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With the Compliments of

ALEXANDER AGASSIZ.

ANNUAL REPORT
OF
THE CURATOR
OF THE
MUSEUM OF COMPARATIVE ZOOLOGY
AT HARVARD COLLEGE,
TO THE
PRESIDENT AND FELLOWS OF HARVARD COLLEGE,
FOR
1890-91.

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FACULTY OF THE MUSEUM.

CHARLES W. ELIOT, *President.*

ALEXANDER AGASSIZ, *Curator.*

GEORGE L. GOODALE.

JOSIAH D. WHITNEY, *Secretary.*

HENRY P. WALCOTT.

OFFICERS.

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- JOSIAH D. WHITNEY *Sturgis-Hooper Professor of Geology.*
- HERMANN A. HAGEN *Professor of Entomology.*
- NATHANIEL S. SHALER *Professor of Geology.*
- E. L. MARK *Hersey Professor of Anatomy.*
- WILLIAM MORRIS DAVIS . . . *Professor of Physical Geography.*
- J. ELIOT WOLFF *Instructor in Petrography.*
- THADDEUS W. HARRIS *Instructor in Geology.*
- W. M. WOODWORTH *Instructor in Microscopic Anatomy.*
- C. B. DAVENPORT *Instructor in Zoölogy.*
- WALTER FAXON *Assistant in Zoölogy.*
- D. D. SLADE *Assistant in Osteology.*
- SAMUEL GARMAN *Assistant in Herpetology and Ichthyology.*
- WILLIAM BREWSTER *Assistant in Ornithology and Mammalogy.*
- ALPHEUS HYATT *Assistant in Paleontology.*
- H. M. KELLY *Assistant in the Zoölogical Laboratories.*
- RICHARD ELWOOD DODGE . . . *Assistant in the Geological Laboratories.*
- J. BACKUS WOODWORTH . . . *Assistant in the Geological Laboratories.*
- HENRY BARNARD KUMMEL . . . *Assistant in the Geological Laboratories.*
- LOUIS GARDNER WESTGATE . . . *Assistant in the Geological Laboratories.*
- ROBERT DECOURCEY WARD . . . *Assistant in the Geographical Laboratory.*
- MISS F. M. SLACK *Librarian.*
- MAGNUS WESTERGREN *Artist.*

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 Zoölogy by Professor Mark, Dr. Slade, and Mr. Parker, assisted in the Laboratory work by Messrs. W. M. Woodworth, Ritter, and Hubbard.

Professors Whitney, Shaler, and Davis, and Dr. J. E. Wolff, gave courses of instruction in Geology, Palæontology, Physical Geography, and Petrography. Messrs. Harris, J. B. Woodworth, Cobb, and Tarr were the Assistants in the Undergraduate instruction 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.

Professor Farlow's report upon the Botanical part of the introductory course of Natural History will appear in the report of the Botanical Department.

The Geological Section of the Museum has been occupied during the past year, and its Laboratories and Lecture Rooms have been found well adapted to their purpose. No progress has as yet been made in the equipment of the Geological and Geographical Museum, but the rooms are used to establish a connection between the Exhibition Rooms of the Museum of Comparative Zoölogy and the Botanical and Mineralogical Collections of the University Museum.

An extensive addition has been made to the Newport Marine Laboratory, so that there is now ample accommodation for eight advanced students, beside the space occupied by myself and assistant. Additional room is thus provided for the housing of books, drawings, and other records in use at the Laboratory. Messrs.

Woodworth, Davenport, Smith, Ward, Nickerson, and Lucas spent some time at the Newport Laboratory, either collecting material for future investigation, or carrying on special work on the embryology of Annelids, Bryozoa, and Acalephs. Mr. Woodworth also passed a few days at Newport before the opening of the season in putting the Laboratory in order for work.

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

There have been no changes in the Exhibition Rooms beyond the additions made to fill gaps existing in our series. The collections open to the public remain in a satisfactory condition, and the interest in the exhibit does not appear to diminish, judging from the constantly increasing number of visitors.

The Pacific Room is little by little preparing for exhibition, and I hope to open it to the public as soon as we can make a reasonably interesting exhibit of the fauna of some of its groups of islands. We have been for some time accumulating collections from the Sandwich Islands, the Galapagos, and the Feejee Islands.

The most important addition to our Exhibition Rooms has been the mounted skeleton of the fine Sperm Whale obtained through Professor Ward, mentioned in my last Report. This skeleton has been suspended from the roof of the large Exhibition Room devoted to the Systematic Collection of Vertebrates, and finds its place naturally by the side of the two other large skeletons of whales similarly placed. *

The magnificent series of Pampas Fossils obtained by Professor Ward have been mounted by him, and safely moved to Cambridge from Rochester. They occupy a part of the central floor space of the rooms devoted to the Tertiary Faunæ. A few other specimens of extinct Vertebrates have been moved to the same rooms, so that as soon as the specimens are labelled it will be possible to open two of the Palæontological Exhibition Rooms to the public. They will, however, contain at first only a small part of the collections they are intended to house.

It will be seen from the special Reports of the Assistants, that the collections of the Museum continue in good condition. Owing to Dr. Hagen's prolonged ill-health, he has been able to

give but little time to the Museum, and has been unable to make his usual Report. The collections have been kept in excellent condition, but of course, owing to his absence, they could not be placed at the disposal of specialists, as has always been the case heretofore.

Mr. J. A. Allen, of the Museum of Natural History of New York, has returned the collection of Muridæ which had been sent to him for study.

Professor Harrison Allen, of Philadelphia, has returned the collection of Bats sent to aid him in the preparation of a monograph on the family, for the Smithsonian Institution.

Messrs. Scott and Osborn have returned an additional invoice of the collection of Western Fossils lent to them.

