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94-95

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

1894-95.

CAMBRIDGE, U. S. A. :

UNIVERSITY PRESS: JOHN WILSON AND SON.

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FACULTY OF THE MUSEUM.

Faculty.

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ALEXANDER AGASSIZ, *Curator.* GEORGE L. GOODALE.
JOSIAH D. WHITNEY, *Secretary.* HENRY P. WALCOTT.

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NATHANIEL S. SHALER *Professor of Geology.*
E. L. MARK *Hersey Professor of Anatomy.*
WILLIAM MORRIS DAVIS *Professor of Physical Geography.*
J. ELIOT WOLFF *Professor of Petrography and Mineralogy.*
H. L. SMYTH *Assistant Professor of Mining.*

APPOINTED BY THE FACULTY OF THE MUSEUM.

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D. D. SLADE *Assistant in Osteology.*
SAMUEL GARMAN *Assistant in Herpetology and Ichthyology.*
WILLIAM BREWSTER *Assistant in Ornithology and Mammalogy.*
ALPHEUS HYATT *Assistant in Palæontology.*
SAMUEL HENSHAW *Assistant in Entomology.*
W. McM. WOODWORTH *Assistant in Charge of Vermes.*
ALFRED G. MAYER *Assistant in Charge of Radiates.*
C. R. EASTMAN *Assistant in Vertebrate Palæontology.*
MISS F. M. SLACK *Librarian.*
MAGNUS WESTERGREN *Artist.*

APPOINTED BY THE PRESIDENT AND FELLOWS.

ROBERT TRACY JACKSON *Instructor in Palæontology.*
J. B. WOODWORTH *Instructor in Geology.*
G. H. PARKER *Instructor in Zoölogy.*
W. McM. WOODWORTH *Instructor in Microscopic Anatomy.*
C. B. DAVENPORT *Instructor in Zoölogy.*
HENRY R. LINVILLE *Assistant in the Zoölogical Laboratories.*
H. S. JENNINGS *Assistant in the Zoölogical Laboratories.*
JOHN T. HAMAKER *Assistant in the Zoölogical Laboratories.*
H. V. NEAL *Assistant in the Zoölogical Laboratories.*
○ ROBERT DECOURCEY WARD *Instructor in Meteorology.*
○ LEON S. GRISWOLD *Assistant in Physical Geography.*
R. A. DALY *Instructor in Geology.*
○ C. L. WHITTLE *Assistant in the Petrographical Laboratory.*
F. C. SCHRADER *Assistant in the Geological Laboratory.*

REPORT.

TO THE PRESIDENT AND FELLOWS OF HARVARD COLLEGE: —

DURING the past year the usual courses of instruction have been given at the Museum in the Natural History Laboratories. Those in Zoölogy were given by Professor Mark, Dr. Slade, Dr. Davenport, and Dr. Parker, assisted in the Laboratory work by Messrs. H. V. Neal, H. S. Jennings, W. B. Cannon, and S. K. Fenollosa. Dr. W. McM. Woodworth has, as in previous years, taken charge of the Laboratory work, and has given some lectures in the course on Microscopical Anatomy.

Professors Whitney, Shaler, Davis, and Wolff gave courses of instruction in Geology, Palæontology, Physical Geography, Meteorology, and Petrography. The Assistants in these departments were Messrs. Robert T. Jackson, J. B. Woodworth, R. E. Dodge, L. S. Griswold, R. DeC. Ward, and C. L. Whittle. The courses in Mining Geology and allied subjects were given by Mr. H. L. Smyth. The valuable Library of Professor Pumpelly, which he deposited in the Library of the Mineralogical Section, has been accessible to the students of 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.

The Newport Marine Laboratory has, as usual, been open to advanced students in Zoölogy. Thirteen students spent a part of their time in the Laboratory collecting material for their special investigations, which they will continue and prepare for publication at the Museum. It is unfortunate that there is not in constant attendance at the Laboratory some one thoroughly familiar with the marine fauna of our coast, who could devote more time to the interests of the students than I am able to give.

Dr. W. McM. Woodworth continued his photographic experiments with great success during the past summer. Our apparatus has been modified and greatly improved. A great part of the time was occupied in taking photographs of some of the larger pelagic animals.

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

The income of the Virginia Barret Gibbs Scholarship was used according to the terms of the gift.

The Faculty of the Museum nominated as occupants of the Naples Table for parts of the year 1894-95 Professor W. E. Ritter, of the University of California, Professor Reighard, of the University of Michigan, and Professor C. E. Nutting, of the State University of Iowa.

It may be useful to lay before the Corporation my observations on some of the Marine Biological Laboratories, as they may assist in shaping the course of the University, when the time comes, either in favor of establishing a station entirely under the control of Harvard University, or in connection with the United States Fish Commission, or in favor of uniting with other Universities in maintaining a station on the principles which control the Classical Schools at Athens and Rome.

During the past winter I visited the zoölogical stations at Naples, Trieste, Ville Franche, Marseilles, Banyuls sur Mer, and Plymouth. With the exception of the stations at Naples and at Plymouth, they are connected with educational institutions, holding to them much the same relations which a chemical, physical, or other laboratory holds. These stations are either managed by a member of the natural history staff, or under the control of a Professor from the institution with which they are connected. The investigations carried on at these stations are usually published in the serials issued by the natural history departments of their respective universities. The teaching staff avail themselves of the facilities offered by the stations to obtain fresh material throughout the year for the use of students during term time.

The organization at Plymouth is different. It depends for its support upon a large number of persons who are interested in the promotion of marine investigations. It is in charge of a Director,

and is managed by a Board of Trustees. The station publishes a Bulletin giving an account of the work accomplished there.

The organization at Naples is still different. Dr. Dohrn, the enthusiastic founder and Director of the Station, receives the support of a number of European governments, who pay an annual subsidy for the use of tables at the rate of £100 a year ; and in addition he receives a grant from the German government. This enables him to keep a permanent staff of skilled assistants, who carry on a zoölogical observatory. Their investigations are published in Monographs and Bulletins, the cost of which is defrayed in part from their sale, in part from the fees and subsidies paid for the occupation of the thirty-five tables available at Naples, and in part by the Director. The special work of the occupants of the tables is also frequently published at the cost of the station.

A fine aquarium is maintained at Naples, to which a small entrance fee is charged. At Marseilles, Plymouth, and Banyuls smaller aquaria are also open to the public. At Banyuls and at Naples small steam vessels are owned by the stations, and are employed in collecting material and in making dredging expeditions at moderate depths. At the other stations steamers and boats are hired when needed.

It is evident that the status of these two types of stations is very different. In the one, the work of the University Biological Laboratories may be said to continue under the same influences as at the University. In the other, governments and universities combine to support and foster more extended investigations in natural history than a single institution can be expected to maintain. How far it is the province of a university to assist in carrying on, outside of its own gates, the investigations of others than its students, is a financial question which need not be discussed. While it is eminently proper for governments to promote the interests of such a station as Naples, it remains to be seen how long it will be possible to interest various universities in any institution in the management of which they have no influence.

The stations at Banyuls and at Roscoff owe their origin and principal support to Professor H. de Lacaze-Duthiers. The stations receive but a small subvention from the Sorbonne, the equipment and the greater part of the running expenses being provided by Professor Lacaze-Duthiers and his friends. Instruction is carried on at both his Marine Laboratories as it would be at the Sorbonne,

and he is assisted during a great part of the year by a large staff of temporary Professors from every part of France. The results of the investigations carried on under his supervision are published in the "Archives de Zoologie Expérimentale," also founded by Lacaze-Duthiers.

There is only a nominal fee to be paid for admission to these Laboratories, which attract students from all parts of the world. Similarly at Trieste, Ville Franche, and Marseilles, students are practically admitted free of cost from Austrian, Russian, and French Universities. Foreigners can readily gain admittance to these Laboratories on the most liberal terms. The Marseilles Station at Endoume has the immense advantage of being within a short distance of the University, and is in fact one of its biological laboratories. The work done at Trieste is published, under the auspices of Professor Claus, in the "Arbeiten aus dem zoologischen Institute der Univ. Wien," and a special appropriation is made by the city of Marseilles for the publication of the Annals of the Laboratory.

The cost of maintaining three or four students at the Naples Station is a serious expenditure for any university, and out of proportion to the expenses incurred for them in other departments, that cost being represented by many things in which a distant educational institution can only have an indirect interest. The cost of a table at Plymouth and in this country at Wood's Hole is very much less than at Naples.

In as far as Harvard University is concerned the annual expenditures of the Newport Marine Laboratory, including those of the steam launch and the transportation of the students to and from Newport, if distributed among the tables in use by the students, by myself and assistants, amount to somewhat less than the expense for the same number of tables at the Wood's Hole Marine Biological Laboratory for similar facilities. The results of the work done at the Newport Marine Laboratory have thus far been published in the Bulletins of the Museum.

It is true that the expense of an independent station for each prominent University would in this country be very large, and that an American Marine Biological Laboratory supported by the joint contributions of the principal Universities would be in the line of economy. But as soon as a single institution of that sort increased in size and attempted to grant facilities for more or less elementary instruction as well as for advanced work, it would

become a cumbrous machine difficult of management. Duplication in all directions would soon become necessary, and the advantages of a compact and easily controlled laboratory would be lost.

Were it possible for each University to use its resources in connection with the facilities for advanced work available at the Laboratory of the Fish Commission at Wood's Hole, a maximum amount of original work might be expected. For no University laboratory can hope to obtain the facilities accruing from the maintenance of the fleet of small boats, steamers, and personnel which forms a necessary part of the equipment of the Fish Commission Station. Such an alliance, however, can only be formed provided an equitable agreement, and one satisfactory to the Fish Commission, could be made. This would enable the Universities to foster original work only, and not to expend, as they do now, their resources or the time of their instructors in elementary work.

The mere collecting of material for ordinary investigation at a marine station is not expensive, but it is expensive to carry on the continuous observations of eminent specialists, and subsequently to publish their investigations. Such observations could well be carried on in connection with the work of a Government Fish Commission, and are not only germane to its investigations, but all-important to their success. Still more expensive is it to settle the many problems in thalassography which have arisen in consequence of the more recent deep-sea explorations, — problems which require for their solution the use of steamers thoroughly equipped for their task. This can be most successfully accomplished either by special explorations, or more naturally in the course of time in connection with the problems of a Fish Commission.

The number of visitors to the Museum Exhibition Rooms continues to increase, the attendance on Sundays specially having become most gratifying. This marked increase is no doubt owing in part to the opening of the Botanical and Mineralogical Museums, and in part to the fact that the Museum is open daily nearly the whole day, and not merely at specified times during the week. It would greatly add to the usefulness of the collection to the public, were the Museum able to appoint guides who would at certain times pass through the exhibition rooms and explain the more interesting features of the collection to a limited number of visitors. This is accomplished to a certain extent for school children who visit the Museum with their teachers.

We are greatly indebted to Professor Hyatt for the care he has given to the collection of Invertebrate Fossils under his charge; he has spent considerable time in picking out additional Cephalopods, which have been placed on exhibition with the Systematic Collection of Mollusks. Mr. R. T. Jackson has also taken great interest in this collection, and we owe to him the acquisition of many interesting fossils filling gaps in our stores, as well as thanks for the time he has spent in arranging certain parts of the collection of Fossil Invertebrates.

Mr. Brewster has, as in former years, kindly supervised the care of the collection of Birds and Mammals.

To Mr. Faxon has fallen the general supervision of the Museum collections, and much of the routine work of the establishment. During the past year he has been mainly engaged in the revision of the collection of Mollusks, and in the printing of his Monograph on the Crustacea of the "Albatross" Expedition of 1891.

Mr. Garman reports that the alcoholic collections of Reptiles and Fishes are in unusually good condition, and the same is the case with the alcoholic collections of Invertebrates.

Mr. Henshaw also states that the Entomological Collections are in excellent condition, and that their use and that of the Entomological Library is constantly increasing.

Since last January, Dr. C. R. Eastman has been placed in charge of our collection of Fossil Vertebrates. Since the death of Dr. G. A. Maack, in 1871, it had received no attention. The immense accessions made since that time by purchase or by expeditions were merely unpacked and laid away in trays, often in the original wrappers. With the exception of the examination of some of the mammalian remains by Professors Scott and Osborne, nothing of value had been done. Dr. Eastman has now made a general revision of this collection, arranging the material systematically. We can therefore form some idea of what our desiderata are to make the collection, what it should be, a representative one both faunally and systematically. A great mass of valuable material will soon be available for exhibition, and we hope to lay aside for the Fossil Faunal Rooms such types as properly belong on exhibition. To give an idea of our Fossil Vertebrate collection, Dr. Eastman has prepared a chronological list of the collections which have at various times become the property of the Museum.

