

ANNUAL REPORT

OF

THE CURATOR

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY

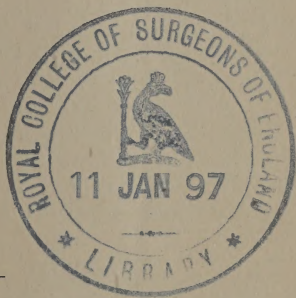
AT HARVARD COLLEGE,

TO THE

PRESIDENT AND FELLOWS OF HARVARD COLLEGE,

FOR

1895-96.



CAMBRIDGE, U.S.A. :

UNIVERSITY PRESS: JOHN WILSON AND SON.

1896.

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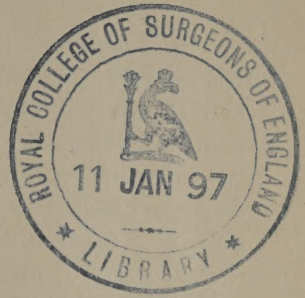
APPOINTED BY THE FACULTY OF THE MUSEUM.

WALTER FAXON *Assistant in Charge.*
SAMUEL GARMAN *Assistant in Herpetology and Ichthyology.*
WILLIAM BREWSTER *Assistant in Ornithology and Mammalogy.*
ALPHEUS HYATT *Assistant in Paleontology.*
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 Paleontology.*
MISS F. M. SLACK *Librarian.*
MAGNUS WESTERGREN *Artist.*

APPOINTED BY THE PRESIDENT AND FELLOWS.

ROBERT TRACY JACKSON *Instructor in Paleontology.*
J. B. WOODWORTH *Instructor in Geology.*
G. H. PARKER *Instructor in Zoölogy.*
W. McM. WOODWORTH *Instructor in Microscopic Anatomy.*
T. A. JAGGAR, JR. *Instructor in Geology.*
C. B. DAVENPORT *Instructor in Zoölogy.*
ROBERT DeCOURCEY WARD *Instructor in Climatology.*
HENRY R. LINVILLE *Assistant in the Zoölogical Laboratories.*
JOHN T. HAMAKER *Assistant in the Zoölogical Laboratories.*
J. H. HATHAWAY *Assistant in the Zoölogical Laboratories.*
VERNON F. MARSTERS *Assistant in Physical Geography.*
J. E. WOODMAN *Assistant in Geology.*
GEORGE C. CURTIS *Assistant in the Geographical Laboratory.*
R. J. FORSYTHE *Assistant in Metallurgy.*

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, Doctors Davenport, Woodworth, and Parker, and Mr. H. V. Neal, assisted in the Laboratory work by Messrs. H. R. Linville, H. S. Jennings, J. T. Hamaker, J. M. Parker, W. L. Tower, A. Rose, A. S. Hanna, R. W. Hall, and B. S. Oppenheimer.

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 Tracy Jackson, J. B. Woodworth, R. DeCoursey Ward, Leon S. Griswold, R. A. Daly, C. L. Whittle, F. C. Schrader, and T. A. Jaggar, Jr. The courses in Mining Geology and allied subjects were given by Prof. H. L. Smyth.

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. Eight students spent a part of their time in the Laboratory collecting material for their special investigations, which they will continue and prepare for publication in Professor Mark's Laboratory at the Museum. From want of funds and for other reasons the Museum Table at the Naples Zoölogical Station has been given up.

We have to thank Commander Brice, 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 1895-96, Dr. R. G. Harrison and Dr. A. W. Weysse.

We are indebted to Professor Hyatt for the care he has given to the collection of Invertebrate Fossils under his charge. Mr. R. T. Jackson has kindly undertaken the selection of a collection of Palæozoic fossil invertebrates to be placed on exhibition during the coming year in the room reserved for the Palæozoic faunæ.

The Exhibition Room devoted to Jurassic and Cretaceous faunal collections has during the past year been opened to the public. The central piece of the room is the mounted cast of *Iguanodon* obtained from the Brussels Museum. A number of fossil Reptiles, as well as of casts of limbs of the larger Western Dinosaurians have also been placed in this room. In the Mesozoic, as well as in the rooms devoted to Tertiary faunal collections, no attempt has as yet been made to place on exhibition a selected collection of Invertebrates. This we hope to do as soon as the Palæozoic faunal collections have been placed on exhibition. The cases of this room are nearly ready for the specimens, and we hope before the next academic year to open this room to the public. As the Museum collections are specially rich in Palæozoic fossils, it should be possible to make an interesting general exhibit of the older faunæ of the world.

Among the collections of fossils received, I may mention a large collection presented by the late Professor Whitney. These collections were principally made by him during his connection with the Geological Survey of California.

The fossil Vertebrates have been in charge of Dr. C. R. Eastman, who has made excellent progress in arranging and storing our material. Dr. Eastman has also secured for the Museum a number of interesting fossil Fishes.

The Europæo-Siberian Room has been rearranged. Several new cases have been added, and a large amount of material has been placed on exhibition, mainly Birds and Mammals. Mr. Brewster has, as in former years, kindly supervised the care of the collection of Birds and Mammals. The Museum is also indebted to him for much valuable assistance in other directions.

Professor Faxon has devoted the greater part of his time to the revision of the collection of Mollusks. This work is now nearly completed, and it will leave the collection quite accessible

to specialists. But until the Museum can afford to employ a conchologist whose whole time will be devoted to the care of his department we can hardly hope to do more than maintain in good condition the conchological collections we now possess, and cannot of course expect to carry out any important original work in a group in which so many of the older American naturalists have attained prominence. Mr. Faxon has devoted considerable time to a careful revision of the collections of Deep-Sea Crustacea, and has succeeded in placing this material in excellent condition for consultation.

The collections of Fishes and Reptiles in charge of Mr. Garman continue in excellent condition.

In the Entomological Department Mr. Henshaw reports that a good deal of his time has been spent in answering requests made upon him for information. He has continued to send out material for examination, while much of his time has also been given to the care of a number of small collections sent to the Museum, and to the supervision of the collections in general.

Dr. W. McM. Woodworth has continued in charge of the collections of Worms, but owing to his absence in Australia for a great part of the past Academic year few additions have been made to the collections in his charge.

The Library has received by gift or purchase the usual number of accessions, and our exchanges have increased somewhat. The number of volumes in the Library is now more than twenty-five thousand, and inclusive of the Whitney Library over thirty thousand. The Library has received from the State Department a set of the Proceedings of the Fur Seal Arbitration. In connection with Library matters, I may call attention to the plan proposed by Professor Davis, of concentrating at the Museum Library more of the Geological material now in the general Library, and of placing in Gore Hall the Geographical collections in the Museum Library. This is merely extending the plans already in existence of splitting up our Library as far as practicable into smaller collections, more readily accessible to workers in special departments. We thus have at the Museum, independent of the general Library, smaller collections devoted to Entomology, to Marine Invertebrates and Thalassography, to Fishes and Reptiles, and the Assistants always keep within reach the most important systematic works in their Departments. It is thus a comparatively

simple task for them to keep track of the bibliography of their respective Departments.

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 publications have been limited to the completion of Volume XXVII., and to the publication of Volume XXIX. of the Bulletin. The Corporation has continued the allowance of \$400 made the previous year to aid in the publication of some of the contributions from the Zoölogical Laboratory. We have this year made the first attempt at joint publication with the Boston Society of Natural History of some of the papers which, while presented to the Society, have yet been worked out at the Zoölogical Laboratory of the Museum in charge of Professor Mark. The American Academy, the Boston Society of Natural History, and the Museum having agreed upon a uniform type and size for their octavo publications, it may hereafter be possible to publish at joint expense illustrated papers which could not otherwise be published.

Of the "Albatross" Expedition of 1891 two Bulletins have been published during the past year, Dr. Müller's Report on the Ostracods, and that of Dr. Goës on the Foraminifera.

Excellent progress has been made with the Monograph of Professors Milne-Edwards and Bouvier on the Galathoidæ of the "Blake," so that we hope to issue it during the early part of the year.

The Report of Professor G. Brown Goode and Dr. Tarleton H. Bean on the Deep-Sea Fishes of the "Blake" has been issued as a special Bulletin by the National Museum and the Smithsonian Institution. By agreement with Professor Goode the Report on the collections of the "Blake" was incorporated with that on the collection of Fishes made by the "Fish Hawk" and "Albatross" along the east coast of the United States and in the Caribbean Sea. The Museum has issued as Volume XXII. of the Memoirs this joint publication of Goode and Bean on Oceanic Ichthyology.

The pressure of other work prevented the late Professor Goode from carrying out his plans regarding a discussion of the geographical and bathymetrical distribution of Deep-Sea Fishes in the publication just completed. It is hoped that this important

work may yet be undertaken by other investigators working in this field.

Good progress has been made on the text and plates of Mr. Garman's Report on the Deep-Sea Fishes of the "Albatross" Expedition of 1891. More than 40 Plates have been finished by Mr. Westergren.

Dr. Chun, to whom a collection of Deep-Sea Crustacea of the "Albatross" had been sent, has published a Preliminary Report on the theory of vision at great depths in the sea, based upon his study of the organs of vision of that group. See *Bibliotheca Zoologica*, Heft XIX. Lief. 4.

Among the specimens purchased for the Museum I may mention a small collection of European Mammals and Birds, an African Rhinoceros, a Zebra, a number of casts of rare vertebrate fossils, a collection of Pteropods, and one of West Indian Strophias.

Among the collections presented to the Museum the following are specially to be noted: a type collection of more than two hundred species of Corbiculæ, received from Mr. Temple Prime; the first instalment of a valuable collection of New England Shells, from Messrs. Smith and Clapp; from the Smithsonian Institution we have received a collection of Deep-Sea Fishes from the Northern Pacific and Behring Sea, made by the "Albatross," and a collection of Fishes, made under the auspices of the United States Fish Commission, from various parts of the southeast coast of the United States; from Mr. F. W. Townsend, a collection of Shells from the Persian Gulf; and a number of Foraminifera from Mr. D. Bryce Scott.

Collections have been sent for study to Mr. S. F. Conant; to Mr. Charles Schuchert of the National Museum have been intrusted a number of specimens of Palæozoic Starfishes; to Messrs. Wachsmuth and Springer, a few Crinoids. Exchanges have been made with the Museum at Santiago, Chile, and the State College of Kentucky. The Crustacea collected by the "Albatross" expedition of 1891 have been returned to the National Museum, on behalf of the United States Fish Commission.

The Monograph of Messrs. Wachsmuth and Springer on the North American Crinoidea Camerata is approaching completion. The whole edition of the 83 Plates which are to accompany the Monograph has been delivered. Mr. Springer, into whose hands has fallen the completion of the text, hopes the volumes may be

issued by the end of this year. The senior author of the work, Mr. Charles Wachsmuth, has not lived to see the publication completed. His whole life had been devoted to the study of the North American Crinoids. He was an ardent collector and a philosophical student of the group. He made during his lifetime two great collections, one of which was secured for the Museum in 1873, and the other he brought together with his friend Mr. Springer. These collections were the materials upon which was based their Monograph, which will be his monument to science.

