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*With the Compliments of*

*ALEXANDER AGASSIZ.*

ANNUAL REPORT

OF

THE CURATOR

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY

AT HARVARD COLLEGE,

TO THE

PRESIDENT AND FELLOWS OF HARVARD COLLEGE,

FOR

1892-93.

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CAMBRIDGE, U. S. A. :

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# FACULTY OF THE MUSEUM.

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CHARLES W. ELIOT, *President.*

ALEXANDER AGASSIZ, *Curator.*

GEORGE L. GOODALE.

JOSIAH D. WHITNEY, *Secretary.*

HENRY P. WALCOTT.

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## OFFICERS.

ALEXANDER AGASSIZ . . . . .	<i>Director and Curator.</i>
JOSIAH D. WHITNEY . . . . .	<i>Sturgis-Hooper Professor of Geology.</i>
NATHANIEL S. SHALER . . . . .	<i>Professor of Geology.</i>
E. L. MARK . . . . .	<i>Hersey Professor of Anatomy.</i>
WILLIAM MORRIS DAVIS . . . . .	<i>Professor of Physical Geography.</i>
J. ELIOT WOLFF . . . . .	<i>Assistant Professor of Petrography.</i>
THADDEUS W. HARRIS . . . . .	<i>Instructor in Geology.</i>
ROBERT TRACY JACKSON . . . . .	<i>Instructor in Palæontology.</i>
J. B. WOODWORTH . . . . .	<i>Instructor in Geology.</i>
H. L. SMYTHE . . . . .	<i>Instructor in Geological Surveying.</i>
W. McM. WOODWORTH . . . . .	<i>Instructor in Microscopic Anatomy.</i>
C. B. DAVENPORT . . . . .	<i>Instructor in Zoölogy.</i>
G. H. PARKER . . . . .	<i>Instructor in Zoölogy.</i>
WALTER FAXON . . . . .	<i>Assistant in Charge.</i>
D. D. SLADE . . . . .	<i>Assistant in Osteology.</i>
SAMUEL GARMAN . . . . .	<i>Assistant in Herpetology and Ichthyology.</i>
WILLIAM BREWSTER . . . . .	<i>Assistant in Ornithology and Mammalogy.</i>
ALPHEUS HYATT . . . . .	<i>Assistant in Palæontology.</i>
SAMUEL HENSHAW . . . . .	<i>Assistant in Entomology.</i>
MISS F. M. SLACK . . . . .	<i>Librarian.</i>
MAGNUS WESTERGREN . . . . .	<i>Artist.</i>
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LEON S. GRISWOLD . . . . .	<i>Assistant in the Laboratories of Geology and Physical Geography.</i>
GEORGE E. LADD . . . . .	<i>Assistant in the Geological Laboratory.</i>
ROBERT DeCOURCEY WARD . . . . .	<i>Assistant in Meteorology.</i>
T. A. JAGGAR, JR. . . . .	<i>Assistant in Petrography.</i>



# REPORT.

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TO THE PRESIDENT AND FELLOWS OF HARVARD COLLEGE :—

DURING the past year the usual courses of instruction have been given at the Museum in Zoölogy by Professor Mark, Dr. Slade, and Mr. Davenport, assisted in the Laboratory work by Messrs. W. M. Woodworth, H. M. Kelley, and W. S. Nickerson.

Professors Whitney, Shaler, Davis, and Wolff gave courses of instruction in Geology, Palæontology, Physical Geography, and Petrography. Messrs. Harris, Robert T. Jackson, J. B. Woodworth, Griswold, Ladd, Ward, Landes, and Whittle were the Assistants in the Geological Department.

For the details of these courses of instruction, as well as of the summer courses in Geology, I would refer to the accompanying special reports of the Professors and Instructors. I would call special attention to the interesting report of Professor Davis in regard to Physical Geography and Meteorology.

The Newport Marine Laboratory has, as usual, been open to advanced students in Zoölogy. An unusually large number of students have come to Newport this year to collect material for their winter's work. It will, however, be impracticable for me to accommodate so large a number again. Some other provision must be made elsewhere for the less advanced students, — at the Aquarium of the Museum, for instance, — if it is necessary to carry on an elementary summer school of Zoölogy.

We have to thank Colonel Marshall McDonald, United States Fish Commissioner, for facilities granted to our students in connection with their work at the Fish Commission Station at Wood's Holl.

The income of the Virginia Barret Gibbs Scholarship was divided, according to the terms of the gift, among three of the students who spent some of their time at the Newport Laboratory.

We have received during the year an anonymous contribution to be applied to the increase of Dr. Hagen's salary.

As will be seen from the reports of the different departments of instruction, considerable time was spent by the Professors and Instructors in preparing an exhibit for the Columbian Exposition, specially intended to illustrate the methods of instruction, and forming a part of the Harvard University exhibit. The Museum sent plans of the building, prepared under the supervision of Dr. Wolff, who also charged himself with advising the Harvard Camera Club in regard to the views of the most characteristic Exhibition Rooms of the Museum which accompanied them. The plans, and the photographs taken by the Camera Club and by Mr. J. L. Gardner, will be hereafter most useful in the preparation of an extended account of the Museum of Comparative Zoölogy which it is intended to publish at some future time.

Photographs and plans of the Newport Marine Laboratory were also sent to Chicago, as well as a complete series of the publications issued in connection with the Laboratory, and of other publications relating to the Marine Fauna of the United States written by officers of the Museum or naturalists connected with the different deep-sea expeditions sent out by the United States Coast Survey and United States Fish Commission in charge of Louis Agassiz, L. F. de Pourtalès, or myself: Colonel Marshall McDonald kindly took charge of this exhibit, which was placed in the space assigned to the Fish Commission in the Government Building. Duplicate collections of these publications are in the libraries of the United States Coast Survey and of the United States Fish Commission.

We have been able to open the Museum on Sundays throughout the year, the Corporation having assumed the additional expense involved in providing the necessary service. The number of visitors has been greatly increased in consequence, and this has emphasized the need of additional and more general labelling of the collections for the benefit of the public. In the Systematic Collection the larger Mammals have been more prominently labelled, and the same has been done with the North American Mammals. With our limited means, considerable time must elapse before

the labelling can be extended to the other rooms and the other classes of the animal kingdom.

I can only repeat what has been stated in former reports, that the increase of the classes in Geology and Zoölogy has been such as to render it desirable that the Geological Department should be accommodated in new quarters to allow for the expansion of the Zoölogical Department. The Geological Department could be housed in the southwest corner piece of the Museum, where large lecture-rooms might also be provided for the use of the Natural History Department. But there seems at present no probability of building such an addition to our building, which would require \$100,000 for its erection and equipment.

During the past winter the Pacific Room, though far from complete, has been opened to the public. The most interesting specimens are its marine Mammals, the Seals, Dugong, and Sea Otter ; a collection of Birds from the Sandwich Islands, to illustrate one of its characteristic insular faunæ ; and a typical collection of Fishes and of Invertebrates, which occupies the central cases of the room.

The Greene Smith Collection of Birds has been placed in the North American Room. New cases have been built to accommodate it, and the whole collection has been carefully examined and thoroughly cleaned by Mr. Clark, who has spent nearly a whole year upon this work. With this addition in place, we have every reason to be satisfied with our North American faunal exhibit.

The additional space devoted to the North American Birds has compelled us to remove the shore marine forms, which up to the present time have formed a part of the faunal exhibits. This has necessitated the rearrangement of the Marine Fishes and Invertebrates, and their removal to the Pacific, Atlantic, and Indian Ocean Faunæ, limiting the faunal exhibits of the Fishes and Invertebrates to the Land and Freshwater types, — a far more consistent geographical arrangement than the former mixture of terrestrial and marine faunal subdivisions. These changes have brought an unusual amount of work upon Mr. Garman, and especially upon Mr. Faxon, who has had the general supervision of this rearrangement. Several of the rooms of the oldest part of the Museum building have been thoroughly renovated.

Although we have received a small Hippopotamus, a few Gazelles, and an African Elephant, we still have some gaps to fill in

the African and Pacific Faunal Rooms. The first invoice of material to illustrate the fauna of Japan has safely reached us.

Extensive changes and repairs in the Entomological Department have greatly facilitated the use of the collections, upon which Mr. Henshaw presents his first annual report. The collections of the Museum generally continue in good condition. The reports of the Assistants of the Museum will give the details of the work accomplished, and of the additions to the collections received in their departments during the past year.

Upon Professor Faxon, who has been placed in charge of the collection of Invertebrates, has also fallen the principal share of the care of the Museum as a whole since he began his duties, and the improvement in the general appearance of the Exhibition Rooms is very marked. We are indebted to Professor Hyatt for the care he has given to the Palæontological Collections in his charge, and to Mr. Brewster for his interest in supervising the arrangement of the Greene Smith Collection of North American Birds.

On the 9th of November Dr. Hagen died, in his seventy-seventh year, after a lingering and painful illness of more than three years. Dr. Hagen joined the Museum staff in 1867, and until incapacitated in 1890 he devoted his time and energies to the interests of the institution with which he had cast his lot. In 1876 he refused an urgent invitation to assume the charge of the entomological collection of the University of Berlin, the greatest scientific prize perhaps in his department. He built up the exceptionally interesting biological collection of the entomological department from nothing, and the comparatively small collection of Insects which he found on entering upon his duties he has left greatly increased in size and value. His varied and extensive information was always at the service of the specialists who frequented his laboratory. During his connection with the Museum, Dr. Hagen published a great number of papers on entomological subjects. Unfortunately for his influence on the progress of Entomology in this country his publications were usually printed in German.

With regard to the "Blake" publications, two additional memoirs have been published, — a Bulletin on the Northern Atlantic Mollusca collected by the "Blake" during the summer of 1880, by Miss Katharine J. Bush, and an elaborate monograph on the Paguridæ by Professor Alphonse Milne-Edwards and Mr. Bouvier, illustrated with twelve quarto plates. Professor Milne-Edwards has also

in hand a final memoir on the Crustacea of the "Blake." This leaves still to be published, of the work on the "Blake" collections, the memoir on the Alcyonaria, by Professor Verrill; the Deep-sea Fishes, by Professor Goode and Dr. Bean; the Comatulæ, by Dr. Hartlaub; and a memoir on Pentacrinus, by Professor H. Ludwig.

Although not published under the auspices of the Museum, I should mention as forming a part of the results of the "Blake" an important paper by Dr. Wiren, on Solenogaster, a great part of which is based on specimens dredged by the "Blake" in 168 fathoms off St. Lucia, in the winter of 1878-79, issued in the Memoirs of the Stockholm Academy of Sciences.