Dr. W. McM. Wordworth, who has had charge of the collection

of Worms during the greater part of the past year, has prepared a number of exquisitely mounted specimens, which have been placed in the Exhibition Rooms. He has devoted considerable time to making these preparations, and to obtaining additional material for the same purpose.

All attempts at placing any collections either in the Geographical or Geological Exhibition Rooms have been given up. One of the rooms is now occupied by the Ornithological Department, and in the other, which leads to the Botanical Exhibition Rooms, we expect to place such collections as will interest both the zoölogist and botanist.

It is hoped that the Geological and Geographical Exhibition Rooms will eventually be arranged in the southwest corner-piece, which is to adjoin the Mineralogical Collections, whenever the time comes, as it soon must, when the Geological and Geographical Departments will find their quarters in that section of the University Museum.

Mr. W. E. D. Scott succeeded, during the past year, in interesting a number of gentlemen in his plans for placing on exhibition a selected series of Birds, artistically mounted and isolated, so that each small case should illustrate some point of interest in ornithology. The sum of \$1,690 has been expended on this exhibit. A list of the gentlemen who have pecuniarily assisted Mr. Scott is given in Appendix D.

One of the Exhibition Rooms connecting the Zoölogical with the Botanical Department was assigned to Mr. Scott, and a short time before Commencement the room was opened to the public. It contained about fifty cases of exquisitely mounted birds, which cannot fail greatly to interest the public, and will add immensely to the value of our ornithological collection. The birds all formed part of Mr. Scott's collection of North American Birds, which he has presented to the Museum. In addition to these, Mr. Scott has also assigned to the Museum his collection of West Indian Birds. The whole consists of over 3,000 specimens, 1,500 North American and 1,600 West Indian Birds, and is an invaluable addition to the Ornithological Department of the Museum. (See Appendix E.) It is to be hoped that the exhibition of this unique collection will interest the friends of ornithology, and lead to some sufficient provision for the full development of Mr. Scott's plan. This embraces a local New England collection, a North American col-

lection, a Western Hemisphere collection, and ultimately a fairly representative general collection, each of which Mr. Scott hopes to illustrate, according to the plan pursued in the collection now on exhibition.

The Library has received either in exchange or by gift and purchase the usual number of accessions. The number of volumes is now nearly twenty-five thousand.

A list of the publications of the Officers and Instructors of the Museum, other than those contained in our Memoirs and Bulletins, will be found accompanying the special reports.

For a complete List of the Publications of the Museum during the past year I refer to Appendix A. The amount of our publications has been exceptionally large, owing to the number of Reports of the "Albatross" Expedition of 1891, as well as the Reports on my expeditions to the Bermudas and Bahamas and Cuba on the "Wild Duck," forming Volume XXVI. of the Bulletin (282 pp. and 77 Plates). Connected with the latter we have published as the last number of Volume XVI. of the Bulletin, which had remained uncompleted for many years, a Report by Professor R. T. Hill of the United States Geological Survey on his exploration of the island of Cuba. We have also issued the first number of the third volume of the Geological Series, Vol. XXVIII. No. 1. The principal Reports relating to the "Albatross" are the Memoir on the Holothurians by Professor H. Ludwig of Bonn, containing a number of colored figures of abyssal Holothuroidea (183 pp. and 19 Plates), and the Memoir on the Crustacea by Mr. Faxon, with ten colored Plates of deep-sea types (Vol. XVII. pp. 292, 67 Plates and 1 Chart). In the Bulletin have appeared the Reports of Dr. Ortman on the Schizopods, of Dr. Bergh on the Opisthobranchs, of Dr. Giesbrecht on the Copepods, of Dr. Hartlaub on the Comatulæ, and of Mr. Townsend on the Birds of Cocos Island and Malpelo, and by Dr. Dall and Mr. A. G. Mayer on some of the collections made by the "Wild Duck."

The Corporation made the Zoölogical Department a grant of \$400 to aid in the publication of some of the contributions from the Zoölogical Laboratory, which either have appeared in Volume XXVII. of the Bulletin, or are in the hands of the printer.

The Memoir by Mr. Garman on the Cyprinodonts (180 pp. and 12 Plates), mentioned in the last Report, has also been published.

These different publications comprise one volume and eleven numbers of the Bulletin, and one volume and two numbers of the Memoirs.

The Plates for Professors Milne-Edwards and Bouvier's Memoir on the Galathoidæ have been completed, and, as soon as they have been revised by the authors their Monograph can be sent to the printer.

The Plates to accompany Dr. Goës's memoir on the Foraminifera of the "Albatross" Expedition of 1891 are in his hands for revision, and the text has been sent to the printer. Dr. Müller's Report on the Ostracods is in the hands of the binder.

Excellent progress is making with the Monograph of Messrs. Wachsmuth and Springer on the Crinoidea Camerata of North America. Over 300 pages have been cast, and 50 Plates have been printed.

Mr. Garman is making good progress with his memoir on the Deep-Sea Fishes of the "Albatross" Expedition of 1891. About 20 Plates have been finished. I have myself prepared the greater part of my Report on the Echini of the same Expedition. It will be illustrated by at least 25 Plates, which will be taken in hand by Mr. Westergren as soon as the Plates for the Fishes are out of his hands. Dr. Mark reports that he has made fair progress with his Monograph of the remarkable deep-water Cerianthoid procured by the "Albatross."

I have also received the manuscript of the Report of Dr. Otto Maas on the Acalephs of the "Albatross" Expedition of 1891, to be accompanied by 15 Plates which are now in the hands of Messrs. Werner and Winter.

Professor Goode writes me that the Report on the Deep-Sea Fishes of the Western Atlantic by himself and Dr. Bean, which contains the "Blake" collection of Fishes, is in the hands of the printer.

In connection with my investigations on the Coral Reefs of the West Indies, and of the "Albatross" Expedition of 1891, Professor R. T. Hill of the United States Geological Survey has with the consent of the Director, made an extended exploration of the Isthmus of Panama, with a view of determining as far as is practicable the period at which the Isthmus of Panama was elevated, and when the connection which once existed between the Gulf of Panama and the Caribbean Sea ceased to exist. He was greatly

assisted in this exploration from the interest taken in the subject by Colonel Rives, the Superintendent of the Panama Railroad, to whom, as well as to the President of the road, we are greatly indebted for various favors connected with his expedition. Professor Hill made an extensive collection of rocks and of fossils, and is now preparing a preliminary report on the results.

During the past winter I spent a couple of weeks along the Florida Keys on a sea-going tug to re-examine them in the light of the experience I had gained in the study of the Bahama and Cuban reefs and of the Bermudas. A preliminary note on the results was published in the "American Journal of Science" from a letter written to the late Professor J. D. Dana. I was fortunate enough to obtain, thanks to the kind offices of Mr. Peter A. Williams of Key West, samples taken at every 25 feet of the core of an Artesian well driven on Key West Island from the surface to a depth of 2,000 feet. These samples have been placed for examination in the hands of Mr. E. O. Hovey and Mr. George H. Eldridge, of the U. S. Geological Survey, and I hope to add to my own report of this last exploration of the Florida Keys the results obtained by Messrs. Hovey and Eldridge. The Director of the U. S. Geological Survey has kindly consented to have an analysis made of the samples obtained, and Mr. Eldridge hopes to make a comparison of the core of the Key West well with those of Lake Worth, St. Augustine, and Tallahassee. It is thought that this examination may give us accurate results regarding the thickness of the Florida Reef, and the nature and age of the rocks upon which it rests.

In connection with the various expeditions undertaken by the Museum, I have to thank Commander C. D. Sigsbee, U. S. Hydrographer, and Colonel Duffield, the Superintendent of the U. S. Coast Survey, for assistance and suggestions.

Among the collections received I may mention that of the Deep-Sea Fishes made by the "Blake," which had been in the hands of Professor Goode and Dr. Bean while they were preparing their Memoir on the Deep-Sea Fish Fauna of the Western Atlantic, now in press. Dr. Goës has also sent back the Foraminifera of the "Albatross" Expedition of 1891, and the material from the Caribbean Sea belonging to the Coast Survey and to the Fish Commission, which had been sent him for comparison, has been returned to the Smithsonian (with a named collection of types) and to the Coast Survey.

We have received from the Smithsonian a series of types of Deep-Sea Fishes collected at various times by the "Albatross"; a collection of Fresh-water Fishes from Tennessee, Kentucky, and Texas; also a collection of Sponges from Alaska, collected by Dr. Dall, and identified by Mr. Lawrence M. Lambe of the Canadian Geological Survey. The National Museum has sent us a set of the more interesting deep-sea types from the collection of Holothurians returned by Dr. Ludwig.

We have as usual filled a few gaps in our collections by purchases from Prof. H. A. Ward and from Rowland Ward & Co. A small collection of Pteropods has been obtained from Mr. Sowerby.

Thanks to the kindness of the authorities of the British Museum, we have been able to secure a large collection of casts representing types the originals of which we can hardly hope to obtain. A part of this collection has been received, and we are indebted to Dr. H. Woodward for supervising that invoice.

Messrs. Scott and Osborne have returned the Fossil Mammals which had been lent to them.

The cast of *Iguanodon* obtained from the Brussels Museum has been successfully mounted, and forms the centre-piece of the Jurassic Exhibition Room.

From the Oxford Museum we have received in exchange some casts through Professor Lankester.

From Mr. Alan Owston we have received a few Japanese desiderata; from Mr. Russell Johnson of Buffalo some specimens of *Eurypterus*; from Dr. Beecher some interesting preparations of *Trilobites*; from Mr. Appleton Sturgis a most interesting Sponge from New Guinea; and from Mr. F. W. Townsend a valuable alcoholic collection of Invertebrates from the Persian Gulf.

As will be seen from the special reports, considerable material has been sent to different investigators, either for study or in exchange, and I may mention the National Museum, the British Museum, and the Jardin des Plantes as having received from us collections to fill some of their desiderata.

The alcoholic specimen of *Pleurotomaria* collected by the "Hassler" has been sent to Professor E. Bouvier of the Jardin des Plantes for investigation.

As usual, the facilities, offered by the Museum Library and its collections have been available to properly qualified persons under

suitable restrictions. These often seem petty to the applicants, but are the results of our experience as necessary for the safe-keeping of the books and of the collections.

I beg to call the attention of the Corporation to the precarious situation of the Museum. We have been most fortunate during the past twenty years in enlisting the support of Assistants who have served the Museum for small salaries, or who have given their services, from the interest they felt in its development, and on account of the facilities for investigation afforded to them. It is evident that, however satisfactory this may be to us at present, we can hardly hope to depend upon this state of things as upon a permanent organization.

The time will come when the Curator must receive an adequate compensation, and whenever we are obliged to pay our comparatively small staff for their whole time such salaries as are paid at other institutions for similar work, our salary lists will have to be greatly increased merely to carry on the organization of the Museum as it now exists. If the Museum is hereafter to expect a reduction of income as great as it has suffered during the past year, a totally different scale of expenditures must be established if we would keep within the limits of our resources.

For the academic year 1894-95 our income has diminished fully fifteen per cent, leaving us a sum totally inadequate for so large an institution. We cannot hope to preserve the collections and properly care for them with a smaller staff than we at present employ for that purpose. We can only curtail our expenditures by limiting our publications and the purchase of books, by withdrawing all facilities now given for original research, and in fact by stopping the wheels of everything which has given it its activity in the past. Such a condition of things is greatly to be deplored; for it is very doubtful if the Museum could long retain the services of skilled Assistants or of a competent Director after its scientific usefulness was so seriously impaired by want of means.

ALEXANDER AGASSIZ.

CAMBRIDGE, October 1, 1895.

REPORT ON THE COURSES OF INSTRUCTION IN GEOLOGY.

DURING the Academic year 1894–95, 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.) A whole course in Elementary Geology; two lectures a week by N. S. Shaler, with a third lecture and an hour for special exercises by R. E. Dodge and R. A. Daly, and with required reading and field-work. Attended by two hundred and twenty-four students.

