor made of wood.† Champlain also describes the Iroquois' armor as made of wood and thread.‡ A plate in the same volume shows a warrior in armor. Wooden breastplates were worn.§ Copper breastplates have been found, like the gold breastplates of Peru.|| One has been described as a plate of rich copper, in length a foot, in width half a foot, for a breastplate.¶ Lucian Carr thinks these breastplates were for ornament, like those found in the Ohio mounds. The size of the New England breastplates, however, would render them a tolerable protection if used as a plastron.

The only reference to eastern skin armor is of the Mohawks, who "wear sea-horse skins and barks of trees made by their art as impenetrable, it is thought, as steel, wearing a headpiece of the same."**

In reference to the Virginia Indians, Hariot says:

They are a people clothed with loose mantles made of Deere skins, and aprons of the same rounde about their middles; all else naked; of such a difference of statures only as wee in England; having no edge tooles or weapons of yron or steele to offend us withall, neither know they how to make any: those weapōs that they have are onlie bowes made of Witch hazle, and arrowes of reeds; flat edged truncheons also of wood about a yard long, neither have they any thing to defend themselves but targets made of barcks; and some armours made of stickes wickered together with thread.††

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* Charlevoix, P. F. X. de, Vol. I, 338. Lond., 1761.

† Voyage des Hurons, I, p. 144.

‡ Champlain, I, p. 201. Paris, 1830.

§ Hakluyt's Voyages, III, p. 305.

|| Breastplate of Gold. Peru. J. Anthrop. Inst., Vol. XVIII. No. 3. Feb., 1889.

¶ Archer account, Griswold's Voyages, p. 75 in Vol. VIII, 35 Mass. Historical Collection.

** New England Prospect, p. 65.

†† A brief and true report of the new-found land of Virginia, Thomas Hariot, 1585, De Bry, p. 24.

I have not met with accounts of armor among the southern tribes, as the Muskoki group and others, but should hesitate to conclude that the idea of a defense for the body against arrows and spears, other than the shields, had not occurred to these progressive tribes.

As a rule, the helmet is the most striking and prominent portion of body armor.

War bonnets and various head coverings of the American aborigines, in many cases. may be classed with helmets. The function of the helmet, after protection, is to adorn the head, but an almost constant feature is that of inspiring fear by grotesque or horrid construction. Thus the helmet is connected with the mask.

There is a large series of Northwest Coast helmets in the National Museum. (See pl. 9.) They are always of wood, fitting the head, carved above to represent animals, grotesque faces, etc., always painted and sometimes carved with a rim like a hat. There is in the collection one helmet of wood covered with leather. Another fine helmet (Cat. No. 168157) from the Taku Indians of southern Alaska is carved from solid wood in form of the Japanese type, called *Kabuto* or pot helmet. The front is finely worked out into the form of a grotesque face, with deep furrows across the nose, cheeks, and forehead, like New Zealand tattooing, and painted green, red, and black. The ears at the side of the mask are accurately executed. The mask projects above the crown of the helmet and the upper ridge is studded with wooden pegs, which once held a fringe of sea-lion whiskers or bristles. Pegs are also seen on the chin and lips. The rear and rim of the helmet bear a totemic-painted carving in low relief.

Through the inner edge of the rim of the helmet four slanting holes have been bored. These were probably for the passage of thongs which held a mask-visor before the face.

Visors were worn, carved to represent a face, or bowed visors ingeniously made by cutting deep scarfs in the wood, allowing it to bend. On the interior of this style of visor was a projecting grommet which was taken between the teeth, holding the visor in place. Other mask-like visors were suspended from the helmet with cords and a *couvre de nuque* was often attached to the back.

The only other survival of helmets in North America is among the Pueblo Indians, where they appear in ceremonies, in the form of mask helmets.

A few historical notices have been given of the helmets used by the eastern Indians.

A summary of the main conclusions which may be drawn from the foregoing paper will show:

(1) That a majority of the American tribes had advanced to the stage where they made use of body armor—that is, were sedentary tribes.

(2) This also implies differentiation of weapons rendering armor necessary, or the migration of the invention, or independent invention.

The coat of thick skin which has appeared at all times and places may have arisen independently, following the prime idea of the concomitance of weapon and antiweapon, but—

(3) Plate armor in America is a clear case of the migration of invention, its congeners having been traced from Japan northeastward through the Ainos, Giliaks, and Chukchis, across Bering Strait by the intervening islands to the western Eskimo. Here the armor spread southward from the narrowest part of the strait, passing into the slat armor of the Northwest Coast, which is possibly a development of the plate idea. The plate armor also may have spread to the eastern coast of North America. Hence it appears to be conclusive that plate armor in America had Asiatic origin. The date of this introduction is not considered.

THE WEAPONS AND WINGS OF BIRDS.

BY

FREDERIC A. LUCAS,

Curator, Department of Comparative Anatomy, U. S. National Museum.

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A more accurate, if not a better, title for this article would perhaps be "Some weapons of birds," for the weapons to be considered are mainly such as are very evidently designed for offensive purposes, and a peaceably disposed bird might very well dispense with.

This paper does not treat of the beaks, claws, and ordinary spurs of birds, not only because they are pretty well known, but because peculiar modifications of bills and claws usually have more to do with preserving than destroying life, being related to some peculiarity of food or feeding.

The toothed beak of the falcon has, of course, a double purpose: to preserve the life of the falcon by destroying that of its prey, and the same is true of the spear-like bill of the heron, but the curious, crossed mandibles of the crossbill, the bent beak of the crook-billed plover, and the open bill of *Anastomus* all have to do with the mere procuring of food. Neither will we say anything of the ostrich, cassowary, and other big birds which strike with their feet, for although the feet are formidable weapons, they are designed rather for running than for fighting, except in the case of the cassowary, whose long, straight, sharp inner toe can inflict a serious wound. Leaving out all these birds, we are practically restricted to such as carry their weapons on their wings, and not only fight "tooth and claw," but buffet an adversary about the head, and have their spurs where they seem best adapted to do mischief. Rather strangely, it does not appear that birds with wing spurs are any more combative than those without, for, while the jacanas are said to fight well, Hudson, who studied them long and carefully, describes them as noisy birds, more given to scolding than to actual fighting.* Neither are the spur-winged plovers, which are also querulous and vociferous, said to be particularly pugnacious, although Gould says that *Lobivanellus personatus* uses its wing spur with good effect to repulse the attacks of birds of prey.† By no means all birds which fight with their wings have spurs upon them. The swan has none, and yet he is a famous fighter, and can deliver a tremendous blow, although the force and effect of a stroke of his pinions have undoubtedly been much exaggerated.

* Hudson, W. H., The Naturalist in La Plata.

† Birds of Australia, II, p. 221.

The common pigeon is another bird which uses its wings with good effect, and although the dove is held up as the type of gentleness, there are few birds of more quarrelsome disposition, and more given to picking upon their weaker neighbors. The company manners of the pigeon are unobjectionable, and the members of a flock will fly and feed abroad in harmony, but, once within the shelter of their own loft, woe betide the bird which dares put foot on his neighbor's territory, for he will be set upon and cuffed without mercy.

The pigeon, too, is a skilled boxer, feinting and guarding with one wing and striking with the other, the blow being delivered by the wing farthest from his opponent, the intention being that the wrist, which is the most effective part of the wing for striking a blow, shall strike the adversary about the head. While this mode of combat is not peculiar to pigeons, it is eminently characteristic of the group, so that they may be called pugnacious in the strictest sense of the term; the Latin verb *pugno* meaning specially to fight with blows of the fist, or, as we say, to come to fisticuffs.

Pigeons, according to our ideas, do not fight quite fairly, and if they have no positive spur upon their wings, they certainly come very near it. If one will carefully part the feathers on the outer edge of a pigeon's wing near the bend, commonly called shoulder, but really the wrist, he will find a small bare spot and a blunt, well-marked prominence, often covered with integument so thick and hard that it can almost be called horn. In some wild pigeons this tubercle or boss is well developed, especially in the curious Samoan *Didunculus*, while at least one extinct species was provided with a sort of natural slung-shot that must have added not a little to the effectiveness of a blow. This bird was the fat and flightless Solitaire, of Rodriguez, a near relative of the dodo, and, like it, a great, ungainly, aberrant member of the pigeon family, taller than a turkey.

All that we know about the Solitaire has been gathered from the journal of Francois Leguat, who tells us that, while the birds were nesting, they would not suffer any other bird of the same species to approach within 200 yards of the place. He writes—

> But what is singular the male will never drive away the females, only when he perceives one he makes a noise with his wings to call the female, and she drives the unwelcome stranger away, not leaving it till it is without her bounds. The female does the same to the males and he drives them away. The combats between them on this occasion last sometimes pretty long, because the stranger only turns about and does not fly directly from the nest.

Leguat says, furthermore, that "the bone of their wing grows greater toward the extremity and forms a little round mass under the feathers as big as a musket ball. That and its beak are the chief defense of this bird."

"As big as a musket ball" very aptly describes the swollen bone at the base of the metacarpus (fig. 1), and this, swung by the short, stout little wing, must have been capable of hitting a pretty hard blow, even if, as is probable, it was surrounded by thick, callous skin. The outer end of the forearm (radius) is also rough and swollen, and it looks very much as if this enlargement of the bone had originally been brought about by the solitaire's combative habits, the wrist joint having been banged and bruised until that diseased outgrowth known as exostosis

Fig. 1.

PART OF WING OF SOLITAIRE, PEZOPHAPS SOLITARIUS.

Showing outgrowth of bone on radius and metacarpus (natural size).

Cat. No. 18251, U. S. N. M.

took place, and finally became a constant character of the bird. Dr. Weismann might object to this, but to a Neo-Lamarckian the thing seems quite plausible.

The true game birds, fowls and pheasants, which have spurs on their legs, have none on their wings, although, as everyone knows who has seen a quarrel in the barnyard, they use their wings in fighting. Some of their Australian cousins, however, the mound-builders, or megapodes, which have no leg spurs, have blunt tubercles on their wings, very much like those found among pigeons.

Although the swan, as we have seen, has no wing spurs and trusts to the sheer force of its wing stroke, some of its near relatives, the

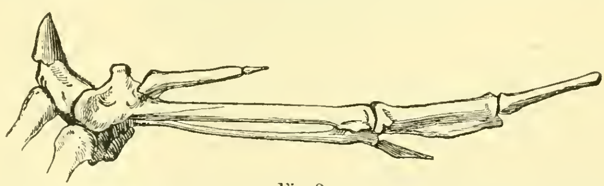

Fig. 2.

OUTER PORTION OF WING OF SPUR-WINGED GOOSE, PLECTROPTERUS GAMBENSIS.

Reduced.

African Spur-winged Geese (*Plectropteri*), have a very peculiarly armed pinion. The peculiarity lies in the fact that while in most spur-winged birds the spur does not occur upon the wrist itself, but upon the metacarpus, or next row of bones, in the Spur-winged Goose (fig. 2) that one of the wrist bones known as the *radiale* projects quite beyond the other bones and is capped with a sharp spur.

The majority of spur-winged birds are plovers, nearly related to the common Lapwing, *Vanellus cristatus*, and placed by different systematists in various genera and subgenera named from their spurs or the face wattles which occur in some species, *Hoplopterus*, *Belonopterus*, *Lobivanellus*, and *Sarciophorus*. A curious fact about the wattled species is that there is a direct relation between the size of the wattles and the size of the spurs (fig. 3); when the spur is long the wattles are large, and when the spur is short the wattles are small. There is also in those species where the spur is small an increase in its size during the breeding season, so that it then becomes fully available as a weapon.*

There are no wattled lapwings in the New World, and only one species straggles northward beyond the latitude of the Himalayas. Africa, south of the Sahara claims half a dozen species, while seven

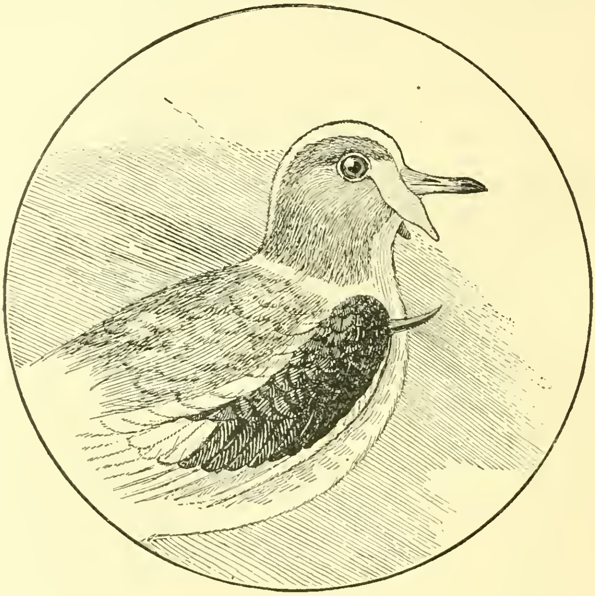

Fig. 3.

WATTLED PLOVER, LOBIVANELLUS ALBICEPS.

Reduced.

more are found between southern Asia and New Zealand. Spur-winged plovers without wattles occur in South America, Africa, and parts of Asia, but none come from Australia. A small and quarrelsome species (*Hoplopterus spinosus*) belonging to this latter group is very abundant in northeastern Africa, and its restless habits—for night and day it is continually on the move—are explained by the Arab tradition that on account of former laziness it was condemned to live in a state of perpetual unrest.

The largest and finest of the South American spurred plovers is *Belonopterus chilensis* (fig. 4), a species ranging southwards to Patagonia, and armed with a long, vicious-looking spur just at the base of the metatarsus. I was about to say "thumb," but it seems quite probable

*Jordan, Birds of India, III, 648.

that birds long ago lost their thumbs, and that the middle finger has come to do duty in its place. However, this digit has been termed thumb for a long time, and since it is one by analogy, we will still call it so.

There is a curious instance among the gigantic extinct group of reptiles, well named Dinosaurs,* where the thumb itself has become changed in function, and instead of aiding the other digits to lay hold of things, has become transformed into a long, sharp spike. This occurs in the Iguanodons (fig. 5), and among them the species particularly noticeable is *Iguanodon bernissartensis*, one of nearly two score that were happily swept into a convenient Jurassic gully and there remained for long ages, until brought to light by the picks of the coal miners of Bernissart. That in this case the spike did duty as a weapon is a little uncertain, and it may have served no more harmful purpose than that of ripping off the husk of some fruit or vegetable which formed part of the food of these great herbivorous reptiles.

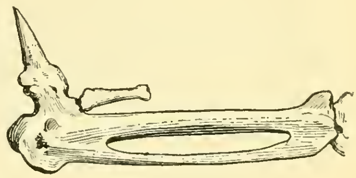

Fig. 4.

METACARPUS OF SPUR-WINGED PLOVER, BELONOPTERUS CHILENSIS.

Cat. No. 18546, U. S. N. M.

When these pointed thumb-spikes were first found, they were not associated with the fore limbs, and so in restoring the *Iguanodon* he was figured with the spike on the end of his nose, something like a rhinoceros.

The late Dr. W. K. Parker, in a memoir on the morphology of the duck and auk tribes, rather hints that the thumb of *Iguanodon* and the spur of *Chauna chavaria* are, morphologically, not so far apart.†

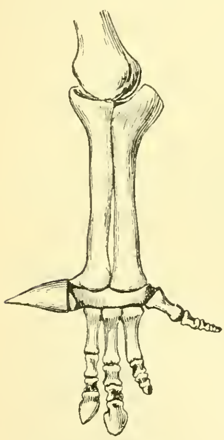

Fig. 5.

FOREARM OF IGUANODON, IGUANODON BERNISSARTENSIS.

Reduced.

Another group of spur-winged birds is the *Jacanidæ*, a family of small birds related to the rails, having such long slender toes that they run as easily over lily pads and floating vegetation as other birds do over dry land. These little birds, which are found in the warmer parts of America, Africa, southern Asia, and Australia, like the spur-winged plovers, have a spur on the metacarpus, although it is not so large as in those birds. As in the spur-winged plovers we find spurs associated with wattles for the African and Asiatic species which have no wattles, have only rudimentary spurs, while the American species which have wattles have well-developed spurs.

* Dollo, Note sur les Dinosauriens de Bernissart. Bull. Mus. Roy. d'Hist. Nat. Belge., 1882-1884, t. I, Pl. IX, t. II, Pl. VIII.

† The Morphology of the Duck and Auk Tribes. Cunningham Memoirs of the Royal Irish Academy. No. VI, pp., 55, 95.

The jacana, like the Hoactzin and Mound Builder, acquires its full activities at an early date, and Hudson says:

> While I was looking closely at one of the eggs lying in the palm of my hand, all at once the cracked shell parted, and at the same moment the young bird leaped from my hand and fell into the water where it swam rapidly to a small mound and escaping from the water, concealed itself in the grass, lying close and perfectly motionless like a young plover.
>
> I am quite sure that the young bird's sudden escape from the shell was the result of a violent effort to free itself, inspired by the loud persistent screaming of the parent birds which it heard while in the shell.

In the jacanas belonging to the genus *Metopidius* the spur is much reduced in size, but the bone of the wing itself is so modified as to become available as a weapon, being flattened and widened so as to be a scimeter on a small scale (fig. 6). The apparent drawback to this weapon lies in the fact that, like a two-edged sword, it must cut both ways, and unless the skin immediately over it is particularly dull and insensible *Metopidius* can not strike an adversary without feeling the effects of the blow himself. Whether or not this tends to promote peacefulness we do not know, but from what we know of bipeds, who claim to be higher in the scale of life, it may be presumed that *Metopidius* does not mind being hurt himself provided the "other fellow" is hurt still more.

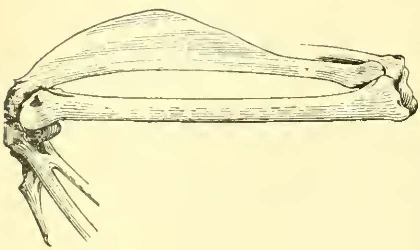

Fig. 6.

FOREARM OF AFRICAN JACANA, METOPIDIUS AFRICANUS.

Natural size.

Cat. No. 18785, U. S. N. M.

Largest and most formidable of all spur-winged birds are the Screamers (*Anhimidæ*), three species of birds related to the ducks, although they do not look it, and restricted to South America.*

These birds have two spurs, instead of one, upon the outer part of the wing (fig. 7), the outermost a short affair, the inner an ugly three-sided, stiletto-like blade, about an inch and a quarter long and almost as sharp as a needle. In fact, it is not unlike part of one of those large needles used by sail-makers known as roping needles, and it would seem quite capable of being driven completely through a man's hand by a stroke of the screamer's powerful wing. And yet we are told that the screamers are peaceable birds, associating amicably in large flocks, so that this array of spurs, like our modern ironclads, is strictly in the interest of peace.

*South America is particularly rich in anomalous birds, remnants or relics, one might say, of a bygone avifauna. The Hoactzin, *Opisthocomus cristatus*, forms an order by itself, and the three species of screamers, *Anhima anhima*, *Chauna chavaria* and *C. derbina* form another. So do the Tinamous (*Crypturi*), while the Trumpeter (*Psophia crepitans*), Cariama (*Cariama cristata*). and Guacharo Bird (*Steatornis caripensis*) each and all are isolated forms.

From spurs to claws is an easy transition, since the only difference between them is in their location, claws being at the ends of toes and fingers, while spurs are placed on or near the ankle and wrist. While the claws on a bird's wing, for claws as well as spurs are found there, serve no purpose as weapons and are seemingly of no use at all in old birds, they have a great deal of interest attached to them.

One who has had the good fortune to see the purple gallinule in its native swamps may have seen the little ones climbing out of their nest and scrambling over the branches very much like four-footed animals. Or, if not the purple gallinule, he may perhaps have seen the young of its humble relative, the Florida gallinule, pulling itself up some little incline by its wings, something as a bat hooks himself along.* If the

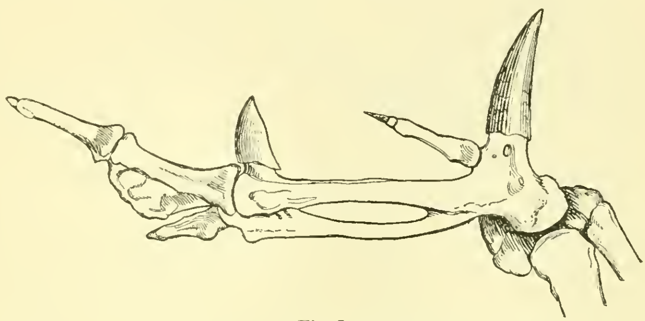

Fig. 7.

OUTER PORTION OF WING OF SCREAMER, ANHIMA ANHIMA.

Reduced.

observer has investigated he will have found on the outermost finger of the wing a small, sharp claw, and may have wondered what this claw was doing there.

This claw is of very common occurrence, and is especially frequent among water birds, or those which are lowest or most generalized in their structure. Sometimes this claw is so small as to almost escape detection, and again, as in the turkey buzzard, it may be so large that it can be found at once. Occasionally, very occasionally in fact, there is a second minute claw, or rudiment of a claw, hidden among the feathers at the very end of the wing bone, but this needs to be carefully looked for. Without a knowledge of fossil birds, it might be difficult to satisfactorily explain the presence of this useless claw, but if we regard rudimentary organs in existing forms as shadows of the past and vestiges of complete useful parts in extinct animals, the reason for its presence is clear, and we will look upon the little wing claws of modern birds as reminiscences of well-clawed ancestors. The earliest bird with which we are at present acquainted is the well known *Archæopteryx*, from the lithographic states of Solenhofen, Bavaria, and this form seems not only to have had wings for flight, but hands for climbing.

*Nuttall Bulletin, 1882, p. 124, and The Ibis, 1889, p. 577.

Unfortunately there is still some doubt as to the exact structure of the wing of *Archæopteryx*, and it seems probable that it is misrepresented in most text books.* One thing, however is undeniable, there were in this wing 3 well-formed, clawed fingers, and if only 2 of them were free, *Archæopteryx* could certainly climb about very readily.

It seems quite a transition from the long-tailed, toothed *Archæopteryx*, with its three clawed fingers, to the ordinary birds of to-day, the more that very few of the intermediate stages have been brought to light. Fortunately, however, there is a bird still living, and not uncommon, in parts of South America, which goes some distance toward bridging over the gap between gallinule and *Archæopteryx*. This bird, which on account of its many peculiarities, stands quite alone among modern birds, and is looked upon as the survivor of a great group of birds which has become extinct, is *Opisthocomus cristatus*. From the unpleasant odor of its flesh, acquired from its food of wild arum leaves, the bird is more commonly known as the stink bird, or stinking pheasant, while what Dr. Coues would term its "book" name is Hoactzin or Hoatzin.†

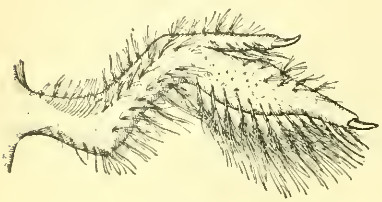

Fig. 8.

WING OF YOUNG HOACTZIN, OPISTHOCOMUS CRISTATUS.

Natural size.

Cat. No. 18523, U. S. N. M.

The adult birds not only have no claws upon their wings, but their thumbs, even, are so poorly developed that one would hardly suspect that in the nestlings we have the nearest approach to a quadruped found among existing birds. Mr. J. J. Quelch, who studied them in British Guiana,‡ tells us that soon after the hatching of the eggs the nestlings begin to crawl about by means of their wings and legs, the well-developed claws on the pollex and index being constantly in use for holding and hooking to the surrounding objects (fig. 8). If they are drawn from the nest by means of their legs, they hold on firmly to the twigs both with their bill and wings; and if the nest be upset by means of a rod pushed up from below, they hold on to all objects with which they come in contact by means of bill, feet, and wings, making considerable use of the bill, not only to reach objects above them, but also, with the help of the clawed wings, to raise themselves to a higher level. When the parent bird is driven from the nest, owing to the close approach of a boat, then the young birds, unless they be only quite recently hatched, crawl out of the nests on all fours, and rapidly try to hide in the thicker bush behind.

* Biological Theories, VII. The Digits in a Bird's Wing: A Study of the Origin and Multiplication of Errors, by C. Herbert Hurst, *Ph. D.* Natural Science, October, 1893, pp. 275–281. Also, The Wing of Archæopteryx. W. P. Pycraft, M. B. O. U. Natural Science, November and December, 1894, pp. 353–360, 437–448.

† Given to the bird by Buffon, who considered it to be the bird mentioned under that name by the Spanish writer Hernandez.

‡ The Ibis for 1890, pp. 327–335.

YOUNG HOACTZINS.
Slightly reduced in size.
Cat. No. 18523, U. S. N. M.

One curious feature noticed with a nestling which had been upset into the river was its power of rapid swimming and diving when pursued. As soon as the hand was placed close to it, it rapidly dived into the dark water, in which it was impossible to see it, and would rise at distances of more than a yard away. Owing to this power, the little creature managed to evade all attempts to seize it, taking refuge eventually far under the bushy growth where it was impossible to pursue it. The prolonged immersion which a nestling will thus instinctively and voluntarily undergo, or which an adult bird will bear in an attempt to drown it, seems quite remarkable.

The nestlings, even when quite small, are frequently found far away from any nest, climbing by the help of their clawed wings, after the parent birds during their feeding time.

Not the least of the many interesting features of the Hoactzin is the rapid change which takes place in the fore limb during the growth of the bird by which the hand of the nestling with its well-developed, well-clawed fingers, becomes the clawless wing of the old bird with its abortive outer finger. It gives us, as it were, an epitome of the past history of birds, and as the events of a century are summed up in a page of history so the slow progress of birds from the Jurassic *Archæopteryx* to the thrush of to-day is represented by a few weeks in the life of the Hoactzin.

NOTES ON THE ETHNOLOGY OF TIBET.

BASED ON THE COLLECTIONS IN THE UNITED STATES NATIONAL MUSEUM.

BY

WILLIAM WOODVILLE ROCKHILL,

Gold Medalist of the Royal Geographical Society, Corresponding Member of the Gesellschaft für Erdkunde, etc., etc., etc.

SYNOPSIS OF CONTENTS.

NOTES ON THE ETHNOLOGY OF TIBET.

[Based on Collections in the U. S. National Museum.]

By William Woodville Rockhill.

I.

TIBET—ORIGIN OF THE NAME—LIMITS—HISTORY OF ITS CIVILIZATION DERIVED FROM TIBETAN AND CHINESE SOURCES.

The word "Tibet," also frequently though erroneously written Thibet, represents two Tibetan words,* meaning "Upper Bod," by which name the central and western portions of Tibet are occasionally called by the natives, to distinguish them from the eastern portion, which is sometimes referred to as *Män-Bod* (*Sman Bod*), meaning "Lower Bod."

As to the meaning of the word *Bod*, different explanations have been offered by European scholars—that which has been most generally accepted, though on insufficient grounds, I think, derives it from the verb *hbod–pa* (pronounced *bodpa*) "to call, to speak," and attention has been called to the fact that the name *Slav* has a similar meaning.† Schlagintweit says the name is derived from a word meaning "force," and Vigne (Travels in Kashmir, II, p. 248) thinks it comes from the turkic and means nothing less than "the mountains of the people professing the Buddhist religion."‡

However this may be, Tibetans from whatever part of the country they come speak of themselves as Bod-pa, pronounced in some districts Beuba, in others, Bopa, and even Gopa. In colloquial Tibetan the country is called Beu lumba, Beu sa-ch'a or Beu yul, all meaning "the Beu (ba) country."

The earliest mention I have found of the word "Tibet" is in the Arab Istakhri's works (*circa* 590 A. D.), where it is used under the form *Tobbat*. Other Arab authors of a later date transcribe the word *Tobbat*, *Tubbat*, *Tibbat*, *Tibat*, and *Thabbat*. The earliest use of the

* *Stod* and *Bod* (pronounced *Teu-beu*).

† See Amédée Thierry, Histoire d'Attila et de ses successeurs, I, p. 284.

‡ This paper also embodies the personal observations made by the author during two journeys to Tibet in 1888–'89 and 1891–'92.

word by an European author is found in Plano Carpini's Historia Mongalorum (A. D. 1247), where it occurs under the form *Thabet*; Rubruk in his Itinerarium uses the form *Tebet*, as does also Marco Polo. (See H. Yule, Glossary of Anglo-Indian words, pp. 332, 698.)*

Mongols speak of Tibet as *Tangut*, and Tibetans they call *Tangutu*, and this is the origin of another appellation for this people and country sometimes used by European authors, Tangast (Theophylactus) and Tangut (Prjevalsky), which should, however, be discarded as useless and misleading, as the people inhabiting this section of country are pure Tibetans.

Tibet is geographically, roughly speaking, that section of central Asia which extends between the 76° and 102° of east longitude and from the 28° to 36° of north latitude, and, with the exception of its extreme western, southwestern, and southern portions, it forms an integral portion of the Chinese Empire.

Elisée Reclus (Géographie Universelle, VII, p. 20 *et seq.*) says that Tibet forms a vast half circle with a radius of 800 kilometers, and that it is one of the best defined natural regions in the world. He roughly estimates its area, rightly including in it the Kokonor Tibetan region on the northeast, and the other Tibetan-speaking countries on the west and south, at about 2,000,000 square kilometers.

It would be premature at the present stage of our researches into the question to give any opinion on the varied affinities of the Tibetans. Philologically they belong to the same linguistic family as the Burmese. Their national records have been so badly kept that they are of little service to us in solving the problem of their early home, and the Chinese annals do not enable us to go back earlier than the eighth century, A. D., at which time the Chinese came in contact with tribes of this race, then scattered throughout the northeast corner of Tibet between the upper Yang-tzŭ kiang, the Kokonor, and the western section of Kan-su and Ssŭ-ch'uan as far east as the river Min, in the latter province.

The purest type of Tibetan is still to be found among the pastoral tribes of that race, and when proper allowance has been made for foreign influences, everything points to a time when the whole Tibetan race lead a purely pastoral life, and it would seem that the early home of the Tibetan must be sought, not as they claim, in the valleys to the south of the city of Lh'asa, but to the northeast section of the country, somewhere near the Kokonor, to which region they probably came, as Chinese annals lead us to believe, from the east.

Reference has been made to Tibetan historical works as a guide in the intricate question of their national origin, but it is believed that these works are of little, if any, assistance. As a means of studying

* Throughout this paper Tibetan words are written phonetically, consonants are pronounced as in English and vowels have the sound of the corresponding Italian ones.

the growth of the country and its advance in civilization they are fortunately of a little more use.

I will here briefly give the principal data bearing on the subject which interests us, contained in a "Book of Kings," or Gyal-rabs sal-vai mé-long (Dr. Emil Schlagintweit's edition, 1866), which it must, however, be admitted is of comparatively modern origin and was unquestionably compiled under Chinese influence.

From this work we learn that in the first century B. C. there appeared in Tibet, in the valley of the Tsangpo ch'u and to the south of the city of Lh'asa, a marvelously endowed child whom the wild natives thought heaven had sent to rule them, and whom they took as their chief. This would point to intercourse with India during the earliest days of their national existence, but as the work goes on to show that this prince was a direct descendant of the Buddha Gautama, a descent than which none could be higher in the eyes of the devout Tibetans, we may doubt the accuracy of the record on this point.

In the reign of this first prince's seventh successor, consequently sometime in the second century A. D., it is stated that charcoal was made for the first time, and iron, copper, and silver were extracted from the ore, plows were introduced, and the irrigation of fields made known.

In the fifth century A. D., in the reign of Tri-nyan zung-tän, fields were for the first time fenced in, skin garments were made, walnut trees were planted, and reservoirs dug to supply water for irrigating the fields.

In the reign of his successor the yak was crossed with the domestic cow and the valuable cross-breed called *djo* obtained. Mules were imported into the country and the people were taught how to make bundles of hay. From the fact that grass is still at the present day twisted into heavy cables and allowed to dry in this shape and is so kept, both in Kashmir (see W. Moorcroft, Travels, II, 153) and in Tibet, it is probable that this method of bundling hay was learned from the former country.

In the seventh century Srong-tsan gambo ascended the throne of Tibet and in his long reign the country made rapid strides in civilization. Under his rule Tibet became an aggressive power and its armies attacked all the neighboring countries, China not excepted.

The King sent T'onmi Samb'ota to India to there find a system of writing applicable to the Tibetan language, and also to open negotiations for his marriage with a Nepalese princess.

T'onmi brought back an alphabet based on the *nagari* in use at the time in Kashmir, and composed of 30 consonants, 24 of which reproduced more or less closely their prototypes, and 6 were invented for sounds which did not exist in Sanskrit.

It is recorded in the Bodhimur (I. J. Schmidt, Geschichte der Ost Mongolen, p. 329) that the King wrote a treatise on horse breeding, besides several other lighter works.

With the Nepalese consort he had taken to himself, Buddhism, which had probably been known to, though not adopted to any extent by, the Tibetans prior to this date, became the state religion, and the form of that religion obtaining in Nepaul was adopted by the Tibetans, though a number of ceremonies and customs peculiar to their national Bönbo religion were retained by them and incorporated in the new faith.

With the Chinese princess who was married to Srong-tsan-gambo, somewhere about 635 A. D., many Chinese customs and valuable inventions found their way into Tibet. The Tibetan history from which most of the preceding data are obtained says that rice wine (*samshu*) and barley wine (*ch'ang*), butter, and cheese then for the first time became known in Tibet, the people learned how to make pottery, and water mills and looms were introduced into the country.

Chinese history tells us that when the king took the princess Wen-ch'eng to his capital, which he had but recently transferred to Lh'asa from a point further south, at or near the capital of the first king, Nya-tri tsanpo, he built her a palace in Chinese style,

But the princess, disliking the reddish-brown color with which the people were in the habit of coating their faces,* the king forbade the practise throughout the realm. He himself, discarding his felt and sheepskin garments, wore fine silks and brocades, and gradually adopted Chinese customs. He sent the children of his chief men to attend the schools of China, there to study the classics, and his official communications to the Emperor were written in Chinese. He asked the Emperor to send him silkworm eggs, wine presses, paper and ink makers. These things, together with the imperial almanack, were all sent him. (Wei-Tsang t'u chih, in Jour. Roy. Asiat. Soc., n. s., XXIII, p. 191.)

But more than anything else the introduction of, and the rapid conquest of the country, by Buddhist missionaries from Nepal, Kashmir, and China helped to mold the culture of the country into its present form, in which the arts and customs of India and China are found side by side overlaying the rude native civilization, though the latter is never entirely hidden from view.

Under the reign of the grandson of Srong-tsan gambo, Gung-srong du-jé by name, tea was introduced into Tibet from China, and earrings and new modes of hairdressing were brought there from India.

A little later on it is said that works on astronomy and astrology, medicine and surgery, were translated from Sanskrit and Chinese into the stilted, artificial literary Tibetan which had grown up since the introduction of the alphabet and the adoption of Buddhism in the country. (See W. W. Rockhill, Life of the Buddha, p. 201 *et seq.*)

At this point in the history of the civilization in Tibet, Chinese and native works alike fail us, but enough has been got from them to show

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* Tibetan women at the present day cover their faces with a black paste made of catechu and grease, to protect the skin, which in such a dry and windy country would, without it, be badly cracked. (See Jour. Roy. Asiat. Soc., n. s., XXIII, p. 225, and W. W. Rockhill, Land of the Lamas, p. 214.)

us that the present civilization and rather advanced degree of culture is entirely borrowed from China, India, and, I may add, possibly Turkestan, and that Tibet has only contributed the simple arts of the tent-dwelling herdsman. What history has partially disclosed to us will be more fully demonstrated by an examination of the Museum's Tibetan collections, and by a comparison of the habits and customs of the country with those of the people living beyond its eastern and southern borders.

II.

CHARACTER OF THE COUNTRY AND PEOPLE.

Tibet is naturally divided into three parts, according to the altitude of the country above sea level and the trend of the valleys:

(1) The northern plateaux, extending over more than 12° of longitude (from east longitude 80° to 92°) and over 6° of latitude (from 30° north to 36°), which are over an average altitude of 15,000 feet above sea level and are inhabited by a scanty population of seminomadic pastoral tribes called Drupa (*Hbrog-pa.*)

(2) Valleys which run either parallel to the southern edge of this great northern plateau or which, having their heads on its eastern edge, trend in an easterly direction for a few hundred miles, and which nowhere descend below an altitude of 10,000 feet above the level of the sea.

(3) Valleys trending approximately north and south in the eastern portion of this country and which descend to an altitude of 6,000 feet above the level of the sea.

In the country comprised in these last two regions permanent habitations and cultivation are found up to an average altitude of about 13,500 feet, which is also approximately the height of the timber line in this latitude.

The northern and southern trend of the valleys in the eastern portion of this third region, opposing no barrier to the moisture-laden clouds driven by the southwest monsoon, the region around the Kokonor and all the country to the southwest of it has probably a much heavier rainfall than any other part of Tibet, and the lower portions of all the valleys in this region are consequently much more fertile than others of the same altitude, but trending east and west, along the northern slope of the Himalaya.

All these natural conditions have exercised marked influence on the degree of culture and on the peopling of the different sections of this country, and must not be lost sight of in any study of the inhabitants and their relationship and intercourse with other tribes and peoples.

With the exception of the extreme northern and northeastern portions of the region here called Tibet, the population belongs essentially to one race, and, as elsewhere mentioned, the purest representatives of this stock are to be found among the pastoral tribes, or Drupa, which, whether found around the Kokonor, in eastern, western, or central Tibet, offer a uniform type which may be called the *Drupa type.*

The second type of the Tibetan race is found in those sections of the country in which there are permanent habitations. It is a mixed race, becoming more Chinese as one goes toward China, or more Indian (Nepalese or Kashmiri) as one travels southward or westward. The reason of the very pronounced departure of this portion of the present Tibetan population from its original type is easily accounted for in the custom of foreign traders, soldiers, pilgrims, or officials inhabiting the country, of never bringing their wives into Tibet, but taking native concubines, a custom, by the way, common in most parts of Asia. In as small a population as that of Tibet, which does not probably exceed 3,000,000 (Journ. Roy. Asiat. Soc., n. s., XXIII, p. 14), where the principal centers of population are and have been inhabited by comparatively large numbers of foreigners for several centuries at least, this profound alteration of the primitive type is easily accounted for in this manner.

Among the Drupa Tibetans the males measure about 5 feet 5 inches; the females not appreciably less.* The head is brachycephalic; the hair, when worn, is nearly invariably wavy; the eyes are usually of a clear brown, in some cases even hazel; the cheek bones are high, but not as high as with the Mongols; the nose is thick, sometimes depressed at the root, in other cases prominent, even aquiline, but usually narrow, but the nostrils are broad; the teeth are strong, but irregular; the ears, with tolerably large lobes, stand out from the head, but to a less degree than with the Mongols; the mouth is broad, the lips not very full, and among the people in the lower regions decidedly thin; the beard is very thin and, with the exception of the mustache, which is sometimes worn, especially in central Tibet, it is carefully plucked out with tweezers. Though I have seen a few men in central Tibet, at Draya and Ch'amdo, for instance, with tolerably heavy beards and hair all over their bodies, as a general rule Tibetans have no hair on their limbs or chests. The shoulders are broad, the arms normal; the legs not well developed, the calf especially small. The foot is large, the hand coarse.

The women are usually stouter than the men, their faces much fuller; their breasts are not large, nor are they very pendent. They do not appear to be very prolific; I have never seen in any one family more than six or seven children; many are barren. They do not entirely lose their good looks before 30 or 35. They are as strong, or perhaps even stronger than the men; because, obliged to do hard work from childhood, their muscles are more fully developed than those of the men, who neither carry water on their backs, work at the looms, nor tend the cattle. The women's hair is long and coarse, but not very thick; it remains black, or only mixed with a little white to extreme old age. I have rarely seen one with white hair; this remark applies also to the men.

* See Brian H. Hodgson, miscellaneous essays relating to Indian subjects, II, p. 95.

There is very little, if any, perceptible odor about the Tibetan's person, save that which is readily traced to dirty clothes. Partial baldness in both sexes is not uncommon. Their heads they keep tolerably clean by frequently anointing the hair and scalp with butter, but vermin is common among them, especially with the women, and it is a very common sight to see a number of them crouching before their houses in the sun cleaning the head of a husband, a child, or a friend; all captures belong to the original owner, who eats them with relish, saying, "As they live on me, they can not be unclean food for me, though they might be for anyone else." Washing the body is never, or hardly ever, indulged in, except involuntarily when fording a stream or when drenched by the rain.*

The skin of the Tibetan is coarse and greasy. Its color is a light brown, frequently nearly white, except where exposed to the weather, when it becomes a dark brown, nearly the color of our American Indians. Rosy cheeks are quite common among the younger women.

The Tibetans' voices are powerful, those of the men deep; those of the women full and not very shrill. Their hearing is good, and they can converse freely from one side of a valley to the other, a distance of fully a half a mile, without ever having to repeat phrases or perceptibly raise the voice. In singing their voices are pitched in a lower key than is usual among Chinese or Mongols, and in their church services the voices are always a deep bass. Their sight does not appear to be exceptionally sharp, but I have seen few nearsighted persons among them, though blindness, resulting generally from cataracts, is rather common, also opthalmia, attributable in a great measure to their using hats but rarely, and to the pungency of the smoke in their dwellings.

They can endure exposure without any apparent inconvenience. In the coldest weather I have seen them slip the upper part of their bodies out of their sheepskin gowns to perform any kind of work requiring freedom of motion. The women do nearly all their work with the the right side of the body completely exposed, and they put no clothes on very small children except in the coldest weather, allowing them to move about naked, or with only a pair of boots on.

Hunger they can also endure, and they are at all times small eaters. Eating a little whenever they drink their tea, they never take a hearty meal, but stave off continually the pangs of hunger. Though the nature of the food they use is such that they can not endure absolute privation from all food for any considerable length of time, they can with ease travel for long periods on starvation rations.

The average length of life is not very much shorter in Tibet than among the Mongols, though it is certainly lower than among the Chinese. I have seen but few old men among them, and they were not

* Speaking of their neighbors, the Mongols, William of Rubruk remarks: "Vestes nunquam lavant quia dicunt quod Deus tunc irascitur, et quod fiat tonitrua si suspendantur ad siccandum. Immo lavantes, verberant, et eis auferunt." (Itinerarium, Edit. Soc. Géog. de Paris, p. 234.)

over 80 years of age. A man of 70 is held to be very old, and I have not seen a woman of that age. The age of puberty is reached in the males about the fifteenth year, and among the girls possibly a little sooner. The women bear until at least 35. The mothers never wean their babies; a child continues to suckle until another comes to take its place; I have repeatedly seen children of 4 years of age walk up to their mother and take her breast. Among the natives married to Chinese infanticide is sometimes practiced, as I have been assured by the husbands themselves, but as a general rule the Tibetan women are good mothers, and the fathers show great fondness for their offspring.

The most common abnormality I have noticed among Tibetan men is a supplementary finger, usually growing from the thumb, and in one case from the side of the palm nearest the little finger. This is also a common deformity in China. I have seen two cases of men having club feet, or an imperfectly developed foot with a shortened leg. One case of distortion of the spine and one of supernumerary teeth (or double row of lower teeth), have also come to my notice, and Ashley Eden (Report on the state of Bootan, p. 76) mentions three albinos in a family of Tibetans in Bhutan.

Father Désideri, who lived in Tibet for thirteen years (A. D. 1716–1729), says that "The Tibetans are naturally gentle, but uncultivated and coarse" (Markham's Narrative of the mission of George Bogle, p. 306); and Father Horacio della Penna, another missionary to that country in the eighteenth century, says:

The Tibetans, speaking as a rule, are inclined to vindictiveness; but they know well how to dissemble, and when opportunity offers will not fail to revenge themselves. They are timid and greatly fear justice. * * * If, however, they are protected by some great lord, they lay aside all fear and become arrogant and proud. They are greedy of money; * * * they are also somewhat given to lust; * * * they are addicted to habits of intoxication; * * * they are but slightly loyal to their chiefs; * * * they are also dirty and nasty and without refinement. (*Ibid*, p. 318.)

Father Desgodins, who has been living in Tibet since 1856, thus describes the Tibetan:

It appears to me that the Tibetan, no matter who he may be, is essentially a slave to human respect. If he believes you great, powerful, and rich, there is nothing he will not do to obtain your good will, your favors, your money, or even a simple mark of your approval. If he has only something to hope for, he will receive you with all the signs of the most profound submission or of the most generous cordiality, according to circumstances, and will make you interminable compliments, using the most fulsome and the most honied expressions that the human mind has been able to invent. In this line he might give points to the most accomplished flatterer of Europe. If, on the contrary, he thinks you of low station, he will only show you stiffness, or at the most, formal, unwilling politeness. Should your fortune change, have you become a beggar in his eyes, abandoned and without authority, he at once turns against you, treats you as a slave, takes the side of your enemies, without being ashamed at the remembrance of his former protestations of devotion and friendship, without listening to the dictates of gratitude. A slave toward the great, a despot to the small, whoever they may be, dutiful or treacherous, according to circumstances, looking always for some way to cheat, and lying shamelessly to attain his end. In a word, naturally and essentially a false character. Such is, I think, the Tibetan of the cultivated countries of the south, who considers himself much more civilized than the shepherd or herdsman of the north, with whom I have had but little intercourse, and of whom I do not pretend to draw the portrait.

One readily understands that with such a character, with dissolute habits, the Tibetan becomes easily cruel and vindictive. Often discussion, begun in laughter and usually while drinking, ends with drawn knives. If he has not appeased his anger, he never forgives. Revenge alone can pacify him if he believes himself insulted. But he does not show it at first. On the contrary, he affects to live on good terms with his enemy. He invites him, trades in preference with him, but he will put a ball in his chest after a good dinner, during which he has shown himself most friendly and has sworn the other lasting friendship.

Such are the principal faults of the Tibetan. What are his virtues? I believe his mind is instinctively religious, and this leads him to willingly perform certain external devotional practices and even to go on long and trying pilgrimages, which cost him, however, but little money. As to religious convictions, he has absolutely none, a result of the profound ignorance in which the lamas leave the people, either on account of their incapacity to teach them, or perhaps so as to keep the business of worship in their own hands, as it insures them a large revenue. The religious acts of the people are only performed through routine; they do not understand them or care to understand them; hence ignorance in the lower classes, scepticism and indifference in the others, principally among the mandarins and lamas. The Tibetan's other virtues are nearly all material ones, if I may use such an expression; thus, he bears with ease and for long periods cold, fatigue, hunger, and thirst; but if he finds good compensation for his sufferings, he will never overlook it. He is generally active, but less industrious than the Chinese, and arts have advanced much less in Tibet than in China. While at work, he sings without a care; at a feast, he goes gossiping about and drinking with his friends; he sings, dances, and drinks during the night without a recollection of the sorrows of the day before, or without thinking of the cares of the morrow. Such is the Tibetan as I have known him. (C. H. Desgodins, Le Thibet, pp. 251–253.)

Though Father Desgodins has lived longer among Tibetans than any other foreigner of whom I know, still the opinions of other travelers must not be overlooked. Turner (Embassy to the Court of the Teshoo Lama, p. 350) says:

The Tibetans are a very humane, kind people; I have personally had numerous opportunities of observing their disposition.

Humanity, and an unartificial gentleness of disposition, are the constant inheritance of a Tibetan. I never saw these qualities preserved by any people in a more eminent degree. Without being servilely officious, they are always obliging; the higher ranks are unassuming; the inferior, respectful in their behavior; nor are they at all deficient in their attentions to the female sex; but, as we find them moderate in all their passions, in this respect also their conduct is equally remote from rudeness and adulation.

Capt. Turner, it is not amiss to remark, attributes these pleasing qualities of the Tibetan to the much-abused practice of polyandry.

Though I would not care to put up my opinion against men who have had so much more experience than I of the native character, I can not but think that the Tibetan's character is not as black as Horace della Penna and Desgodins have painted it. Intercourse with these people extending over six years leads me to believe that the Tibetan is kind-hearted, affectionate, and law-abiding, and that many of the most objectionable features in his character, those on which Desgodins chiefly dwells, only appear in his intercourse with foreigners with whom he has had hardly any relations, and whom he instinctively fears and mistrusts, in view of the open hostility shown them by the official class throughout the country.

Let us finish this sketch of Tibetan character by quoting what they say of themselves, and we need not judge them more harshly than the author of the Mani Kambum:

> The earliest inhabitants of Tibet descended from a king of monkeys and a female hobgoblin, and the character of the race partakes of those of its first parents; from the king of monkeys (he was an incarnate god) they have religious faith and kind-heartedness, intelligence, and application, devotion to religion and to religious debate; from the hobgoblin, their ancestress, they get cruelty, fondness for trade and money making, great bodily strength, lustfulness, fondness for gossip, and carniverous instincts. (Land of the Lamas, p. 359.)

III.

ORGANIZATION—CONSANGUINEAL—POLITICAL—INDUSTRIAL.

Our present knowledge of Tibetan society is still too imperfect to justify touching on this subject except with extreme caution.

As far as I have been able to ascertain during my residence among the Drupa or tent-dwelling tribes of Tibet, which, as previously stated, I am led to believe represent the purest type of that race, and in which the earliest form of Tibetan civilization has been well preserved, all the members of a clan have no family name except that of the chief or clan which is prefixed to their own. Thus, there are the Konsa, Chamri, Arik, Nyam-ts'o, Chu, Su, Na, etc., clans, and individuals of these clans are spoken of as Chamri Solo, Nyam-ts'o Purdung, Konsa Arabtan, etc. While a man may marry a woman either of his own tribal name or one of another, he may not a relative within at least three degrees, and chiefs do not marry, I think, in their clans. The looseness of the marriage relations, the difficulty of identifying people who are only known by surnames, such as Lobzang, Dorjé, Drolma, etc., all names of Buddhist origin, together with the habit of never using a person's name when addressing him or her, and the very marked disinclination of this people, in common with most Asiatics, I may remark, of speaking of their families or family affairs, make researches on this subject extremely difficult. The fact that throughout Tibet not only polyandry but also polygamy obtains, adds wonderfully to the confusion in which the question of consanguineal organization is involved.

Sarat Chandra Das (Narrative of a journey round Lake Yamdo, p. 73) says:

> In Tibet there are no social restrictions or hindrances to marriage. The rich may bestow their daughters on the poor, the daughter of a poor man may become the bride of the proudest noble of the country.

The Annals of the T'ang Dynasty (T'ang shu, Bk., 221, quoted in Land of the Lamas, p. 338) speaking of the T'ang-hsiang, a pure Tibetan tribe living in the seventh or eighth century, A. D., somewhere near the western border of the Chinese province of Kan-su, says of them:

A son may marry his deceased father's or uncle's wife (or wives); a younger brother his deceased brother's wife, but he may not marry a person of the same cognomen as himself.

Speaking of the Eastern Kingdom of women (*Tung nü kuo*), also a principality of eastern Tibet of the same period, and of which the people may have been Tibetans, the same work remarks that "the sons take the family name of their mothers." (Land of the Lamas, p. 341.)

In the more highly civilized portions of Tibet there is no trace of family or tribal organization, nor is there any of castes. Certain families in each district, town, or city have acquired wealth, and numbers of them have held official positions—some in the church, others in the state—for many generations past. Around them, or on the land granted them by the state (*jaghirs*, they call such grants in India), live numerous tenants, serfs (*misser*), or slaves in some parts of the country, but they are held as members of the family they serve, and the misser at least are not bound to the land, but may move where they please.

Butchers, those who cut up corpses, beggars, and criminals, are the only persons at the present day who do not enjoy the same social privileges as are granted to the highest classes. Dyers and workers in metal are also, in some localities, looked down on, and the ostracism of these two latter classes is in all probability a result of continued intercourse with India.

As further bearing on the subject of relationship, it is interesting to note that, while the Tibetan language is comparatively rich in words expressing "father," "mother," "brothers," in relation to age, or to sisters, uncles, and aunts, it has only one word for "nephew" or "niece," and this is also used for "grandson" and "granddaughter," and it has none to express "cousin," but the word *pon* (*spun*), "brothers," or "brothers and sisters," is sometimes used to express this relationship. (Land of the Lamas, p. 213.)

The following table gives all the names for the various degrees of relationship that I have been able to note, in the Lh'asan and the eastern Tibetan dialects: *

English.	Lh'asan.	East Tibetan.
Grandfather	Amnyi	
Grandmother	Amnyi	
Father	Ap'a	Ap'a.
Mother	Ama	Ama.
Father's brother	Akeu	Kuwo ch'e-wa.
Mother's brother	Ajong zangbo	Kuwo ch'e-wa.
Aunt	Ané	Kuwo ch'e-wa.
Stepfather	Ané	P'aya.
Stepmother	Ané	Maya.
Son	Bu	Bu.
Daughter	Bumo	Bumo.
Elder brother	Punjya	Bui.
Younger brother	Chung-wa	Lo-ch'ung.
Grandson	Tsabo	Yangtsa.
Granddaughter	Tsamo	Yangtsa.
Husband	Kyoga	Jyéba.
Wife	Kyoma	Jyémo or Namo.
Cousin	Akeu-gi pugu (lit. "uncle's child"). Ané-gi pugu (lit. "aunt's child").	

* See, however, Jaeschke, Tib. Engl. Dict., s. v. *ch'ung*, *et passim*.