Professor S. I. Smith, of New Haven, has returned the part of the "Blake" Crustacea remaining in his possession.

Professor Solas, of Dublin, has sent back a few of the types of the "Blake" and other Sponges.

Messrs. Scudder and McMurrich have returned drawings of Lepidoptera and of Actiniæ, which had been lent to them for examination.

We have received from Messrs. Wachsmuth and Springer a number of Palæozoic Crinoids; from Mr. Charles Chilton, a collection of New Zealand Crustacea; from the Zoölogical Museum of the University of Copenhagen, a collection of Fishes and Invertebrates from the Kara Sea, made by the Expedition of the "Dijmphna"; from the Paris Museum, a collection of Deep-sea Fishes, mainly from the "Travailleur" and "Talisman" Expeditions; from Mr. Arthur H. Gordon, an interesting collection of Lepidoptera from Central China; and from Lieut. Commanding J. F. Moser, a collection of Corals from the submarine cable between Key West and Havana, illustrating the rate of growth of corals. (See the Museum Bulletin, Vol. XX. No. 2.)

In addition to the specimens purchased from Professor Ward, we have also filled a few gaps in our collection of Reptiles, mainly for the Exhibition Rooms.

With the exception of an exhaustive Report on the Paguridæ of the "Blake" Expedition, for which the Museum is indebted to Professor Alphonse Milne-Edwards, the Blake publications and collections remain in the same state as last year. The Report of Professor Milne-Edwards is accompanied by twelve beautifully

executed plates. The Report will be published as soon as the plates can be reproduced. It will form an important contribution to our knowledge of the Paguridæ. Messrs. Goode and Bean hope to finish their Memoir on the "Blake" Fishes within a few weeks. Fair progress has been made on the Memoirs and Bulletins mentioned in my last Report as preparing for the press, and the greater part will undoubtedly be issued during the coming year.

Appendix A of this Report contains a list of the publications of the Museum issued during the past academic year. We have published twelve Bulletins in the Zoölogical Series, making nearly two volumes of the Bulletin. With the exception of one number by Messrs. Scott and Osborne, and three short Bulletins by myself, the publications represent work done in the Zoölogical Laboratory in charge of Professor Mark. The activity in that Laboratory shows the excellent use which can be made of our publications in bringing out such original work as may be considered worthy of publication by the instructors in the various departments connected with the Museum.

Among the publications based upon Museum materials, I may mention a Review of the South American Nematognati, by C. H. and Rosa S. Eigenmann, published in occasional papers of the California Academy, I., July, 1890. Nearly the whole of this systematic paper is based upon the collection of Catfishes made by Professor Agassiz during the Thayer Expedition. The authors, with the alacrity with which impracticable plans are so readily laid out for others, needlessly go out of their way to criticise the state of the collection as left by Dr. Steindachner, and give the Museum excellent advice as to what ought to have been done with this collection when it was first brought together.

Professor W. B. Scott has published in the American Journal of Morphology an extensive paper on the Osteology of Pæbrotherium, based in part upon Museum material.

Professor Osborn has kindly made out for future use of the Museum a list of our desiderata in Western Fossils, both generic and stratigraphic.

I ought also to mention a short paper on *Nettastoma* by Dr. Bürger, published in a recent number of the *Zoologische Jahrbücher*, IV., the material for which was obtained from the Newport Laboratory.

The additions to our Library show a satisfactory increase in the

number of accessions, especially from the exchanges with other institutions. Among the latter I must specify an important addition to our Geographical Library, consisting of a number of Government Surveys and Reports of Geographical Institutions, with extensive series of their maps and publications. These have been generously sent to us in exchange for our Geological publications, and with the full knowledge of how small a return we were able to make for their magnificent publications.

Last fall I was invited by Colonel Marshall McDonald, the U. S. Fish Commissioner, to take charge of a deep-sea dredging expedition off the coasts of Central America and of Mexico. With the consent of the President of the United States, the "Albatross" Lieut. Commander Z. L. Tanner, Commanding, was ordered to Panama, where I joined her in February. Our cruise extended from Panama to Cocos Island, thence south toward Malpelo, and back to Panama. Our second cruise ran from Panama to Galera Point, thence to the Galapagos, and from there to Acapulco; and in May I left the expedition at Guaymas, after a short exploration of the Gulf of California. The letters written on the voyage to Colonel McDonald give a preliminary account of this trip; they have been published in the Museum Bulletin (Vol. XXI. No. 4), and a more extended account of the expedition is in preparation. The collections made have arrived safely at Washington, and, with the consent of Colonel McDonald, arrangements have been made for the publication of the results in the Memoirs and Bulletins of the Museum. The following gentlemen have kindly agreed to work up the collections: Dr. P. H. Carpenter, the Comatulæ; Professor S. F. Clarke and Mr. Peabody, the Hydroids; Dr. W. H. Dall, the Mollusks; Mr. C. B. Davenport, the Bryozoa; Professor Faxon, the Crustacea; Professor W. E. Hoyle, the Cephalopods; Mr. S. Garman, the Fishes; Dr. Goes, the Foraminifera; Dr. V. Lendenfeld, the Phosphorescent Organs of Fishes; Professor Ludwig, the Holothurians; Professor Lütken, the Ophiurans; Dr. John Murray, the specimens of the bottom; Professor Mark, the Actinians; Professor Studer, the Gorgonians; Dr. W. M. Woodworth, the Planarians; and Dr. H. V. Wilson, the Sponges. I shall myself undertake the general account of the Pelagic Fauna, the Acalephs, and the Sea Urchins. The groups forming the remainder of the collection will probably be distributed during the coming winter.