2. (Geol. 8.) A course in General Critical Geology; two lectures a week by J. B. Woodworth, with an additional hour for review. During the autumn and spring ten half-day excursions were made in the field to points in the vicinity of the University. Each student prepared a thesis during the winter months, and a map and report upon some locality in the neighborhood. Fourteen students took this course.

3. (Geol. 22 *a*.) 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, conducted by Mr. Griswold, under the direction of N. S. Shaler, W. M. Davis, and J. E. Wolff. Conferences were held once a week during the year. It was attended by three students.

4. (Geol. 22 *b*.) An advanced course of research for special geological investigation in the field and laboratory, designed for second-year students who have already passed in the work of 22 *a*. The work in this course is under the personal supervision of the different instructors of the Department. It was attended by three students.

Instruction in Petrography.

5. (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 nine students.

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

Instruction in Mining Geology.

7. (Geol. 10.) A course in Mining Geology, by H. L. Smyth. Lectures, laboratory and field work; half-course three times a week, beginning the first Monday in December and closing the last Friday in April. Attended by ten students.

8. (Geol. 11.) A course in Geological Surveying, by H. L. Smyth. Lectures, laboratory and field work, three times a week, beginning the first Monday in December and closing the last Friday in April. Attended by five students.

9. (Geol. 25.) A course in Mineral Veins and Metalliferous Deposits; their mode of occurrence, and theories of their origin; by J. D. Whitney. Lectures once a week, with additional laboratory hours and required reading and theses. Attended by four students.

Instruction in Palæontology.

10. (Geol. 14) A course in Palæontology, by N. S. Shaler, assisted in the laboratory by R. T. Jackson and C. R. Eastman. Three lectures and four hours of laboratory a week, with theses. This course was attended by seven students.

11. (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 and C. R. Eastman. This course was taken by four students.

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, second half-year. Attended by seventy students.

13. (Geol. 2.) A half-course in Physical Geography, by W. M. Davis, assisted by L. S. Griswold. Two or three lectures a week, with laboratory work and recitations, first half-year. Attended by thirty-four students.

14. (Geol. 20.) A course in advanced Physical Geography, by W. M. Davis. Conferences held once a week. Attended by six students.

15. (Geol. 21.) A course in advanced Meteorology, by W. M. Davis. Conferences held once a week. Attended by one student.

16. (Geol. 6.) A half-course in the Physical Geography of the United States, by W. M. Davis. Lectures, library work, and reports, second half-year. Attended by eleven students.

Instruction in Special Geology.

17. (Geol. 16.) A course in Glacial Geology, by J. B. Woodworth. Lectures once a week, with additional hours for conferences, field and laboratory work. Attended by four students.

18. (Geol. 27.) A course in the Pre-Cambrian Geology of North America; with especial reference to the stratigraphy and economics of the rocks in the original Laurentian area, and the region of the Great Lakes, by H. L. Smyth. Three times a week. Attended by three students.

Summer Courses.

19. (Geol. S. 1.) A course in Elementary Geology, beginning July 5, and lasting six weeks, under the direction of N. S. Shaler, by R. A. Daly. Instruction was in the form of lectures, laboratory work, and field excursions. Besides the systematic lectures by Mr. Daly, special subjects were treated by Professors Whitney, Shaler, Davis, and Wolff, and Mr. Woodworth. Attended by sixteen students.

20. (Geol. S. 2.) An advanced course in field study of the Geology of the stratified rocks, beginning August 17, and continuing six weeks, at Utica, N. Y., by A. P. Brigham, Professor of Geology, Colgate University; at Catskill, N. Y., by H. B. Kümmel, of the New Jersey Geological Survey; and at Meriden, Conn., by L. S. Griswold. Attended by six students.

21. (Geol. S. 6.) A course in Physical Geography, beginning July 5, and lasting five weeks, by W. M. Davis. Lectures, laboratory work, and excursions. Attended by nine students.

22. (Geol. S. 8.) A course in Meteorology, beginning July 5, and lasting four weeks, by R. DeC. Ward. Lectures and laboratory work. Attended by one student.

REPORT OF THE STURGIS-HOOVER PROFESSOR
OF GEOLOGY.

BY PROFESSOR J. D. WHITNEY.

DURING the past year (1894-95), in accordance with the plan indicated in the Sturgis-Hooper Professor's last Report, a course of lectures, lasting through the year, was delivered by him. This course was entirely devoted to the subject of the Economical Geology of the metalliferous minerals, embracing the mode of occurrence, origin, and classification of the metals and their ores, and including statistics of their production throughout the world, as also a very condensed statement of the historical development of this branch of industry. This part of the course of Economical Geology having been expanded to twice its former length, it was possible to go much more fully into details than had ever before been done. As the course is now arranged, a student should, if properly fitted, be able to acquire during the two years given to the whole subject of applied geology, which necessarily embraces a considerable amount of applied chemistry, as much knowledge as seems necessary for one not making a specialty of either of these branches. That every geologist should have some general idea of the nature of mining operations and of the mode of occurrence of ores seems certainly most desirable, and that every chemist should have a corresponding amount of knowledge of the origin and distribution of the raw materials with which he has to do, as well as of the nature of metallurgical operations in the large way, seems equally important. In point of fact, however, the number of students who desire to take Economical Geology, and who are fitted for this work by previous elementary preparation, is but small, and seems to be growing smaller. There appears to be a growing inclination to neglect the practical side of geology and chemistry, and to take instead subjects which are purely theoretical, and in regard to some of which it can be said with truth that they have not yet

become settled on a sufficiently solid basis of fact to be fit subjects for elementary teaching.

To get together as complete a library as possible in the department of Economical Geology has been, and still is, the aim and desire of the Sturgis-Hooper Professor, and it can be said with truth that there are but few important works in this line which cannot be found in the libraries at the Museum. Only two very desirable mining periodicals are wanting to complete sets. These are, the *Journal of Mining*, published by the Russian Government, and the *Transactions of the North of England Institute of Mining Engineers*. Of several of the more important older works published in England and Germany and devoted to mining geology, copies have been obtained, at last, after years of search. Miss H. S. Clark has continued, during the past year, the arrangement and cataloguing of this material, and a beginning has been made of classifying and cataloguing the manuscripts and pamphlets which have been collected for the purpose of illustrating the various topics embraced in the lectures on Economical Geology. Many of these works are rare and important. The value of this material is not yet thoroughly appreciated, but it will become so in proportion as more thorough work is found desirable in this department.

The Sturgis-Hooper Professor has given whatever time was available, after the preparation of his lectures and the superintendence of the work in the library, to the general topics in geology toward which his thoughts have been turned during the past years, the most important of which is that of historical climates, a subject which still remains involved in deep obscurity.

REPORT ON COURSES IN GENERAL GEOLOGY
AND PALÆONTOLOGY.

BY PROFESSOR N. S. SHALER.

DURING the past year Mr. Shaler has been compelled to devote a large share of his time to administrative tasks connected with scientific and academic work outside of the department, in addition to his duties as Professor of Geology. As Dean of the Scientific School, Chairman of the Committee on the Summer School, President of the American Geological Society, and member of the Massachusetts Highway Commission, he has been called on to do a considerable amount of executive labor. The result of this is shown in the small amount of publication which he has made. In addition to the few papers noted in the list, he has however brought substantially to completion, with the assistance of Mr. J. B. Woodworth and Dr. A. F. Foerste, a memoir long in hand concerning the Narragansett Basin, which is to be published by the U. S. Geological Survey. He has also sent in to the same Survey a paper for the Annual Report of 1894-95, concerning the Road Building Stones of Massachusetts. On this work he has had the collaboration of Mr. L. W. Page.

Mr. Dodge reports regarding the course in General Geology substantially as follows. During the past year, extensive additions have been made to the laboratory materials for students' use and for reference, by gift, by personal collection, and by purchase. Among the gifts, should be mentioned a number of stalactites, concretions, and friable sandstone, from Prof. J. A. Merrill, of the State Normal School, Warrensburg, Mo.; and twenty geological maps from Dr. C. Willard Hayes, U. S. Geological Survey. All specimens for students' use have been procured in sets of fifty, each set being numbered alike. All the collections, old and new, have been numbered and catalogued, following the system employed by Dr. Jackson in the palæontological collections. While the teaching collections have thus been placed in good condition, large table specimens for class illustration are still needed; and

a small series of fossils especially designed for use in the elementary course would be useful in avoiding the present practice of borrowing from the collections primarily intended for the palæontological courses. A clinometer-compass was designed especially for the use of students in their field-work; it is now made by Messrs. Keuffel and Esser of New York. The laboratory and field work in the elementary course have been somewhat changed from last year's plan; more attention has been given to study of rock specimens indoors, and to the construction of field maps outdoors. The Pondville locality of carboniferous rocks in Norfolk County has been included in the excursions, of which eleven were made, the class being divided into small sections for this purpose.

Mr. Dodge gave a course in elementary geology to a class of sixteen students in Radcliffe College; the plan of the course was similar to that given to the Harvard College students, and this year for the first time equivalent laboratory opportunities were given to the two classes.

During the summers of 1894 and 1895, Mr. Dodge has acted as assistant to Dr. C. W. Hayes in geological field-work in Tennessee. At the close of the past year he resigned his position as Instructor in Geology at Harvard to accept the instructorship in geography and geology in the Teachers College, New York City.

Dr. R. T. Jackson reports substantially as follows concerning the courses in Palæontology. The teaching collections have been increased by various additions, and arranged throughout in a manner that much facilitates their use by students. A moderate number of palæontological books and papers have been added to the working library. The Museum library has deposited with these collections, as a permanent loan, fifty-eight diagrams, including fifty-six palæontological diagrams by Zittel; these have now been mounted on rollers. The following gifts are acknowledged. A collection of fossils and rock specimens from Dr. T. W. Harris, including specimens from localities not before represented, and samples of the unfossiliferous layers of our palæozoic formations. Some specimens needed to fill gaps have been received from the Museum of Comparative Zoölogy. Mr. B. S. Oppenheimer gave a small collection of fossil gums, other than amber, from localities of economic interest. Prof. A. P. Brigham, of Colgate University, presented a lot of fossils from the Devonian of New York. Gifts were also received from Prof. A. Hyatt, Dr. C. R. Eastman,

and Messrs. R. E. Dodge, J. B. Woodworth, J. H. Sears, and F. M. Lowe. Purchases of material include sixty species of fossils from the coal measures of Peoria, Ill., mostly Invertebrates; a number of well preserved Trilobites and Brachiopods, showing spires, hinge structure, muscular impressions, etc.

The most pressing needs of the palæontological collections in use by the instructors are well preserved fossils showing structural details, and microscopic sections of fossils exhibiting minute structure. Additional cases are needed for storage. Several palæontological reports of State surveys, constantly in demand in the laboratory, could with advantage be added to the working library.

Dr. Jackson spent a considerable share of his time working in the palæontological department of the Museum of Comparative Zoölogy. During his sickness, in the autumn and early winter, he was replaced by Dr. C. R. Eastman, who resigned a fellowship at Yale in order to assist the department at this time of need; for the remainder of the year Dr. Eastman was occupied on collections of fossil Vertebrates in the Museum.

During the past year, Mr. J. B. Woodworth was in charge of the second course in General Geology (Geol. 8) and of the course in Glacial Geology (Geol. 16). Owing to the destruction of several of the most instructive geological exposures in the immediate vicinity of the University by the advance of quarrying and grading, it has been necessary to visit more distant points in the excursions of Course 8. The Carboniferous rocks of the Norfolk County Basin, at Pondville and Canton Junction, were selected for new teaching localities. During the April recess, a voluntary excursion — allowed to count as the equivalent of four spring half-day excursions — was made to the Cambrian and Carboniferous rocks near Attleborough, Mass.

Course 16, Glacial Geology, was given to four students for the first time this year. It was devoted mainly to a study and exposition of the glacial deposits as they exist in this country, with particular reference to training students in the discrimination and description of these deposits, and of attendant glacial phenomena in the field. The University is favorably located for this kind of investigation, and with the recent advances made in the interpretation of the stratified drift deposits, almost every square mile in Eastern Massachusetts affords opportunity for instruction. One

student examined the brick clays about Boston, and confirmed an earlier unpublished conclusion of the instructor that they are older than the last glacial deposits, including the drumlins, and that they are likewise of glacial origin. Work was also done in Rhode Island in tracing boulder moraines. The results of these investigations will be embodied in forthcoming publications.

A course equivalent to Geology 8 was given to two students of Radcliffe College.