The available bulk of our Pentacrinus material has been sent to Professor Ludwig of Bonn, who has kindly consented to work up this genus from the collections made by the "Blake" in the West Indies.

A number of publications are in preparation in the different Laboratories of the Museum. The following work has been done during the past year on the Collections of the Fish Commission Steamer "Albatross" expedition of 1891. Mr. Westergren has nearly completed the plates (fifty in number) which are to accompany Professor Faxon's memoir on the Crustacea of the expedition. Mr. Faxon has already completed the text, and a preliminary report of the collection has been published in the Bulletin, awaiting the preparation of the plates for the final monograph.

Professor Ludwig also reports that he has completed the monograph on the Holothurians. A preliminary notice was published in the *Zoologischer Anzeiger* and in the Museum Bulletin. Professor Ludwig states that his report is to be illustrated by nineteen plates in all, of which eight will be colored plates. The plates are distributed among different families as follows: Synalactinæ, one plate; Psychropotinæ, five plates; Deimatinae, five plates; Elpidiinae, one plate; Dendrochirotae, two plates; Molpadiidæ, three plates; Synaptidæ, one plate; and Pelagothuriidæ, one plate. The whole of his manuscript has been received, and the last plate is in the hands of Werner and Winter.

Professor Schimkéwitsch has sent in a report on the Pycnogonidæ accompanied with two plates, Dr. W. McM. Woodworth a Report on the Planarians, with one plate and Professor S. F.

Clarke one on the Hydroids, with three plates. The illustrations of these papers are in the hands of the lithographer.

Mr. Scudder's Report on the Orthoptera of the Galapagos (three plates) has been issued, and a short Bulletin on the Rocks of the Galapagos has been published by Mr. George P. Merrill.

Excellent progress is also reported by Professor Hoyle, Dr. G. W. Müller, Dr. Ward, Dr. Bergh, Mr. Garman, and Professor Studer with regard to the various collections intrusted to their care. Professor H. V. Wilson spent some time at the Museum in examining our collection of Sponges, in preparation for his report on the Sponges of the "Albatross" expedition.

Owing to my prolonged absences from Cambridge, I have myself made little progress with the groups which I had selected to work up; but I hope during the coming year to be able to devote some time to them, and also to take up for publication the large amount of material on the Acalephs of the East Coast of the United States now in my hands. For nearly thirty years since the publication of the Catalogue of North American Acalephs, I have every summer, and frequently during the winter months also, paid a good deal of attention to the Jelly-Fishes of our coast. An immense amount of drawings and of undigested notes have thus accumulated. Their publication, as well as a revision of the papers on the same subject issued up to the present time in the Museum publications and elsewhere, would form an instructive and connected account of the Acalephian Fauna of our shores.

For a complete list of the Publications of the Museum I would refer to Appendix A. Of the Bulletin we have issued during the past academic year four numbers of Volume XVI. of the Geological Series, three numbers of Volume XXIII., completing the volume, and the whole of Volume XXIV. Of the Memoirs, we have issued No. 3 of Volume XIV., completing the volume.

About the usual number of volumes have been added to the Library, either by gift, exchange, or purchase. The number of volumes is now over twenty-three thousand.

As far as the available stock permitted, we have distributed a number of more or less complete sets of our publications to institutions and societies with which we have only lately begun to exchange. It has now become impossible for us to supply complete sets of our publications. Many parts of the earlier volumes

both of the Bulletins and Memoirs are out of print, as the demand for certain numbers has far exceeded that for others.

We have purchased from Zeiss a complete microphotographic apparatus; during the summer months it will be available for the Newport Marine Laboratory, and during the rest of the year it will be at the service of the Museum officers.

In addition to the collections of the Albatross expedition of 1891 sent to the various specialists<sup>1</sup> who have kindly consented to work up the material brought together, specimens were sent for examination to Professor Goode and Dr. Bean, to Professor Bütschli, to Dr. Steindachner, to Professor Lankester, to Dr. S. J. Hickson, and to Mr. Bigelow.

To Professor F. Eilhard Schulze was sent our collection of types of Sponges from the deep waters of the Gulf of Mexico and the West Indies. This he has examined and already returned, with notes on the species suggested by his examination of the extensive series of Hexactinellidæ from all quarters now in his hands for monographic purposes.

Our collection of North American Hydroids was sent to Dr. Camille Pictet, to be used in preparing a monograph on the Hydroids of the Bay of Naples for the Zoölogical Station. This collection reached Switzerland a few days before Dr. Pictet's death, and it has been returned by the authorities of the University of Geneva.

I hear from Professor Dupont that excellent progress is making with the cast of the Iguanodon which is to be sent from the Brussels Museum to Cambridge.

Arrangements have been made with Dr. Dohrn by which one of the tables of the Zoölogical Station at Naples has been placed at the disposal of the Faculty of the Museum for three years. The conditions upon which the table is assigned are shown in Appendix B, and a notice<sup>2</sup> of this has been sent to all the Universities and Colleges of the country, as well as to specialists interested in the study of Marine Zoölogy. I regret to say that thus far the number of applications has been most limited, and there does not

<sup>1</sup> A list of the persons who are preparing the Reports will be found on the third page of the cover of this Report, with the list of the publications of the Museum now in preparation.

<sup>2</sup> Professor James D. Dana was kind enough to give this notice the benefit of an insertion in the American Journal of Science.

appear to exist the imperative demand for the maintenance of the table represented by American zoölogists. The Smithsonian Institution has also undertaken to supply this need for American students. The Faculty of the Museum nominated Professor Meek of Fayetteville, Arkansas, as the incumbent of the table for the coming winter, and this nomination has received the approval of the Corporation.

During the past winter I spent three months exploring the Bahama Banks in the steam yacht "Wild Duck," which my friend, the Hon. John M. Forbes, was kind enough to place at my disposal for the purpose.

Mr. J. H. Emerton and Mr. A. M. Meyer accompanied me as draughtsmen and assistants. On our return to Nassau, after exploring the Great Bahama Bank and the shore of Cuba from Santiago de Cuba to Havana, I sent a short account of the progress of the expedition to Professor James D. Dana for publication in the American Journal of Science. Subsequently, we examined the Little Bahama Bank, and I am now preparing an account of the expedition for the Bulletin. I have to thank Colonel Macdonald, the U. S. Fish Commissioner, for the use of some deep-sea thermometers and of a Tanner sounding machine. Professor Mendenhall, the Superintendent of the Coast Survey, was kind enough to appoint me Acting Assistant of the Coast Survey, as I had been already on former occasions while attached to the "Blake," in order to enable him to assist the expedition in various ways and to give it an official character. I have specially to thank the Hon. J. W. Foster, the Secretary of State, and Mr. Wharton, the Assistant Secretary, for securing the interest of the Spanish Minister at Washington, and the kind offices of the Captain General of Cuba in procuring for the "Wild Duck" free entrance to all ports of the Cuban coast, as well as the assistance of the naval authorities and of the governors of the various provinces which we visited. To Captain J. W. Wharton, the Hydrographer of the Admiralty, as well as to Lieut. Commander Richardson Glover, U. S. N. Hydrographer, I am also indebted for valuable information regarding the Bahamas. The cruise of the "Wild Duck," while not as successful as I hoped on account of the unusual violence of the trades, yet accumulated important information on the structure of the islands and banks, their geological history, and the theory of coral reefs. The pelagic fishing, both



at the surface and at moderate depths, which I hoped to make an important feature of the expedition, was quite limited, owing to the continuous unfavorable weather we encountered. Still we made sufficient use of the deep-sea Tanner towing-net to confirm in general the results at which I had arrived while on the "Albatross," in 1891, regarding the limited bathymetrical range of the pelagic fauna. I may mention as one of the interesting catches a pelagic *Amphioxus*, of which the specimens we collected were sent to Professor Lankester for examination. Mr. Meyer devoted his time mainly to the study of the *Acalephs* collected during our trip.

To Dr. Theo. W. Richards, and to Mr. Churchill of the Class of 1893, I am indebted for many analyses of the rocks and bottoms, and to Professor Wolff for kindly preparing slides of some of the more interesting æolian rocks from the Bahamas. The report of this reconnoissance of the Bahamas is well under way.

It is hoped that some arrangement may yet be made between the representatives of the leading Universities and the Fish Commissioner by which the exceptional facilities for marine research now existing at the Fish Commission Station at Wood's Holl may be made available for original investigation. It has been suggested that the Commission should continue to carry on the station as it now does, and supply to capable naturalists representing the Universities or independent specialists the mass of material which it cannot afford to have worked up. The Fish Commission can hardly be expected to devote any part of its limited appropriation on expenditures which have no direct bearing on the practical side of the fishery question. An extensive and expensive plant has been built up at Wood's Holl, which it seems useless to duplicate. It is more than is needed for the purposes of the Fish Commission. At least twenty persons properly qualified could be supplied with all they need for original work, provided these persons represented an outside interest able to carry on those investigations which are not directly in the line of the work of the Fish Commission, but which yet may prove of great value to it. By allowing the leading Universities to subscribe to a fund which should be sufficiently large to relieve the Commission of its purely scientific work, and to afford sufficient means for its publication, fifteen such subscribers might be found to bring together such a fund, and

leave five places open to non-subscribers, to be filled by the governing board of the Station.

A governing board consisting of representatives of the government bureaus interested in subjects kindred to those of the Fish Commission, together with appointees of the subscribers from the leading Universities, might form a board of trustees empowered by Congress to carry on the Wood's Holl Station for the best interests of the Fish Commission and of the different branches of science connected with marine explorations. The vessels under the control of the Commission would, as far as practicable, also be available for the general purposes both of the Commission and of the scientific investigators. Such a combination as that suggested above would in no way interfere with the marine laboratories now or hereafter to be connected with the different Universities. The Wood's Holl Laboratory would be a permanent station, occupied during the whole year by the officers of the Fish Commission and the Scientific Director, and in addition to the central station well equipped laboratories would soon be established for all branches of the scientific investigation of the sea; and these permanent laboratories in their turn would be supplemented by expeditions of greater or less duration in the vessels connected with the Fish Commission. Should such a central station be found to work well, it would have a fair claim for support both from the government and the public.

A beginning might be made by securing an annual sum of five thousand dollars for five years from the Universities interested in this work, and a plan prepared to be presented to Congress for their approval. The position of the laboratory at Wood's Holl, and its connection with a government bureau, are perhaps the only drawbacks to enlisting the interest of Universities in the proposed scheme.