A good deal of confusion regarding the date of publication of this Monograph has been caused by the premature publication, a few months ago, of a review of the volumes by a person having access to the sheets and plates in Mr. Wachsmuth's hands.

It is hoped that by the arrangements made by the Corporation on behalf of the Museum, the funds which for the past years have been expended for the benefit of the Undergraduate Department may gradually be restored to the Museum account, and expended more in accordance with the original aims of the Museum.

During the past year the Museum has lost the services of two of its officers.

Dr. D. D. Slade, who for many years had devoted his time to the Osteological Collection of the Museum, died at Chestnut Hill in February last. Dr. Slade attempted to build up an advance course of osteological research, and it was a great disappointment to him that he met with so little encouragement. He devoted his time mainly to the arrangement of the material in his charge, and wrote a number of papers on special subjects connected with osteology. He hoped to build up the osteological collection with special reference to its use as an aid in palæontological research.

By the death of Josiah D. Whitney, American geology loses one of its oldest Professors and one of its soundest and most thorough investigators. He was the oldest officer of the Museum. In 1875, when the Sturgis-Hooper Professorship was changed to one of Geology, and his duties as Director of the Mining School ceased, Professor Whitney became attached to the Museum. From that time he was identified with its interests, devoting his time mainly to higher instruction and to the publication of the material he had accumulated during his connection with various geological surveys.

Of the more important publications which the Museum owes to him, I may mention "The Azoic System," "The Auriferous

Gravels of the Sierra Nevada of California," and "The Climatic Changes of Later Geological Times."

A pioneer among American geologists, he began as assistant to Dr. Charles T. Jackson on the Geological Survey of New Hampshire. He occupied, as one of the older State geologists, a prominent place among those who have laid the foundation of American field geology. The work he accomplished as United States Geologist of Lake Superior, and as State Geologist of Wisconsin, of Iowa, and of California, was of high grade, and the important publications he issued in connection with these surveys have stood the test of time. After the Legislature of California had refused to continue their appropriations for the State Survey, he continued it for some time at his own expense. The "Yosemite Book" was issued in connection with that Survey, and on his return to the East from California he published at Cambridge six volumes of the "Geological Survey of California."

He published a number of minor reports and papers in scientific journals. He wrote the article "United States" in the ninth edition of the *Encyclopædia Britannica* and the definition of many of the geological and mining terms in the *Century Dictionary*. Among his other important publications should be mentioned his "Metallic Wealth of the United States," the result of extensive travels throughout the country, and his "Studies in Geographical and Topographical Nomenclature." His scientific sympathies extended over a broad field. Besides his special geological work he was interested in geographical questions, and had made a profound study of Mining, Metallurgy, and Chemistry, so far as they relate to geology.

A man of strong convictions, he was naturally impatient with many of the cruder theories of the younger school of geologists, and was often considered as not sufficiently in touch with modern methods. He was devoted to the interests of his students, allowing them the fullest access to the materials he had brought together, and most generous in his dealings with his fellow workers. He brought together during his lifetime a large and valuable library, which he gave to the Museum as the nucleus of a library for the Sturgis-Hooper Professorship. The greater part of it, about 5,000 volumes and nearly 1,500 pamphlets, as well as the palæontological collections he possessed, mainly from California, were already deposited in the Museum at the time of his death.

He retained his activity to the last, and his death found him occupied in writing papers on the origin and mode of occurrence of iron and its ores, and in their classification.

In connection with my work on the Florida coral reef, Mr. L. S. Griswold made an exploration into the Everglades, in order to determine if practicable how far inland the coral reef region extended. He penetrated inland a considerable distance, reaching the edge of the Everglades at three points. His explorations have added greatly to our geological and geographical knowledge of the region. His report will be published as an Appendix to my Notes on the Coral Reefs of Florida, now in the press. (Bull. Mus. Comp. Zool., Vol. XXVIII. No. 2.)

While preparing this work an interesting report on the borings of the Key West Artesian well was sent in to me by Dr. E. O. Hovey. From the report of Dr. Hovey it is evident that the Florida coral reef is, as I have always contended, of very moderate thickness, well within the range of depth at which corals can grow, and that it rests upon Pliocene deposits. (Bull. Mus. Comp. Zool., Vol. XXVIII. No. 3.) A further examination of the borings of the Key West Artesian well will be made by Dr. W. H. Dall and Dr. Woodward, in connection with material collected by the U. S. Geological Survey at other deep wells extending into the Tertiary strata of Florida and of Texas.

In pursuance of a plan to investigate the coral reefs of the Pacific, I spent some weeks on the Great Barrier Reef of Australia. Dr. W. McM. Woodworth and Dr. A. G. Mayer of the Museum accompanied me as assistants. A complete outfit for sounding and for collecting pelagic animals was shipped to Sydney and placed on board the steamship "Croydon," which had been chartered for the expedition. A complete photographic outfit, as well as the equipment necessary for taking care of the collections, was also sent out. Unfortunately the explorations we made were restricted by the boisterous weather we encountered along the coast of Australia. I succeeded, however, in examining the reef sufficiently in detail to satisfy myself that subsidence had played a very insignificant rôle in the formation of that great reef. A preliminary account of the expedition has been published in the September number of the American Journal of Science. It was a great disappointment to me to be unable to carry out either my plans for sounding off the sea face of the barrier reef, or for

making a number of deep-sea hauls in the same district with the self-closing Tanner net; — the more so as we were specially well equipped for doing this work, and I anticipated a large harvest of pelagic material from a district about which so little is known.

I am, however, satisfied that this visit to the Great Barrier Reef of Australia, however unsuccessful it has been, will enable me to carry out future expeditions to the coral districts of the Pacific with far better ideas of the difficulties to be encountered and of the nature of the problems to be solved than if I had made my trip to Australia after an examination of the coral islands of the Southern seas. As it would have been impossible for me to have carried on my own investigations regarding the Great Barrier Reef and to have made a collection of the corals of the region at the same time, I sent Professor H. A. Ward of Rochester to Australia, and he is at present on the Great Barrier Reef, making a collection of the corals of the reef for the Museum. From what I hear, he has been favored with better weather, and has been most successful in gathering a representative collection of the corals of the northeast coast, mainly in Torres Straits.

I have to thank for information regarding my trip to Australia Mr. W. Saville Kent, formerly Fish Commissioner of Queensland, Commander C. D. Sigsbee of the U. S. Hydrographic Office, and especially Admiral Wharton, R. N., Hydrographer to the Admiralty, whose advice was of the greatest value. To Mr. H. M. Gray, the managing director of the India Rubber and Gutta Percha and Telegraph Works, Limited, I am also indebted for information regarding the deep-sea sounding machinery in use on the telegraph steamer of their company.

Through the kindness of the Hon. Richard Olney, the Secretary of State at Washington, letters of introduction to the governments of Queensland and New South Wales were sent to me from the Foreign Office, and to prominent officials of the Australian colonies from the Colonial Office, in London, and by Sir Julian Pauncefoot, H. B. M. Ambassador at Washington. The Governor General of Queensland, Lord Lamington, facilitated my explorations in every possible way, and the "Croydon" received every courtesy in all the ports we touched at.

To Colonel Duffield, the Superintendent of the U. S. Coast and Geodetic Survey, I owe valuable assistance regarding the expedition of Mr. L. S. Griswold to the Everglades.

Some radical changes have taken place during the past year in the organization of the Museum. The Department of Petrography has been merged into that of Mineralogy. Professor Wolff having been placed in charge of the collection of mineralogy, it was natural that he should transfer his former department into the section of Mineralogy.

Professor Smyth will also hereafter find such facilities as may be given to mining geology in the same section of the Museum, until technical and applied geology, or geology as a whole, are in their turn transferred to more spacious and more appropriate quarters than those they now occupy.

It is becoming self-evident that, with the great increase in the number of Professors and students of the Zoölogical, Geological, and Geographical Departments in the University, the continuance of their present intimate connection with the Museum is only a question of time and money.

We are rapidly approaching the condition when each one of the Natural History Departments must work in its own quarters independently, supervising its own instruction, publishing its own researches, and having the charge of its own collections; all holding, in short, the same relation to one another that the Botanical and the Mineralogical sections and the Peabody Museum now hold to the University Museum.

This naturally brings up the question of carrying on the various departments of Natural History contained in the University Museum quadrangle. With the gradually decreasing means now at their disposal, we cannot hope even to keep up with the progress of science. For a healthy increase of the work done in the different sections of the Museum a very large annual income is needed, — two or three times larger at least than is now at our disposal.

With our present resources we are barely keeping alive, and the future has nothing in prospect beyond the merest routine work. Each of the Departments needs funds for additional Professors and Assistants, as well as for the running expenses of each Professorship, to enable them to carry on original research. An annual income is needed to send out expeditions both on land and at sea to collect material connected with the questions of the day, and a publishing fund large enough to allow the publication of the original work of the members of each Department, be they Professors or students. With the enormous increase in the number

of scientific publications annually issued, the funds at the disposal of the University Library are totally inadequate to purchase the books wanted for each branch of the Museum. To this should be added the building and maintenance of a Marine Laboratory, which is as important an adjunct to the Natural History Departments of the University as a Physical or a Chemical Laboratory.

The public to-day can hardly realize the interest that was taken by the Commonwealth and the friends of Professor Agassiz in the establishment of the Museum of Comparative Zoölogy. Nor is it likely that they fully appreciate the part which the Museum has played in the development of the study of Nature at Harvard and elsewhere in this country.

The Commonwealth came forward most generously, and sustained, often under most unpropitious circumstances, the interest it had shown in the Museum. From the treasury of the Commonwealth no less than \$240,000 has been received at various times, and up to the beginning of 1895 more than \$1,580,000 (exclusive of income) has been received from all sources, including the State grants, the subscriptions of friends, and the gifts of the family of Professor Agassiz.

This large sum is represented by the buildings, exclusive of the Botanical and Mineralogical sections; by the collections and the work expended upon them; by the Library, and an extensive series of publications (20 quarto volumes of Memoirs and 30 octavo volumes of Bulletins); and by an endowment of over \$580,000, the income of which is available for the salaries and running expenses of the Museum of Comparative Zoölogy and its allied departments.

Soon after the death of Professor Agassiz the Trustees of the Museum deemed it advisable to ask the Legislature to transfer the interest of the State in the Museum to the President and Fellows of Harvard College, who already held pre-eminent rights in some of the funds and collections. This connection with Harvard University led to a great increase in the study of Natural History, both in the undergraduate and graduate departments. The Museum itself has always been primarily an institution for research, although its collections and laboratories are to a limited extent available to undergraduates.

A further concentration of the Natural History departments of the University was effected in 1888-89 by the building of the Botanical and Mineralogical sections, the Geological and Geo-

graphical Departments having before that time found their abode in the Museum Laboratories. Quite early in the history of the Museum the establishment of the Peabody Museum led to the transfer to that section of the University Museum of all the collections brought together by Professor Agassiz and others which related to that Department. What now remains to be built is a comparatively small section of the Museum of Comparative Zoölogy, and the completion of the wing devoted to the Peabody Museum. This, when erected, would complete a University Museum, in which are duly recognized the claims of the undergraduates, of the advanced student, and of the investigator. The staff of instructors through its connection with Harvard must always retain the highest character, and the amount of original work which can be carried on there by investigators will depend entirely upon the interest shown by the public in keeping up the resources for investigation and publication available to the officers of the University Museum.