Politically Tibet may be divided into three parts: (1) Country under direct Lh'asan rule or influence; (2) country under Chinese rule or influence; (3) country under British or other rule or influence.

The first part comprises all central, western, most of the northern portion of the country, and a few outlying districts in eastern Tibet, such as Märk'ams, Nyarong, Ts'arong, etc. The second part includes all northeastern Tibet, most of eastern, and a long, narrow strip called Jyadé, extending nearly as far west as the Tengri nor. The third part comprises Sikkim, Bhutan, Ladak, etc.

The spiritual and temporal ruler of the Kingdom of Lh'asa (Déba djong is the term usually employed by natives to designate this portion of Tibet) is an incarnation of the god Shenräzig, the patron saint of the land. He is called Jyal-wa jyamts'o or Talé lama. Prior to 1720 the Talé lama was only spiritual ruler of Tibet, but at that date he was also made temporal ruler of the country by the Chinese. (Journ. Roy. Asiat. Soc., n. s., XXXIII, pp. 74, 285 *et seq*).

Under him is a regent, colloquially called "King of Tibet," or *Désri*, who is also a lama, chosen in turn from one of the four great monasteries (*ling*) of Lh'asa, and whose appointment is made, like that of the Talé lama himself and of all other high dignitaries of the state, subject to the approval of the Emperor of China. The Désri is president of the council of ministers, or *Kalön*, who are five in number, one lama and four laymen. These administer the country and act also in a judicial capacity. (Journ. Roy. Asiat. Soc., *loc. cit.*, p. 239.) The country for administrative purposes is divided into 53 *djong* or "districts," over which are *Djong-pön*, appointed by the Council of Ministers; they are both civil and military chiefs of their districts. Besides these there are a number of *Déba*, some of whom are chiefs of the pastoral tribes, or Drupa, inhabiting the more elevated and open parts of the country.

Certain tracts of land are assigned to officers of high rank for their support, in lieu of salaries, and others are given as endowments to lamaseries. On many, if not all, of these the beneficiaries have not only all the revenues derivable therefrom, but exercise also judicial rights over the people inhabiting these estates, who are their serfs, subject to all such *corvées* as they may see fit to order, such as working the land, going on caravans, on which they have also to supply pack animals or saddle ponies, supplying food to officers when passing through their place of residence, etc., all such service being known as *ula*.*

Although I do not believe that slavery exists in the greater part of Tibet, and certainly not among the pastoral tribes, beyond, perhaps, a

* For further details on the organization, both ecclesiastical and civil, of this part of Tibet, I must refer the reader to the following works: Sarat Chandra Das, Narrative of a Journey to Lh'asa in 1881–'82, p. 175 *et seq.*; Journal Royal Asiatic Society, new series, XXIII, pp. 10–12, 238–242; Land of the Lamas, p. 289 *et seq.*; C. H. Desgodins, Le Thibet d'après la correspondence des missionnaires, p. 263 *et seq.*; C. R. Markham, Narrative of the Mission of George Bogle to Tibet, p. 319 *et seq.*

mild form of domestic slavery or serfdom, in some of the outlying districts where there is a large non-Tibetan population, as in the Ts'arong province in southeastern Tibet, regular slavery prevails, persons becoming slaves through birth, debt, or crime, and their offspring being also slaves. (Land of the Lamas, pp. 285, 286.)

The second part of Tibet comprises that which is under Chinese rule and influence. It consists of the 18 districts of eastern Tibet, whose organization I have described elsewhere (Land of the Lamas, p. 218 *et seq.*), the Jyadé or "Chinese Province," and the Kokonor Tibetan districts. In the Jyadé there are 36 chiefs or Débas, chosen from among the most influential headmen of the country; they receive their appointment from the imperial Chinese minister resident at Lh'asa, and are in receipt of a yearly stipend from the Emperor of China of 100 ounces of silver. Under them are numerous chiefs of clans whose charges are hereditary. (Geographical Journal, III, p. 377.) The organization of the Tibetan tribes living around the Kokonor is similar to that of Jyadé, but the chiefs receive their commissions from the imperial resident at Hsi-ning (Kan-su). (Land of the Lamas, p. 73 *et seq.*, and Diary of a journey in Mongolia and Tibet, p. 122 *et seq.* and p. 288.)

The advantages to China of this organization are manifold, and have been demonstrated during many centuries of its history. With a minimum expenditure of forces and money, China attaches the frontier tribes to it through small allowances made to the most powerful chiefs, by granting the people certain advantages in trade (exemption from duties at all Chinese towns along the border), and by giving them liberty as to the administration of the internal affairs of their country. Whenever necessary a Chinese military expedition can vindicate the supreme authority of the Emperor by a small display of force, whether it be in Lh'asa or in the unruly districts of northeast Tibet.

T. T. Cooper (The Mishmee Hills, p. 131), speaking of the application of this system to the wild Indian hill tribes, says:

> It is a curious fact that, while we have only for a few years adopted this system of quieting some of the Indian hill tribes, the Chinese Government commenced several centuries ago by a similar system the subjugation of the numerous tribes on her western frontiers, which to-day form one of the finest and most effectual frontier guards formed by any country in the world. Along a hill frontier of over 600 miles the tribes of western China form a complete barrier against ingress from the west. The chief of every clan or tribe has a nominal rank conferred upon him, to which is attached a trifling annual stipend. He is furnished with an official dress, which he wears in the presence of all Chinese officials. He is allowed to visit the court of Pekin every five years at his own expense, if he chooses, as a mark of homage to the Emperor. Such visits, however, are properly discouraged by the Chinese officials, though the nominal privilege of being allowed to go to Pekin is grateful to the pride of the barbarians, and makes them feel that, although subjects paying tribute, they are still persons of consequence and allies of a powerful empire.

Although incorrect as to some details, I think Cooper has accurately weighed the value of this system to China.

The political organization of the third section of Tibet, which comprises Bhutan, Sikkim, and Ladak, is properly beyond the scope of this study. Suffice it to say that in Bhutan the dual organization noticed in Lh'asa of a spiritual and temporal ruler is found in the Dharma Rāja, the spiritual head of the state, and the Deb Rāja or temporal ruler; there is also a council (or Lenchen) of ten members, which has under it a certain number of district officers or Djongpon. (Ashley Eden, Report on the State of Bootan, p. 108 *et seq.*)

In Sikkim and Ladak a similar form of government obtains, with only slight differences, due to continued intercourse with or subjection by people of different origin.*

Industrial organization.—In all parts of Tibet, whether among the pastoral tribes or in the towns and villages, the women not only do most of the household work, but they attend to much of the bartering, make the butter, assist in milking the cows and looking after the flocks and go on the ula. The men, aided by the women, work in the fields, or go on distant journeys, hiring out their yaks or mules to carry freight, or hiring themselves out as mule or yak drivers to merchants or to some neighboring lamasery. Those who remain in their town or village sometimes follow a trade which occupies them during a small portion of their time. Some are smiths, working silver, copper, or iron, and, when needs be, becoming carpenters, gunsmiths, or locksmiths; others, again, occupy themselves, when industriously inclined, twisting yarn, weaving garters, or making felt. In the towns nearly all shops are kept by women.

Although the division of labor between the sexes is very unequal, much the greater part devolving upon the women, the position of that sex is not affected injuriously thereby. The wife's opinion is always asked in household matters and in questions of trade, and her authority in the house is supreme. She joins with the men in all discussions with perfect freedom and assurance, and in nearly every walk of life she is held to be on a footing of perfect equality by the male sex. Thus Turner (Embassy to the Court of the Teshoo Lama, p. 350) says:

> Comparatively with their northern neighbors, the women of Tibet enjoy an elevated station in society. To the privileges of unbounded liberty the wife here adds the character of mistress of the family and companion of her husband. The company of all, indeed, she is not at all times entitled to expect. Different pursuits, either agricultural employment or mercantile speculations, may occasionally cause the temporary absence of each; yet whatever be the result, the profit of the laborer flows into the common store, and when he returns, whatever may have been his fortune, he is secure of a grateful welcome to a social home.

Father Desgodins, speaking, however, more especially of eastern Tibet, says (Le Thibet, p. 244):

> It is not amiss to give here a further sketch of the condition of women in Tibet, where they are not confined to their homes as in India and in China. Here the women go about, look after their household affairs, or trade on the market place, work in the field, spin before their doors while gossiping with their friends, go on long journeys—

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* *See* J. D. Hooker, Himalayan Journals, II, p. 290 *et passim;* G. T. Vigne, Travels in Kashmir, Ladak, Iskardo, II, p. 252 *et seq.;* W. Moorcroft, Travels in the Himalayan Provinces of Hindoostan, II, pp. 11, 15, 20, 42, etc.

sometimes on foot, at others on horseback. In this respect the Tibetan woman is very free, but she is, nevertheless, the slave, the drudge of one or more husbands; she is bought like any other goods without asking her consent. In this way she, by right, becomes a kind of household chief, but she has to submit herself to all the wishes, the caprices, the brutal passions of her husbands. * * * In all heathen countries the woman is looked down upon as an inferior creature to man. The Tibetans have even a word to designate her by, which may be translated by "low creature."*

Father Huc (Souvenirs d'un voyage dans la Tartarie et le Thibet, II, p. 260) looks at the subject in a different light.

One thing which tends to make me believe that in Tibet there is possibly less depravity than in certain other heathen countries, is the great freedom enjoyed by the women. Instead of vegetating imprisoned in their homes, they lead a laborious life full of activity. Besides having the care of their households, they monopolize all the small commerce of the country. They peddle goods here and there, spread them out in the streets, and keep nearly all the retail shops. In the country they also take a large share in all family pursuits.

Chinese authors have found the cause of this superior position of Tibetan woman over those of most other Asiatic countries in their superior physique (Journ. Roy. Asiat. Soc., n. s., XXIII, p. 230, also Land of the Lamas, p. 211), but it is probably in part due to Buddhism, and still more to polyandry. The former by admitting women into the *sangha* raised them materially in the social scale; the latter by the important rôle it makes them play in the family life has had the same effect.†

Inheritance.—Property is inherited by the sons or brothers of the deceased. The daughters or wife get nothing. It is common, if not usual, for a wife, on the decease of her husband, to shave her head and become a nun or *ani.* This custom is also found among the Mongols.

According to Chinese authors (but I have been unable to corroborate their statements), none of the personal property of a deceased person is inherited by his relatives.

One-half of the property of the deceased is given away in charities and the other half is sent to the Lamas, who are invited to read the sacred books to his intent and entertained while so doing. It follows that all the (personal) property of the deceased is disposed of, the parents, children, husband, or wife retaining no part of it whatever. (Journ. Roy. Asiat. Soc., n. s., XXIII, p. 232.)

The real estate remains, however, in the family, and, consisting usually of a large house and some very small and not by any means fertile fields, not sufficient to support several families, it is usual to keep the estate undivided; all the children of the deceased live in the house of their parent, the sons only taking one wife to themselves.

**Sman-ba* (pronounced *manba*). This inferiority is not very noticeable among pastoral or nomadic tribes.

†Jaeschke, Tib. Engl. Dict., s. v. *spun*, says: "Several neighbors or inhabitants of a village, who have a common *lh'a* and thus become *rus-pa-gchig-chig*, 'members of the same family,' are called *spun* or brothers. This common tie entails on them the duty, whenever a death takes place in their number, of caring for the cremation of the dead body."

(Land of the Lamas, p. 211.) Among the pastoral tribes, the sons divide the flocks and herds of their deceased father, after deducting a considerable portion for presents to the clergy, but among them, as in the more civilized regions of the country, the widow does not inherit; she goes back to her family, or, if she has children, becomes dependent on them, or else she becomes an *ani*.

IV.

DRESS AND PERSONAL ADORNMENT.

The earliest description I have met with of a Tibetan tribe, the T'ang-hsiang previously referred to, is in the Annals of the T'ang dynasty of China (A. D. 618–907). It is said of them: "Men and women wear long skin gowns, or gowns of coarse woolen stuff with a rough surface" (Land of the Lamas, p. 338). Of the Tukuhun, who inhabited the Kokonor, and were possibly of Tibetan stock, we read in the Annals of the Sui dynasty (A. D., 581–618) that their women "did up their hair in plaits, on which they sewed beads and cowrie shells; they wore long gowns and the men wore broad-brimmed hats." (*Op. sup. cit.*, p. 336).

Friar Odoric, who visited Tibet in the early part of the fourteenth century remarked that "the women have their hair plaited in more than one hundred tresses" (H. Yule, Cathay and the way thither, I, p. 150), and since that time the fashion of dressing and wearing the hair has not materially altered in the wilder parts of the country, although under Chinese and Indian influences the fashion has been slightly changed in parts of the country adjacent to those inhabited by people of these two races.

The national dress of both sexes consists in a very full, high collared, large, and long-sleeved gown called *ch'uba* (a word of Turkish origin). This gown is of sheepskin in winter, of native cloth (*truk* or *ta*)* in summer. It is tied tightly around the waist with a woolen girdle so as to make it very baggy about the waist, and it reaches down to about the knee when worn by men and to the ankle when worn by women. In a large part of the country this is the only garment worn. The collar and cuffs and hem are sometimes faced with black velvet or red or blue cloth, or striped *truk*, or with otter or leopard skin. Buttons are not usually used, although those of Chinese make or army buttons obtained from India are much sought after, and small silver coins (half rupees generally) are frequently made into buttons, but more on account of them being ornamental than for any use they are put to.

The cut of the *ch'uba* and the way of wearing it differ in various parts of the country; the pastoral Tibetans wear it much shorter than those living in towns and villages, and who do not pass much of their time riding or climbing. So likewise the trimming of the cuffs and sleeves differs according to the tribe.

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* See for a description of these native cloths, p. 699.

GIRL'S CH'UBA OF STRIPED TRUK, TRIMMED WITH OTTER FUR.

Cat. No. 131209, U. S. N. M.

In the case of the summer cloth *ch'uba*, the favorite color for men when it is made of *truk* is purple. The color of the *ch'uba* worn by women is blue, or striped throughout eastern Tibet. *Ta* (or *lawa*) is an undyed woolen stuff usually of coarser texture than the *truk*. One *ch'uba* in the collection (No. 167195)* is of fine purple *truk* trimmed with leopard skin. Another is of undyed *ta*, made at Draya, the collar faced with striped *truk* (No. 167196).* In this section of country the people do not usually wear sheepskin *chu'bas*, and a gown of undyed *ta* is commonly worn over an inner one of purple or blue *truk*. The length of the *ch'uba* shown in pl. 1 is 5 feet 5 inches; this is the average length of all such garments, which have no particular fit, or rather which fit any wearer.

The sheepskin *ch'uba* (No. 167194) *, such as is worn by the Tibetans of the Kokonor, is also found in eastern Tibet. The collar and cuffs are faced with red cloth and otter skin, and the hem with black velvet stitched with silks of different colors. This gown is a very handsome one of the kind.

Another *ch'uba* in the collection (No. 131062) * is of red *truk* lined with sheepskin. Such gowns are usually worn by lamas, but many laymen also wear red clothes, the color being a favorite one in Tibet and Mongolia.

In pl. 1 is shown a *ch'uba* for a girl of 12. It is made of striped *truk*, in which green, red, white, and blue preponderate. It is trimmed on the collar and cuffs with otter skin.

In L'hasa and the more civilized portions of Tibet generally, *ch'ubas* of foreign broadcloth or Chinese gowns (*ao-tzŭ* and *p'ao-tzŭ*) of silk or satin are frequently worn by the wealthy of both sexes. These are too well known to require description.

Rain coats made of felt and cut on a pattern similar to the *ch'uba*, though somewhat shorter (4 feet 8 inches) on account of the stiffness of the material, are worn in the Kokonor district and in some other portions of northeastern Tibet. The museum collection contains one of these (No. 131050).* A circular cape of felt is worn instead of this in the Horba country. It is especially useful on horseback, covering not only the rider but the horse completely, and is large enough to enable the wearer to wrap himself in it and sleep well protected without any other covering. I do not believe that similar garments are worn in central or western Tibet. Good *truk* is waterproof, and light *ch'ubas* are often carried by travelers to use in bad weather.

The girdles worn are usually of woven wool, from 2 to 3 inches broad and 6 or 7 feet long. The patterns vary in color, but little in design, which is always a narrow traverse stripe. The collection contains one of red, blue, white, brown, and yellow wool (No. 167291),* terminating at either end in a fringe. Another girdle is of red, blue, green, black, and white wool (No. 167289).* Very frequently a few yards of Chinese silk or a piece of Chinese blue cotton cloth take the place

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* Not illustrated in thispaper.

of the home-made girdle. Other specimens in the collection, such as the one from Jyadé, may be compared with this.

A pair of boots (*lh'am*) completes with the *ch'uba* the costume of the wild Tibetan. Near the Chinese border, in the Kokonor, these boots are of cowhide and of Chinese make and pattern, as shown in pl. 2. Women and men wear the same kind of boot. It is bound tightly below the knee with a leather thong or a long garter of wool.

In localities more distant from China the national boot is found. It has a sole of raw yak hide which laps and turns up around the sides, which are of several thicknesses of white cotton cloth strongly stitched together with a broad seam down the middle of the top to the turned-up pointed toe. Sometimes, in men's boots, the upper and leg is of red leather, brought to Tibet from western China, the best coming from the Chien-ch'ang, in southwestern Ssŭ-ch'uan. The legs of most boots are of *truk*, sometimes of one color, sometimes of pieces of different and somewhat gaudy colors, as shown in pl. 2, figs. 1 and 2. The leg of the boot is usually lined with a very coarse woolen stuff, and no socks are worn on the feet. The garters are about 4½ feet long and 1 inch broad, the designs usually very narrow longitudinal stripes. Some of them are beautifully fine and show great taste in the selection of the colors. (See pl. 13.)

Among lamas the legs of the boots are invariably red and the uppers are always of white cotton cloth. Some fine boots are made with the uppers and legs of red leather, or the legs of red and black leather, as in fig. 4. Another very handsome pair of boots in the collection (No. 167179 and Diary of a Journey, etc., p. 14, fig. 5)* is worn only by high lama dignitaries in the northeast part of the country (Kokonor). This boot is entirely of red russian leather, and the seams are covered with embroidery in different colored silks.

In Lh'asa and among Tibetan officials in the more civilized portions of the country generally the Chinese official velvet or satin boot is frequently worn, as is also a boot of black buckskin of Chinese pattern, as far as the foot and sole are concerned, but with a high Tibetan leg. This latter style is worn with a garter, is made in many localities by Chinese artisans, and is much liked by the natives. (See Diary of a Journey, etc., p. 14, fig. 6.)

Trousers are occasionally worn by the men; they are always made like those worn in China, and are of either sheepskin, native cloth, or coarse cotton, rather baggy, and reach down to about the ankle, where they are held by a garter. The boot is worn over them. In some of the more civilized portions of the country leggings (*tao-ku*), like those used by Chinese, are also worn by the wealthy.

Men and women frequently wear a short shirt of raw silk (*buré*, in Tibetan), reaching to above the waist and with long sleeves. Among the Kokonor Tibetans and in eastern Tibet it is made with a broad

*Not illustrated in this paper.

EXPLANATION OF PLATE 2.

TIBETAN BOOTS WITH GARTERS.

Fig. 1. TIBETAN BOOT AND GARTER. Truk leg, cotton top, yak hide sole.
(Cat. No. 131045, U. S. N. M.)

Fig 2. TIBETAN BOOT AND GARTER. Truk leg, leather top, yak hide sole.
(Cat. No. 131045a, U. S. N. M.)

Fig. 3. KOKONOR TIBETAN BOOT. Chinese manufacture. Woolen garter.
(Cat. No. 131072, U. S. N. M.)

Fig. 4. TIBETAN BOOT AND GARTER. Leather leg and top; yak hide sole.
(Cat. No. 167303, U. S. N. M.)

TIBETAN BOOTS WITH GARTERS.

collar faced with red cloth and edged with otter fur. The style of shirt worn at Lh'asa and in central Tibet generally is similar to the above, except that the collar is narrower. Examples of these shirts are in the Museum collection. *Buré* is manufactured in Bhutan.

In central and western Tibet the women frequently wear over their shoulders a shawl (*kadri*), fastened at the neck with a large buckle of gold or silver. In Ladak, instead of this shawl a sheep or lambskin cape is worn.

The Tibetans have adopted the Chinese waistcoat or *kan-chien*, a rather close-fitting garment buttoning at the neck and down the right side under the arm, with no sleeves, and large armholes. This they make of native cloth (*truk*) among the less civilized tribes, and in eastern Tibet it is nearly invariably of the striped pattern. It is worn next to the skin under the *ch'uba*. The Chinese riding jacket (*ma kua-tzŭ*), with short, wide sleeves and reaching down to a little above the waist, made of native cloth or of foreign broadcloth, is also often worn in central Tibet by officials and soldiers.

As previously stated, the *ch'uba* is the garment *par excellence* of all Tibetans, but only the pastoral tribes have strictly adhered to it; elsewhere the women more especially have adopted a modified costume. Thus, in parts of eastern Tibet, Bat'ang, for instance, over the *ch'ubas*, usually made of native cloth, but sometimes of blue cotton, they wear a kind of box-plaited petticoat reaching to the ankle and made of striped *truk*, or else an apron which nearly meets in the back. Others, as in Chala, wear a long sleeveless gown over the cloth *ch'uba*, the two bound around the waist by a sash.

In central Tibet the costume of the women of wealth is most elaborate, frequently of brocaded silk or satin, but the general style of dress is essentially the same, one or perhaps two long gowns, a shirt, and possibly a *kan-chien*. The boots of men and women are the same, though wealthy women also frequently wear Chinese velvet boots.

The men of Ladak wear a cloak (*La-pa-sha*) of woolen, thick and warm. It is usually white, or rather it has once been white; for as the people only wash themselves once a year, and never wash their clothes, their cloaks are always of a dirty hue. Round their legs, from knee to ankle, they have coarse woolen leggings (*rkang phying*) of felt, fitting tightly, or else wrapped close round the leg and secured by a garter (*rkang-gdub*), which is wound spirally round the leg from the ankle upward. The garter is generally black, but sometimes red. On their heads they wear either quilted skull caps, as filthy as their cloaks, or capes of sheepskin with the wool inside, and with a large flap behind, which covers the back of the neck as well as the ears. Those in better circumstances have fur caps of the same shape. Their boots are of felt, with soles of sheep or goatskin, which are turned up all round and sewn to the felt. The upper part of the felt boot is open to the front and is allowed to fall over, something in the manner of the boots worn in England in Charles II's time. (Alex. Cunningham, Ladak, p. 303.)

In Ladak the women wear a black woolen jacket with a large striped woolen petticoat of many colors, generally green, blue, red, and yellow, reaching below the mid leg. Over all they wear a sheepskin with the wool inside, secured, or rather skewered, in front by a large iron or brass needle. The poorest classes have the outside of the skin plain, but those in better circumstances cover it with coarse woolen baize, either red, blue, green, or yellow, with a broad border always of a different color. The upper classes cover this sheepskin cloak either with brocade or with silk. (Cunningham, *loc. sup. cit.*)

In Bhutan the dress is a loose woolen coat reaching to the knees, bound round the waist by a thick fold of cotton cloth. The full front of the coat is used as a pocket, and is well stored with betelnut, prepared chunam, etc. The women's dress is, like that of the Sikkimese, a long cloak with loose sleeves. Their chief ornaments are amber beads, corals with those who can afford them, and large pins. (Ashley Eden, Report on the State of Bootan, pp. 129, 130.)

Hats.—Among the Kokonor Tibetans, on account of the custom prevailing among the men of shaving all the hair off the head, some head cover is invariably worn. A low-pointed cap of green, red, or blue cloth or cotton and faced with lambskin is the most common head cover worn by men and women (pl. 3). This cap is also worn by the Mongols in this region, but the latter usually add to it a red tassel or fringe fixed to the apex and hanging all over the crown.*

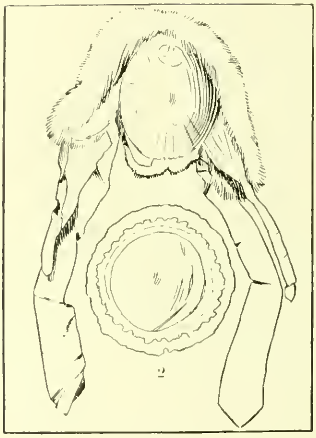
In winter the men wear a pointed cap of felt, sometimes covered with blue or red silk, with ear flaps, a large flap behind and one in front, which is frequently worn slightly inclined forward so as to make a visor. These flaps are covered with fox skin (pl. 4). The women and girls of all ages wear, winter and summer, the low-pointed cap described above, though many always go bareheaded. Some of the wealthy ones wear a round cap wadded or made of felt and covered with silk, with a wide turned-up brim faced with fur, fox, or sable. It is copied on the Mongol hat for women, worn alike among the eastern as well as the western tribes of that race.

The above are the hats peculiar to the Kokonor Tibetans, and the one shown in pl. 3, fig. 2 appears, from Chinese works, to have been worn by them as early as the eighth century of our era. But besides these national ones, the Chinese felt hat is frequently worn by them, usually dark brown or black, with a brocaded band around the turned-up brim. This hat, which is very popular throughout Tibet, is worn by both men and women. A turban made of a piece of rather coarse raw silk dyed purple, about ten feet long and a foot broad, is also frequently worn by the men among the Kokonor Tibetans and in all other parts of the country.

In those sections of Tibet where the men never trim their hair, and where it forms a thick and tangled mass falling over the shoulders, only cut in a fringe just over the eyes, the poorer people either wear no head cover at all or only a piece of cloth or sheepskin arranged so as to come down over the ears. This rude head cover has no top to the crown; the tangled hair under it is a sufficient protection against the weather. A summer hat of a peculiar form is, however, worn in eastern

*According to a Chinese work entitled Hsi-Tsang fu, p. 2, these Kokonor Tibetans are descended from Turkish tribes which used to live in the Altai Mountains, and who at that time wore conical iron helmets shaped like the caps these Tibetans now wear.

EXPLANATION OF PLATE 3.



TIBETAN AND MONGOL CAPS.

Fig. 1. MONGOL FUR CAP. Wadded; covered with purple satin, trimmed with sable, red ribbons

(Cat. No 131182, U. S. N. M.)

Fig. 2. KOKONOR TIBETAN CAP. Red cotton; green rim, faced with lamb-skin.

(Cat. No. 131186, U. S. N. M.)

TIBETAN AND MONGOL CAPS.

EXPLANATION OF PLATE 4.

TIBETAN CAPS AND HATS.

Fig. 1. TIBETAN WINTER CAP. Felt; covered with green cloth, trimmed with fox-skin.

(Cat. No. 167193, U. S. N. M.)

Fig. 2. KOKONOR TIBETAN WINTER CAP. Felt; covered with blue satin, trimmed with fox-skin.

(Cat. No. 167189, U. S. N. M.)

Fig. 3. SUMMER HAT OF TS'AIDAM MONGOLS. Felt; rim faced with red cloth.

(Cat. No. 167191, U. S. N. M.)

Fig. 4. SUMMER HAT OF TIBETANS. Straw; covered with cotton cloth; rim faced with red.

(Cat. No. 167192, U. S. N. M.)

TIBETAN CAPS AND HATS

and northern Tibet, and also by the Mongols of the Ts'aidam. That worn by the Mongols of the Ts'aidam (pl. 4, fig 3) is of felt, the crown a truncated cone about 8 inches high with a flat top and about $4\frac{1}{2}$ inches in diameter where it joins the brim, which is some 15 inches in diameter. The brim is usually faced with red or blue cotton, and a string, with a slipknot drawn tight under the chin, holds it on the head. The summer hat worn in Tibet, and called *shara* or *chyar dja*, is higher and heavier. The crown and brim are made of blades of coarse grass bound together with woolen thread; over this is sewn white cotton. The inside of the brim is faced with red cloth. A band of felt about an inch broad projects from the base of the crown, and the head fits in it. It is held on the head by a throatlatch, on which slides a bead as seen in fig. 4. The specimen in the Museum is an exceptionally fine *shara*, made in Namru dé, near the Tengri nor. The inhabitants of this district are noted for the quality of the summer hats they manufacture. This hat is not, as far as I am aware, used in central or western Tibet, but I have seen it in common use among the K'amba of eastern Tibet. (Land of the Lamas, pp. 182, 256.)

The common fur-trimmed cap with a large flap behind and broad ear pieces, in general use in northern China and Mongolia (pl. 3, fig. 1), is manufactured in Peking for the trade; it is also in common use in Tibet. The Tibetan form is shown in pl. 4, fig. 1. In Lit'ang the men wear in summer a circular piece of white cotton cloth ornamented on the top with a blue-cloth disk, the center of which is red. A drawing string fixed in the lining enables them to fasten it on their heads, and their heavy queues are twisted around it. (Land of the Lamas, p. 243.)

George Bogle, who visited Shigatsé, in Ulterior Tibet, in 1774, thus describes the dress of the people of that country:

> The servants and peasants wear horizontal caps made of locks of sheeps' wool, dyed yellow. They are like the Scotch bonnets, but much larger. I never saw one above 3 feet in diameter. The women in the winter time cover their heads with small, rough caps of the same materials. Sometimes they dye them a deep blood-red. * * * The higher laymen wear tunics of satin, brocaded or plain, lined with sheep and lamb skin or Siberian furs, a round cap faced with fur and crowned with a silk tassel, and Bulgar-hide boots. Red broadcloth tunics are also far from uncommon. The women wear a jacket and petticoat, reaching a little below the knee, of coarse blanket, or serge, striped or plain, or of Chinese satin, according to their condition; Tatar stockings, soled with leather and gartered under the knee. When dressed, they have a piece of cloth thrown cloak-like over their shoulders. All ranks of them are at great pains in adorning their heads, plaiting their hair neatly enough with coral and amber beads, bugles, or pearls. They wear, also, necklaces of them, where the pieces of amber are sometimes as large as a hen's egg. The quantity of the two first kinds of beads that is on the head, even of a peasant's wife or daughter, is amazing. The last two sorts fall to the share only of the ladies. (C. R. Markham, Narrative of the Mission of George Bogle, etc., p. 120.)

Before passing to a description of the ornaments worn by Tibetans, it is necessary to describe the mode of wearing the hair, as most of the ornaments worn by the women are attached to their hair.

Among the men the head is either entirely shaved, as among the Panaka of the Kokonor, or they follow, in central and parts of eastern Tibet, the Chinese fashion of shaving all the hair except on the crown, and doing that up into a queue, or else the hair is allowed to hang down naturally over the shoulders and is trimmed over the eyes, as among the Drupas. Among these latter a concession is usually made to Chinese ideas, and while wearing the hair in the last-mentioned way, a portion of it is plaited into a queue, or a queue of false hair is fastened onto the shaggy mop of natural hair and falls down to the ground.*

Among the women the national mode of arranging the hair, a mode which in slightly modified forms is found from Ladak to the Kokonor, is to make innumerable little plaits falling from the crown of the head down over the shoulders and reaching to the waist. (See Diary of a Journey, etc., p. 266.) In some parts of the country, as in Bat'ang, Chala (Ta-chien-lu), etc., the hair is worn in one big plait hanging down the back, while in central Tibet (Lh'asa, Shigatsé, etc.) it is done up in two or three large plaits, worn either hanging down in front or more usually twisted around the head. In certain parts of Jyadé a combination of the national headdress and the Chinese queue is the style adopted. The mode of dressing the hair does not vary in the same locality among the unmarried and married women, though the ornaments do, the married ones wearing many more, but among the males it is customary to keep boys' heads completely shaved till they are nearly nubile.

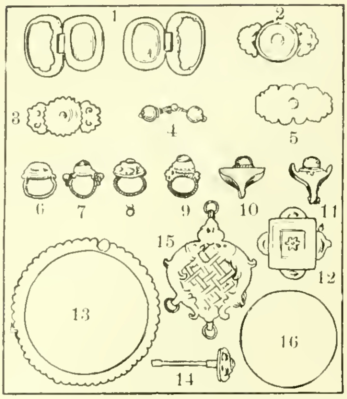
Though the men among the pastoral Tibetans take absolutely no care of their hair, beyond rubbing occasionally a little butter on the scalp, by which means, they say, they keep out vermin and the skin is made healthier, the women devote much time to rearranging their frequently elaborate headdress, combing the hair (they use the coarse heavy wooden Chinese combs) and in plaiting it once or more a week.

The only Tibetan men who wear ornaments on their hair are to be found among the pastoral tribes, where a large queue, usually of false hair, is worn in addition to their full suit of tangled locks. On this queue, which terminates in a tassel of black silk and frequently reaches to the ground, they either string finger rings (pl. 5, figs. 10 and 11) and rings of ivory, or they sew on a narrow strip of red cloth big pieces of turquoise and small charm boxes, similar in shape and size to fig. 12. This band is fastened on the queue at about the height of the shoulders and reaches to the waist or lower. The queue is usually worn wound around the head, and the ornaments on it form a crown, the big ivory ring being always in front.

An earring is worn in the left ear by the men in most parts of Tibet. In the Kokonor it is a large gold or silver hoop about 2 inches in diam

* E. H. Parker, China Review, XVIII, p. 57, says: "Long before the Mongols existed as a State the Nüchen Tartars were called *pien-fa-cho* ('queue wearers') by the Chinese, and, like their kinsmen, the Manchus, they made the Chinese they conquered shave their heads."

EXPLANATION OF PLATE 5.



RINGS, BUCKLES, AND OTHER ORNAMENTS.

Fig. 1. PAIR OF GILT CHATELAINES. Large turquoise in center.
(Cat. No. 131180, U. S. N. M.)

Fig. 2. GOLD SHIRT BUCKLE. Turquoise around coral, representing butterflies. Lh'asa.
(Cat. No. 131399, U. S. N. M.)

Fig. 3. SILVER SHIRT BUCKLE. Coral center; design, butterflies. Kanzé.
(Cat. No. 131179a, U. S. N. M.)

Fig. 4. SHIRT BUTTON. Coral beads mounted in silver. Ta-chien-lu.
(Cat. No. 131180, U. S. N. M.)

Fig. 5. SILVER SHIRT BUCKLE. Center of coral; body in turquoise. Ta-chien-lu.
(Cat. No. 131179b, U. S. N. M.)

Figs 6-11. SILVER RINGS. Coral and turquoise.
(Cat. Nos. 167277, 167280, 167278, 167279 167281, 131677, U. S. N. M)

Fig. 12. GILT CHARM BOX. Set with turquoise. Nepalese manufacture. Lh'asa.
(Cat. No. 167241, U. S. N. M.)

Fig. 13. PLAQUE. Center of silver, border of coral beads. The ornamentation represents butterflies. In the center is the mystic syllable OM. Worn in Chala. (Ta-chien-lu.)
(Cat. No. 167242, U. S. N. M.)

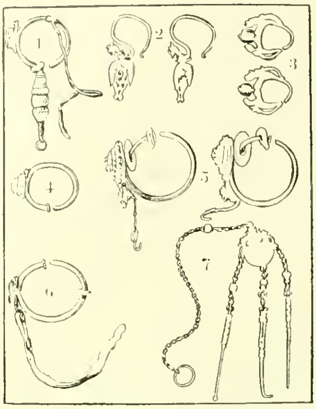
Fig. 14. SILVER STOPPER OF SNUFF BOTTLE. With snuff spoon. Top set with coral and turquoise. Ts'aidam.
(Cat. No. 167294, U. S. N. M.)

Fig. 15. BREAST ORNAMENT. Worn by Mongol Women. Copper ornament at top set with turquoise and coral beads.
(Cat. No. 167340, U. S. N. M.)

Fig. 16. HEAD PLAQUE OF SILVER. Set with coral and turquoise. Hor Chango.
(Cat. No. 167243, U. S. N. M.)

RINGS, BUCKLES, AND OTHER ORNAMENTS.

EXPLANATION OF PLATE 6.



EAR RINGS AND OTHER ORNAMENTS.

Fig. 1. MAN'S EAR RING. Silver; three turquoises set on hoop. Coral beads at base and middle of pendant. Lh'asa.

(Cat. No. 167282, U. S. N. M.)

Fig. 2. WOMEN'S SILVER EAR RINGS. Flower at end of hoop. Pendant Fo shou fruit. Chin ch'uan.

(Cat. No. 131178, U. S. N. M.)

Fig. 3. WOMEN'S SILVER EAR RINGS. Coral bead in lower part. Bat'ang.

(Cat. No. 167283, U. S. N. M.)

Fig. 4. MAN'S SILVER EAR RING. Coral set on hoop. Kokonor.

(Cat. No. 167284 U. S. N. M.)

Fig. 5. WOMEN'S SILVER EAR RINGS. Heart-shaped plaque studded with turquoises. Silver hook holds up ear-ring. Jade ring on hoop; also horn ring to keep the former in place. Ch'amdo and Lh'asa.

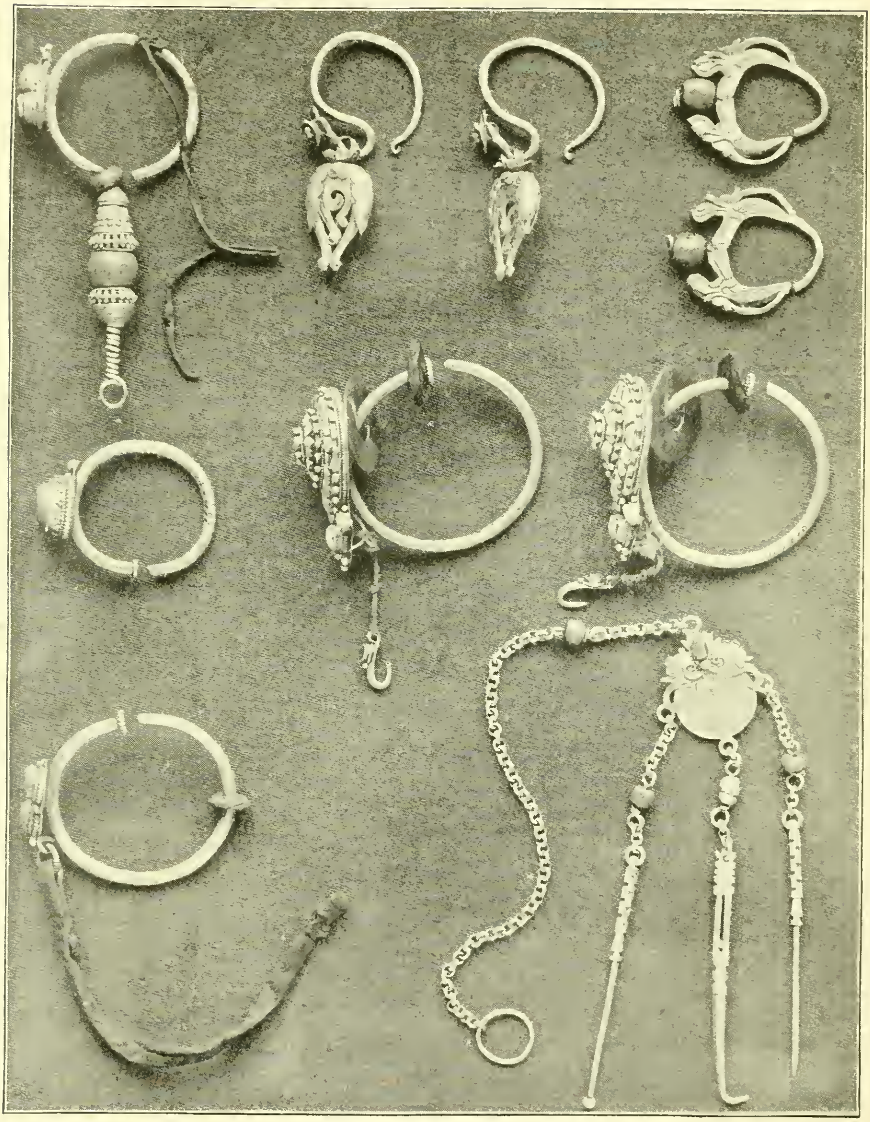
(Cat. No. 167210, U. S. N. M.)

Fig. 6. MAN'S EAR RING. Carnelian and two turquoises set on hoop. Korluk Ts'aidam.

(Cat. No 167212, U. S. N. M.)

Fig. 7. SILVER TOOTHPICK, EAR SPOON, AND TWEEZERS.

(Cat. No. 167272, U. S. N. M.)



EAR RINGS AND OTHER ORNAMENTS.

eter set with a coral or turquoise bead. (See pl. 6, figs. 4 and 6.) Although made in Korluk Ts'aidam, the latter is a Tibetan earring in shape and style. Frequently a little strap passes over the ear and takes the weight of the earring off of the lobe of the ear. A small disk of leather or bone fixed on the hoop presses against the ear, prevents the earring from turning, and keeps the jewels in front, which would without it fall to below the ear by their weight.

Among the pastoral tribes of central Tibet (Namru, Jyadé, etc.) the men, while sometimes wearing the above-described earring, wear also a larger one consisting of a pendant of gold or silver in the middle of which is a large coral bead. The lower part is a hoop, on which is fastened a circular or heart-shaped plaque set with turquoises. (Pl. 6, fig. 1.) This earring is about 3 inches long. A rough piece of turquoise is frequently tied to the right ear, without any setting whatever. This is a favorite ornament all over Tibet, even among the wealthy people in the most civilized parts of the country.

In Lh'asa and other parts of central Tibet, besides the hoop previously described, officials usually wear a plain gold hoop to which is fixed a pendant about 3 inches long, in the middle of which is a large pearl; in this pendant are set turquoises; the lower end is enameled a turquoise blue. (J. D. Hooker, Himalayan Journals, II, p. 271, and Diary of Journey, etc., p. 236.)

Around their necks most Tibetans wear charm boxes (*gawo*) of wood, silver, copper, or leather, in which are carried charms against the various accidents which may overtake them. These charms are usually unintelligible or meaningless sanskrit words (see Emil Schlagintweit, Buddhism in Tibet, pp. 174, 254, etc.), or sometimes a copy of a short canonical work, as, for example, the "Diamond cutting sûtra" (*Dorjé chöd-pai do*). A bit of the gown of a saintly lama, a little of the tsamba left over from his meal and which has been molded into a small disk, on which is impressed the image of a god (on one in the Museum the image is that of Tsongk'āpa), are also frequently kept in these *gawo*, together with painted images of some god or guardian saint, also a piece of peacock's feather, supposed to keep off moths.

Some of these *gawo* are very elaborately decorated. In the Museum collection is an oblong silver box (No. 130391)* 4½ inches long by 3 inches broad and 1½ inches deep. On either side of the box is a silver tube, through which the cord passes by which the box is worn around the neck or fastened to a broad strap passed over one shoulder and under the other arm, by which means five or six such *gawo* are carried, as is frequently the case. The decoration of this box consists in arabesques, Chinese dragons, and the "eight signs of good luck" (*trashi tar jyä*).† This *gawo* was made at Lh'asa, but shows Chinese influence in its style of decoration.

* Not illustrated in this paper.

† *See* H. A. Oldfield, Sketches from Nipal, II, p. 179.

On pl. 5, fig. 12, is shown a small gilt *gawo* set with turquoises. It is 1½ inches square. This *gawo* is also of Lh'asa make, but is distinctly Nepalese in its filagree style of ornamentation. Other *gawos* showing this Nepalese style of ornamentation (the best silversmiths in Tibet are Nepalese and Chinese) are shown in Dr. J. D. Hooker's Himalayan Journals, I, pp. 176, 270. A small wooden *gawo* purchased in Mongolia, containing a gilt terra-cotta image of a tutelary deity, is in the Museum collection. It is probably of Tibetan origin.

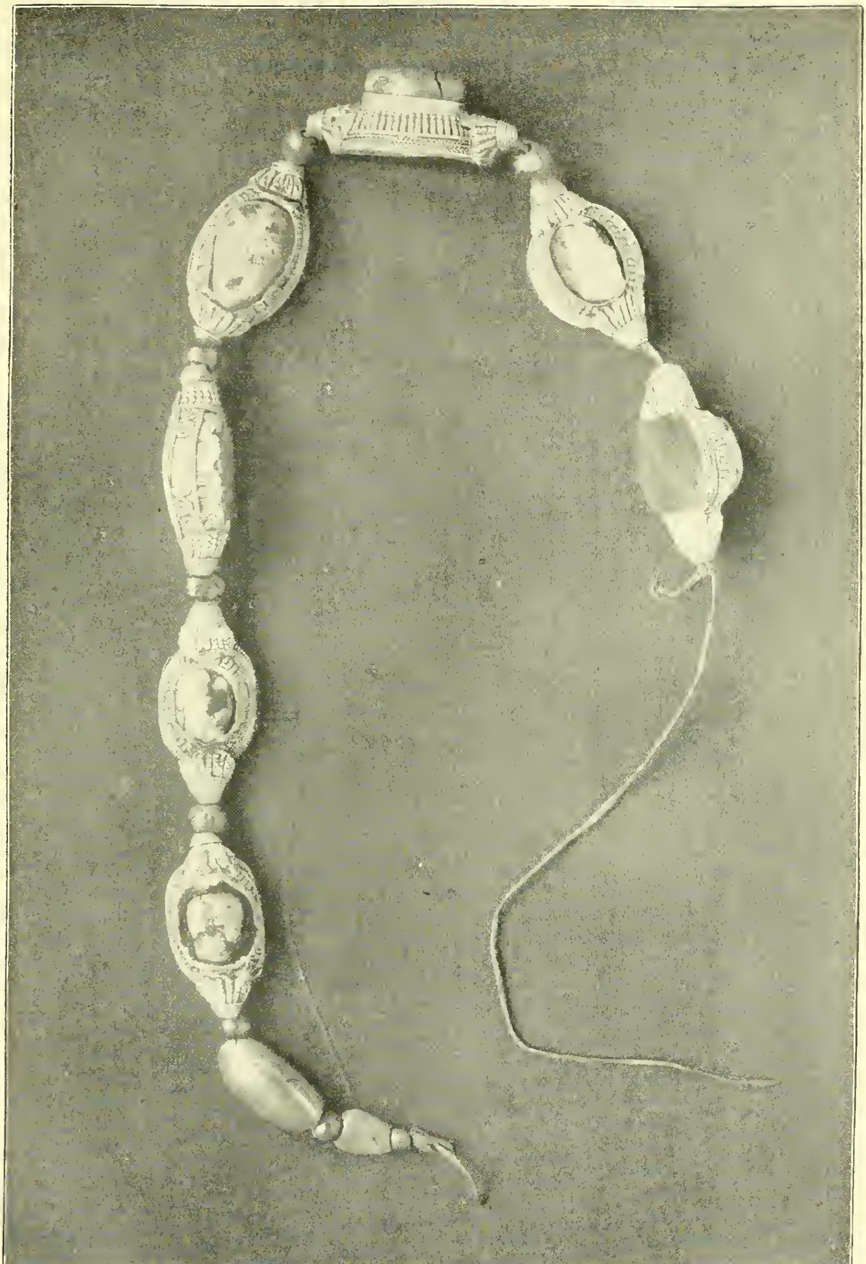
The other ornaments worn by the men of Tibet are finger rings, which are the same as those previously referred to as being worn on the queues, or else bands of chased silver in which are set turquoises or coral beads (pl. 5, figs. 6–11). The women frequently wear a smaller gold ring set with a cluster of small turquoises. These Tibetan rings are found among the Mongols of the Ts'aidam, who obtain their jewelry from passing Tibetan travelers or when visiting Lh'asa or Trashilunpo on a pilgrimage. Two of these rings shown on the plate mentioned are known to the Chinese in Tibet as the "Tibetan saddle ring," on account of their shape. They are chiefly made in Dergé, in eastern Tibet (Land of the Lamas, pp. 202, 227).

I have seen in certain portions of Tibet (Miri, near Shobando, for instance) the men wearing necklaces of coral beads and a substance which I believe is onyx, and which is called by them *zé*. (Diary of a journey, etc., p. 275.)

Most of the ornaments worn by Tibetan women are displayed on their hair. Among the Panaka of the Kokonor, where, as previously explained, the women's hair is plaited in innumerable little braids falling from the crown of the head over their shoulders and back like a cloak, they have three broad bands of red satin or cloth fastened to the hair. On these are attached embossed silver plates or cowrie shells, pieces of chank shell, and large pieces of red agate called "Chinese cornelian" (*Han ma-nao*) by Chinese traders, and which are said to be brought from Liao-tung. Besides these they wear turquoises, coral, or glass beads. Two of the bands begin at the height of the shoulders and the middle one at the waist; all of them reach down to the lower hem of the gown. The same kind of hoop earring as previously described is worn in both their ears, but most of the women wear none.

Among the K'amba of eastern Tibet the hair of the women is dressed in the same way as among the Panaka, but the usual ornaments are discoidal pieces of amber, in the center of which coral beads are frequently set. A number of these disks are worn on the crown of the head. On the bands of cloth which depend from the plaits hanging down the back are also sewn similar amber disks or silver ornaments. (Land of the Lamas, p. 184.)

In portions of eastern Tibet, more especially the Horba country, Lit'ang and Chala (Ta-chien-lu), the married women wear large gold or silver plaques on their heads, sometimes wearing one set in front or on the back of the head (as in Horba and Chala), sometimes one on either



TURQUOISES, SET IN SILVER AND SEWED ON THE QUEUES OF WOMEN IN MAR K'AMS.

Lower extremity turquoises and coral beads.

Cat. No. 167275, U. S. N. M. Gart'ok.

side of the head and meeting over the crown, as in Lit'ang. Fig. 16 of pl. 5 is a silver one set with torquoises and coral, and is of the pattern worn in Hor Chango (Land of the Lamas, 260). In fig. 13 of pl. 5 is represented the kind worn in Chala where such ornaments are called *mélong*, *pongyü* or *k'ok'or*. In portions of western Tibet, where they are also the fashion, they are known as *chir-chir* (*p'yir-p'yir*).

In portions of the country, Mark'ams and the adjacent country, for example, where the women wear a long queue down their backs, large pieces of turquoise set in silver are worn fastened the whole length of the queue; between each consecutive piece is a small coral bead. (Pl. 7.)

Turner thus describes the dress of a Lh'asan lady of high rank, the mother of the infant Panch'en rinpoch'é lama:

> Her complexion was somewhat darker than her son's. She had regular features, black eyes, and a character that particularly distinguishes ladies of rank in Tibet, the corners of the eyelids being extended as far as possible, by artificial means, toward the temples. Her hair was black, but scarcely visible, from the vast profusion of ornaments that nearly covered it, consisting of pearls, rubies, emeralds, and coral. Pearls, intermixed with beads of gold, and some relics, constituted the ornaments of her ears. Chaplets of larger gems hung round her neck, among which were balas rubies,* lapis-lazuli, amber, and coral in numerous wreaths, one chaplet beneath the other, descending to the waist. Her vest was close buttoned round the neck. A girdle embraced it round the waist, which was fastened by a golden buckle, having a large ruby in the center. A garnet-colored shawl, wrought with white stars, completed her dress, which descended to the knee. She wore bulgar boots. (Capt. Sam. Turner, Embassy to the Court of the Teshoo Lama, p. 336.)

Huc (Souvenirs d'un Voyage, II, p. 257), speaking of the women of Lh'asa, says:

> The Tibetan women's dress is very like that of the men. Over their gowns they wear a short jacket of many-colored stuff. They divide their hair in two plaits, which they let fall down on their shoulders. Women of low class wear a little yellow cap, resembling somewhat the liberty cap which used to be worn under the French Republic. The *grandes dames* only ornament their heads with an elegant and graceful crown made of pearls.†

The fashion in earrings among women varies considerably in Tibet from one locality or district to another. Besides those referred to on preceding pages, the Museum's collections contain several other varieties. On pl. 6, fig. 5, is shown a favorite style in central Tibet, Ch'amdo, and other districts. It is a large silver hoop over 2 inches in diameter, on the front of which is a heart-shaped plate thickly set with bits of turquoise. A small hook is attached to the plate and to the wearer's hair so as to take the weight of the ring off the ear. The pair in the Museum was worn by the native wife of a Chinese soldier stationed near Ch'amdo, and jade rings, such as are worn on earrings in

* A balas or balass ruby. The word *balas* is a corruption of *Balakhshi*, a popular form of *Badakhshi*, because these rubies came from the famous mines on the upper Oxus, in one of the districts subject to Badakhshan. See H. Yule, Glossary of Anglo-Indian Words, p. 39.

†For further details, see Journ. Roy. Asiat. Soc., n. s., XXIII, pp. 121–133 and pp. 222–226, where I have translated all that is to be found in Chinese works on the subject. Also Dr. L. A. Waddell, The Buddhism of Tibet, p. 572.

China, especially in the south, have been added to these by the Chinese husband.

In fig. 3 of this plate is shown the Bat'ang style of earring, also worn in all Tibetan localities east of that district. It approaches more the Chinese style of earring than any other worn by Tibetans. It is frequently made of gold, but is invariably of the form here shown. The jewel in the lower part of it is also invariably a red coral bead.

The silver earrings worn by the women of the Chin-ch'uan, a border district of Ssŭ-ch'uan inhabited by Tibetans, are shown in fig. 2. They are made by Chinese silversmiths, and represent the peculiar form of citron called in Chinese *Fo-shou*, or "Buddha's hand."