Twice before I had been on the point of making an exploration of the deep waters of the Pacific off Panama. Once my plans were disarranged by the breaking out of war between Chili and Peru, and three years ago, when the "Albatross" was on her way from New York to San Francisco, I was unable to meet her at Panama, although she was detained there for a time by the Fish Commissioner, in hopes I might be able to join the ship before she left for the Galapagos. I find it difficult to express my obligations to Colonel McDonald for having given me the opportunity of accompanying the "Albatross" on her second cruise, and of carrying on the explorations of the past winter in so new and so interesting a field on a vessel so admirably adapted and equipped for the purpose as the "Albatross," and commanded by so experienced and enthusiastic deep-sea dredger as Lieut. Commander Tanner. To Mr. Richard Rathbun, Assistant of the U. S. Fish Commission, I must express my thanks for the care, interest, and patience with which he attended to the endless details connected with the fitting out of the "Albatross" for her voyage.

We are unfortunately compelled for want of funds gradually to restrict the work of the assistants of the Museum to the mere care and maintenance of the collections, and to limit their use by specialists. Our inability to engage a sufficient number of assistants compels us to refuse many of the constant demands made upon the administration of the Museum for an opportunity of working up or of examining parts of our collections, the value of which to science is thus greatly diminished. It is true we have a number of volunteer assistants, but we cannot expect these gentlemen, who have kindly undertaken the general supervision of special departments, to spend their time in the drudgery necessary to meet the legitimate demands which every fairly organized Museum ought to be able to meet, and which are naturally made upon our collections and assistants. With the exception of Dr. Hagen and Mr. Garman, there is no assistant upon whom I feel at liberty to call for work of that kind. The annual expenditure of a comparatively moderate sum would go far to remedy the unfortunate attitude we are compelled to assume towards specialists. But I need not dwell upon the unsatisfactory condition of the Museum finances. As I have stated in former Reports, it is no longer practical for me, in connection with other plans I have in view, to continue to give to the Museum the support, or to devote to its interests the time

it has hitherto received from me. It is becoming self-evident that an attempt to establish at Cambridge a Museum devoted to original investigation, in addition to its other functions of providing a University Museum and Laboratories, is not destined to be carried out. We cannot compete with the general government or municipal institutions without an endowment or resources far greater than any University can hope to obtain, and the sooner the future plans of the Museum are modified to meet the existing state of things, the less will be the waste, and the sooner shall we adapt our organization to the comparatively limited field of a University establishment.

ALEXANDER AGASSIZ.

CAMBRIDGE, October 1, 1891.

REPORT OF THE STURGIS-HOOPER PROFESSOR OF GEOLOGY.

BY JOSIAH D. WHITNEY.

DURING the year a course of lectures was given on Mineral Veins and Metalliferous Deposits, with special reference to the mode of occurrence and utilization of the useful metals and their ores, the course forming an introduction to the sciences of Mining and Metallurgy. This course was attended by about twenty students, mostly Seniors, with a few Graduates.

The slides belonging to the lithological collections, mentioned in the last Report as having been transferred to the keeping of the Instructor in Petrography in the College (Dr. Wolff), still remain in the hands of Professor Wadsworth, Director of the Michigan Mining School, and no recent information has been received from him in regard to the preparation of the report intended as the continuation of the "Lithological Studies," of which the first part was published in the Museum Memoirs several years ago. These slides would be useful, as a necessary complement of the collection to which they belong, for the Instructor in Petrography, and should be returned unless Professor Wadsworth finds himself able within a reasonable time to prepare a report on the same.

The beginning of cataloguing the library belonging to this department has been made by Miss Clark, and a portion of the books temporarily arranged on the shelves. A considerable number of volumes have been transferred to the Museum Library. The shelf room, however, is quite inadequate for the proper arrangement of the books, and it is necessary that more room be provided, or that the Geological and Mining Library belonging to this department be divided up in some such way as shall be found to be best suited to meet the wants of those who desire to use it.

Most of the time of the Sturgis-Hooper Professor has, during the past year, been given to work on the Century Dictionary,

which work is now finished, the last part of the Dictionary being all in type, and almost ready for publication.

The Sturgis-Hooper Professor proposes now to resume his investigations into historic and prehistoric changes of climate, the first part of which was published in the Museum Memoirs, under the title of "Climatic Changes of Later Geological Times," in 1882.

REPORT ON THE GEOLOGICAL DEPARTMENT.

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

DURING the Academic year 1890-91, the following named courses of instruction were given in the Geological, Geographical, Petrographical, and Palæontological Laboratories, and in the field, by the instructors in the department.

1. Geol. 4. A course in Elementary Geology, by N. S. Shaler. Two lectures a week, with certain required reading; attended by two hundred and fifty-eight students.

2. Geol. 4 *a*. A course of practical Geological Exercises in the laboratory and in the field, by T. W. Harris, assisted by R. S. Tarr and J. B. Woodworth, designed especially for those who intend in subsequent years to continue the study of Geology and Palæontology. Attended by one hundred and four students.

3. Geol. 8. A course of Advanced Geology, two lectures a week, by N. S. Shaler, together with assigned reading and field-work, conducted by W. M. Davis and J. E. Wolff. Students in this course were required during the winter to prepare theses on assigned subjects. Those only who had passed a satisfactory examination in the elementary courses were permitted to attend. Forty-three persons received this instruction.

4. Geol. 9. A course in Structural Geology, by T. W. Harris. Two lectures a week with required reading and theses. Six students took this course.

5. Geol. 14. A course in Palæontology, by N. S. Shaler. Two lectures a week, with laboratory work and theses. The course was attended by eleven students.

6. Geol. 20 *b*. A course in field-work, designed to afford special training in the processes of geological surveying, by N. S. Shaler, W. M. Davis, J. E. Wolff, and T. W. Harris. Attended by sixteen students.