The want of the southwest corner piece of the Museum is severely felt in the crowding of the Laboratories available for Zoölogy and Geology, both for undergraduates and advanced students. Nothing can be done to complete the system of Exhibition Rooms planned for Geology and Geography until that section is built. This will require about one hundred thousand dollars for its erection and equipment. No greater advantage can accrue to the Natural History Departments of Harvard University than the completion of the building forming the quadrangle of the University Museum.

The income of at least two millions of dollars is necessary to carry out the plans I have sketched and to maintain a Marine Laboratory.

It is now fifty years since the founder of the Museum landed in this country. Since his death the Museum has more than doubled in size, but its endowment has remained stationary, and its income has decreased with the fall in the rate of interest since 1874. May we not hope in this fiftieth anniversary to obtain the funds necessary to complete the building, and to carry on the whole Museum on a scale proportional to the demands of a great University.

ALEXANDER AGASSIZ.

REPORT OF MEMBERS OF THE DEPARTMENT OF
GEOLOGY AND GEOGRAPHY.

IN recognition of the good share of attention given under the Department of Geology to instruction in Geography, a change in the name of the Department has been made, as indicated in the above heading. Herewith is associated for the present the instruction in Mining and Metallurgy, although it may be anticipated that, with the fuller development of these subjects, they will in time be placed in an independent department, similar to that which a year ago was constituted by bringing together the courses in Mineralogy from the Department of Chemistry, and those in Petrography from the Department of Geology.

The liberal appropriations made by the Council of the University Library for several years past have made it possible to obtain a nearly complete collection of large-scale topographical maps of the various countries of Europe. As further expenditure in this direction will henceforward be limited to the purchase of new mapsheets, as they are issued, it is desired now to turn attention to the accumulation of the large-scale maps and detailed memoirs issued by the various geological surveys abroad. A good beginning in this direction has been made in the Whitney library, where the publications of the geological surveys of Germany, Italy, Spain, Sweden, and Switzerland are already in hand, as far as published. A second step has been taken during the past year by the allotment of a special sum from the funds of the University Library for the purchase of geological maps. The maps of Saxony and a considerable number of those of England have thus been bought. It is hoped that a sum, equivalent to that allowed for topographical maps in recent years, may now be appropriated for geological maps for several years to come.

The better concentration of geological and geographical materials is promoted by a plan proposed during the past winter. Geographical journals and topographical maps, hitherto in the Library of the Museum, have been transferred to the University Library, in so far as they are not duplicates. In like manner, geological

journals, reports, and maps in the University Library will be deposited in the Museum Library, so far as may be needed to fill out the Whitney collection. In this manner, each collection will be as thorough as it can be made. The recent alteration in the University Library building has allowed opportunity for concentrating all the geographical journals on a single group of shelves, so that they may be most conveniently consulted.

REPORT ON THE COURSES OF INSTRUCTION IN
GEOLOGY AND GEOGRAPHY.

DURING the Academic year 1895-96, the following named courses of instruction were given in the laboratories and in the field by the instructors of the Department of Geology and Geography.

Instruction in General Geology.

1. (Geol. 4.) A course in Elementary Geology; two lectures a week by N. S. Shaler, with a third lecture and an hour for special exercises by R. A. Daly, assisted by F. C. Schrader, and with required reading and field-work. Attended by two hundred and sixty-two 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. Twenty-two students took this course.

3. (Geol. 22 *a*.) A course in Field Work and Geological Mapping, designed to afford training in original investigation, with work in the library and in the preparation of geological reports, supplemented by special training in the experimental method of solving field problems. Conducted by T. A. Jaggar, Jr., under the direction of N. S. Shaler, W. M. Davis, and J. E. Wolff. Conferences were held once a week during the year. The course 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 one student.

Instruction in Meteorology and Physical Geography.

5. (Geol. 2.) A half-course in Physiography, 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.

6. (Geol. 1.) A half-course in Elementary Meteorology, by R. DeC. Ward. Two or three lectures a week, with laboratory work and recitations, second half-year. Attended by fifty-eight students.

7. (Geol. 3.) A half-course in Physiography and Meteorology, by W. M. Davis and R. DeC. Ward. Two lectures a week. Attended by twelve students.

8. (Geol. 7.) A half-course in the Physiography of Europe, by W. M. Davis. Lectures, library work, and reports, second half-year. Attended by seven students.

9. (Geol. 20.) A course in advanced Physiography, by W. M. Davis. Conferences held once a week. Attended by five students.

Instruction in Palæontology.

10. (Geol. 14.) A half-course in Palæontology, by N. S. Shaler, assisted by R. T. Jackson. Two lectures a week, with theses. This course was attended by fifteen students.

11. (Geol. 13.) A course in Invertebrate Palæontology, by R. T. Jackson. Two lectures a week with laboratory work. Attended by three students.

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

Instruction in Special Geology.

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

Instruction in Mining Geology.

14. (Geol. 10.) A half-course in Mining Geology, by H. L. Smyth. Lectures, laboratory and field work; three times a week, first half-year. Attended by six students.

15. (Geol. 11.) A half-course in Geological Surveying, by H. L. Smyth. Lectures, laboratory and field work; three times a week, second half-year. Attended by seven students.

16. (Geol. 18.) A course in Economical Geology, by J. D. Whitney. Lectures three times a week, with required reading and theses. Attended by two students.

NOTE.—The instruction in Petrography is now announced under the department of Mineralogy and Petrography.

Summer Courses. 1896.

17. (Geol. S. 1.) A course in Elementary Geology, beginning July 3, and lasting six weeks, under the direction of N. S. Shaler, by G. E. Ladd. Instruction was in the form of lectures, laboratory work, and field excursions. Besides the systematic lectures by Mr. Ladd, special subjects were treated by Professors Shaler and Davis. Attended by thirteen students.

18. (Geol. S. 2.) An advanced course in field study, beginning July 3, at Cambridge, and continuing six weeks, in Southern New England, by N. S. Shaler and J. B. Woodworth. Attended by five students.

19. (Physiog. 1.) A course in Elementary Physiography, beginning July 3, and lasting six weeks, by W. M. Davis, assisted by J. M. Boutwell. Lectures, laboratory work, and excursions. Attended by fifty-three students.

20. (Physiog. 2.) A course in Advanced Physiography, beginning July 3, and lasting six weeks, by W. M. Davis. Conferences, reports, and theses. Attended by one student.

REPORT ON COURSES IN GENERAL GEOLOGY AND PALÆONTOLOGY.

BY N. S. SHALER.

A HALF-COURSE of lectures, designed to set forth the phenomena of Geology to beginners, and known as Course 4, was given as in previous years.

The laboratory and field work of the course in Elementary Geology was conducted under the general supervision of Professor Shaler, by Mr. Reginald A. Daly, with the assistance of Mr. F. C. Schrader, following the plan of instruction developed in previous years by Mr. R. E. Dodge. Substantial additions were made to the teaching collection, mainly in the form of fossils and lithological specimens purchased from dealers. The system of numbering and cataloguing these collections mentioned in the last Report upon this course has been maintained. The use of a clinometer compass manufactured by F. Barker & Son of London, and larger than that heretofore employed, was introduced in the field work.

Mr. Daly gave also a course in Elementary Geology to students in Radcliffe College, following the plan of instruction noted in last year's report. By this arrangement the students of Radcliffe College are admitted to the Geological Laboratory on equal terms with those of Harvard College. In June, Mr. Daly, having received the degree of Ph. D. and having been appointed to a Parker Fellowship, resigned his position as Instructor in Geology to take up the study of geology in Europe.

Mr. J. B. Woodworth reports as follows on the instruction in General Geology (second course, Geol. 8), and Glacial Geology (Geol. 16): —

The second course in General Geology (Geol. 8) was completed by twenty-two men, the number in attendance being somewhat larger than during the previous year. The survey of square-mile areas in the vicinity of the University by students in this course

was continued as heretofore. Each year there is a noticeable increase in the effacement of our glacial deposits. It is hoped that, by carefully recording the occurrence of these superficial phenomena, the field work of our students will preserve the knowledge of an interesting district, the natural features of which are rapidly vanishing. The same advance of culture upon the natural ground in the environs of Boston has rendered it desirable to extend the regular field excursions to more distant points than were formerly visited. Half-day excursions were therefore made again this year to Attleboro, Plainville, and Pondville, Mass. During the April recess, a voluntary excursion was made to Martha's Vineyard for the purpose of examining the terminal moraine on that island, and of making a section of the Gay Head cliffs. Mr. Francis Noyes Balch, a student in the course, succeeded in verifying the reported occurrence of a substance resembling amber in the Gay Head section. The teaching collection was farther enriched by a collection of lignite from the non-marine Cretaceous of the island, and by characteristic lithological specimens from the Cretaceous, Neocene, and Pleistocene beds. In the lectures, more attention than usual was given this year to the light which the alluvial deposits of modern great rivers throw upon the structure and origin of certain ancient fresh water or non-marine deposits of the Carboniferous and Triassic Periods. The subject of joints and fractures in rocks was illustrated by new and undescribed material largely collected on the excursions made with students in this course.

The course in Glacial Geology (Geol. 16) was taken by two men. In addition to the instruction given, some time was spent with one student in elaborating a classification of glacial deposits, paying especial attention to the recognition of the moraine terrace or ice-contact slope at the rear of sand plains and moraines as a key to the understanding of the relations of the departing ice sheet to the drift laid down about it. Excursions were made tending to show the widespread distribution of this feature in Southern New England. Trips were also conducted to Mt. Monadnock, N. H., to the Falmouth moraine and the Queen's River boulder belt in Rhode Island, in the interest of students in this course.

In addition to the instruction in the above courses, work was done by Mr. Woodworth with the aid of Mr. F. C. Schrader, in

collecting and preparing a series of rocks for the University of Missouri, and in gathering material from localities in Eastern Massachusetts for exchange with the laboratories of other institutions. As Assistant Geologist of the U. S. Geological Survey, Mr. Woodworth spent a week in January in the examination of the Richmond coal basin, work on which was resumed again in June. Other work done in connection with this organization is set forth in the report of Professor Shaler in the 17th Annual Report of the Director of the Survey.

Dr. R. T. Jackson reports that the collections used in teaching Palæontology are in good condition, and have received some desirable accessions. A new feature has been introduced in wall diagrams for class use. These diagrams are photographic enlargements of structural and developmental figures of fossils, taken directly from original publications. The method was adopted first by Dr. W. M. Woodworth of the Zoological Department, and it has proved to be very useful in palæontological instruction as well.

A few palæontological papers and specimens have been received as gifts from Professors C. E. Beecher and A. Hyatt, and Messrs. Wm. F. E. Gurley, C. L. Whittle, and J. B. Woodworth.