There will of course be some difficulty in devising a practical plan of co-operation between the Fish Commission and the representatives of the purely scientific interests of the country. The distance of Wood's Holl to the open Atlantic is also a very serious drawback. During the summers which I spent at Wood's Holl, my experience was that, while the shore fauna is perhaps as varied as that of more exposed parts of the adjoining coast, it is far less productive so far as the pelagic fauna is concerned which forms so great a share of the material of a marine laboratory. But with an ample equipment of sea-going launches and of

larger boats such as are controlled by the Fish Commission, this is not a very serious difficulty. The expense of living at Wood's Holl is practically neither greater nor less than at other New England summer resorts.

I regret to report that the Visiting Committee of the Museum appointed by the Overseers have been unsuccessful in their efforts to obtain funds for some of the most pressing needs of the Museum. The committee have shown the greatest interest in attempting to supply the deficiencies to which their attention had been called by the reports of the Professors and of the Curator of the Museum.

Mr. W. E. D. Scott, who is greatly interested in the progress of ornithology in this country, is making the attempt to collect funds for an additional exhibition room of birds. The collection he proposes to bring together is to be modelled on the plan of exhibition which has been introduced with great success in the British Museum, and to a limited extent in the National Museum at Washington. The plan embraces isolated cases of mounted birds, representing single species as life-like and at the same time as artistically mounted as possible. Next, cases illustrating the variation of such species as are non-migratory, but which range uninterruptedly over large geographical areas. Next, cases showing the dichromatic phases occurring in many families, as well as cases showing the various phases of appearance in any given species correlated with sex, season, age, etc.

There are many problems of a similar nature which have been brought into prominence during the past thirty years. Many of them can be illustrated in a satisfactory way to the public by exhibits of the different classes of the animal kingdom. The greater familiarity of the visitors with birds and insects will make it comparatively simple to explain to them the object of a limited exhibit of these classes. As regards the more general questions of development, and the multitude of minor problems which it would be interesting to place before the public, other classes must be selected, and the Director of any public Museum will only be at a loss to know what to exclude from the limited room usually at his disposal, so as not to occupy his available space with exhibits which, however interesting to the student, will only have a limited interest for the average visitor.

ALEXANDER AGASSIZ.

## REPORT ON THE COURSES OF INSTRUCTION IN GEOLOGY.

BY PROFESSORS J. D. WHITNEY, N. S. SHALER, W. M. DAVIS, ASSISTANT  
PROFESSOR J. E. WOLFF, AND DR. T. W. HARRIS.

DURING the Academic year 1892-93, the following named courses of instruction were given in the laboratories and in the field by the instructors of the Department of Geology.

### *Instruction in General Geology.*

1. (Geol. 4.<sup>1</sup>) A half-course in Elementary Geology; two lectures a week by N. S. Shaler, with one hour for special exercises, conducted by R. E. Dodge and L. S. Griswold, and with required reading in Dana's Manual of Geology. In the spring, voluntary excursions were made to points of geological interest in the vicinity of Cambridge under the guidance of the assistants. The course was attended by two hundred and eleven students.

2. (Geol. 5.) A half-course in Practical Geological Exercises in the laboratory and in the field, requiring two two-hour exercises a week, with occasional lectures: by T. W. Harris, assisted by G. E. Ladd; designed especially for those who intend in subsequent years to continue the study of Geology and Palæontology. Attended by fifty students.

3. (Geol. 8.) A course in General Critical Geology, two lectures a week, and for a part of the year three, by N. S. Shaler; with an additional hour for review of assigned reading and for conference, conducted by J. B. Woodworth. Lyell's Principles of Geology was read parallel with the lectures. During the autumn and spring months, eight half-day excursions were made in the field in the vicinity of Cambridge, under the guidance of J. E. Wolff and J. B. Woodworth. During the winter months, theses were prepared on subjects chosen with the advice of the instructors. Those only who passed a satisfactory examination in the elementary courses were permitted to take the course. Thirty students received this instruction.

<sup>1</sup> These abbreviated names of courses correspond to those given in the "Announcement of Courses of Instruction," issued by the Faculty of Arts and Sciences.

4. (Geol. 9.) A course in the Structural and Dynamical Geology of the Stratified Rocks, by T. W. Harris. Two conferences a week, with required reading and theses. This course was attended by eight students.

5. (Geol. 18.) A course in Economical Geology, by J. D. Whitney. Lectures twice a week, with required readings and theses. Attended by thirty students.

6. (Geol. 22.) A course in Field-work and Geological Surveying, designed to afford special training in original investigation, with work in the library and in the preparation of geological reports, under the direction of N. S. Shaler, W. M. Davis, J. E. Wolff, and T. W. Harris. Conferences were held once a week during the year. This course is open only to those who have attained satisfactory grades in Courses 8, S. 2, and in either Chemistry C or 2. It was attended by eighteen students.

#### *Instruction in Petrography.*

7. (Geol. 12.) A course in Petrography, by J. E. Wolff, assisted by C. L. Whittle. Two lectures a week, with laboratory work, theses, and field-work. Attended by sixteen students.

8. (Geol. 23.) A course in Petrographic Research, by J. E. Wolff. Field and laboratory work. Attended by five students.

#### *Instruction in Palæontology.*

9. (Geol. 14.) A course in Palæontology, by N. S. Shaler, assisted in the laboratory by R. T. Jackson. Two lectures and four hours of laboratory work a week, with theses. This course was attended by twenty-three students.

10. (Geol. 15.) A course in Historical Geology, designed to train advanced students in the use of fossils in determining geological horizons, by N. S. Shaler, assisted by R. T. Jackson. This course was taken by five students.

11. (Geol. 24.) A course in Palæontological Research, under the direction of N. S. Shaler, assisted by R. T. Jackson. Attended by one student.

#### *Instruction in Meteorology and Physical Geography.*

12. (Geol. 1.) A half-course in Elementary Meteorology, by W. M. Davis, assisted by R. DeC. Ward. Two or three lectures a week, with laboratory work and recitations, first half year. Attended by seventy-three students.

13. (Geol. 2.) A half-course in Physical Geography, by W. M. Davis, assisted by R. DeC. Ward. Two or three lectures a week, with

laboratory work and recitations, second half-year. Attended by one hundred and two students.

14. (Geol. 20.) A course in Advanced Meteorology and Physical Geography, by W. M. Davis. Conferences held once a week. Attended by eleven students.

*Instruction in Summer Schools.*

15. (Geol. S. 1.) An elementary course in General Physical Geology. This course was given in Cambridge, beginning Wednesday, July 5th, and closing Friday, August 11, 1893, under the direction of T. W. Harris. The instruction, primarily intended to meet the needs of those who intend to take the second summer course and the second course during term time (Geol. 8), was adapted also to the needs of teachers. Lectures and laboratory work occupied the forenoon of each day of the session, and short excursions to localities of geological interest were taken in the afternoon. This course was attended by fifteen students, of whom ten are students in the University.

16. (Geol. S. 2.) A more advanced course in geological field-work was given at different points in Eastern New York and Connecticut, commencing Monday, August 14, and lasting six weeks, closing Saturday, September 23d. The class assembled at Utica, N. Y., under the direction of T. W. Harris. On August 28th it moved to Catskill, N. Y., and there remained until September 9th. On September 11th the class went to Meriden, Conn., where the remainder of the time was spent, under the charge of L. S. Griswold, in a study of the Triassic sandstones and trap-sheets. Eleven students took this instruction, all of whom are students in the University.

17. (Geol. S. 3.) A course in independent field investigation and geological surveying, under the supervision of the officers of the Department. One student was engaged in this work upon the Pleistocene deposits of Eastern Connecticut.

*Additional Instruction.*

18. During the year the students in the advanced courses attended regular Tuesday evening meetings in the Geological Laboratory, which were designed to serve the purpose accomplished by the Seminaria of the German Universities. A number of the papers read at these conferences have been announced in the College Calendar. Outside of the papers presented by members of the University, one was read by Mr. Warren Upham relating to a theory of the origin of Drumlins.

19. (Geol. 26.) A half-course on Geographical Methods and Results. One lecture a week, by J. D. Whitney. Attended by thirteen students.

REPORT OF THE STURGIS-HOOPER PROFESSOR OF  
GEOLOGY.

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BY PROFESSOR J. D. WHITNEY.

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DURING the past year (1892-93) two courses of lectures were given by the Sturgis-Hooper Professor. The first of these was geographical, and was attended by about fifteen students, mostly Graduates and Seniors. The object of this course was to give an outline of the progress of geographical science, beginning with the very earliest times, and having special reference to the methods by which this kind of information has been obtained and represented, on paper or otherwise, so as to be available for practical use. This course was comprised in about thirty lectures, and brought the subject down to the circumnavigation of the globe by Magellan. In the libraries of the University there is a large amount of illustrative material for a course of this kind, which could very properly and profitably have been expanded to twice the length attempted.

The second course, which was attended by about thirty students, was devoted to the economical geology of the metals and their ores, and included brief sketches of the methods of mining, ore-dressing, and smelting. This course is simply a continuation of one given the previous year on economical geology in general, which, however, was devoted to the non-metalliferous minerals exclusively. As matters are now arranged, it seems best to make a permanent division of the subject of Economical Geology into two courses of lectures and study, these to be given in alternate years. The first course will be devoted to the non-metalliferous minerals, the second to the metals and their ores, each of these courses to run through the entire College year. The object of these courses is, to give the student an opportunity to acquire such an amount of general knowledge of the subject of economical geology as will be useful both to those who are not intending to make a specialty of

mining, and to such persons as, having this object in view, may desire to have at least so much superficial knowledge of the subject as will be useful to them in arranging their future studies in this line of work, and in selecting a place where these studies can be pursued.

Chiefly to aid students in Economical Geology, certain chapters in the "United States: Facts and Figures illustrating the Physical Geography of the Country and its Material Resources," published in 1889, and which have special reference to the subjects treated in the courses indicated above, have been rewritten, considerably amplified, and brought down to the latest available date. These chapters, which will be published separately, are now being printed, and will be available for reference during the coming College year, 1893-94.



REPORT ON COURSES IN GENERAL GEOLOGY  
AND PALÆONTOLOGY.

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BY PROFESSOR N. S. SHALER.

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THE course in Elementary Geology (Geol. 4) maintained during the year the special meetings in small sections instituted in the previous year and commented upon in the last Report. The aid of an additional Assistant in the course rendered the work of instruction more effective than it has heretofore been.

In the advanced course in Geology (Geol. 8) the plan of assistance employed in the previous year was also pursued. The field work was slightly increased by the addition of exercises in geological surveying, undertaken by each student on an assigned area of one square mile. In order to make the most of the limited time which our students can command for field work, their attention was directed to a discrimination and survey of the pleistocene deposits of the country adjacent to the College. The result of this work has been the preparation of twenty-eight maps covering as many square miles. The correctness of the maps and the progress of each student has been gauged by means of a manuscript map already prepared, and by visits to particular localities.