The shirts described previously (p. 686) are buckled at the throat in eastern Tibet, when worn by women, with gold or silver buckles set with coral beads and turquoises. This buckle is sewn on to the shirt. A very fine specimen in gold, of Nepalese workmanship, is shown in fig. 2 of pl. 5. It was made in Lh'asa for a wealthy woman of Ta-chien-lu (Chala). Figs. 3 and 5 of pl. 5 are of silver set with turquoises and small coral beads. The design is in one case butterflies, in the other an open lotus flower. These were purchased in the Horba country in eastern Tibet.

Two small buttons of coral linked together by a gold or silver ornament are also much used in eastern Tibet on the shirts worn by women to fasten them at the shoulder and take the place of buttons. Fig. 4 in pl. 5 shows one of these linked shirt buttons.

In central and western Tibet the shawl (*kadri*) worn by the women is held together in front by a broad breastpin of gold or silver, called, I believe, *chab-pang*. A picture of one of these buckles is given by Dr. Hooker. (*Op. cit.*, II, p. 195.)

Capt. Gerard, speaking of the people of Spiti in the extreme western part of Tibet, says:

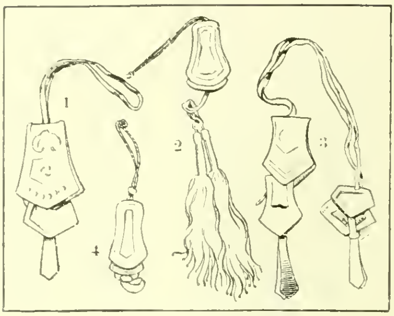
> The women were literally almost weighed down and groaning under a load of ornaments, such as immense anklets and bracelets of silver or pewter, heavy earrings, metal chains of various kinds, beads of silver, precious stones, colored glass, and cowrie shells strung around the necks, ankles, and arms, and attached to different parts of their dress.
>
> The Tartars of both sexes are very fond of ornaments, and they wear as many as they can afford to purchase, some laying out large sums upon their pipes, knives, and trinkets of all sorts. They have necklaces upon which are strung large irregular pieces of a yellow substance called Poshel,* which looks like amber, and when rubbed attracts feathers. They have beads of coral and other precious stones which resemble rubies, emeralds, and topazes, and have tassels of red beads hanging from the back part of their caps. (Capt. Alex. Gerard, Account of Koonawur, Vol. III.)

Capt. Alexander Cunningham (Ladak, p. 304), speaking of the Ladaki women, says:

> Their heads are always bare, the hair being arranged in a border of narrow plaits, which hang round the head like a long fringe. From the forehead, over the division

*Spos-shel (pronounced *pö-shel*) is the Tibetan word for amber. It means literally "perfumed crystal."

EXPLANATION OF PLATE 8.



NEEDLE CASES.

Fig. 1. NEEDLE CASE. Red and green leather. Brass nails along lower edge. Kokonor.

(Cat. No. 167157 U. S. N. M.)

Fig. 2. NEEDLE CASE. Red leather. Gold lace. Silk tassels. Upper part trimmed with silver thread. Chala.

(Cat. No. 131054, U. S. N. M.)

Fig. 3. NEEDLE CASE. Red leather. Ring pouch of red leather. Lit'ang.

(Cat. No. 167158. U. S. N. M.)

Fig. 4. NEEDLE CASE. Red and black leather. Dergé.

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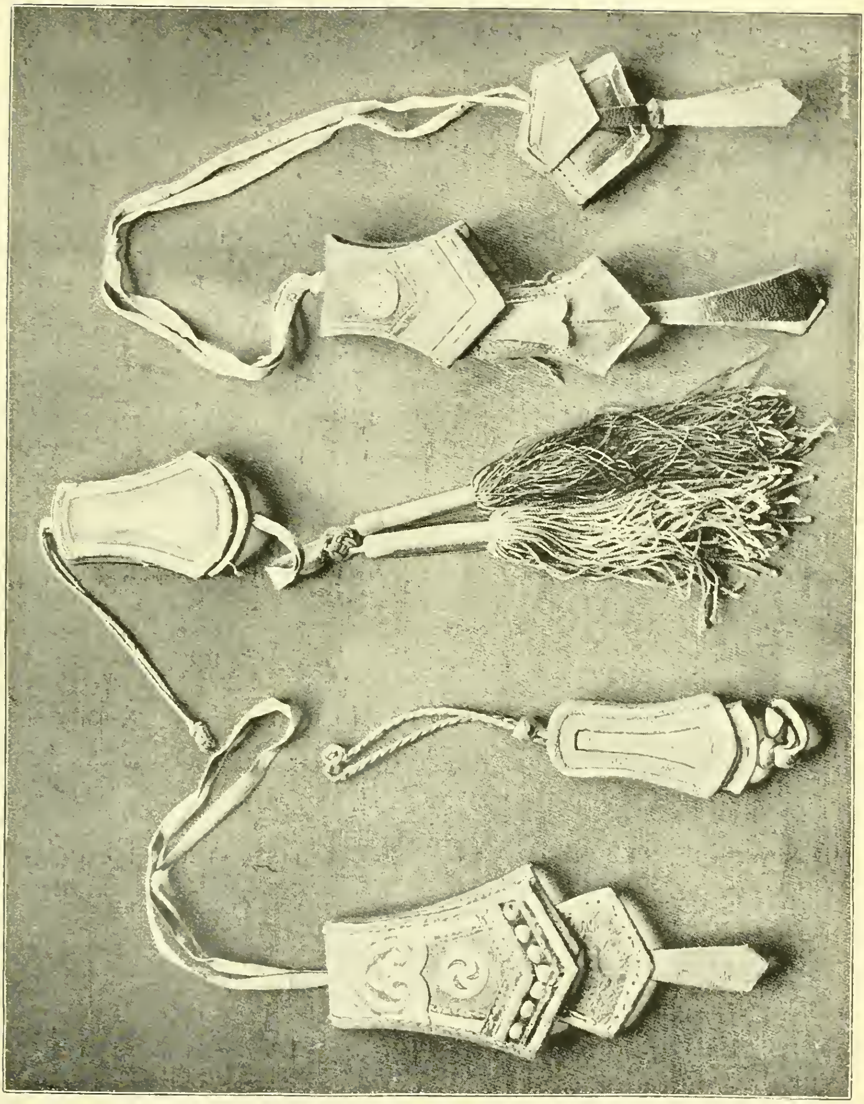

NEEDLE CASES.

of the hair, they all wear a long narrow band of cloth studded with coarse many-flawed turquoises, which hangs down behind as low as the waist, and is usually finished off with a tassel of wool or a bunch of cowries. The ears are covered with semicircular woolen lappets, fastened to the hair and edged with brown or black fur, generally of the otter skin, called Kundnz.* These ear flaps are always red, the inside being woolen, and the outside brocade. These are made coarse or fine according to circumstances, for the Ladaki women seem to pride themselves upon the style and material of these lappets just as much as European ladies do upon the fashion of their bonnets.

These "ear lappets," I may add, are commonly worn in northern China, where they are known as *erh mao.*

Although rosaries (*treng-wa*) belong properly to the chapter on objects used in religious worship and will be more fully described in that connection, they are considered by all Tibetans as not only indispensable in their daily devotions, but as ornaments, and are also used by many as a means of reckoning sums. (Land of the Lamas, p. 253.) They are worn by both men and women around the neck or on the wrist, and have invariably 108 beads. Some are made of ivory, others of seeds, of wood, of bone, of coral, turquoises, crystal, or glass.

Throughout northern and eastern Tibet most people carry a needlecase (*kab-cho*), suspended to a silver or brass chatelaine frequently of elaborate workmanship, to which is attached a short broad leather strap, through which the belt or sash passes. (Land of the Lamas, p. 166 and pl. 11.) A Chinese chatelaine (No. 167222)† is in the Museum collection. These needlecases are usually flat, bell-shaped, and made of red leather. The interior case can be pulled out by means of a strap or tassel from the cover, which is open along the lower edge (pl. 8.) Another form of needlecase, manufactured in Dergé, is a narrow iron case with a sliding top held in place by a spring, and is often highly ornamented (pl. 10).

Another article, frequently most elaborately ornamented and worn by all Tibetans and hanging from the same chatelaine to which the needlecase is attached, is a tinder‡ and flint pouch on the lower edge

* Probably the name of the country from which they are obtained.

† Not illustrated in this paper.

‡ The tinder is made from the flowers of a small plant of the edelweiss family. It is called *pai pao-tzŭ* in Chinese. Moorcroft (Travels, 1, 408) thus describes the preparation of tinder in Ladak:

"At Undar or Shak-than Ring-mo (in Ladakh) I witnessed the preparation of a peculiar kind of tinder. A small shrub, not above an inch and a half high when in flower, was gathered and placed on the bottom of a dry iron vessel over a fire. As the hairy heads expanded they were plucked off and thrown away. The plants were repeatedly turned over to prevent their being burnt. When considered sufficiently dry the pan was inverted, and the leaves, placed on its blackened under surface, were beaten upon it with a small stick until well impregnated with the soot, any loose dirt being carefully blown off. In this state the slightest spark was sufficient to ignite the preparation. This substance, wrapped up in a thin roll of paper, is also used as moxa, or as actual cautery, pieces about three-fourths of an inch thick being laid upon the skin and set fire to. This is a favorite application for pain in the stomach." I have myself seen it prepared in exactly the same way among the Panaka of the Kokonor and the K'amba of eastern Tibet. Instead of soot they mixed a little very fine gunpowder with the parched and crushed plant.

of which is a steel. These are called *mé-chag* (written *mé lchags*) and are in common use all over Tibet, China, and Mongolia. The Chinese style of tinder pouch shown in Dr. Hooker's work (Himalayan Journals, II, p. 219) as existing in Sikkim, has been found by other travelers in Bhutan and even among the Abors and Mishmis. The Tibetan *mé-chag* is of two styles, the Dergé and Pomäd forms. The first is always decorated with silver bosses, coral, and turquoise beads, and is of either red cloth or leather. (pl. 9, fig. 2.) The Pomäd kind, as shown in the specimen in the Museum collection, is a beautiful piece of work in open gold and silver, in which are set 3 large beads, 2 of coral, and 1 of turquoise. The pouch is of red cloth, and is 5½ inches long and 2½ inches broad. An embroidered cloth case fits over it to protect it from the weather (pl. 9, fig. 4) In pl. 9, fig. 3, and another specimen not here illustrated* are *mé-chag* of Mongol manufacture, and were probably made in eastern Mongolia among the Halhas, though the former is Tibetan in its style of decoration.

Another ornament sometimes worn in eastern Tibet by women is shown in pl. 9, fig. 1. It consists of a toothpick, ear spoon, and tweezers, the latter, however, being only used as a toothpick. It is attached to the gown by a ring at the end of a silver chain; the implements hang by a few links of chain to a half rupee surrounded by silver work, in which are set coral and turquoise beads.

A short knife is carried suspended from the belt of all Tibetans; with it they cut their meat. The scabbard in some cases is highly ornamented; especially is this the case with knives of Dergé make (pl. 10).

A finely-ornamented belt with knife, needlecase, and strike-a-light, belonging to the writer, and of Dergé manufacture, is shown in pl. 10.

The knife used in the Kokonor region is 9¾ inches long—the blade, which is of iron, 5¼. The handle is of horn, and iron and copper wires are inlet into it; the scabbard is of iron. These knives are made in two or three localities along the Kokonor border by Chinese blacksmiths. The knives from Shang-wu-chuang (about 20 miles from Hsi-ning in Kan-su) are especially prized, as are also the swords coming from the same locality (see Diary of a Journey, etc., p. 104). The products of this locality are recognizable by the damascening on the blades. The people in this locality are a mixed Chinese-Turkish race, and this industry was probably brought here from Turkestan.

In the more civilized portions of Tibet the Chinese knife and chopsticks are frequently used, the case often richly ornamented with embossed silver, the handle of the knife and the ends of the chopsticks being also covered with worked silver (pl. 11, right-hand figures).

As a general rule Tibetans allow no hair to grow on their faces, but pluck out the few hairs growing on them as they appear with tweezers (*chyamutser*), which they carry suspended around their neck or from their

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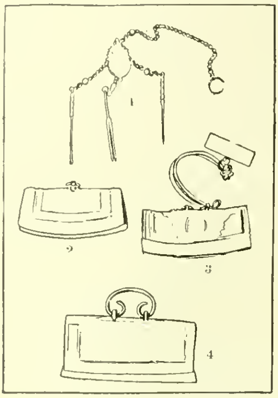
*Cat. No. 131023 U. S. N. M.

EXPLANATION OF PLATE 9.



TOOTH-PICK AND STRIKE-A-LIGHTS.

Fig. 1. SILVER TOOTHPICK, TWEEZER, AND EAR SPOON. Attached by a silver chain to a half rupee. Upper ornament, butterfly with turquoise body. Chala.

(Cat. No. 167272, U. S. N. M.)

Fig. 2. TINDER AND FLINT POUCH. Red cloth. Silver nails around the edge. Three coral beads in the center. Dergé.

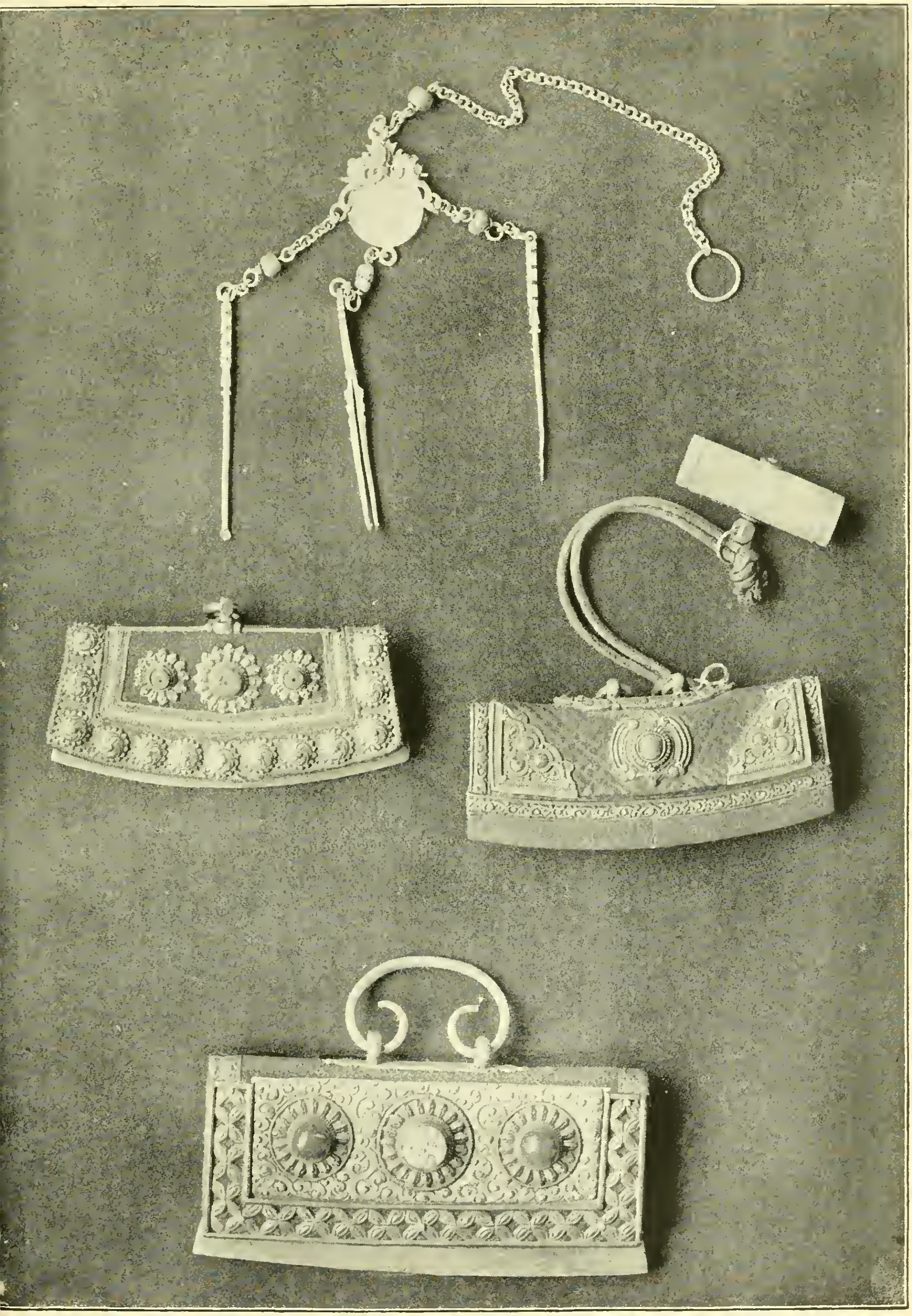
(Cat. No. 131024, U. S. N. M.)

Fig. 3. TINDER AND FLINT POUCH. Russia leather. Ornamented with silver, turquoises, and coral. Jade cylinder to pass through belt. Eastern Mongolia.

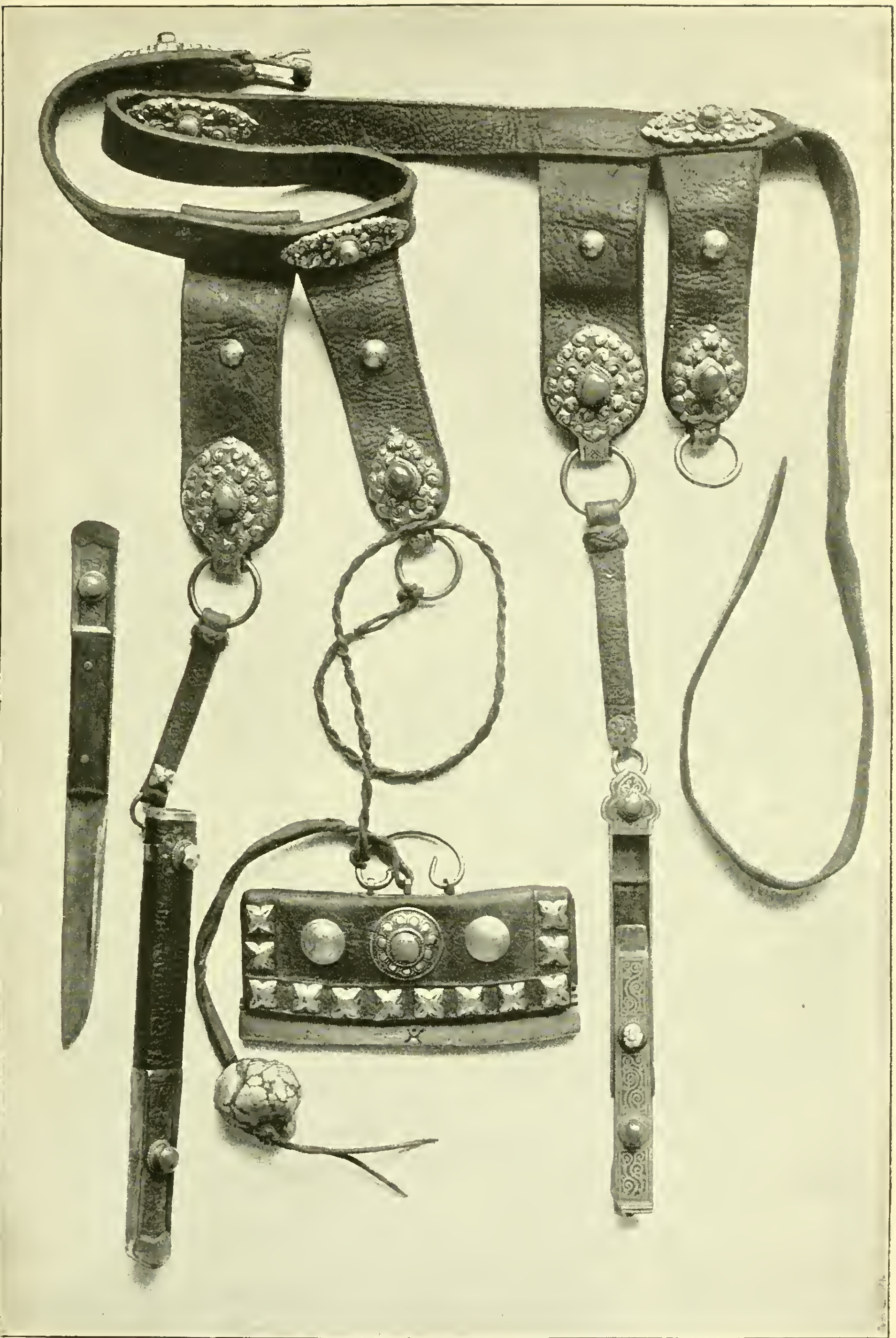
(Cat. No. 167262, U. S. N. M.)

Fig. 4. TINDER AND FLINT POUCH. Red cloth. Gold and silver ornamentation. Turquoise and coral beads in the center. Poyul.

(Cat. No. 167260, U. S. N. M.)

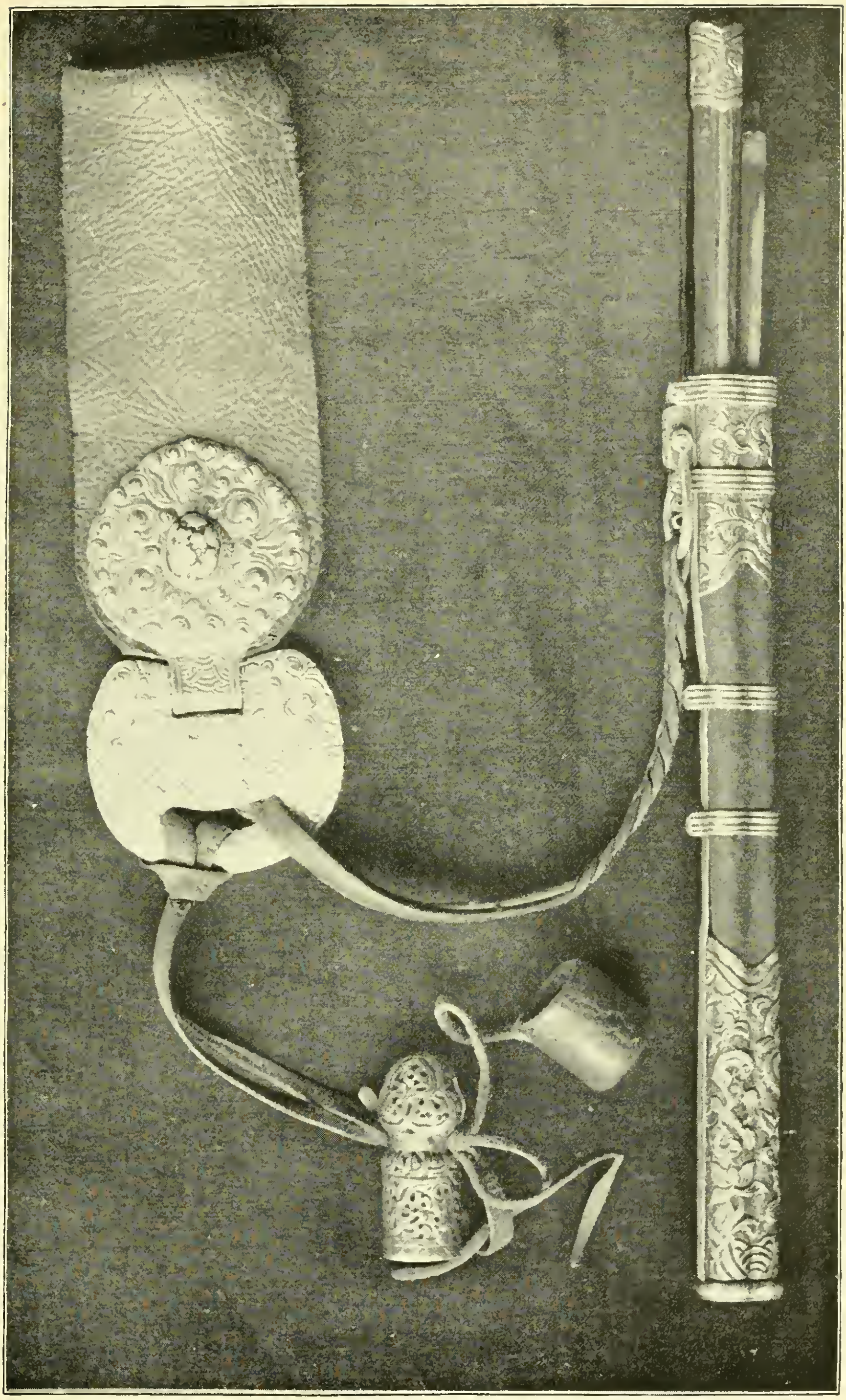


TOOTH-PICK AND STRIKE-A-LIGHTS.



BELT OF RED LEATHER, WITH ORNAMENTS IN SILVER AND CORAL:

Knife:—scabbard of iron and gold ; coral and turquoise beads in handle and on scabbard. Tinder and flint pouch, with silver studs, large turquoise at end of thong. Needle-case of iron and gold, set with turquoise and coral beads. Dergé.



CHATELAINE OF SILVER: TURQUOISE SET IN CENTER. CHOPSTICKS AND KNIFE IN CASE, WITH SILVER MOUNTINGS. IRON SEAL WITH LEATHER COVER.

Cat. No. 131230, U. S. N. M. Eastern Tibet.

belt or prayer beads.* In the more civilized portions of the country, especially in the south and near China and India, it is not uncommon to see men wearing a mustache, and in some instances, among lamas especially, I have seen men wearing full beards, some quite thick and long. Chinese razors, or the sheath knives above referred to, are used to shave the head and face. I have seen no razor of native manufacture.

Dr. Griffiths, speaking of the ornaments worn by the women of Bhutan, says that they "wear a plate of silver fastened round the head and crossing on the upper part of the forehead, wire earrings of large dimensions, and peculiar rings fastened to a straight silver wire, and worn projecting beyond the shoulder." (William Griffiths, Journal of the Mission to Bootan in 1837–'38, p. 166.)

Dr. Hooker (Himalayan Journals, II, p. 86) describes as follows the dress of some Tibetan women from K'amba djong,† a district to the north of Sikkim, within the confines of Ulterior Tibet (Tsang):

> The men were dressed as usual in the blanket cloak, with brass pipes, long knives, flint, steel, and amulets; the women wore similar but shorter cloaks, with silver and copper girdles, trousers, and flannel boots. Their headdresses were very remarkable. A circular band of plaited yak's hair was attached to the back hair, and encircled the head like a saint's glory, at some distance round it. A band covered the forehead, from which coins, corals, and turquoises hung down to the eyebrows, while lappets of these ornaments fell over the ears. Their own hair was plaited in two braids brought over the shoulders, and fastened together in front, and a little yellow felt cap, traversely elongated, so as not to interfere with the shape of the glory, was perched on the head.

This mode of dressing the hair, as well as that of Bhutan referred to by Griffiths, are but modifications of the crowns worn at Lh'asa.

Tattooing as a means of ornamentation is hardly ever practiced by Tibetans. I have seen a few men from Lh'asa, or the adjacent countries, who had a "hooked cross" (*yung-drung*) tattooed on the back of their hands near the thumb, and some others with a round dot or two tattooed at the same place, but beyond this I have neither read nor heard of any tattooing among this people. The persons on whom I saw tattooing were traders, who had frequently visited China and India, where tattooing is known and practiced to a limited extent, and in either one of these countries, or by a man from one of these countries residing in their own, they may have had the marks on their persons done.

Weaving.—Although according to Tibetan accounts (see p. 672) the art of weaving was only introduced into this country in the seventh century, after intimate relations with China had been established, we may on good grounds doubt the accuracy of this tradition, for the Sui shu, or Chronicles of the Sui dynasty (A. D. 589–618) Bk. 83, speaking of the Tibetan T'ang-hsiang tribes, says: "They weave yak and goat

* Du Plan Carpin (*Historia Mongalorum*, 658) says of the people of Tibet (his *Terra Burithabet*): "Isti pilos in barbâ non habent: imò quoddam ferrum in manibus portant, sicut vidimus, cum quo semper barbam depilant, si fortè aliquis crinis crescit in ipsâ."

† These Tibetans are black-tent dwellers and originally came from northeast Tibet.

hair and sheep's wool, and make tents," and the Annals of the T'ang dynasty (T'ang shu, Bk. 221), which covers the period from A. D. 618 to 907, says of these same people, "Men and women wear long skin gowns, or gowns of coarse woolen stuff with a nappy surface."

Among the pastoral Tibetans of the present day cloth is woven from the hair of yaks and goats and from the wool of sheep. The wool is cut off the sheep with a knife and is of very irregular staple; very generally it is not washed before it is spun into yarn. The usual occupation of pastoral Tibetan men and women, or perhaps one may call it their usual amusement, is spinning yarn. They carry a small package of wool or yak hair in the bosom of their gowns and twist the yarn as they walk along herding their sheep, or when sitting in their tents over their tea. The spindle, of which a specimen is in the museum (see Diary of a Journey, etc., p. 132), is about 11½ to 12 inches long and consists of a straight wooden rod with a notch at the end in which the yarn is caught, and terminates at the lower end in a flattened clay whorl about 2 inches in diameter.

Sometimes the clay whorl is replaced by two sticks at right angles, and a little iron hook is fixed in the end of the rod instead of the notch above referred to. There is in the collection even a more primitive spindle, in which the whorl is a short bone and the rod has a fork at the end on which the yarn catches. This spindle was collected among the Ordos Mongols, who spin and weave, by the way, exactly as the Tibetans do, though they practice the latter art to a much less extent (see Diary of a Journey, etc., p. 22).

The loom usually used in Tibet is of extreme simplicity; it is also in use in Mongolia and generally in the border country of northern China. The warp, which is hardly ever over 10 inches to a foot broad and about 40 to 50 feet long, is fastened to the ground by large pegs at either end; the weaver squats over this and pushes the balls of thread through the warp; two or three blows from a heavy wooden batten are given on each thread of the woof, and the alternate threads of the woof are kept separated by two small sticks and the batten itself. The part of the warp near the weaver is kept raised to a convenient height from the ground by either a little rounded piece of wood raised on feet and placed under it, or else by a big stone. The woof, according to Jaeschke (Tib. Engl. Dict., p. 331), is called *pun* (*spun*), the spindle, (*pang*) and the whorl (*pang-lo*). In this primitive fashion the material for the black hair tents of the pastoral tribes is woven, and also the woolen material used to make clothes, boot-linings, bags, etc. This latter stuff, which is always used undyed, is called *la-wa*, or *ta* in some sections of the country, and is sometimes quite fine. The coarser varieties, all manufactured by the Kokonor Tibetans, are represented in the Museum's collections by Nos. 131208, 167202, and 167203,* in the last there are narrow bands of black wool.

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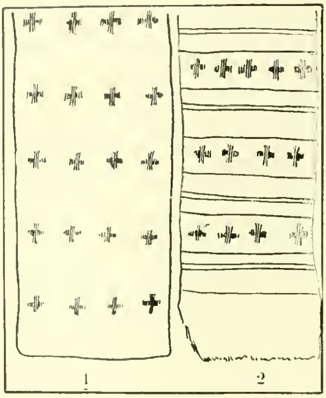
* Not illustrated in this paper.

EXPLANATION OF PLATE 12.



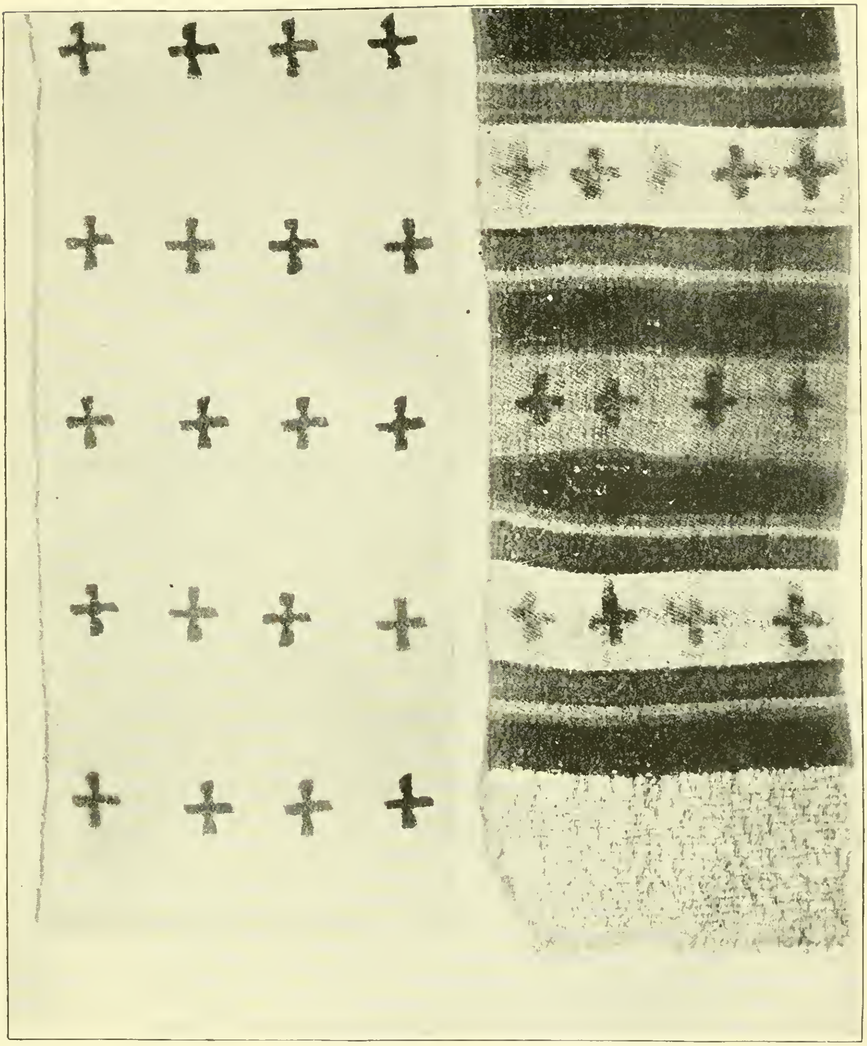
SPECIMENS OF TIBETAN CLOTH (TRUK).

Fig. 1. FINE WHITE TRUK. Stamped with red and blue crosses.

(Cat. No. 131205, U. S. N. M.)

Fig. 2. ORDINARY STRIPED TRUK. Yellow, blue, green, and red, with blue and red crosses.

(Cat. No. 167201, U. S. N. M.)



SPECIMENS OF TIBETAN CLOTH (TRUK).

In some parts of the country a rude vertical loom (called, I believe, *tag-tan* written *htag-stan*) is used, but, as far as my unpracticed eye could discern, it showed no material difference in the mode of weaving from that above described. Jaeschke (Tib. Engl. Dict., s. v. *dong po*) speaks of a shuttle made of a piece of bamboo called *dong po*. This implement, which I have never seen used, may be common in western Tibet, where that missionary resided, but in all parts visited by me the yarn was made up into balls. The woof in the vertical looms is wrapped around two rollers so that the weaving may be done in a confined space, but I noticed no such mechanical devices as I was expecting to find for drawing up the parts of the warp as required, but only small sticks, varying in number, as in the ruder loom previously referred to. This loom has unquestionably been borrowed from China, and it is highly probable that in many parts of Tibet the one in use is of the pattern usual in China; unfortunately, I can find no description of one in any works to which I have access, and my own knowledge of the subject is too limited to make a description of it intelligible.

Father Desgodins says:

In Tibet the profession of weaver, called Ta-ken (*htag-mk'an*), is confined to the women. The loom employed is not complicated; it has only the essential elements usually found in such appliances.

Nearly all the woolen stuffs are diagonals. The pieces are from 30 to 35 centimeters broad, often less, and 10 meters long. They are thick and rather coarse, for the surface is not shorn as is done with cloth with us, but they are very warm and nearly waterproof.

I have been told of a woolen stuff, very fine and rather loosely woven, called *tirma*. It is a very fine texture, and resembles somewhat the stuff we call serge; it is frequently used to make the scarfs worn by the lamas over their shoulders during prayers; it is, I believe, the most expensive tissue they manufacture. They do not know how to weave wide stuffs as in Europe, but all the little narrow strips are afterwards sewn together with woolen thread, and look very well, though they would not suit French taste. (Desgodins, Le Thibet, p. 390.)

The cloth most commonly used in Tibet is that called *prug* (pronounced *truk*), but which is perhaps better known under its Chinese name of *pulo*, a transcription, I take it, of the native name. It is chiefly manufactured in Ulterior Tibet, near the city of Shigatsé (see Turner, Embassy to the Court of the Teshoo lama, p. 225), whence it is exported to all parts of Tibet, to Mongolia and China. The principal colors are red, purple, blue, white stamped with crosses, narrow stripes of blue, yellow, green, etc., running across the stuff, or a combination of the stripes and crosses. (Pl. 12.)

The price of *pulo* varies from an ounce of silver a piece to 30 or 40 ounces for the finest kinds. It is usually 10 or 11 braces (*damba*) long.

The variety of cloth called *tirma*, mostly used, as Father Desgodins remarks, for lamas' shawls, is invariably dyed red. It is of the same width as the *truk*, about 9 inches, a good sample of it is in the Museum collection.

In Po-yul, in southern Tibet, a very closely woven stuff, which is quite waterproof, is woven by the natives. It is extremely narrow, about 4½ to 5 inches in breadth, and in it are narrow stripes of red, white, green, blue, and yellow. This stuff is very much prized. The women make their aprons and skirts of it in some portions of the country (Mark'ams and Bat'ang for instance), and blankets of it are in great demand, 13 bands of the stuff being sewn together to make a blanket, never more or less.

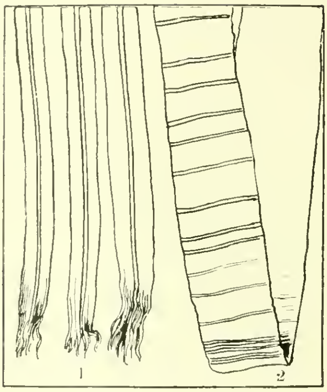
I have found but few notices concerning Tibetan weaving in books accessible to me. William Moorecroft, however, gives some interesting details on the methods of weaving of the northern Ladakis:

> To the northward a coarse loom is in use, little unlike in its parts to the one common in Europe. Here the two ends of the warp are fastened together, and it is then stretched upon two rods, one fixed to the body of the weaver (who is invariably a woman) by a cord, which admits of the work being loosened or tightened at pleasure, and the other well fastened to some stones at a distance equal to half the length of the cloth. The whole is close to the ground, on which the work woman sits, but the portion close to her is slightly elevated by a third rod. Loops, each including a thread, and received upon a small stick like a rattan, supply the place of a heddle;* of these there are three sets, which draw up parts of the warp alternately as required. A large heavy mash, into which a thin bar of iron is inserted, is a substitute for the reed, and three or more heavy strokes are made with its armed edge upon every thread of the woof. The last instrument must be taken out after the insertion of each piece of yarn, and when placed perpendicularly, with its two edges separating the warp, abundance of room is given for the passage of the balls of worsted made use of, without the covering of a shuttle. This part of the process is tedious, but the warp is prepared in a quick and simple way. Several pegs are driven into the ground so near each other that the whole may be reached without any material movement of the body; the yarn is fastened to one of them, and carried on round the others till a sufficient quantity has been wound; all are then taken off except three, which have their places supplied by rods, and the warp only requires spreading. * * * Each piece is about 17 inches broad, and the average length may be stated at 7½ yards. * * * Very good sacking is also made of the hair and wool taken from the yak. (Travels in the Himalayan Provinces of Hindoostan, etc., II, pp. 72–74.)

Felt (*chying-pa*) is also largely used in Tibet. Its mode of manufacture is extremely simple. The wool, having been first picked over, is spread out a handful at a time on a large piece of felt on the ground, each handful overlapping the preceding one in such a way that a piece of uniform thickness and of whatever size is desired is made. This is rolled up tightly and with much pounding of the closed fist and then unrolled, and this work is kept up for an hour or more; then the roll is soaked in water and the work of rolling, unrolling, kneading, and beating with the closed fist goes on for another hour or two. I was told that a piece of felt had to be kneaded at least 1,000 times before it was ready for use. After the roll has been left to dry for a while it is opened, and by pulling it slightly in different directions the surface is made smooth, and the edges are trimmed with a knife. Sometimes it is bleached. Altogether, Tibetan and Mongol felt is vastly inferior to that made by the Chinese.

* The Navajo loom, I take it, resembles this one very closely.

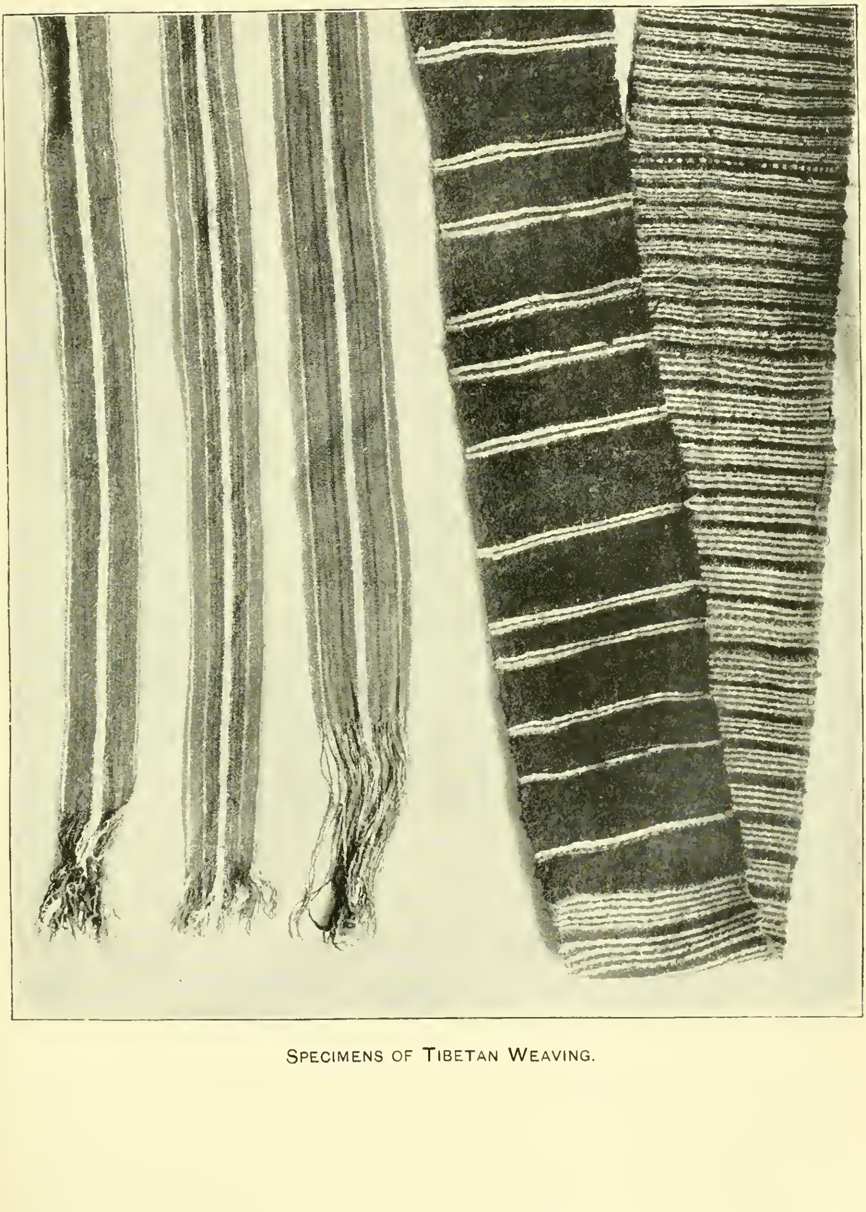
EXPLANATION OF PLATE 13.



SPECIMENS OF TIBETAN WEAVING.

Fig. 1. GARTERS. Woven in the Ts'arong.

Fig. 2. BELT. Woven in Jyadé.
(Cat. No. 167200, U. S. N. M.)



SPECIMENS OF TIBETAN WEAVING.

There are fairly good specimens of Tibetan, Chinese, and Mongol felts in the Museum's collection. A specimen of fine Chinese felt formed into a pair of socks by the Eastern Mongols is also in the Museum. It was made at Chang-chia k'ou (Kalgan).

All the cotton stuffs used in Tibet are brought there either from China or India, as are also the silks, satins, broadcloths, etc., there made use of.

Dyeing.—Desgodins says:

The profession in which Tibetans excel is that of dyeing; not that there are artists specially given to this work, for every family can dye the stuffs woven in the house. Vegetable dyes are nearly exclusively used, and they know how to fix the colors so well that they are practically permanent. * * * To dye red they use a kind of garance *teu* and *ka*, which imparts to the former a deeper but very fine color. I am unable to say what this latter substance is. With the refuse of *ka* they make sealing wax *laguia*.* For dyeing yellow a very bitter root is used, which is also used in medicine for inflammatory diseases; they call it *ching-tsa* and the Chinese *huang-lien*. Indigo, which they call *ram*, comes to them from India, but they can also get it from certain of the warm valleys of their country. * * * Sometimes they paint on the stuffs flowers and principally crosses. These colored stuffs are then called *Laoua-chra-cha* or *chra-cha* according as the stuff is *laoua* or *chra*. (Desgodins, Le Thibet, pp. 391, 392.)

The dye called *teu* by Desgodins is possibly the *tzŭ-ts'ao* of the Chinese (*Anchusa tinctoria?*), and *huang-lien* is the *Picrorhiza kurroa* (Royle). Dr. Hooker (Himalayan Journals, p. 41) says that the leaves of a shrub (*symplocos*) are dried in Sikkim to be sent to Tibet, where they are used as a yellow dye. I have seen in parts of Tibet (west of Ch'amdo) people gathering a yellow gooseberry which, I was told, supplied a yellow dye, and the root of the rhubarb plant is also used to supply that color in parts of Tibet and in the Ts'aidam. I have been unable to learn where the Tibetans get their brown or green colors. The latter are especially fine. In northwest China a fine brown is obtained from the acorns of the holly-leafed oak (*ching k'ang* in Chinese). Possibly this is used by Tibetans, for the tree is very abundant in many places of eastern and southern Tibet.

According to Abbé Huc (Souvenirs, II, p. 268), the Nepalese at Lh'asa do most of the dyeing, but, he adds, they are only allowed to dye native cloths, and all imported stuffs must be used as received there, this being done to encourage the consumption of native products.

V.

HABITATIONS—HOUSEHOLD UTENSILS—FOOD—TOBACCO.[1]

The pastoral Tibetans throughout the country inhabit tents made of yak hair. The Tibetan tents are rectangular, with a flat roof. Some of them are not more than 10 or 12 feet long, but I have seen many 50 feet long by 30 feet broad. A space about 2 feet wide is left open along the center of the top to admit light and let smoke escape. Under it is a

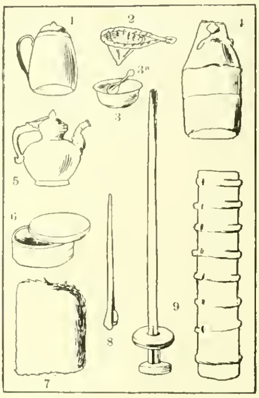
* It is the lac produced by the *Coccus lacca*.

ridge pole supported at each end by vertical posts. These are the only posts used for holding up the tent. The roof is stretched by cords which are fastened outside to the sides and corners, and which, passing over short poles some distance from the tent, are pegged to the ground. The lower edge of the tent is held down by iron pins or by horns of the *Antilope Hodgsoni*. Huc most felicitously compares these tents to huge black spiders with long thin legs, their bodies resting upon the ground. Sometimes to keep off the wind and snow the inmates build a low wall of mud and stones, or else of dry dung, around the outside of the tent, or, when large enough, inside of it; but they do not frequently resort to this expedient in the Kokonor section, where there is but little snow.

In the center of the tent is a long, narrow stove made of mud and stones, with a fireplace in one end and a flue passing along its whole length, so that several pots may be kept boiling at the same time. These stoves, in which only manure is burnt, have sufficient draft to render the use of bellows needless, and are altogether a most ingenious contrivance (see Diary of a Journey, etc., p. 123). Around the walls of the tents are piled up leather bags in which the occupants keep their food; also saddles, pieces of felt, and innumerable odds and ends, of which only the owner knows the use and value. A small stone or birch-wood mortar for pounding tea, a wooden tea churn about 2 feet high—made of a hollowed log and hooped with wood (pl. 14, fig. 9), or out of a joint of bamboo, which are, in some parts, used also to churn butter in—a few small and very dirty wooden milk pails with handles of plaited yak hair (see Diary of a Journey, etc., p. 204), a log or two of wood roughly squared, and which take the place of tables, and a small quern are the principal articles of furniture in these "black tents."

Food.—The food of the tent-dwelling Tibetans consists principally of tea and parched barley or *tsamba;* the barley they buy from the agricultural Tibetans in exchange for butter, hides, or wool. The preparation of *tsamba* is not difficult. The grain is parched in a pan and winnowed, when most of the husk falls off; after this it is ground in a small quern, when it is ready for use. The flavor of *tsamba* depends on the browning or roasting of the grain, and on the fineness of the meal. When it is too fine it is not considered good, nor is it liked when it is ground in a large water mill, although large quantities of it are prepared by the Chinese for the Kokonor Tibetans in this way. The Museum has several samples of *tsamba*. The meal when ready for use is kept in small bags (*tsam kuk*), some of cloth, others of red leather, the lower part of the bag being sometimes covered with marmot or leopard skin (pl. 14, fig. 4). The other articles of diet of these people are mutton and, occasionally, game, sour milk (*sho* or *tarak*), granulated cheese (*chura*), cream cheese (*pima*), the root of the *potentilla anserina* (*chouma*), and, occasionally, vermicelli (*kua-mien*) and wheaten cakes (*palé* or *koré*). (See also Diary of a Journey, etc., pp. 239, 274, and 278.)

EXPLANATION OF PLATE 14.



ARTICLES USED IN MAKING TEA.

Fig. 1. BRASS POT. Used by Kokonor Tibetans. Made by Chinese.
(Cat. No. 131189, U. S. N. M.)

Fig. 2. BAMBOO TEA STRAINER. Eastern Tibet.
(Cat. No. 131039, U. S. N. M.)

Fig. 3. WOODEN BOWL. Bat'ang.
(Cat. No. 167230, U. S. N. M.)

Fig. 3a. SILVER SPOON. Lh'asa.
(Cat. No. 131020, U. S. N. M.)

Fig. 4. TSAMBA BAG. Made of red leather and striped cloth. Dergé.
(Cat. No. 167211, U. S. N. M.)

Fig. 5. COPPER TEAPOT. Silver spout. Handle and spout, dolphin-shaped; neck and lid finely chased. Dergé.
(Cat. No. 167176, U. S. N. M.)

Fig. 6. WOODEN BUTTER BOX. Lh'asa.
(Cat. No. 131061, U. S. N. M.)

Fig. 7. BRICK TEA. Known as *go-mang-chupa* variety. Ta-chien-lu.
(Cat. No. 131033, U. S. N. M.)

Fig. 8. SMALL TEA DASHER. Jyadé.
(Cat. No. 167216, U. S. N. M.)

Fig. 9. WOODEN TEA CHURN AND DASHER. Made of two pieces of a hollowed log; hoops of willow twigs. Kanzé.
(Cat. No. 131040, U. S. N. M.)

ARTICLES USED IN MAKING TEA.

Tea is, however, the principal article of food among all Tibetans. It is not simply the beverage but the food of this people, for it is nearly invariably taken mixed with butter and *tsamba* and the leaves are not infrequently eaten. For a full description of the "brick tea" used in Tibet and its mode of preparation I must refer the reader to the account I have published elsewhere.* The Museum collection contains a number of specimens of brick tea of various grades (pl. 14, fig. 7, shows one). I shall only describe here the way in which the beverage is prepared.

Tea, previously reduced to powder in a mortar, is put in the kettle (Diary of a Journey, etc., p. 96, figs. 1 and 4) when the water is hot, but before it is boiling, and is left to boil for about five minutes. Frequently a little concentrated extract of tea, kept for the purpose in a small tea-pot, is added to give additional flavor, and a little salt or soda is also thrown in. Sometimes it is partaken of at this stage of its preparation, but much more generally it is poured through a small bamboo strainer called *ja-ts'ag* (pl. 14, fig. 2) into one of the previously described tea churns (*dong-mo*), and a chunk of butter and a little *tsamba* having been added, it is vigorously churned for a minute or so, when it is poured into tea-pots of earthenware or metal (pl. 14, figs. 1 and 5, and pl. 15) and is then ready to be drunk. Each one draws from the bosom of his gown a little wooden bowl (*purba*), frequently lined or otherwise ornamented with silver (pl. 14, fig. 3), and, a little tea having first been sprinkled toward the four cardinal points as an offering to the gods, the bowls are filled. Taking with his fingers a chunk of butter from a sheep's paunch in which it is kept, or from a wooden butter box (*marpa*) (pl. 14, fig. 6), the drinker lets it melt in his bowl, drinking the while some of the tea and blowing the melted butter to one side. When but a little tea is left in the bottom of the bowl, a handful of *tsamba* is added, and the tea, butter, and meal are deftly worked into a ball with the right hand, the bowl being meanwhile slowly turned around in the left. The resulting lump of brown dough, which is of a rather agreeable taste, if the butter is not too rancid, is then eaten, and enough tea is drunk to wash down the sodden lump. When dried cheese (*chura*) is eaten it is first soaked in tea and then eaten with buttered tea and *tsamba*.†

The Tibetans of all parts of the country make tea as above described, and eat their *tsamba* in this way. They have no regular meals; the kettle is always kept full of tea and each one takes tea when he is hungry.‡ Those who, like lamas reading the sacred books and others, are continually employed during the day, keep beside them a pot of

*Land of the Lamas, pp. 278–281 and p. 310, and also to E. Colbourne Baber's Travels and Researches in Western China, p. 192 *et seq.*

†Frequently, also, the tea is drunk plain with the addition of about a fifth its volume of milk.