The most important accessions of material to the Department are choice specimens of *Metacrinus rotundus* and *Nautilus pompilius*, both in alcohol, purchased of Ward's Natural Science Establishment. From the same source was obtained a collection of Permian fossils from Europe. A collection of Permian and Cretaceous fossils from Kansas was purchased of Mr. C. N. Gould. A choice lot of Cretaceous Invertebrates, recently collected by Mr. C. L. Johnson, in Texas, Alabama, and New Jersey, was purchased of the Wagner Free Institute of Science. A limited number of Silurian Sponges and Brachiopods, showing silicified arms and other details of structure, was purchased of Mr. G. K. Greene.

As in previous years, Dr. Jackson spent a considerable part of his time in working on the Palæontological collections of the Museum.

Mr. T. A. Jaggard, Jr., reports as follows concerning the advanced courses in Geological Field and Laboratory Work:—

During the past year, research in general geology has been carried on in two courses: Geology 22a, planned for students just

entering upon geological research work in the University, and Geology 22*b*, intended for more experienced men. The work of the first course was closely supervised by Mr. Jaggar, and the students were individually given much time in the field and laboratory by the instructor. In the fall they were offered a series of seven general excursions conducted by the officers of the department to various carefully studied localities in New England, so that by note-taking, collateral reading, and conferences each student attained at the outset a somewhat varied field experience as a basis for original work. During the winter months a short course of lectures was given by Mr. Jaggar on the experimental or synthetic method of interpreting geological processes, and this was supplemented by regular laboratory work in devising, constructing, and applying special apparatus for the solution of problems in dynamical geology. During the spring season the northwestern part of the Boston basin was carefully studied in three sections, especially with a view to discovering the source of the remarkable series of fragments included in the younger eruptive rocks which cut the Somerville slate; the adjacent crystalline rocks of Belmont, Arlington, and Medford were found to contain many types identical with these inclusions, and the results of this investigation will be published in the near future.

In course 22*b*, Mr. J. E. Woodman prepared, under the supervision of Professor Shaler, a report "On the Geologic Forces and Forms of the North Jersey Coast," based upon field work done during the previous summer.

Following the plan carried out by Mr. Ward in Meteorology, Mr. Jaggar, at the request of Mr. W. A. Baldwin, Superintendent of Schools in Belmont and Danvers, gave a course of lectures to a class of fifteen teachers in Danvers, Mass., on "Physiographic Types, as illustrated in Southern New England." At the close of the season an extended excursion was made with the class in Essex County, where examples of many typical geographical forms were seen and studied in the field.

Mr. Jaggar has devoted much time to the construction and arrangement of special pieces of apparatus, with the view of establishing a Laboratory of Experimental Geology. Two basement rooms in the Museum have served well for this purpose, being immediately associated with the motor, dynamo, petrographical workshop, and photographic room.

The students of Geology 22a carried on experimental work on two subjects. Mr. C. W. Dorsey made a series of models of glacial sand plains by means of an apparatus imitating the conditions of glacial drainage, and the resulting delta deposits were studied minutely with respect to form, bedding in cross-section, influence of water level, and other variable conditions. Messrs. W. A. Baldwin and E. E. McCarthy, the other students of the course, were led through a series of experiments imitative of the deformation of stratified rocks under compression, following in general the plan adopted by Mr. Bailey Willis in his work on the "Mechanics of Appalachian Structure" (13th Ann. Rep. U. S. Geol. Survey). For general work of this sort a massive compression chest was constructed of oak, provided with two heavy thrust pistons at opposite ends, which can be advanced by screws. The models are cast from mixtures of wax and plaster, and are then submitted to slow compression under a heavy load of fine shot. The apparatus is so made that the amount of movement and pressure is registered on special indices at various points; a metronome is used for regulating the rate of compression. Each model is removed and photographed at different stages of deformation, and the records so obtained are used by the students for comparative study with structures in the field and with published descriptions of similar phenomena.

In addition to the apparatus above described, and in preparation for a special course in Experimental and Dynamical Geology, to be given in 1896-97, the following instruments have been collected:—

Machine for the reproduction and measurement of Ripple-mark.

Ring-shaped tank for producing a continuous current of water; for the study of Ripple-drift, rate of transportation of material in suspension, etc.

Five vessels of different form, for the study and optical projection of vortical movements in a liquid, as affecting conditions of transportation and deposition.

Gas Furnace, model Leclerc and Forquignon, made by Lequeux in Paris, with adjustable blowpipe and improved hydraulic blast (after Damoiseau). The latter may also be used as sucking or vacuum pump. This apparatus is most useful for general work in the synthesis of minerals and rocks.

Electric Furnace, model O'Neill, for experiments requiring excessively high temperature.

The following instruments are in preparation :—

Geyser apparatus, after the models of Petersen and Andreaæ.

In addition Mr. Jaggar has devoted some time to the preparation of photographs, lantern slides, and diagrams illustrative of the work of former experimenters.

The following papers, results of work in the experimental laboratory, are in preparation :—

Ripple-mark, and related Geologic Phenomena.

On the Geological Work of Vortices and Eddies.

An Experimental Study of Glacial Delta Deposits.

The Influence of Rate of Compression and of Composite Thrusts, in Rock Deformation.

Summer Courses in Geology.

The elementary summer course was given in Cambridge, under the direction of Professor N. S. Shaler, by Dr. G. E. Ladd. In addition to the systematic instruction by lectures and laboratory work, about twenty field excursions were made to localities easily accessible from Boston, the most remote being Newburyport on the north and Newport on the south. Lectures were given by Professor Shaler on dynamical geology, Professor Davis on physiographic geology, Dr. Jackson on palæontology, and Mr. Woodworth on glacial geology. The course closed with a written examination and a practical test in field work.

The second course in geology in the Summer School was given by Professor Shaler and Mr. J. B. Woodworth. One week was spent in Cambridge at the beginning in preparation for the subsequent outdoor work. The districts then visited included the Norfolk County and Narragansett basins, the Island of Martha's Vineyard, and the Triassic valley in Connecticut. These districts afford an exhibition of the Pre-Cambrian, Cambrian, Carboniferous, Jura-Trias, Cretaceous, Miocene, and Pleistocene rocks of Southern New England, with a variety of secondary structures. Five students took this course, three of these being registered in the University during the college year.

REPORT ON COURSES IN PHYSICAL GEOGRAPHY.

BY PROFESSOR W. M. DAVIS.

THE most important changes during the past year have been the addition of field excursions to the course in Elementary Physiography (Geol. 2), the transfer of the course in Elementary Meteorology to Mr. Ward, and the presentation for the first time of the course on the Physiography of Europe, by Professor Davis. As in former years, all these courses were repeated for the students of Radcliffe College.

The field excursions in Elementary Physiography, conducted by Professor Davis and Mr. Griswold, were introduced because the experience of previous years made it only too plain that our undergraduate students have no sufficient acquaintance with actual land forms as objects of conscious study, and that without such acquaintance it was difficult for many of them to acquire the art of reading maps, on which much of the laboratory work depends. The excursions proved of distinct value, although the necessity of limiting them narrowly in time and expense was somewhat embarrassing.

In the course on the Physiography of Europe, the sets of large-scale topographical maps of foreign countries, accumulated in the University Library chiefly during the last five years, and the collection of grouped sheets of the same maps mounted for laboratory use, were put into active service and proved to be simply invaluable in giving vivid ideas concerning the facts of geographical form. Exercise in reading these maps largely superseded reference to written text, although the latter was drawn from the most recent monographs accessible. In view of this, an article was prepared for the Chicago "Journal of Geology," advocating the more general use of large-scale maps in teaching, and indicating by special examples the character of the results thus obtainable. One of the most noticeable advantages of the maps was that they were susceptible of uniform treatment in study and description; while the

use of texts required a frequent change of point of view, aim, and method, according to the habit of the author consulted. The absence of any complete and consistent method of treating geographical subjects became inconveniently conspicuous during the progress of the course. It was found impossible to illustrate the Physiography of Europe with any thoroughness by means of the Gardner collection of photographs, for, in spite of the large number of foreign views in the collection, it does not yet include a systematic series selected to represent the leading physical features of each country. It is therefore suggested that special effort be directed, during the coming years, to making good this deficiency. The time of a well prepared and well disposed graduate, during a year of foreign travel, might be pleasantly and profitably given to this task.

The course in Advanced Physiography was devoted, as in former years, to individual study of selected problems. Mr. Gulliver completed his discussion of the development of shore lines, embodying his results in a thesis which was accepted as contributing towards the degree of Ph. D., which he secured at the end of the year. He is now continuing his studies abroad, having already during the past summer visited a number of interesting shore localities. Mr. Woodman undertook the study of Brittany, as an example of an old land adjoining a denuded coastal plain (the western part of the Paris basin), with special attention to the courses of rivers as indicative of the area of old land from which the coastal plain cover has been stripped. In another connection, the same student examined the western slope of the central plateau of France, with the same problem in mind. Although not intended to lessen the importance of local field study, the investigations by Messrs. Gulliver and Woodman may be taken to confirm the contention that original physiographical research may be based on good maps, provided the student has acquired the art of map reading. In regions of complicated structure, geological maps and text constitute an essential supplement to topographical maps. Mr. Curtis undertook a novel subject: the design of a coastal region in which various features should be rationally associated, and its representation in a model. The essentials of this task were that every element of form should be reasonably accounted for by citation of a similar form in nature; and that the association of these forms in the designed model should follow a reasonable scheme

of geographical development. Mr. Wadsworth undertook a description of volcanic topography with the intention of giving a better proportion of "values" to the various forms, and relegating symmetrical volcanic cones to a less prominent rank than is given to them in current text-books.

Summer Course in Physiography.

The summer course in Elementary Physiography seems to have met a popular want, as the number attending it increased from nine in the summer of 1895, when it was first offered, to fifty-three this year. In this course Professor Davis had the assistance of Mr. J. M. Boutwell, of the College class of 1897. With the exception of one person who was enrolled as a "student," all the others were actually engaged in professional work. The greater number were teachers in Massachusetts grammar schools, but teachers in high schools, academies, and normal schools, and school superintendents, were also represented. Instruction was given by morning lectures, illustrated by diagrams, maps, and lantern slides, and frequently interrupted for informal conferences; by laboratory work, in which many diagrams and maps besides those used in the lectures, were conveniently placed for personal study; and by field excursions to Waverly, Newtonville, Nantasket, Provincetown, and Greenfield, Mass. It was manifest from the avidity with which the teachers accepted a rational method of studying and teaching geography that empirical methods are outgrown, even though they may still be preserved by those who have no escape from them. Another result of the course was the determination to introduce, in the next session of the school, a series of systematic exercises in outdoor observation and description of elementary forms, so as to overcome if possible the embarrassment now prevailing among teachers when in the presence of nature and in the absence of a text-book. On the whole, it may be said that the summer physiographical work with teachers, as now developing, takes high rank among the duties of the year.