In the work of palæontological instruction, Dr. Jackson continued to bring the collections into a more extended use by the students, and a large amount of time was spent in improving the condition of the teaching collections. The laboratory work is now considerably hindered by the want of room.

A machine for cutting and grinding fossils was added to the equipment of the Department. It is placed in the Petrographical workshop, and is run by electric power with which that department is supplied.

Mr. A. Agassiz very kindly gave the department a fine specimen of the recent *Pentacrinus decorus*, in alcohol, which will be an invaluable accompaniment to fossil types. Considerable palæonto-

logical material was received from the Museum as a gift or in exchange.

A collection illustrating typical fossils of the New York State rocks was received from the New York State Museum, at Albany, through the kindness of Professor John M. Clarke. For this collection an exchange will be returned. Thanks are due to Mr. H. L. Jones for a collection of fossils illustrating the Waverly Group of Ohio. Considerable material was purchased from Ward's Natural Science establishment at Rochester, and material was obtained by purchase, exchange, or gift from several other sources.

The thanks of the Department are due to Miss Mary L. Ware, of Boston, who generously gave one hundred dollars to the Palæontological section. With this recent gift much important material has been purchased.

A few necessary palæontological books were purchased for the laboratory. Thanks are due for a number of technical papers received from their authors. Especially to be mentioned are nearly complete sets of their publications, given by Professor Alpheus Hyatt, and Dr. E. C. Beecher of New Haven.

Arrangements have been made to employ the electric arc-light with a magic lantern in the Geological Lecture Room, in place of the gas-light heretofore used. By the transfer of a number of duplicates of government geological reports from the Museum Library to the Department, means have been provided for perfecting the preparation of theses in Geology 8, the books being at present reserved for the use of students in this course. During the year, the usual number of rock specimens were added to the teaching collection to replace worn or undesirable material.

The work of cataloguing the collection of photographs belonging to the department was advanced by Mr. J. V. Lewis. Through the generosity of Mr. J. L. Gardner, the department has a fund of \$5,500 devoted to the augmentation and care of this means of instruction, which it has been voted by the Corporation to call the "Gardner Collection of Photographs."

During the winter and early spring much time was given by the officers of the Department to the preparation of exhibits of our means of instruction for the World's Columbian Exposition at Chicago. A special edition of the General Account of the Department has been issued, in which these exhibits are fully described. The preparation of this exhibit has made felt the want of illus.

trative material in the form of rock collections, maps, and models, particularly in Course 8.

The Commonwealth of Massachusetts has called on the Professor of Geology for service in three boards: the Commissioners of the Topographical Survey, the Commissioners of Highways, and a committee of the State Board of Agriculture charged with the extermination of the *Ocneria dispar*, or Gypsy Moth. These duties have demanded a considerable part of his time, and have necessarily diminished the amount of research work which should otherwise have been done. He has also been much engaged in supervising and directing the work of several assistants in the Atlantic Coast division of the United States Geological Survey.

## REPORT ON THE PETROGRAPHICAL LABORATORY.

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BY ASSISTANT PROFESSOR J. ELIOT WOLFF.

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THE instruction in Elementary Petrography was attended by fifteen students. The usual lectures were given twice a week, supplemented by a large amount of laboratory work. Mr. C. L. Whittle was appointed assistant by the Corporation, and gave the instructor much needed aid in the care of the laboratory and the more systematic arrangement of the laboratory work.

Six students pursued advanced work in Petrography, and made original investigations in the following subjects, among others:—

The Felsites of the Boston Basin.

The Schistose Bombs of the Laacher See, in the Hubbard Collection.

A Basic Dike in the Connecticut Triassic.

During the winter extensive improvements were made in the geological workshop in the basement, and in the arrangements for illumination and projection in the Petrographical Lecture Room upstairs, and in the large Geological Lecture Room. The increasing size of the classes and large amount of mechanical work done by them and other students of geology, in slicing and polishing rocks and fossils and preparing thin sections, made the use of power desirable, and almost necessary. A five-horse power electric motor was therefore placed in a corner of the Chemical Laboratory in the basement, and the shafting carried through the wall to the adjoining workshop. From this a lathe is run carrying the vertical tin disk charged with bort for sawing rocks, and three other lathes with horizontal revolving iron or zinc plates for grinding and polishing rocks and sections through the different stages. A useful saving of time and labor is thus gained over the old method of working by foot and hand power.

At the same time a one-kilowatt, 55-volt dynamo is run from the motor by suitable shafting, and the current carried to the two

lecture-rooms on heavily insulated wire with all possible precautions. In the Petrographical Lecture Room this is utilized alternately for illuminating the room by incandescent lights and by means of a 2,500 c. p. arc lamp for microscopic projection or photo-micrography with the large Zeiss apparatus placed there. In this way brilliant projections of thin rock sections are shown to the class in illustration of the lectures ; and for the ordinary screen projection of photographs by lantern slides the same apparatus is eminently satisfactory, especially since, owing to the great power of the lamp, the projection can take place by daylight or by partial darkening of the room.

The instructor has continued during the year his work on the Archæan of the New Jersey Highlands, and in the preparation of a monograph on the Crazy Mountains of Montana.

An exhibit in Petrography was prepared for the Chicago Exposition as part of the contribution of the Department of Geology to the general exhibit of Harvard University, comprising illustrations of the methods of laboratory work and material for lecture illustration, examples of the collections, etc.

## REPORT ON THE LABORATORY OF PHYSICAL GEOGRAPHY.

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BY PROFESSOR W. M. DAVIS.

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INSTRUCTION in Physical Geography and Meteorology has been continued on the same plan as in former years; the intention being to give under the first heading a general account of the oceans and a more particular account of the meaning and development of land forms and their relation to habitation; and under the second heading, an understanding of the arguments on which the acceptance of the modern physical theories of meteorology are based. The instruction in these elementary courses was given in the form of lectures delivered in the large Geological Lecture Room, supplemented by exercises in the Laboratory on the fourth floor. Written and verbal tests were required nearly every week under the two instructors, besides the usual final examinations.

The lectures, particularly those on Physical Geography, received frequent illustration by the lantern, for which our growing collection of slides gives abundant means. The laboratory exercises were based, much as in previous years, on the special collection of maps and models formed for this purpose and still increasing. The paper models, described in previous Reports, are still in constant use in the Laboratory; although it is now desirable that a new edition of them should be prepared, not only thus better to meet our own needs, but also to be able to supply the demand for the models that comes from other colleges. At present the series is not duplicated for sale or exchange. The employment of a capable assistant to revise the models is greatly desired.

An almost equal use is made of the large-scale topographic maps of our own and of foreign countries, of which the Laboratory contains an extended collection, apart from the much larger collection in the University Library, which is referred to below. In most

cases these maps are prepared for students' use by mounting together a group of sheets, representing some chosen district. Besides many examples that might be mentioned from our own country, the following may be cited from abroad: the longitudinal forms of the Austrian coast of the Adriatic, the transverse forms of the coast of southwestern Ireland, the straight-lined coast of southwestern France, the dissected plateau of northwestern France, the rugged highlands of Scotland, the lacustrine lowland of Finland, the fluvial plain of Hungary, etc. It is found in teaching that these large-scale maps supply an essential supplement to even the best physical wall maps, such as Kiepert's. The latter show the general form of a country as a whole, yet they fail to represent its physical features with exactness; but the former remedy this deficiency, and enable the student to recognize almost the smallest details of geographical form. Their use has greatly improved the quality of our teaching. It is believed that the knowledge of the value of accurate maps thus gained by our students will contribute to establishing an interest in the continued preparation of accurate and large-scale maps of our own country.

The advanced course in Physical Geography and Meteorology is, as in previous years, still carried on chiefly through informal class conferences, but partly also in individual meetings. This course was attended by eleven students, of whom five were Graduates and five Seniors. The subjects studied were: the physical features of Missouri, Arkansas, and North Carolina, by Messrs. Clendenin, Griswold, and Harris, based on personal observation in these States, as well as on a review of what has been written about them: the physical features of Middle England, by Mr. Moore; the development of river terraces, by Mr. Dodge; the features of our eastern coast line, by Mr. Hill; foreign studies of thunder-storms, by Mr. Ward; maps of annual and seasonal temperature anomalies, by Mr. Batchelder, and of equal annual temperature ranges, by Mr. Connolly, these being based on Buchan's "Challenger" charts. Mention may be made in this connection of two models constructed under my direction by Mr. Gulliver; one showing the Newtonville glacial sand-plain in its present condition, and the other restoring it as it presumably existed in the closing stages of the glacial period. Some of the essays prepared by these students will be published during the coming year.

Some beginning has been made on a project to form a teaching collection of photographs and lantern slides, with which to illustrate the geology and geography of our several States. Besides a considerable number of excellent views obtained by gift, the income of the Gardner Fund, supplemented by the general laboratory funds, enables us to purchase practically all the good photographic illustrations of geographical and geological features that we can find for sale. Most of the photographs have now been catalogued and classified, in order to show not only what we have, but what we want as well. Correspondence has been opened with a number of photographers in different parts of the country, and with the officers of certain State geological surveys, in order to extend our collection in certain desired directions. It is believed that in a few years we shall be able to select from this large amount of material a series of graded collections of much educational value, thus extending the usefulness of the University in this direction beyond its immediate classes.

It is noticeable, however, that in spite of the ease with which good photographs are now taken, it is still difficult to obtain a well selected series of views properly illustrating the characteristic features of any State. The attempt has therefore been made, through an address to the National Geographic Society, to turn the attention of our State surveys to the subject of a geographical examination of their domains. It is indeed a curious fact, that, while the geological accounts of our States have advanced greatly, the descriptions of the more elementary subject of their geography are still scanty. Such as they are, they may generally be found in the State or national geological reports; but most of them fall far short of what they should be in the light of modern geographical study. Just as the State surveys have specialized their work in the direction of palæontology and later of petrography, it is hoped that the next few years may see a specialization by the surveys in the direction of geography, in the hands of trained experts, as other technical subjects are. There is encouragement to think that some of the surveys will at once proceed to the development of this line of study. If so, a decided improvement in local geographical teaching may be looked for through the reports that shall thus be prepared. At present, school teachers have practically no source of information outside of ordinary text-books to which they may turn for accounts of the physical features of



their home districts ; but such accounts might be well supplied through the illustrated geographical reports published by the State surveys.