‡In Kunduz the people use *Keimuk chah* or cream tea; fat is sometimes added and salt is the uniform substitute for sugar. (Wood, Journey to the Source of the Oxus, p. 143, 2d edit.) Milk tea is or was served a taudiences given by the Emperor of China.

tea on a heap of hot ashes or a little *brasero*, and occasionally give it a stirring up with a small churning stick (pl. 14, fig. 8) resembling that used in chocolate pots with us.

When one has eaten sour milk (*sho* or *tarak*), or anything which soils the bowl, it is customary to lick it clean before putting it back in the gown.

If mutton or any other meat forms part of the meal, it is boiled in the same kettle in which the tea is prepared, and each one picks out a piece from the pot and holds it in his hand, cutting mouthfuls off it with his sheath knife and carefully removing every particle of meat from the bone. The Kokonor Tibetans and the K'ambas have a saying to the effect that one can judge of the way a man will manage important business by seeing him pick a bone. (Land of the Lamas, 79–80.)

Butter is made either in the tea churn or in a goatskin bag roughly shaken about. Dr. Hooker (Himalayan Journals, II, p. 77), speaking of some black-tent Tibetans he visited in Upper Sikkim, says:

> The churns were of two kinds, one being an oblong box of birch bark, or close bamboo wickerwork, full of branched rhododendron twigs, in which the cream is shaken. * * * The other churn was a goatskin, which was rolled about and shaken by the four legs. The butter is made into great squares and packed in yak hair cloths; the curd is eaten either fresh or dried and pulverized (when it is called "Tschenzip").

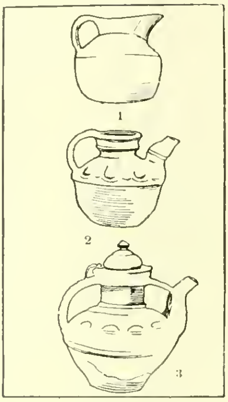
Wherever I have traveled in Tibet I have found the butter made into balls, sometimes weighing 20 pounds or more; it is sewed up in a sheep's paunch or wrapped in a bit of goatskin with the hair left on. Dr. Hooker's Tschenzip is perhaps better known as *chura;* it is not used to any great extent except among the tent dwellers.

Moorcroft (Travels, II, p. 79) says:

> At Kinar (in Ladak) I first learned that dahi, or curdled milk, is churned into butter, and found a pail employed as a churn, the churning stick being supported by two arms fastened to a post and turned by a rope, as in Hindostan. The natives affirm that butter made from milk in the first instance disagrees with them.

The teapots used by Tibetans are of earthenware or metal, and, though the ornamentation on them varies somewhat in different localities, the general shape is everywhere the same—a very narrow neck, a large globular body, and a rather small base. The spout is most frequently ornamented so as to represent a dragon's head, the extremity of the spout projecting from out the mouth. A metallic cover is attached by a chain to the handle, in which, in the case of earthenware teapots, a hole is made for the extremity of the chain. In some of the earthenware teapots, especially those from Lit'ang and farther east, irregular cubes of broken chinaware are pressed into the parts so as to form a rough kind of ornamentation. The mouth, spout, and handle of these teapots are luted on, and there are lines grooved around the neck and body of the pot, the lines on the latter part being usually vertical. Some pots are made of black earth, but most of them of coarse reddish clay, in which there is a good deal of mica, and all are very porous. Before being used, earthenware pots are slightly heated

EXPLANATION OF PLATE 15.



EARTHENWARE TEAPOTS.

Fig. 1. EARTHENWARE TEAPOT. Jyadé.
(Cat. No. 167231a, U. S. N. M.)

Fig. 2. RED EARTHENWARE TEAPOT. Lh'asa.
(Cat. No. 167231b, U. S. N. M.)

Fig. 3. BLACK EARTHENWARE TEAPOT. Having small pieces of Chinaware pressed into the surface. Stamped brass top. Lit'ang.
(Cat. No. 167231c, U. S. N. M.)

EARTHENWARE TEAPOTS

and well rubbed with butter. Good specimens of earthenware teapots are shown on pl. 15.* The best metal teapots are made in Dérgé in eastern Tibet, and in many of them brass, copper, and silver are combined so as to produce a highly ornamental effect. A Dérgé pot of wrought brass is in the collection, and on pl. 14, fig. 5 is shown a teapot of copper with chased spout and handle; both have highly ornamental tops. Several teapots in my private collection are of silver and brass, and show much taste and great cleverness in execution.

Throughout Tibet it is not uncommon to now and then find poor people reduced to using a substitute for tea—chips of wood, roasted pease, or willow leaves, anything, in fact, which can impart a little color and slight astringent taste to their drink.

Among the Rongwa Tibetans of northwest Kan-su it is customary to eat *tsamba* dry, with a small spoon. (Pl. 14, fig. 3*a*.) They throw a little meal into their mouths, taking it from a large bowl placed before them, and then wash the dry stuff down with a gulp of tea from their wooden bowls.

Dr. Griffiths says of the people of Bhutan:

> They use brick tea from Tibet and make *rungapah,* a substitute prepared from the leaf of a pear or medlar; also *chang*, made from rice. (Dr. W. Griffiths, *op. sup. cit.*, p. 167.)

In the more civilized parts of Tibet tea and *tsamba* are used in the same way and nearly to the same extent as among the tent dwellers, and vegetables form a very small portion of the diet of any of the Tibetan people. Rice, imported from China and Bhutan, is occasionally used, sometimes boiled with milk, sometimes made into a pillaw (*dré-sil* in Tibetan), in which is put melted butter (*marku*), raisins, and sugar. Spaghetti (in Chinese, *mien*) is also eaten by the house-dwelling Tibetans, by whom it is known as *jyat'ug*, and this dish, as well as vermicelli (*kua-mien*), has been introduced into the country by the Chinese. Chinese condiments are also used by the wealthy Tibetans, who frequently have their meals served in purely Chinese fashion.

While pork is never eaten by the tent-dwelling Tibetans, it is used to a considerable extent by the people of central and some parts of eastern Tibet, but mutton and yak flesh supply by far the largest part of the animal food eaten by them. The pastoral Tibetans export in winter to Lh'asa and elsewhere frozen sheep's carcasses, and they themselves use large quantities of dried mutton (*sha kam*). The meat is cut in strips, boiled, and then dried. In this shape it will keep for nearly a year, and is much used while traveling.

Cabbages, turnips sometimes dried, radishes and potatoes, pease, and several varieties of beans are eaten, but in very small quantities, the people preferring tea and *tsamba* to any other diet which can be placed before them.

*I have never seen pottery manufactured in Tibet, and the only reference to the subject I have found in any work on Tibet is in Captain Pemberton's Report on Bootan, p. 74.

The only alcoholic drink of the Tibetans is barley wine, or *näs ch'ang.* Jaeschke (Tib. Engl. Dict., p. 154, s. v. *ch'ang*) thus describes its preparation:

When the boiled barley has grown cold some *pabs* (or yeast) is added, after which it is left standing for two or three days, until fermentation commences, when it is called *glum.* Having sufficiently fermented, some water is poured on it, and the beer is considered ready for use.

In some parts of the country this *näs ch'ang* is distilled, and a very strong colorless liquor of considerable strength thus obtained, which is called *arrak.*

Houses.—Tibetan homes are so much alike throughout the whole country that a description of one will serve for all. They may, however, be divided into two classes, those of the rich, in which there is a central court, around three or more generally four, sides of which rise buildings usually three stories high, and those of the poorer class, which are two storied, and have a courtyard in front or behind them. In both classes of houses the ground floor is used as a stable and godown. The following description of the houses of East Tibet will apply, with such slight differences as the scarcity or abundance of timber in the different localities must occasion, to houses throughout Tibet:

The walls of the houses are generally made of flat stones, held together with mud mortar. I do not believe that lime is ever used. Often the walls are of beaten earth. The ground floor is ordinarily given up to cattle. On the first floor are the rooms, usually large, and lit by means of little square or oblong windows divided by a bar in the shape of a cross. There is no glass in the window frame—not even paper, as in China. The windows have wooden shutters, which are carefully closed at night. Around the doors and windows is sometimes a molding painted in red, white, and blue, consisting of the ends of the projecting rafters, and frequently on this kind of cornice are flat stones, on which are written the famous prayer *Om mani peme hum.* In large buildings the first-story apartments form three sides, and sometimes even a square around an interior courtyard, which is always disgustingly dirty. In the better sort of buildings there is always a covered gallery opening onto the courtyard in front of the rooms. The roof forms a terrace, is of earth, and is used as a thrashing floor. On the uppermost terrace there is usually a little pavilion, or idol room, surmounted by a terrace, where are planted *la-der*, long poles to which are attached narrow pieces of linen covered with superstitious sentences.* As a general rule, at each corner of the house there is a small tower, on the top of which is an earthen vase, in which every morning the devout burn in honor of the devil, sweet-smelling wood, little twigs of cypress or pine.† Ninety-nine times out of a hundred the stairway is only a long log of wood 6 or 8 inches broad and 4 or 5 thick, on one side of which and 7 or 8 inches apart are notches about 2 or 3 inches deep, just enough to rest half the foot in when going up sideways. The people prefer these ladders to ordinary stairways because in case of an attack by robbers they can draw them up and defend themselves better. It is also as a measure of safety that they are careful to have only one door leading into the courtyard, and no windows on the ground floor. (C. H. Desgodins, Le Thibet, pp. 379–381.)

Cunningham, speaking of the houses of Ladak, says:

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*Georgi, Aphabetum tibetanum, p. 509, calls these "*tarpoch'é* arbor salutaris, depulsoria mali."

† Conf. Land of the Lamas, p. 248.

The houses usually consist of 2 or 3 stories and sometimes of 4. The foundations and lower parts of the walls are built of stone, the upper walls of large sun-dried bricks, 20 by 10 by 6 inches. In the better houses some of the rooms are of considerable size, 25 feet long and 18 broad, but they are always very low, the highest not exceeding 7½ or 8 feet. The roofs of these large rooms are always supported by plain wooden pillars. The roof is formed of poplar spars 5 or 6 inches in diameter, peeled white, and laid only 1 to 1½ feet apart. The beams are covered in with small, straight pieces of poplar branches about 1 inch in diameter, peeled white, and placed touching each other.* Generally they are laid straight across the beams, but sometimes at different angles, in the alternate intervals, so as to form a pattern like herring bones. The whole is then covered with a layer of leaves and a thick coat of well-beaten clay. The floors are generally of earth, but the better sort are paved with small slit pebbles, about the size of turkey's eggs, set in clay with the flat surface upward. They form a clean, hard, smooth, and lasting floor.

The principal room generally has a balcony toward either the south or the west from 10 to 20 feet in length and usually about 2½ feet in width, where the family sit to enjoy the sun in the winter season. The doors are mere rough planks of wood, joined together by wooden tenons, and sometimes strengthened by crossbars fastened by wooden pins. Purdahs or wadded curtains are also used as an additional means of excluding the cold wind,† but when the doors are shut there is only a dim light admitted into the apartments through one or two loopholes, which are closed with small shutters at night. * * * In Ladak the upper story is usually reached by a flight of earthen steps, but in Lahul by the sloping trunk of a tree notched into steps. (Alex. Cunningham, Ladak, pp. 313, 314.)

In the mountainous and well-timbered regions of western Kan-su, inhabited by Tibetans, log houses of one story are much used, and in portions of eastern Tibet the second story of many of the houses is made of logs. This work is, in most cases, done by Chinese carpenters.

As regards the houses of eastern Tibet and such other portions of the country as I have visited, there is absolutely no furniture in them. Sometimes a log of wood, roughly squared, or a low Chinese table is found near the hearth, the smoke from which escapes as best it can through a hole in the ceiling or by the low door and little windows. Some houses contain furnaces or cooking stoves, similar to those used in the black tents, on which the kettles boil over a dung or wood fire. In others there are large, open hearths, in the center of each of which are three stones to rest the pot on. The simplicity of the nomad is found in all the appointments of the agricultural Tibetan's house. (Land of the Lamas, pp. 191–195, Comp. C. R. Markham, Narrative of the mission of Geo. Bogle, p. 122.)

The houses of the people of Bhutan differ principally from those previously described in the roofs, which are made of "shingles of pine, 5 or 6 feet in length, laid over a framework and kept in their place with stones. The slope is, of course, very inconsiderable, otherwise the stones would roll off. * * * The appearance of the houses is precisely that of Swiss cottages. They are singularly picturesque and comfortable, and

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*When a house has been used for a year or more the ceilings become a shining black color from the smoke of the fires.

†These are also used in parts of eastern Tibet, where they have been introduced by the Chinese. Felt or wadded door curtains are used all over northern China.

the only drawback is a want of chimneys; but the Bootanese do not know how to construct these, and the smoke finds its way out as best it can." (Ashley Eden, Report on the State of Bootan, p. 121.)

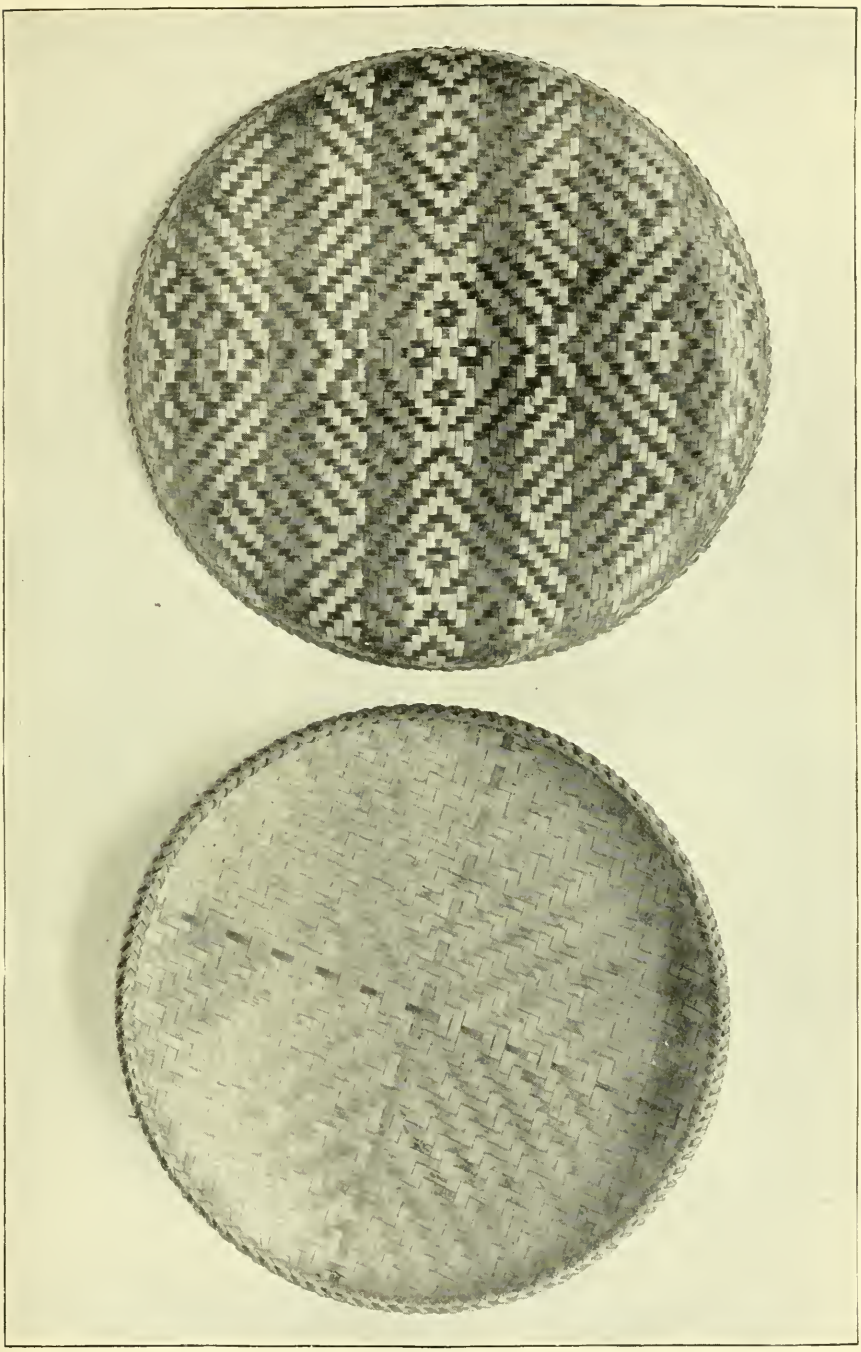
Tibetan houses are lit by means of small lamps (*mar-mé* or *zumar*) filled with butter in which a little cotton wick is stuck. Sometimes this lamp is of brass or copper and is about 3½ inches high. Lamps of the same pattern are used on altars in temples, where one will frequently see long rows of them, several hundred in number, burning before the sacred images. Other lamps are but small earthenware saucers or cups, in design similar to the brass ones. Besides this mode of lighting the house the only other which I have seen consisted in chips of pitch pine burnt on a flat stone, put in the middle of the room. As a general rule, Tibetans go to sleep as soon as it becomes dark, and in many houses there are not even to be found the primitive lamps above described.

The kettles used in Tibetan households, whether it be among tent dwellers or people living in houses, are the same; they are usually rather flat and thin so that they can be easily heated by a dry dung fire, as dung is the only kind of fuel available in the greater part of the country. These kettles, several of which are in the Museum collections, vary in size from 8 to 10 inches in diameter to 24 inches or even more. The Shigatsé kettles, which are all tapering from the middle toward the bottom so as to fit in the holes on the cooking stoves, are frequently of very large dimensions in the houses of the rich and in lamaseries. I have seen some over 2 feet in diameter. The rounded form is in general use in Mongolia, northern and eastern Tibet, though in the two latter countries it is usually without handles. Most of the copper kettles in use in eastern Tibet, Bat'ang, Lit'ang, etc., are made in China in the Chien-ch'ang (in southwest Ssŭ-ch'uan). Those used in the Kokonor and adjacent countries are also made by the Chinese of Hsi-ning and Sung-p'an (see Diary of a Journey, etc., p. 96).

In some parts of the country near Ladak, and which are inhabited by tent dwellers, large stone vessels are also in use. In the report of Nain Singh's journey of 1873, when speaking of the people inhabiting the tablelands in northwest Tibet, it is said—

> At the permanent camps they had large caldrons, generally made of stone; in these they used to make a very weak soup, into which they threw a handful of flour. At their smaller camps they cook in smaller vessels made of stone or copper, both of which are imported from Ladakh. All articles of copper or iron are very much valued. * * * (Jour. Roy. Geog. Soc., XLVII, p. 93; Conf. Wm. Moorcroft, Travels, I, p. 397.)

Among the other household utensils represented in the Museum collections are small birch bark pails, in use wherever the tree is found growing, in northwest Kan-su, in Bat'ang and Sikkim, and closely resembling those made by the Ainu. There are also small, round wooden boxes with tops, turned by the Chinese in Yün-nan, and used to keep salt or red pepper (*latsé*) in, brass ladles, and bellows made of



WICKERWARE BOX.

Pattern, red and black ; made of mountain bamboo.

Cat. No. 167287, U. S. N. M. Poyul.

tanned goatskin. In this latter implement an iron nozzle about 18 inches in length is tied in the skin of one of the legs, the skin is cut off at the fore legs, and the opening left by the other hind leg is sewed up. The mouth of the bag is held with the left hand stretched out from the body, and with the right hand the open end is opened and shut; when filled with air the right hand is held firmly against the body and the left arm, against which the closed mouth of the bag presses, is lowered, and the air thus expelled through the nozzle. These bellows, called *kumo*, are used throughout Tibet in camp as well as in the houses. In some of the lower valleys near regions where the bamboo grows, a simple bamboo tube is used instead, and through it the cook blows the fire, applying the tube against his mouth. This simple contrivance is used also throughout Ssŭ-ch'uan.

The Lh'asan iron padlock (*dongpa*) has the hasp armed with 4 springs, and slides inside the lock until the springs have passed 2 shoulders on the inside which catch and secure it. By means of a forked key worked horizontally on slides along the under side of the lock, the springs of the hasp are pressed down from the shoulders and the hasp flies out. The key is quite complex, owing to the number of guides along which it must pass in order to move the spring. These guides vary in each lock, and the lock is copied on those in general use throughout China (see Diary of a Journey, etc., p. 281).

Wickerware is never used among the tent-dwelling Tibetans, and none of that which I have seen in other parts of the country was made by the people themselves. In Poyul, in southern Tibet, the people of which are not pure Tibetans, very pretty wickerwork is made. Pl. 16 shows the usual shape of a little covered basket which comes from that country. It is made of white, black, yellow, and red strips of cane woven in diagonal pattern. In shape the basket is cylindrical, 11 inches in diameter and 1 inch deep; the cover fits over the bottom. I have also seen joints of bamboo covered with similar wickerwork and made in the same country. They are used to keep *ch'ang* in.

The Tibetans in some parts of the country make very coarse crates of a truncated pyramidal form which they carry on their backs; they use them principally to collect dry dung in. The tea strainers previously referred to are made either by the Chinese or by the people living near the Indian border. In the various books of travel to which I have had access, I have found no mention of wickerware in Tibet, and the various names giving different forms of baskets by Mr. Jaeschke in his dictionary (*pé-ra*, "a flat basket;" *gzed-ma*, "a box-shaped basket with lid;" *tsé-po* or *tsél-po*, "a basket carried on the back;" *bag-tsé*, "a little basket for wool or clews of wool,") are nearly all peculiar to portions of the country in close proximity to India.

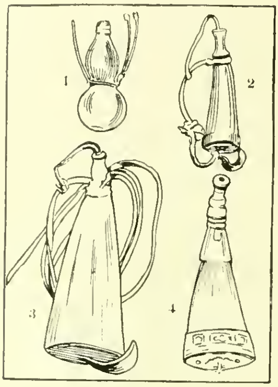
Tobacco.—Tobacco is in general use in Tibet, but probably from the fact that lamas are only allowed to take it in the form of snuff, this mode of using the weed is much more popular than smoking. The tobacco used comes from either China, Bhutan, Sikkim or Nepaul, that from Bhutan being, as I understand it, greatly preferred. This tobacco is, however, rather expensive and strong, so it is frequently used for smoking either mixed with the leaves of the rhubarb plant, or the latter substance is even used pure in its stead. This substitute for tobacco is in great demand in Tibet among smokers, and is exported from Lh'asa, or the countries to the southwest of it rather, where the plant is found, all over eastern Tibet where it is called *Lh'asa t'ob-cho*. Snuff is made in the country or imported from China; the latter variety is, however, too much perfumed to suit the Tibetan taste. Frequently, to make the snuff milder, ashes are mixed with it. In the northeastern part of Tibet well-polished ox horns are used to hold the snuff, several examples of which are shown on pl. 17.* One of these is handsomely ornamented with silver bands, bits of coral, and turquoise. In other parts of the country (among the K'amba of northeastern Tibet for example), the coarsely pounded tobacco is put in a leather pouch, and when a pinch is wanted the finer particles are scraped off the sides with a knife.

In Lh'asa a snuffbox is made of wood of oblate-spheroid shape, across the interior of which is stretched a fine cloth sieve. The coarse tobacco is put in the top of the box through a hole made for that purpose, and by lightly striking the box on the knee the finer parts are sifted through into the lower compartment. By a little hole in the lower part of the box the snuff is poured out onto the nail of the left thumb held against the index, and is thus inhaled daily in enormous quantities. Pl. 18 shows a fine specimen of this kind of snuffbox. Women use snuff, but rarely smoke; when they do, they use the Chinese water pipe.

The tobacco pipes used by the Tibetans are usually of Chinese make, the bowls of brass, iron, or white copper (pl. 19, figs. 1 and 2), the stem of bamboo and about 2 feet long. Mouthpieces are not usually used. I have only seen three kinds of pipes of purely Tibetan manufacture; one, in use among the Panaka, is made of the horn of the antelope (*huang yang*), with a metallic mouthpiece and a metal bowl. Some of these pipes, in which they only smoke Chinese water tobacco, and which are a modification of the short bamboo pipe in use in Ssŭ-ch'uan for the same purpose (as seen in fig. 4), are ornamented with coral and turquoise beads. Another pipe, in use in Jyadé, is made of a forked twig; the larger part is hollowed out, then lined with iron, and this forms the bowl; in the smaller and longer branch the pith is removed, and this constitutes the stem. In southeastern Tibet, in the Ts'arong and among the Mishmis and the hill tribes along southern Tibet, the root of a small mountain bamboo is used to make the bowl of the pipe, and the same plant supplies the stem. (Fig. 3).

*Similar mulls or snuff horns are in use not only in Scotland, but among the *Wachaga* of Kilimanjaro, in East Africa. (See Cat. Nos. 151242, 151243, and 151244, U. S. Nat. Museum.)

EXPLANATION OF PLATE 17.



SNUFF HORNS.

Fig. 1. CHINESE SNUFF BOTTLE. Made of a small gourd. Stopper and spoon of ivory.

(Cat. No. 167256, U. S. N. M.)

Fig. 2. SMALL SNUFF BOTTLE. Made of ox horn; band of copper around lower edge. Ts'aidam Mongols.

(Cat. No. 167255, U. S. N. M.)

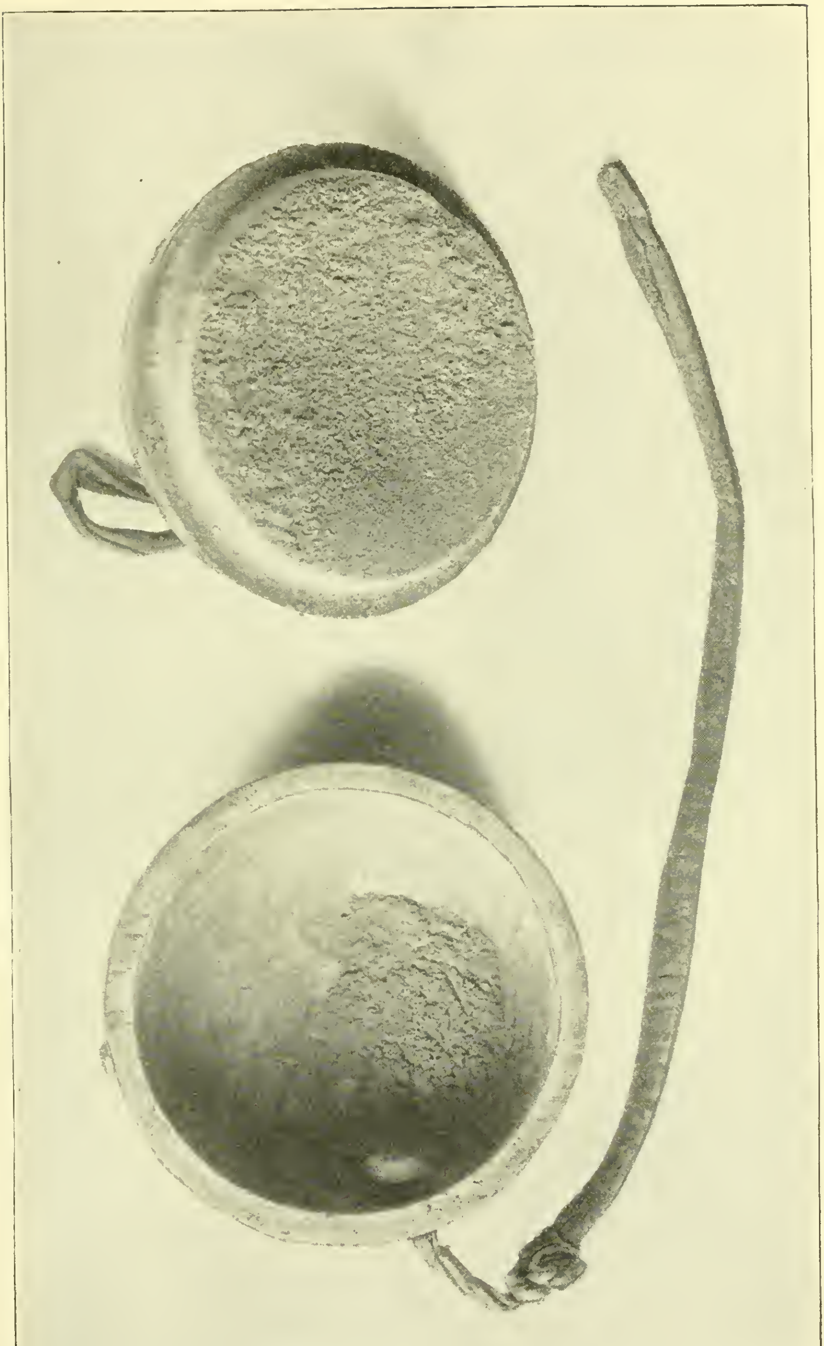
Fig. 3. YAK HORN SNUFF BOTTLE. With leather thong to fasten it to the gown; bottom, of wood: stopper, of leather. Kokonor Tibetans.

(Cat. No. 167263, U. S. N. M.)

Fig. 4. SNUFF BOTTLE. Made of light colored horn. Extremities, of black horn in which is set ivory, coral, and turquoise beads. Stopper, of ivory with silver rings. Kokonor.

(Cat. No. 167183, U. S. N. M.)

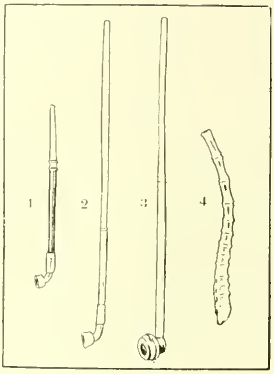
SNUFF HORNS.



WOODEN SNUFF BOX, WITH INTERIOR SIEVE.

The snuff is poured out through a hole shown at the top of the left-hand figure.

EXPLANATION OF PLATE 19.



TIBETAN PIPES.

Fig. 1. MONGOL PIPE. Bowl, of white copper (Peking manufacture): Stem of bamboo. Mouthpiece of silver (Mongol manufacture). Ts'aidam.
(Cat. No. 167152, U. S. N. M.)

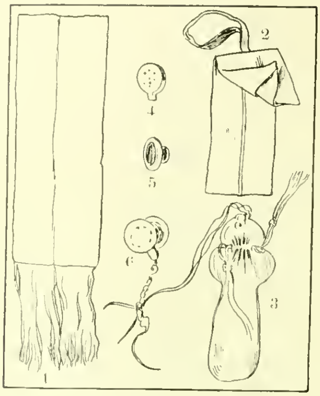
Fig. 2. TIBETAN PIPE. Chinese white copper bowl. Bamboo stem. Bat'ang.
(Cat. No. 131319 U. S. N. M.)

Fig. 3. LISSU BAMBOO PIPE. Bowl, of bamboo root. Southeastern Tibet.
(Cat. No. 131190, U. S. N. M.)

Fig. 4. SSŬ-CH'UAN BAMBOO PIPE. For smoking water tobacco. Ya-chou Fu.
(Cat. No. 167257, U. S. N. M.)

TIBETAN PIPES.

EXPLANATION OF PLATE 20.



TOBACCO POUCHES AND FIRE HOLDERS.

Fig. 1. EMBROIDERED TOBACCO POUCH. Red and black cotton. Ts'aidam.
(Cat. No. 167258, U. S. N. M.)

Fig. 2. TIBETAN TOBACCO POUCH. Red leather Kanzé.
(Cat. No. 131019 U. S. N. M.)

Fig. 3. CHINESE TOBACCO POUCH. Black leather. Bat'ang.
(Cat. No. 167176, U. S. N. M.)

Fig. 4. BRASS FIRE CUP. Provided with lid. Ts'aidam.
(Cat. No. 131204, U. S. N. M.)

Fig. 5. WOODEN FIRE CUP. Kan-su.
(Cat. No. 167253, U. S. N. M.)

Fig. 6. WROUGHT-IRON FIRE CUP. Provided with lid and pipe cleaners. Dergé.
(Cat. No. 131319, U. S. N. M.)

TOBACCO POUCHES AND FIRE HOLDERS.

Smokers carry their tobacco in long red leather pouches (pl. 20, fig. 2), or in the black leather pouches in general use in China (fig. 3). To these are suspended a small metal or wooden fire bowl (figs. 4–6) and a pipe cleaner. The pipe is usually carried passed through the belt, in front of the person, and the pouch either hangs from the belt, or, when a short pipe is used, it is stuck in the pouch and both are carried inside the gown.

Those among the Tibetans who smoke the water pipe use the Chinese pipe, or else the short wooden hubble-bubble in use in Kashmir. The tobacco used in water pipes is prepared in China, in Ssŭ-ch'uan and Kan-su, that coming from Lan-chou, in the latter province, being considered the best; its preparation I have described in Land of the Lamas (pp. 34–35). Dr. Hooker, in his Himalayan Journals (II, p. 152), tells us that the Phipun of Lamteng, in Sikkim, "was an inveterate smoker, using a pale, mild tobacco, mixed largely with leaves of the small wild Tibetan rhubarb, called 'chula.' Snuff, he says elsewhere (II, p. 232), is little used, and is principally procured from the plains of India."

VI.

AGRICULTURE—WEAPONS—HUNTING—MUSIC—DANCING.

Throughout Tibet the only instruments of husbandry are the hoe and the plow. The former is usually made entirely of wood. The handle, about 30 inches long, is slightly curved, and on the natural bend at the end of the handle is tied a pointed wooden blade (see Diary of a Journey, etc., p. 362). The plow is of the same rude description, and is without even a share in most parts of the country. It is drawn by one yak; a yoke or stick resting on its neck is fastened to the plow. A man leads the yak and another guides the plow, scratching slightly the soil. For harvesting a rude sickle is used, consisting in a handle about 18 inches long, in which a short iron blade is set at right angle. The flail is in use in some parts of the country, but as a general rule the grain is thrashed out by goats or ponies driven over it, and is afterwards winnowed on the housetops. (See, for further information on the subject, C. H. Desgodins, Le Thibet, p. 397.)

Irrigation is well understood in Tibet and is extensively used. (See Pemberton's Report on Bootan, p. 66.) Among the Tibetans of Northwest Kan-su water is carried considerable distances across valleys in troughs dug in logs supported by light trestlework, and this system is also found in many portions of southern Tibet. The fields are usually fenced either with brush, poles, or low stone walls.

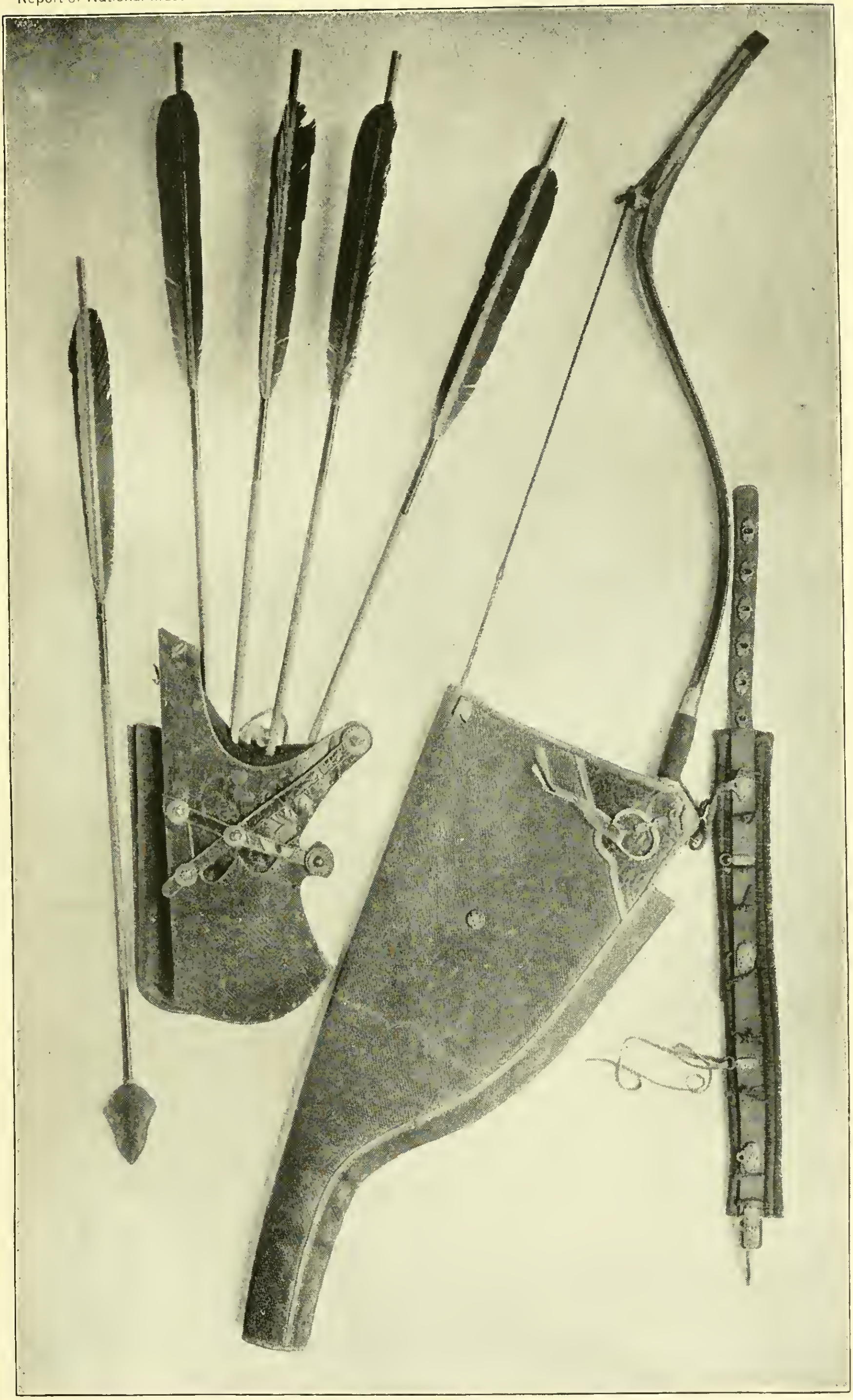
Weapons.—The bow is apparently not a Tibetan weapon, as all those in use in the country are imported from China or Bhutan. The quiver, bow case, and all the accouterments are purely Chinese or Bhutanese in style. The usual length of the Chinese bow (*dzu* in Tibetan) is about 5 feet, and the arrow (*da*), 2 feet 6 inches. Pl. 21 shows the best arrangement of these articles. This specimen is a beautiful piece of workmanship; the leather used is red Russian (*bulgar* in Tibetan), and the metal work very highly finished and thickly gilt.*

The Tibetan sword is of two kinds. Both are straight and of iron, but in one kind the extremity of the blade runs to a sharp point; in the other (copied from the Chinese) the point is oblique, like the Japanese and Chinese swords. The average length of the blade of Tibetan swords is 25 inches. Fig. 3 of pl. 22 shows a fine sword of the latter pattern, made in Poyul. The hilt is covered with shagreen, and in the pommel, which is of iron, wires of brass and copper have been set in the metal. The scabbard is of wood covered with shagreen and plain bands of silver extend half its length. The upper half of the scabbard is covered with red cloth, a strap fastened to the scabbard near the hilt passes around the wearer's waist, and the sword is worn in front of the person, as are nearly all Tibetan swords. In Lit'ang, Ch'amdo and a few other localities, however, a variety of sword is made which is worn in Chinese fashion, hanging from the left side (see Diary of a Journey, etc., p. 330), but the usual Tibetan mode of carrying a sword is passed in the belt in front so that the right hand rests on the hilt. Fig. 2 represents a sword with a rough wooden scabbard, and was manufactured in the Horba country, in eastern Tibet. It is in shape like the preceding.

In Land of the Lamas (p. 257) is figured a fine sword of Dérgé make. The scabbard and hilt are highly ornamented with *repoussé* silver work, in which are set coral beads. The edges of the scabbard are protected by a rim of iron. This style of sword is the most highly prized of any in Tibet, and large sums of money ($100 to $150) are frequently paid for them. (Pl. 22, fig. 1.)

The Tibetan matchlock gun (*mé-da* or *pao;* the latter is a Chinese term) has a barrel about 48 inches long with a half-inch bore. The stock is of wood, sometimes covered with wild ass skin, and extends to near the muzzle of the barrel. This gun and the accouterments to be described are shown on pl. 23. A wooden ramrod fits in the stock, and the barrel is fastened into it by either rawhide thongs or brass wire. Through the stock, about 6 inches behind the breech of the gun, passes a trigger, the upper end of which is forked so as to hold a slow-match of plaited cotton soaked in powder and then dried. The lower end of the trigger projects slightly beyond the lower side of the stock so that the match can be depressed onto the pan. The unused part of the slow-match is held in a leather case on the right side of the stock from which it passes out by a small iron tube. It is held firm in the fork of the trigger by a strap fixed on the left side of the stock to a small ring. The powder in the pan is in like fashion protected by a leather cover. Attached to the muzzle of the gun by a bolt is a long wooden fork (*ra-jo*) with iron or antelope horn tips. When the gun is

*See also Capt. Turner's remarks, p. 714 of the present paper.

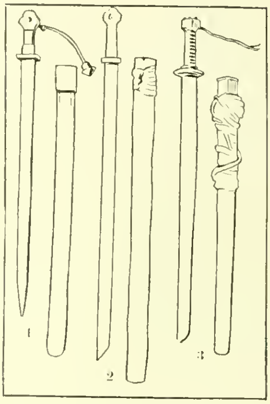


ARCHER'S EQUIPMENT.

Bow and arrows, of Chinese make. Quiver, bow-case and belt of Russian leather. Quiver lined with red cloth. Upper part, of stamped leather, decorated with gold nails, having coral beads in center. Belt wadded.

This form of bow and arrows is used in China, Mongolia, and Tibet.

EXPLANATION OF PLATE 22.



SWORDS AND SCABBARDS.

Fig. 1. DERGÉ SWORD AND SCABBARD. Large coral beads set in handle and scabbard. Ornamentation in silver. Iron guards along the edge of the scabbard. Dergé.

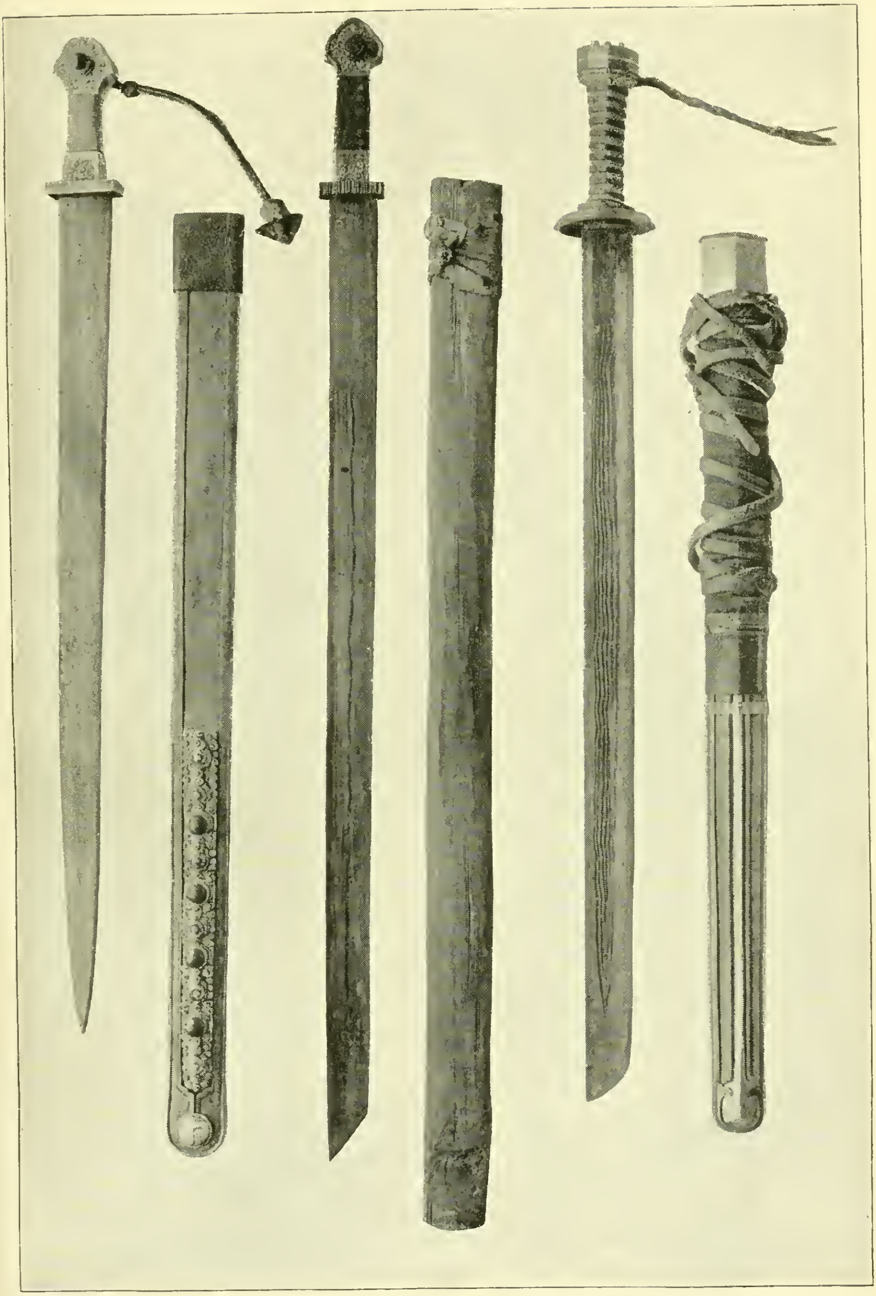
(Cat. No 131321, U. S. N. M.)

Fig. 2. SWORD AND WOODEN SCABBARD. Handle, of repoussé brass. Dawo.

(Cat. No. 131041, U. S. N. M.)

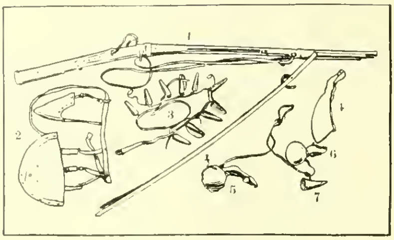
Fig. 3. SWORD AND SCABBARD. Scabbard and handle of sword covered in shagreen. Scabbard ornamented with bands of silver and with iron guards. Poyul.

(Cat. No. 167301, U. S. N. M.)



SWORDS AND SCABBARDS.

EXPLANATION OF PLATE 23.



GUN AND ACCOUTREMENTS.

Fig. 1. Matchlock with Fork. Ts'aidam.
(Cat. No 131042, U. S. N M.)

Fig. 2. Red Leather Belt. Studded with brass nails, with bullet pouch and bag for powder horn, etc. Dergé.
(Cat. No. 167261, U. S. N. M)

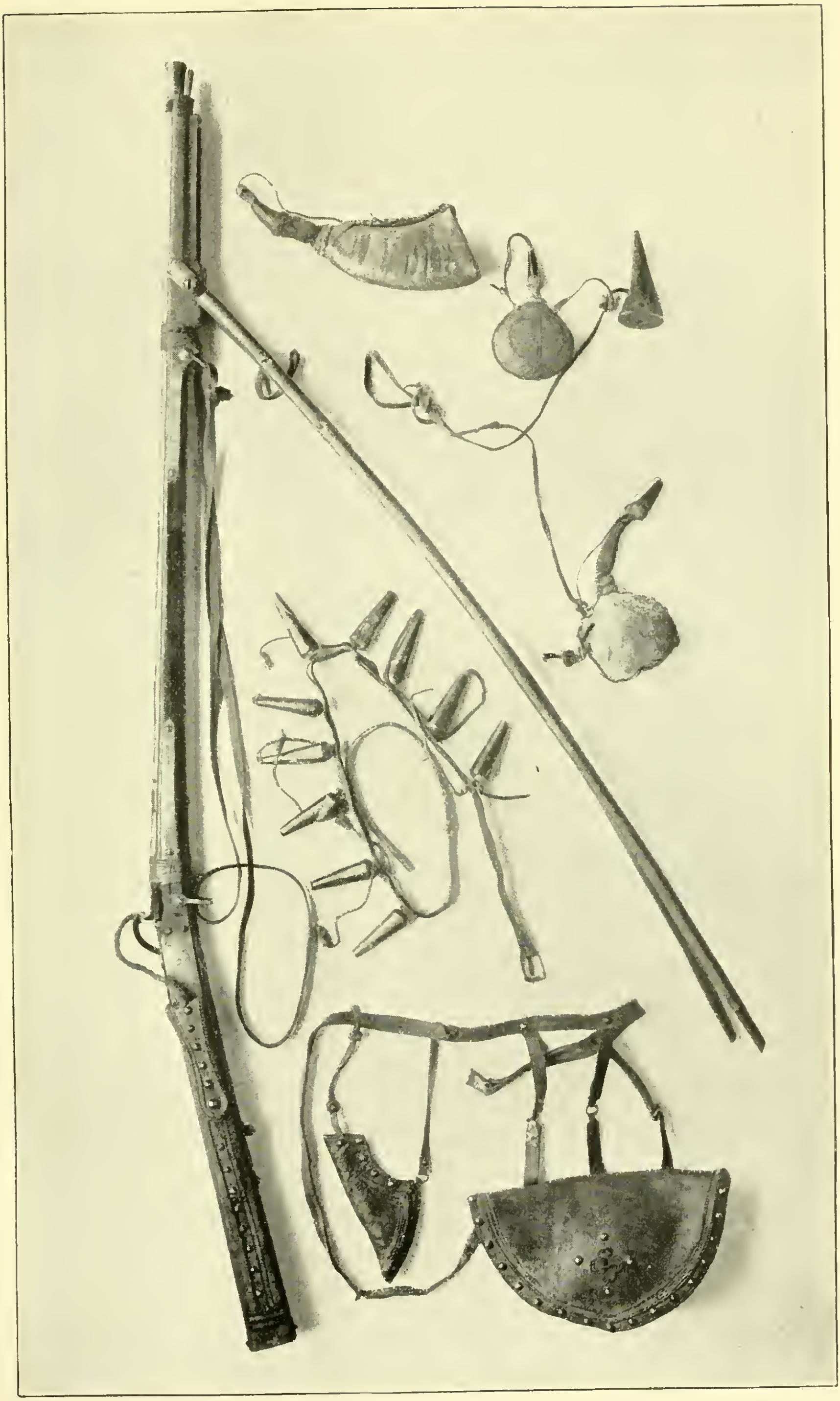
Fig. 3. Brass Chargers. Ts'aidam.

Fig. 4. Powder Flask. Made of *Ovis poli* horn. Ts'aidam.
(Cat. No. 167260, U. S. N. M.)

Fig. 5. Powder Horn, Leather. Covered with felt. Ts'aidam.
(Cat. No. 167285, U. S. N. M)

Fig. 6. Powder Horn. Made of boiled leather. Ts'aidam.
(Cat. No. 131183, U. S. N. M.)

Fig. 7. Horn Primer. Eastern Tibet.
(Cat. No. 167285, U. S. N. M.)



GUN AND ACCOUTREMENTS.

being used this fork rests on the ground and the marksman shoots kneeling or even lying down.

Most Tibetans carry a number of horn or brass chargers around their necks or in their bosoms, and in a leather bag hanging from a belt on their right side is a horn primer, which can be opened by a bit of thin elastic horn which covers the end, also a powder horn, frequently made of the horn of an *ovis poli*, or of wood covered with leather. In another small pouch hanging from the same belt, but on the left side, is kept a supply of leaden bullets.

The gun described is a good specimen of the matchlocks used in eastern Tibet and among the Ts'aidam Mongols. Guns mounted by these latter people are much prized in parts of Tibet, as they are much lighter than any others.

The stock and lower end of the gun are kept wrapped in a waterproof case of different colored woolen cloths or in a case of pulo or one made of marmot skin or simply in a piece of felt.

The barrels of all Tibetan guns are imported from either China or India, the Tibetans not being able apparently to make them, though those I have seen were of very rough workmanship and far from being true.*

Dr. Griffiths (Journal, p. 166) says that the matchlocks used in Bhutan are of Chinese manufacture but gun forks are not used among this people. Nain Singh, speaking of the nomads of northwestern Tibet, says:

> Most families possess a matchlock, generally of Nepal manufacture, and the men of the Rudokh district seldom move about without either a gun or a bow and arrows, in the use of which latter they are very expert. (Journ. Roy Geog. Soc., XLVII, p. 93.)

To the fork of their gun Tibetans often attach a small piece of white cotton cloth on which are printed magic formulas, and it is customary among the wilder tribes to smear the stock of the gun with some of the blood of any animal they may kill. This, as explained to me, was "for good luck."