Mr. Woodworth's time, when not employed in teaching, has been given to the completion of a map and report upon the Carboniferous Rocks of the southeastern part of Massachusetts and Rhode Island, in collaboration with and under the direction of Professor Shaler, for the U. S. Geological Survey.

The following papers are in preparation as the result of investigations carried on or brought to a close during the year:—

The Stratigraphic Succession in the Rhode Island Coal Area.

On the Fracture System of Joints in Pelites.

The Glacial Sand-Plains of Narragansett Bay.

The Geology of Block Island.

Geological Field-Work.

During the past year research in general geology has been carried on in two classes: Geology 22 *a*, comprising students just entering upon research work in the University, and Geology 22 *b*, including more experienced men. In 22 *a* the work was closely supervised by Mr. Griswold, and the students individually were given considerable time in field and laboratory by the instructor. In the fall, work in the Boston Basin gave valuable results, and one paper was published, "The Southwestern Part of the Boston Basin," by Mr. J. L. Tilton, in the Proceedings of the Boston Society of Natural History. During the spring season a considerable part of the Nashua Basin was studied, and interesting features of structure and metamorphism determined. In Geology 22 *b* the men followed work of their own choice with the advice of a selected instructor. Mr. H. I. Richmond continued the work of a previous year upon New England shore lines. Mr. C. F. Marbut pursued work upon the geology of part of Missouri for publication by the State Geological Survey. Mr. Marbut is now Instructor in Geology at the Missouri State University, and is

also connected with the Missouri Geological Survey. Mr. Tilton has returned to his position as Professor of Natural Science in Simpson College, Indianola, Iowa.

A trip made by Mr. Griswold through the West during the past summer has been fruitful in the way of geographical and geological observation. Visits were made to the Arizona plateau, in the neighborhood of the Grand Canyon of the Colorado and the San Francisco Mountains; to the Pacific slope, with sections across the Sierra Nevada and the Cascade ranges to the interior basins; to the desert regions of Idaho, Utah, and Arizona; and to the Rocky Mountain plateau in Montana, Wyoming, and Colorado. During this excursion an address was made to the Teachers' Institute of Lewis and Clarke County, Montana, on Geology in a Common School Education.

REPORT ON COURSES IN THE SUMMER SCHOOL.

THE department has this year somewhat increased its offering of courses which may be pursued during the summer vacation. The aggregate attendance on these courses was thirty-two. The greater part of the instruction was given by officers of the department, all those in service taking some share in the work. It was, however, as heretofore, found necessary to call on others for aid in the second summer course in Geology. The department is indebted to Prof. A. P. Brigham of Colgate University, and to Dr. H. B. Kummel of the New Jersey Geological Survey, for instruction at Utica and Catskill respectively.

REPORTS OF SUB-COMMITTEES.

THE more formal departmental business has been carried on in meetings that have been held on the evening of the second Tuesday of each month, after the close of the geological conference. The subjects thus discussed have been plans of courses for the coming academic year, recommendations of applicants for graduate scholarships and fellowships, and the development of the departmental resources. Special consideration by sub-committees has been given to several subjects. The field-work introduced in the various courses has been carefully revised by Professor Shaler and the instructors engaged in this branch of teaching, with the object of securing for those students who give a large share of attention to geology a systematic acquaintance with the features of our neighborhood. A general revision has been made by Messrs. Dodge, Jackson, and Woodworth of all the geological maps in the various libraries and laboratories, in the hope of completing a central collection: all the maps of this kind belonging to the department have been arranged and catalogued, and a rough list has been made of similar maps in the College Library. It is hoped that a special appropriation may be made by the University Library Council for the purchase of foreign geological maps during the coming year, thus continuing the systematic growth of our collections in the manner already so successfully applied in the collection of foreign large-scale topographical maps. Mr. A. L. Rotch of the Blue Hill Observatory has kindly acted with Mr. Ward in looking over all our meteorological materials, in order to concentrate climatological works in the library of the Harvard College Observatory, where a large collection of such material already exists; the College Library is thus relieved of a certain responsibility, and enabled to extend its collection of general meteorological publications.

The report of the sub-committee on the Gardner Collection of Photographs, Messrs. Woodworth, Griswold, and Dodge, shows a great improvement in the condition of the collection, and a considerable increase in its size. All the photographs are now arranged in geographical order in large folios; a list of accessions and a systematic card catalogue are maintained. It is now proposed to select those views that are most frequently used in teach-

ing, and keep them aside from the general collection, protecting them by adjustable covers. An exhibition of representative general views is also contemplated, and a selection of local views is proposed for exchange with similar collections from other institutions. Many new lantern slides have been secured; some by purchase, as the set illustrating the Great Barrier Reef of Australia, from the negatives of Mr. Kent, some by copying photographs in the general collections. These slides are continually in use in our various courses for class illustration. The negatives from which many slides are made are preserved and catalogued, so that they can easily be duplicated. The committee is under obligations to Professor William Libbey, Jr., of Princeton, for prints of his Hawaiian views and of those he obtained on the Peary Relief Expedition to Greenland in 1894; to Professor I. C. Russell, of Ann Arbor, for the set of views in the Malaspina District of Alaska; to Dr. C. Hart Merriam of the Department of Agriculture, Washington, for the privilege of copying his collection of views from Death Valley, Cal.; to Mr. F. H. Newell, of the United States Geological Survey, for a similar privilege with certain views illustrating irrigation; to Mr. Edward L. Wilson, of New York City, for the gift of a number of views of Natal and the Azores, as well as for assistance in procuring views from South Africa and New Zealand. About six hundred and fifty pictures have in all been added to the collection during the year.

REPORT ON COURSES IN MINING GEOLOGY.

BY ASSISTANT PROFESSOR H. L. SMYTH.

THE courses in Mining Geology and allied subjects given by Mr. Smyth were, by arrangement with the Department of Chemistry, held in the Mineralogical Lecture Room of the University Museum. The three courses began early in December, 1894, and ended in the April recess, 1895; the open season before and after these dates being reserved by Mr. Smyth for his own field-work and other studies. During the April recess, a voluntary excursion was made for the benefit of the students in the course on Mining Geology to Pennsylvania and New Jersey, in the course of which the nickel mine at Lancaster Gap, the iron mines at Cornwall, several blast furnaces at Lebanon, the Bethlehem Iron Works at South Bethlehem, the zinc deposits at Franklin, and the experimental magnetic concentrating plant at Ogden were visited, the latter by the permission of Mr. Edison.

During the year the scientific library of Professor Raphael Pumpelly was made accessible to the students in these courses, as well as to those in the courses in Mineralogy, the Department of Mineralogy having provided the room in which the library is temporarily installed in the University Museum. The collection includes upwards of three thousand bound volumes, besides numerous pamphlets and maps; it is especially strong in economic geology, metallurgy, and mineralogy.

Numerous additions have been made to the collections of mine maps and of photographs illustrating the structural relations of ore bodies. A number of typical specimens of ores were collected. About one hundred thin sections were added to the series available for study in the course on Pre-Cambrian Geology.

The most pressing need in these courses is room for the proper storage and arrangement of geological specimens, so that they can be conveniently examined by students. During the past year two rooms in the basement of the University Museum were used for these purposes; but in the coming year the rooms will be needed by the Department of Mineralogy and Petrography. A number of instruments are needed in the course on geological surveying.

REPORT ON COURSES IN PETROGRAPHY.

BY PROFESSOR J. E. WOLFF.

THE usual courses were given in Elementary Petrography (Geol. 12) and in Advanced Petrography by Professor Wolff, assisted by Mr. C. L. Whittle. The former course was attended by nine students and the latter by three.

Original work was carried on by Mr. R. A. Daly in the preparation of a Monograph on Ascutney Mountain, Vermont, and in completing some work on the Porphyritic Gneiss formation of New Hampshire. Mr. C. F. Marbut investigated the microscopic characters of some siliceous limestones and allied rocks.

Field work in the Archæan Highlands of New Jersey in connection with the United States Geological Survey has been carried on by Professor Wolff in the summer, and during the winter considerable time was devoted to the preparation of a joint Monograph on the Crazy Mountains, Montana, in collaboration with Mr. Walter H. Weed.

The subjects of Mineralogy and Petrography, of which the former has been placed under Chemistry and the latter under Geology, were in June united to form a new department of instruction, named the "Department of Mineralogy and Petrography," and placed in the Division of Natural History. This union of two closely connected subjects will prove a great advantage both as regards instruction and investigation and economy of resources. The two chemical laboratories belonging to each separately have thus been united into one in the Mineralogical Section of the Museum, and an excellent laboratory for mineral and rock analysis will thus result. In the same way, a joint library has been formed by uniting the two previously separate partial libraries, and the collections and apparatus will be used to better advantage.

REPORT ON COURSES IN PHYSICAL GEOGRAPHY.

BY PROFESSOR W. M. DAVIS.

THE courses of instruction in charge of Professor Davis have been carried on in much the same manner as in previous years. In Elementary Physical Geography, Mr. L. S. Griswold has acted as Assistant, while in Elementary Meteorology this duty has been performed by Mr. R. DeC. Ward. A new half-course in the second half-year on the Physical Geography of the United States was offered for the first time: it was given by lectures in the Geographical Laboratory, where maps and photographs could be conveniently displayed. The chief subjects discussed in the advanced course in Physical Geography were the features of shore lines, and their use as criteria of uplift and depression, this being the subject of the thesis in preparation by Mr. Gulliver; the physical features of Missouri, in which Mr. Marbut of the Missouri Geological Survey introduced a number of original observations; the Physical Geography of New York State, by Mr. Kennedy; the Alleghany Plateau, by Mr. Abbe; and the Physical Geography of Utah, by Mr. Tanner. In the advanced course in Meteorology, Mr. Schoenfeld made what may be called a meteorological section of Africa from north to south, from which it appears clear that the southwest monsoon of the northern summer is well developed in the interior of the continent for a number of degrees north of the equator.

The chief addition to the collection of laboratory materials has been a number of grouped sheets of the Topographical Map of the United States; these proved to be invaluable in the course on the Physical Geography of our country. The laboratory has lately been uncomfortably crowded by the necessity of storing there a number of maps and models that have been previously kept in the Geological Exhibition Room, on the floor below. There is at present no adequate provision for the exhibition of these excellent geographical illustrations.

The visit to Europe made by Professor Davis in the summer of 1894 supplied a number of photographs, taken by himself, and since then reproduced in lantern slides; those illustrating certain details in the process of the migration of river divides along the margin of the Swabian Alp in Würtemberg being especially useful. The same visit served as the basis of two studies on the natural history of rivers: one on certain rivers in England, mentioned in the list of publications given below; the other on the Seine, the Meuse, and the Moselle, shortly to be published in the "Annales de Géographie" of Paris, and in the "National Geographic Magazine" of Washington. The latter subject served also as the title of a lecture before the National Geographic Society in February last.

Following a plan laid in the spring of 1894, a course of informal lectures on "Meteorology in the Schools" was given by Professor Davis and Mr. Ward, to an audience of about thirty teachers selected from the Cambridge Grammar Schools. This course was originated by a committee of the New England Meteorological Society, in order to promote instruction in Elementary Meteorology. The course was repeated by Mr. Ward to the teachers of Hingham, Mass. Good results are believed to have followed these efforts. A considerable measure of time was given during the winter by Professor Davis to supervision of the physical element in Frye's "Complete Geography," lately published by Ginn & Co.; the share of attention allowed to Physical Geography being much greater than is commonly the case in grammar school text-books.

For the first time in several years, Professor Davis took part in the summer courses of instruction, offering the subject of Physical Geography. Although the class numbered only nine, two women and seven men, the spirit of the work was encouraging in the highest degree. Lectures were given daily in the laboratory, followed by various practical exercises on maps, models, books, etc. Excursions were made to Nantasket, Newtonville, Provincetown, and the Connecticut and Deerfield valleys, giving good opportunity for the study of a variety of geographical forms in the field. A brief interruption was made during the progress of the course, in order that the instructor might give three lectures in the State Summer School at Norwich, Connecticut.

PUBLICATIONS BY MEMBERS OF THE GEOLOGICAL
DEPARTMENT SINCE THE LAST REPORT.

By N. S. Shaler: —

Report of the Work done in the Atlantic Coast Division of the U. S. Geological Survey for the year ending June 30th, 1893. Fourteenth Annual Report of the Director, U. S. Geological Survey, Part I. pp. 194-197. Washington, 1893.