7. Geol. 1. A course in Elementary Meteorology, by W. M. Davis. First half-year. Two lectures a week, with recitations and laboratory exercises; attended by ninety students.

8. Geol. 2. A course in Physical Geography, by W. M. Davis. Second half-year. Two lectures a week, with recitations and laboratory exercises; attended by one hundred and ten students.

9. Geol. 20 *a*. A course in Advanced Meteorology and Physical Geography, by W. M. Davis. Weekly conferences; attended by six students.

10. Geol. 22. A course in Petrography, by J. E. Wolff. Two lectures a week, with laboratory work and theses; attended by six students.

11. Geol. 20 *d*. A course in Petrographic Investigation, by J. E. Wolff. Field and laboratory work; one student.

12. Geol. 25. A course in Mineral Veins and Metalliferous Deposits, by J. D. Whitney. First half-year. Two lectures a week; attended by twenty students.

During the winter season the students in the advanced classes attended regular evening meetings, which were designed to serve the purpose accomplished by the Seminaria of the German universities.

During the summer of 1891, forty-one students received instruction in the field. This instruction was given in three graded schools, one of which, the elementary school, was taught in Cambridge, and the other two in New York, New Jersey, and the New England States. Instruction in these courses was given by N. S. Shaler, W. M. Davis, J. E. Wolff, C. Cobb, and J. B. Woodworth, with the assistance of Prof. H. S. Williams of Cornell University, Prof. A. P. Brigham of Utica, N. Y., Prof. R. D. Salisbury of the University of Wisconsin, and Mr. C. W. Coman, Assistant, New Jersey Geological Survey, who collaborated with the other instructors in the work done in New York and New Jersey.

During the year, the following papers of a scientific nature have been published by N. S. Shaler:—

General Account of the Fresh Water Morasses of the United States, with a Description of the Dismal Swamp District of Virginia and North Carolina. Tenth Annual Report of Director of United States Geological Survey.

The Antiquity of the Last Glacial Period. Proceedings Boston Society of Natural History, Vol. XXV.

Individualism in Education. Atlantic Monthly, Vol. LXVII.

College Examinations. Atlantic Monthly, July, 1891.

Atlas of Massachusetts, fifty-five sheets quarto (with F. A. Walker and H. L. Whiting). January, 1891.

Report of the Massachusetts Topographical Survey Commission. January, 1891.

The instruction during the past year in the elementary courses in Physical Geography and Meteorology, by Professor W. M. Davis, has been greatly benefited by the occupation of the new rooms assigned to these subjects in the Geological Section of the Museum; and by the aid of Mr. R. DeC. Ward, of the class of 1889, who has acted as assistant in the laboratory work. Under these favorable conditions, it has been possible to introduce certain practical methods of laboratory teaching that have been in mind for several years past, but which have been unattainable heretofore in smaller rooms and without assistance. Each of these elementary courses occupied half a year, the number of students in the course on Meteorology being ninety, and in Physical Geography one hundred and ten. In each course, two lectures a week were given to the whole class in the large Lecture Room on the first floor; and an hour of laboratory work was arranged for each of the five sections into which the class was divided for this purpose, this work consisting of exercises on charts, maps, diagrams, models, photographs, etc., and involving about two hours' additional work by each student for its proper completion. In order to test the progress made by the class, it was divided into twelve sections, each of which met the instructor or the assistant weekly for a half-hour's recitation, followed by half an hour for a written exercise. Although the amount of time required for the work by the instructor and the assistant was great, it is believed to have been well expended, to the profit of the students: moreover, the marks assigned on the frequent recitations and written exercises, when combined at the end of the term, are found to be a valuable check on the mark given upon the final written examination.

The second course in Physical Geography and Meteorology, for students already acquainted with the rudiments of these subjects, was attended by six students. The work in this course is done individually by the students, and discussed in a weekly conference of two hours. The subjects studied in the past year were the Natural History of Rivers; the Physical Geography of Wisconsin; Professor Russell's Theory of Cold Waves; the Chinook Wind of the Rocky Mountains; and Faye's Theory of Cyclones. To this

may be added a statement of the work in a similar course by three students of the Society for the Collegiate Instruction of Women, the subjects here studied being the Physical Geography of New York, of New Jersey, and of Pennsylvania.

The collections of the Laboratory of Physical Geography have been materially enlarged during the past year. A pair of projecting lanterns, purchased for the general use of the Geological Department, has greatly improved the means of illustration in the lectures; and a beginning has been made towards a series of geographical lantern slides. Especial effort is given to securing views characteristic of our own physical geography, at present very poorly represented in the collections of dealers. The laboratory collection has been added to by numerous gifts, of which the following may be mentioned:—

Photographs and slides of Rocky Mountain views, from F. H. Chapin, Esq., of Hartford, Conn.

Photographs of Saxon Switzerland, from Mr. R. DeC. Ward, of Cambridge.

Photographs of scenery on the Canadian Pacific Railway, from the Canadian Pacific Railway Company.

Photographs of scenery of the New York Central and Hudson River Railroad, from Hon. Chauncey M. Depew, President.

Photographs of Clouds, from Professor Riggenbach-Burckhardt, of Basel, Switzerland.

Photographs of Clouds, from Captain D. Wilson-Barker, of London, England.

Topographical Maps, from the United States Geological Survey.

The Laboratory collection will be soon extended by a number of important maps, already ordered from samples seen in the Geographical Exhibition of the Brooklyn Institute; and a considerable number of geographical text-books by various authors have already been secured in preparation for the proposed course for teachers, during the coming year.