It was particularly with a view to introducing observational work at an early stage in the teaching of geography that Professor Davis prepared for Connecticut and Rhode Island small pamphlets on "The State Topographical Map as an aid to the Study

of Geography in Grammar and High Schools." These pamphlets have been published by the Board of Education of the respective States, and distributed to the public schools of grammar grade. Similar pamphlets will probably be published by Massachusetts and New York. The following extract will indicate the intention of these efforts: "Lack of experience in the use of the State Map in field teaching is, for the present, a necessary result of the recent completion of the map. Three, four, or five years hence, a similar lack of experience will be interpreted, by those who understand the advance in the teaching of geography now in progress, as the result of the neglect of the opportunities for self-improvement that every teacher is in duty bound to use to the utmost. Fifteen or twenty years hence, it will be a reproach to the school in which the younger teachers of that time began their education, if they do not bring from it an acquaintance with home geography and the geography of the State, such as the proper use of the State Map in the grammar schools will surely develop."

Instruction in Meteorology.

Besides giving the lectures and conducting the laboratory work of the course in Elementary Meteorology during the second half-year, Mr. Ward gave much time to accumulating material in preparation for the course on Climatology, to be offered for the first time during the coming year. The course of informal lectures to teachers given by Mr. Ward in Hingham a year ago was repeated during the past winter at Braintree, North Abington, Brockton, and Natick. At each place the course consisted of ten lectures, the attendance being about two hundred teachers in all. As a result of this work, instruction in local observation and its systematic correlation with the practical uses of the daily weather maps has been introduced to some extent in all the places above mentioned. This work seems likely to grow rapidly during coming years. A paper on "Meteorological Observations in Schools" was prepared for the Connecticut State Board of Education by Mr. Ward, and was published by that Board as a School Document. Mr. Ward continued to act as editor of the "American Meteorological Journal," to which work he devoted much of his time, until the suspension of the Journal with the April number, at the close of the twelfth volume; since then he has undertaken

to report current notes on Meteorology to "Science." In conjunction with Mr. A. L. Rotch, proprietor of the Blue Hill Meteorological Observatory, Mr. Ward has given some time to the accumulation of climatological reports in the Library of the Astronomical Observatory of Harvard College. Through the active support of the Director of the Observatory, this Library promises to become exceptionally complete in climatological material.

REPORT ON COURSES IN MINING GEOLOGY.

BY ASSISTANT PROFESSOR H. L. SMYTH.

IN 1895-96 the courses in Mining Geology and Geological Surveying were given by Assistant Professor Smyth, as in the year preceding, in the Mineralogical Section of the University Museum, where also, by the courtesy of the Department of Mineralogy and Petrography, the library of Professor Pumpelly, and the special collections for these courses, are still temporarily installed.

The course in Mining Geology began with the Academic year, instead of in December as in former years, and ended at the mid-year examinations. It was followed in the second half-year by the course in Geological Surveying. For the coming year noteworthy changes are made in these courses. Mining Geology (Geology 10) becomes a full course, running through the year, and is thrown open to College students; while Geological Surveying (Geology 11) is transferred to the new group of courses in Mining and Metallurgy, as Mining 1, and remains open only to students in the Scientific School.

No formally announced excursions were made during the year, but several students who intend to specialize in Economic Geology accompanied Mr. Smyth on professional visits to Lake Superior, California, and South Dakota.

The time of the instructor, aside from his University duties, was entirely devoted to the completion of a Monograph on the Michigamme District in Michigan, and to the preparation of a paper on Magnetic Observations in Geological Mapping, the latter soon to appear in the Transactions of the American Institute of Mining Engineers.

During the year considerable additions have been made, by gift and purchase, to the collections in Economic Geology, the most important being very complete suites of specimens of the iron ores and coals of the Southern States, which were generously given by many exhibitors at the Atlanta Exposition. It is to be regretted that the usefulness of the collections continues to be hampered by the lack of room for arrangement and study.

EXCURSIONS AND CONFERENCES.

A SERIES of fourteen geological and geographical excursions was conducted by the instructors of the department, with the co-operation of the geological departments of other New England colleges, during the autumn and spring. These were in general charge of Mr. Jaggar, and were open to members of other colleges and technical schools, and afforded opportunity to obtain a general view of the geology and physical features of Southern New England. Excursions were made to the following localities during the Academic year 1895-96:—

- Nantasket, Mass., Mr. L. S. Griswold.
- Hoosac Mountain, Mass., Professor Wolff.
- Nahant, Mass., Messrs. Woodworth and Jaggar.
- Meriden, Conn., Professor Davis.
- Salem and Marblehead, Mass., Mr. John H. Sears of Salem.
- Plainville and Attleboro, Mass., Mr. J. B. Woodworth.
- Niantic and Exeter, R. I., Professor Davis and Mr. J. B. Woodworth.
- Monadnock Mountain, N. H., Mr. J. B. Woodworth.
- New Haven, Conn., Prof. H. S. Williams of Yale College.
- The Middle Susquehanna District, Pa., (April recess,) Professor Davis.
- Gay Head, Martha's Vineyard, (April recess,) Mr. J. B. Woodworth.
- Cape Ann, Mass., Professor Shaler.
- Provincetown, Mass., Professor Davis.
- Mount Toby and Bernardston, Mass., Prof. B. K. Emerson of Amherst College.

Twenty-nine conferences were held on Tuesday evenings throughout the year. At each meeting there was a leading paper by an instructor, occasionally illustrated by stereopticon or experimental demonstration. Abstracts of papers presented were published regularly in "Science," under the following titles:—

- The Development of Oligoporus, by R. T. Jackson.
- Tidal Sand-cusps, by F. P. Gulliver.
- Some Features of the Arizona Plateau, by L. S. Griswold.
- The Great Barrier Reef of Australia, by J. B. Woodworth.
- Notes on Geological Excursions, by W. M. Davis.
- The Pirna and Kirchberg (Saxony) Zones of Contact Metamorphism, by T. A. Jaggar, Jr.
- Theories of Ocean Currents, by W. M. Davis.

Some Causes of the Imperfection of the Geologic Record, by N. S. Shaler.

Some Features of Joints, by J. B. Woodworth.

The Geology of the Woonsocket Basin, by F. C. Schrader.

Preliminary Report on the Stamford Gneiss, by W. H. Snyder.

Notes on the North Jersey Coast, by J. E. Woodman.

Some Occurrences of Eruptive Granite in the Archæan Highlands of New Jersey, by J. E. Wolff.

On the Origin of the Copper Deposits of Keweenaw Point, by H. L. Smyth.

On the Geological Work of Vortices and Eddies, by T. A. Jaggar, Jr.

The Harvard Meteorological Stations in Peru, by R. DeC. Ward.

Geography and Geology for Training and Elementary Schools, by R. E. Dodge.

Experiments imitative of Glacial Esker and Sandplain Formation, by C. W. Dorsey.

An Elementary Presentation of the Tides, by W. M. Davis.

Tidal Scour, by F. P. Gulliver.

Note on Penning's Field Geology, by T. A. Jaggar, Jr.

Longshore Transportation on the North Jersey Coast, by J. E. Woodman.

Ice Phenomena in Green Bay, Lake Michigan, by E. P. Carey.

On the Function and Systematic Importance of the *Aptychus* in Ammonites, by C. R. Eastman.

The Quartz Porphyry and Associated Rocks of Pequawket Mountain, N. H., by R. A. Daly.

April Recess Excursion to the Middle Susquehanna, Pa., by W. M. Davis.

THE GARDNER COLLECTION OF PHOTOGRAPHS.

THE Gardner Collection of Photographs has been increased by a considerable number of views, secured chiefly by purchase, under the direction of a committee consisting of Messrs. Woodworth, Daly, Griswold, and Ward. In the latter part of April an exhibition of about a thousand photographs, selected from the collection to exhibit different subjects in geology and geography, was made on the lower floor of Massachusetts Hall, attracting a satisfactory attendance of students and teachers, and bringing to the attention of many persons for the first time the existence of the considerable resources of the department in this direction. The most notable addition to the collection, a series of views taken by W. H. Rau along the line of the Lehigh Valley Railroad, and presented by Mr. Charles S. Lee, general passenger agent of that road, was received just in time to be displayed in the exhibition.

PUBLICATIONS BY OFFICERS AND STUDENTS OF THE
DEPARTMENT OF GEOLOGY AND GEOGRAPHY
SINCE THE LAST REPORT.

By N. S. Shaler:—

1. Administrative Report of Work done in the U. S. Geological Survey for the Year 1893-94. 15th Annual Report of the Director of the U. S. Geological Survey. Washington, 1895, pp. 160, 161.
2. Preliminary Report on the Geology of the Common Roads of the United States. 15th Annual Report of the U. S. Geological Survey for 1893-94. Washington, 1895, pp. 255-306. Also separately printed.
3. The Geology of the Road-building Stones of Massachusetts, with some Consideration of similar Materials from other Parts of the United States. 16th Annual Report of the U. S. Geological Survey, 1894-95, Part II., pp. 277-341. Washington, 1895. Also separately printed.
4. Origin, Distribution, and Commercial Value of Peat Deposits. 16th Annual Report of the U. S. Geological Survey, 1894-95, Part IV. Washington, 1895, pp. 305-314. Also separately printed.
5. Third Annual Report of the Massachusetts Highway Commission. Boston. Public Document No. 54. (With Geo. A. Perkins and W. E. McClintock.) January, 1896, pp. 126. Separately printed.
5. Beaches and Tidal Marshes of the Atlantic Coast. National Geographic Monographs, Vol. I. American Book Co., New York.
7. Some Causes of the Imperfection of the Geologic Record. *Science*, II., 1895, pp. 858, 859.
8. Sea and Land: Features of Coasts and Oceans, with special Reference to the Life of Man. New York, Charles Scribner's Sons, 1895.
9. Relations of Geologic Science to Education. Annual Address by President of the Geological Society of America. *Bull. Geol. Soc. of America*, Vol. VII. Rochester, 1896, pp. 315-326. Also separately printed. Also *Science*, Vol. III., 1896, pp. 609-617.
10. Conditions and Effects of the Expulsion of Gases from the Earth. *Proc. Boston Soc. Nat. Hist.*, Vol. XXVII., 1896, pp. 89-106. Abstract in *Science*, Vol. II., 1895, p. 281; also in *Am. Geol.*, Vol. XVI., 1895, pp. 244, 245.
11. Domesticated Animals: Their Relation to Man and to his Advancement in Civilization. New York, Charles Scribner's Sons, 1895, pp. 267.
12. American Highways: A Popular Account of their Conditions and of the Means by which they may be Bettered. New York, The Century Co., 1896, pp. 293.

13. The Economic Aspects of Soil Erosion. *The Nat. Geog. Mag.*, Vol. VII., 1896, pp. 328-338, 368-377.

14. The Share of Volcanic Dust and Pumice in Marine Deposits. *Bull. Geological Society of America*, Vol. VII., 1896, pp. 490-492. Abstract in *Am. Geol.*, Vol. XVII., 1896, p. 93.

15. [Discussion regarding low Temperature Gradients in Mines.] Abstract in *Am. Geol.*, XVII., 1896, p. 100.

16. [Discussion on the Carriage of Boulders by Indians.] Abstract in *Am. Geol.*, 1896, p. 104.