Evidences as to Change of Level. Bull. Geol. Soc. Amer., Vol. V. pp. 141-166. January, 1895.

Second Annual Report of the Mass. Highway Commission. Public Document, No. 54, January, 1895, pp. 68. (With George H. Perkins and W. E. McClintock.)

Edited Geological Terms in the Standard Dictionary of the English Language, Vol. II. 1895. (With Prof. W. B. Dwight and J. B. Woodworth.)

By William M. Davis: —

Note on Croll's Glacial Theory. Trans. Geol. Soc. of Edinburgh, 1894, Vol. VII. pp. 77-80.

Meteorology in the Schools. School Review, November, 1894, Vol. II. pp. 529-539.

The Ancient Outlet of Lake Michigan. Pop. Sci. Mo., December, 1894, Vol. XLVI. pp. 217-229.

The Development of Certain English Rivers. Geographical Magazine (London), February, 1895, Vol. V. pp. 127-146.

The Education of the Topographer. Science, 17 May, 1895, (New Series,) Vol. I. pp. 546, 547.

Need of Geography in the University. Educational Review, June, 1895, Vol. X. pp. 22-41.

Current Notes in Physiography. Science, 15 February, 1895, and following numbers.

By J. E. Wolff: —

Geology of the Green Mountains in Massachusetts. By Raphael Pumphrey, J. E. Wolff, and T. Nelson Dale. Monograph 23 U. S. Geological Survey, 4to, 206 pp., 23 pl. (Part II., "The Geology of Hoosac Mountain," by J. E. Wolff.)

By H. L. Smyth:—

The Quartzite Tongue at Republic, Michigan. *Journal of Geology*, Nov.—Dec., 1894.

The Republic Trough. Chapter IV. of an article on the Marquette Iron District, Fifteenth Annual Report of the U. S. Geological Survey. [In press.]

The Geological Structure of the Western End of the Vermilion Range. [With J. R. Finlay.] *Transactions of the American Institute of Mining Engineers*, Atlanta Meeting, October, 1895. [In press.]

By R. DeC. Ward:—

1. Distribution of Thunderstorms over the Earth's Surface. *Bulletin of the New England Weather Service*, October, 1894.

2. Recent Foreign Studies of Thunderstorms: Russia. *Am. Met. Jour.*, February, 1895, Vol. XI. pp. 364–358.

3. Recent Foreign Studies of Thunderstorms: Switzerland. *Am. Met. Jour.*, April, 1895, Vol. XI. pp. 435–441.

4. Edited the *American Meteorological Journal*. An Illustrated Monthly devoted to Scientific Meteorology and Allied Branches of Study. Vol. XI. Boston, Ginn & Co., 1894–95.

By L. S. Griswold:—

Origin of the Arkansas Novaculites. *Proc. Bost. Soc. Nat. Hist.*, February 9, 1895. 8 pp.

Origin of the Lower Mississippi. *Proc. Bost. Soc. Nat. Hist.*, May 14, 1895. 5 pp. and Map.

By J. B. Woodworth:—

1. Edited *Geological Terms* in *The Standard Dictionary of the English Language*, Vol. II., 1894. (With Professors Shaler and W. B. Dwight.)

2. The Relation between Baselevelling and Organic Evolution. *The American Geologist*, Vol. XIV., 1894, pp. 209–235.

3. Notices of two Papers by John H. Sears. *The American Geologist*, Vol. XV., 1895, pp. 264–266.

4. April Recess Excursion. *The Harvard Graduates' Magazine*, Vol. III., June, 1895, pp. 538, 539.

By R. T. Jackson and T. A. Jaggar:—

Arrangement and Development of Plates in the Melonitidæ. *Abstract. Amer. Geol.*, Vol. XV. No. 4, October, 1895, pp. 239, 240.

REPORT ON THE INSTRUCTION IN ZOOLOGY.

By PROFESSOR E. L. MARK.

As in previous years, the number of students from each of the various classes completing the several courses in Zoölogy is given in tabular form.

Courses.	Grad.	Sen.	Jun.	Soph.	Fr.	Spec.	Sci.	Total.
Zoöl. 1	4	8	15	25	37	5	33	127
" 2	3	7	7	21	4	2	14	58
" 3	1	3	5	1	0	0	13	23
" 4	4	3	1	1	0	0	5	14
" 5	3	3	1	1	0	0	5	13
" 6	5	4	0	0	0	0	0	9
" 7	5	2	1	0	0	0	3	11
" 20 a	8	1	0	0	0	0	0	9
" 20 c	0	0	1	0	0	0	0	1
Totals	33	31	31	49	41	7	73	265

During the year 1894-95 there was an increase over the preceding year in the number of students taking Zoölogy, which was fairly evenly divided among the different courses.

Zoölogy 1 was conducted by Dr. C. B. Davenport, without material changes from the course as given in the previous year. His Assistants were: Chief Assistant, Mr. H. V. Neal; Sub-Assistants, Messrs. S. K. Fenollosa, J. M. Prather, and F. H. Pratt. The limit of accommodations in laboratory work in this course has been reached, and any further increase in numbers will have to be met by providing a supplementary room for the excess.

Dr. G. H. Parker had charge of Zoölogy 2, and his Assistant was Mr. H. S. Jennings. The animals studied and the laboratory methods pursued were substantially as in former years.

Dr. Parker also conducted Zoölogy 3, as in the year 1893-94. He was assisted in the laboratory work by Mr. W. B. Cannon. The only considerable change in the laboratory work was an increase in the time given to special-topic work from four weeks to six weeks. In connection with this course a paper was prepared by Dr. Parker and Mr. R. Floyd on the Preservation of Mamma-

lian Brains by Means of Formol and Alcohol, which will appear in the "Anatomischer Anzeiger."

The demand for instruction in microscopical technique exceeded the accommodations of the room devoted to that work, so that it was with considerable inconvenience that places — some of which were unsuitable — were provided for most of the applicants for Zoölogy 4. In this course Dr. W. McM. Woodworth, as usual, had charge of the laboratory work and gave part of the lectures.

Zoölogy 5 was elected by all the students who took Zoölogy 4, except in the case of a Graduate student in Botany. Dr. Woodworth conducted the laboratory work in this course also. His duties were considerably greater than in previous years, owing to the increased size of these two classes.

In Zoölogy 6, by Dr. Davenport, there were four constant attendants upon the lectures, who were not regularly enrolled, and who undertook no laboratory work. In connection with this course the following paper, among others, was prepared: On Acclimatization of Organisms to Poisonous Chemical Substances. By C. B. Davenport and H. V. Neal.

It is intended to divide the subject matter of this course in the future, so that those problems of Morphogenesis which relate to the development of the individual (Ontogenetic Part) and those which relate to the evolution of the race (Phylogenetic Part) shall be treated of in alternate years. This will allow a more thorough and exhaustive treatment of the whole field, and will be equivalent to offering to advanced students an additional course.

Zoölogy 7 consisted in a course of lectures by Dr. Parker, given in the first half-year, as previously, and covering the same ground. It is proposed in this course, also, to divide the subject so that in alternate years the lectures will be different. These will consist of a general introduction to the study of the nervous system, followed by a fuller treatment of one or more of its main divisions. In the introductory lectures the following topics will be presented: —

- (1) Methods for the study of the nervous system.
- (2) General structure and functions of the nervous system.
- (3) Types of sense organs and the origin of afferent impulses.
- (4) Central organs and the transmission and translation of impulses.
- (5) Terminal organs of efferent nerves: muscles, luminous organs, glands, etc.

The topics for more extended consideration will not be the same in successive years. The special topic for 1895-96 will be the Sense Organs.

An account of the work in Zoölogy 20 *c* is contained in the Report on Osteology, by Dr. Slade.

All the students engaged on special problems (Zoölogy 20 *a*) made satisfactory progress in their work, except in the case of one Scientific School student, who was compelled by the condition of his eyes to give up Zoölogy.

The degree of Doctor of Philosophy was conferred at the last Commencement upon three students in Zoölogy, two of whom now have college positions. The degree of A. M. was conferred on four zoölogical students.

The Zoölogical Club seems to have become a permanent and valuable adjunct to the department. Its meetings are well attended, and the interest in them does not diminish.

By a special appropriation from the Corporation of the University, and a generous gift from the Curator of the Museum, it was possible to publish in the Museum Bulletin a portion of the Contributions from the Zoölogical Laboratory that had not been provided for at the end of last year. The Contributions published since my last report are, Nos. XLII.-XLIX., as follows:—

XLII. On the Cell Lineage of the Ascidian Egg. A Preliminary Notice. By W. E. Castle. Proc. Amer. Acad., Vol. XXX. pp. 200-216. 2 Pls. October, 1894.

XLIII. On the Blastodermic Vesicle of *Sus scrofa domesticus*. By A. W. Weysse. Proc. Amer. Acad., Vol. XXX. pp. 283-323. 4 Pls. December, 1894.

XLIV. Spermatogenesis of *Caloptenus femur-rubrum*. Preliminary Notice. By E. V. Wilcox. Anatomischer Anzeiger, Bd. X. No. 9, pp. 303, 304. Dec. 19, 1894.

XLV. On the Introitus Vaginæ of certain Muridæ. By Gerrit S. Miller, Jr. Proc. Bost. Soc. Nat. Hist., Vol. XXVI. pp. 459-468, Pl. 5. February, 1895.

XLVI. Studies in Morphogenesis.—III. On the Acclimatization of Organisms to high Temperatures. By C. B. Davenport and W. E. Castle. Archiv für Entwicklungsmechanik der Organismen, Bd. II. Heft 2, pp. 227-249. July 23, 1895.

XLVII. Spermatogenesis of *Caloptenus femur-rubrum* and *Cicada tibicen*. By E. V. Wilcox. Bull. Mus. Comp. Zoöl., Vol. XXVII. No. 1, pp. 1-32. 5 Pls. May, 1895.

XLVIII. On the Early Development of *Limax*. By C. A. Kofoid. Bull. Mus. Comp. Zoöl., Vol. XXVII. No. 2, pp. 35-118. 8 Pls. August, 1895.

XLIX. On *Stichocotyle Nephropis*, Cunningham. By W. S. Nickerson. Zoologische Jahrbücher, Abth. f. Anat. u. Ontogenie, Bd. VIII. Heft 4, pp. 447-480, Taf. 29-31. July 30, 1895.

Nos. XLIII., XLVII., and XLVIII. were presented as Theses for the degree of Ph. D.

Of the Contributions, Nos. L. to LVI. are either in press or ready for the printer.

The need of a permanent fund for the publication of the Contributions, set forth in my last report, is still urgent.

REPORT ON OSTEOLOGY.

BY DANIEL DENISON SLADE.

DURING the past year no progress has been made in additions to the osteological collections. They remain in essentially the same condition as at the last report, owing to the lack of means for the maintenance and and increase of the valuable material.

The plan proposed two years ago of making the course of Comparative Osteology one of research, thereby offering the highest usefulness of the Museum to those who wished to pursue original investigations, has been pursued during the academic year. A few only have availed themselves of the opportunities thus liberally offered, a fact which has satisfactorily proved that there was little or no interest in the work required. In addition to this singular apathy manifested by students who must necessarily appreciate and value the knowledge so essential in their zoölogical studies, it should be stated that during a prolonged illness in the winter months, which prevented my attendance in the department, certain irregularities occurred which has led the Curator of the Museum to pass more strenuous rules, which must hereafter govern both assistants and students in all the collections. For those fitted for the proper pursuit of their work, it is probable that ample opportunities will still be presented in the Osteological Department.

A paper, "The Significance of the Jugal Arch," originally intended for publication in the Museum Bulletin, was read before the American Philosophical Society, March 15, 1895, and published in their Proceedings, Vol. XXXIV.

A paper, "Abnormal Attachment of the Atlas to the Base of the Skull," published in the Boston Medical and Surgical Journal, July, 1895, has been reprinted.

REPORT ON THE MAMMALS AND BIRDS.

 BY WILLIAM BREWSTER.

THE collection of Mammals has received the following additions during the past year: —

By purchase. A fine Burchell's Zebra (*Equus burchellii*), mounted by Roland Ward, of London; a Wolf (*Canis lupus*), from Siberia, and a Virginia Deer (*Cervus virginianus*), from Moosehead Lake, Maine, mounted by J. T. Clark; and skins of a Bear and Land Otter from Japan, furnished by Alan Owston, of Yokohama.