The special appropriation allotted by the Council of the University Library for the purchase of large-scale topographical maps has been increased from \$300 for the year 1891-92 to \$350 for the current year, and in this way our collection of modern maps has been most serviceably enlarged. The University Library previously possessed in the Kohl collection a large number of older maps of great historical interest, but of practically no value in teaching physical geography. When the recent purchases began, the only considerable topographical maps in the Library were the Ordnance Survey of Great Britain, the *État Major* and the Public Works maps of France, the Dufour and the plane-table maps of Switzerland. Since then, the topographical maps of the Netherlands, Belgium, Norway, Germany, Saxony, Austria, Italy, and Spain have been secured. It is hoped that the appropriation for this purpose may be continued for several years to come, as all of the best geographical material of the world can then be placed before our students.

There has been opportunity of extending the relations of the geographical section of the University with the public schools in several ways. In the summer of 1892, an address was delivered before the American Institute of Instruction at Narragansett Pier, R. I., on Geographical Illustrations, and repeated before the Middlesex Teachers' Association and the Bristol County Teachers' Association in the autumn. The object of the address was to emphasize the importance of using various means of illustration, such as maps, models, views, diagrams, etc., in teaching geography. It has since then been published by the University as a reprint from the Proceedings of the Institute. During the year, a course of lectures on Geography was given to teachers ; this being one of three courses of lectures, on Geometry, Physics, and Geography, offered by the University to the teachers of the Cambridge public schools. In this way sixty or seventy of the teachers from the grammar schools met in our large Geological Lecture-Room once a week, from November to April.

During the Christmas recess the writer attended a conference of ten members, appointed by a special committee of the National Educational Association, and held in Chicago, to consider the

teaching of geography and related subjects in the secondary schools. A report on the work of the conference will be duly published. A sub-committee was appointed by the geographical conference, consisting of Mr. C. F. King of the Dearborn Grammar School, Boston, Professor G. L. Collie, of Beloit College, Wisconsin, and the writer, to prepare a list of governmental maps that might be advisably used in geographical teaching. The committee met in our Laboratory in June, and made a selection of about two hundred maps and charts from among those published by our various official surveys. This list will be shortly published, with indications of the means of obtaining the maps, and with some account of the features that they illustrate. It is believed that the list may have a beneficial effect on the teaching of geography in the schools.

The field study of the Triassic area of Connecticut, mentioned in my previous reports as having been undertaken for the United States Geological Survey, has been finished during the past year, with the assistance of Mr. L. S. Griswold. Mr. Griswold has also completed a colored map of the district on the topographical sheets of the survey, and has prepared a number of true-scale sections, on which, after plotting the various fault-lines by which the formation is frequently dislocated, he has indicated the inferred depth of the deposits underground, and has restored the portion lost by erosion above ground; he then reversed the movements on the fault-lines, and thus returned the dislocated blocks of each section to their original positions, as nearly as can be determined; producing an excellent illustration of the trough in which the Triassic sandstones and lavas were accumulated.

Much spare time has been given during the past two years to the completion of a text-book of Meteorology, which is now in the printer's hands. It will be ready for use with the class in Elementary Meteorology, in the second half of the current year.

Besides the share that Mr. Ward has had in the work of the elementary courses, he has carried on a special study of thunderstorms in New England for the National Weather Bureau, and has continued in the editorship of the "American Meteorological Journal," of which mention was made in the last Report. Finding that the preparation of the Journal calls for an increasing share of his time, he proposes to withdraw from certain of his other duties for the coming year, and devote a greater part of his time to editorial work.

PUBLICATIONS BY MEMBERS OF THE GEOLOGICAL  
DEPARTMENT.

THE following papers of a scientific nature have been published during the year.

By N. S. Shaler: —

1. The Conditions of Erosion beneath Deep Glaciers, based upon a study of the Boulder Train from Iron Hill, Cumberland, R. I. *Bull. Mus. Comp. Zoöl.*, XVI. No. 11, pp. 185–225. January, 1893. 4 plates, 1 map.

2. *The Interpretation of Nature.* Houghton, Mifflin & Co., Boston and New York, 1893. 16mo., pp. xi., 305.

3. Report on the Work done in the Atlantic Coast Division of the U. S. Geological Survey for the Year ending June 30, 1890. Eleventh Annual Report of the Director of the U. S. Geological Survey, Part I. pp. 62–64. Washington, D. C., 1891.

4. Report of the Commission to improve the Highways of the Commonwealth of Massachusetts. Boston, 1893, pp. 238. [With Geo. S. Perkins and W. E. McClintock.]

5. On the Antiquity of Man in North America. *Amer. Geol.*, 1893, XI. pp. 180–184.

By W. M. Davis: —

1. Geographical Illustrations. Suggestions for teaching Physical Geography, based on the Physical Features of Southern New England. An Address delivered at Narragansett Pier, R. I., July 6, 1892. *Proc. Amer. Inst. Instruction*; also reprinted and for sale by the University.

2. The Extension of Physical Geography in Elementary Teaching. An Address delivered before the Middlesex Schoolmasters' Club in Boston, October, 1892. *School and College*, December, 1892, I. pp. 599–608.

3. Geography in the Schools. *School Review*, June, 1893, I. pp. 327–339.

4. The Improvement of Geographical Teaching. *Nat. Geogr. Mag.*, July, 1893, IV. pp. 68–75.

5. The Subglacial Origin of Certain Eskers. *Proc. Bost. Soc. Nat. Hist.*, 1892, XXV. pp. 477–499.

6. The General Winds of the Atlantic Ocean. *Amer. Met. Journ.*, 1893, IX. pp. 476-488.

7. Brief Meteorological Articles : — Proposed Subjects for correlated Study by State Weather Services. *Amer. Met. Journ.*, 1893, X. pp. 68-74. Notice of H. F. Blandford, *Ibid.*, pp. 74-76. Cloud Measurements at Blue Hill Observatory, *Ibid.*, pp. 107-109.

8. The Convex Profile of Bad-Land Divides. *Science*, Oct. 28, 1892, p. 245.

9. The Topographical Maps of the United States Geological Survey, *Science*, April 28, 1893, pp. 225-227.

10. The Geologic Atlas of the United States. *The Nation*, Jan. 19, 1893, pp. 45, 46.

11. Lunar Craters. [Review of "The Moon's Face," by G. K. Gilbert.] *The Nation*, May 11, 1893, pp. 342, 343.

12. Special Students in Harvard College. *Harv. Grad. Mag.*, 1893, I. pp. 536-541.

13. Articles on (Lake) Agassiz, Bad-lands, Beach, (Lake) Bonneville, Cañon, Cataracts, Cave, Cliff, Coast, Colorado River, Coral Islands, Delta, Deserts, Dune. *Johnson's Universal Cyclopædia*, New York, 1892, Vols. I. and II.

By J. E. Wolff : —

Acmite Trachyte from the Crazy Mountains. *Bull. Mus. Comp. Zoöl.*, XVI. No. 12, April, 1893, pp. 227-233. [With R. S. Tarr.]

By T. W. Harris : —

1. Mountains as Storm-breeders. *Amer. Met. Journ.*, X. 1893, pp. 126-131.

By R. T. Jackson : —

Beecher's Studies of the Brachiopoda. *Amer. Nat.*, XXVI. 1892, pp. 837, 838.

By R. DeC. Ward : —

1. Thunderstorms in New England during the Year 1887. *American Meteorological Journal*, IX. pp. 211-215.

2. The First Aerial Voyage across the English Channel, *Ibid.*, IX. pp. 307-311.

3. Recent Foreign Studies of Thunderstorms, *Ibid.*, IX. pp. 532-541, X. pp. 111-126, 178-184.

4. Thunderstorms in New England during the Years 1886 and 1887. *Annals Astronomical Observatory of Harvard College*, XXXI. Part II. pp. 261-343.

5. Investigation of Thunderstorms in New England. In Report on the Forecasting of Thunderstorms during the Summer of 1892,

by N. B. Conger. United States Department of Agriculture, Weather Bureau, Bulletin No. 9, 8vo, Washington, 1893, pp. 30-50.

6. Our Immigration Laws : What they are and what Changes should be made in them. The Boston Commonwealth, July 15, 1893.

7. Edited : The American Meteorological Journal, an Illustrated Monthly devoted to Scientific Meteorology and Allied Branches of Study, 8vo, Ginn & Company, Boston, Mass., Publishers.

By J. B. Woodworth : —

1. The Ice-wall on the Beach at Hull, Mass., January, 1893. Science, Feb. 10, 1893, XXI. pp. 71, 72 (3 figs.).

2. Feeding-lines of a Living Land Gasteropod on Lichened Slate. Science, March 24, 1893, XXI. p. 159.

3. *Spirula fragilis* found on the Beach near Gay Head, Mass. The Nautilus, February, 1893, VI. pp. 119, 120.

4. Subjects for Theses, with leading References to the Literature. Department of Geology, Course 8, Bulletin VII. Published by the University. pp. 15.

5. Notes on the Wood or Fallow Ant of Southeastern Massachusetts. Science, Sept. 8, 1893, XXII. pp. 132, 133.

By L. S. Griswold : —

Whetstones and the Novaculites of Arkansas. Annual Report of the Geological Survey of Arkansas, 1890, Vol. III., Little Rock, Ark., 1892, pp. xviii., 443, with 9 plates and 2 maps.

A Basic Dike in the Connecticut Triassic. Bull. Mus. Comp. Zoöl., August, 1893, XVI. No. 14, pp. 239-242, with 1 plate.

By C. L. Whittle : —

1. Some Dynamic and Metasomatic Phenomena in a Metamorphic Conglomerate in the Green Mountains. Bull. Geol. Soc. Am., Feb., 1893, IV. pp. 147-166, with 2 plates.

2. An Ottrelite-bearing Phase of a Metamorphic Conglomerate in the Green Mountains. Amer. Journal Sci., Oct., 1892, XLIV. pp. 270-277.

By R. E. Dodge : —

1. The Moon's Face, by G. K. Gilbert. [A review.] Amer. Met. Journ., 1893, X. pp. 126-131.

## REPORT ON THE INSTRUCTION IN ZOÖLOGY.

BY E. L. MARK.

THE instruction in Zoölogy during the Academic year 1892-93 has been substantially the same as that of the previous year, the only exception being a change in the course in Osteology by Dr. Slade, which is now conducted as a research course (Zoöl. 20 *c*).