The materials here named, as well as those accumulated during earlier years, are conveniently kept in the spacious Laboratory storeroom, where cases and shelves have been prepared for them. Among the most important of these materials is a complete set of the weather maps of the United States Signal Service, from the beginning of publication, for the most part in bound volumes, the gift of the Chief Signal Officer several years ago. This set is

continued by the receipt of the current maps of the United States Weather Bureau.

The records and collections of the New England Meteorological Society are also kept in the Laboratory storeroom. Mr. J. Warren Smith, lately of the United States Signal Service, and now of the United States Weather Bureau, acting as assistant to the Society in its capacity as a local weather service for New England, has his office here.

During the winter, Mr. S. Ward Loper, of the United States Geological Survey, classified the fossil fish collected under the direction of Professor Davis from the Triassic formation of the Connecticut valley, and now temporarily placed in the Laboratory storeroom. An account of the results of this study has been published, as stated below.

The publications of Professor Davis during the year are as follows :—

Two Belts of Fossiliferous Black Shale in the Triassic Formation of Connecticut. By W. M. Davis and S. W. Loper. *Bull. Geol. Soc. America*, 1891, Vol. II. pp. 415-430.

Dr. Hann's Studies on Cyclones and Anticyclones. *Science*, Jan. 2, 1891, Vol. XVII. pp. 4-5.

The Geographical Exhibition of the Brooklyn Institute. *The Nation*, March 28, 1891, Vol. LII. p. 257.

Abstracts of Three Lectures delivered at Johns Hopkins University in January, 1891: Tornadoes, a Story of a Long Inheritance; The Physical Geography of Southern New England; The Triassic Sandstones of the Connecticut Valley. *Johns Hopkins University Circulars*, April, 1891.

European Weather Predictions. *Amer. Met. Journ.*, June, 1891, Vol. VIII., pp. 53-58.

The Story of a Long Inheritance. *Atlantic Monthly*, July, 1891, Vol. LXVIII. pp. 68-78.

The Geological Dates of Origin of Certain Topographic Forms on the Atlantic Slope of the United States. *Bull. Geol. Soc. America*, 1891, Vol. II. pp. 541-586.

The instruction in Petrography was given by Dr. Wolff in the new Petrographical Laboratory of the University Museum. During the year the Lecture Room was fitted up for the microscopical projection of thin sections of rocks before the class. Six students attended the course through the year, and one student spent the year in original investigation.

The following papers were published during the year by Dr. Wolff :—

On the Lower Cambrian Age of the Stockbridge Limestone at Rutland, Vt. Bull. Geol. Soc. America.

On the Metamorphism of Clastic Feldspar in Conglomerate Schist. Bull. Mus. Comp. Zoölogy.

An investigation of some akmite trachytes from the Crazy Mountains, Montana, was completed by Mr. R. S. Tarr and Dr. Wolff (not yet published), and on other rocks of that range and of New England. In the spring, the instructor began the field and laboratory investigation of the Archæan Highlands of New Jersey and New York, in connection with the United States Geological Survey.

REPORT ON THE INSTRUCTION IN ZOÖLOGY.

 BY PROFESSOR E. L. MARK.

SINCE the last report, courses of instruction in Zoölogy have been somewhat rearranged. Corresponding to alterations in the organization of the Faculty of Arts and Sciences, there has been a change in the announcement of the courses, so that those previously designated as courses in Natural History are now named, from their respective departments, Botany 1, 2, etc., and Zoölogy 1, 2, etc. This has allowed a more natural sequence of the courses announced in Zoölogy, which with their previous equivalents are as follows:—

Zoölogy	1,	formerly Nat. Hist.	2.
"	2,	" "	5 (the Zoölogical half).
"	3,	" "	6.
"	4,	" "	13.
"	5,	a new course.	
"	10,	formerly Nat. Hist.	21.
"	20 <i>a</i> ,	" "	9.
"	20 <i>b</i> ,	" "	10.

With the exception of a new half-year course (Zoöl. 5), the lectures were substantially the same as those in 1889-90 and were given by the same instructors.

Ninety-one students completed the course in Zoölogy 1. The Assistants were Mr. William E. Ritter, upon whom the most of the laboratory work devolved, and Mr. J. C. Hubbard.

Zoölogy 2 was conducted as heretofore in the second half of the year by Mr. G. H. Parker, and his Assistant in the laboratory work was again Dr. W. A. Setchell. There were thirty-four students in this course.

The course on the Comparative Anatomy of Vertebrates (Zoöl. 3) was also given by Mr. Parker to twenty students.

There were nine students in Zoölogy 4, which covered about the same ground as in the previous year. Mr. W. M. Woodworth had charge of the laboratory work, and he also gratuitously assisted the instructor in connection with the laboratory work of Zoölogy 5. The latter course extended through the second half of the year, and was taken by nine students. The lectures, on the Embryology of Vertebrates, were accompanied by laboratory work on the development of the Chick.

There were eight persons, all Graduates, engaged in special researches (Zoöl. 20 *a*), as large a number as the Laboratory designed for this purpose will accommodate. All the students in this work made satisfactory progress with their investigations; at the last Commencement two of them received the degree of Ph. D., one the degree of S. D., and one the degree of A. M.

The following table shows the numbers and sources of the students in Zoölogical courses:—

Class.	Gr.	Sen.	Jun.	So.	Fr.	Sp.	Sc.	Total.
Zoöl. 1	3	12	9	21	21	18	7	91
" 2	1	9	4	12	3	1	4	34
" 3	4	7	6	..	..	..	3	20
" 4	5	..	1	..	..	..	3	9
" 5	6	..	1	..	..	..	2	9
" 10 . . . . .	..	3	1	..	..	..	..	4
" 20 <i>a</i>	8	..	..	..	..	..	..	8

The removal of Professor Farlow's Laboratory and the Cryptogamic Herbarium to the new Botanical section of the University Museum has added a large room to the Zoölogical Laboratories. By assigning this new room to the less advanced students in microscopic work, it has been possible to relieve the overcrowded condition of the room designed for students working on advanced subjects.