The spear (*dung*) is a weapon in common use in Tibet, especially among the black-tent people. It varies in length from 7½ feet to 10 or 12 feet. One in my possession (See Diary of a Journey, etc., p. 170), made in Poyul, has a shaft 5 feet 7½ inches long; the point is of iron, the shaft fitting into a socket at its end. The point is a long, narrow two-edged blade. The butt of the shaft has a heavy iron shoe. A strong band of iron is coiled around the shaft its whole length; this device is resorted to throughout the country to strengthen the shaft, for making which the country supplies no good wood. The shaft of the spear in my possession appears to be of cocoanut wood.

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* Kashmir produces fine gun barrels. In all likelihood many are imported into Tibet. On their manufacture, see Moorcroft, Travels, II, 203–213.

The Tibetans are very expert in using the sling (*orta*, or *gudo*, according to Jaeschke), and among the tent dwellers and the people of the more remote localities, one is always seen hanging from the belt of both men and women. It is made of wool and hair mixed; one string terminates in a leash, and the instrument is also used as a whip in driving sheep or cattle (see Diary of a Journey, etc., p. 264). I have seen time and again a stone thrown a distance of over 300 yards from one of these slings.

Hunting is not allowed in many parts of Tibet, it being forbidden by the religion of the country to take animal life. In the remoter parts and in eastern Tibet generally, the people hunt, however, yak, deer, antelope, and especially musk deer.

Nain Singh says:

The Champas are keen in the pursuit of game, which they kill in large quantities, partly with firearms and bows and arrows, but chiefly with a kind of trap called *Redokh chum*, very similar in principle to an English rat trap. It consists of a ring made of rope, to whose inner surface are attached elastic sharp-pointed slips of wood converging toward the center of the ring, where a space is left sufficiently large to allow the passage through it of the animal's foot. Small holes are dug in the ground near the water which the wild animals are known to frequent. These traps are placed at the top, hidden from view by a covering of earth, and attached by a strong rope, also concealed from view, to a stout peg, which is driven into the ground at a considerable distance off. The animals on their way to the water pass over the holes, and the weight of the body drives the foot through the ring. Once through, it is impossible for the animal to free his foot from the trap, and he soon falls a victim to the sword and spear of the hunter, who lies concealed somewhere in the neighborhood. Great numbers of wild horses, sheep, and antelopes are killed in this manner. (Journ. Roy. Geo. Soc., XLVII, p. 94.)*

Capt. Samuel Turner says of the father of the then Panchen Rinpoché lama of Tashilunpo:

I found Gyap to be not only a lover of manly sports and martial exercises, but also a perfect connoisseur on the subject of arms. His collection was exhibited, and he liberally descanted on the peculiar merits of each weapon. There were arrows famed for their remote and steady flight, which had names inscribed on each of them, and places assigned to them in a quiver, in separate cells. He honored me with a present of three of these, and a large Chinese bow, near 5 feet in length, made of the horns of buffaloes, which he had used, he said, for many years. * * * His own favorite bows were of bamboo, a species produced in the mountains bordering upon Tibet, of great strength, and almost entirely solid. The bow is framed from two pieces of bamboo, split off next the outside; the inner sides of which, after being well fitted, are united together by many strong bands. Gyap put one of these bows into my hands, which, when bent, was of extreme tension. I was unable to draw the arrow, but taking it himself, he pointed it at a mark upon the opposite hill, at a distance, as I judged, of 500 or 600 yards. I could not trace the flight of the arrow, though steadily intent upon it, when he discharged it. * * * He mentioned also the dexterity with which a horseman here would dismount his adversary, particularly when in pursuit, by means of a running noose. (Turner, Embassy to the Court of the Teshoo Lama, pp. 341, 342.)

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*One of these traps is figured in Capt. H. Bower's Diary of a Journey through Tibet, p. 117. From this we further learn that the converging slips in the trap are not of wood but of horn. It is interesting to find an identical trap used by the Shuli near Khartum on the Nile. (F. Ratzel, Völkerkunde, I, p. 504.)

Musical instruments.—Exclusive of the musical instruments used in religious worship, which will be described in another section. the only instruments I have seen or heard of among the Tibetans are, first, the whistle (*ling-bu*), (pl. 24, figs. 1–3) made of bamboo or the bone of an eagle's wing, and with 6 or 7 keyholes; second, the jew's-harp (*k'a-pi*) (figs. 4–6) and third, the banjo or guitar (*piwang*, *kopong*, or *dra-nyan*), with 3 or more strings.

The jew's-harp is made not by the Tibetans, but by the Lissus and other non-Tibetan tribes inhabiting southeast Tibet, and is a favorite instrument in eastern Tibet, where nearly all the women carry one suspended from their girdles. Three harps are used simultaneously, each giving a different note; the deepest note is called *p'o kä* or "male sound," the intermediate one *ding kä* or "middle sound," the sharpest one *mo kä* or "female sound." They are held the one below the other in the order above given between the thumb and the index of the left hand, and struck with all the fingers of the right hand, the one after the other. These *k'api* are carried in small bamboo cases ornamented with little rings of bamboo, often dyed, and also with geometric carvings, which are also colored. They are shown in the lower portion of this plate.*

The banjo or guitar is similar to that instrument in China and Kashmir, being round-bodied and long-armed. Desgodins (Le Thibet, p. 393) mentions a rude one with only 2 strings, which are struck by means of a plectrum.

Capt. Turner, in the work previously cited (p. 343), says:

> Gyap gave into my hand a flageolet, and desired me to use it. I was unable. He then took it, and accompanied Gyeung upon the cittaur (a stringed instrument, something resembling a guitar) and they played several pleasing airs together. At length, Gyeung accompanied the instruments with her voice, which was by no means inharmonious; and I am not ashamed to own that the song she sung was more pleasing to my ear than an Italian air. * * * Gyap regretted his inability to entertain me with a great variety of instrumental music, saying that he was obliged to leave behind him his collection on leaving Lassa. * * * He told me that their music was written down in characters, which they learnt.

The statement made at the end of the preceding quotation is highly interesting, but I fancy that Turner's host only referred to church music, which is recorded by an ingenious system of descriptive notation. (See Land of the Lamas, p. 88.)

Vocal music is an amusement of which all Tibetans are very fond, and the power and sweetness of their voices have been noted by most travelers. (Dr. J. D. Hooker, Himalayan Journals, I, p. 304, C. H. Desgodins, Le Thibet, p. 393, etc.)

Tibetan dancing (*tra-chyam* or *chyam*) is of the most primitive kind.

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* Jew's harps similar to those used in Tibet are found among the Ainu and in New Guinea, but in many other countries where a bamboo harp is used, the sound is produced by jerking the harp by a string—this is the case in Assam, in parts of Sumatra, among the Yakuts, the tribe of Torres Straits, etc.

Single female dancers sometimes perform while playing on the jew's-harp. In this dance they shuffle slowly about, without raising the feet, and keeping time to their music. In other dances five or ten men stand on one side holding hands, and facing them stand as many women. One line sings a verse while slowly moving forward and backward, then the other side does likewise. (See C. H. Desgodins, *op. sup. cit.*, 394, and Land of the Lamas, p. 247.)*

George Bogle thus describes a dance he witnessed near Shigatsé.

The court held about 30 dancers, half of them men, half of them women. The men were dressed in different and party-colored clothes, with their large sheep's-wool bonnets, a bit of colored silk in one hand, and a leather machine, something in shape of, but rather less than, a fiddle at their side. The women had their faces washed, and clean clothes, abundance of rings upon their fingers, and of coral, amber beads, bugles, etc., on their heads and necks, and each wore a small round hat, covered with circles of white beads. They formed a ring, the men being altogether, the women altogether, and five men were in the middle of it. They danced to their own singing, moving slowly round in a sort of half-hop step, keeping time with their hands, while the five in the center twisted round and cut capers, with many strange and indescribable motions. The second part of the entertainment was performed by four or five men, with winged rainbow-colored caps, who jumped and twisted about, to the clashing of cymbals and the beating of tabors. Among the rest was a merry Andrew with a mask stuck over with cowries, and a clown with a large stick in his hand. These two men were more alike than the others, and between whiles carried on a dialogue, and the grimace and conversation gave great entertainment to those who understood it. (C. R. Markham, Narrative of the Mission, etc., p. 92.)

VII.

TRANSPORTATION.

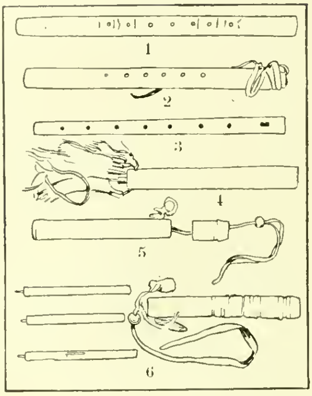
Wheeled vehicles are practically unknown in Tibet; all traveling is done on horse or mule back or on foot, and freight is carried by yaks, mules, horses, donkeys, or sheep, hardly ever by men, except for short distances over exceptionally rough or steep ground.

The Tibetan riding saddle (*taga*) differs but little from that used in China; in eastern Tibet those most prized are made in Dergé (see Diary of a Journey, etc., p. 192.), and in central Tibet saddles of Chinese make, but ornamented with silver and precious stones in Tibetan style, are much sought after.

Pl. 25 shows a Kokonor pony equipped with a good Dérgé saddle. The tree is made of four pieces of birchwood, covered on the outside before and behind with shagreen and trimmed with polished iron bands. The seat is of several thicknesses of felt covered with pulo. The stirrup straps are of plaited rawhide, the stirrup irons of Chinese make. The girth passes over the saddle; frequently a hind girth is used. A broad crupper and a breast band are generally used. From the latter hangs, when the rider is an official, a long red tassel or *dom*, (called *ch'i-hsün* in Chinese), such as are worn in China by military

* The religious dances of Tibet, of which there are quite a large variety, have been so frequently and minutely described by different writers that they require no mention here.

EXPLANATION OF PLATE 24.



WHISTLES AND JEW'S-HARPS.

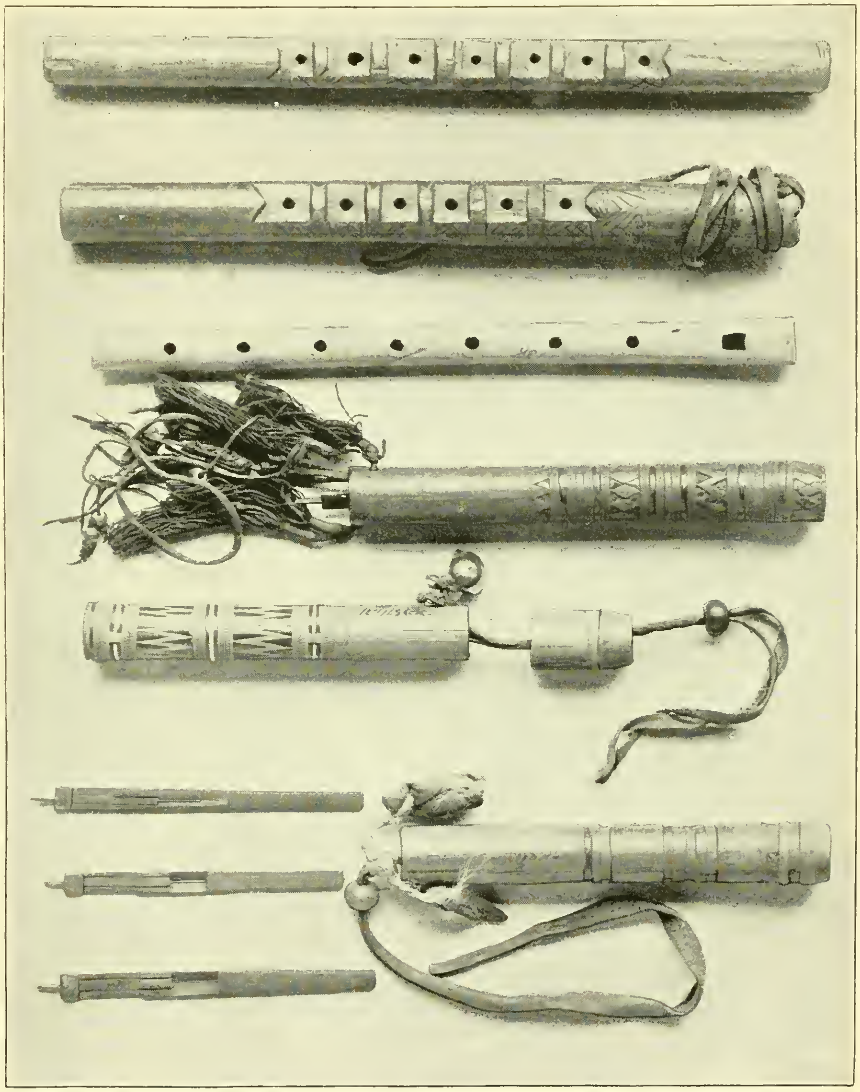
Fig. 1. BAMBOO WHISTLE. Bat'ang.
(Cat. No. 167165a, U. S. N. M.)

Fig. 2. BAMBOO WHISTLE. Bat'ang. Strap to tie to girdle.
(Cat. No. 167165b, U. S. N. M.)

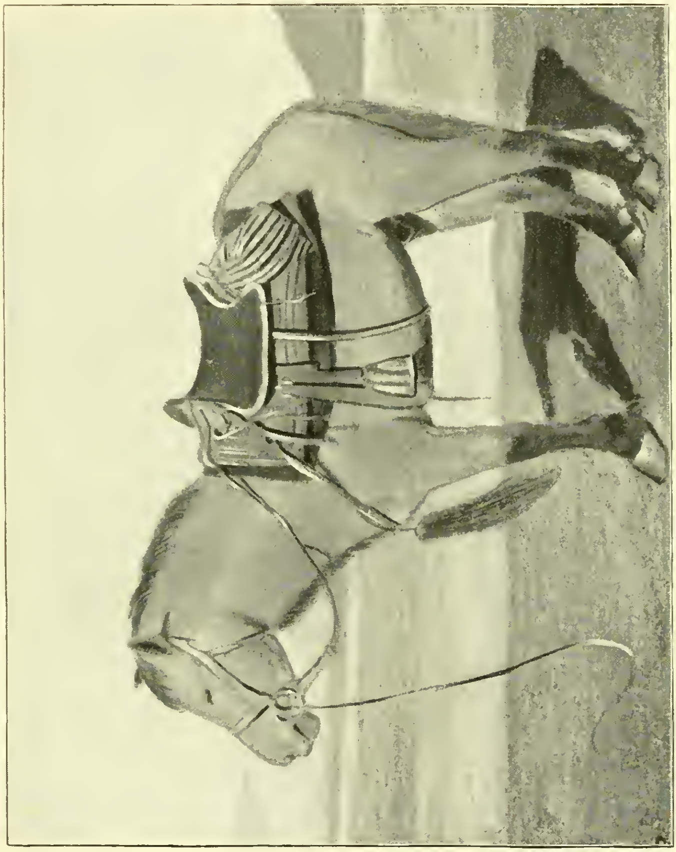
Fig. 3. EAGLE BONE WHISTLE. Kokonor Tibetans.
(Cat. No. 167166, U. S. N. M.)

Fig. 4 and 5. BAMBOO JEW'S-HARP CASES. Bat'ang.
(Cat. Nos. 167168e and 168168c, U. S. N. M.)

Fig. 6. BAMBOO JEW'S-HARP AND CASE. Bat'ang.
(Cat. No. 167168b, U. S. N. M.)



WHISTLES AND JEW'S-HARPS.



Kokonor Pony, with Tibetan Saddle and Harness.

From a photograph by the author.

officers. The bit used throughout Tibet is a very light, large-ringed snaffle, and the headstall and reins are of either rawhide or plaited hair. A long plaited rawhide rope is usually carried, tied to the saddle, one end attached to the ring of the bit. Under the saddle are two pads made of felt and covered with ornamented leather facings; those of this saddle were made in Poyul. These pads, which do not quite touch along the upper edge, keep the saddle well off the horse's back. Underneath them is a large blanket or a felt rug which extends nearly to the horse's tail. Sometimes, especially in eastern Tibet, the whole saddle is covered with a green cloth cover with a felt lining.

Woolen saddle bags (*sata*), varying in size and in fineness of texture, are used by most Tibetans when traveling; in them they carry all their provisions. Some of them are so closely woven that they are quite waterproof.

The Tibetans use rawhide and yak hair hobbles, with which they fasten the two fore feet and one hind foot of their horses and mules. Sometimes iron chain hobbles fastened with a padlock are used. This latter kind of hobble is of Chinese make.

The pack saddle, used alike on mules, horses, and yaks, consists of two light wooden wings with a light wooden arch at each end, as seen in pl. 26. On either side are two parallel sticks projecting about 3 inches beyond the arches. The girth, which is of wool, is fastened to the lower stick, and the hair or rawhide ropes with which the load is fastened on, passes over and under the upper one. When carrying loads done up in rawhide so as to protect them from the weather (and in this way all the tea and other valuable merchandise is carried), short rawhide loops fastened to the loads by means of sticks fitting in small slits made in the rawhide are passed over the end of the upper stick of the saddle and the load hung by them. Crupper sticks, as well as cruppers and broad breast straps of wool, are always used. The form of pack saddle used in eastern Tibet and the Kokonor is a little larger and heavier than that used in other parts of the country. Two rectangular felt pads covered with coarse cloth (*lawa*) are tied to the saddle, and under these again are one or more felt rugs. (See Diary of a Journey, etc., p. 108.)

The Tibetans do not generally use riding whips; the end of the rope tied to the bridle is used in its stead; when they do, it is made with a short wooden handle to which is tied a heavy lash about 18 inches long.

Pilgrims traveling on foot usually have on their backs a light wooden framework about 20 inches high, made of a couple of small twigs bent into a rectangular shape; on this they tie their small load of baggage, a similar frame tied to the lower part of the first one folds up against it and holds the load in place, and woolen straps pass over the bearer's shoulders. This contrivance is called a *k'ur-shing*.

Women carrying water in the long narrow wooden barrels in use throughout Tibet for that purpose, rest the bottom of the barrel on the thick folds of their gown gathered above the waist, and passing a strap around the top of the barrel and across their breasts, thus ascend the steepest hills, their arms folded before them.

Boats.—The only purely Tibetan boat I have seen or heard of is the skin coracle or *ku-dru.* It is composed of yak hides stretched over a few bent twigs with a slightly heavier piece of wood bent around the top to which the skin is firmly sewn. So frail is it that one must be careful not to put one's foot on the hide, but only on the ribs, for the least direct pressure on the skins makes the seams give way. A man kneeling in the bow paddles or stears with a short paddle, crossing the river diagonally, and then carrying his boat on his back upstream so as to come back to his starting point when swept across again. These coracles are about 5 feet long, 4 broad, and 30 inches deep; two or three men and a couple of hundred pounds of goods can be carried in one. When leaking slightly the holes are filled with butter. With these skin boats we may compare the "bull boats" used by the Mandans on the Upper Missouri, which are, however, slightly smaller than the Tibetan ones, though identical with them in all other respects.

All other boats used in Tibet are made by the Chinese. On some of their rivers the Tibetans use heavy rafts, which four or six men paddle across. They are about 12 feet long and 6 feet broad, made of heavy squared logs held together by a pinned crosspiece in front and behind.

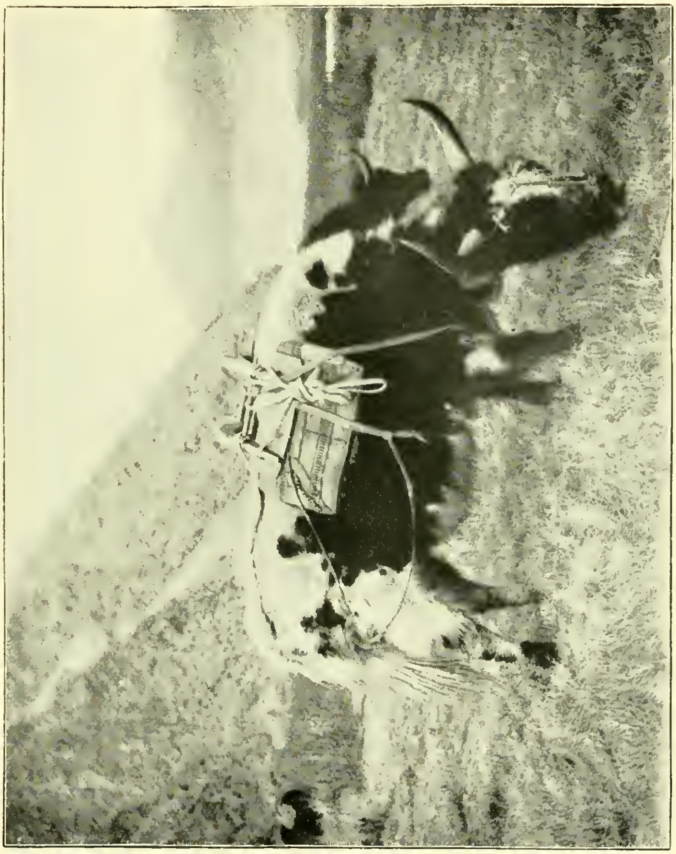
VIII.

MONETARY SYSTEM—MEDIUMS OF EXCHANGE—WRITING—PRINTING—TIME RECKONING—MEDICAL KNOWLEDGE—MISCELLANEOUS OBJECTS.

A Chinese author, called Wei Yüan, in his work entitled Sheng-wu chi (Book XIV, p. 53), says that in ancient times the Tibetans used cowrie shells and knife-shaped coins, but that since the Sung, Chin, and Ming periods (i. e., since the twelfth century) they have used silver. He further adds that since the Cheng-tung period of the Ming (A. D. 1436) they have paid their taxes (or tribute to China) in silver coins.

As far as my information goes the present coinage of Tibet has been in use since the middle of the eighteenth century. It comprises only one coin, a silver one called *tranka*, of the nominal value of about 16 cents of our money. Fractional currency is made by cutting the tranka into pieces. (Land of the Lamas, p. 207.) The only mint I know of in Tibet is at Lh'asa. The trankas minted there bear on the obverse the inscription *Jyal-wai Gadän p'odrang chyog-las*, "From the Jyal-wa's castle of Gadan,"—*Jyal-wa* standing for *Jyal-wa jya-mts'o*, the usual title of the Talé lama. On the reverse are the eight signs of good luck, each inclosed in a small circle, and in the center is what I take to be a lotus flower. These trankas are colloquially called *Gadän tranka.*

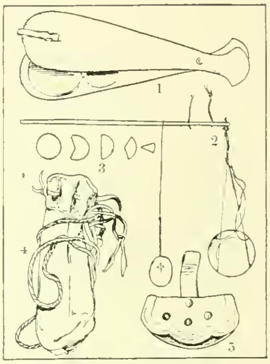
Coins of similar value, but minted in Nepaul, Indian rupees and Chinese bullion, are also in use, and rupees, from their purity and the impossibility of counterfeiting them, are in much greater demand than



HALF BREED YAK, WITH PACK SADDLE. KOKONOR TIBETANS.

From a photograph by the author.

EXPLANATION OF PLATE 27.



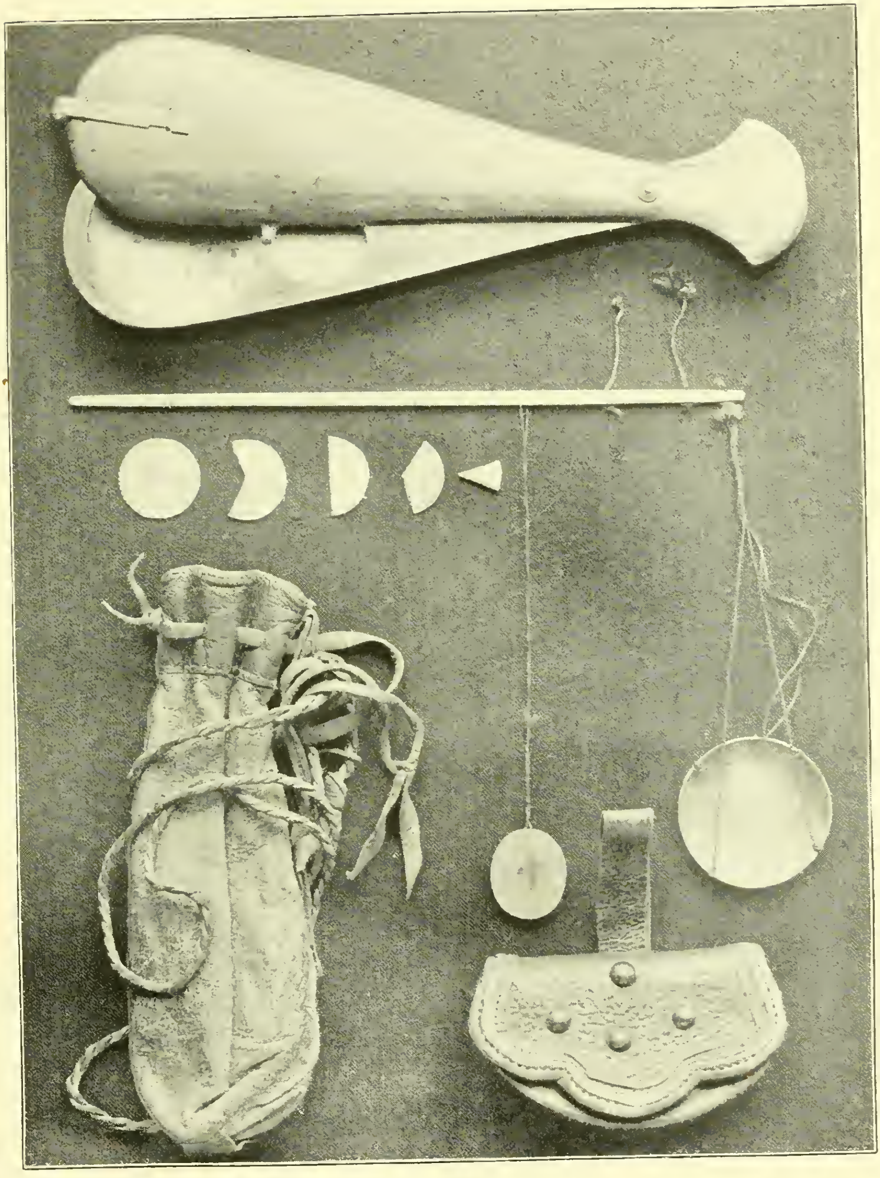
MONEY, MONEY SCALES AND POUCHES.

Figs. 1 and 2. MONEY SCALES AND WOODEN CASES. China.
(Cat. No. 131027, U. S. N. M.)

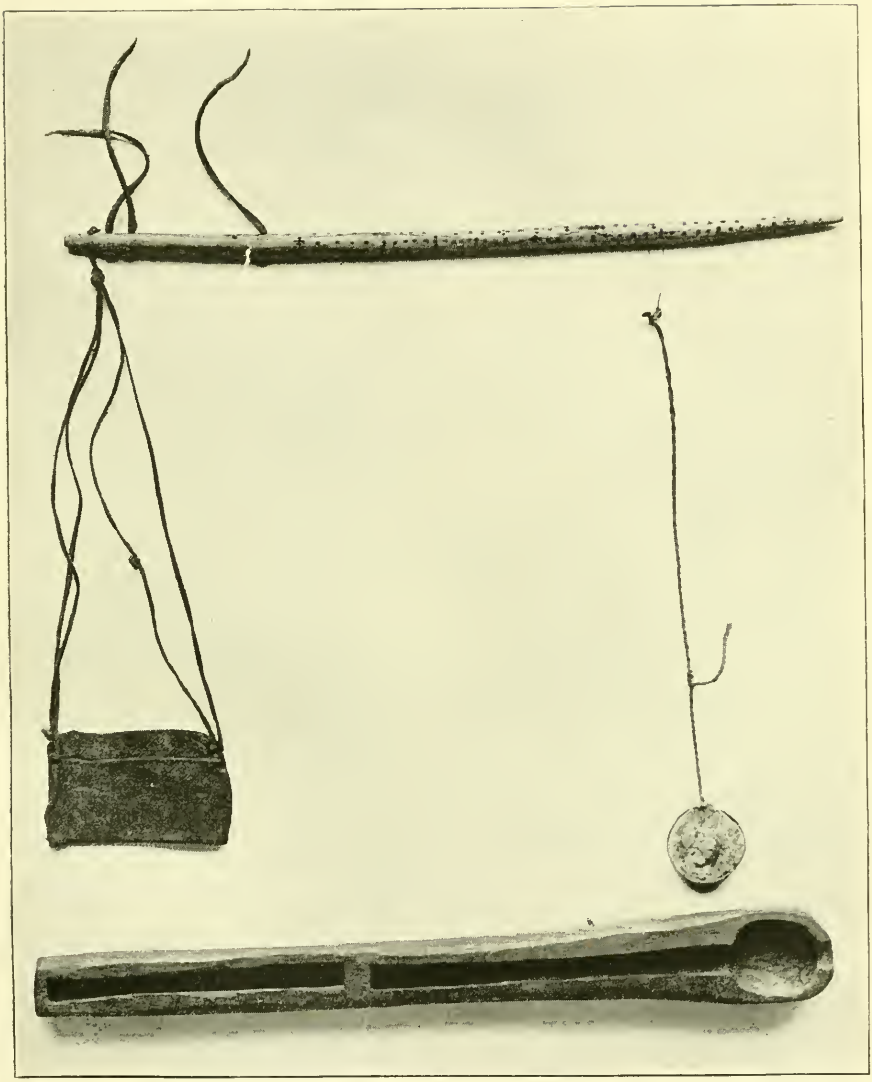
Fig. 3. TANKA AND FRACTIONS OF TANKA.
(Cat. No. 131027, U. S. N. M.)

Fig. 4. BUCKSKIN MONEY BAG. Dergé.
(Cat. No. 131028, U. S. N. M.)

Fig. 5. RED LEATHER POUCH. Ornamented with brass studs. Dergé.
(Cat. No. 167153, U. S. N. M.)



MONEY, MONEY SCALES, AND POUCHES.



MONGOL MONEY SCALES AND CASE.
Cat. No. 167249, U. S. N. M. Taichinar Ts'aidam.

the native coins or even Chinese bullion, the purity of which the people have no means of testing.

In the Museum collection is a full set of Tibetan coins (see also pl. 27, fig. 3); all the older ones, bearing Chinese and Tibetan inscriptions, are plaster casts obtained from the British Museum cabinet.

Chinese money scales (*jama*) are used by the Tibetans and in Mongolia. The form met with throughout China is shown on pl. 27, fig. 1, and pl. 28 shows a rough copy made in Taichinär Ts'aidam. In the latter the wooden beam is roughly indented to indicate ounces, tenths, and hundredths of ounces (in Tibetan called *srang*, *djo*, and *karma*); instead of a brass tray one of buckskin suspended by horse-hairs is used, and the weight is a bullet roughly flattened out. These scales fit in a wooden trough roughly whittled out with a knife.

Money (see fig. 3) is carried either in a small leather bag (pl. 27, fig. 4) with a long buckskin string by which it is tied to the gown, or in a small pouch with a leather loop through which the girdle passes (fig. 5). At Lh'asa the people use portemonnaies of semicircular form made of red leather embossed and with an ornamental border. They have two pockets and close with a hook, with a large silver boss on the flap.

In most parts of the country money is but little used, the people bartering for most of the things they require. Brick tea is used to such an extent in their mercantile transactions that it is, for all practical purposes, a unit of value. Salt, *tsamba*, boots in the Kokonor, *pulo*, cotton cloth, and even walnuts (in the Bat'ang country), are accepted without a murmur instead of silver, and in most places one or any of these articles are preferred to it.

Writing.—Tibetans write from left to right in horizontal lines, using a bamboo pen or *nyugu* (pl. 29, fig. 8), which they carry in pen cases (*nyu-shu*) of metal, brass, copper, or silver (figs. 6 and 7), in form like a sheath, with a sliding top and rings on either side, by which it may be suspended by a cord from the girdle. Hanging from the same string is a small ink pot (*napang*) also of metal, in which they carry dissolved india ink (*natsa*). In fig. 7 is shown a Lh'asan silver pen case and ink pot finely chased. The brass pen-case shown in fig. 6, made at Lit'ang, has the eight signs of good luck in repoussé work on it. A small cast brass ink pot from Lh'asa is shown in fig. 3.

Chinese paper is usually used for letter writing, but when copying books or when printing the Tibetans use paper made in Nepaul and Bhutan from the bark of various species of Daphneæ, and especially of *Edgeworthia gardneri*, which has been previously washed with a little milk and water, so that it may not blot. They also manufacture themselves a paper from the root of a small shrub, which is of a much thicker texture and more durable than Daphne paper. In western Tibet this paper is manufactured with a species of *Astragalus*, the whole shrub being reduced to pulp. (J. D. Hooker, Himalayan Journals, II, 162.)*

* See also B. H. Hodgson, Miscellaneous essays relating to Indian subjects, II, p. 251.

Printing.—Printing is done in Tibet exactly as in China. The manuscript, written on very thin paper, is pasted over a smooth, thin block of wood, and with a small chisel the surface of the block around the letters is carefully removed to a depth of about one-eighth of an inch. Ink is rubbed lightly over the block, a sheet of paper is then placed on it and a brush lightly passed over the sheet, which is, when removed, left to dry, when the other side is printed in like manner from another block.

The Tibetans distinguish nine or ten different styles of writing, but these may be reduced to three, capitals (*wu-chän*), small capitals (*wu-méd*), and running hand (*chyug-yig*). Books are usually written in the first, and the two other forms are used in correspondence and for all the ordinary purposes of life.*

Like most Asiatics the Tibetans never sign their letters but seal them, nearly every one, even those who can not write, carrying a small seal (*titsé*) suspended from his girdle. These seals have on them a letter or a religious symbol surrounded by an ornamental design. They are cut in iron and are frequently of very delicate workmanship. In pl. 29, fig. 4, is shown a seal made in Dérgé; it is cylindrical, 2½ inches long, terminates in a knob head, and is bored out, chased, and fretted. The design is a *swastika* or "hooked cross" in the center of a foliated motive.

Letters and packages are sealed with wax (*lajya*) made of lac, and on the wax is an impress of the sender's seal. A piece of wax is carried suspended to the girdle with the seal, as shown in the figs. 1, 2, and 5.

Time reckoning.—"The Tibetans received their astronomical science from their neighbors in India and China, the Chinese also becoming their teachers in the art of divination. Their acquaintance with the astronomical and calendrical systems of these nations coincides with the propagation of the Buddhist religion by the Chinese and Indian priests, to whom they are also indebted for the respective systems of defining the year. Both systems are based upon a unit of sixty years, differing, however, in the modes of denominating the years." (Emil Schlagintweit, Buddhism in Tibet, 273.)

In these cycles of sixty years, when numbered according to the Indian principle, each year has its particular name, but when the Chinese mode is used, the names used in the Chinese duodecimal cycle are used five times, coupled with the names of the five elements or their respective colors, each of the latter being introduced in the series twice in immediate succession. A masculine and feminine are also frequently added to the above, represented alternately by *p'o* (male) and *mo* (female).

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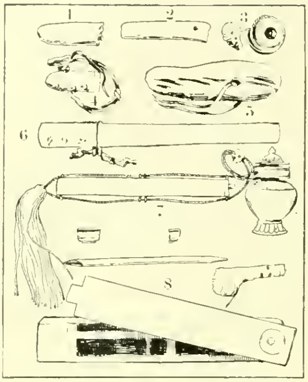
* For further details on the subject and for specimens of all the various Tibetan scripts, I must refer the reader whom the subject interests to Sarat Chandra Das' paper on "The sacred and ornamental characters of Tibet," in Journal Asiatic Society of Bengal, LVII, part 1, pp. 41–48, and to the Appendix in Csoma de Körös' Tibetan grammar.

EXPLANATION OF PLATE 29.



WRITING IMPLEMENTS.

Figs. 1 and 2. SEALING WAX. Ts'arang.
(Cat. No. 131022. U. S. N. M.)

Fig. 3. BRASS INK POT. Wooden stopper. Lh'asa.
(Cat. No. 167164. U. S. N. M.)

Fig. 4. SEAL OF WROUGHT IRON. Dergé.
(Cat. No. 131317, U. S. N. M.)

Fig. 5. SEALING WAX. Provided with thong to hang to belt. Ts'arong.
(Cat. No. 131022. U. S. N. M.)

Fig. 6. BRASS PEN CASE. Lit'ang.
(Cat. No. 167162. U. S. N. M.)

Fig. 7. CHASED SILVER PEN CASE AND INK POT. Lh'asa.
(Cat. No. 130401. U. S. N. M.)

Fig. 8. BAMBOO PEN AND INDIA INK; WOODEN PEN AND INK CASE. Ts'aidam.
(Cat. No. 167163, U. S. N. M.)

WRITING IMPLEMENTS.

The first year of the first cycle of sixty years is A. D. 1026, consequently 1894 is the twenty-ninth year of the fifteenth cycle, or the "Wood Horse" (*shing ta*) year of the fifteenth cycle.

The cycle of twelve years is copied on the Chinese, and needs no description here. This cycle is, in Tibet as in China, the one most commonly used, and in both countries to ask a person's age they say "to what sign (of the duodecimal cycle) do you belong ?"

Schlagintweit (*Op. cit.*, p. 276) says:

> In books as well as in conversation, the dates of past events are not unfrequently determined by counting back from the current year. For instance, the present year being 1863, the birth of Tsongkhapa, which occurred in 1355 A. D., would be said to have taken place five hundred and eight years ago.

I may add that in conversation events which have occurred more than three or four years ago are invariably spoken of as having happened in "olden times" or "a long while ago." Sometimes an event is referred to such and such a year of the reign of such and such a Talé-lama. On the whole Tibetans care very little about chronology of any kind.

Another method of counting, but very little used, is that based on a cycle of two hundred and fifty-two years made by a combination of the five elements, 12 animals of the duodecimal system, and the masculine and feminine particles previously referred to. (Schlagintweit, *op. cit.*, p. 287.)

The Tibetan year (*lo*) is divided into twelve lunar months (*dawa*), named "first month," "second month," etc. Every three years an intercalary month (*da lh'ag*) is added to compensate for the difference between the solar and the lunar year. The days are divided into twelve hours, as they are among the Chinese, from whom they have borrowed these divisions.*

Medical knowledge.—As with their astronomy and other sciences, so with their medical science, the Tibetans have borrowed it from India and China. While nearly all their medical works are translations from Indian originals (see Csoma de Körös, Journ. Bengal Asiatic Soc., IV, 1 *et seq.*), their pharmacopœia is largely borrowed from China, and is nearly entirely vegetable. The Chinese derive a great number of their most valued simples from Tibet, and the large lamaseries of that country have medical faculties and pharmacies attached to them which supply not only their own people with drugs, but nearly the whole of Mongolia.

The Museum contains a few samples of Tibetan drugs, among which I will only mention the *chyar-tsa gong-bu* (*Cordyceps sinensis*), *tsampaka* seed, or pod of the orxylum (*Colosanthus indica*, Blum.), and the *yadro* (*Anemarhena asphodeloides*, Hanbury).

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* For further details on Tibetan chronology and astrology I must refer the reader to Emil Schlagintweit, Buddhism in Tibet, pp. 273–328; Csoma de Körös, Grammar of the Tibetan Language, 148 *et seq.*; Ph. E. Foucaux, Grammaire Tibétaine, and Journ. Roy. Asiat. Soc., n. s., XXIII, p. 206.

Rhubarb (*djim-tsa*), though used sometimes for a dye, is never employed as a medicine in Tibet. Among the Mongols its medicinal properties are known, but its use is confined to camels.

Ophthalmia is one of the commonest diseases in Tibet. When so affected the sufferer either wears Chinese smoked glasses or eye shades (*migra*) of horsehair (pl. 30, fig. 1). These eye shades consist in a band of closely-woven horsehair about 2½ inches broad. The ends are sewed into bits of embroidered flannel. Some of these shades are convex over the eyes, but I believe that these are not made in Tibet, but on the Kan-su frontier, by Chinese. The eye shades are carried suspended from the girdle in a cylindrical cotton case, which can be pulled out of another case of similar material, but usually handsomely embroidered, which slides over it.

Pl. 30, fig. 1, shows a *migra* and case made in eastern Tibet. The Chinese form of eye shade (fig. 2) is also occasionally used by Tibetans.

It is interesting to note that a similar horsehair shade is worn by Persians in some parts of their country. (John Bell, Lives of Celebrated Travellers, II, p. 133.)

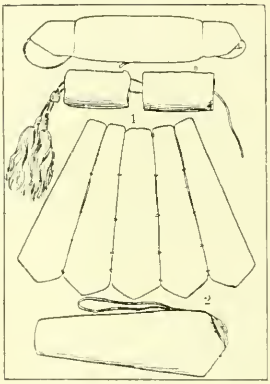
Miscellaneous objects.—In Tibet sewing is about equally divided between the two sexes, the men making most of their own clothes and all tailors being men. They use scissors and needles of Chinese make and woolen thread which they twist themselves. They sew toward the body. The men do not use a thimble, but women have a small ring made of copper resembling a seal ring, but where the stone should be there is lead. They put this ring on the forefinger and press the needle against it. It is used in parts of Mongolia (Ts'aidam) as well as in Tibet, but the Chinese thimble, in shape like our tailor's thimble, is rapidly superseding it in popular favor.

A fly brush, made of the tail of a small yak, is shown in fig. 2, pl. 31. The hair of the upper part of the tail has been scraped off and a handle made of the hardened hide. The hair is dyed a light red. The other fly brush (fig. 1) is of coir, and is in use in China.

Rouge pads of felt which have been soaked in a red coloring matter are used by Mongol and Tibetan women. A portion of this is readily transferred to the cheek by slightly moistening the pad. These pads are prepared in China. The Mongols use them much more commonly than do the Tibetans, who have naturally rosy cheeks.

Loosely woven scarfs of silk, called in Tibetan *K'atag* (*K'a-btags*), are in common use. Some of them have Buddhist symbols or images of the Buddha woven in the texture; others are of less value and are stiffened with plaster or rice powder. The usual color of these *K'atag* is light-blue or white. The smaller ones are about 20 inches long and 6 inches wide, and are worth a few copper cash apiece. The largest are frequently 40 or 50 feet long and of proportionately greater value. Most of these *K'atag* are made in Ch'eng-tu in Ssŭ-ch'uan for the Tibetan and Mongol markets. Huc thus describes the use of the *K'atag:*

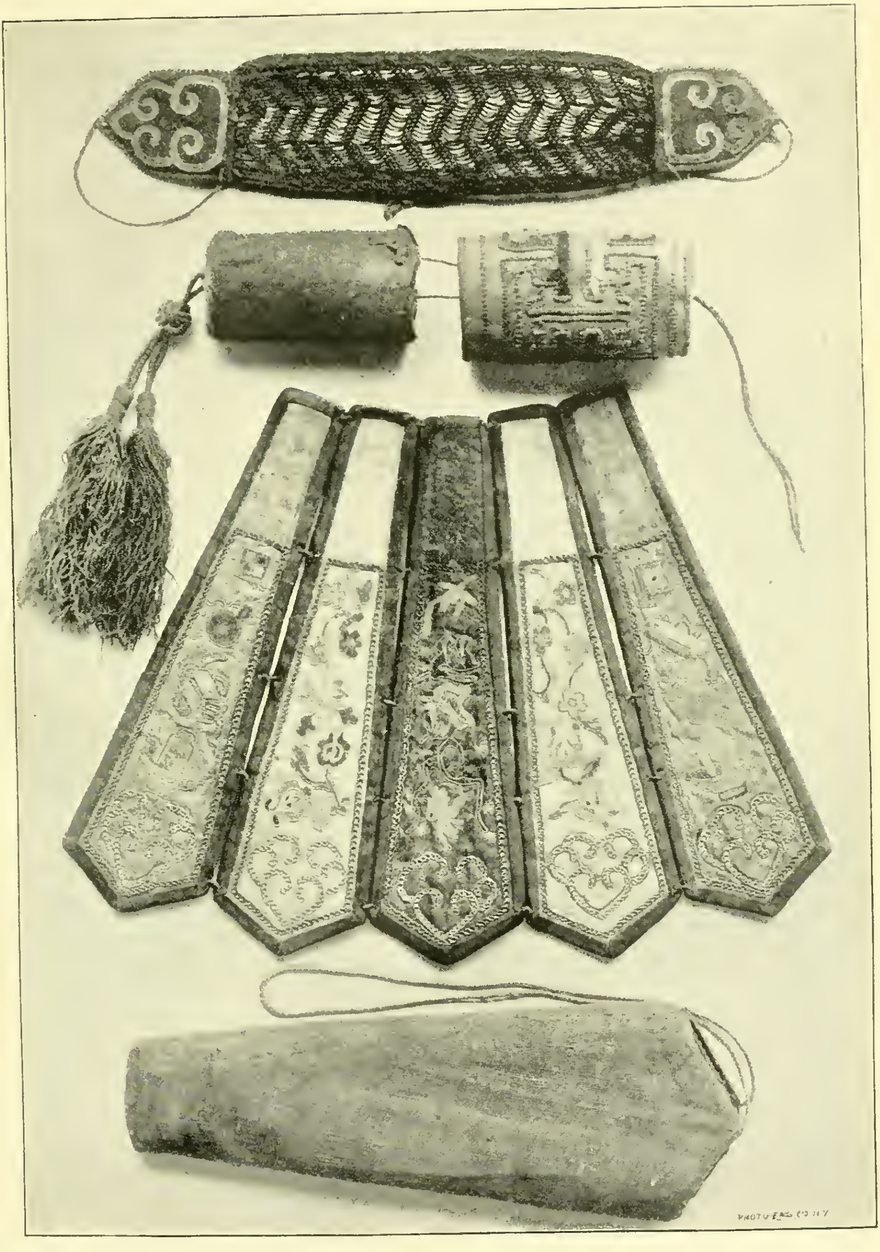
EXPLANATION OF PLATE 30.



EYES SHADES.

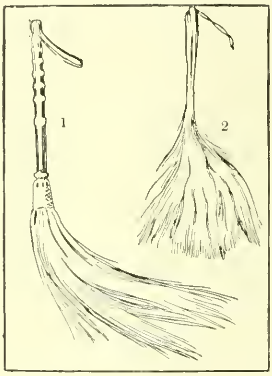
Fig. 1. HORSEHAIR EYE SHADE AND CASE. Eastern Tibet.
(Cat. No. 131053, U. S. N. M.)

Fig. 2. CHINESE EYE SHADE AND CASE.
(Cat. No. 167159, U. S. N. M.)



EYE SHADES.

EXPLANATION OF PLATE 31.



FLY BRUSHES.

Fig. 1. COIR FLY BRUSH WITH BAMBOO HANDLE. Used by Buddhist priests in China.

(Cat. No. 151283, U. S. N. M.)

Fig. 2. YAK TAIL FLY BRUSH. Hair dyed red. Bat'ang.

(Cat. No. 151283, U. S. N. M.)

FLY BRUSHES.

The *khata* or *scarf of felicitation* plays such an important role in Tibetan life that it is in place to say something of it. The *khata* is a piece of silk, nearly as fine as gauze. Its color is a bluish white. Its length is about three times its width; the two extremities usually terminate in fringes. There are *khatas* of every size and price; for it is an object that the poor as well as the rich can not do without. No one ever goes anywhere without carrying a small supply of them with him. When one pays a formal visit, when one has a service to ask of some one, or to thank a person, the first thing to do is to unroll a *khata*; it is taken in both hands and offered to the person one wishes to honor. If two friends, not having met for some time, suddenly run across each other, the first thing they do is to offer each other a *khata*. It is done with as much *empressement* and as promptly as one shakes hands in Europe. It is also customary when one writes a letter to fold up in it a little *khata*. It is incredible what importance the Tibetans, Si-Fan, Hung-Mao-Eul, and all the people living to the west of the Blue Sea attach to the *khata* ceremony. It is among them the purest and sincerest expression of all noble sentiments. The finest words, the most costly presents, are nothing without the *khata*. With it, on the contrary, the most ordinary object acquires immense value. If some one asks a favor of you, a *khata* in his hand, it is impossible to refuse it, unless one wishes to show contempt for all rules of propriety. (Huc, Souvenirs d'un voyage, II, p. 88.)

Besides these everyday usages referred to by Huc to which the *K'atag* is put, it is the most ordinary form of offering to the gods. Hundreds and thousands of them are suspended on the statues of the gods in every temple or shrine in Tibet and Mongolia, and in some sections of the country a *K'atag* of a certain quality, called by the Chinese *wu chai shou-pa*, is a recognized standard of value in commercial transactions. (Land of the Lamas, pp. 66, 105, and p. 122, note.*)

Ceremonial scarfs appear to have been at one time used among the Chinese. In 1575 Mendoza visited Fu-chou, in the province of Fu-kien, and was received with several other missionaries by the viceroy, who—

commanded in his presence to put about the neckes of the friers, in manner of a scarfe, to eyther of them sixe peeces of silke and unto the shoulders of their companions, and unto Omoncon and Suisay, each of them foure peeces and to every one of their servantes two a peece * * * so with the silke about their neckes, and with the branches in their hands, they returned out of the hall and downe the staires the way they came, and through the court into the streetes. (Mendoza, History of China, Hakluyt Soc. Edit., II, p. 83.)

A similar custom would appear to have existed in India in olden times; for we read in early Buddhist works of a piece of light stuff being put over the shoulders or around the neck of an honored person.

Games and toys.—I have given much time, while traveling in Tibet, to inquiring concerning toys for children and games, and have also carefully examined nearly all the works of Asiatic and European travelers for information on these subjects, but I have failed to hear of or learn anything of any importance on these subjects. What I wrote in The Land of the Lamas (p. 248) concerning the Tibetans of the Horba country seems applicable to the whole land:

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* See also Journ. Roy. Asiat. Soc., n. s., XXIII, p. 228, and Turner, Embassy to Court of Teshoo Lama, p. 233.

I noticed but few games of chance among them. Dice they have, but they are for divining purposes, not for gambling. A few men who had passed much of their time among the Chinese played cards, and chess is also known among them, but both are of foreign importation, and I could hear of no national game.

I have seen children amusing themselves with rag dolls and little bows and arrows, and Dr. Hooker (Himalayan Journals, I, p. 317), speaking of a place in upper Sikkim, says:

I was much amused here by watching a child playing with a popgun, made of bamboo, similar to that of quill, with which most English children are familiar, which propels pellets by means of a spring trigger made of the upper part of the quill.

Jack stones, or knuckle bones, is the only game I have seen played in the country, and that only on two or three occasions. This game is also known in China and Mongolia and, in fact, throughout eastern Asia. (See Bergmann, Voy. chez les Kalmuks, p. 151.)

In Ladak and Balti the men play polo, which some authors say is a game of Tibetan origin. It was once very popular under the name of *chaogan* in India, in which country it was introduced by the Mussulman conquerors toward the end of the twelfth century, but after Baber's time it gradually became obsolete. (Alexander Cunningham, Ladak, p. 311.)

Dr. Hooker (Himalayan Journals, I, p. 317) says that the Lepchas play at quoits, using slate for the purpose, and at the Highland game of "putting the stone" and "drawing the stone." The game of quoits is also played in the adjacent country of Bhutan and, I believe, in other portions of southern Tibet. Wrestling is also a popular amusement in most parts of Tibet; it is, I believe, that known among us as Greco-Roman.

IX.

BIRTH—MARRIAGE—DEATH.

Birth.—"They (the Tibetans) do not wash and bathe a newly-born child, but the mother licks it as soon as it is born. After three days they smear the child's body all over with butter and expose it to the sun's rays for several days. Children are fed on parched meal (*tsamba*) mixed with soup, the greater part of them getting no milk whatever." (Journ. Roy. Asiat. Soc., n. s., XXIII, p. 231.)

As a general rule the name given the children is chosen by a lama, who also casts the child's horoscope, and no festivities attend this naming. The name chosen is usually a Buddhist term, such as Lozang, "the intelligent," or Dorjé, "the thunderbolt (*vadjra*)," for a boy, while Padma, "the lotus," and Drolma, the name of the goddess Tārā, who was incarnated in the Chinese and Nepalese consorts of King Srong-tsan gambo, are favorite names for women. Frequently two sons of a same mother will have the same name, and *Ch'en*, "the big one, senior," and *Ch'ung*, "the little one, junior," will be added to their names. There are no family names.

Cunningham says that in Ladak they celebrate a "birth feast" (*Tsas-Ton*) and a "naming feast" (*Ming-Ton*).

The birth-feast (*Tsas-Ton*) is held one week after the mother's confinement, when all the relatives assemble at her home to celebrate the child's birth. All the guests make presents to the mother, according to their means, of pieces of cloth and food, and occasionally of money. The party then dines, and the entertainment ends with a bowl of chang. The mother remains at home for one month.

The naming-feast (*Ming-Ton*), which answers to our christening, is held just one year after the birth. The child is then taken before some great lama, to whom an offering is made of a rupee or a quantity of wheat or barley, according to the means of the parties. The lama pronounces a name, and the relatives retire to the usual entertainment of dinner and chang. (Alex. Cunningham, Ladak, p. 307.)

Marriage.—Marriage by capture still survives in portions of western Tibet, in Spiti, in Sikkim, and Bhutan, where the bridegroom and his friends, when they go to bring the bride from her father's home, are met by a party of the bride's friends and relations who stop the path; hereupon a sham fight of a very rough description ensues, in which the bridegroom and his friends, before they are allowed to pass, are well drubbed with good thick switches.