17. High Buildings and Earthquakes. *No. Am. Review*, Vol. CLVI., 1893, pp. 338-345. (Omitted from previous lists.)

By W. M. Davis : —

1. The Quarries in the Lava Beds at Meriden, Conn. *Amer. Jour. Sci.*, 1896, Vol. I. pp. 1-13.

2. The Physical Geography of Southern New England. *Nat. Geogr. Monograph*, No. 9, pp. 269-304, November, 1895. *Amer. Book Co.*, New York.

3. La Seine, la Meuse et la Moselle. *Ann. de Géogr.*, Vol. V., 1895, pp. 25-49.

4. The Seine, the Meuse, and the Moselle [original English version of the above]. *Nat. Geogr. Mag.*, Vol. VII., 1896, pp. 189-202, 228-238.

5. Plains of Marine and Subaerial Denudation. *Bull. Geol. Soc. Amer.*, Vol. VII., 1896, pp. 377-398.

6. The Outline of Cape Cod. *Proc. Amer. Acad.*, Vol. XXXI., 1896, pp. 303-332.

7. Large Scale Maps as Geographical Illustrations. *Chicago Journ. Geol.*, Vol. IV., 1896, pp. 484-513.

8. Current Notes on Physiography. *Science* (through the year).

9. A Speculation in Topographical Climatology. *Amer. Met. Journ.*, Vol. XII., 1896, pp. 372-381.

10. Physiography as an Alternative Subject for Admission to College. *School Rev.*, Vol. III., 1895.

11. A Word with President Coulter [on teaching physical geography, etc., in public schools]. *School Rev.*, Vol. IV., 1896, pp. 173-175.

12. The State Map of Connecticut as an Aid to the Study of Geography in Grammar and High Schools. *Conn. School Doc.*, No. 6, 1896.

13. The State Topographical Map as an Aid to the Study of Geography in Grammar and High Schools. *State of R. I. Educ. Pub.*, 1896.

14. Outline of Summer Courses in Physiography, 1896. *Harvard Univ.*, 8 pp.

By R. T. Jackson:—

1. Studies of Oligoporus. *Science*, Vol. II., Nov. 22, 1895.
2. Studies of Palæochinoidea. *Bull. Geol. Soc. Am.*, Vol. VII. pp. 171–254, Table and Plates 2–9 inclusive.
3. With T. A. Jaggar. Studies of Melonites multiporus. *Bull. Geol. Soc. Am.*, Vol. VII. pp. 135–170. Plates accompanying this paper are included in the preceding reference.

By R. DeC. Ward:—

1. Reviews of American Meteorological Publications in *Annales de Géographie*, No. 18, 4 année, 15 Juillet, 1895. *Bibliographie de l'année 1894*, 8vo, Paris, 1895.
2. Meteorology as a University Course. *Am. Met. Journ.*, December, 1895, Vol. XII. pp. 242–250.
3. The Harvard Meteorological Stations in Peru. *Science*, Vol. III., March 27, 1896, p. 490.
4. Meteorological Observations in Schools. *Conn. School Document*, No. 10, 1896. Whole number 123. *Conn. State Board of Education*, 1896, 8vo, pp. 9.
5. Edited the *American Meteorological Journal*. An Illustrated Monthly devoted to Scientific Meteorology and allied Branches of Study. Vol. XII. Boston, Ginn & Co., 1895–96.
6. Current Notes on Meteorology. *Science*, Vol. III., May 1, 1896, and following numbers.

By J. B. Woodworth:—

1. Three-toed Dinosaur Tracks in the Newark Group at Avondale N. J. *Am. Jour. Sci.*, Vol. L., 1895, pp. 481, 482.
2. Harvard University. Summer School of 1896. *Fieldwork in Course 2 in Geology*. pp. 6.
3. The Gardner Collection of Photographs. *Boston Evening Transcript*, March 24, 1896.
4. Marsh Gas under Ice. *Science*, Vol. III., 1896, p. 203. *
5. (Notice of) Las Rocas eruptivas del suroeste de la Cuenca de México, by E. Ordoñez. *Science*, Vol. III., 1896, p. 450.
6. Some Features of Joints. *Science*, Vol. II., 1895, pp. 903, 904. Also reprinted, pp. 2.
7. (Notice of) Great Barrier Reef of Australia. *Science*, Vol. II., 1895, p. 743.

8. (Notice of) The Laccolitic Mountain Groups of Colorado, Utah, and Arizona, by Whitman Cross. *Science*, Vol. II., 1895, pp. 700, 701.

9. (Notice of) Fauna fosil de la Sierra de Catorce en San Luis Potosi, by Aquilera y Del Castillo. *Science*, Vol. II., 1895, pp. 739, 740.

By T. A. Jaggar, Jr. : —

1. With R. T. Jackson. Studies of Melonites multiporus. *Bull. Geol. Soc. Am.*, Vol. VII. pp. 135-170.

2. The Pima and Kirchberg Zones of Contact Metamorphism. *Science*, Vol. II., No. 50, Dec. 13, 1895.

3. On the Geological Work of Vortices and Eddies. *Science*, Vol. III., No. 62, March 6, 1896.

4. Note on Penning's Field Geology. *Science*, Vol. III., No. 67, April 10, 1896.

5. Edited "Abstracts of the Geological Conference of Harvard University," in *Science* (through the year).

6. Current Studies in Experimental Geology. *Science*, Vol. III., No. 71, May 8, 1896.

By F. P. Gulliver : —

1. Cusped Forelands. *Bull. Geol. Soc. Amer.*, Vol. VII., 1896, pp. 399-422.

REPORT ON THE INSTRUCTION IN PETROGRAPHY.

BY PROFESSOR J. E. WOLFF.

THE usual courses were given in Elementary and Advanced Petrography, the former attended by six and the latter by three students. Two students obtained the Ph. D. degree, presenting theses on petrographical subjects, viz.: —

Mr. L. G. Westgate: Thesis "On the Geology of the Northern Part of Jenny Jump Mountain, Warren County, New Jersey" (published in the Annual Report of the State Geologist, 1895).

Mr. R. A. Daly: Thesis "On the Porphyritic Gneiss of New Hampshire."

Professor Wolff continued his work on the Franklin, New Jersey, sheet of the Geological Map of the United States, and was engaged during the winter on the Monograph on the Crazy Mountains. A short paper was published in the American Journal of Science, "On an Occurrence of Theralite in Costa Rica."

The work of consolidating the Laboratories of Petrography and Mineralogy has been completed, and the two rooms used for Petrography on the second floor of the Geological Section of the Museum have been vacated, and their contents transferred to the Mineralogical Section. The Department Library has been arranged and increased by the transfer of the leading periodicals from Gore Hall, and by purchase of books. The Chemical Laboratory is now thoroughly equipped for analysis. A machine for cutting rocks by an endless revolving wire has been added to the workshop.

REPORT ON THE INSTRUCTION IN ZOÖLOGY.

BY PROFESSOR E. L. MARK.

* THE number of students attending courses in Zoölogy during the Academic year 1895-96 was somewhat in excess of the number for the preceding year. The increase was about eight per cent; the increase of the previous year having been ten per cent. The accompanying table gives as usual the numbers in each course from the several classes. A comparison with the numbers of the preceding year shows slight fluctuations in the several courses. The gains have been in courses 1, 3, 7, and 20a. In Course 5 there were two additional students who were in regular attendance on lectures, one of whom also did the laboratory work, and in Course 4 there was one such. In the second half of Course 6 there were also two unenrolled attendants upon lectures.

Courses, 1895-96.	Grad.	Sen.	Jun.	Soph.	Fr.	Spec.	Sci.	Total.
Zoölogy 1	4	17	21	28	36	7	28	141
" 2	3	9	7	15	2	1	16	53
" 3	5	5	8	2	0	0	11	31
" 4	4	5	0	0	0	0	3	12
" 5	2	5	0	0	0	0	3	10
" 6	3	3	1	0	0	0	2	9
" 7	5	7	1	0	0	0	3	16
" 20a	10	2	0	0	0	0	2	14
Totals	36	53	38	45	38	8	68	286

Even the small increase (about ten per cent) in the size of the class in Course 1 resulted in considerable inconvenience, and it is becoming a serious question how to provide accommodations for all who elect the course. The nature of the lectures and the laboratory work was not materially changed from that of the preceding year. Some experimental work of a simple sort was tried for the first time, to the satisfaction of the instructor. Dr. Davenport had, as his Chief Assistant, Mr H. R. Linville; as Sub-Assistants, Messrs. J. M. Prather, W. L. Tower, A. Rose, and A. S. Hanna.

As previously, Dr. Parker conducted the course in Zoölogy 2. His Chief Assistant was Mr. J. I. Hamaker, and Messrs. R. W. Hall, A. S. Hanna, and B. S. Oppenheimer served as Sub-Assistants in the laboratory work.

In Zoölogy 3, the plan of allowing six weeks for the special-topic work, as in 1894-95, was continued. It is believed that this plan of special topics has a distinct advantage over that which made the laboratory instruction consist wholly of prescribed routine work. It is of course at the cost of a certain amount of detailed information, but the additional experience offered by this plan, and the greater stimulus to individual effort, more than compensate for this loss. The results obtained in the study of two of the topics assigned are deemed worthy of publication, and will be published under the following titles: "The Brachial and Lumbosacral Plexuses in *Necturus*," by F. C. Waite, and "The Azygos Veins in Swine," by C. H. Tozier. In conducting this course Dr. Parker had the assistance in the laboratory of Messrs. P. E. Sargent and W. L. Tower. Two short papers on the use of Formol, prepared last year by Dr. Parker, in collaboration with Mr. R. Floyd, have been published as Nos. LI. and LIV. of the Contributions.

The lectures in Zoölogy 4, by Dr. Mark, covered about the same ground as usual, and were supplemented by additional lectures given by Dr. Woodworth, who also had charge of the laboratory work. The class being a little smaller than in the previous year, it was not found necessary to seat the students in different rooms; but the facilities for laboratory work are insufficient even for the number of students taking the course the past year.

Dr. Woodworth, owing to the exceptional opportunity offered him of accompanying the Curator of the Museum in an expedition to Australia, was released from his duties in connection with the laboratory work of Zoölogy 5 at the end of February, and Mr. H. V. Neal was employed to take his place. The lectures and laboratory work were nearly the same as in previous years.

The lectures in Zoölogy 6, by Dr. Davenport, were devoted to ontogenetic problems during the first half-year, to phylogenetic ones during the second. The laboratory work had to be conducted under the great disadvantage of being in different rooms, and often at tables where the student was carrying on other studies; for the laboratory in the basement, though well adapted to certain work,

is not a suitable place in which to conduct many of the experiments.

Of the several topics investigated, two have been completed ready for publication: (1) "On the Determination of the Direction and Rate of Movement of Organisms by Light. By C. B. Davenport and W. B. Cannon." (2) "Variation in the Markings on the Thorax of *Doryphora decemlineata*, and their Experimental Production. By W. L. Tower." A paper prepared by Dr. Davenport last year, in conjunction with Mr. Neal, has been published as No. LIII. of the Contributions.

Next to a permanent laboratory, the most pressing need in connection with this course is additional expensive apparatus for the measurement of the intensity of the physical agents used in experimental work.