The meetings of the Zoölogical Club have been well attended during the year.

During the past year the following Contributions from the Zoölogical Laboratory, under Dr. Mark, have been published, all except No. XXIII. in the Museum Bulletin:—

XIX. *Cristatella* : the Origin and Development of the Individual in the Colony. By C. B. Davenport. 52 pp., 11 pls. November, 1890.

XX. The Eyes in Blind Crayfishes. By G. H. Parker. 10 pp., 1 pl. November, 1890.

XXI. The Origin and Development of the Central Nervous System of *Limax maximus*. By Annie P. Henchman. 40 pp., 10 pls. December, 1890. — This paper was the result of work done at the Museum by Miss Henchman while a student in the "Harvard Annex."

XXII. The Parietal Eye in some Lizards from the Western United States. By W. E. Ritter. 20 pp., 4 pls. January, 1891.

XXIII. Preliminary Notice on Budding in Bryozoa. By C. B. Davenport. Proc. Amer. Acad. Arts and Sci., Vol. XXV. [1890]. 5 pp. 1891.

XXIV. Contributions to the Morphology of Turbellaria. — I. On the Structure of *Phagocata gracilis*, Leidy. By W. M. Woodworth. 44 pp., 4 pls. April, 1891. — This paper was presented as a thesis for Ph. D.

XXV. The Compound Eyes of Crustacea. By G. H. Parker. 98 pp., 10 pls. May, 1891. — Presented as a thesis for S. D.

XXVI. On some Points in the Anatomy and Histology of *Sipunculus nudus*, L. By Henry B. Ward. 42 pp., 3 pls. May, 1891.

XXVII. The Development of the Pronephros and Segmental Duct in Amphibia. By Herbert H. Field. 142 pp., 8 pls. June, 1891. — Presented as a thesis for Ph. D.

The plates are printed for papers by Mr. Davenport, "Observations on Budding in *Paludicella* and some other Bryozoa," — now in press, — and by Mr. Frank Smith, "Gastrulation of *Aurelia flavidula*, Pér. & Les." The papers by Mr. Smith and Mr. H. P. Johnson are ready for the printer, and Mr. Boyer's paper is to be forwarded soon.

The greatest need of the Zoölogical Laboratories at present is the equipment of the Aquarium and Vivarium, to which the Curator called attention in former Reports. It is to be regretted that the department has been so long deprived of this essential accessory to zoölogical work.

REPORT ON THE OSTEOLOGICAL DEPARTMENT.

BY D. D. SLADE.

SEVERAL valuable additions have been made to the collection since the last Report. Among the articulated skeletons, mention should be made of the fine specimens of *Balæna cisarctica*, *Physeter macrocephalus*, and *Monodon monoceros*, all of which have been suspended in the main Exhibition Hall. The extreme rarity of the *Chlamydophoridae* among the *Edentata* renders the recent possession of *C. truncatus* a most valuable acquisition. The disarticulated skeletons also comprise several of much interest to the scientist and student. The entire collection is in good order and preservation, and, while extremely valuable, is still sadly deficient in many of the orders. Attempts have been made by the Assistant, during the last few months, to induce some of the wealthy friends of the University to contribute to a fund for the care and increase of the collection, than which none can be more useful and important in the pursuit of a scientific education. Although not so successful as he could wish, perseverance may produce good results in the near future.

Instruction has been given in Comparative Osteology during the past year by means of lectures, laboratory work, and by frequent examinations. The course has been attended by three Seniors and by one Junior.

While this course, Zoölogy 10, is usually selected by those who have the medical profession in view, it presents rare opportunities for special study and research, both to the graduate and undergraduate.

The following papers have been published during the year : —

The Significance of the Jugal Arch. *Science*, Vol. XVI. p. 332.

The Jugal Arch in the Primates. *Science*, Vol. XVII. p. 317, and Vol. XVIII. p. 53.

On the Genus *Chlamydophorus*. *American Naturalist*, June, 1891, p. 540.

MAMMALS AND BIRDS.

MR. BREWSTER has nothing of special interest to report in regard to the Mammals and Birds during the past year. He has been for some time in correspondence with collectors to bring together birds from the islands of the Pacific for our Pacific Faunal Room. He has published the following papers since the appearance of the last Annual Report.

In "The Auk": —

"Summer Robin Roosts."

"A New Subspecies of the Solitary Sandpiper."

"Breeding of the Pileated Woodpecker in Worcester County, Massachusetts."

"A Study of Florida Gallinules, with some Notes on a Nest found at Cambridge, Massachusetts."

"Notes on the Birds of the Lower Suwanee River." (By William Brewster and F. M. Chapman.)

"Descriptions of Seven supposed new North American Birds."

"Notes on Bachman's Warbler (*Helminthophila Bachmani*)."

"The Whistling Swan in Massachusetts."

"*Megascops asio Macfarlanei*, — a Correction."

In "Forest and Stream": —

Two notes without formal titles, both relating to the whistling sounds made by the American Woodcock while flying.

REPORT ON THE REPTILES AND FISHES.

BY SAMUEL GARMAN.

CONTRIBUTIONS to the collections in this department have been made by Mr. H. L. Shumway, Dr. G. O. Rogers, Mr. J. E. Hall, Dr. W. M. Haines, Prof. Walter Faxon, Mr. A. N. Cheney, Mr. Eugene A. Browne, Mr. J. H. Blake, Miss I. Batchelder, and Prof. Alexander Agassiz. In that made by Dr. Rogers, received through the kindness of Prof. F. W. Putnam, there were a number of very desirable Reptiles and Batrachians from Central Mexico.