In other parts of Tibet the preliminaries of marriage are very similar to those of China. Go-betweens (*Bar mi* or *Long mi*) on the part of the man make overtures to the family of the girl, and if these are well received, astrologers are consulted to see whether the horoscope of the man and woman do not antagonize each other, and "if the good and evil of the life of the male harmonize in the calculation with those of the life of the female, longevity is counted upon. If not, the happiness of the couple will be short-lived."

As soon as the astrologer declares that the *Thun-tsi*, i. e., the circumstances of harmony necessary in the marriage, are favorable, the parents consult their friends and relations in order to ascertain the suitability of the match, and send one or two *Bar mi* (go-betweens) to ascertain the views of the maternal uncle of the maiden selected regarding her marriage. He generally withholds his opinion under various excuses. According to the customs of the country the *Shangpo* (maternal uncle) of a maiden is the real arbiter of her fate in the matter of marriage. Nothing can be settled without reference to him. When his leave is secured the marriage proposal can be formally made to the maiden's parents.*

The *Bar mi*, with the permission of the *Shangpo*, on an auspicious day during the increasing lunation of the month, proceed to the home of the parents of the maiden to present them with the *Long chang*, and therewith formally make the proposal of marriage. * * * The parents of the maiden receive the *Bar mi* with politeness, and serve them with wine and tea. After emptying one or two cups of tea the *Bar mi* present them with a scarf, and beg leave to state their mission. Then they pour out chang, but before the parents will partake of it, the maternal uncle of the girl must be got to give his consent, and as soon as he has, the parents drink the chang and the betrothal is made.

The marriage festivities generally last for three days at the home of the bride's parents, when the friends and relatives make her presents and the parents give her a dowry of cattle, clothes, jewelry, furniture, etc.

Before leaving the bridesmaid's house the domestic dieties are propitiated by a Bonbo lama, and here also is performed the ceremony of *trashi tré-wa*, or calling down blessings and long life on her. After this the bride rides to her husband's house

* This seems to point to a survival of the custom of reckoning descent through the females.

preceded by a man in white riding a white horse.* On arriving there she is received with other ceremonies, especially noticeable among which is that of driving away any evil spirits which may have accompanied her from her parents' house. The mother of the groom advances now toward the bride and presents her with a *k'atag*, *tsamba* mixed with butter, and a jar of milk.

There is after this a marriage dinner and the friends and relatives of the groom present them with *k'atag* and presents, and it is they who supply the provisions for the marriage feast.

After this a Bonbo priest gives the bride a new name which she is henceforth to bear, connecting it in some manner with the name of her mother-in-law. When this is performed a small piece of wood about 6 inches long is held to the lips of the bridegroom. The bride now sits in front of her husband, and takes the other end of the wood between her lips.

In the meantime a tuft of wool is placed in the hands of the bridegroom, who draws out the fibers to some length. The bride takes it from his hands and twists it into a thread. This is called the ceremony of the first work of harmonious union. Then the party of the bride separate from that of the bridegroom, and sitting in rows of seats facing each other sing repartee songs. When the festivities terminate the bridegroom dismisses the *kyel mi* (the men who have escorted the bride from her home) with suitable presents. (Sarat Chandra Das, Marriage Customs in Tibet, Journ. Asiat. Soc. Bengal, I, 1893, Pt. III, pp. 6–31.†)

Although the ceremonies in different parts of Tibet vary somewhat from the above, they are analogous, as the betrothal and the marriage ceremonies, which are nothing but a long feast, are their essential features. Chandra Das, in the interesting articles from which the preceding facts are derived, describes the ceremonies as they are performed in Ladak, Sikkim, and central Tibet, and I must refer the reader whom the subject interests to his paper for further details on the subject.

So much has been written about Tibetan polyandry that it is only necessary to touch on it here.

As far as my information goes the husbands of a given woman are always brothers, the elder brother choosing the woman and the younger brothers cohabiting with her. Whatever may have been the origin of polyandry, there can be no doubt that poverty, a desire to keep down population and to keep property undivided in families, supply sufficient reasons to justify its continuance. The same motives explain its existence among the lower castes of Malabar, among the Jat (Sikhs) of the Punjab, among the Todas, and probably in most other countries in which this custom prevails.

Polygamy is not uncommon among the wealthier classes of Tibet throughout the whole extent of the land, and monogamy is, naturally enough, frequently met with, especially among the Drupa tent dwellers, where it is in fact the invariable rule, I believe.‡

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* Among the Mongols it is deemed proper when inviting a guest to one's tent to send him a white horse to ride.

† See also Journ. Roy. Asiat. Soc., n. s., XXIII, pp. 228–230, and Alex. Cunningham, Ladak, p. 207.

‡ See, on this subject, Sarat Chandra Das, Narr. of First Journey to Tashilhunpo in 1879, p. 34; Col. Edw. Parke in Journ. Anthropol. Institute, VIII, 195 *et seq.*, and Land of the Lamas, pp. 190, 212 *et seq.*

Sarat Chandra Das, in his paper on Marriage Customs of Tibet, says (quoting Crooke's Notes and Queries):

In Spiti polyandry is not recognized, as only the elder brother marries and the younger ones become monks. But there is not the least aversion to the idea of two brothers cohabiting with the same woman, and I believe it often happens in an unrecognized way, particularly among the landless classes, who send no sons into the monasteries.† * * * In Spiti there is a regular ceremony of divorce which is sometimes used when both parties consent. Husband and wife hold the ends of a thread, repeating meanwhile, "Our father and our mother gave, another father and mother took away. As it was not our fate to agree, we separate with mutual good will." The thread is then severed by applying a light to the middle. After a divorce a woman is at liberty to marry whom she pleases.

I do not believe that in other parts of the country divorce or second marriage exist, though among the Kokonor Tibetans, at least, it sometimes happens that a wife deserts her husband to cohabit with another man or a husband his wife for another woman.

Death—Mortuary ceremonies.—Speaking of the T'ang-hsiang, the Sui shu says:

When people of eighty or over die the relatives do not mourn, for they say that they had reached the end of their allotted time, but if a young person dies they cry and lament, saying that it is a great wrong. (Sui shu, Book, 83; Conf. T'ang shu, Book, 221.)

The T'ang shu (Book, 221), speaking of the Tung nü kuo, which embraced in the seventh or eighth century the greater part of northeastern Tibet, says:

They wear mourning for three years, not changing their clothes and not washing. When a man of wealth dies they remove the skin from the body and put it aside; the flesh and bones they place in an earthen vase, mixed with gold dust, and this they carefully bury. When the sovereign is buried several tens of persons follow the dead into the tomb.

Early European travelers in eastern Asia tell us that the Tibetans used to devour the bodies of their dead parents. Thus William of Rubruk (Itinerarium, Edit. Soc. Geo. de Paris, p. 289) says:

Post istos sunt Tebec, homines solentes comedere parentes suos defunctos, ut causa pietatis non facerent aliud sepulcrum eis nisi viscera sua. Modo tamen hoc demiserunt, quia abhominabiles erant omni nationi. Tamen ad huc faciunt pulcros ciphos de capitibus parentum, ut illis bibentes habeant memoriam eorum in jocunditate sua. Hoc dixit michi qui viderat.

Plano Carpini (Historia Mongalorum, IX, p. 658) says:

Venit ad terram Burithabet * * * qui sunti pagani. Qui consuetudinem mirabilem imo potius miserabilem habent: quia cum alicujus pater humanæ naturæ debitum solvit, omnem congregant parentelam, et comedunt eum sicut nobis dicebatur pro certo.

Friar Odoric, who was the first European traveler to visit Tibet, gives a different account of their mortuary customs, and one more in

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* It is a difficult matter to say where polyandry begins and cohabitation ends in Tibet. These terms seem nearly interchangeable.

accordance with what we know to have obtained among the Tibetans for some centuries back. Charges of cannibalism against a remote people only known to the informants of the writer of a narrative by hearsay are not uncommon. To only mention one, I find that the early Arab travelers in China charged the Chinese of the 7th century, A. D., with eating all their enemies killed in war.* Altogether, I think there is very little foundation for the charge made by Rubruk and du Plan Carpin. It is probably the result of a jumbled-up account of the true methods of disposing of the dead, which will be described farther on.

Friar Odoric says (H. Yule, Cathay and the Way Thither, I, p. 151):

Suppose such an one's father to die, then the son will say, "I desire to pay respect to my father's memory;" and so he calls together all the priests and monks and players in the country round, and likewise all the neighbors and kinsfolk, and they carry the body into the country with great rejoicings. And they have a great table in readiness, upon which the priests cut off the head, and then this is presented to the son, and the son and all the company raise a chant and make many prayers for the dead. Then the priests cut the whole of the body to pieces, and when they have done so they go up again to the city with the whole company, praying for him as they go. After this the eagles and vultures come down from the mountains, and every one takes his morsel and carries it away. Then all the company shout aloud, saying, "Behold! the man is a saint. For the angels of God come and carry him to paradise." And in this way the son deems himself to be honored in no small degree, seeing that his father is borne off in this creditable manner by the angels. And so he takes his father's head and straightway cooks it and eats it, and of the skull he maketh a goblet, from which he and all the family always drink devoutly to the memory of the deceased father. And they say that by eating in this way they show their great respect for their father.

Colonel Yule, commenting on the preceding passage, says:

Klaproth quotes passages showing a knowledge of this mode of disposing of the dead from Strabo, Cicero's Tusculan Questions, and Justin. Strabo also ascribes to the Caspii the opinion that those whose bodies the birds appropriated were blessed. Herodotus and Mela ascribe such practices to the Issedonians and Scythians, "Corpora ipsa laniata et cæsis pecorum visceribus immista epulando consumunt. Capita ubi fabri expolivere auro vincta pro poculis gerunt." (Pomp. Mela, II, p. 1.)†

I have shown in my paper "On the use of skulls in lamaist ceremonies" (Proc. Amer. Orient. Soc., Oct., 1888, p. XXII) the notions prevailing in Tibet on this subject. As further elucidating the above passage from Odoric's travels, I may mention that the rapidity with which the body of the dead is devoured by the birds or other animals to whom it is fed is held to be a proof of the good luck (or *karma*) of the deceased, and therefore the skull of one who has been so devoured is a good one out of which to make a libation bowl.

Chinese authors describe as follows Tibetan mortuary customs:

When a person dies in Tibet the corpse is tied up with ropes, the face being put between the knees and the hands stuck under the legs. The body is wrapped in the everyday clothes of the deceased and put in a rawhide bag. The men and women having lamented in common over their loss, suspend the corpse by means of

*See Reinaud. Relation des voyages faits par les Arabes, etc., I, pp. 52, 68, 70.

†Conf. Strabo's remarks about the Hibernians and the Massagetæ. Bk. V. 4 and Bk. XI, 8. Also Ammianus Marcellinus, XXVII. 4, and Herodotus IV. 65.

ropes from the rafters and request the lamas to come read the sacred books. * * * A few days later the body is carried to the corpse cutter's place, where it is tied to a stake and the flesh cut off and given to dogs to eat. This is called a "terrestrial burial." The bones are crushed in a stone mortar, mixed with *tsamba*, made into balls, and also given to the dogs or thrown to the vultures, and this latter mode of disposing of them is called a "celestial burial." Both these methods are considered highly desirable.

The poor dead are buried in the streams, the corpse being simply thrown in. This is not an esteemed mode of burial. The bodies of lamas are burnt and cairns erected over their remains. (Jour. Roy. Asiat. Soc., n. s., XXIII, pp. 231-232; Conf. Land of the Lamas, pp. 81, and 286–287.)*

Georgi (*op. cit.*, p. 443) gives some interesting details, which I have not seen noticed elsewhere. He says:

Mos est etiam, ut Summorum Lhamarum, aliorumque paucorum cadavera vel sandalo, quodcum aloes ligno nonnulli confundunt, comburantur, vel balsamo condita sacris in loculis reponantur. * * * Vulgaris quoque ac fere quotidiana consultudo in Civibus, honestisque hominibus sepeliendis ist haec servatur. Lhama, vel Traba quivis aninam, ut somniant, e summo capite cadaveris ad huc tepescentis primum educit. Educit autem hoc pacto cutem verticis digitis arcte prehendam, et corrugatam tam celeri ac vehementi succussionis impetu attrahit, ut eam uno momento subsilire, ac crepitare faciat. Tum vero, inquiunt, anima defuncti erupisse creditur.

Capt. Samuel Turner (Embassy, p. 260) says:

It is the custom of Tibet to preserve entire the mortal remains of their sovereign lama only; every other corpse is either consumed by fire or given to be the promiscuous food of beasts and birds of prey. As soon as life has left the body of a lama it is placed upright, sitting in an attitude of devotion, his legs being folded before him, with the instep resting upon each thigh and the soles of the feet turned upward. * * * The right hand is rested with its back upon the thigh, with the thumb bent across the palm. The left arm is bent and held close to the body, the hand being open and the thumb at right angles with the fingers touching the point of the shoulder. This is the attitude of abstracted meditation.

If we seek for mortuary customs similar to those of the Tibetans we have not far to go to find them among other Buddhist people, who may probably have seen in the custom of having their dead bodies fed to birds or beasts a supreme act of charity, for which Gautama Buddha himself set the example when, in several of his births, prior to his reaching Buddhahood, as related in the Jātaka, he gave his body as food to hungry tiger whelps or other famished animals.

In Siam it is not uncommon for a person to direct that his body after death shall be cut up and fed to vultures and crows (Sir John Bowring, The Kingdom and People of Siam, I, p. 122), and in Korea it is customary, after the bodies of lamas have been consumed by fire, to mix the ashes with rice flour and feed them to birds. The "towers of silence" of the Parsees in which the bodies of the dead are devoured by birds is another analogous method, but the reasons which have called this custom into existence with them, are, of course, quite different.†

* For a vivid description of a "terrestrial burial," see Annales de la Propagation de la Foi, 1865, p. 289; Conf. also Georgi, Alph. Tibet., p. 441 et seq.

†The Kafirs put their dead in boxes and expose them on the tops of high mountains (Sir P. Lumsden, Jour, Anth. Inst. III, p. 361.

In Ladak bodies are burned fifteen or twenty days after death, during which time prayers are said by lamas. In the case of a very wealthy man or a chief, after the body has been burned in a metal vessel, the ashes are carefully collected and made into an image of the deceased. A ch'ürten or pyramid is erected for the ashes, and in it are placed various kinds of grain, precious stones and metal, rolls of prayers and incense.

The body of a great lama is interred in a sitting posture with his clothes and all the implements of worship he was accustomed to use daily. The coffin is deposited in a ch'ürten, before which for some time food and water are offered daily, and a light is kept burning every night. (Alex. Cunningham, Ladak, p. 309.)

As to their signs of mourning, Chinese authors tell us that the Tibetans, both "men and women put on mourning clothes, and for one hundred days they wear no colored clothes, and during that period they neither comb their hair nor wash. The women do not wear their earrings and put away their prayer beads, and these are the only changes (in dress) they make. The rich invite lamas at short intervals to come and read the sacred books, so as to procure for the deceased the joys of the nether world. After one year it is all at an end." (Journ. Roy. Asiat. Soc., n. s., XXIII, p. 233.)

X.

RELIGION–LAMAS–RELIGIOUS ARCHITECTURE–OBJECTS CONNECTED WITH RELIGIOUS WORSHIP.

It does not enter into the plan of this paper to describe even cursorily the religious beliefs of the Tibetans. Many works have already been written on the subject, but much remains yet to be done before we possess a thorough knowledge of it. Buddhism, which was introduced into the country in the seventh century A. D., has remained since then the religion of Tibet. It is that form of Buddhism which is known as Mahāyāna Buddhism, in which magic demonolatry and mysticism have become such commanding features that it is with difficulty that we can trace in the forms of worship obtaining at present in Tibet any of the simplicity characteristic of early Buddhism and still to be found, to a certain extent, among the Buddhists of Southern Asia.*

The Buddhism of Tibet is usually called Lamaism, the word "lama," written *bla-ma* and meaning "the superior one," being that given by Chinese and foreigners generally to the members of the Buddhist monastic order in Tibet. In Tibet, however, this word is reserved for

* Primitive Lamaism may be defined as a priestly mixture of Shivaic mysticism, magic and Indo-Tibetan demonolatry overlaid by the thinnest veneer of Mahāyāna Buddhism. And to the present day Lamaism still retains these features. * * * But neither in the essentials of Lamaism itself nor in its sectarian aspects do the truly Buddhist doctrines, as taught by Sakya Muni, play any leading part. (L. A. Waddell, Lamaism and its Sects, in Imp. and Asiatic Quarterly Review, VII. and his Buddhism of Tibet, p. 17.)

those monks who have not only taken the highest theological degrees, but who have also led a saintly life and become famed for their knowledge. The word *draba* is used by Tibetans as a generic term for all persons connected with the order, monks as well as lay brethren.*

The usual dress of the lamas consists in a kilt reaching down to a little above the ankle, a close-fitting waistcoat, similar to that worn by the laity (see p. 687), and a shawl passed around the body, and the left arm, the end thrown over the right forearm, so as to leave the right shoulder and arm uncovered. The head is shaved and the lamas wear no head covering except during church ceremonies or when traveling; in the latter case they wear the same kind of hats as the laity and also the same kind of clothes; and in the former, hats of yellow or red color, varying in shape according to the school or sect to which their convent belongs. Gélugpa lamas usually wear a high yellow hat with a fringe, closely resembling the helmets worn by carabiniers. (pl. 32.) It is called *dja-ser* or "yellow hat." † The clothes of the wealthier lamas are made of *tirma* (see p. 699), on which are neatly sewed a few little patches, as it is forbidden them to wear any but torn or worn-out stuffs. Those of the poorer lamas are of *pruk* ‡

Emil Schlagintweit (Buddhism in Tibet, pp. 170–173) says of the dress of lamas (he in all probability refers to those of Ladak) that "their caps are made of double felt or cloth, between which are put charms. The shape of the cap varies considerably, but it is curious that they are all of Chinese or Mongolian fashion, whilst the form of the robes has been adopted from the Hindus.' Most of the caps are conical with a large flap, which is generally doubled up, but is let down over the ears in cold weather. The head lamas wear a particular cap, generally low and conical, and some head priests of western Tibet have an hexagonal hat formed of pasteboard, and showing four steps diminishing toward the top." §

Others wear a miter of red cloth ornamented with flowers of gold worked in the stuff. This latter kind of cap bears a remarkable resemblance to the miters of Roman Catholic bishops.

The gown reaches to the calves, and is fastened round the waist by a slender girdle; it has an upright collar and is closely buttoned up at the neck. In Sikkim the lamas occasionally wear, slung round the shoulders, a kind of red and yellow striped woolen stole.

The inner vest has no sleeves and reaches to the haunches. The trousers are fastened to the waist by a sort of lace running in a drawing hem. In winter they

* For a general knowledge of lamaic worship, I must refer the reader to C. F. Kœppen, Die Religion des Buddha, Vol. II. and Emil Schlagintweit, Buddhism in Tibet, where a full account of the various religious ceremonies will be found; also, for various interesting details, to Sarat Chandra Das, Indian Pundits in the Land of Snow, and to Dr. L. A. Waddell's, The Buddhism of Tibet, now the standard work on this subject.

† Dr. Waddell, *op. cit.*, p. 196, shows 20 styles of lama's hats and cowls.

‡ On the Gelugpa Sect, see Dr. Waddell, *op. cit.*, p. 38.

§ See for an illustration of this cap, Alex. Cunningham, Ladak, pl. 26.

are worn over the larger gown as a better protection against the cold. In Bhutan the lamas wear, instead of trousers, philibegs hanging nearly as far as the knee.

The cloak is worn, in the way previously described, by all lamas; it is their distinctive ecclesiastical dress.

The costume of the nuns (*ani*) is in all essential particulars the same as that of the monks; in fact, it is quite difficult to tell an old *ani* from a man when one meets her with shaved head, a prayer-wheel in one hand and alms bowl in the other, wandering from house to house begging.

Other styles of headdress, as worn in eastern Tibet, are described in my Land of the Lamas, p. 238. (See also Alex. Cunningham, Ladak, p. 372.)

The boots of lamas are of the kind previously described (p. 686), the only peculiarity being as there stated, that the vamps are of white cloth and the tops of red *pulo*.

The costume worn by lamas in Tibet is, with slight modifications, the same as that still worn in Nepal by Buddhist monks, and which was originally the national costume of the inhabitants of that country, and was probably borrowed from the latter by the early Tibetan monks.

> At religious ceremonies the priests wear * * * a close-fitting jacket called the "chivasa" and a long skirt or petticoat called the "nivasa," which reaches to the ankles, and which is gathered at the waist into a number of small plaits or folds. The chivasa and nivasa are joined together into one dress at the waist, round which there is wrapped an ordinary "kammerband" or thick-rolled waistcoat. (H. A. Oldfield, Sketches from Nepal, II, 140.)

Religious buildings.—Religious buildings and monuments in Tibet comprise, (1) *Gonba* or monasteries; (2) *Lh'a-k'ang* or temples; (3) *Mch'od-rten* (pronounced *ch'ürten*), literally "offerings receptacle," and perhaps better known by their Indian name of *chaitya*, and *tsa-tsa k'ang*, receptacles for offerings called *tsa-tsa*; (4) *Māni walls*, or piles of stones on which are incised prayers or magic formulas; (5) *Lab-tsé*, or heaps of stones on the summits of mountain passes.

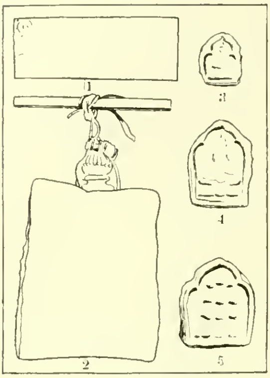
The monasteries usually consist of rows of small houses of the usual Tibetan style of architecture, built in close proximity to, and commonly around, one or more temples. These houses consist of a dwelling, generally two stories high, a storehouse and a small courtyard. The ground floor of the dwelling is used as a stable. The outside walls of the houses are painted white, and those of the dwellings of high lama dignitaries red. These houses belong to individual lamas, who rent portions of them to pilgrims or to resident lamas who have no homes of their own.

Around the whole monastery is usually a high wall, and the approach to the main entrance is marked by rows of ch'ürtens and māni walls. All lamas residing within a gonba are entered on a register, and are obliged, when duly qualified after a period of study, to take part in the daily ceremonies performed in the house of assembly (*duk'ang*). In

YELLOW HAT, WORN BY LAMAS OF THE GÉLUG SECT IN CHURCH CEREMONIES.

Cat. No. 131181, U. S. N. M. Kumbum.

EXPLANATION OF PLATE 33.



CEREMONIAL OBJECTS.

Fig. 1. WOODEN MOLD. Used in certain religious ceremonies, depicting a man driving a loaded yak and followed by a dog. Ts'aidam.

(Cat. No. 131013, U. S. N. M.)

Fig. 2. COPPER WATER BOTTLE. With red truk cover; used by Lamas. Kumbum.

(Cat. No. 167167, U. S. N. M.)

Fig. 3. CLAY TSA-TSA. Image of Tsongkapa.

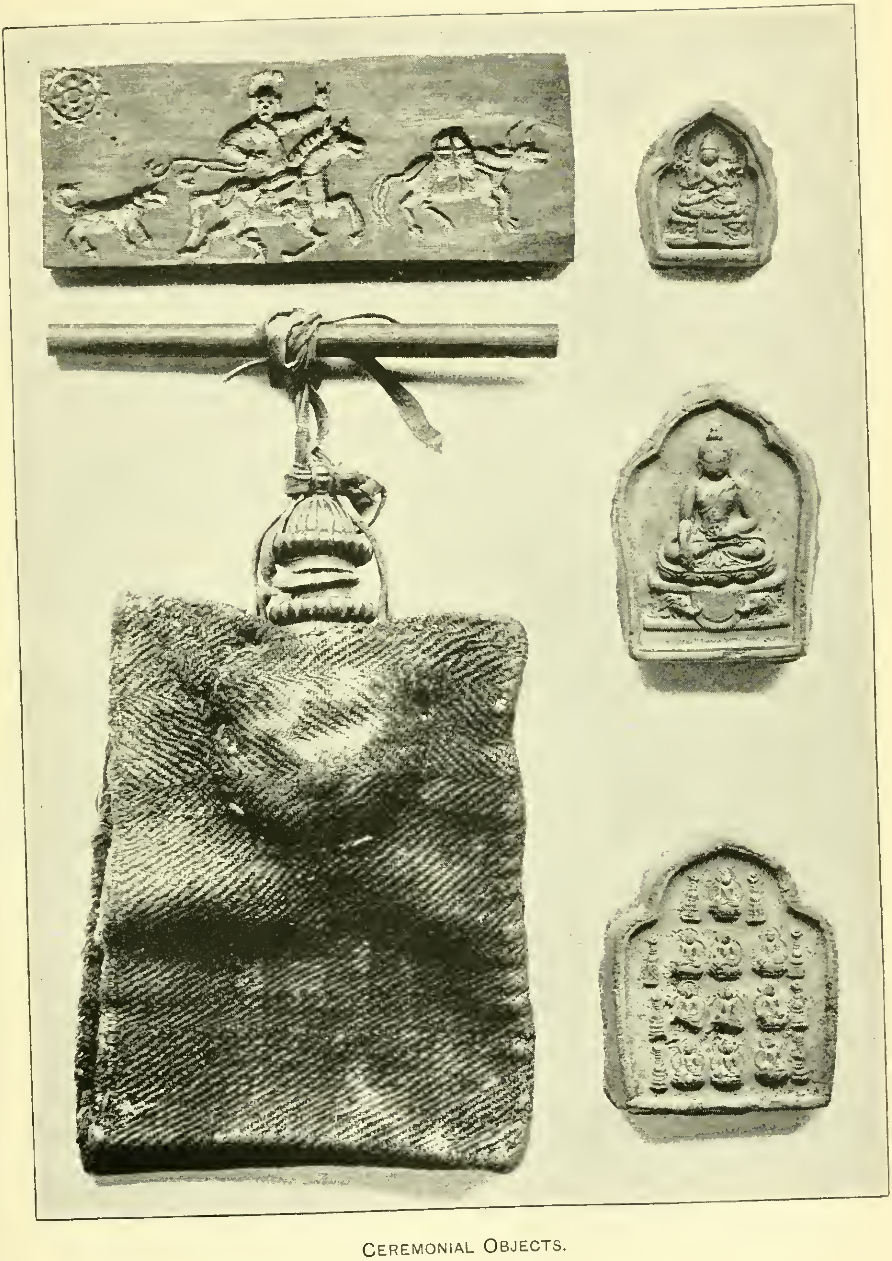
(Cat. No. 167170c, U. S. N. M.)

Fig. 4. CLAY TSA-TSA. Image of Tsépamed.

(Cat. No. 167170a, U. S. N. M.)

Fig. 5. CLAY TSA-TSA. Ten images of Tsépamed (?) ch'urtens on either side of each row of images.

(Cat. No. 167170b, U. S. N. M.)



CEREMONIAL OBJECTS.

consideration of this they are supplied daily with tea, and also receive an annual allowance of barley. The lamas partake of their first meal after noon, until which time they are only allowed to moisten their lips with water. For this purpose they carry in their belts a little copper or silver bottle sewed in a bit of *truk* (see pl. 33, fig. 2). This one has two brass bands around the mouth; it has a brass stopper, on the top of which is a hole, through this passes a leather string, by which the stopper is held in place.

The temples (*lh'a-k'ang*) are throughout Tibet of a Chinese style of architecture, the roofs being, however, flat, dirt covered ones, except in some of the larger and more famous temples, where Chinese tiles, yellow or blue, have been used. The orientation of the temples does not appear to be a matter of much importance, as I have seen some facing south, others facing east, but I do not remember having ever heard of any facing west. Schlagintweit (*op. cit.*, p. 188) says:

> The walls of the temples look toward the four quarters of heaven, and each side should be painted with a particular color, viz, the north side with green, the south side with yellow, the east side with white, and the west side with red, but this rule seems not to be strictly adhered to.

Most temples, as a matter of fact, are painted red, and the columns in front of them are also frequently painted of the same color.

As to the interior arrangement of the temples, I must refer the reader to Dr. Waddell's work (p. 287 *et seq.*) and to Georgi's Alphabetum Tibetanum (p. 406 *et seq.*), in which latter work will be found a very detailed description of the great temple of Lh'asa (the Jo k'ang).

The ch'ürten or "receptacles for offerings" are built over the remains of revered lamas, or else they are simply decorative or commemorate some important event. When simply used as receptacles for offerings they are filled with *tsa-tsa*, that being the name given to a small clay cone which the Tibetans make in incalculable thousands in molds and deposit in these ch'ürtens. In some parts of the country they build little hutches of rough logs for this purpose. These are called *tsa-tsa k'ang*.

These *tsa-tsa* are usually conical, in imitation of the form of the ch'ürten. In figs. 3, 4, and 5, of pl. 33, are depicted another variety of *tsa-tsa*, flat and in the shape of a shrine. In one of these, which is 3 inches long and about 2 wide, are 10 figures of gods in relief; in another is Tsépamed (Amitayus), and in a third Tsongkapa is represented.

> The form of the chortens varies much more than that of their prototypes, the stupas. The base of the stupa is a cylinder or cube, upon which a body shaped like a cupola is set up. Stupas which have been broken down have been found to be solid buildings, with a little shrine in the center only, in which has been deposited the burnt bones of a human being, together with coins, jewels, and inscribed slabs. The bones are sometimes inclosed in small cases made of the precious metals.
>
> In the Tibetan chortens this form has in general undergone considerable modifications. The unaltered ancient type has remained limited to the smaller chortens put up in the temples. The principal difference between a stupa and chorten is that in

the latter the cupola is either surmounted by a cone or that it is inverted. The most general style is the following: The base is a cube, upon which rests the inverted cupola. This cupola is the principal part. It incloses the objects enshrined, and in it is the hole leading to the space for the offerings. A graduated pinnacle rises above it, and this is either a cone of stones or a wooden spire. It is surmounted by a disk placed horizontally and a spear-shaped point, or, instead of it, by a crescent supporting a globe and the pear upon that. * * *

The materials used for the chortens in the open air are rough stones, bricks, or clay; they are almost all of solid masonry. The outer surfaces are thickly plastered with mortar, which is colored red with the dust of pounded bricks. * * * The height of the chorten is in general from 8 to 15 feet, though a few considerably exceed this latter height. * * * Those set up in the temples are molded from metal, or, more generally, from clay mixed with chopped straw. Occasionally they are carved of wood, but such chorten scarcely ever exceed 4 feet. They are often not higher than as many inches. (Emil. Schlagintweit, Buddhism in Tibet, pp. 192–196.)*

There is in the Museum collection a photograph of the celebrated lamaist sanctuary of Wu-t'ai shan (*Ri-vo tsé na*), in Shan-hsi, in northern China, which shows a very fine ch'ürten, probably 60 feet high, with a large gilt spire of the horizontal circle and vertical disk and crescent style described by Schlagintweit. In this ch'ürten is said to be kept a body relic of the Buddha Gautama.

Māni walls.—This name is given to long, low walls of rough stones, on the surface of which are incised sacred formulas, usually the famous six-syllable formula *Omi māni padmé hūm.* The name given the wall is derived from the name of this prayer, which is colloquially called "the māni." They are also known as *mendong*, probably written *mang dong*, "many stones." Frequently images of gods are incised on the stones, and I have also seen long passages of the Scriptures on them. Frequently a whole *māni* wall will be covered with slabs on which are inscribed one of the long theological works in which lamas so delight, sometimes the Prādjna paramita in 8,000 verses. Plate 34 shows an inscribed stone from a *māni* wall in a Bonbo country of northeastern Tibet (Jyadé). It is of slate, is painted red, and the *mantra* incised on it is *Om, matrimuyé sale hdu*, a favorite one of the Bonbos.

Schlagintweit (*op. cit.*, p. 197) says the longest *māni* wall known of is 2,200 feet long. Some, he says, have a kind of tower at either end, occasionally in the form of a ch'ürten, with a sacred image in front, and a large pole to which flags with prayers are attached are also not unfrequent at the ends of mānis. Travelers, when passing along these *māni* walls, leave them on their left side if they are true believers, and on their right if they belong to the Bonbo faith.†

Lab-tsé or heaps of stones, also called *dobong*, and in Mongol *obo*, are to be seen on the summit of every pass in Tibet, and frequently at the

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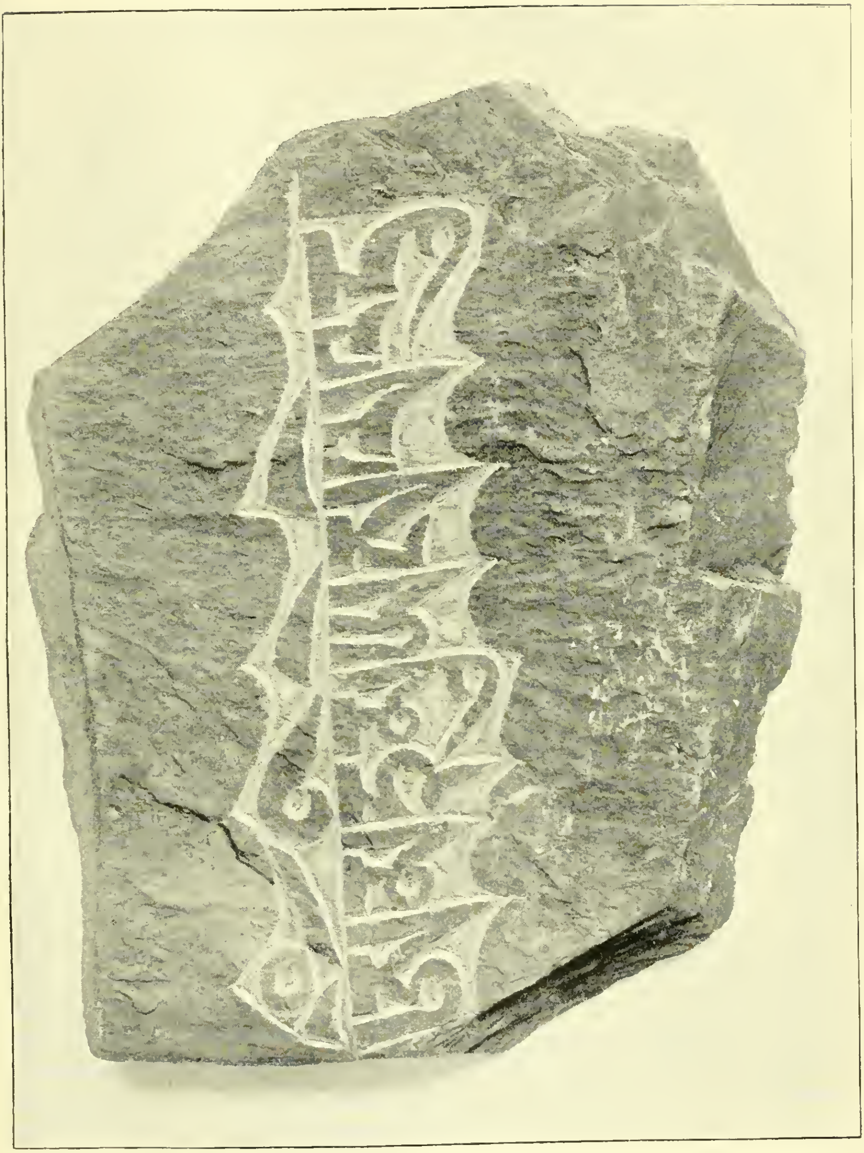
* The shape of the ch'ürten is symbolical, but I can not enter into an explanation of it here. See Dr. Waddell, *op. cit.*, p. 262 *et seq.*

† See also on ch'ürtens, H. A. Oldfield, Sketches from Nipal, II, 211.



PIECE OF RED SCHIST, WITH *dharani* INCISED ON SURFACE.

Cat. No. 167171, U. S. N. M. Jyadé.

mouths of the valleys leading up to them. Though in all probability they had no religious signification originally, they have acquired one, and the stone which every traveler as he passes by does not fail to throw on the heap, is now put there as an offering to the gods, and when throwing it down each one makes a short prayer, which ends with, "*Lha jya-lo, lha jya-lo*" "Gods, (give me) a hundred years; gods. (give me) a hundred years."

In these stone heaps are usually stuck large bunches of brushwood and also frequently huge wooden arrows, the meaning of which latter I have failed to ascertain. Bits of wool, rags, and pieces of cotton on which are stamped *mantras* and *dhāranis* flutter from the branches or hang in long rows from strings tied to them and to some big stone fifty or more feet off.*

Stone heaps similar in shape and built for similar purposes are found in the Navajo and Moqui countries in Arizona. Speaking of the Moqui, Fewkes says:

> Ma-sau-wuh shrines are simply heaps of sticks or piles of stones, and it is customary for an Indian toiling up the trail with a heavy bundle of wood on the back to throw a small fragment from the load upon these shrines or to cast a stone upon them as he goes to his farm. These are offerings to Ma-sau-wuh, the fire god, or deity of the surface of earth. (J. Walter Fewkes, Journ. Amer. Ethnology and Archæology, IV, p. 41.)

The custom of making offerings on mountain tops is too common in other countries, especially in South America, to require more than a passing reference here. Acosta, in his History of the Indies (II, p. 309, Hakluyt Soc. Edit.), says of the Peruvians;

> They have used as they goe by the way, to cast in the crosse ways, on the hilles, and toppes of mountaines, which they call Apachitas, olde shooes, feathers, and coca chewed, being an herb they use much. And when they have nothing left, they cast a stone as an offering, that they might passe freely, and have greater force, the which they say increaseth by this means. * * * They used another offering no lesse absurd, pulling the hair from the eyebrowes to offer it to the Sunne, hills, Apachitas, to the winds, or to any other thing they feare.

We also find this custom of offering rags at sacred shrines in Ireland and among the Mohammedan peoples of northern Africa.

The custom of walking around a sacred building or monument, a custom called *Korwa* in Tibetan, was followed in India in the early days of Buddhism as well as by the wild Turkish tribes which inhabited northern and northeastern Asia in the second century B. C. Thus in the Ch'ien Han shu, book 94, it is said that the Hsiung-nu and the Sien-pi, at the great autumnal sacrifice to heaven, rode three times around a little clump of trees. It is also common in parts of Africa, as, for example, among the Oromo of Abyssinia (Borelli, L'Éthiopie méridionale, p. 210), and was followed centuries ago in northern Europe and in other parts of the world. (See Land of the Lamas, p. 67.)

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* On this subject the reader should also consult Emil Schlagintweit's valuable work, pp 198–200.

A Tibetan history of the sandal-wood image of the Buddha, known as the Tsandan Jovo and now preserved in the Chan-tan ssŭ at Peking, referring to the benefits to be derived from walking round sacred monuments, says (p. 14 *et seq.*):

> He who walks around a ch'ürten,
> In all circumstances of life,
> By gods, nagas, and yakshas,
> As by rakshas, shall be honored.
>
> Whoever makes a ceremonial circle
> Of the ch'ürten of the Lord of the world [i. e., the Buddha]
> Acquires more [might] than by reciting
> Charms during a million of world periods.
>
> Fire and poison and weapons
> Shall never bring about his death;
> Living in wisdom, in the fullness of time—
> When his life is run, he shall die.
>
> He who circumambulates a ch'ürten
> Shall have wealth of castles, wealth of land,
> Of villages a goodly store;
> He shall reach the summit of worldly bliss.

While walking round the ch'ürten he must repeat the following Sanskrit charm:

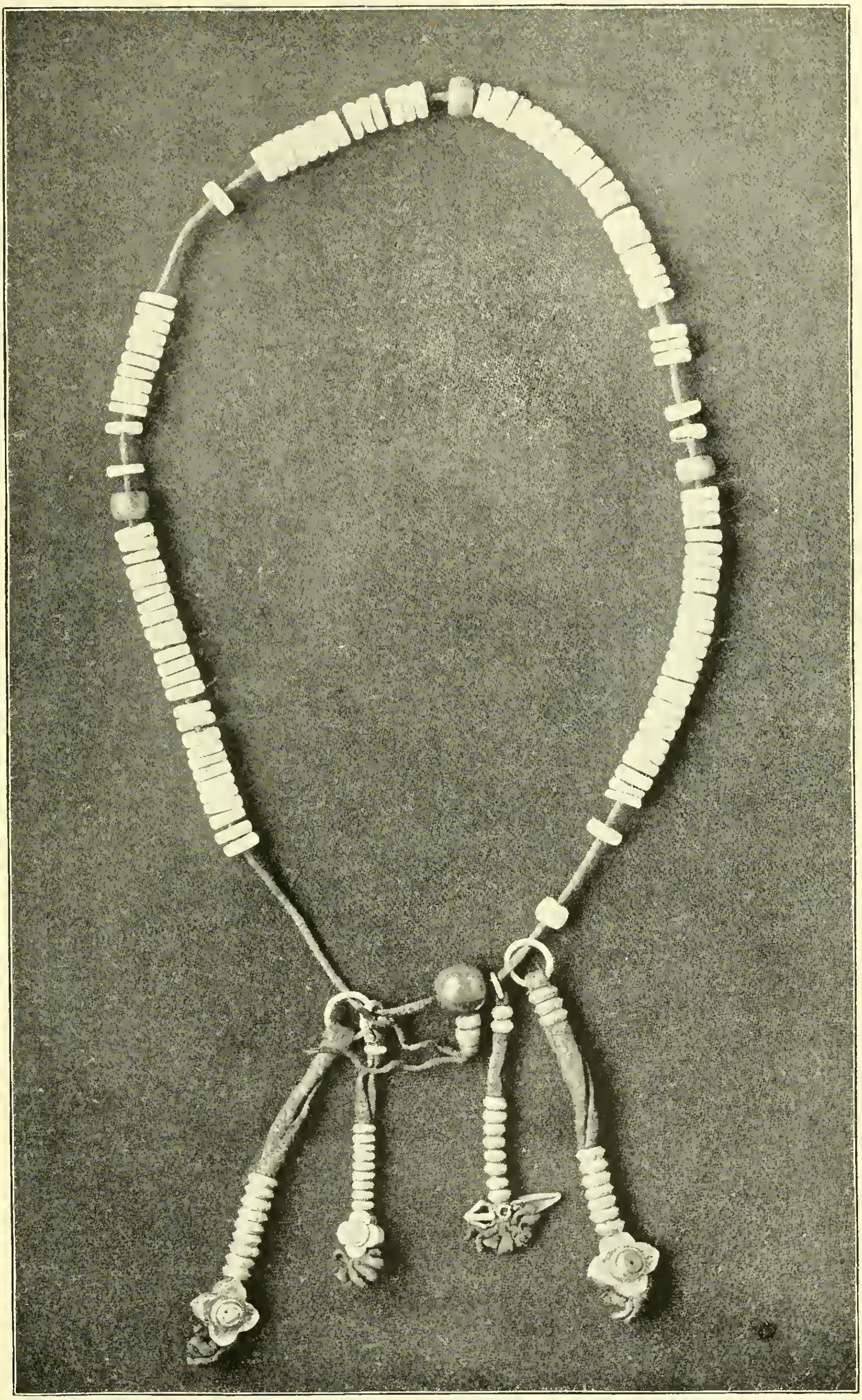
Namo Bhagavate ratna ketu radjāya Tathāgathāyu aryate samyak-sam-Buddhāya tatyathā. Om ratne, ratne, mahā ratna, ratna vidzaya. Swāha.

Objects connected with religious worship.—The rosary (*treng-wa*) is not only an essential part of the lama's dress but of that of nearly all the laity, male and female, in Tibet.

As a Buddhist article [says Dr. Waddell] the rosary is especially peculiar to the northern school of Buddhists, and the outcome of the esoteric teachings of the Mahāyāna school, instilling belief in the potency of muttering mystic spells and other strange formulas. (L. A. Waddell, Jour. Asiat. Soc. Bengal, LXI, p. 24, *et seq.*)

On pl. 35 is shown the form of rosary in common use among lamas. It contains 108 discoidal shell beads, of uniform size, divided into four groups of 27 beads each by 3 red coral beads; where the two ends of the string of beads come together they are passed through a large amber bead, a smaller discoidal, and a conical one, so that the two look like a fat, long-necked vase. These last two beads are called *do-dzin* (*rdog-hdzin*), "retaining or seizing beads."

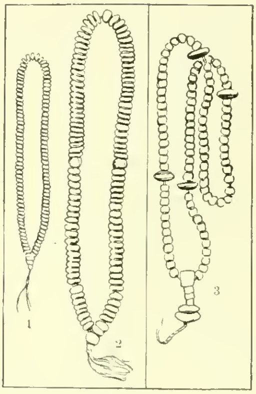
Four short leather thongs strung on the rosary beside the *do-dzin* by silver rings have silver beads on each of them, and at the lower end of one there is a little silver *dorjé*. These strings are used as counters (*drang-dzin*) in the following fashion: When a certain charm has been recited 108 times the first bead on the string, to which is attached the *dorjé*, is slid up the string, and so on for each series of 108 repetitions till the tenth time; then the first bead on the string next to the *dorjé* string is slid up, and so on for the four strings of counters. Usually the string



ROSARY OF SHELL BEADS; COUNTERS OF SILVER.

Cat. No. 167271, U. S. N. M. Kumbum.

EXPLANATION OF PLATE 36.

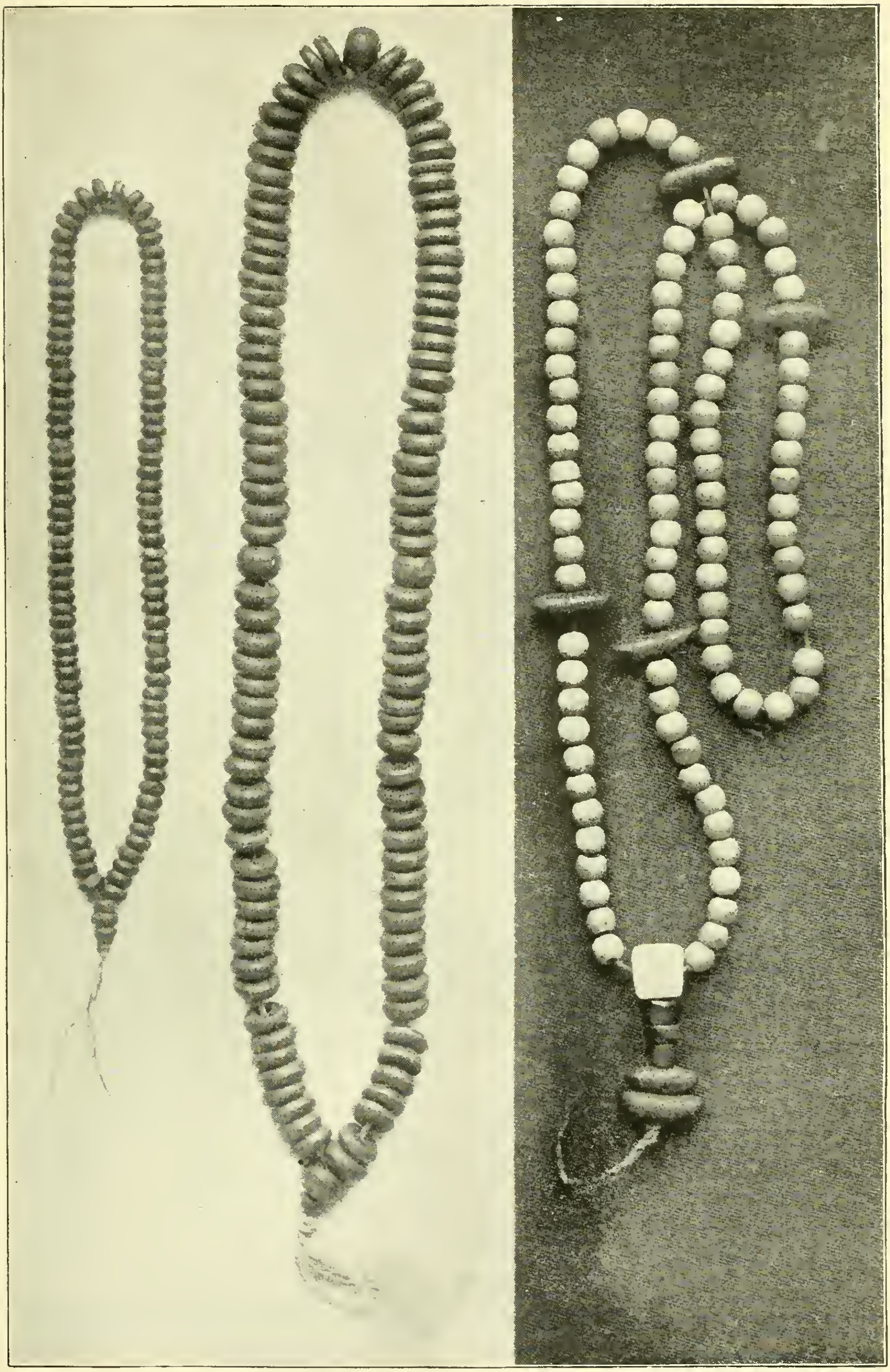


ROSARIES.

Fig. 1. ROSEWOOD ROSARY. Ta-chien-lu
(Cat. No. 167267, U. S. N. M.)

Fig. 2. YELLOW WOOD ROSARY. Bat'ang.
(Cat. No. 131058, U. S. N. M.)

Fig. 3. MOHAMMEDAN ROSARY. Of bone and date seeds. Hsi-ning Fu.
(Cat. No. 167300, U. S. N. M.)



ROSARIES.

next to the one on which is hung the *dorjé* has a bell (*drilbu*) attached to it; the third string has a magic peg (*purbu*) on it, and the fourth a wheel (*k'or-lo*).

Rosaries are frequently ornamented with small coral or turquoise beads hanging from them, and it is usual to put narrow silver rings on either side of the large coral beads dividing the successive groups of beads in the string.

Another *treng wa*, the beads of which are sections of human skulls, and the dividing beads pieces of conch shell, is in the Museum collection. The *do-dzin* are two in number, a large amber bead and a small wooden one. Such rosaries, Dr. Waddell remarks (*loc. sup. cit.*), are especially used for the worship of *Dorjé jig-ch'é* (Yāma), the King of the Dead.

One set of small beads, of narrow discs of rosewood, with four red coral beads, is shown in fig. 1 of pl. 36. In this set the coral beads have to be counted, so as to complete the number of 108. This string is as it came from the dealer, and has no counters on it. Such rosaries are apparently of the class called "red sandal-wood rosary" by Dr. Waddell, which, he says, are used only in the worship of the fierce deity Tamdrin, a special protector of lamaism.

Fig. 2 shows a rosary of discoidal beads of yellow wood, in which narrow lines of lighter color radiate from the center to near the circumference. The dividing beads are of the same material as the rest of the rosary but slightly larger and thicker. This rosary belongs to the class called *ser-treng*, or "yellow rosary," and is the special rosary of the Gélupa, or reformed school of lamaism. It may be used for all kinds of worship, including that of the furies.

On pl. 37 is shown a Chinese rosary of 18 olive-shaped beads of some hard, light-brown wood (or seeds); each bead is cut into an image of one of the 18 Lohan (Arhats). This is the usual number of beads used in rosaries (*su-chu*) in China. Another Chinese rosary, made of some kind of rough brown seed, possibly the same as that used in Tibet for rosaries, and there called *Bodhi shing*, is in the Museum collection.* Dr. Waddell (*op. sup. cit.*, 28) says the tree which bears this seed grows in the outer Himalayas.

Besides the materials used in the manufacture of rosaries mentioned by Dr. Waddell, I found that the Tibetans greatly prized for this purpose two varieties of seeds, the one, called by the Chinese *feng-yen po-ti mu* or "Bodhi wood with phœnix eyes," the other *hsing yüeh mu* or "wood with the stars and moon on it." These seeds are turned spherical and then polished. The *feng-yen kuo* is, I believe, the same as the *Pin-po* of the Cantonese, identified, if I am not wrong, with *Sterculia lanceolata*.

Rosaries made at Wu-t'aishan, the famous lamaist sanctuary of northern China, are turned from pieces of poplar wood and stained

* Not illustrated in this paper.

yellow. Great quantities are carried away from this place every year by Mongol and Tibetan pilgrims.

Pl. 36, fig. 3 shows a rosary of 99 bone beads divided into three series of 33 beads each by date stones. The two ends of the string pass through a large bead made of a piece of conch shell. This is the style of rosary used by Mohammedans in China. The number 99 corresponds to the number of the names or attributes of Allah.*

Prayer wheels.—The same teachings which caused the northern Buddhists to believe in the efficacy of continually mumbling unintelligible formulas must be held responsible for the invention of the ingenious mechanical contrivance known as a "prayer wheel" or "prayer-barrel," which, when turned the right way—from left to right—is as efficacious as if the person turning it, or who had it built, recited himself all the prayers inclosed in it on printed slips of paper. Each complete revolution of the wheel counts as one repetition of all the prayers contained in the barrel.