In accordance with the statement made in the last Report, Zoölogy 7, by Dr. Parker, was so modified as to make the ground covered in two successive years different. During the past year the brief introduction to the study of the nervous system was followed by an extended discussion of the Anatomy and Physiology of Sense Organs. Laboratory work in connection with this course is desirable, and it is hoped that provision for it can be made as soon as the Department has at command the necessary room.

Following out the plan proposed in the Report of last year, Zoölogy 6 and 7 have been enlarged, the former into two courses, the latter into two half-courses. In both instances the work in alternate years will be different, so that the change practically amounts to offering to students one and a half additional courses in Zoölogy. It has been decided to make in connection with this change an alteration in the numbering of the courses involved, so that for the present Zoölogy 6 and Zoölogy 7 disappear from the annual announcement, and in their stead occur respectively the courses numbered 10 and 11, and 15 and 16.

The work of the students in Zoölogy 20a was highly creditable, and as an outcome a considerable number of papers have been well advanced or completed for publication. Some of these have been preliminary notices, the nature of the subjects being such that a prompt announcement of the chief results seemed desirable.

The degree of Doctor of Philosophy was conferred at the last Commencement upon two candidates in Zoölogy, Mr. Herbert S.

Jennings and Mr. Herbert V. Neal. The titles of their theses appear in the list of forthcoming Contributions from the Zoölogical Laboratory. The thesis of a candidate for the degree of Doctor of Science, Mr. Alfred G. Mayer, was received and approved, and Mr. Mayer was granted leave of absence from the end of February to the close of the College year, in order that he might accept the invitation of the Curator of the Museum to accompany him in his expedition to Australia. Mr. Mayer's thesis, No. LIX. of the Contributions, has already been printed in the Bull. Mus. Comp. Zoöl., Vol. XXIX. No. 5.

Doctors Jennings and Neal are to continue their zoölogical studies in Germany, the former as holder of a Parker Fellowship from this University, and Mr. Mayer holds the position of Assistant in the Museum in charge of Echinoderms, Polyyps, etc.

The degree of A. M. was conferred on four students whose work was chiefly in the Department of Zoölogy.

The generous action of the Corporation of the University in appropriating a sum of money, and the liberality of the Curator of the Museum, have again made it possible to continue the publication of the more important Contributions from the Zoölogical Laboratory, of which the following twenty numbers have appeared since my last Report:—

- L. DAVENPORT, C. B.—Studies in Morphogenesis, IV.—A Preliminary Catalogue of the Processes concerned in Ontogeny. Bull. Mus. Comp. Zoöl., Vol. XXVII. No. 6, pp. 171–199. 31 Figs. in text. November, 1895.
- LI. PARKER, G. H., AND FLOYD, R.—The Preservation of Mammalian Brains by Means of Formol and Alcohol. Anatomischer Anzeiger, Bd. XI. No. 5, pp. 156–158. September 28, 1895.
- LII. CASTLE, W. E.—The Early Embryology of *Ciona intestinalis*, Flemming (L.). Bull. Mus. Comp. Zoöl., Vol. XXVII. No. 7, pp. 201–280. 13 Pls. January, 1896.
- LIII. DAVENPORT, C. B., AND NEAL, H. V.—Studies in Morphogenesis, V.—On the Acclimatization of Organisms to Poisonous Chemical Substances. Archiv für Entwickelungsmechanik der Organismen, Bd. II. Heft 4, pp. 564–583. 3 Figs. January 28, 1896.
- LIV. PARKER, G. H., AND FLOYD, R.—Formaldehyde, Formol, Formalin, and Formalose. Anatomischer Anzeiger, Bd. XI. Nos. 18, 19, pp. 567, 568. February 14, 1896.
- LV. PARKER, G. H.—The Reactions of *Metridium* to Food and other

Substances. Bull. Mus. Comp. Zoöl., Vol. XXIX. No. 2, pp. 105-119. March, 1896.

- LVI. GEROULD, J. H. — The Anatomy and Histology of *Caudina arenata* Gould. Proc. Bost. Soc. Nat. Hist., Vol. XXVII. pp. 7-74. 8 Pls. April, 1896. Also Bull. Mus. Comp. Zoöl., Vol. XXIX. No. 3, pp. 121-190. 6 Pls. April, 1896.
- LVII. PARKER, G. H. — Variations in the Vertebral Column of *Necturus*. Anatomischer Anzeiger, Bd. XI. Nos. 23, 24, pp. 711-717. 2 Figs. March 27, 1896.
- LVIII. WILCOX, E. V. — Further Studies on the Spermatogenesis of *Caloptenus femur-rubrum*. Bull. Mus. Comp. Zoöl., Vol. XXIX. No. 4, pp. 191-206. 3 Pls. June, 1896.
- LIX. MAYER, A. G. — The Development of the Wing Scales and their Pigment in Butterflies and Moths. Bull. Mus. Comp. Zoöl., Vol. XXIX. No. 5, pp. 207-237. 7 Pls. June, 1896.
- LX. FOLSOM, J. W. — *Neelus murinus*, representing a new Thysanuran Family. Psyche, Vol. VII, No. 242, pp. 391, 392, Pl. 8. June, 1896.
- LXI. GOTO, S. — Vorläufige Mittheilung über die Entwicklung des Seesternes, *Asterias pallida*. Zool. Anzeiger, Bd. XIX. No. 505, pp. 271-274. June 15, 1896.
- LXII. PARKER, G. H. — Pigment Migration in the Eyes of *Palæmonetes*. A Preliminary Notice. Zool. Anzeiger, Bd. XIX. No. 506, pp. 281-284. 2 Figs. June 29, 1896.
- LXIII. WOODWORTH, W. McM. — Preliminary Report on Collections of Turbellaria from Lake St. Clair and Charlevoix, Michigan. Bull. Michigan Fish Commission, No. 6, pp. 94, 95. 1896.
- LXIV. GOTO, S. — Preliminary Notes on the Embryology of the Starfish, *Asterias pallida*. Proc. Amer. Acad. Arts and Sci., Vol. XXXI. pp. 333-335. July, 1896.
- LXV. WOODWORTH, W. McM. — Report on the Turbellaria collected by the Michigan State Fish Commission during the Summers of 1893 and 1894. Bull. Mus. Comp. Zoöl., Vol. XXIX. No. 6, pp. 237-244. 1 Pl. June, 1896.
- LXVI. TOWER, W. L. — On the Nervous System of Cestodes. Zoöl. Anzeiger, Bd. XIX. No. 508, pp. 323-327. 2 Figs. July 20, 1896.
- LXVII. DAVENPORT, GERTRUDE C. — The Primitive Streak and Notochordal Canal in *Chelonia*. Radcliffe College Monographs, No. 8. 54 pp. 11 Pls. Boston, Ginn & Co., [Aug.] 1896.
- LXVIII. LEWIS, MARGARET. — Centrosome and Sphere in Certain of the Nerve Cells of an Invertebrate. Anat. Anzeiger, Bd. XII. Nos. 12, 13, pp. 291-299. 8 Figs. Aug., 1896.]

LXIX. JUDD, SYLVESTER D. — Descriptions of three Species of Sand Fleas (Amphipods) collected at Newport, Rhode Island. Proc. U. S. Nat. Mus., Vol. XVIII. No. 1084, pp. 593-603. 11 Figs. Aug., 1896.

The money for the publication of the paper by Mrs. G. C. Davenport was provided by Radcliffe College.

Besides the foregoing there are already in hand the following Contributions, some of which will appear before this Report is in print:—

LXX. JENNINGS, H. S. — The early Development of *Asplanchna Herickii* de Guerne. A Contribution to Developmental Mechanics. Bull. Mus. Comp. Zoöl., Vol. XXIX. No. 1, pp. 1-117. 10 Pls. Oct., 1896.

LXXI. NEAL, H. V. — A Summary of Studies on the Segmentation of the Nervous System in *Squalus acanthias*. A Preliminary Notice. Anat. Anzeiger, Bd. XII. No. 17, pp. 377-391. 6 Figs. Oct. 20, 1896.

BREWSTER, E. T. — A Measure of Variability and the Relation of Individual Variations to Specific Differences. Proc. Bost. Soc. Nat. Hist., Vol. XXVII.

MAYER, A. G. — On the Color and Color Patterns of Moths and Butterflies. Bull. Mus. Comp. Zoöl., Vol. XXX.; also Proc. Bost. Soc. Nat. Hist., Vol. 27. 10 Pls.

PORTER, J. F. — Two new Gregariinida. 2 Pls. Journal of Morphology.

PORTER, J. F. — *Trichonympha* and other Parasites of *Termes flavipes*. 3 double plates. Bull. Mus. Comp. Zoöl.

PARKER, G. H. — Photomechanical Changes in the Retinal Pigment Cells of *Palæmonetes*. 1 Pl. Bull. Mus. Comp. Zoöl.

NEAL, H. V. — The Segmentation of the Nervous System in *Squalus acanthias*. 10 Plates.

DAVENPORT, C. B. AND CANNON, W. B. — On the Determination of the Direction and Rate of Movement of Organisms by Light. 1 Fig. Journ. of Physiol.

DAVENPORT, C. B., AND BULLARD, C. — Studies in Morphogenesis, VI. — A Contribution to the Quantitative Study of Correlated Variation and the Comparative Variability of the Sexes. 1 Fig. Proc. Amer. Acad. Arts and Sci.

Owing to the illness of Professor Whitney, Dr. Mark was appointed during the latter part of the year temporary Chairman of the Division of Natural History, and Dr. Davenport was chosen Secretary of that body.

Besides the work done by Dr. Davenport in connection with the Contributions from the Laboratory, he has published in the "Educational Review" for May, 1896, a discussion on "Botany as an Alternative in College Admission Requirements," and has nearly completed Part First of a book on "Experimental Morphology," to be published by the Macmillan Company.

In addition to the papers by Dr. Parker, already enumerated in the Contributions, he has nearly finished an article on the "Arrangement of the Mesenteries in Metridium."

Dr. Woodworth has collaborated with the Curator of the Museum in a paper on "Some Variations in the Genus Eucope," which is to appear in the Studies from the Newport Marine Laboratory.

The translation of Part First of Korschelt und Heider's "Entwicklungsgeschichte der wirbellosen Thiere," by Drs. Mark and Woodworth, was published soon after my last Report.

The meetings of the Zoölogical Club have, as usual, been well attended by the instructors and advanced students.

All of the courses in Zoölogy given in Harvard were likewise given to students of Radcliffe College. There were in all 62 students, as follows:—

Zoöl.	1	. . . . .	10	|	Zoöl.	5	. . . . .	7
"	2	. . . . .	8	|	"	6	. . . . .	5
"	3	. . . . .	6	|	"	7	. . . . .	7
"	4	. . . . .	5	|	"	20a	. . . . .	4

The lectures have all been given at the Museum; but for want of necessary room the laboratory work in one of the courses, Zoölogy 3, was conducted elsewhere.

REPORT ON THE MAMMALS AND BIRDS.

BY WILLIAM BREWSTER.