Among the exchanges sent us there was a valuable series of deep-sea types, secured by the French Government Expeditions in the "Travailleur" and the "Talisman," forwarded by Prof. Leon Vaillant from the Paris Museum. Another series of species from the Kara Sea was received from Prof. Chr. Lütken, of the Copenhagen Museum; and various Reptiles and Batrachians were sent us by Dr. George Baur and Mr. A. L. Babcock.

By purchase, a number of choice representatives of West Indian, African, and Australian species were obtained from the Linnæa Naturhistorisches Institut.

The outgoing exchanges were a comprehensive series of the South American Siluroids to Dr. K. Kraepelin, of the Naturhistorisches Museum zu Hamburg; another to Prof. C. H. Eigenmann, of Indiana University; a lot of Deep-sea Fishes to Prof. R. Collett, of Christiania, Norway; and others to Dr. George Baur, of Clark University.

In connection with the continued preparations for the Exhibition Rooms, certain Selachians, Reptiles, and Fishes have been sent to Professor Ward for mounting. The condition of the collections as a whole has been much improved; the waste from evaporation or other causes has been comparatively small, and the number of identified species from which exchanges may be made has been considerably increased.

The publications from this department include the following, besides unsigned reviews and notices of works on related subjects.

In the Bulletin of the Essex Institute: —

“On a Genus and Species of the Characines (*Henochilus Wheatlandii*, gen. n. et sp. n.)”

“On *Balistes vetula*.”

“*Silurus* (*Parasilurus*) *Aristotelis*.”

“The Gila Monster (*Heloderma suspectum*).”

“On a Tortoise found in Florida and Cuba.”

In the Twenty-fifth Annual Report of the Commissioners on Inland Fisheries of Massachusetts: —

“Massachusetts Carp.”

“The River or Brown Trout.”

“New England Saibling.”

In “The Nation”: —

“The Blizzard Fossils.”

In “Forest and Stream”: —

“The Golden Trout.”

In the “American Angler,” and in “Shooting and Fishing”: —

“The Alpine Trout.”

“The Freshwater Salmon.”

“*Salmo alpinus*, 1758 — *S. aureolus*, 1888.”

“Nova Scotian Salmon.”

“The Sunapee Saibling.”

“A new Trout from Maine.”

“The Sunapee Trout (*Salmo alpinus*).”



CRUSTACEA.

THE only items of importance mentioned by Professor Faxon in regard to the Crustacea are the accessions received from Mr. Charles Chilton from New Zealand, and the Crustacea of the Dijnphna Expedition, presented to the Museum by the Director of the Zoölogical Museum of the University of Copenhagen. A few dried Crustacea have also been purchased from Ward for our Exhibition Rooms.

REPORT ON THE PALÆONTOLOGICAL DEPARTMENT.

BY ALPHEUS HYATT.

THE work of the past year has been marked by a notable advance towards completion of the general arrangement of the Invertebrates. With the exception of certain small collections of Permian and Triassic Fossils in Room C which still remain undivided, and a collection of slabs and undeveloped materials which have been placed in cases reserved for such purposes in Room A, the larger part of all the fossils of each class have been brought together in the following order: the Protozoa, Sponges, Hydroids, Corals, and Echinoderms in Room A; the Worms, Bryozoa, Brachiopods, Insects, Crustacea, and Trilobites in Room B; the Lamellibranchs, Pteropods, and the larger part of the Gasteropods in Room C; and the remaining Gasteropods and all the Cephalopods in Room D. There still remain, in all of the collections which have not been carefully gone over specimen by specimen, a considerable proportion of misplaced fossils, which can only be weeded out by very close work. This is the case especially in those collections, such as the Schary, Dyer, Day, and others, which contain considerable amounts of unnamed specimens. During the progress of this revision, a large number of choice Fossils suitable for exhibition in the Stratigraphic Collection were picked out and marked with appropriate labels. Although the separation of the classes into genera has made considerable progress in past years, and in some classes may be said to be well advanced, it is hopeless to expect to complete this for any one of these natural divisions until the general arrangement has been practically finished.

This work, and that of picking out specimens for exhibition in the Stratigraphic Collection, can now be continued with much greater facility. Blue print maps are hung in each room giving floor plans with the cases in white, and upon these the number of each case is given and brief abstracts of its contents. Each case has an outside label hanging to the knob of the sash giving a number and a

synopsis of the contents, so that any material may be as quickly found as is practicable in the present condition of the collections. This system admits of constant alteration and replacement of maps and labels as the arrangement progresses, an obvious advantage which does not need explanation.

The Assistant has finished the systematic collection of Cephalopods on exhibition, and a full presentation of the genera has been given. The collections contain a very large proportion of the original types of all the genera yet described in this class, and of the remaining genera good examples of all except a few recently published in Europe. This exhibition is therefore probably the most complete now in existence as an exposition of the range of natural modifications in this important class of Fossils.

The Sponges, Hydroids, and Echinoderms have been more or less worked upon for the purpose of getting together all of the forms in each genus, thus preparing the way for the permanent arrangement and the final selection and naming of specimens for exhibition. Some of the more important families of the Lamellibranchs in the Jura and Cretaceous have been similarly treated, and are almost completed.

By the kind permission of Alexander Agassiz, Director, the extensive foreign collections in the Trias and Jura of the Museum have been placed at my disposal for the study and comparison of our American species with the typical European forms. The great advantages thus gained will be appreciated by all professional palæontologists, especially those engaged in similar work, but obliged to rely solely upon foreign publications. These collections will require considerable time to bring them into proper shape for this purpose, since much of the material has been acquired in separate lots from different collectors, and needs to be concentrated and arranged. This work has been begun and an appreciable advance made during the past year.