Alexander Cunningham (Ladak, p. 375) says that the earliest mention of the prayer-wheel is found in the Records of the Western World of the Chinese Buddhist pilgrim Fa-hsien, who visited India in the fifth century of our era. This, however, is an error resulting from a mistranslation in Abel Remusat's rendering of the Chinese text. Gen. Cunningham also gives a medal of Hushka (first century A. D.) on which is a man holding in his hand what he takes to be a prayer wheel. At all events the prayer wheel is and has been for five or six centuries at least a popular instrument in not only Tibet but in Korea and Japan, in which two latter countries, however, only the larger *ch'ös k'or-lo* are found. (See on this subject Emil Schlagintweit, Buddhism in Tibet, p. 229 *et seq.* and Land of the Lamas, p. 334.)

The prayer-wheel is of two kinds: The first comprises hand wheels, wheels turned by the wind or by water, and small stationary wheels or barrels placed either in a house or in rows near a temple or along an interior gallery of a house or the base of a ch'ürten. The second class are much larger machines and are only found in temples. They are sometimes 30 or 40 feet high and 15 or 20 feet in diameter. In them is placed a collection of the canonical books of lamaism (*Kandjur*), and by means of bars fixed in the lower extremity of the axis of the barrel it is put in motion. These wheels, from the works in them being "the law" (*ch'ös*), are called *ch'ös k'or-lo*, while the first class of wheels having usually only the formula *om mani padme hūm* (colloquially called "the *mani*") printed on the pages wrapped up in them, are known as *mani k'or-lo*.

The prayer-wheel consists of a cylinder of metal, or, in the larger wheels, of leather or even wood, through which runs an axle of wood or iron around which it pivots. In the interior are arranged, one on

* On Burmese Buddhist rosaries, see Dr. L. A. Waddell, Proc. Asiatic Soc. of Bengal, December, 1892.

CHINESE ROSARY.

Each bead cut to represent one of the eighteen Lohan.

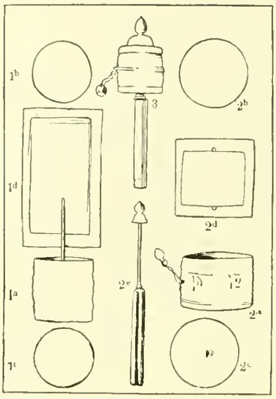
Cat. No 130388, U. S. N. M.

PRAYER WHEEL COVERED WITH RED COTTON CLOTH.

Roughly carved wooden handle.

Cat. No. 167169, U. S. N. M. Ts'aidam.

EXPLANATION OF PLATE 39.



PRAYER-WHEEL AND PARTS OF PRAYER-WHEEL.

Fig. 1a. STATIONARY PRAYER-WHEEL. Drum of brass.
(Cat. No. 130393, U. S. N. M.)

Fig. 1b. TOP OF STATIONARY PRAYER-WHEEL.
(Cat. No. 130393, U. S. N. M.)

Fig. 1c. BOTTOM OF STATIONARY PRAYER-WHEEL.
(Cat. No. 130393, U. S. N. M.)

Fig. 1d. PRAYER SHEETS.
(Cat. No. 131014, U. S. N. M.)

Fig. 2a. BODY OF BRONZE PRAYER-WHEEL. With silver ornamentation.
(Cat. No. 130392, U. S. N. M.)

Fig. 2b. TOP OF BRONZE PRAYER-WHEEL. With silver ornamentation.
(Cat. No. 130392, U. S. N. M.)

Fig. 2c. BOTTOM OF BRONZE PRAYER-WHEEL.
(Cat. No. 130392, U. S. N. M.)

Fig. 2d. PRAYERS WRAPPED ROUND AXLE.
(Cat. No. 130392, U. S. N. M.)

Fig. 2e. HANDLE OF PRAYER-WHEEL. With knob of silver on top.
(Cat. No. 130392, U. S. N. M.)

Fig. 3. BRASS HAND PRAYER-WHEEL. From Darjeeling.
(Cat. No. 74493, U. S. N. M.)

PRAYER WHEEL AND PARTS OF PRAYER WHEEL.

top of the other, sheets of paper or leaves of a book on which "the *mani*" or some other spell is printed in very fine characters, the finer the better. The sheets are wound on the axle from right to left, and the wheel when set in motion must revolve in the opposite way, so that the writing passes in front of the person turning the wheel in the way in which it is to read, i. e., from left to right.

A roughly made hand prayer-wheel with a felt barrel covered with coarse woolen cloth is represented in pl. 38. An iron pivot runs through the barrel and fits in a roughly carved wooden handle. The cylinder is covered with a piece of red cotton cloth, to the corners of which are attached glass beads.

On pl. 39, fig. 2 is shown a hand prayer-wheel. The cylinder is of bronze, the top being ornamented with a silver wheel decorated with coral and turquoise beads. The bottom has four *dorjé*, and on the sides is the six-syllable spell in landza characters in silver. On a band above this are *dorjé*, and on a band around the bottom are lotus leaves. On the top is a wheel in silver in which are set coral and turquoise beads. This is a very fine specimen of Tibetan workmanship. The top of the axis terminates in a silver ornament of pineapple shape.

On this plate is also represented a small stationary table or wheel (fig. 1), the axle of which projects above the top, so that it may be put in motion without moving it from the stand on which it rests. The cylinder is of bronze with raised ornamentation of *dorjé*, and the *mani* prayer in Nepalese Sanskrit characters.

In fig. 1 there is also represented a strip of Chinese paper on one side of which is printed the formula *Om, mani padme, hūm.* This formula is repeated nearly 400 times on this sheet, and in one of the small prayer-wheels previously described about 100 pages can be wrapped in the cylinder. Consequently a complete revolution of the wheel is equivalent to repeating the formula 40,000 times. A prayer-wheel complete, from Darjeeling, India, is also shown in fig. 3.

The cups used with the small prayer-wheels turned by the force of the wind are cut out of pieces of pine wood and are in shape exactly like the cups of an anemometer. (See Smithsonian Report, 1892, p. 676, where is also shown a prayer-wheel turned by water.)

Bits of cotton with prayers printed on them and tied to strings or to high poles placed over houses, and known as *la-der*, belong to the same class of objects as the prayer-wheels; each time these bits of stuff flutter in the breeze it is as if the prayer written on them had been recited. The figure of a horse is frequently stamped on these pieces of cloth and around it is a long formula. These are called *lung ta*, or "wind horses," and are, among many other uses, for the special protection of travelers. (See Emil Schlagintweit, Buddhism in Tibet, p. 253 *et seq.*, and Waddell, *op. cit.*, p. 408 *et seq.*)

The principal objects used by lamas in church ceremonies, or while reading the sacred books, are the small hand drum (*damaru*), frequently made of children's skulls and covered with snake skin, the bell (*drilbu*), and the *dorjé* (the Indian *vajra* or Indra's thunderbolt). Next in importance to them come the holy-water vase (*bumba*), the mirror (*mé-long*), the triangular nail (*purbu*), and the skull bowl (*t'ödpa*).

On pl. 40, fig. 2 is shown a *damaru*, made of two skulls attached together by a wooden disk cemented to them. Heads of devils and skulls are painted on them in red and blue. A small cotton band covers the disk between the two heads and projects a few inches, so that the person using the drum may hold it in his hand, his thumb and forefinger being placed around the disk of wood between the drumheads. There are two small knobs covered with cloth depending from this band by short strings of such length that when the drum is twirled sharply around they strike the heads. This *damaru* was collected by Rev. C. H. A. Dall.

The other figure on the same plate represents a *damaru* rather smaller than the preceding one. The skulls of which it is made are not decorated, but the band by which it is held in the hand is of embroidered satin decorated with elaborately knotted silk tassels of Chinese make.

The bell (*dril-bu*) of the lamas is of bronze and usually about 2¾ inches in diameter. In pl. 41, fig. 4 is shown a bell having on its outer surface near the handle certain mystic syllables, eight in number. On the interior surface are three mystic syllables and a 7-petalled flower in the dome. The handle is cylindrical and has a head of *Dharma* surmounted by a *dorjé*. This bell was made in Dérgé, which country is famous for the clear toned bells cast there.

Similar to the preceding, except that the head of *Dharma* does not appear in the handle, which is only a half *dorjé*, is the bell shown in fig. 5. This bell comes from the famous lamasery of Dolon nor, in eastern Mongolia.

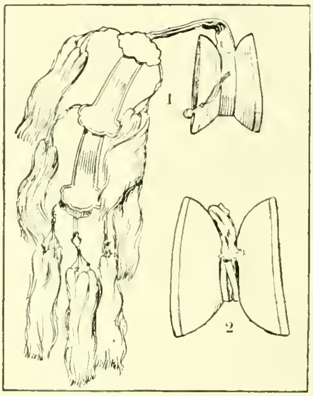
The usual position in which the bell is held is in the left hand, the opening of the bell pointed towards the body, the thumb against the handle and the fingers around the body of the bell. (For description of lamaist bells see Alex. Cunningham, Ladak, p. 373.)

The *dorjé*, or thunderbolt, is generally used with the bell, it being customary to hold it in the right hand between the thumb and index, the other fingers extended. It was looked upon in early times in India as a sacred symbol of Indra, and in Nepal it has become symbolical of the Buddha and his religion. Possibly this symbolism is known to the Tibetans, but I have not seen it mentioned in any of their sacred books

The Nepalese scriptures say that a contest once occurred between Buddha and Indra, in which the latter was defeated, and had wrested from him his chief and peculiar instrument of power, the vajra or thunderbolt, which was appropriated as a trophy by the victor, and has ever since been adopted by his followers as the favorite emblem of their religion. * * *

The Vajra and the ghanta or bell have a peculiar symbolic meaning attached to them by Buddhists, similar to that attached by Hindus to the Linga and Yoni. The Vajra represents Buddha and corresponds to the Linga; the ghanta represents Prajna Devi or Dharma, whose head is often figured on its handle, and corresponds to the Yoni. (H. A. Oldfield, Sketches from Nipal, II, 199—200.)

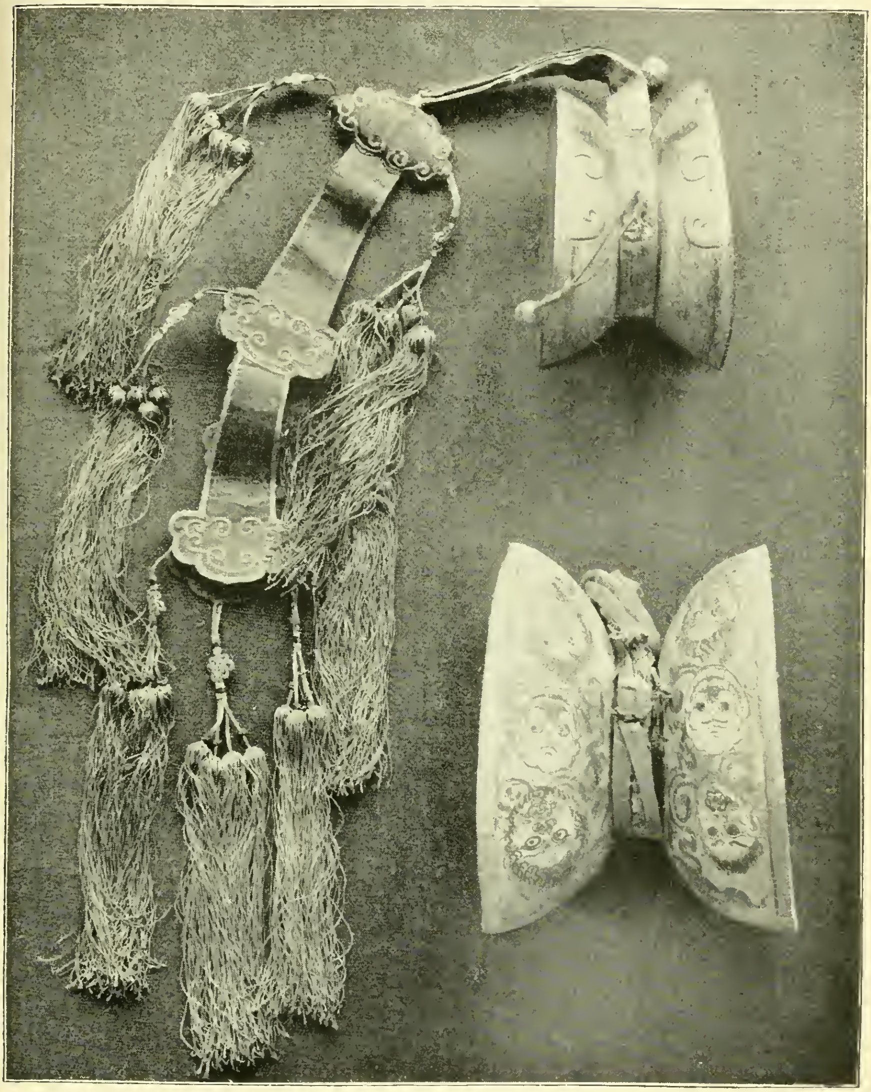
EXPLANATION OF PLATE 40.



DRUMS MADE OF HUMAN SKULLS; USED IN RELIGIOUS CEREMONIES.

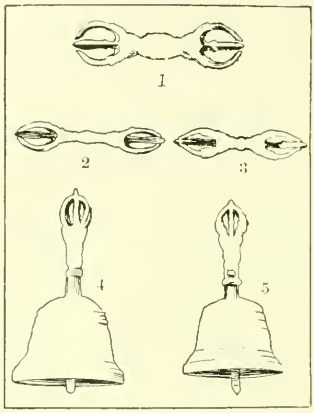
Fig. 1. DAMARU, OR HAND DRUM OF SKULLS. Silk tassels. Kumbum.
(Cat. No. 130385, U. S. N. M.)

Fig. 2. DAMARU. Painted white and red with heads of demons, skulls, etc.
(Cat. No. 153363, U. S. N. M.)



DRUMS MADE OF HUMAN SKULLS, USED IN RELIGIOUS CEREMONIES.

EXPLANATION OF PLATE 41.



Dorjé and Bells used in religious ceremonies.

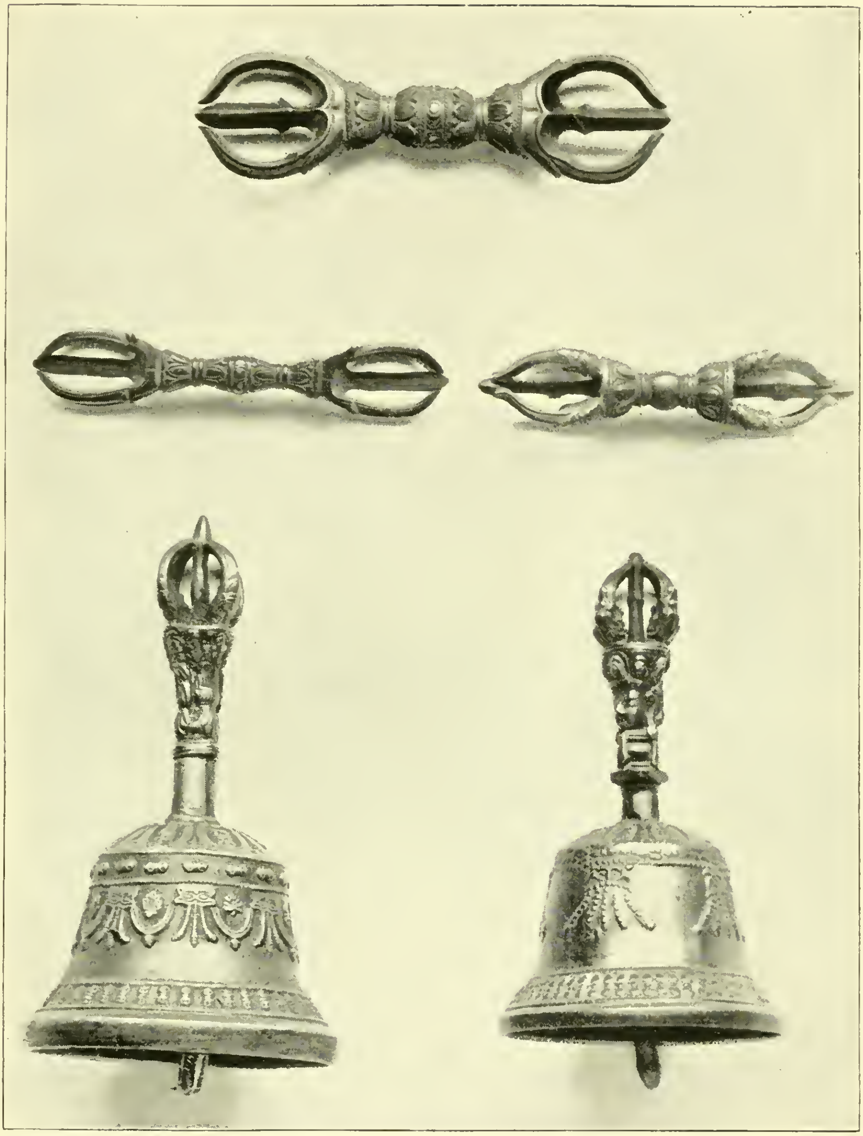
Fig. 1. Japanese Dorjé.
(Cat. No. 130390, U. S. N. M.)

Fig. 2. Japanese Dorjé.
(Cat. No. 167172, U. S. N. M.)

Fig. 3. Tibetan Dorjé.
(Cat. No. 167268, U. S. N. M.)

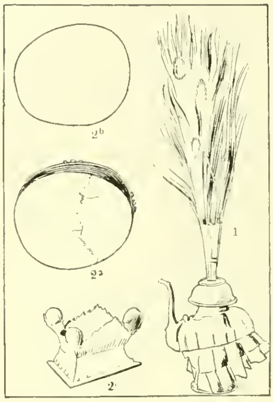
Fig. 4. Church Bell. Dergé.
(Cat. No. 131011, U. S. N. M.)

Fig. 5. Church Bell. Dolon nor.
(Cat. No. 130389, U. S. N. M.)



DORJÉ AND BELLS USED IN RELIGIOUS CEREMONIES.

EXPLANATION OF PLATE 42.



LIBATION BOWL AND HOLY-WATER VESSELS.

Fig. 1. HOLY WATER VASE. Kumbum.
(Cat. No. 130402, U. S. N. M.)

Fig. 2a. SKULL BOWL. Kumbum.
(Cat. No. 130384, U. S. N. M.)

Fig. 2b. COVER OF BOWL. Made of copper, gilded
(Cat. No. 130384. U. S. N. M.)

Fig. 2c. BASE OF BOWL. Made of brass, gilded. Heads at corners painted.
(Cat. No. 130384. U. S. N. M.)

LIBATION BOWL AND HOLY-WATER VESSEL.

The usual form given the *dorjé* in Tibet is shown in fig. 3. It is of bronze and about 5 inches long. Exactly the same form is found in Japan (fig. 2).

Fig. 1 is another form of the *dorjé* used by certain sects in Japan. Here there are but three prongs at each end instead of five, as in the more commonly used one.

The holy-water vase (*bumba* or *ts'é bum*) is used in certain lamaic ceremonies connected with the worship of Ts'é-pa-med.*

On pl. 42, fig 1, is shown one of these vases made of brass, with the spout, top, and base heavily gilded. The vase is of Persian shape, with a large spherical body and slender bent spout. The neck is short and narrow and terminates in a flaring mouth, in shape like an overturned bowl. In the top of this is a small circular opening, in which a chased metal tube fits, reaching far down into the vase and having in its upper end a bunch of *kusa* grass and some peacock feathers—this instrument is the aspergil. The vase has a covering of silk fastened around the neck so as to completely hide the vase. Such coverings are not only put on these vases but on most objects used in church worship, on the sacred images, books, etc., probably as a mode of honoring these sacred objects. The water used in these vases has a little saffron in it and sometimes a little sugar. The vase is 6½ inches high and elaborately chased where exposed to view. The portion of the vase under the silk covering (*nabzé* or "gown") is roughly beaten copper. Frequently these vases are of silver and finely chased over the whole of their surface.

The Tuisol, "to pray for ablution," ranks among the most sacred of the Buddhist rites, and is performed at every solemn assembly for the washing away of sins. Water is poured out from a vessel similar to a teapot, called mangu, and also bumpa, over the vessel's well-cleaned cover, called yanga, or a particular metallic mirror, melong, which is held so that it reflects the image of Sakyamuni, which stands on the altar. The water falls down into a flat vessel, called dorma, placed upon a tripod. (Emil Schlagintweit, Buddhism in Tibet, p. 239, and T. W. Rhys Davids, Buddhism, p. 248 *et seq.*) See also Waddell, *loc. sup. cit.*, in which he describes the ceremony called "The obtaining of long life;" also W. W. Rockhill, On the lamaist ceremony called "The making of mani pills" (Journ. Amer. Orient. Soc., XIII), which is a ceremony of the same class as that described by Dr. Waddell.

The *purbu* or nail is a triangular nail ending in a sharp point. The handle is in the shape of a half *dorjé*, with a human head terminating it. It is used in exorcising evil spirits. (See Waddell, Buddhism of Tibet, pp. 483 and 488).

The skull bowl is used in worshiping Ts'é-pa-med, when it is filled with nectar brewed from ch'ang. After the ceremony it is drunk by those present. It may be noted that various gods—among others Ts'é-pa-med and Paldän-lh'amo—are represented with skulls in their hands filled with ambrosia (*dud-tsi*, literally "devil's juice"). The custom of using skulls as holy vessels, or even as eating bowls, is a very old one in Asia;

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*See L. A. Waddell, The so-called "eucharist" of the lamas, in Asiatic Quarterly Review, April, 1894, and Buddhism of Tibet, p. 298, 444 *et seq.*

a certain class of lamas use them for the latter purpose at the present time. We find, however, in the Buddhist *Vinaya* or canon law, which dates from the early days of Buddhism, that monks were forbidden using skulls as alms-bowls as being then used by devil worshippers. (Sacred Books of the East, vol. xx, p. 89.)

Fig. 2, on pl. 42, represents a libation bowl made of a human skull (*a*); it has a lining of iron, with an ornamented copper gilt rim fitting on it. The cover (*b*) is finely and intricately chased; on each side is a *landza* character—or rather monogram—the mystic syllable *om*, with an arabesque design surrounding it. The top is surmounted with four half dorjé at right angles, a fifth and larger one forming a handle. The stand (*c*) on which the skull rests is of gilt copper and triangular in shape. At the three angles are human heads painted white, red, and green. The triangular design on the face of the base seems to be flames, and the Chinese symbol of the *yang* and the *yin* (the two principles of nature) appear in the middle of each side. For further particulars bearing on the mode of selecting and consecrating such skulls, I must refer the reader to my paper "On the use of skulls in lamaist ceremonies." (Proc. Amer. Oriental Society, Oct. 1888, p. XXIV, *et seq.*)

The Museum collection contains also a few images of gods of the finest workmanship. They are made of copper, cast and then very finely gilt, chased, and polished. The interior, which is hollow, is filled with some of the same articles as are put in ch'örtens (see Cunningham, Ladak, p. 309). When the image rests on a circular base of the open lotus flower style, these articles are inclosed in it. These images are all distinctly Brahmanic—a peculiarity of nearly all lamaist images—with the exception of the heads, which are usually made with terrifying features colored red, blue, or green.

Pl. 43 represents a small gilt image of Jambyang, the "sweet singer" (*Manjushri*) of the Indians. He is here represented seated, holding in his right hand the sword of wisdom with a flaming point, to dissipate darkness among men, and a noose in his left. Behind his left arm is an open flower, in which rests a book.

Jambyang is the god of wisdom, and his principal sanctuary is at Wu-t'ai-shan, in the Chinese province of Shan-hsi.

Pl. 44 is an image of Drolma, "The Savioress," called in Sanskrit *Tārā*.

> It is [says Dr. Waddell] to this attribute of being ever ready to help and ever approachable that she owes her popularity; for most of the other deities of "northern Buddhism" can not be approached without the mediation of a lama, while the poorest layman or woman may secure the immediate attention of Tārā by simply appealing to her direct.
>
> She has the attributes of a female Avalokita, and in Tibet she is expressly regarded in her most popular forms as the *Sakti* or female energy of Avalokitesvara. (Dr. L. A. Waddell, Journ Roy Asiat Soc., 1894, p. 63 *et seq.*)

This image was made at Ch'amdo in eastern Tibet.

GILT IMAGE OF JAMBYANG (MANJUHSRI.

Cat. No. 130396, U. S. N. M. Lh'asa.

GILT IMAGE OF DROLMA (TĀRĀ).
Cat. No. 130395, U. S. N. M. Ch'amdo

GILT IMAGE OF TS'É-PA-MED (AMITAYUS).
Cat No. 130400, U. S. N. M. Dolon Nor

Pl. 45 represents an image of Ts'é-pa-med, the "god of endless life;" in Sanskrit, Amitayus. This god is also known as Wu-pa-med, or "Endless light;" in Sanskrit, Amitabha. Under the name of Ts'é-pa-med he is implored for longevity. The god is represented seated, holding before him in his right hand a bowl (often a skull) filled with the water of life; the left hand rests with upturned palm in his lap under the right.

Pl. 46 represents Tamdrin; in Sanskrit, Hayagriva. This god is one of the Drag-shed or gods who protect man against evil spirits. He is here represented with three faces of hideous expression and on his head is a crown of flames. He has six arms and two legs, and around his waist is a girdle of leaves. In his upper right hand he holds a noose, and in the lower an arrow; in his upper left hand is a 3-leaved flower(?) and in his lower left a bow. The middle right hand, which he holds before him, has in it a cross *dorjé*. The middle left hand is empty, the thumb touching the second and third fingers, the index and little finger held extended. A long rosary hangs around his neck, and he is kneeling on his left knee. He has three eyes in each face, the third eye upon the forehead being that of wisdom.*

Pl. 47 shows a remarkably fine specimen of work, representing the god of wealth or god protector of treasures (*Gunkar yijin norbu*), also a Drag-shed. The god is three-faced, with a crown of flames. He stands erect on two elephants, and has six arms. The middle ones are held before him with offerings in them. The upper right hand holds a dorjé, the upper left a *béchon* or club. The lower right holds a damaru or small hand drum, and the lower left a snare (*dzagpa*). This image was made at Lh'asa.

Pl. 48 is supposed to represent Ch'ös-bjin jamba. The saint is clothed in a mantle falling over the arms, while his hands are held in the position of prayer or supplication. The earrings are peculiar and unusual. This image and the following were bought at the great lamasery of Kumbum, and are not of as fine workmanship as the three preceding ones.

Pl. 49 represents the image of some holy man, apparently a Chinese; but I have not been able to identify him.

One of the principal treasures of the great lamasery of Kumbum is the so-called white sandal wood, sprung from the hair of Tsongk'apa, the founder of the "Yellow church," who was born at this place toward the middle of the fourteenth century of our era. The leaves of this tree are carefully collected and sold to pilgrims, who use them as medicine or wear them as charms in their *gawo*. Abbé Huc says that when he saw the tree, characters of the Tibetan alphabet were visible on every leaf and in the bark. At present it is said that images of Tsongk'apa are *sometimes* visible on some of the leaves, when the person

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* Wherever seen in images of gods, the third eye in the middle of the forehead is the eye of wisdom, or foreknowledge.

looking for them has sufficient faith.* The tree is probably a lilac. (*Syringa villosa*, Vahl.)

A lot of leaves of this tree were bought by me at Kumbum in 1891.

Trees sprung from the hair of saints are quite numerous in Tibet. Explorer U— G— saw, on the left bank of Tsangpo ch'u, below Chét'ang and near the Sangri Khama monastery, a hill overshadowed by cypress trees, "all of which sprung from the scattered hairs of a saint, which were cast to the winds hereabouts." (Report of Explorations in Tibet, Bhutan, etc., p. 28.) Sarat Chandra Das saw at Tashil'unpo a juniper bush in which the hair of Gédundrub, the founder of the lamasery, is still "said to exist."

The Arab traveler Ibn Batutah saw, in the fourteenth century, at Deh Fattan, on the Malabar coast, a tree on the leaf of which there appeared every year, "written by the pen of divine power," the words, "There is no god but Allah, and Mohammed is the envoy of Allah." (Ibn Batutah, Travels, Defrémery's edition, IV, p. 88.) This last-mentioned tree was probably, according to Mr. T. Dyer, a *graftophyllum*.

A small mold of wood with a number of figures of a loaded yak, of a man, a dog, etc., and Buddhist emblems cut in it, may be found in pl. 33, fig. 1. It is used to mold figures in *t'samba*, which are afterwards colored and figure in certain ceremonies for expelling the demon of sickness.†

The two most commonly used kinds of incense (*spös*) are the larger sticks of the *shakama pös* or saffron-colored incense, also known as *jambling kun-jyab* or "world pervading," on account of the great strength of the perfume, and a smaller variety which is of a deep violet color, and is in common use in all temples and for household worship. Great quantities of it are manufactured in central Tibet (Lh'asa and Shigatsé) and exported to China, Mongolia, and every corner of Tibet.‡

A frequently used substitute for incense consists in dried spines of the juniper (*shuka*) mixed with a little butter and salt, these ingredients making the spines burn more readily and completely. This kind of incense is very extensively used throughout Tibet and parts of Mongolia.

Pl. 50 shows a pitcher 6 inches high, of cast brass, in the shape of an ewer. It is roughly ornamented with a series of lines and dots, and around the base is written in Tibetan characters a *mantra*. The handle is large and cast at the same time as the body. The use to which this ewer is put is not known, but it is certainly not a household utensil. It is a rough piece of work; probably in an unfinished state.

Musical instruments.—Music, both instrumental and vocal, is a prominent feature in lamaic ceremonies. The principal instruments used are the drum, trumpet, flageolet, cymbals, and conch shell. The drums

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* See Prince Henri d'Orleans, Le père Huc et ses critiques, pp. 34–42.

† For a full account of these ceremonies, the reader is referred to Emil Schlagintweit, Buddhism in Tibet, p. 269 *et seq.*

‡ See also Journ. Roy. Asiat. Soc., n. s. XXIII, p. 281.

GILT IMAGE OF TAMDRIN (HAYAGRIVA).

Cat. No. 130398, U. S. M. N. Lh'asa.

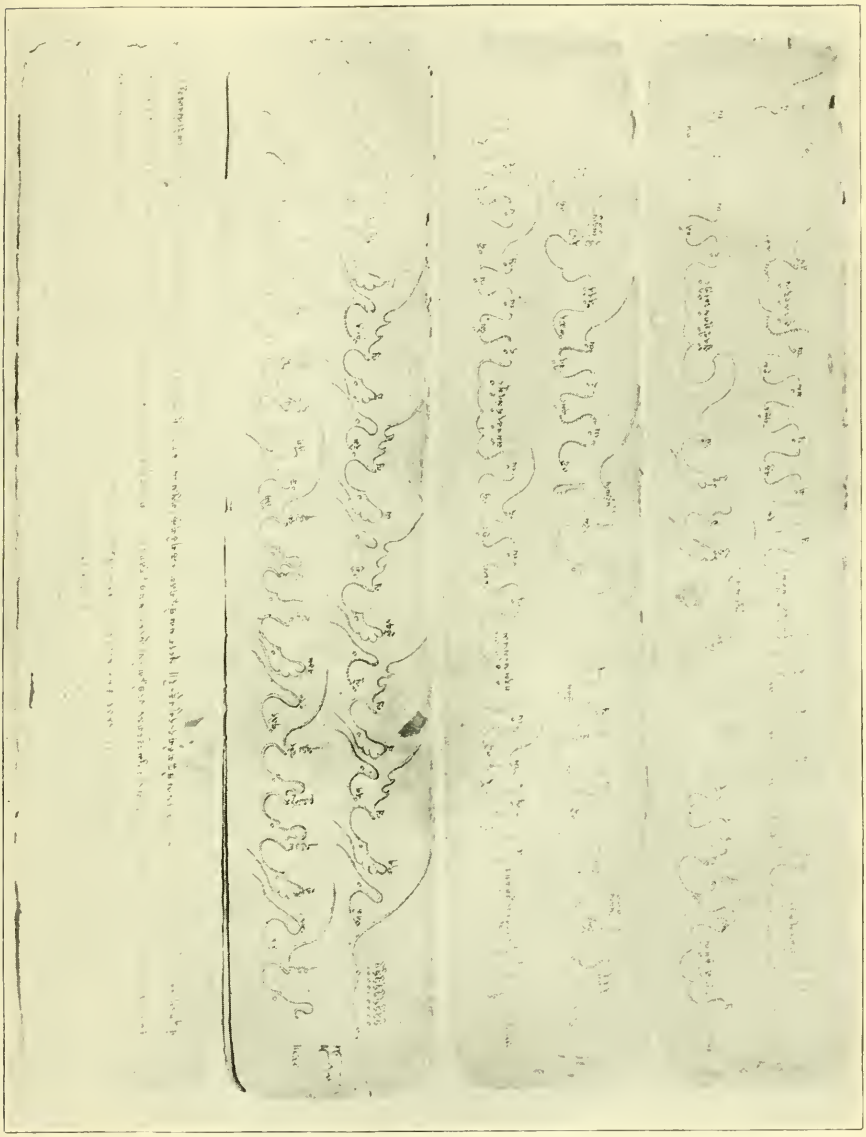
GILT IMAGE OF THE GOD OF RICHES (GUNKAR YIJIN NORBU).
Cat. No. 130399, U. S. N. M. Lh'asa.

GILT IMAGE OF CH'ÖS-BJIN-JAMBA.
Cat. No. 167270, U. S. N. M. Kumbum.

GILT IMAGE OF A HOLY MAN—PROBABLY CHINESE BUDDHIST.
Cat. No. 167269, U. S. N. M. Kumbum.

PITCHER OF CAST BRASS.

Cat. No. 167292, U. S. N. M. Lh'asa.



DESCRIPTIVE SCORE, USED IN LAMAIST CHURCH SERVICES.

Cat. No. 130377. U. S. N. M. Kumbum.

are of two kinds—the small hand drum previously described, and the large drum (*ch'örna*), which is cylindrical, about 2 feet in diameter and 8 or 10 inches high. To it is fastened a handle about 3 feet long, by which it is held erect. It is struck by means of a stick shaped like a sickle, with a long handle. This drum and also the hand drum are apparently copied from two well-known kinds of Chinese drums. (See J. A. Van Aalst, Chinese Music, p. 76.)

The big trumpet or *dung-ch'en* is from 6 to 8 feet long, made of copper, and is slightly bent so that the end may rest flat on the ground. A smaller trumpet is made of a human tibia, and is called *kang-dung* "leg-bone trumpet." No. 130386 is one of these.* A piece of skin (supposed to be human) is sewed around it, and a plaited lash about 20 inches long hangs from its end. Such trumpets are used in exorcising ceremonies. Another form of *kang-dung* is made with the mouthpiece and the lower portion of chased copper, the central part only being of bone.

The hautboy (*jyeling*) used by the lamas is of Chinese origin and pattern, and calls for no particular remark beyond stating that most of them have loose or sliding tubes by which means the sounds are modulated. The cymbals (*sinyen*) used are also Chinese in shape and probably manufacture. A small kind of cymbal called *ding-sha*, the disks of which are about 2 inches in diameter and suspended horizontally by a short string so that their edges may be struck together, is also used by the lamas—not in church ceremonies, but only when reading prayers in their houses. This latter instrument is the Indian *mandira*, used to measure time in musical performances.

Conch shells are used to call to prayers and for other purposes similar to those for which the big trumpets are used. They have frequently a metallic mouthpiece and are handsomely ornamented around the rims. There is a most beautiful specimen of such a conch shell with inscriptions on it in Chinese, Tibetan, Mongol, and Manchu in the British Museum. Conch shells with whorls turning to the right are especially prized, and a lamasery which is so fortunate as to possess one is famed throughout the land. (Land of the Lamas, p. 110.)

A system of musical notation is used by the lamas to teach chanting and accompanying liturgies. These books, called *yang yig*, "hymn or song books," contain a kind of descriptive score, consisting of wavy lines, showing when and for what space of time the voice should rise or fall. Plate 51 shows several pages of this music. Where the conch shells should be sounded or the drum beaten is shown by a figure of a shell or a drumstick. This system of notation is specially interesting from the fact that it is, so far as I am aware, the only one found in eastern or central Asia. (Plate 51, and Land of the Lamas, p. 88, also Waddell, Buddhism of Tibet, p. 432.)†

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*Not illustrated in this paper.

† On lamaic musical instruments, see also Georgi, Alphabetum tibetanum, p. 404.

MISCELLANEOUS OBJECTS FROM THE CHINESE BORDER LANDS.

In fig. 1 of pl. 52 is shown a shoe made of oxhide and in shape somewhat like an Indian moccasin. The sole is turned up all round the vamp, which latter has a tongue coming over the instep. These shoes, called *p'i-hai* in Chinese, are worn in the extreme western part of Kan-su by the poorer classes.

Inside these shoes coarse woolen socks, knit of sheep's wool, are worn (fig. 2). These socks are invariably knit by the men. It is, by the way, no uncommon thing in Mohammedan countries for the men to knit. I have noticed it in Algeria, and Friar Odoric, speaking of the people of Huz in Khuzistan (Persia), remarks of them "and 'tis the custom for the men to knit and spin, and not the women." (H. Yule, Cathay and the way thither, I, p. 53.)

Sandals made of hemp (figs. 3 and 4) are known as *ma hai* in western Kan-su where they are made and worn. They closely resemble the Ssŭ-ch'uanese sandal (figs. 5 and 6), woven of rice straw over hempen cords, with some slight difference in the width of the piece in front to protect the great toe. The Kan-su sandal is in all respects like the Korean one. In all these sandals a string passes through loops fastened to the sole and heel and is tied around the ankle.

In western Ssŭ-ch'uan, where these sandals are the only foot gear worn by hill porters, iron clamps or crampons, consisting in an oval plate of iron with four short flat points on them, are tied to the middle of the foot when the ground is wet or slippery.

The collection contains a brass saucepan 9 inches in diameter, the back and handle beaten out of the same piece. It is used by Mongol and Chinese traders when traveling, not only as a pan but as a ladle.

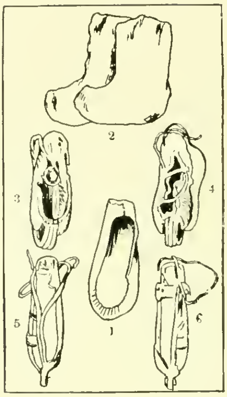
A copper tea-kettle with top fitting closely in it is also in the collection. It is egg-shaped, with a rude handle, and is without a spout. It is manufactured by the Chinese of Hsi-ning and Tankar in western Kan-su for the Tibetans and Mongols of the Kokonor.

A wooden pail in the collection, made of numerous wooden staves held together by three brass hoops, is from the Ordos Mongols. It has a brass ear and ring on each side and through this passes a yak hair handle. It is a little larger at the bottom than at the top. Such pails are very much valued by these Mongols, and the handles are frequently decorated with cowrie shells or beads.

In the collection is a fine blanket of mixed goat hair and sheep's wool dyed a clear brown color. It is made of four strips, each 18 inches wide. Such blankets are woven by the border Chinese for travelers and are practically waterproof. This one was bought in Kuei-hua Ch'eng (eastern Mongolia).

Fig. 15 of pl. 5 represents a breast ornament worn by Mongol women. It is in the shape of two of the eight signs of good luck, "the fishes," and the "chest-mark" (or "intestines," as the Chinese call them). It

EXPLANATION OF PLATE 52.



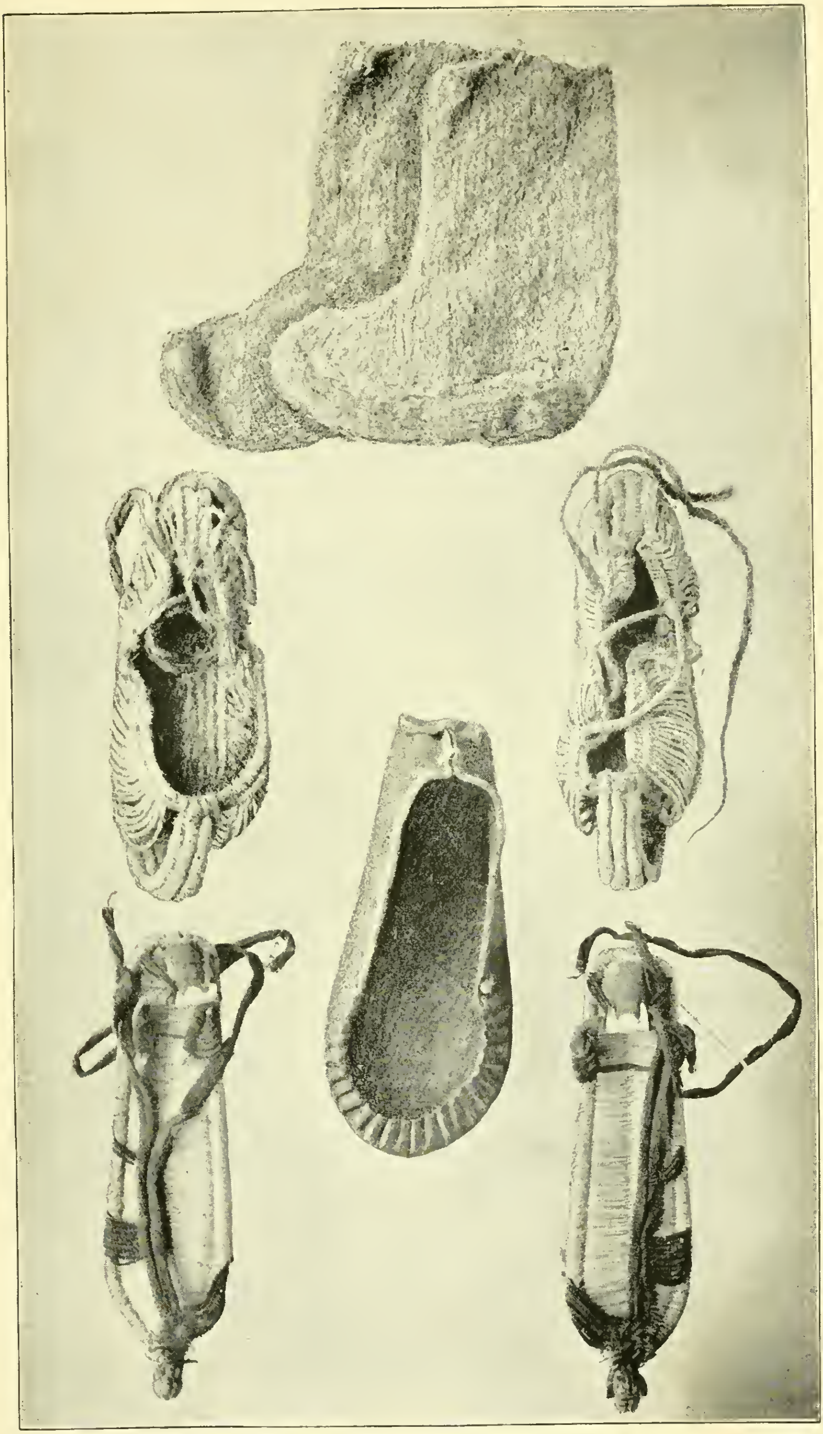
Tibetan Foot Wear.

Fig. 1. Leather Moccasin. Kan-su.
(Cat. No. 131202, U. S. N. M.)

Fig. 2. Woolen Socks. Kan-su.
(Cat. No. 131199. U. S. N. M.)

Figs. 3 and 4. Hempen Sandals. Kan-su.
(Cat. No. 131198, U. S. N. M.)

Figs. 5 and 6. Straw Sandals. Ssŭ-ch'uan.
(Cat. No 167181. U. S. N. M.)



FOOTWEAR OF KAN-SU AND SSŬ-CH'UAN BORDER LANDS.

is of brass. heavily gilt, and in the center of it is an ornament in coral and turquoises. Three rings are fastened to it: by one a string passes by which it is suspended around the neck, and to the other two are fastened the ends of long strings of coral beads, the other ends of which are attached to the earrings.

The Museum collection also contains a curious picture executed by some Chinese painter, probably in the latter part of the eighteenth century. It represents a town in Chinese Turkestan, and gives a vivid picture of the people of that province, their mode of living, their various occupations and amusements. It is 30 feet long and about 30 inches broad, and deserves careful and detailed study, it being replete with valuable ethnological data. It was purchased in Peking in 1887.

TWO PERSEPOLITAN CASTS IN THE U. S. NATIONAL MUSEUM.

BY

CYRUS ADLER.

TWO PERSEPOLITAN CASTS IN THE U. S. NATIONAL MUSEUM.

By Cyrus Adler.

A private expedition was sent out from England with the assistance of Lord Saville, in the winter of 1891, for the purpose of securing molds of the sculptures and inscriptions at Persepolis.

Although frequently drawn, and even photographed,* it was important that these splendid monuments of Persian sculpture should be presented to the archæologist and student of art in a more worthy form.

Some excavations were found necessary in order to uncover sculptures which were partially or wholly buried. These were made under the direction of Mr. Herbert Weld Blundell, whose observations are recorded in an interesting paper read before the Ninth International Congress of Orientalists.†

Under date of March 10, 1892, the Hon. Truxton Beale, then U. S. minister to Persia, in a communication to the late Hon. James G. Blaine, Secretary of State, announced that he had obtained permission from the Persian Government to remove some objects from Persepolis for the U. S. National Museum. Upon reaching Persepolis, however, Mr. Beale saw that nothing very characteristic could be obtained without grossly defacing the ruins. The detached parts that had fallen to the ground were huge drums and capitals of columns, each of which weighed many tons. Their transportation across the desert and two ranges of mountains was therefore out of the question.

When Mr. Beale arrived at Persepolis, he found that Mr. Blundell was already engaged in taking molds of the bas-reliefs and cuneiform inscriptions on the walls, for the British Museum. Mr. Blundell presented to Mr. Beale two molds for the U. S. National Museum. These were shipped to Washington and there cast. These two molds were the first ever taken of Persepolitan inscriptions.

* Die achämenidischen und sassanidischen Denkmäler und Inschriften von Persepolis, etc. * * * zum ersten Male photographisch aufgenommen von F. Stolze. Herausgegeben auf Veranlassung des fünften internationalen Orientalisten-Congresses zu Berlin. 2 Bde. Berlin, 1882.

† See Proceedings of the Congress (London 1893), vol. 11, pp. 537–559. The molds were made by Mr. Giuntini and are for sale by Mr. Cecil H. Smith, 3 The Avenue, Fulham Road, London, SW.

The paper molds were most carefully made and the Museum modelers succeeded in securing excellent casts, as the accompanying plates show.

A Spanish diplomat, Garcias Silva Figueroa, who was sent as ambassador to Goa, a fortified Portuguese settlement on the west coast of India, about 250 miles from Bombay, by Philip III, had his interest excited by some monkish tradition and stopped on his way back at Persepolis. "He was on the ground in 1618 and was the first, not only to put on record any description of the ruins that even approached sober accuracy, but also to give an account of the strange characters that covered them." (Francis Brown.)*

In view of this fact it is not without interest that the first mold taken at this place should have been brought back to the United States by an American in the diplomatic service of his country.

Mr. Blundell's work was eminently successful. In a letter from London, under date of August 30, 1892, he wrote:

> They (the moldings) have all arrived safely and they comprise nearly all the best known examples of the bas-reliefs at the group of palaces and halls at Persepolis and the figures of Cyrus at Meshed Murgheb.

The inscription on pl. 1 is in the language of Ancient Persia, and is written in the Persian cuneiform character. It was engraved at the command of Artaxerxes (III) Ochus, who reigned 358–344 B. C., or, according to some, from 359–338 B. C.

Ochus was a ruler of great vigor, and under him the Empire took a new lease of life. Phenicia and Cyprus, which had been Persian colonies, rebelled, but he reduced them to submission. Egypt he reconquered. The accession of Ochus to the throne was marked by his murder of three brothers; according to some, of his entire family. His own death was by poison at the hands of his vizier.

The inscription is well known and has been frequently translated.†

Most of the Achæmenian building inscriptions have the same style.

In Persepolis there are on the north side of Artaxerxes's Palace three identical old Persian inscriptions. The present inscription is, however, that from the west staircase.‡

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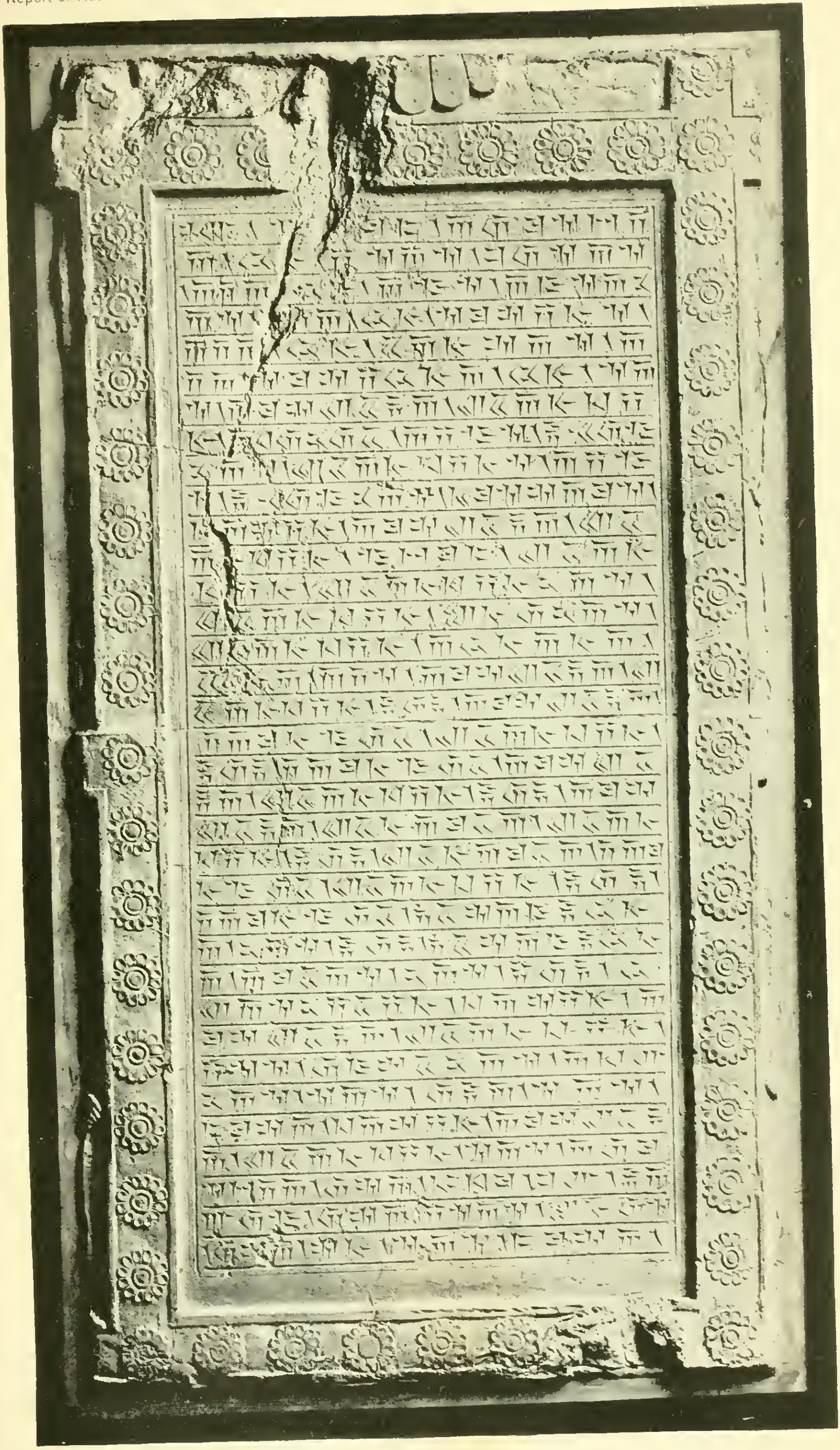
* His work, De rebus Persarum epistola, was published at Antwerp in 1620.

† Theodor Benfey: Die persischen Keilinschriften mit Uebersetzung und Glossar, Leipzig, 1847, p. 67 ff. Here it is wrongly ascribed to his predecessor. Oppert, Journal Royal Asiatic Soc., Vol. x, p. 297. Rawlinson, *ibid.*, p. 341. Die altpersischen Keilinschriften im Grundtexte, mit Uebersetzung, Grammatik und Glossar, von F. Spiegel, zweite vermehrte Auflage, Leipzig, 1881, p. 128 f. The most recent translation of the inscription is by F. H. Weissbach and W. Bang. "Die altpersischen Keilinschriften" Leipzig, Hinrichs, being Vol. x., Pt. 1, of the Assyriologische Biliothek of Friedrich Delitzsch and Paul Haupt, pp. 46, 47.

‡ Published by Flandin & Coste, vol. 3, pl. 125. Photographed by Stolze, vol. 1, pp. 26, 27, 28, 41, 47, and 48. See Weissbach, p. 9. Spiegel states (p. 128) that the inscription is given by Rich, in Nineveh and Persepolis, Pl. XXIII; on p. 69 in the footnote he says of Rich (Babylon and Persepolis, Pl. XXIII): "The text he employed, however, was not that of Rich, but of a similar inscription on the east wall, copied by Westergaard and published by Lassen."



INSCRIPTION OF ARTAXERXES III OCHUS.

From a cast presented to the U. S. National Museum by Hon. Truxton Beale, United States minister to Persia.

BAS-RELIEF FROM PERSEPOLIS.

From a cast presented to the U. S. National Museum by Hon. Truxton Beale, United States minister to Persia.