By gift. From Mr. F. L. Omstead, Jr., an alcoholic specimen of a Star-nosed Mole (*Condylura cristata*), obtained at Biltmore, North Carolina; from Dr. L. C. Jones, the skin of a Black Squirrel (*Sciurus niger*), said to have been taken at Melrose, Mass., October 28, 1894.

Of birds the Museum has received the following: —

By gift. From Mr. Thurlow Washburn, upwards of two hundred skins, chiefly from New Jersey and Colorado; from Mr. George A. Dorsey, of the Peabody Museum, seven especially fine and valuable skins from British Guiana; from Mr. D. F. Turnbull, of the Lawrence Scientific School, skins of a Tanager (*Rhamphocelus*), a Manikin (*Pipra*), and a Jacomar (*Galbula*) from the island of Pedernales in the Delta of the Orinoco; from Mr. W. E. D. Scott, eight skins from Panama, collected by Mr. Matthew H. Simons, U. S. N.; from Mr. Walter Faxon, a mounted Black and Yellow Warbler (*Dendroica maculosa*), from Revere, Mass.; and a mounted Black-throated Blue Warbler (*Dendroica caerulescens*), and a nest of the Solitary Vireo (*Vireo solitarius*), from Arlington, Mass.; from Mr. R. T. Jackson, the skin of a young Cuckoo (*Coccyzus erythrophthalmus*), from Swampscott, Mass.

By purchase. Thirteen skins representing twelve species of Japanese birds, furnished by Alan Owston.

Unfortunately Mr. Washburn's collection proved on examination to be in such bad condition, owing to the ravages of moths and other insect pests, that only twenty-six specimens, representing twenty-two species, could be retained.

Still more unlucky was the fate which befell a collection of Western birds, chiefly from Colorado and Arizona, which Mr. George L. Toppan, of Chicago, formally presented to the Museum last April. This collection contained about one thousand skins, and included many rare and valuable specimens; but before it could be packed and forwarded to Cambridge it was wholly destroyed by the burning of the storage warehouse in which it had been temporarily placed.

Early in the present year Mr. Scott obtained funds sufficient to begin his artistic collection of mounted birds. Indeed, he has made much more than a beginning, for he has already placed on exhibition in one of the Exhibition Rooms no less than fifty-six cases containing about one hundred and seventy-five specimens. These are mounted in spirited and original attitudes, for Mr. Scott disregards the conventions of his art and models his birds after his own ideas and impressions. Many of his subjects are very lifelike, and the best are masterpieces. With respect to what are technically called "accessories" — that is, the branches, stumps, rocks, etc., on or among which the birds are placed — Mr. Scott's taste is severely simple and hence altogether admirable. It is to be hoped that nothing will occur to prevent him from carrying out his plans for the further increase and elaboration of this collection, for it can scarcely fail to become one of the chief popular attractions of the Museum.

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

Notes and Song-flight of the Woodcock (*Philohela minor*).

Breeding of the Prairie Horned Lark (*Otocoris alpestris praticola*) near Pittsfield, Mass.

Notes on the Habits of the Northern Shrike (*Lanius borealis*).

A remarkable Plumage of the Prairie Hen (*Tympanuchus americanus*).

Notes on Certain Flycatchers of the Genus *Empidonax*.

The White Gyrfalcon in New England.

Second Occurrence of Harris's Sparrow (*Zonotrichia querula*) in British Columbia.

A Ground Nest of the Black-throated Green Warbler.

Notes on Birds observed in Trinidad (by William Brewster and Frank M. Chapman).

A remarkable Flight of Pine Grosbeaks (*Pinicola enucleator*).

The Assistant has also edited a second edition of Mr. H. D. Minot's "Land Birds and Game Birds of New England," which appeared in March, 1895.

REPORT ON THE REPTILES AND FISHES.

By SAMUEL GARMAN.

ADDITIONS to the collections in these departments have been received from Mr. Phillip Adams, Outram Bangs, Esq., Mr. Ralph Brandreth (through the favor of Dr. Wm. M. Woodworth), Hon. E. T. D. Chambers, William Clapp, Esq., Miss Annie E. Cutler, Clarence M. Dyer, Esq., Prof. H. Garman, Dr. L. C. Jones, Mr. T. I. Potts (through the kindness of Prof. F. W. Putnam), Mr. Robert K. Smith, M. P. Thompson, Esq., Mr. Arthur R. Torrey, the United States Fishery Commission, and the United States National Museum. Those received from the National Museum were in greater part rare forms or types of species secured in the investigations of the United States Fishery Commission Steamer "Albatross"; those sent by the Commissioners were mainly fishes from inland waters collected in explorations of the Southwestern States. The contributions of Messrs. Bangs and Potts are particularly interesting on account of the localities represented. By purchase a number of fine live specimens were obtained, desiderata for the Exhibition Rooms. Professor Goode and Dr. Bean, having finished their work on them, have returned the Blake Collections to this Museum, with the exception of such duplicates as were retained for the National Museum.

Certain collections belonging to the University of Iowa, gathered by Professor C. C. Nutting, were received some time ago, to be subjected to comparative study and publication.

The ichthyological work begun for the Museum last season, with the drawing and engraving, has been continued to the present date.

The loss from evaporation, leakage, or breakage has been less than in any previous report.

In addition to unsigned reviews and book notices, the following papers, exclusive of that on the Cyprinodonts, have been published in the Memoirs of the Museum since my last report:—

The Suspended Animation of Snakes. *Nature*, Jan. 17, 1895, p. 274.

Thirst Endurance in some Vertebrates. *Nature*, Feb. 1, 1895, p. 343.

Lobster Reproduction. *Zoologischer Anzeiger*, No. 467.

REPORT ON THE ENTOMOLOGICAL DEPARTMENT.

By SAMUEL HENSHAW.

ACKNOWLEDGMENTS are due Miss C. G. Soule, Messrs. A. L. Babcock, Outram Bangs, S. A. Beach, H. K. Burrison, C. B. Davenport, G. A. Dorsey, W. L. W. Field, J. W. Freese, H. Garman, S. Garman, G. L. Goodale, Roland Hayward, G. H. Horn, G. de N. Hough, J. G. Jack, C. W. Johnson, A. G. Mayer, A. P. Morse, B. L. Robinson, S. H. Scudder, F. A. Sherriff, Chauncey Smith, L. Y. Swett, Roland Thaxter, S. Watase, and H. E. Weed, for donations to the collection of the Department.

To Messrs. Godman and Salvin we are especially indebted for another instalment of Central American Coleoptera. The series received includes the Buprestidæ and several families of the Heteromera.

The increased use of both the collections and library, noted last year, has continued; as many as seven persons have taken advantage of the facilities of the Department in a single day, and the average throughout the year is more than two for each day the collection has been available.

Assistance, either by the loan of material or in other ways, has been given Messrs. J. E. Chase, J. H. Comstock, C. H. Fernald, W. J. Fox, F. L. Harvey, G. de N. Hough, J. G. Jack, C. W. Johnson, A. G. MacGillivray, A. P. Morse, A. S. Packard, F. C. Paulmier, Theodore Pergande, S. H. Scudder, F. A. Sherriff, Roland Thaxter, and the Biological Department of Wellesley College.

The entire collection is remarkably free from museum pests, a result due to Miss Parker's care. When not engaged in inspecting the collection, Miss Parker's time has been wholly employed in remounting and labelling specimens of Microcoleoptera.

The routine work has consisted of a revisional arrangement of (1) the Danaidæ, Satyridæ, and Morphidæ of the Lepidoptera Rhopalocera; (2) the families of the Pyralidina and of the Tineina of the Lepidoptera Heterocera; (3) the Dixidæ, Rhyphidæ,

Xylophagidæ, Cœnomyphidæ, Tabanidæ, Leptidæ, Midaidæ, Nemestrinidæ, Bombylidæ, Therevidæ, Scenopinidæ, and Cyrtidæ of the Diptera ; and (4) the Cicindelidæ, Carabidæ, and Coccinellidæ of the Leconte collection of Coleoptera.

Numerous additions to the biological collections of Lepidoptera and Coleoptera have been incorporated ; some parts of these have been rearranged.

Long exposure in alcohol has rendered some of the labels almost illegible. Prof. C. L. Jackson kindly made some experiments to restore these ; he finds that by gently washing them with yellow ammoniac sulphide the legend, though not permanently restored, is made plain enough to be copied before it fades.

The selection of the series for the African Faunal Room progresses but slowly, owing to a lack of material and the difficulty of its determination.

A series of galls for the botanical section of the University Museum awaits the receipt of the exhibition boxes.

REPORT ON THE INVERTEBRATA (EXCLUSIVE OF
INSECTS).

By WALTER FAXON.

THERE have been received, through exchange with the United States National Museum, a collection of 39 species (119 specimens) of Crustacea, 17 species (33 specimens) of Sponges, and a duplicate set of the Holothurians secured during the "Albatross" Expedition of 1891. The Peabody Academy of Science has presented the Museum with 22 species (45 specimens) of Crustacea, including Cymothoids determined by Schiödte and Meinert. To Mr. C. E. Hoyle the Museum is indebted for a small but choice collection of land snails from Jamaica and 39 specimens of land crabs (*Cœnobita diogenes*) brought to Cambridge alive from Jamaica; to Dr. R. T. Jackson for a small miscellaneous lot of marine Invertebrata from Eastport, Me.; to Professor S. E. Meek for 3 species (16 specimens) of Crayfishes from Arkansas and Texas, including the rare *Cambarus lancifer*; to D. F. Turnbull for a specimen of *Panulirus guttatus* from the Barbados; to Professor H. L. Osborn for specimens of Crayfishes from Fort Snelling, Minn. A small supplementary collection of Japanese Crustacea has been got by purchase. The Pycnogonida and Copepoda of the "Albatross" Expedition of 1891 have been returned by Messrs. Schimkéwitsch and Giesbrecht, to be divided between this Museum and the United States National Museum. An interesting Sponge from New Guinea has been presented by Mr. Appleton Sturgis. The Foraminifera sent to Dr. Goës for examination have been returned by him. Material has been sent out, as gift or exchange, to the United States National Museum, the Boston Society of Natural History, the British Museum, and Mr. A. F. Foerste.

A short paper on the Development of *Dicranodromia* has been published by E. Caustier in the *Comptes Rendus* for 1895, p. 573, based upon material collected by the "Blake." A number of Memoirs have been issued in the Museum publications (see Appendix A) based upon the collections of this department connected

with the explorations of the "Albatross" and the "Wild Duck." I have myself completed the Report on the Stalk-eyed Crustacea of the "Albatross" Expedition of 1891, which has been issued as Vol. XVIII. of the Memoirs, 292 pp., 67 Pl. I have also published the following ornithological notes in the "Auk" for 1895 (Vol. XII.): —

The Philadelphia Vireo in Cambridge, Mass.

The Rough-winged Swallow breeding in North Adams, Berkshire County, Mass.

Bicknell's Thrush and the Prairie Horned Lark as Summer Residents of Berkshire County, Mass.

The work on the Museum collections has been carried on along the lines indicated in my last annual report.

REPORT ON THE DEPARTMENT OF VERTEBRATE
PALÆONTOLOGY.

BY CHARLES R. EASTMAN.

THE period embraced by the following report dates from the 1st of January of the present year, when the Assistant was appointed. Owing to the absence of a special custodian for this Department, it has only been possible for a number of years past to store the numerous accessions to the collection in trays, in practically the same condition in which the material was received,—sometimes, indeed, without removing it from the original wrappers. It was therefore necessary thoroughly to overhaul, clean, rearrange, and distribute the contents of each tray in the collection according to the families and genera represented. Up to the present time a number of the individual collections (such as the Ennis-killen, Stock, Haerberlein, and Damon collections, etc.) had been kept intact, one label on the outside of the tray serving to indicate the source and general nature of the contents. These collections were left undisturbed until the general arrangement was completed, when they too were broken up and the material distributed. In all cases where the specimens were unmarked, care was taken to provide new labels specifying the locality and name of the original collection. No time was spent, however, in determining unidentified specimens beyond families or genera, one label on the outside of the tray sufficing as before to indicate the name of the family or genus, and the geological horizon. Neither was any attempt made to care for broken or oxidized specimens. But during the coming year it is proposed to go through the whole collection again, labelling and repairing all specimens in need of attention. Pains will also be taken to select such materials as may be deemed suitable to be placed on exhibition. With the material now on hand, it will be possible to fill up the Mesozoic Exhibition Room in such manner as shall make it fully as interesting and instructive to the general public as the much frequented

Tertiary and Quaternary Exhibition Rooms. The faunal series of the two latter rooms can be still further supplemented by the mounting of several nearly perfect skeletons.