The accompanying table shows the number of students by classes in each of the zoölogical courses:—

Class.	Gr.	Sen.	Jun.	Soph.	Fr.	Sp.	Sc.	Total.
Zoöl. 1 . . . . .	6	6	8	21	24	7	19	91
“ 2 . . . . .	5	7	6	8	1	..	9	36
“ 3 . . . . .	6	8	3	1	..	..	4	22
“ 4 . . . . .	5	6	1	..	..	..	3	15
“ 5 . . . . .	6	6	1	..	..	..	2	15
“ 20 <i>a</i> . . . . .	12	..	..	..	..	..	..	12
“ 20 <i>c</i> . . . . .	2	1	..	..	..	..	1	4

The laboratory work in Zoölogy 1 was under the immediate supervision of Mr. H. M. Kelly, the Assistant during the previous year, who had as sub-assistants Dr. H. S. Pratt, and Messrs. J. H. Gerould, H. L. Jones, C. A. Kofoid, and A. G. Mayer.

The department was also fortunate in being able to retain for another year the services of Mr. W. S. Nickerson as Assistant in Zoölogy 2. The number of students in Zoölogy 3 necessitated the employment of an assistant in that course, — Mr. W. A. Lecompte. Each of the students wrote a thesis in connection with and supplementary to the routine dissections of the course on a problem in comparative anatomy.

As usual, Dr. W. McM. Woodworth assisted in the laboratory work in Zoölogy 4 and 5, and gave a portion of the lectures in the former course. The number of students in these courses exceeded the accommodations in room 2, and it was necessary to divide the class for laboratory work into sections, and assign them to different

rooms, — an arrangement that entailed considerable inconvenience to students as well as instructors. If the classes continue to be as large, it will be very desirable to provide in the future additional room for their accommodation. Temporary relief from the overcrowded condition of the room for students engaged in research was provided by the Director of the Museum, who allowed Drs. Davenport and Woodworth to fit up one of the rooms used for the storage of collections as a private laboratory, in which a place was also made for one of the advanced students.

Satisfactory progress was made by those engaged in research, and the meetings of the Zoölogical Club every two weeks were well attended. At Commencement the degree of Ph. D. was conferred on one student, now Professor of Zoölogy in the University of California, and that of A. M. on three others.

Considerable time was given, especially by the chairman of the Department and Dr. Woodworth, to the preparation and arrangement of material for the World's Fair Exhibit at Chicago. The zoölogical exhibit contained, besides photographs of the various laboratories, samples of work done by students, and special appliances and apparatus used in the laboratories and lectures. The collection also embraced both wax and plaster models, in various stages of advancement, made from microscopic objects and such apparatus as is employed by advanced students in making them.

During the second half of the year Dr. Davenport gave at the Museum a brief course of lectures on "Morphogenesis," which was open to all members of the University interested in the subject. Similar courses of lectures on other topics would undoubtedly be valuable both to zoölogical students and others interested in the work of the Department.

Since my last report the following contributions from the Zoölogical Laboratory, Nos. XXXIII.—XXXVII., have been published: —

XXXIII. On *Urnatella gracilis*. By C. B. Davenport. 44 pp., 6 pl. January, 1893.

XXXIV. Note on the Carotids and the Ductus Botalli of the Alligator. By C. B. Davenport. 6 pp., 1 pl. January, 1893.

XXXV. On the Eyes, the Integumentary Sense Papillæ, and the Integument of the San Diego Blind Fish (*Typhlogobius californiensis*, Steindachner). By W. E. Ritter. 54 pp., 4 pl. April, 1893.

XXXVI. The Development of the Scales of *Lepidosteus*. By W. S. Nickerson. 26 pp., 4 pl. July, 1893.

XXXVII. Studies in Morphogenesis. I. On the Development of the Cerata in *Æolis*. By C. B. Davenport. 8 pp., 2 pl. July, 1893.

Since the last report there has also been published "*Polychærus caudatus*, nov. gen. et nov. sp.," by Edward Laurens Mark. "*Festschrift zum siebenzigsten Geburtstage Rudolf Leuckarts*," pp. 298-309. 1 Pl. Leipzig, [Oct.] 1892. Also the translation of Hertwig's "*Lehrbuch der Entwicklungsgeschichte*," etc., under the title, "*Text-book of the Embryology of Man and Mammals*."

The first part of Korschelt u. Heider's "*Entwicklungsgeschichte der wirbellosen Thiere*," by Drs. Mark and Woodworth, is nearly ready for the printer.

By the appointment of an additional Instructor in Zoölogy more time will be allowed for the supervision of research work, and two half-courses are added, one by Dr. Parker on The Nervous System and its Terminal Organs, the other by Dr. Davenport on Experimental Morphology.

The most urgent need of the Department is still the proper equipment of the aquarium and vivarium, there being no adequate provision for keeping even the animals required in the laboratory work of the regular courses; these are often needed at a time when fresh material cannot otherwise be had. But, for the proper development of the department, provision for keeping fresh material to be used in the class-work of undergraduates, is less important than it is to have well arranged compartments in which animals may be subjected to constant and predetermined conditions of environment, the effects of which may be systematically studied. Provision should be made for carrying on investigations of this kind running over long periods of time, as well as for the briefer experimentations which may be carried on by students during the term of a single course. Those engaged in embryological work should also be provided here with every facility for accumulating and keeping under control the material needed in their researches.

The necessities of the Department in this particular, which have long been anticipated by the Curator, so far as regards the space in the Museum building required, cannot much longer remain unsatisfied, unless we are willing to accept an inferior position in the facilities afforded for advanced work in Zoölogy.



## REPORT ON OSTEOLOGY.

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BY DANIEL DENISON SLADE.

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SINCE my last report, the osteological collections have received no important additions. They remain in good condition.

In the collection of disarticulated skeletons, many of the orders, notably the Chiroptera, Insectivora, and Rodentia, are deficient in several of the families. This lack of material is a serious drawback, not only to the instructor, but to the scientific student, and it is hoped that it may be supplied in the near future by means now unforeseen.

Specimens from various sources have been received for identification, and have been duly returned after determination.

In accordance with my own previous ideas, and in unison with the suggestions made by the Curator in his last Annual Report, in regard to the original aim of the Museum, to the effect that its highest usefulness may be made available for the purposes of science, and for the more advanced studies, the course of comparative osteology during the last academical year, was devoted more especially to research. This plan, although it does not debar those students who desire to gain merely a general acquaintance with the subject, allows those more advanced to pursue the investigations in which they may be especially interested.

Instead of a final examination, as formerly required, written theses have been adopted, and the results have been very satisfactory. Lectures, as also oral examinations, have been given at the option of the instructor. The important subject of Dentition also received more attention than it has been possible to give to it during the few past years. Four students, three Graduates and one Senior, availed themselves of the opportunities offered by the extensive collections of the University in this department during the last year, — opportunities not to be obtained in any other institution in the country.<sup>1</sup>

<sup>1</sup> This small number of students, as is the case in other departments, must be attributed to the increased number of elective studies.

Besides a review of Professor Flower's volume on "The Horse," and also other papers, the following have been published by me:—

Osteological Notes, Science, Vol. XXI., No. 523, p. 78; No. 539, p. 301.

Ready for publication in the Museum Bulletin:—

The Significance of the Jugal Arch.

## REPORT ON THE MAMMALS AND BIRDS.

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BY WILLIAM BREWSTER.

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THE collection of mounted Mammals has received the following additions :—

A Bat from Alaska ; an Elephant, a Hippopotamus, four Antelopes (*Oryx beisa*, *Nanotragus melanotis*, *Cephalolophus pygmeus*, and *C. Maxwelli*) and a Wild Hog, from Africa ; and five Lemurs (including *Lemur catta*, *L. renifrons*, *Propithecus coronatus*, and *Microrhynchus laniger*), from Madagascar. A fine skin of the African Leopard has also been mounted for exhibition in the African Room.

The large and very valuable collection of mounted birds given to the Museum by Mrs. Greene Smith, as described in the last Annual Report, has been prepared for exhibition and arranged in the new cases in the North American Room. After the specimens had been reidentified and relabelled by the assistant and catalogued by Miss Parker, they were transferred from the original moss-covered stands— which proved unsuitable for Museum purposes— to plain white painted stands, uniform with those in general use throughout the Exhibition Rooms. This part of the work and the general renovation of the collection were intrusted to Mr. James T. Clark, a well known professional taxidermist, whose skill in removing dust and grease stains, mending broken parts, and restoring rumped or defective plumage has enhanced very materially the general beauty of the collection, as well as reduced the number of specimens too imperfect to be retained to but little more than one hundred.

Our old North American collection has been similarly treated, and all the damaged or worthless specimens remounted or thrown out. Those remaining have been arranged with the Greene Smith birds, but the latter are distinguished by their different labels. The combined collection, in accordance with the promise made to Mrs.

Smith, will be hereafter called the "Greene Smith Collection of North American Birds." Taken as a whole, it forms an attractive and very satisfactory representation of the North American bird fauna. Of course there are still gaps to be filled, but most of these concern birds which can be obtained without much difficulty. A pair of Bachman's Warblers, a Snowy Heron, Night Heron, Mallard, Wood Duck, Harlequin Duck, Goosander, and Hooded Merganser have been already bought for this purpose.

The Greene Smith Humming-birds, numbering about three hundred specimens, have been placed on exhibition in the South American room, where an entire case has been devoted to them. This disposition is perhaps open to some criticism on the ground that certain of the species are peculiar to the West Indies, while others breed only in North America. But as by far the greater number are exclusively South or Central American, and as the family is of undoubted Neotropical origin, it seemed best to waive this objection. The only alternative was a place in the Systematic Room or in one of the halls, where the light would have been more or less unsatisfactory. The case in the South American room has a clear, direct light, admirably adapted for bringing out the metallic or iridescent tints which form the chief glory of these exquisite little creatures. Mr. Clark has displayed the specimens to unusual advantage by mounting them on invisible wires fastened to horizontal wooden strips, which extend quite across the case and rise in tiers, each above and a little behind the next, like the seats in a theatre. The flexibility of the wires made it easy to adjust each specimen at precisely the right angle with the rays of light, and the birds, being placed close together and freed from the usual detracting adjuncts of shelves and stands, present an appearance nearly as brilliant and striking as that of a bank of flowers. If the approval of the visiting public may be taken as a criterion, the success of this unconventional treatment can be open to no doubt, for the case of Humming-birds has attracted general and marked attention ever since it was first placed on exhibition. It is perhaps necessary to add that æsthetic considerations were not allowed to interfere with a strict scientific classification, and that small labels bearing the usual inscriptions are pasted on the horizontal strips below the specimens to which they relate.

Five birds sent to the American Museum a year or more ago have been returned by Mr. Allen.

The Assistant in this department has published the following papers and notes in "The Auk":—

Description of a new Humming-bird from Northern Mexico.