The following is a translation of the inscription:

A great god is Auramazda, who created this earth, who created that heaven, who created mankind, who gave prosperity to mankind, who made me, Artaxerxes, king, the sole king of multitudes, the sole ruler of multitudes.

Thus speaks Artaxerxes, the great king, the king of kings, the king of countries, the king of this earth. I am the son of King Artaxerxes, Artaxerxes (was) the son of King Darius, Darius (was) the son of King Artaxerxes, Artaxerxes (was) the son of King Xerxes, Xerxes (was) the son of King Darius, Darius was son of (one) named Hystaspes, Hystaspes was son of (one) named Arshama, the Achæmenide.

Thus speaks the King Artaxerxes: "This structure of stones I have built for myself."

Thus speaks the King Artaxerxes: "May Auramazda and the god Mithra protect me, and this land, and what I have made."

The other cast (Pl. 2) is no doubt a relief, "representing one of the royal bodyguards, probably one of the 10,000 immortals described by Herodotus, of whom 9,000 had at the end of their spears a silver apple, 1,000 a golden apple. He wears long drapery, sandals, and an upright quilted headdress; over his shoulders is slung a bow and quiver, and in his hands he holds upright a spear which terminates in a ball (probably the silver apple). This figure closely resembles the figures in the frieze of enameled bricks found by Dieulafoy at Susa, and now in the Louvre. It is from the stairway on the southeast side of the Palace of Darius." Height, 8 feet 8 inches; width, 2 feet 8 inches.*

LIST OF CASTS MADE FROM MOLDS SECURED AT PERSEPOLIS.

1. Throne relief, 25 feet 3 inches high, 9 feet 5 inches wide.
2. Stairway of Artaxerxes Ochus. Height, 7 feet 2 inches; length, 44 feet.
3. Figures ascending staircase representing persons bringing offerings to the king. Height, 4 feet 7 inches; width, 4 feet 11½ inches.
4. Frieze of figures and animals decorating the passage leading to stairway on the north side of the Hall of Xerxes. Height, 4 feet; length, 50 feet 1 inch.
5. Part of frieze belonging to same series. Height, 4 feet; length, 8 feet 4 inches.
6. Cyrus. Height, 9 feet 7 inches; width, 5 feet 1½ inch.
7. Immortal guard. Height, 8 feet 8 inches; width, 2 feet 8 inches.
8. King stabbing a monster. Height, 8 feet 4 inches; width, 4 feet 7 inches.
9. King stabbing a lion. Height, 8 feet 4 inches; width, 4 feet 7 inches.
10. Lion. Height, 1 foot 9 inches; width, 2 feet 3 inches.
11. Inscription of Xerxes. Height, 5 feet; width, 2 feet.
12. Base of a column.

* Flandin et Coste, III, pl. 1, 114, 115, general view; pl. 122 in general restoration. Stolze, I, pl. 44. Catalogue of casts of sculpture from Persepolis and the neighborhood, p. 10.

MUSEUM COLLECTIONS TO ILLUSTRATE RELIGIOUS HISTORY AND CEREMONIALS.

BY

CYRUS ADLER,

Custodian of the Collections of Religious Ceremonials, U. S. National Museum.

MUSEUM COLLECTIONS TO ILLUSTRATE RELIGIOUS HISTORY AND CEREMONIALS.*

By Cyrus Adler.

Museum collections perform a double function. They instruct the public and they furnish material for the investigator. They render the reading of books more intelligible, and their writing more accurate. Infinitely more than the popular illustrated magazine or scientific monthly are they the means of communication between the average man and the scholar.

The study of religious history and ceremonial institutions stands on a footing different from that of any other branch of knowledge. Political history, though in a lesser degree, suffers under similar disadvantages.

The study of biology or the physical sciences is approached with no predisposition. Their terminology is arbitrarily given, and the errors of their followers are due to infirmity of the powers of observation or generalization.

The study of political history, no matter how scientific the spirit in which it be approached, is influenced by an emotion—that worthy emotion known as patriotism—for which men sacrifice life, health, and fortune. An emotion even stronger is religion; its influence is second only to that of domestic affection, and sometimes overcomes it; its lessons are the earliest instilled into the mind; none escapes its influence. Even with unusual precautions in the case of a human being bereft of most of the avenues of perception, religious teaching could not be excluded.†

All modern literatures presuppose a definite belief, and the creeds which differ therefrom are described in terms which carry a derogatory implication.‡

It is obvious, therefore, that if the public is to be taught the history

* A paper read at the International Congress of Anthropology, Chicago, 1893.

† Laura Bridgman.

‡ This sometimes occurs as a result of scientific prejudice; witness the placing of many religious objects under the headings of "superstition" and "cruelty" in the Museo Psychologico at Florence.

of religion or religious ceremonies, it will be most advisable to approximate the methods of those branches of study in which the knowledge is acquired for its own sake, without thought of professional use or partisan advantage, simply for the enlargement of the mental horizon of the individual and the increased mental power thereby attained.

Modern investigation and modern teaching are based upon phenomena. Science deals with objects and phenomena; it collects them, describes them, and classifies them. A few great men in the world generalize; speculation, acknowledged to be such, is out of fashion.

This tendency of investigation to deal with phenomena has reacted upon all forms and grades of instruction, the higher as well as the popular. It has given the impulse to and shaped the growth of the highest modern method of popular instruction, "the most powerful and useful auxiliary of all systems of teaching by object lessons"*— the educational museum.

Religious history and ceremonial have been the very last to profit by the awakened impulse acquired through the museum and the general exhibition.

The first museum established solely for the collection and preservation of objects having to do with religion was the Musée Guimet, founded at Lyons in 1879 by M. Emile Guimet on his return from the mission intrusted to him by the French ministry of public instruction to study the religions of the extreme Orient. The collection thus assembled is the largest and best single collection of objects relating to religion ever put together. It has occasioned the publication of a series of volumes which form by far the most remarkable contributions yet produced to the scientific study of religions.

In 1885 this museum was removed to Paris, a special building erected for it, and it is now included among the series of museums under Government control.

But, in spite of the splendid character of the collections and the great impetus they have given to scientific research, the museum has serious weaknesses which should not be overlooked. The general classification as well as the special arrangement are defective from the point of view of a museum of religions.

Geographical considerations have dictated the general classification, so that the Chinese, Japanese, and Indian Buddhism, for example, are shown out of relation to one another. Æsthetic considerations have directed the arrangement of the groups themselves. The special objects are in the main without labels, making the use of the printed guide, always tiresome and distracting, an absolute necessity for the general visitor. So strongly has the æsthetic arrangement predominated that I am informed the character of the museum is to be changed, and that in future it will be devoted to Oriental art.

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*Goode, Dr. G. Brown, Museums of the Future. Report U. S. National Museum, 1889, p. 427.

The most serious fault of the museum, however, is that it fails to furnish an intelligent train of thought to the mind of the average visitor. The real method of popular education consists in imparting the unknown in terms of the known. Just as the scientific investigator obtains results by the comparison of facts and phenomena does the museum visitor have his interest awakened by the opportunity of comparing familiar objects with those brought to his knowledge for the first time. From the point of view of popular education it is therefore a capital error that the Musée Guimet has not included the Christian religion, as well as the Mohammedan and Jewish religions, with which the first named has such close affiliations, in the series which it places on exhibition.

Many museums contain objects which would find place in a collection of religions. These are usually installed in ethnological exhibits, and more frequently still are shown as objects of art.

In a few museums religious art is treated as a distinct subject, and, being arranged chronologically, may be considered as showing the development of both church history and religious symbolism. The most important of these is the Lateran Museum at Rome. In 1843 Pope Gregory XVI set apart the Palazzo del Laterano as a museum for heathen and Christian antiquities, styling it Museum Gregorianum Lateranense. The Christian Museum was founded by Pius IX. It contains a most valuable collection, including a series of early Christian inscriptions arranged by De Rossi.

The National Bavarian Museum at Munich contains a rich collection of Christian ecclesiastical art, as well as a goodly series of Jewish religious objects.

The Arab Museum in Cairo, although not erected from the point of view of religions, is yet to a considerable extent a collection of Mohammedan ecclesiastical art. Its purpose is the preservation of monuments of Arab art, but, as the mosque was the chief inspirer of elegant work, most of its objects are directly or indirectly related to Mohammedan worship.

The U. S. National Museum contains Buddhist objects from India, Siam, China, Corea, and Japan, as well as considerable collections from Polynesia—the result of the Wilkes Exploring Expedition. In the department of ethnology much attention has been paid to collections of objects of religious import employed by the aborigines of North America, and special series, as, for instance, mortuary customs have been for some time on exhibition.

As a result of the travels of Hon. W. W. Rockhill in Tibet, the National Museum secured a rich and unique collection of the religious objects of the Buddhists of that little known country.

In 1889 a collection of objects illustrating Jewish religious ceremonials was placed on exhibition, and in his report for that year Dr. Goode announced the purpose of the Museum to form a collection which would illustrate the comparative history of religion.

Having found a place in the museum, it was but proper that the subject of religion should be assigned space in the great exhibitions and that in the natural course of events special exhibits of religious objects should be made. These exhibits are quite distinct from the church exhibits—either from the point of view of propaganda or philanthropy—which have usually been included in exhibition classifications.

A special religious exhibition of considerable importance was the Esposizione Vaticana, held to commemorate the jubilee of Pope Leo XIII, from December, 1887, to May, 1888. It took place in the Basilica di San Pietro e Palazzi Vaticani and its story is told in a serial publication, L'Esposizione Vaticana Illustrata Giornale Ufficiale per la Comsione Promotrice, as well as in a valuable catalogue.*

While not exclusively religious, the exhibition was in the main an exhibit of ceremonial objects of the Roman Catholic religion, although costumes of other religious functionaries were admitted.

In the same year there was held in London, in honor of the Queen's jubilee, the Anglo-Jewish Historical Exhibition, in which the richest collection of Jewish ceremonial objects ever gotten together was placed on exhibition.†

At the Paris Exposition of 1889 the Society of Anthropology of Paris included a history of religions in its classification, with the subdivisions of amulets and divinities. Amulets, however, were given most attention.

In April, 1892, a loan collection of objects used in religious ceremonies and charms and implements for divination was held at Philadelphia under the auspices of the department of archæology and paleontology of the University of Pennsylvania.

A useful catalogue of this collection (edited by Mr. Stewart Culin) was published. The classification followed that of the Musée Guimet, and, was geographical in the main, though not strictly so.‡ A decided improvement on the Musée Guimet plan was the admission of one great Semitic religion, Mohammedanism.

In the Columbian Historical Exhibition at Madrid (1892), 7,000 square meters were devoted to a splendid exhibit of Christian ecclesiastical art, arranged by cathedrals.

The Chicago Exposition has made considerable advance on its predecessors in this regard. Two exhibits of religions are to be found here, one in the Ethnological building and one in the United States Government building. On the Midway Plaisance there is a mosque in charge of an Imam, officially appointed by the Sultan of Turkey, in his capacity of Caliph, i. e., successor, or rather substitute, of Mohammed, the title of the head of the Mohammedan Church.

A parliament of religions has been called which, while conducted on church lines, and almost exclusively from the propagandist or

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* See Appendix No. 1. † See Appendix No. 2. ‡ See Appendix No. 3.

philanthropic point of view, yet possesses a certain interest, in that it enables the presentation of many creeds by their own professors.

Of the exhibits I shall not speak in detail, as the congress has set apart a special day for visiting them, yet I may be pardoned for making a few general statements covering the exhibit in the Smithsonian section.* Some time before the plans for the National Museum exhibit were under way, the purpose of forming a section devoted to comparative religion had been definitely announced. It was accordingly decided to prepare a type exhibit for the World's Fair. This exhibit suffered under limitations as to space and time for preparation. It was further decided to limit the religions shown to a selection of the nations inhabiting the Mediterranean basin. This selection had a conscious significance already referred to in the discussion of the Musée Guimet, which is of considerable practical value for the advance of the study of religions in America. The Mediterranean basin has been the seat of the civilizations of the modern western world. The art, philosophy, and religion of Europe and America arose among the ancients of that region, and the highest ideals even of the moderns are still to be found in the books and the works of art of those ancient peoples. In an attempt, therefore, to introduce the study of religions into universities, or to create departments of religious ceremonial in museums, it behooves us for the nonce to put aside the American Indian, and the Central African, and to begin at least with those religions whose history has an interest for all men of our day, the knowledge of which should really become a part of general culture.

The exhibits comprised the following religions: Assyro-Babylonian, Jewish, Oriental Christian, Mohammedan, Greek, and Roman.

It is expected that in the coming year a collection of religious history and ceremonial institutions will be installed in the National Museum. For the present, museum economy will render it necessary that objects relating to the religion of the aborigines of North America be retained in the general ethnological exhibits, though they will be carefully differentiated.

With that exception the museum collections already referred to, those on exhibition at the Exposition, and some recently acquired, will be labeled and installed as soon as practicable. So fully is the importance of this subject recognized that, in spite of the great pressure for floor space at the Museum, adequate room will be provided, although it will require the retiring of some interesting collections.

Religion consists in what men believe concerning the supernatural, and what they do in consequence of that belief, in creed and cult.

It is the cult which most readily lends itself to museum exhibition, and this will be taken up first, although there are devices by which even creeds may be shown in museum collections.

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* See Appendix 4.

The objects will be exhibited in religious groups and not in any geographical relation, except in so far as the worship has actually been affected by geographical considerations.

The cult objects will be arranged under certain well recognized heads.

There is usually a public worship in which the sacerdotal and lay classes have definite functions; there are places of worship with furniture and appointments, symbols about them and shrines within them; there is the sacerdotal person, his costume and the implements he employs; the sacred writings, the altar or its equivalent; the special public religious occasions, such as feasts; the public religious ceremonies on special occasions that affect the community, as wars, triumphs, distress, famine, and drought.

The relation of the individual to the cult will come next in order—marriage, birth and death, in some cases, bethrothal; ceremonies at certain ages, more especially of the attainment of puberty; the relation of religion to the organized community, state religious observances; finally the secret religious practices, among which charms and divination would probably fall.

Such collections once made for the individual religions, certain groups of ceremonies will be taken up in the hope that a comparison of the underlying ideas may form a fruitful subject of study.*

A double purpose would be served, for instance, by an exhibit of sacred books, which would furnish an opportunity for the classification of the book religions. This may be followed by a collection to illustrate the altar and sacred inclosure. Another subject that would lend itself to such a comparative collection would be votive offerings. Still another would be music and musical instruments. Mortuary and marriage customs and many other subjects will readily suggest themselves.

I can not do better than quote a sentence from the suggestive article of Prof. Jastrow † as expressing the aspirations of the National Museum in this connection:

> With the admirable facilities possessed by a government institution [he says], for obtaining objects from all parts of the world, the scope of this section ought at an early day be made coequal with the universe.

The study of religions is one by no means narrow, but full of significance for the historian and anthropologist. The greatest movements in political history have either been occasioned by or resulted in religious movements; and these are not infrequently stereotyped in some religious ceremony.

It is no exaggeration to say that the history of the Roman Church,

* How effectively this may be done as a matter of investigation has already been shown by the study of sacrifice among the Semites by the late Prof. W. Robertson Smith in his work, The Semitic Religions: Fundamental Institutions, the most notable contribution to the study of Semitic religions which has ever been made.

† Biblical World, January, 1893, pp. 24-32.

as well as the history of the church symbolism, might be studied in a collection of Papal medals; yet, so far as I am aware, no attempt has ever been made to form such a collection.

As Dr. Brinton has pointed out, religion has had much to do with the growth of the arts and forms of government.*

A subject of such wide import and so great general interest ought rapidly be admitted to our museums, find a place in the curriculum of our universities, and gain an entrance to all the avenues of public instruction.†

Appendix I.

CLASSIFICATION OF OBJECTS RELATIVE TO CATHOLIC WORSHIP AND RELIGION.

Group I.—Woven Goods.

First Class.—*White Goods.*

Principal objects.—Amices, albs, cinctures, corporals, palls, purificators, handkerchiefs, finger towels, altar linens, communion cloths, surplices, and rochet towels for the sacristy, etc.

Second Class.—*Colored goods.*

Principal objects.—Chasubles, stoles, maniples, chalices, veils, burses for chalices (colors, white, red, green, violet, black, and gold and silver cloth), cushions for missals, dalmatics, copes, veils for subdeacon, coverings for the bench in solemn masses, coverings for the missal in the same solemn masses, canopy or altar coverings, burse for pyx, veil for pyx, veil for processions, altar coverings, carpet or cloth for altar steps, covering for immovable lecturns, covering for movable lecturns, cloths, arras, veils, etc., to adorn churches, artificial flowers (in silk, cloth, and talc), pennants, banners, etc.

Group II.—Objects in Metal, Wood, etc.

Third Class.—*Vessels of metal.*

Principal objects.—Chalices (cups of gold and silver gilt), patens, vessels for hosts (i. e., ciboriums), little basins for cruets, peace instruments, pyxes, ostensoria, vessels for purifications, vessels for water to be blessed, portable vessels for holy water, vessels for oil for the lamps, vessels for the holy oils, vessels for washing the hands in the sacristy.

Fourth Class.—*Furniture of various kinds.*

Principal objects.—Crosses for altars, processional crosses, crosses for the sick, chandeliers for altars, triangular chandeliers, chandeliers for the pascal candle, altar cards, antependiums, missal stands, censers, incense boat, umbrellas and canopies,

* Iconographic Cyclopedia, Vol. I, 141.

† Since the close of the Chicago Exposition a considerable interest has been developed in the subject. The British Museum has placed on exhibition a collection of comparative religions, comprising among others objects relating to the Abyssinian and Coptic churches, Judaism, Mohammedanism, and Buddhism, the latter a rich collection. The classification is to an extent geographical.

The Chicago University has received an endowment to found the Haskell Oriental Museum of Comparative Religions, and at least two college presidents are urging the establishment of similar collections.

wooden boxes for chalices, case for ostensoria, folding seats, bishops' chairs, fold-stool (i. e., unofficial episcopal throne), kneeling benches, pulpits, official throne of bishop, gates, wooden altars, cornices, etc.

FIFTH CLASS.—*Glass.*

Principal objects.—Cruets, vessels for purifications, lamps, colored glasses.

GROUP III.—BOOKS.

SIXTH CLASS.—*Books for worship.*

Principal objects.—Missals, psalters, graduals, antiphonaries, breviaries, martyrologies, rituals, pontificals, ceremonials, etc.

SEVENTH CLASS.—*Religious books.*

Principal objects.—Theological and catechetical works, moral and casuistry, philosophy, ascetic works, history, biography, apologists, liturgies, sacred archæology and epigraphy, reliefs and monographs of sacred monuments now existing, religious journals and periodicals, etc.

GROUP IV.—FINE ARTS AND THEIR AFFINITIES.

EIGHTH CLASS.—*Architecture.*

Principal objects.—Plans and designs for churches, chapels, altars, baptisteries, small models, designs of existing churches, designs and plans for restoration of churches, etc.

NINTH CLASS.—*Painting.*

Principal objects.—Altar pieces in oil, encaustic, distemper, miniatures, etc.

TENTH CLASS.—*Sculpture.*

Principal objects.—Statues, groups, bas-reliefs, wall decorations, and sacred furniture (in marble, metal, wood, terra cotta, cement, scagliola, stucco), etc.

ELEVENTH CLASS.—*Music.*

PART FIRST.

Principal objects.—Treatises on religious music, collection of ancient religious music, modern church music, etc.

PART SECOND.

Principal objects.—Organs, harmoniums, bells, large and small, etc.

TWELFTH CLASS.—*Affinities.*

PART FIRST.

Photography, silography, lithography, engravings in steel and in copper, seals, mosaics, plaster, etc.

The reproduction of devotional objects, sacred images, monuments, etc.

PART SECOND.

Small devotional objects, as rosaries, medals, crucifixes, etc.

PART THIRD.

Different products.—Wax, oil, wine, incense, etc.

Appendix II.

CLASSIFICATION OF THE ANGLO-JEWISH EXHIBITION.

HISTORIC RELICS AND RECORDS.

(*a*) Pre-expulsion period.
(*b*) Title deeds, etc.
(*c*) Pictures, etc., of Jewish buildings.
(*d*) Trowels, etc.
(*e*) Synagogue documents, etc.
(*f*) Personal relics.
(*g*) Montefioriana.
(*h*) Autographs and family documents.
(*i*) MSS. and books of historic interest.
(*j*) Beni-Israel.
(*k*) Portraits.
(*l*) Newman collection.
(*m*) Miscellaneous prints, etc.

JEWISH ECCLESIASTIC ART.

Synagogue:
(*a*) Ark and curtain.
(*b*) Perpetual lamp.
(*c*) Lavers for priests.
(*d*) Scrolls of the law, etc.
(*e*) Synagogue decorations.
(*f*) Synagogue music.
Home:
(*g*) Mezuzoth and Mizrachs.
(*h*) Sabbath requisites.
(*i*) Festival requisites.
Home—Continued.
(*j*) Shekhita.
Personal:
(*k*) Weddings.
(*l*) Circumcision.
(*m*) Tephillin and Talith.
(*n*) Charms.
(*o*) Miscellaneous.
(*p*) Straus collection.
(*q*) Sassoon collection.

ANTIQUITIES.

(*a*) Manuscripts.
Crawford collection:
(*b*) Books.
(*c*) Inscriptions, etc.
(*d*) Temple.
Crawford collection—Continued.
(*e*) Palestine exploration fund.
(*f*) Sandeman collection.
(*g*) Seals and rings.
Coins and medals.

Appendix III.

CLASSIFICATION OF UNIVERSITY OF PENNSYLVANIA EXHIBIT OF RELIGIONS.

Ancient Egypt.
Religions of India:
Sectarian Brahminism.
Buddhism.
Jainism.
Religions of China:
The state religion.
Confucianism.
Worship of ancestors.
Taoism.
Buddhism.
Tibetan Buddhism.
Religious ceremonies of the Chinese in the United States.
Japan:
Shintoism.
Buddhism.
Mohammedanism.
American religions:
Northwest Coast.
United States.
Mexico.
Yucatan.
San Domingo.
Peru.
Polynesia.
Bantu tribes.

APPENDIX IV.

The following account of the exhibit appeared in the New York Evening Post, September 9, 1894:

To students of religious ceremonial an exhibit made by the Smithsonian Institution in the Government Building will prove of absorbing interest. Placed in a small room on the south side of the building, it might escape notice by casual observers; but while not extensive, being only the nucleus of a collection recently commenced, it comprehends a rather large quantity of objects used in the Jewish, Greek, Mohammedan, and Assyro-Babylonian religions, and a great many copies of ancient statues and bas-reliefs representing characters and scenes from the Roman and Greek mythology. For comparative study it offers an opportunity truly rare, as it is the only collection of the kind in the world except that of the Royal Museum at Berlin.

In the first two cases are articles, ancient and modern, used by the Jews in the religious observances of the synagogue and household. Among these are scrolls of the law or Torah wrapped in embroidered velvet cloth with silver-worked belt and silver bells on the rollers; also a manuscript copy of the Book of Esther, inserted in a revolving silver case, with illuminations illustrating the chief events narrated in the book. The Book of Esther, generally called Megillath Esther (roll of Esther), is read in the synagogue in the feast of Purim on the 15th of Adar (March-April), which was established to commemorate the deliverance of the Jews from the machinations of Haman. It is one of the five rolls read on various occasions in the synagogue, the others being the Song of Solomon, Ruth, Ecclesiastes, and Lamentations. There are several objects connected with the Passover meal or seder. Among these are brass and pewter plates for holding the green herbs, and twelve wine glasses with engravings upon them representing human life. During the seder, each person is supposed to drink of four cups of wine, and the glasses are refilled at stated parts of the service, one cup being set apart for the prophet Elijah, the expected herald of the Messiah.

Of especial interest is a delicately wrought silver spice box, supposed to have been manufactured in Würtemberg about 1740. This box, filled with spice, is used in the Jewish service known as Habdalah (or separation), the service of the conclusion of the Sabbath. There is a tradition that at the beginning of the Sabbath a special angel accompanies the worshiper from the synagogue and remains with him until the holy day is ended. The departure of the angel leaves the man faint, and the spices are intended to restore him. The objects used in this service are a cup of wine, the spice box, and a candle. A blessing is first said over the wine, then over spices, and lastly over the light, the candle being then extinguished by having wine poured upon it.

A Jewish marriage contract is exhibited, dated at Rome in the year of creation 5576 (1816). In the kethubah or marriage contract the obligations of the husband to love, honor, and provide becomingly for his wife are set forth, and also the amount of dowry allowed to the bride. The minimum of the dowry is fixed by the law at 200 shekels (about $50) for a virgin and 100 shekels for a widow or divorced woman. To this is usually added what the bride has received from her parents and what the husband settles voluntarily, all of which she gets in case of the death of her husband or of divorce. The established form of the kethubah usually commences "Under good auspices and with good luck to bridegroom and bride, whoso findeth a wife findeth a good thing and obtaineth favor of the Lord." The contract exhibited is decorated around the margin with symbolical figures, and contains the liturgy of the wedding ceremony and passages from the Bible and the Talmud The Jewish marriage is made valid by the bridegroom's putting a ring on the hand of the bride while saying the words, "Behold thou art wedded to me according to the law of Moses and Israel." These are the only words uttered by either bride or groom.

Next to the contract a wedding ring of odd design in gold is shown. Against the back of the first case is a veil of the Holy Ark, made in Padua, Italy, in 1736, of yellow silk, richly embroidered in silver, gold, and silk, with the beginning of the ten commandments beautifully worked in gold. In the Holy Ark are kept the scrolls of the law or the Pentateuch, written on parchment, for use in the services of the synagogue. The Holy Ark, being the most important object in the synagogue, is richly adorned, and whenever opened the congregation rises in reverence, for it contains the Law of God. There is also another veil of blue silk elaborately decorated in gold.

In the same case are two interesting tapestries in green and white, supposed to have been made in England in the thirteenth century. One represents the story of David and Bathsheba and the other that of David and Goliath. A knife and cup used in the rite of circumcision are exhibited, and a number of amulets, or charms, such as are still used and prized among the Eastern Jews; cushions, heavily embroidered in silver, used at the Passover meal; prayer books in Dutch and Spanish, printed at Amsterdam early in the eighteenth century, and a Jewish horn, or shofar, usually made from a ram's horn and employed in the ceremonial on various solemn occasions—notably New Year's Day, the first of the month of Tishri (September-October), and Atonement Day, 10th of Tishri. The long peculiar knife used for the slaughter of animals is also seen. The killing of animals for food is performed by a person especially trained and authorized. After the throat is cut the internal organs are examined for traces of disease, and during each act short prayers are recited. If there be a notch in the knife or trace of disease found, the animal is (terefa) unfit to be eaten.

Lamps used at the feast of Hanuka are another evidence of the elaborate ceremonial of the Jewish religion. The lamps, eight in number, joined, are of ancient Roman design. This feast is held in remembrance of the rededication of the temple after its defilement by Antiochus Epiphanes, 169 B. C. Josephus records that it was a feast of lights. The celebration lasted throughout eight days, on the first night one light being lit, on the second two lights, etc. Examples of phylacteries, or tefillin, are also shown as used by the Jews at morning prayers, except on Saturdays. These objects are employed in the Jewish ritual in pursuance of the command that the word of God should be "a sign upon thy hand and for frontlets between thy eyes." They consist of parchment cases containing the passages Deuteronomy vi, 4-9, and xi, 13-21, written on slips of parchment attached to leather straps for binding on the forehead and left arm.

Next to the Jewish articles comes a case containing a variety of articles explanatory of the form of worship in the Greek Church, of which the Czars of all the Russias have since Peter the Great been the head. The full title of the Greek Church is the Holy Oriental Orthodox Catholic Apostolic Church. The title Holy Catholic Apostolic, derived from the Nicene Creed, is also claimed by the Roman Church in an exclusive sense. The numerical strength of the Greek Church is estimated at about 80,000,000, being less than half as large as the Roman Catholic membership. The doctrine of the Greek Church is substantially like the Roman, though the government is a patriarchal oligarchy, while the Roman is a papal monarchy. Perhaps the most valuable relic in this collection is a Russian icon set in a gold frame studded with pearls and precious stones. The lids are decorated with scenes from the lives of Christ and Mary. The emeralds, ruby spinels, and garnets are all genuine and very old, dating probably from the eleventh or twelfth century, if not earlier, as they are all drilled and were evidently used for some other purpose before they were set in the icon. This piece was bought at Nizhni Novgorod for Tiffany & Co. in 1891, and is said to be the finest icon in the United States. There are also several other icons, one very interesting one showing painted figures of Cosmos and Damianus, the two brothers who died as martyrs in the persecutions organized by the Emperor Diocletian between 303 and 311 A. D. A curious object is a gilded bronze crown which at one time decorated an image in the demolished church of St. Anna, the former nunnery in the old Post street of Prague.

At the back of the cabinet is an eighteenth century cover for a coffin, and an altar cloth of the same period, of brocaded silk. On either side are richly embroidered vestments of the last century, done in white and gold upon a purple background; there are also vestments, such as are worn in the Russian churches to-day. Gongs, scepters, and many other objects explain the ceremonial of the Greek Church.

The Mohammedan forms of worship next claim attention. Prominently displayed in the adjoining cabinet is a Koran stand and a Koran open upon it. The stand is inlaid with mother-of-pearl and tortoise shell; inscribed upon its face is the usual invocation, "In the name of God," and at the top edge, the date, A. H. 1210. The Mohammedans treat the Koran with at least great outward veneration. It is always placed upon a high and clean place, and never held or brought in contact with other books or objects. Its reading is preceded by legal ablution and the usual prayer, "I seek protection with God against Satan, the accursed," after which follows the invocation, "In the name of God the Merciful, the Compassionate." In the services of the mosque the prayer and invocation are chanted by the imam or leader in prayer. The Koran upon the stand is in a richly illuminated text and binding. Under the Koran stand is displayed the costume of a Persian priest, consisting of vest, inner and outer coat, girdle, stockings, green morocco shoes, etc., also the costume of a dancing dervish. The different orders of dervishes are distinguished by their dress, chiefly the cap (taj), the most common being made of felt in the shape of a cone. By these is a dervish drum used at festivals by the Egyptian dervishes, and also employed by the criers who go about the streets at night during Ramadan reciting prayers. The instrument, of a kettledrum order, is held in the left hand and beaten with a small leather strap.

There is no sacerdotal class in the Mohammedan religion, but each mosque has its imam, properly "leader," who reads the Koran and leads in prayer in public service. In the larger mosques there are usually two imams, one whose duty it is to lead the prayers and preach the sermon on Friday, the Mohammedan Sunday, and the other who recites the five daily prayers in the mosque. In most of the smaller mosques the offices are performed by the same person; each mosque has also one or more muezzins who call the faithful to prayer from the minaret.

In the back of the case are hung many silver cases for charms against evil spirits, witchcraft, or disease, a belief in the efficacy of these charms being very general throughout the East. For this purpose a small copy of the whole or certain portions of the Koran is usually employed. This cabinet contains miniature Korans, silver Koran cases, and a quantity of other accessories to the Mohammedan ceremonial.

Another case is devoted to the Assyro-Babylonian religion, and contains several bas-reliefs and many seal cylinders in cast. A sacrificial dish, the original of which is in the Royal Museum of Berlin, is adorned on the four corners with the head of a bull, an animal much venerated by the Assyro-Babylonians, and engraved upon the sides are various symbols and figures. One monument represents Shamash, the God of the Sun, by his symbol, the sun disc. Another shows the head of a priest in bas-relief. According to Diodorus Siculus, the Assyro-Babylonian priests were divided into three grades, the temple priests, who made sacrifices and performed the purification, the expiatory priests, who by conjurations and penitential exercises kept off or exorcised the evil spirits, and the augurs, who explained portents, interpreted dreams, and divined from the flight of birds. In the back of the case are bas-reliefs representing eagle-headed and winged divinities, and also divinities holding in the hands baskets and five cones. Beyond the Assyro-Babylonian case are others devoted to Roman and Grecian mythology. These contain the busts and full lengths of the deities familiar to all, but they become especially interesting in this connection. Altogether the collection is very unique and deserving of careful study.

IF PUBLIC LIBRARIES, WHY NOT PUBLIC MUSEUMS?

BY

EDWARD S. MORSE.

H. Mis. 184, pt. 2——49

IF PUBLIC LIBRARIES, WHY NOT PUBLIC MUSEUMS?*

By Edward S. Morse.

The success which has accompanied the public library act in Massachusetts encourages the friends of science to believe that the time is propitious for establishing public museums in the smaller towns of the Commonwealth. It certainly is time to direct public attention to the importance of the museum as an adjunct to the public library. The tendencies of modern public-school education which introduce Sloyd as part of its work, and ask for pictures and casts to decorate the barren schoolroom, are indications that the time is ripe to found, in a modest way, museums of science, art, and history in our smaller towns and villages.

A few devoted students have in past times endeavored to establish institutions of this kind, but in most instances their efforts have been abortive. A few larger cities in the country have managed to keep alive the interest manifested, and their museums are now permanently established. The failures, however, have outnumbered the successes ten to one, and for this there must be a reason.

The founding of a museum is far more difficult than that of a library. People are trained to the latter in the development of a private library; and one capable of cataloguing books can establish a small library. The furniture is reduced to the simplest expression in the form of a case of shelves. The material to be put upon them can readily be ordered from the nearest book mart. On the other hand, the building of a museum requires special gifts and special training. Besides, one thoroughly imbued with the spirit of a collector should have charge of a museum, though this is equally true in regard to libraries of any magnitude. The absence of a public demand for museums in the past has arisen from the methods of public instruction. Lessons from books, and not from nature, have been the tiresome lot of school children. Questions and answers, cut and dried, have tended to deaden the inquiring spirit. That portion of a child's brain which is involved in

*Reprinted, by permission, from The Atlantic Monthly, July, 1893, pp. 112–119.

observation has been reduced to atrophy by the usual public-school methods. A distinguished English authority suggests to school boards, high and low, "that the teaching is out of all proportion in excess of the training, the latter being with difficulty weighed in the scales of school examination." Agassiz said: "The pupil studies nature in the schoolroom, and when he goes out of doors he can not find her." I shall never forget the bitter disappointment I felt as a boy, on my first journey, when the stage driver pointed out to me with his whip the dividing line between the States of Maine and New Hampshire. There was no colored line! There was no change in the color surfaces of the two sides! I felt grieved and rebellious at the imposition which had been practiced upon me. Nor can I ever forget the surprise—my delight was distracted by the novelty of my ignorance—when my father, in one of the periodic family drives, chanced to remark, on a shore road near Portland, that the water expanse before us was the Atlantic Ocean. Had he said that one of the islands in sight was Madagascar, I should not have been more astonished. Every one can recall experiences of a similar nature, and I venture to believe that these two truthful incidents are pertinent examples of the results of pernicious educational methods universal forty years ago and by no means uncommon to-day—book-cramming, with no reference to the objects or illustrations in sight from the windows, or within stone's throw of the school door. This undeniable condition of many schools in the land emphasizes the necessity of museums where the objects may verify some of the lessons learned at school. The book method of education has almost paralyzed public desire for museums, and the result has been that the museum, when instituted, has been in the interest of specialists, and mainly through their efforts. The whole animal kingdom may be epitomized, in a manner, between the covers of a single book; the specimens properly to illustrate such a book would require a good-sized hall in which to be displayed.

The Commonwealth of Massachusetts has liberally provided a way in which every town may have a collection of books free to all. So successfully has the enactment been carried out that only 3 per cent of the State's population is unprovided with a free public library, and this remnant will soon be favored with its public stock of standard books. This is all very well, and in the right direction; but is it not possible to create a similar public sentiment for the establishment of some kind of a museum as a proper accompaniment of the library? If there is the slightest necessity for a museum in the crowded metropolis, why does not the same necessity hold good for the small town or village? In the Public Libraries Act of England and Ireland (1855), provision is made for the erection of buildings "suitable for public libraries or museums, or both, or for schools of science and art;" and a similar act for Scotland (1867) provides for the erection of buildings "suitable for public libraries, art galleries, or museums, or each, respectively." Every community, borough, district, or parish exceeding five thousand in population may, by a two-thirds majority, adopt the Public Libraries Act, and a sum not exceeding a penny in a pound may be levied for carrying out the provisions of the act.

Thomas Greenwood, the author of a special work on museums and art galleries, expresses his belief that "the museum of the future must stand side by side with the library and the laboratory, as a part of the teaching equipment of the college and the university, and in the great cities cooperate with the public library as one of the principal agencies for the enlightenment of the people."

Prof. Goode, the officer in charge of the U. S. National Museum, says:

> I am confident, also, that a museum, wisely organized and properly arranged, is certain to benefit the library near which it stands in many ways through its power to stimulate interest in books, thus increasing the general popularity of the library and enlarging its endowment.

England discovered that art schools were not sufficient to place her art manufactures on a level with those of her continental competitors, and was forced to supplement her schools with museums of art handiwork, and the large endowment granted the South Kensington Museum was fully justified by the results shown in the great exhibition of 1867. A museum seems as much an integral part of the public library as are the experiments part of a lecture on chemistry or physics. If the public library is established primarily for educational purposes, surely the public museum should come in the same category. The potency of an object in conveying information beyond all pages of description is seen in the fact that in the museum a simple label associated with a veritable object is often sufficient to tell the story at a glance; the eye seizes the essentials at once.

The rapid development of the modern arts of illustration, and the conspicuous use of these methods in books, magazines, dictionaries, and even the daily papers, attest the power of the pictorial art, barbarous as it is in many cases, in imparting information quickly and clearly. If illustrations are so important in the modern publication—and to do without them would seem well-nigh impossible—how far more important it would seem to be to provide an exhibition of the objects themselves in science, art, and history, to which the public might have free access.

A museum adds dignity to a trifle. What seems a worthless object to the minds of the multitude becomes at once endowed with interest when carefully framed or mounted, and clearly labeled. Furthermore, the object is seen to have a definite relation to other equally common objects with which it is associated; a lesson is learned, and sooner or later the observer finds an added interest in his studies, if indeed he is not aware for the first time of regions of thought utterly unknown to him before. The charm that attends the demonstration of the minor factors of natural selection comes from the love of causality, a desire which, as Peschel truly says, accounts for the intellectual supremacy of Europe over the great Asiatic nations lying east of her.

Charles Kingsley, in an address to workingmen, said:

> You must acquire something of that industrious habit of mind which the study of natural science gives—the art of comparing, of perceiving true likenesses and true differences, and so of classifying and arranging what you see—the art of connecting facts together in your mind in cause and effect.

The public museum fosters the art of collecting; and of all habits to encourage, in the young and old alike, the habit of collecting is one of the best. It has been said that one who does not learn to play whist is laying up a dismal old age; the same might be said of one who has not cultivated the collector's spirit. It induces habits of neatness, order, and skill, says one writer. Young people are kept out of mischief; to middle-aged people it is a rest and relaxation, and old people find in their collections a perennial source of pleasure.

Prof. Goode quotes an eminent English lecturer as stating that our nation is deteriorating in regard to culture; that where, twenty years ago, five hundred towns supported, year after year, courses of lectures on scientific and literary subjects, to-day scarcely fifty of these places feel encouraged to continue the effort. If there is no apparent reason for this decadence, then it will be well-nigh useless to hope for the establishment of museums. If, however, it can be shown that with the advent of the lecture bureau the market was flooded with poor or sensational lecturers, comic readers, etc., and as a result the lecture platform, as we formerly knew it, became converted into an amusement stage; if, furthermore, it can be shown that the magazine literature of the country gives far greater space to matters of science and art, thus providing the kinds of intellectual food formerly given from the lecture platform, then we may hope that there is no decadence in the culture of the people, and that an interest in public museums may be easily aroused.

A change has certainly taken place in the last thirty years in the tendency of the community toward collecting objects of natural history. Private collectors of shells, insects, birds, etc., were far more numerous thirty years ago than they are to-day. The same is true of England. An eminent authority laments that "private collections are failing in Liverpool and all around; and teaching is everywhere hard and hardening in its results." Yet there is surely no dying out of the collector's spirit in certain lines, as witness the thousands interested in postage-stamp collecting, with their established societies and periodicals.

To awaken a desire in the smaller towns for a public museum, it is needful that a good example be cited. To see examples of any kind, one must go up to the great cities to find them. For New England the fingers of one hand could almost count them, and for the rest of this great Republic, outside of college museums, the fingers of the other hand would be sufficient to keep tally.

If we examine into the character of these museums, we shall find that, with some notable exceptions, they stand where they did before

Darwin's time. The museum then, as now, consisted of accumulations of species of animals that were of interest only to specialists in their respective branches of study. The interest attaching to such collections was incomprehensible to the layman. He strayed through a museum bewildered by cases filled with apparently similar kinds of shells, insects, and the like. The insects were always in their mature state. Not a suggestion of the life history of even a single species could be found. Regiments of shells were marshaled in pasteboard trays, with no inkling of the kind of life associated with them. The collection of birds gave no hint of the quaint appearance of the young, or of the infinite variety in the construction of their nests. As to whether the creatures ever laid eggs could be ascertained only by going to some other part of the hall. The schoolbooks of the time gave no idea of the way in which these collections might be studied; and if by chance the text-book had a more thoughtful chapter on morphology or other point of view, the museum might be ransacked in vain for an illustration. If one chanced to have a general book on natural history, it told him about the elephant and the kangaroo, which he already knew by name, at least, through the lines of a popular ditty, but not a word of the little creatures that hid under his own doorstep. The museum might have a small collection of mammals, but to find a complete collection of those of his own State he would have to go to the museums of the Old World.

Within recent years a great change has taken place, in this and some other respects, in the large museums of the country, notably in Boston, Cambridge, Salem, New York, Philadelphia, and Washington; but advances are yet to be made in some of these museums to bring their collections abreast of the knowledge of to-day. Prof. Goode insists that the "museum of the past must be set aside, reconstructed, transformed from a cemetery of bric-a-brac into a nursery of living thoughts."

That the importance of a museum of some kind connected with the larger schools has been realized in the past is seen in the custom of every country academy and female seminary which sets apart a room for the purposes of a school museum. But no more ingenious device could have been planned to create a loathing for museums in the minds of the young than those wretched travesties called "cabinets of natural history." With few exceptions they were dismal failures. The scant collections rarely contained anything belonging to the surrounding country, unless it might be a moth-eaten owl, a plethoric paper wasps' nest, or a horseshoe crab from the nearest seacoast; clutter, dust, and disorder, and poorly executed labels, usually written with a hard lead pencil on the bluest of writing paper, and all concealed in cases, the wood of whose doors generally exceeded the glass in superficial area. This description applies not only to the class of schools above mentioned, but to many of the large institutions of learning as well. Even to-day there are many colleges and universities that have no museums, and others that would be better off if deprived of the wretched apologies they have. A prominent Western university has a museum literally bathed in soot, the most instructive features of which are the foot-tracks of various insects delicately traced on the soot-laden shelves. I mention these facts not in a way of reproach, but to emphasize an important truth, and that is that the creating of a proper museum requires the services of one endowed with special taste and talent for the work. A man may be an excellent collector and systematist, but disorderly to the last degree. As a collector and specialist he may have made a record; but museum work demands more than these qualifications. One must have the power of clearly illustrating truths in science by the proper and adequate display of specimens. Labels must be neatly, clearly, and concisely drawn. A hand-made label, if well done, is better than a printed one. Prof. Goode, to whom we are greatly indebted for numerous essays and addresses on museum matters, has said with truth that "*an efficient educational museum may be described as a collection of instructive labels, each illustrated by a well-selected specimen.*"

But we anticipate. The importance of the museum as an adjunct of the public library having been indicated, the pre-Darwinian condition of many of the smaller and some of the larger museums having been shown, we come now to consider the question, What kind of a museum may properly be demanded as the working companion of a public library? Museums are almost as varied in their character as human knowledge. There are zoological, anatomical, botanical, mineralogical, geological, paleontological, ethnological, archæological museums; historical museums of art and armor; museums of architecture, terrestrial and marine; industrial museums; museums showing the history of a nation, such as the wonderful one at Nuremberg; museums solely to commemorate the work of great men, as the Thorwaldsen Museum at Copenhagen; museums, again, limited in scope to the last degree, as seen in the unique one at Berlin, illustrating the history and development of the postal service. Obviously, not one of these various museums would answer to parallel the public library; but an epitome of all of them would answer the purpose completely, were it possible to bring the material together. And such an epitome is within the reach of any well-ordered community willing to spend a portion of its library endowment for such a collection.

Thomas Greenwood, of England, in his work already alluded to, summarizes the main objects of a public museum as follows: First, that it provide rational amusement of an elevating character to the ordinary visitor; second, that it be in the fullest sense an educational institution, easily accessible to all classes; third, that it provide a home for examples of local objects of interest of an antiquarian, geological, or other character; fourth, that a section of it be a commercial museum, containing specimens of manufactures resembling those produced in the immediate locality; fifth, that it be one in a series of institutions whose object shall be to further the education of the many and the special studies of the few. The section that Mr. Greenwood devotes to a commercial museum would be far better devoted to objects of art. The commercial products of a community are always accessible, and every recurring State or county fair makes full display of the material, with the machinery and men producing it in full operation.

In a committee's report, made to the British Association for the Advancement of Science, upon the provincial museums of the United Kingdom, it is stated:

The special objects of a free rate-supported museum in a provincial town should be—

(1) To contribute its share to the general scientific statistics of the country by collecting and preserving specimens of the natural and artificial productions of the district in which it is situated.

(2) To procure such other specimens as may be desirable for illustrating the general principles of science, and the relations of the locality to the rest of the world.

(3) To receive and preserve local collections or single specimens, having any scientific value, which the possessors may desire to devote to public use.

(4) So to arrange and display the specimens collected as to afford the greatest amount of popular instruction consistent with their safe preservation and accessibility as objects of scientific study.

(5) To render special assistance to local students and teachers of science.

F. T. Mott, esq., a member of the above-mentioned committee, in a paper read before the Leicester Literary and Philosophical Society, on the "development of museums as public educators," says:

Museums, free libraries, and art galleries have this in common: that they are each expected to fulfill two purposes which are somewhat incongruous, and require to be pursued by different methods and with different appliances. Each of these institutions is expected to minister to the wants both of trained students and of the untrained and ignorant public; and the demands of these two classes of persons are so diverse that they must be provided for separately. The free library must have its lending department for the general public, and its reference department for students. The art gallery must have attractive and interesting pictures for ordinary visitors, but it must also have masterly studies for the instruction of young artists. The museum, however, has a still more complex and difficult part to play. It has not only to provide for the diverse wants of students and of visitors, but it has also to contribute to the general progress of scientific knowledge. Every museum, at least every provincial rate-supported museum, which is a public and in some sense a national institution, has a threefold duty: (1) to the nation at large, (2) to the students of the neighborhood, and (3) to the local public. If museums are ever to be more than a confused compound of the curiosity shop and the peep show, which is what very many of them are at present, this threefold duty must be very clearly recognized, and means must be found for the efficient carrying on of each department.

First and foremost, then, the town museum should illustrate the natural products of the immediate region. By natural products is meant, of course, the animals, plants, rocks, and minerals found in the county, or possibly in the State, for a county collection would require but a few extra-limital forms to compass the State; second, a general collection of similar material from elsewhere, to show the relation of the country to the rest of the world. Anatomical, physiological, and morphological series should next find place in such a museum. The minor factors of natural selection, such as protective, alluring, and warning coloration, mimicry, etc., should be illustrated, as far as possible, from collections made in the immediate neighborhood. And finally, a series of forms to show the phyllogenetic development of the animal kingdom should in some way be given. Such a series would require large floor space, and the solution of many perplexing problems as to form of cases and methods of display. Yet a scheme of this sort must ultimately be devised. The importance of developmental series is clearly brought out by a comparison between the famous Cluny Museum in Paris and the University Museum at Oxford under the charge of Prof. E. B. Tylor. In the former is a homogeneous mass of beautiful and elaborate objects of mediæval times, each exciting thought so disjointed that fatigue soon ensues from the rich surfeit, and one comes away with the feeling that he has seen a marvelous lot of most exquisite objects in the dim light of an artistic receptacle. Not an emotion has been evoked that will be set vibrating again unless he drops into a choice bric-a-brac shop, and the medley there seen pleases him less in its *ensemble* than that of the Cluny collections; with the advantage, however, that he can buy, if he has the means, and not burn with envy. The Pitt-Rivers collection now displayed in the Oxford Museum arrests the thoughtful attention at every step; inquiry is provoked at every turn; doubt may be engendered, yet ever after one finds fertile subjects to think about, to discuss, or to impart to one's friends. In other words, the collection has stimulated inquiry; and this is what a properly arranged collection should always do.

This, then, is a general idea of what a public museum should be. It has been attained in part by the Peabody Academy of Science in Salem. The collections comprise, first, a remarkable series of the animals and plants, rocks, minerals, and archæological specimens collected in the county of Essex. These collections are continually increasing as new forms are added. They occupy upright cases to an extent of over three hundred running feet, or a superficial area for their display of nearly three thousand square feet. Besides this there is an epitome collection of the animal kingdom, brought from all parts of the world, requiring an area of sixteen hundred square feet for its proper display; and, finally, an ethnological collection, arranged by countries, filling a hall 60 by 48 feet, with broad galleries and spacious cases. These collections are all fully and clearly labeled. At close intervals throughout the entire collection special colored labels are displayed, calling attention, by title and shelf number, to books in the public library referring to the immediate group, so that a student or pupil from the public schools need only transcribe on a bit of paper a set of numbers and present it at the delivery window of the public library to be provided at once with the books on the special subject desired. Great credit is due to Mr. Robinson, in charge of the museum, for the good taste shown in the arrangement of the collection, and to Mr. Jones, the librarian of the public library, for cooperating so heartily in the work of the academy.

Courses of lectures are given in the academy hall every year, which are practically free to the public. The city librarian usually supplements these lectures by printed lists of books treating of the subject-matter of the lecture, and these lists are distributed to the auditors. A like service is often done for the free courses of lectures given by the Essex Institute. In this manner these three institutions cooperate with one another in utilizing the collections in their possession in an educational way, and for the good of the general public. The collections thus made available are the results of years of devoted labor by many ardent students and collectors.

Is it to be supposed that other communities may call into existence even a limited collection of objects for a museum, as they might bring together the material for a public library? With any reasonable appropriation of money this can be done. At the present time there are many reputable firms which stand ready to furnish, at reasonable prices, collections representing the various departments of science. All the mercantile features of a museum, such as cases, adjustable brackets, tablets, insect boxes, jars, etc., can be got from the proper sources. If a public library has its salaried officer and assistants, and buys its books, why should not a public museum be installed under precisely similar conditions? There is no reason, save the fact that most of the museums in the country have had a fortuitous beginning, usually due to a coterie of men directly interested in science who, bringing together collections of interest, have been generous enough to permit the public to enjoy them on certain days in the year. In some cases a large endowment has enabled the society to share its treasures with the public more freely. But we are digressing. With the facilities thus indicated for purchasing material, a definite plan is to be laid out, upon which the collections are to be brought together. An epitome collection of the animal kingdom, large or small as the case may be, is to be secured. This will come to hand properly prepared, mounted and labeled. Having obtained this, the museum has the models upon which to prepare the local collection. Home talent will have to be looked to for this material; and if none are found competent to do the work, a collector from elsewhere must be employed for the purpose. The initial steps having been taken, the lines are indicated along which it is possible to utilize the voluntary aid of such collectors as the community may possess, although the museum of to-day can not depend upon voluntary service entirely. Special private collections of shells, insects, minerals, archæological relics, etc., will naturally gravitate toward the public museum, either by gift or by purchase; and thus, slowly but surely, the foundations of a museum will have been fairly started.

Finally, in the museum of the future the errors of the past should be avoided. Private collections, when given to a museum, must be incorporated with the other collections. Collections should not be accepted with the condition that they are to have separate rooms or cases for their display. There are occasions when an exception can be made; as when, for instance, the collection is far more complete than the one already possessed, though in this case the smaller collection should be merged with the larger. An inconvenience has always arisen from the continual accession of material which necessitates the rearranging of collections for their admission. This difficulty can be overcome by setting apart a special room or a set of cases in which the donations can be kept for one year, this receptacle to be plainly marked "new accessions to the museum." In this way a rearrangement, and consequent disturbance, takes place only once a year. Furthermore, the exhibition of these accessions separately will stimulate the activity and pride of local collectors and others interested.

Above all, the bane and misery of dubious accumulations should be avoided. A specimen is either of use, or it is not. If worthy of preservation, it should find its place in the collections; if not, it should be transferred to those who will make use of it, or be destroyed. The rubbish which accumulates in many of our museums and is hoarded from year to year with the hope that it may some time be of use is paralleled by the collections of junk with which some are inclined to encumber their premises.

That some kind of a public museum, along the lines and in the ways above suggested, is possible for smaller towns there is no doubt. A wholesome spirit of rivalry might naturally arise, and each town having its museum would excel in certain departments, in the same way that each town can pride itself on certain special features, such as a fine park, spacious town hall, public library, or superior high school building. Unfortunate, indeed, is that town—and there are hundreds of them in this country—that can show nothing but the mere elements of material existence; in this respect not a whit removed from the barrenness of a sheep pasture. To bring up young children in such a town is to stunt their intellectual powers, and to narrow persistently the horizon of their life.

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