The size of the collection is considerable, filling nearly 1,500 trays. More detailed lists have been made out in two series for the use of the Department; one showing the faunal series comprised by the collection, arranged stratigraphically; and the other showing the extent to which the smaller zoölogical subdivisions are represented. No record has been kept of the size of the various individual collections, but it may be stated that the bulk of the fossil Reptiles and Mammals are contained in the Garman and Sternberg collections; and the fossil Fishes in the same, together with the Enniskillen, Stock, and Haeberlein collections. The last two comprise about 60 trays each, or upwards of 3,000 specimens. Much of the material is of great interest, and wholly undescribed.

The collection as a whole may be considered as a very representative one. Parts of it could well be increased, especially in certain orders of Mammals. Other parts are not only extremely rich (as, for instance, the Palæozoic Fishes, Cretaceous Reptiles, the Proboscidea, etc.), but contain a large number of duplicates, by means of which a profitable exchange may be carried on in the course of time. The older portions of the collection, and most particularly the collection of fossil Fishes, have a very great historic interest. The number of type specimens is quite large, and they are exceedingly valuable. A few of Professor Agassiz's types are preserved in the Old Collection, presented to the Museum in 1859. The Bronn, Boucault, de Koninck, Enniskillen, Geinitz, and above all the Schultze Collections, contain specimens of extraordinary interest. A list is appended, for convenience of reference, which is intended to include the name and date of reception of all the more important individual collections that have been added to this department since the Museum was founded. Further information in regard to them is preserved in the records of the Department; and scattered notes, together with lists of minor accessions, may also be found in back numbers of the Annual Reports of the Museum. References to the more important of these reports, and to a few additional sources of information, are given in the subjoined index.

According to the Annual Report of 1870 the fossil Vertebrates then belonging to the Museum were numbered and catalogued by

Dr. G. A. Maack, who was the Assistant at the time. Unfortunately this catalogue was not found among the effects left by Dr. Maack, and only a few sheets are extant. This is the more to be regretted, since in many cases, where numbers take the place of separate labels, the catalogue furnishes the only information we have as to the locality, collector, and history of the older specimens in the collection. In conclusion, it may be said that there are ample materials in the collection to serve as a basis for a number of interesting publications.

Additions to the Collection made during the Year.

Clidastes tortor Cope. Niobrara; Western Kansas. A small mounted specimen purchased of the collector, Mr. Charles H. Sternberg. Received Jan. 10, 1895. Also a fairly complete skeleton of a fossil Peccary, and a Pteranodon skull.

Pareiosaurus Baini Seeley. Karoo Formation [Trias]; South Africa. Cast of the original in the British Museum. Purchased.

Compsognathus longipes Wagner. Lithographic slates; Solenhofen, Bavaria. Cast of the unique specimen preserved in the Munich Museum.

Casts of *Aëtosaurus* and of Dodo from the Oxford Museum.

Papers published during the Year.

History of Instruction in Geology and Palæontology in German Universities. Translated from the German of Professor K. A. von Zittel. [Amer. Geol., Vol. XIV. pp. 179-185.]

Beiträge zur Kenntniss der Gattung *Oxyrhina*, mit besonderer Berücksichtigung von *Oxyrhina Mantelli*, Agassiz. [Palæontographica, Bd. XLI. pp. 141-191.]

Elements of Palæontology. Translated and edited from the German of Professor K. A. von Zittel. Vol. I., Part I. Protozoa to Mollusca. (In press.)

References to the principal Published Documents relating to the Department of Vertebrate Palæontology.

Annual Reports of the Museum of Comparative Zoölogy, 1859 to 1895. In particular, the Reports on the Palæontological Department for the years 1869 to 1874, beginning with the following pages: 1869, p. 44; 1870, p. 30; 1871, p. 29; 1872, p. 18; 1873, p. 34; 1874, p. 20.

Naturhistorische Museen in Nord-America. Von K. A. von Zittel. [Beilage zur Allgemeine Zeitung, No. 349, Dec. 16, 1883.]

Preliminary Account of the Fossil Mammals from the White River Formation contained in the Museum of Comparative Zoölogy. By W. B. Scott and H. F. Osborn. [Bull. M. C. Z., Vol. XIII., Sept., 1887.]

Preliminary Account of the Fossil Mammals from the Loup Fork Formation. Part II. Carnivora and Artiodactyla, by W. B. Scott. Perissodactyla, by H. F. Osborn. [Bull. M. C. Z., Vol. XX., 1890.]

Vertebrate Palæontology in some American and Canadian Museums. By A. Smith Woodward. [Geol. Mag., Dec. III., Vol. VII., 1890.]

List of the Principal Collections of Vertebrate Fossils Belonging to the Museum.

1852. Old Collection. Purchased by private subscription from Professor Agassiz.

1859. Professor Agassiz Collection. Presented. Contains a number of valuable types.

1859. Boucault Collection. Purchased. Gray Fund.

1859. Bronn Collection. A rich collection of German Mesozoic Fossils, for the most part determined by Professor Bronn. Purchased.

1859. Duval Collection. Chiefly Fishes and Mammals from the Mesozoic and Cenozoic of France. Purchased. Gray Fund.

1861. Campiche Collection. Purchased. Gray Fund.

1861. De Koninck Collection. Purchased. The entire collection of L. G. de Koninck.

1861. Enniskillen Collection. First instalment received by exchange.

1862. Enniskillen Collection. Second instalment purchased.

1862. Imhoff Collection. Contains chiefly Invertebrates. Purchased.

1865. Gastaldi Collection. Exchange.

1865. Michellotti and Rigacci Collection. Exchange.

1866. Leonard Collection. Fossil Footprints, Connecticut Valley. Presented.

1868. Haast Collection. Four species of *Dinornis* from New Zealand. Exchange.

1869. Shaler and Barnard Collection. Pleistocene Mammals, chiefly Bison and Mastodon remains, from Big Bone Lick, Ky. Presented.

1870. Professor Agassiz Collection. Fossil Fishes from the Connecticut Valley.

1870. Allen Collection. Green River Fishes. Collected by J. A. Allen.

1870. Lesquereux Collection. Mostly fossil plants, but containing some fish and amphibian remains from the American Coal Measures. Purchased.

1871. Lartet Collection. Fossil Mammals from France. Presented.

1871. Quimby Collection. A large series of fossil Vertebrates from the Red Crag of England.

1871. Schultze Collection. An exceedingly valuable collection of Devonian fossils, chiefly from the Eifel District. Purchased of Dr. L. S. Schultze.

1871. St. John Collection. Fossil Fishes from the Sub-Carboniferous of Indiana, Iowa, Illinois, and Missouri.

1871. Von Cotta Collection. Fossil Fishes from the Harz Mountains and Bohemia. Presented.

The collections obtained from 1875 to the present time were purchased by Mr. Agassiz.

1875. Boylston Hall Collection. Mastodon remains. Deposited by Harvard College.

1875. Sladen Collection. A small but interesting series of English Carboniferous Fishes. Exchange with W. Percy Sladen, Esq.

1878. A collection of casts purchased from H. A. Ward.

1879. Dyer Collection. A very large collection, but consisting chiefly of Invertebrates, from the Cincinnati Group. Purchased.

1879. Gebbard Collection. Walcott Collection. Contain mostly Invertebrates. Purchased.

1880. Bird Collection. Chiefly Invertebrates, but some Fishes, from the Cretaceous of Mt. Lebanon. Purchased of Rev. Wm. Bird.

1880. First Garman Collection. Vertebrates from the Bad Lands. Purchased.

1881. Second Garman Collection. Vertebrates from the Bad Lands. Purchased.

1881. Day Collection. Mostly Invertebrates from the Niagara Limestone of Wisconsin. Collected by Rev. F. H. Day. Purchased.

1881. First Sternberg Collection. Vertebrates from the Cretaceous of Western Kansas. Purchased.

1881. Taylor Collection. Mostly Invertebrates from the Silurian of New York. Purchased of Prof. G. W. Taylor.

1882. Third Garman Collection. Vertebrates from the Western States. Purchased.

1882. Second Sternberg Collection. Vertebrates from the Permian of Texas. Purchased.

1882. Damon Collection. Fossil Fishes from the Devonian of Scotland, Carboniferous Limestone of Ireland, and Cretaceous of Mt. Lebanon. Purchased.

1882. Haeberlein Collection. A magnificent collection of Vertebrate and Invertebrate fossils from the Lithographic Slates of Solenhofen and Kelheim, Bavaria. First instalment received in 1882; second in March, 1883. Purchased of Ernst Haeberlein, of Pappenheim, Bavaria.

1882. Schary Collection. An unrivalled collection of Palæozoic fossils, almost entirely Invertebrates, from Bohemia. Purchased from the heirs of J. M. von Schary.

1882. Tracy Collection. Fishes, Reptiles, and Invertebrates from the Cambridge Greensand. Purchased.

1883. Fearon Collection. Fossil Fishes from the Coal Measures of East Liverpool, Ohio. Purchased from R. N. Fearon.

1883. Fourth Garman Collection. Jurassic Reptiles and Tertiary Mammals from the Western States. Purchased.

1883. Stock Collection. Fossil Fishes and Amphibians from the Carboniferous of Scotland; a large and extremely interesting collection. Purchased of Thomas Stock, Esq., Edinburgh. First instalment received in November, 1883; second, in March, 1884.

1884. Fifth Garman Collection. Fossil Vertebrates from Kansas, Nebraska, Dakota, and Wyoming, including the secondary collections made by H. C. Clifford, G. R. Allaman, and L. Hollywood. Purchased.

1885. Casts of fossil Vertebrates described by Professor O. C. Marsh. Purchased.

1885. Terrell Collection. Fossil Fishes from the Huron Shales [Upper Devonian] of Lorraine County, Ohio. Collected by J. Terrell, Esq., of Oberlin, O., and described in part by Prof. J. S. Newberry. Purchased.

1886. Rossignol Collection. A small but valuable collection of fossil Mammals from the Phosphorites of France. Purchased.

1886. Eyerman Collection. A series of fossil Footprints from the Trias of New Jersey and Eastern Pennsylvania. Purchased of J. A. Eyerman.

1889. Fritsch Collection. A complete set of Stegocephalan casts from the Gaskohle of Bohemia. Purchased of Professor Anton Fritsch.

1889. Ward Collection. Five mounted skeletons of Mammals from the Pampas Formation of Argentina, forming the finest exhibit of fossil Vertebrates in the Museum. Purchased of Prof. H. A. Ward.

1890. Springer Collection. A small but valuable collection of Cretaceous fossils from New Mexico. Presented.

1894. Cast of *Iguanodon Bernissartensis* Boulenger. Purchased.

A number of smaller collections, together with some whose date of instalment is uncertain, are not enumerated in the above list. Mention should be made of the following, however, which were received previous to 1869, and were secured by purchase, exchange, or donation: Carl Meyer, Eichwald, Hoernes, Michelotti, Bellardi, Appellius, Rigacci, Roualt, Tarbé, Krantz, Geinitz, and Lyell Collections. (See Annual Report for 1869, p. 32.)

REPORT ON THE FOSSIL INVERTEBRATES.

BY ALPHEUS HYATT.

THE systematic collection of Cephalopoda has been greatly enlarged. The Assistant has picked out, labelled, and placed on exhibition a large number of appropriate fossils. He has also revised the collections of Pectenidæ and Monotidæ, describing many genera and species in preparation for a monograph of these groups. This work has been finished throughout Palæozoic and Mesozoic time, inclusive of the Jura.

The department is indebted to Dr. R. T. Jackson for a large amount of work in labelling and arranging and otherwise improving the condition of the collections, especially the fossil Corals, Echinoderms, and Cephalopods.

Dr. E. C. Beecher has presented to the Museum one of his valuable preparations of *Trinucleus concentricus*, showing the eyes as recently described by him, and also some beautiful silicious fossils from the Trenton Limestone etched out in relief with the aid of acid.

Thanks are due also to Mrs. W. D. Boardman for a fine series of extremely large and interesting *Hippurites* from Gosau, Austria.

Several desirable specimens of *Eurypteri* have been received from Mr. Roswell Johnson of Buffalo, and also a number of fine specimens of carboniferous and cretaceous *Crinoids* have been obtained by exchange with Professor Ward of Rochester.