A Brood of Young Flickers (*Colaptes auratus*) and how they were fed.

On the Occurrence of certain Birds in British Columbia.

The Ipswich Sparrow (*Ammodramus princeps*) on the Coast of Georgia.

## REPORT ON THE REPTILES AND FISHES.

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 BY SAMUEL GARMAN.
 

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THE work in these departments has included fitting up exhibits for the Pacific and the Asiatic rooms, and rearrangement of the North American and the Australian specimens, beside the usual routine work, identifications, and studies. Better representatives have replaced a considerable number of those formerly on the shelves, and many duplicates have been entirely withdrawn from the collections. Several tortoises and a large alligator were mounted for the North American room. Among the outgoing material was that furnished students in the laboratories, and a couple of series of Reptiles and Batrachians sent to Dr. Hurter.

Donations were received from Mr. Philipp Adams, Dr. Harrison Allen, A. N. Cheney, Esq., Mr. Chick, William Clapp, Hon. J. G. A. Creighton, Prof. W. Faxon, J. B. Greenough, Esq., Mr. Thomas A. Hillery, Dr. L. C. Jones, W. H. Jones, Esq., Mrs. J. M. Maynard, Colonel McDonald, U. S. Fish Commissioner, Gerrit S. Miller, Esq., Mr. Wm. B. Richardson, Mr. W. W. Rockwell, Robt. Gaston Smith, Esq., Mr. Rollo W. Snell, Miss Elizabeth Taylor, Bradford Torrey, Esq., and Mr. N. Vickary. Many of the accessions are of rare and desirable species. Especially valuable are the live specimens sent by Dr. Hurter; kept living for a time, they afforded the means of determining much relating to the life histories of their species.

A particular study of the Acipenseroids was made by Mr. Nicolas Borodine, sent out by the Russian government.

The amount of loss from evaporation, leakage, or breakage is very small.

The list of publications is made up of the following, in addition to unsigned reviews and other articles.

In "Science": —

"On *Chelydra serpentina*."

"On the Growth of the Rattle of *Crotalidæ*."

“The Lac de Marbre Trout.” (Reprinted by Forest and Stream, and others.)

In the Proceedings of the Massachusetts Historical Society :—

“On Cabinet, Library, and Wardrobe Pests,” in “The Ravages of Bookworms,” by the Librarian of the Society, Dr. S. A. Green. (Also in Science.)

## REPORT ON THE ENTOMOLOGICAL DEPARTMENT.

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BY SAMUEL HENSHAW.

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ADDITIONS to the collection of the department have been received from Messrs. A. Agassiz, M. A. Barber, F. Blanchard, P. P. Calvert, D. W. Coquillett, J. W. Freese, H. H. Lyman, C. J. Maynard, G. S. Miller, Jr., A. P. Morse, S. H. Scudder, J. G. Shute, Roland Thaxter, William Trelease, and the Peabody Academy of Science, Salem.

Various portions of the collection have been studied at the Museum by Messrs. F. Blanchard, T. L. Casey, H. G. Dyar, E. P. Felt, C. H. Fernald, Roland Hayward, G. H. Horn, J. G. Jack, A. P. Morse, F. W. Russell, S. H. Scudder, and Roland Thaxter; assistance has also been given to Messrs. P. P. Calvert, D. W. Coquillett, H. H. Lyman, and Roland Thaxter.

The entire collection has been examined three times, and though not entirely free from pests, is, as a whole, in excellent condition.

The withdrawal of duplicates and the condensation of scattered material has relieved the department of various odd boxes and cabinets; the Loew collection of Diptera and a part of the Odonata are the only portions of the collection not in the regular Museum boxes and cabinets.

A rearrangement of the cabinets, rendered desirable by the increased space afforded by the additional room, has been effected; the systematic and biological collections of Lepidoptera and Coleoptera are in one room, the other orders are in a second room, while the third room is reserved for the library and laboratory.

The routine work has been chiefly to facilitate the work of specialists wishing to study the collection; for this purpose portions of the Odonata, Orthoptera, Hemiptera, Coleoptera, and Lepidoptera Rhopalocera have been rearranged.

Additional space having been granted in the North American room, three boxes, two of Odonata and one of Hemiptera, are ready to be placed on exhibition.

The library has been rearranged; a considerable number of books have been transferred to the Museum library.



REPORT ON THE INVERTEBRATA (EXCLUSIVE OF  
INSECTS).

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BY WALTER FAXON.

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A GOOD deal of time has been spent during the past year in rearranging and extending the exhibition collections of Invertebrata. A change of plan was decided upon early in the year, by which the marine forms were to be eliminated from the rooms assigned to illustration of the Continental Faunæ. Space was thereby gained for a fuller display of land and fresh-water types, and much unnecessary duplication of species exhibited in the rooms devoted to the Oceanic Faunæ was avoided. This radical change of plan involved a complete overhauling of the Invertebrata in the North American, South American, and Europæo-Siberian Rooms. An entirely new series of land and fresh-water shells has been selected, mounted, and placed on exhibition in the African, Australian, and Indian Faunal Rooms; another collection of terrestrial shells from the Polynesian Islands has been placed in one of the cases in the Pacific Ocean Room. The preparation of these collections for exhibition was intrusted to Misses Clark and Parker. The Pacific Ocean faunal collection, though far from completed, was brought up to a condition such as to warrant opening the room to the public last winter.

Material for study has been sent from the Museum to F. E. Schulze, Berlin, C. Pictet, Geneva, F. Meinert, Copenhagen, G. W. Müller, Naples, and R. P. Bigelow, Baltimore. A collection of corals has been given to the Bigelow School, Marlborough, Mass. Gifts of specimens have been received from the California Academy of Sciences, the Boston Society of Natural History, the U. S. National Museum, A. Agassiz, Cambridge, Ign. Bohrer, Madrid, G. S. Miller, Jr., Cambridge, and C. J. Maynard, Boston.

An elaborate final Report on the Museum collection of Paguridæ dredged by the "Blake" Expeditions of 1877-80 has been prepared by Professor Alphonse Milne-Edwards and Mr. E. L. Bou-

vier, and published in the *Memoirs of the Museum*, Vol. XIV., 172 pages, 12 plates. My own Report on the Crustacea secured during the cruise of the U. S. Fish Commission steamer "Albatross" off the tropical Pacific Coast and in the Gulf of California, during 1891, was finished last winter. On account of the length of time required to prepare the plates which are to accompany this Report, preliminary descriptions of the new genera and species have been printed in the *Museum Bulletin*, Vol. XXIV., pp. 147-220.

## REPORT ON THE PALÆONTOLOGICAL DEPARTMENT.

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 BY ALPHEUS HYATT.
 

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IN connection with work on the Carboniferous Cephalopods of Texas, which will be shortly published, the Assistant has classified and renamed the corresponding collection in the Museum, and made a number of preparations showing the stages of growth of different species and genera.

The Whitney Collection of California fossils presented to the Museum this year has been looked over and in part studied. It is small, but it contains some fossils of extraordinary interest. Among those that may be mentioned are a number of the types of Gabb's descriptions of California fossils. The value of these originals, especially with reference to the history of Mesozoic Geology of the West cannot be overestimated.

Through Professor Pickering the Museum has also received a small collection of South American fossils collected by Mr. A. E. Douglass.

The department is indebted to Dr. R. T. Jackson for work upon the collections, and the superintendence of the work of Miss Clarke in mending broken fossils of the Gebhard and other collections.

The following papers have been published: —

Bioplastology and the related Branches of Scientific Research, by Alpheus Hyatt, Proc. Bost. Soc. Nat. Hist., XXVI., 1893, pp. 59-125.

The Terms of Bioplastology, by Alpheus Hyatt, Zool. Anzeiger, Nos. 426, 427, 1833.

Bemerkungen zu Schulze's System einer deskriptiren Terminologie, Biol. Centralbl., XIII., Nos. 15, 16, 1893.

## REPORT ON THE LIBRARY.

BY MISS F. M. SLACK.

DURING the year ending September 1, 1893, the Library has received 633 volumes, of which 5 are atlases, 1,830 parts, and 107 pamphlets :—

	VOLUMES.	PARTS.	PAMPHLETS.
Gift . . . . .	8	113	11
Exchange . . . . .	138	675	48
Purchase . . . . .	33	224	1
A. Agassiz . . . . .	136	785	40
Binding Parts . . . . .	316		
Whitney Library . . . . .	2	33	7
	633	1830	107

The number of volumes now in the Library (exclusive of pamphlets and the Whitney Library) is 21,024. There are 14,417 pamphlets bound in 2,452 volumes, making the total number of volumes 23,476.

[A]

## PUBLICATIONS

OF THE

## MUSEUM OF COMPARATIVE ZOÖLOGY

FOR THE ACADEMIC YEAR 1892-93.

Of the Bulletin :—

Vol. XVI. [Geological Series Vol. II.].

No. 11. The Conditions of EROSION beneath DEEP GLACIERS based upon a Study of the BOULDER TRAIN from IRON HILL, Cumberland, R. I. By N. S. SHALER. pp. 42. Map and 4 Plates. January, 1893.

No. 12. ACMITE TRACHYTE from the CRAZY MOUNTAINS, Montana. By J. E. WOLFF and R. S. TARR. pp. 10. April, 1893.

No. 13. Report on the DREDGING OPERATIONS off the WEST COAST of Central America to the GALAPAGOS, etc. V. Report upon ROCKS collected from the Galapagos Islands. By G. P. MERRILL. pp. 4. July, 1893.

No. 14. A BASIC DIKE in the CONNECTICUT TRIASSIC. By L. S. GRISWOLD. pp. 4 and 1 Plate. August, 1893.

[Vol. XVI. *to be continued.*]

Vol. XXIII. [Complete.]

No. 4. Studies from the Newport Marine Laboratory.—XXIX. Preliminary Note on some Modifications of the CHROMATOPHORES of FISHES and CRUSTACEANS. By A. AGASSIZ. pp. 6. 1 Plate. December, 1892.

No. 5. Reports on the DREDGING OPERATIONS off the WEST COAST of Central America to the GALAPAGOS, etc., by the U. S. Fish Commission Steamer "ALBATROSS." III. On a Peculiar Type of ARENACEOUS FORAMINIFER from the American Tropical Pacific, NEUSINA AGASSIZI. By A. GOËS. pp. 4. 1 Plate. December, 1892.

No. 6. Report on the RESULTS OF DREDGING by the U. S. Coast Survey Steamer "BLAKE." XXXIV. Report on the MOLLUSCA dredged by the "BLAKE" in 1880, including Descriptions of several NEW SPECIES. By KATHARINE J. BUSH. pp. 43. 2 Plates. January, 1893.