Besides efficient services in connection with the general arrangement and superintendence of the removal and placing of fossils, the department is indebted to Dr. R. T. Jackson for a large amount of work in the revision of the Mollusca, Corals, and Brachiopods, which contained unarranged material and considerable special work upon some smaller groups.

Miss Clark has been employed in preparing labels, and dusting and remounting specimens. It became necessary to remount a very

large number of the specimens in the older parts of the collections which had been glued to card boards. These were in no danger of being lost or materially damaged, but had cracked off and were lying loose in the trays. It is probable, in consequence of the more durable glue now used and the fact that the trays have reached their final destination in the Museum, that this work will not require to be done over again.

The following papers were published during the year by the assistants in this department:—

Guides for Science Teaching, No. VIII. *Insecta*, by Alpheus Hyatt and J. M. Arms. 323 pages, illustrated by 223 figures. D. C. Heath & Co., Boston, 1890.

The Next Stage in the Development of Public Parks. By Alpheus Hyatt. *Atlantic Monthly*, February, 1891.

Dall on Dynamical Influences in Evolution. By R. T. Jackson. *Am. Nat.*, October, 1890.

Studies of Pelecypoda. By Robert Tracy Jackson. *Am. Nat.*, December, 1890, p. 1132.

The Mechanical Origin of Structure in Pelecypods. *Am. Nat.*, January, 1891, p. 11.

REPORT ON THE LIBRARY.

BY MISS F. M. SLACK.

DURING the year ending September 1, 1891, the Library has received 705 volumes, of which 57 are atlases, 1,998 parts, and 147 pamphlets:—

	VOLUMES.	PARTS.	PAMPHLETS
Gift	8	43	20
Exchange	212	854	84
Purchase	78	240	10
A. Agassiz	66	841	31
Binding Parts	254		
Whitney Library	87	20	2
	705	1998	147

The number of volumes now in the Library (exclusive of pamphlets and the greater part of the Whitney Library) is 19,807. There are 13,281 pamphlets bound in 2,182 volumes, making the total number of volumes 21,989.

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PUBLICATIONS

OF THE

MUSEUM OF COMPARATIVE ZOOLOGY

FOR THE ACADEMIC YEAR 1890-91.

Of the Bulletin.

Vol. XX. [Complete.]

- No. 2. On the Rate of GROWTH OF CORALS. By A. AGASSIZ. pp. 4. 4 Plates. August, 1890.
- No. 3. Preliminary Account of the FOSSIL MAMMALS from the White River and Loup Fork Formations. Part II. CARNIVORA and ARTIODACTYLA, by W. B. SCOTT. PERISSODACTYLA, by H. F. OSBORN. pp. 36. 3 Plates. November, 1890.
- No. 4. Contributions from the Zoölogical Laboratory.—XIX. CRISTATELLA: the Origin and Development of the Individual in the Colony. By C. B. DAVENPORT. pp. 52. 11 Plates. November, 1890.
- No. 5. Contributions from the Zoölogical Laboratory.—XX. The EYES in BLIND CRAYFISHES. By G. H. PARKER. pp. 12. 1 Plate. November, 1890.
- No. 6. Notice of CALAMOCRINUS DIOMEDÆ, a New Stalked Crinoid from the Galapagos, dredged by the U. S. Fish Commission Steamer "Albatross." By A. AGASSIZ. pp. 4. December, 1890.
- No. 7. Contributions from the Zoölogical Laboratory.—XXI. The Origin and Development of the CENTRAL NERVOUS SYSTEM in LIMAX MAXIMUS. By ANNIE P. HENCHMAN. pp. 40. 10 Plates. December, 1890.
- No. 8. Contributions from the Zoölogical Laboratory.—XXII. The PARIETAL EYE in some LIZARDS from the Western United States. By W. E. RITTER. pp. 20. 4 Plates. January, 1891.

Vol. XXI. [Complete.]

- No. 1. Contributions from the Zoölogical Laboratory.—XXIV. Contributions to the Morphology of the TURBELLARIA. I. On the Structure of PHAGOCATA GRACILIS, Leidy. By W. M. WOODWORTH. pp. 44. 4 Plates. April, 1891.
- No. 2. Contributions from the Zoölogical Laboratory.—XXV. The COMPOUND EYES in CRUSTACEANS. By G. H. PARKER. pp. 98. 10 Plates. May, 1891.

- No. 3. Contributions from the Zoölogical Laboratory.—XXVI. On some Points in the Morphology and Histology of *SIPUNCULUS NUDUS*, L. By H. B. WARD. pp. 42. 3 Plates. May, 1891.
- No. 4. THREE LETTERS from ALEXANDER AGASSIZ to the Hon. Marshall McDonald, on the DREDGING OPERATIONS off the West Coast of Central America to the Galapagos, to the West Coast of Mexico, and in the Gulf of California, carried on by the U. S. Fish Commission Steamer "Albatross." pp. 16. June, 1891.
- No. 5. Contributions from the Zoölogical Laboratory.—XXVII. The Development of the PRONEPHROS and SEGMENTAL DUCT in AMPHIBIA. By H. H. FIELD. pp. 140. 8 Plates. June [August], 1891.

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INVESTED FUNDS OF THE MUSEUM.

IN THE HANDS OF THE TREASURER OF HARVARD COLLEGE, SEPT. 1, 1890.

Sturgis-Hooper Fund	\$100,000.00
Gray Fund	50,000.00
Agassiz Memorial Fund	297,933.10
Teachers and Pupils Fund	7,594.01
Permanent Fund	117,469.34
Humboldt Fund	7,740.66
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	\$580,737.11

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

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

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

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





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