The following papers have been published :—

“Remarks on the Genus *Nanno*, Clarke,” by Alpheus Hyatt. *American Geologist*, Vol. XVI., July, 1895, pp. 12, 1 Plate.

“Terminology proposed for Description of the Shell in *Pelecypoda*,” by same. *Proc. Amer. Assoc.*, 1895. Abstract in *Am. Geol.*, Vol. XVI. No. 4, pp. 252–254.

REPORT ON THE LIBRARY.

BY MISS F. M. SLACK.

DURING the year ending September 1, 1895, the Library has received 569 volumes, 1,937 parts, and 132 pamphlets.

	VOLUMES.	PARTS.	PAMPHLETS.
Gift	13	69	12
Exchange	163	771	85
Purchase	27	264	0
A. Agassiz	79	819	35
Binding Parts	287	0	0
Whitney Library	0	14	0
	569	1,937	132

The number of volumes now in the Library (exclusive of pamphlets and the Whitney Library) is 22,171. There are 15,637 pamphlets bound in 2,649 volumes, making the total number of volumes 24,820.

[A]

PUBLICATIONS

OF THE

MUSEUM OF COMPARATIVE ZOOLOGY

FOR THE ACADEMIC YEAR 1894-95.

Of the Bulletin:—

Vol. XVI. (Geological Series, Vol. II.)

- No. 15. Notes on the GEOLOGY of the Island of CUBA, based on a Reconnoissance made for ALEXANDER AGASSIZ. By R. T. HILL. pp. 45. 9 plates. April, 1895.

[Vol. XVI. *is complete.*]

Vol. XXV.

- No. 8. Reports on the DREDGING OPERATIONS off the WEST COAST of Central America to the GALAPAGOS, etc., by the U. S. Fish Commission Steamer "ALBATROSS." XIV. The Pelagic SCHIZOPODA. By A. ORTMANN. pp. 14. 1 Plate. September, 1894.
- No. 9. Cruise of the Steam Yacht "WILD DUCK" in the BAHAMAS, January to April, 1893, in Charge of ALEXANDER AGASSIZ. II. Notes on the SHELLS collected. By W. H. DALL. pp. 12. 1 Plate. October, 1894.
- No. 10. Reports on the DREDGING OPERATIONS off the WEST COAST of Central America to the GALAPAGOS, etc., by the U. S. Fish Commission Steamer "ALBATROSS." XIII. Die OPISTHOBRANCHIEN. Von R. BERGH. pp. 110. 12 Plates. October, 1894.
- No. 11. Cruise of the Steam Yacht "WILD DUCK" in the BAHAMAS, January to April, 1893, in Charge of ALEXANDER AGASSIZ. III. An Account of some MEDUSÆ obtained in the Bahamas. By A. G. MAYER. pp. 8. 3 Plates. November, 1894.
- No. 12. Reports on the DREDGING OPERATIONS off the WEST COAST of Central America to the GALAPAGOS, etc., by the U. S. Fish Commission Steamer "ALBATROSS." XVI. Die Pelagischen COPEPODEN. Von W. GIESBRECHT. pp. 22. 4 Plates. April, 1895.

[Vol. XXV. *completed.*]Vol. XXVI. (December, 1894-April, 1895. *Complete.*)

- No. 1. A Reconnoissance of the BAHAMAS and of the ELEVATED REEFS of CUBA in the Steam Yacht "WILD DUCK," January to April, 1893. By A. AGASSIZ. pp. 204. 47 Plates. December, 1894.
- No. 2. A Visit to the BERMUDAS in March, 1894. By A. AGASSIZ. pp. 78. 30 Plates. April, 1895.

Vol. XXVII.

- No. 1. SPERMATOGENESIS of *CALOPTENUS femur-rubrum* and *CICADA tibicen*.
By E. V. WILCOX. pp. 34. 5 Plates. May, 1895.
- No. 2. On the Early DEVELOPMENT of LIMAX. By C. A. KOFOID. pp. 86.
8 Plates. August, 1895.
- No. 3. Reports on the DREDGING OPERATIONS off the WEST COAST of Central
America to the GALAPAGOS, etc., by the U. S. Fish Commission Steamer
"ALBATROSS." XVII. BIRDS from COCOS and MALPELO ISLANDS, with
Notes on PETRELS obtained at Sea. By C. H. TOWNSEND. pp. 8. 2 col-
ored Plates. July, 1895.
- 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," XVIII. Die COMATULIDEN. Von C. HARTLAUB. pp. 24.
4 Plates. August, 1895.

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

Vol. XXVIII. (Geological Series, Vol. III.)

- No. 1. FOSSIL SPONGES of the Flint Nodules in the LOWER CRETACEOUS of
TEXAS. By J. A. MERRILL. pp. 26. 1 Plate. July, 1895.

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

Of the Memoirs:—

Vol. XVII.

- No. 3. Reports on an EXPLORATION off the WEST COASTS of MEXICO, CENTRAL
and SOUTH AMERICA and off the GALAPAGOS ISLANDS, in Charge of ALEX-
ANDER AGASSIZ, by the U. S. Fish Commission Steamer "ALBATROSS," etc.
XII. The HOLOTHURIOIDEA. By H. LUDWIG. pp. 183. 19 Plates. October,
1894.

[Vol. XVII. *is completed.*]

Vol. XVIII. contains:—

- Reports on an EXPLORATION off the WEST COASTS of MEXICO, CENTRAL and
SOUTH AMERICA, and off the GALAPAGOS ISLANDS, in Charge of ALEXAN-
DER AGASSIZ, by the U. S. Fish Commission Steamer "ALBATROSS," etc.
XV. The CRUSTACEA. By WALTER FAXON. pp. 292. 67 Plates, 1 Chart.
April, 1895.

Vol. XIX.

- No. 1. The CYPRINODONTS. By S. GARMAN. pp. 180. 12 Plates. July, 1895.

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

[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, 1895.

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 1895-96.

ALEXANDER AGASSIZ,

Director.

[C]

INVESTED FUNDS OF THE MUSEUM.

IN THE HANDS OF THE TREASURER OF HARVARD COLLEGE, SEPT. 1, 1894.

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
Humbolt 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 Overseers. 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 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."

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 Hole, or elsewhere.

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

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

[D]

CONTRIBUTIONS TO THE ORNITHOLOGICAL COLLECTION MOUNTED
BY W. E. D. SCOTT.

O. Ames 2d	\$100	Wm. Minot	\$100
Charles C. Beaman	100	Geo. Mixter	100
W. S. Bigelow	100	H. Milliken	100
W. L. Bryant	100	Richard Morgan	10
Walter G. Chase	300	Geo. A. Nickerson	50
W. H. Forbes	50	A. B. Otis	10
L. C. Fenno	50	Dr. E. D. Peters, Jr.	50
Geo. A. Goddard	50	Dudley L. Pickman	100
Joel Goldthwait	500	Mrs. W. D. Pickman	100
A. Hemenway	50	S. D. Warren	25
J. J. Higginson	50	Chas. G. Weld	100
R. C. Hooper	50	S. M. Weld	50
A. A. Lawrence	50	A friend	25
Samuel C. Lawrence	50	A friend	10
Augustus Lowell	100	A friend	10

[E]

FOR and in consideration of one dollar to me in hand paid, and other good and valuable considerations, the receipt of which is hereby acknowledged, I have this day sold and conveyed to Alexander Agassiz, Esq., of Cambridge, Massachusetts, all the skins and mounted birds collected by me, and now in four cases in the Museum building, being in the aggregate about three thousand (3,000) specimens in all, and being the residue of birds collected by me; the last and highest catalogue number in my catalogue being No. 13,105. This bill of sale embraces all birds collected by me or in my collection on this first day of April, 1895, and remaining undisposed of at that date, and more particularly described in my catalogue below the number 13,105.

W. E. D. SCOTT.

In the presence of
WALTER FAXON.

APRIL 1, 1895.

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 ALEXANDER AGASSIZ, by the U. S. Coast Survey Steamer "Blake," as follows: —

- A. MILNE-EDWARDS. Crustacea of the "Blake."
- E. EHLERS. 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.
- 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 BURKHARDT, 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.
- " On the Florida Keys With Notes by O. E. HOVEY and W. H. ELDRIDGE.
- 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*.
- M. E. WADSWORTH. Lithological Studies. Part II.
- J. D. WHITNEY. Origin and Mode of Occurrence of Iron and its Ores.
- " Nomenclature and Classification of Ore Deposits.
- R. T. HILL. Notes on the Geology of the Isthmus of Panama.
- CHARLES WACHSMUTH and FRANK SPRINGER. The North American Fossil Crinoidea Camerata. With an Atlas of 83 Plates.

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

- W. WHITNEY. The Histology of *Thyone*.
- 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 WOLFF.

Studies from the NEWPORT MARINE LABORATORY, communicated by ALEXANDER AGASSIZ.

- A. AGASSIZ and W. McM. WOODWORTH. Some Variations in the Genus *Eucope*.

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. | R. VON LENDENFELD. The Phosphorescent Organs of Fishes. |
| " The Echini. | C. F. LÜTKEN. The Ophiuridæ. |
| " The Panamic Deep-Sea Fauna. | O. MAAS. The Acalephs. |
| J. E. BENEDICT. The Annelids. | E. L. MARK. The Actinarians. |
| K. BRANDT. The Sagittæ. | JOHN MURRAY. The Bottom Specimens. |
| " The Thalassicolæ. | ROBERT RIDGWAY. The Alcoholic Birds. |
| C. CHUN. The Siphonophores. | P. SCHIEMENZ. Pteropods and Heteropods. |
| " The Eyes of Deep-Sea Crustacea. | W. PERCY SLADEN. The Starfishes. |
| W. H. DALL. The Mollusks. | L. STEJNEGER. The Reptiles. |
| C. B. DAVENPORT. The Bryozoa. | THEO. STUDER. The Alcyonarians. |
| S. GARMAN. The Fishes. | M. P. A. TRÄUTSTEDT. The Salpidæ and Doliolidæ. |
| A. GOËS. The Foraminifera. | E. P. VAN DUZEE. The Halobatidæ. |
| H. J. HANSEN. The Cirripeds and Isopods. | H. B. WARD. The Sipunculids. |
| W. A. HERDMAN. The Ascidians. | H. V. WILSON. The Sponges. |
| S. J. HICKSON. The Antipathids. | W. McM. WOODWORTH. The Planarians. |
| W. E. HOYLE. The Cephalopods. | |
| G. VON KOCH. The Deep-Sea Corals. | |
| C. A. KOFOID. Solenogaster. | |

PUBLICATIONS
OF THE
MUSEUM OF COMPARATIVE ZOÖLOGY
AT HARVARD COLLEGE.

There have been published of the BULLETINS Vols. I. to XXVI.; of the MEMOIRS, Vols. I. to XVIII.

Vols. XXVII., XXVIII., and XXXI. of the BULLETIN, and Vols. XI. and XIX. of the MEMOIRS are now in course of publication.

The BULLETIN and MEMOIRS are devoted to the publication of original work by the Professors and Assistants of the Museum, of investigations carried on by students and others in the different Laboratories of Natural History, and of work by specialists based upon the Museum Collections.

The following publications are in preparation:—

Reports on the Results of Dredging Operations from 1877 to 1880, in charge of Alexander Agassiz, by the U. S. Coast Survey Steamer "Blake," Lieut. Commander C. D. Sigsbee, U. S. N., and Commander J. R. Bartlett, U.S.N., Commanding.

Reports on the Results of the Expedition of 1891 of the U. S. Fish Commission Steamer "Albatross," Lieut. Commander Z. L. Tanner, U. S. N., Commanding, in charge of Alexander Agassiz.

Contributions from the Zoölogical Laboratory, in charge of Professor E. L. Mark.

Contributions from the Geological Laboratory, in charge of Professor N. S. Shaler.

Contributions from the Petrographical Laboratory, in charge of Professor J. Eliot Wolff.

Studies from the Newport Marine Laboratory, communicated by Alexander Agassiz.

Subscriptions for the publications of the Museum will be received on the following terms:—

For the BULLETIN, \$5.00 per volume, payable in advance.

For the MEMOIRS, \$8.00 " " "

These publications are issued in numbers at irregular intervals; one volume of the Bulletin (8vo) and half a volume of the Memoirs (4to) usually appear annually. Each number of the Bulletin and of the Memoirs is also sold separately. 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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