Vol. XXIV. [Complete.]

No. 1. Contributions from the Zoölogical Laboratory.—XXXIII. On URNATELLA GRACILIS. By C. B. DAVENPORT. pp. 44. 6 Plates. January, 1893.

No. 2. Contributions from the Zoölogical Laboratory.—XXXIV. Note on the CAROTIDS and the DUCTUS BOTALLI of the ALLIGATOR. By C. B. DAVENPORT. pp. 4. 1 Plate. January, 1893.

- No. 3. Contributions from the Zoölogical Laboratory. — XXXV. On the EYES, the Integumentary SENSE PAPILLÆ, and the INTEGUMENT of the San Diego Blind Fish (*TYPHLOGOBIUS CALIFORNIENSIS*, STEINDACHNER) By W. E. RITTER. pp. 54. 4 Plates. April, 1893.
- No. 4. Reports on the DREDGING OPERATIONS off the WEST COAST of Central America to the GALAPAGOS, etc., by the U. S. Fish Commission Steamer "ALBATROSS." IV. Vorläufiger Bericht über die erbeuteten HOLOTHURIEN. Von H. LUDWIG. pp. 10. June, 1893.
- No. 5. Contributions from the Zoölogical Laboratory. — XXXVI. The DEVELOPMENT of the SCALES of LEPIDOSTEUS. By W. S. NICKERSON. pp. 27. 4 Plates. July, 1893.
- No. 6. Contributions from the Zoölogical Laboratory. — XXXVII. STUDIES in MORPHOGENESIS. I. On the DEVELOPMENT of the CERATA in ÆOLIS. By C. B. DAVENPORT. pp. 8. 2 Plates. July, 1893.
- No. 7. Reports on the DREDGING OPERATIONS off the WEST COAST of Central America to the GALAPAGOS, etc., by the U. S. Fish Commission Steamer "ALBATROSS." VI. Preliminary Descriptions of NEW SPECIES of CRUSTACEA. By W. FAXON. pp. 72. August, 1893.

Of the Memoirs : —

Vol. XIV. [Complete.]

- No. 3. Reports on the RESULTS OF DREDGING by the United States Coast Survey Steamer "BLAKE." XXXIII. Descriptions des CRUSTACÉS de la Famille des PAGURIENS recueillis pendant l'Expédition. Par A. MILNE-EDWARDS et E. L. BOUVIER. pp. 172. 12 Plates. April, 1893.

## [B]

THE Faculty of the Museum of Comparative Zoölogy will receive applications from candidates desiring to occupy the table at the Naples Zoölogical Station, which has been placed at its disposal from October 1, 1893.

The applicant must be (or have been recently) a student or instructor at some American University, preferably a person who has taken the degree of Ph. D. or S. D. ; he must have published some creditable original investigation, and should be recommended as an able investigator by the professor under whom he has studied.

Applicants will please forward to the undersigned their recommendations, and a statement of their qualifications, and of the subject to which they hope to devote themselves.

In order that the Faculty may make the most satisfactory disposition of the table during the whole year, the applicants are requested to state the length of time they desire to remain at Naples, and also the earliest and latest dates within which they can avail themselves of the appointment.

The Faculty will, at suitable intervals, nominate to the Corporation of Harvard College for approval the incumbent or incumbents for the year 1893-94.

ALEXANDER AGASSIZ,

*Director.*

## [C]

## INVESTED FUNDS OF THE MUSEUM.

IN THE HANDS OF THE TREASURER OF HARVARD COLLEGE, SEPT. 1, 1893.

Sturgis-Hooper Fund . . . . .	\$100,000.00
Gray Fund . . . . .	50,000.00
Agassiz Memorial Fund . . . . .	297,933.10
Teachers and Pupils Fund . . . . .	7,594.01
Permanent Fund . . . . .	117,469.34
Humboldt Fund . . . . .	7,740.66
Virginia Barret Gibbs Fund . . . . .	5,000.00
	<hr/>
	\$585,737.11

The payments on account of the Museum are made by the Bursar of Harvard College, on vouchers approved by the Curator. The accounts are annually examined by a committee of the Museum Faculty. The only funds the income of which is restricted, the Gray and the Humboldt Funds, are annually charged in an analysis of the accounts with vouchers to the payment of which the income is applicable.

The income of the Gray Fund can be applied to the purchase and maintenance of collections, but not for salaries.

The income of the Humboldt Fund (about \$400) can be applied for the benefit of one or more students of Natural History, either at the Museum, the Newport Marine Laboratory, the United States Fish Commission Station at Wood's Holl, or elsewhere.

Applications for the tables reserved for advanced Students at the Newport Marine Laboratory, and for the tables at the Wood's Holl Station, should be made to the Curator of the Museum before the 1st of May. Applicants should state their qualifications, and indicate the course of study they intend to pursue.

The income of the Virginia Barret Gibbs Scholarship Fund, of the value of \$250, is assigned annually, with the approval of the Faculty of the Museum, at the recommendation of the Professors of Zoölogy and of Comparative Anatomy in Harvard University, "in supporting or assisting to support one or more students who have shown decided talents in Zoölogy, and preferably in the direction of Marine Zoölogy."

See Appendix B of this Report for the conditions upon which the table at the Naples Zoölogical Station is assigned.



The following Publications of the Museum of Comparative Zoölogy  
are in preparation : —

Reports on the Results of Dredging Operations in 1877, 1878, 1879, and 1880, in Charge of ALEX-  
ANDER AGASSIZ, by the U. S. Coast Survey Steamer "Blake," as follows: —

- A. MILNE-EDWARDS. Crustacea of the "Blake."  
E. EHRLERS. The Annelids of the "Blake."  
G. B. GOODE and T. BEAN. Deep-Sea Fishes of the East Coast of the United States.  
"Blake" and "Albatross" Collections published in connection with the National Museum.  
A. A. HUBRECHT. The Nemertean.  
C. HARTLAUB. The Comatulæ of the "Blake," with 15 Plates.  
A. E. VERRILL. The Alcyonaria of the "Blake."  
Illustrations of North American MARINE INVERTEBRATES, from Drawings by BURK-  
HARDT, SONREL, and A. AGASSIZ, prepared under the Direction of L. AGASSIZ.  
Selections from EMBRYOLOGICAL MONOGRAPHS, compiled by A. AGASSIZ, W. FAXON,  
and E. L. MARK (discontinued for the present).  
A. AGASSIZ. The Acalephs of the East Coast of the United States.  
" On Dactylometra quinquecirra Agass.  
" A Reconnaissance of the Bahamas and Elevated Reefs of Cuba, in the Steam  
Yacht "Wild Duck."  
AGASSIZ and WHITMAN. Pelagic Fishes. Part II., with 14 Plates.  
LOUIS CABOT. Immature State of the Odonata, Part IV.  
E. L. MARK. Studies on Lepidosteus, continued.  
" On Arachnactis.  
W. B. SCOTT and H. F. OSBORN. White River Fossils, continued.  
M. E. WADSWORTH. Lithological Studies. Part II.  
ALFRED G. MAYER. On some Medusæ from the Bahamas.  
J. D. WHITNEY. Origin and Mode of Occurrence of Iron and its Ores.  
" Nomenclature and Classification of Ore Deposits.

Contributions from the ZOÖLOGICAL LABORATORY, in Charge of Professor E. L. MARK,  
as follows: —

- W. WHITNEY. The Histology of Thyone.  
A. T. HOLBROOK. The Development of the Heart in Bony Fishes.  
T. G. LEE. The Suprarenals in Amphibia.

Contributions from the GEOLOGICAL LABORATORY, in charge of Professor N. S. SHALER.

Contributions from the PETROGRAPHICAL LABORATORY, in charge of Professor J.  
ELIOT WOLFE.

Reports on the Results of the Expedition of 1891 of the U. S. Fish Commission Steamer  
"Albatross," Lieutenant Commander Z. L. TANNER, U. S. N., commanding, in Charge of  
ALEXANDER AGASSIZ, as follows: —

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|--|--|
| A. AGASSIZ. The Pelagic Fauna.                               | H. LUDWIG. The Holothurians.                       |
| A. AGASSIZ. The Echini.                                      | C. F. LÜTKEN. The Ophiuridæ.                       |
| J. E. BENEDICT. The Annelids.                                | O. MAAS. The Acalephs.                             |
| R. BERGH. The Nudibranchs.                                   | E. L. MARK. The Actinarians.                       |
| K. BRANDT. The Sagittæ.                                      | F. MEINERT. The Isopods.                           |
| " The Thalassicolæ.  | G. W. MÜLLER. The Ostracods.                       |
| C. CHUN. The Siphonophores.                                  | JOHN MURRAY. The Bottom Specimens.                 |
| S. F. CLARKE. The Hydroids.                                  | ROBERT RIDGWAY. The Alcoholic Birds.               |
| W. H. DALL. The Mollusks.                                    | P. SCHIEMENZ. Pteropods and Heteropods.            |
| C. B. DAVENPORT. The Bryozoa.                                | W. SCHIMKÉWITSCH. The Pycnogonidæ.                 |
| W. FAXON. The Crustacea.                                     | W. PERCY SLADEN. The Starfishes.                   |
| S. GARMAN. The Fishes.                                       | L. STEJNEGER. The Reptiles.                        |
| A. GOËS. The Foraminifera.                                   | THEO. STUDER. The Alcyonarians.                    |
| C. HARTLAUB. The Comatulæ.                                   | M. P. A. TRAÜTSTEDT. The Salpidæ and<br>Doliolidæ. |
| W. A. HERDMAN. The Ascidiæ.                                  | E. P. VAN DUZEE. The Halobatidæ.                   |
| W. E. HOYLE. The Cephalopods.                                | H. B. WARD. The Sipunculids.                       |
| G. VON KOCH. The Deep-Sea Corals.                            | H. V. WILSON. The Sponges.                         |
| R. VON LENDENFELD. The Phospho-<br>rescent Organs of Fishes. | W. McM. WOODWORTH. The Planarians.                 |

PUBLICATIONS  
OF THE  
MUSEUM OF COMPARATIVE ZOÖLOGY  
AT HARVARD COLLEGE.

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There have been published of the BULLETINS Vols. I. to XXIV.;  
of the MEMOIRS, Vols. I. to XVI.

Vols. XVI. and XXV. of the BULLETIN, and Vols. XI. and  
XVII. of the MEMOIRS are now in course of publication.

*A price list of the publications of the Museum will be sent on  
application to the Director of the Museum of Comparative Zoölogy,  
Cambridge, Mass.*

ALEXANDER AGASSIZ, *Director.*







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