MOST of our collections of mounted Mammals and Birds were long since so nearly completed,—at least in the sense of filling the spaces available for their exhibition,—that of late there has been neither incentive nor opportunity to add much to them. The Europæo-Siberian Room has constituted an exception to this rule, but during the past year its collections have been augmented by the addition of several valuable Mammals, and no less than one hundred and fifty-four Birds. The Mammals are a Reindeer (*Rangifer tarandus*), a fine male Beaver (*Castor fiber*), a male Marmot (*Arctomys marmota*), and two Varying Hares (*Lepus variabilis*), representing the summer and winter pelages of the species. The Beaver was taken in Germany, the Marmot and Hares are from Switzerland. All of these specimens were purchased mounted of a dealer in Switzerland.

The Birds comprise eighty specimens from Japan, and seventy-four from various parts of Europe and Siberia. Of the latter, a Wall-Creeper (*Tichodroma muraria*), a Chough (*Fregilus graculus*), a Great Black Woodpecker (*Dryocopus martius*), two Three-toed Woodpeckers (*Picoides tridactylus*), a Pygmy Owl (*Glaucidium passerinum*), and a Coot (*Fulica atra*) were bought mounted of the Swiss dealer above referred to. The remaining European birds, as well as all of those from Japan, were mounted by J. T. Clark from skins taken from the Museum collections or furnished by Alan Owston of Yokohama. A pair of Red-cockaded Woodpeckers (*Dryobates borealis*), a Traill's Flycatcher (*Empidonax traillii*), and an Alder Flycatcher (*Empidonax traillii alnorum*) have also been mounted to fill gaps in the North American Faunal Room. The selection and identification of the skins, and the labelling and arrangement of the mounted birds after they were ready to be placed in the cases, have been done chiefly by Mr. Faxon, who, during my absence from Cambridge, has been kind

enough to devote much of his time and attention to this part of the work.

In addition to the specimens just mentioned, the Museum has acquired during the past year the following. By gift, from Lieut. Wirt Robinson, U. S. A., skins (with the skulls) of a Bay Lynx (*Lynx rufus*), a Canada Porcupine (*Erethizon dorsatus*), and an Opossum (*Didelphys virginianus*); from Mr. Walter Faxon, mounted specimens of a Rose-breasted Grosbeak (*Habia ludoviciana*)—an adult male in a peculiar and very interesting autumnal plumage—shot at East Lexington, Massachusetts, September 14, 1895, and a young Virginia Rail from the same locality, taken September 17, 1895; from Mr. J. D. Sornborger, the skin of a Labrador Jay (*Perisoreus canadensis nigricapillus*), obtained in Labrador; from Mr. W. Brewster, a Florida Wild Turkey (*Meleagris gallopavo osceola*), taken at Fort Thompson, Florida. By purchase, a fine male Two-horned Rhinoceros (*Rhinoceros bicornis*) from Mashonaland, Africa, and a female Hedgehog Rat (*Aulacodus swinderianus*) from West Africa, both furnished mounted by H. A. Ward,—who has also mounted for the Museum a skeleton of the Florida Manatee (*Trichechus latirostris*).

I have published during the past year only the following article, which appeared in the "Auk":—

Descriptions of a New Warbler and a New Song Sparrow.

REPORT ON THE REPTILES AND FISHES.

By SAMUEL GARMAN.

THE series of Deep-Sea Fishes from the Northern Pacific, secured by the steamer "Albatross" in 1890-91, sent by the United States Fishery Commission, forms the most important addition to these collections since the last Report. The list of species is large; the specimens arrived in excellent condition, and at an opportune moment for use in connection with studies of the fauna of the tropical Pacific. The Commission also furnished the Museum a large number of Fresh-Water Fishes from the basins of the Upper Missouri, the Maumee, and different rivers along the southeastern coast of the United States. Other collections were received from Messrs. Charles A. Parker and James Reed.

Among accessions to the Reptiles and Batrachians there are a fine lot of Floridan species sent by Outram Bangs, Esq., a number of handsome live Ophidia from Georgia by Prof. George E. Ladd of the United States Geological Survey, a considerable lot of Batrachians by Rev. Robert K. Smith, some desiderata collected in Central America by George B. Gordon, Esq., and representatives of various species contributed by Messrs. Wm. F. Clapp, M. A. Frazar, Frank W. Haven, and M. Reitz.

A collection of Reptiles and Batrachians was forwarded to Dr. Fernand Lataste, of Chili, as exchanges, and another, including certain Fishes and Selachians, to Prof. H. Garman of the State College of Kentucky.

The ichthyological work noted in the preceding Report has been continued; likewise the changes, rearrangements, and classification of the exhibition and storage collections. Aside from a number of unsigned articles in various publications, the following papers were published in the American Naturalist: "Sexual Rights and Lefts," and "Cross Fertilization and Sexual Rights and Lefts among Vertebrates."

REPORT ON THE ENTOMOLOGICAL DEPARTMENT.

By SAMUEL HENSHAW.

ADDITIONS to the collections of the Department have been received from Miss Isabel Johnson, Messrs. A. L. Babcock, Outram Bangs, W. S. Bigelow, Frederick Blanchard, H. K. Burrison, S. C. Carpenter, T. D. A. Cockerell, W. G. Farlow, J. W. Folsom, G. B. Gordon, F. P. Gulliver, F. L. Harvey, Roland Hayward, Brainard Hooker, G. H. Horn, L. O. Howard, J. G. Jack, R. T. Jackson, F. C. Kenyon, A. D. Macgillivray, E. L. Mark, A. G. Mayer, A. P. Morse, E. A. C. Olive, Wirt Robinson, S. H. Scudder, M. V. Slingerland, L. W. Swett, Roland Thaxter, and E. V. Wilcox.

The Australian specimens generously given by Mr. Olive, together with those collected by Mr. Mayer, form the largest and most important addition received.

Material for study has been loaned to Messrs. W. H. Ashmead, William Beutenmüller, O. F. Cook, J. W. Folsom, W. J. Fox, Roland Hayward, L. O. Howard, A. D. Macgillivray, A. P. Morse, S. H. Scudder, and E. P. Van Duzee.

The use of the collection and of the library continues to increase, and attention to requests for information, identifications, etc., has increased the number of contributors,—a direct benefit to the Museum.

The collection, though not absolutely free from insect pests, is practically so.

A revisional rearrangement of (1) the Mutillidæ, Uroceridæ, and Tenthredinidæ of the Hymenoptera, (2) the Sesiidæ of the Lepidoptera Heterocera, (3) the Cicindelidæ, Buprestidæ, Cassidinæ, and Meloidæ of the Coleoptera, (4) the Cicadidæ of the Hemiptera Heteroptera, and (5) the Ixodidæ of the Arachnida, has been completed. Considerable portions of the Carabidæ, Scarabæidæ, and Tenebrionidæ of the Coleoptera have also been revised.

The specimens illustrating the Europæo-Siberian fauna, which have been on exhibition since 1885–86, have been replaced by a new series, representing more than double the number of forms previously shown.

REPORT ON THE CRUSTACEA AND MOLLUSCA.

By WALTER FAXON.

A VALUABLE lot of fresh-water Crustacea from Arkansas, Texas, and the Indian Territory has been given to the Museum by Professor S. E. Meek. Acknowledgments of gifts of specimens are also due to Mr. Ralph Hoffmann and to Professor D. W. Thompson, of University College, Dundee. Other important accessions are the result of exchanges carried on with the United States National Museum.

The Stalk-eyed Crustacea of the "Albatross" Expedition of 1891 have been divided between this Museum and the National Museum. A first set, comprising types of all the species, has been retained for our Museum, while the rest, including the larger part of the duplicates, have been sent to Washington. The large collections of Crayfishes that have accumulated in this Museum as well as in the National Museum during the last six years have been worked up by me, and the results embodied in a paper illustrated by nine plates, to be published in the Proceedings of the National Museum. A considerable collection of deep-sea Crustacea obtained by the "Blake" in 1877-79 — composed in part of duplicates reserved when the bulk of the collection was sent to Professor Alphonse Milne Edwards, in Paris, in part of specimens returned by him unused — has also been determined and catalogued. This collection revealed several new and interesting forms of deep-sea Crustacea, and added something to our knowledge of the distribution of many species already known.

I am happy to report that all of the deep-sea Crustacea in this Museum, the rich booty secured during the cruises of the "Bibb," "Hassler," "Blake," and "Albatross," are now — with the exception of the "Albatross" Cirripeds and Isopods, which are still in the hands of Dr. Hansen, of Copenhagen — identified and catalogued, and thus made available to workers in this important field.

Among the more valuable gifts to the department of Mollusca

are a lot of shells from the west coast of the United States and Mexico, made over to the Museum by Professor J. D. Whitney a short time before his death, and a small but valuable collection from the Persian Gulf and the neighborhood of Bombay, presented by Mr. F. W. Townsend. The Reverend R. K. Smith, of Woburn, Mass., and Mr. R. Clapp, of Cambridge, have deposited in the Museum the first instalment of a special collection of New England shells. Rather curiously, the Museum collection is particularly weak in material from New England. Mr. Smith and his coadjutor have been at great pains to collect a fine series of each species, selecting specimens with a view to showing individual variations and the changes induced by growth. This collection, when completed according to the design of the donors, will form an invaluable aid to the student of our local fauna. Mr. Temple Prime has lately given to the Museum his valuable collection of Corbiculidæ (Cyrenidæ), answering to his printed catalogue of 202 species, and rich in types.

By purchase, a set of beautifully preserved Pteropod shells has been got from Mr. G. B. Sowerby, of London, and from Mr. C. J. Maynard a series of the Bahama Cerions (Strophias) that form the subject of his "Monograph of the Genus Strophia." Last winter Mr. Maynard spent some time in the study of the Cerions in our old collection, particularly the Cuban forms. The results of this investigation were published, as a continuation of the "Monograph of Strophia," in Maynard's "Contributions to Science," Vol. III. No. 1, pp. 1-40, Pls. I.-VII., March, 1896.

REPORT ON VERMES.

By W. McM. WOODWORTH.

THE work done on the Museum collections of Vermes was confined chiefly to the preparation and arrangement of specimens for exhibition. All of the material in the Atlantic and Synoptic Rooms has been relabelled and rearranged, and a number of jars have been added to these exhibits. Considerable progress has been made with the systematic exhibit, the chief additions being some fine preparations of several intestinal parasites of the Sheep and Hog, collected and presented by Mr. C. Bullard. A good beginning has been made in the arrangement of the general collections, in separating the determined material from the undetermined, and a systematic arrangement of the same.

The Chaetognatha were sent to Mr. F. C. Conant for determination, and were returned by him with some additions to the collection. Thanks are also due to Dr. S. Goto for determining the ectoparasitic Trematodes, and to Prof. H. B. Ward for depositing in the Museum the Turbellaria collected by the Michigan State Fish Commission during 1893 and 1894, descriptions of which have been published in the Museum Bulletin.

The Assistant has deposited in the Museum his collection of Vermes, amounting to about one hundred bottles, and the Museum has also received from the Bureau of Animal Industry of the U. S. Department of Agriculture a small collection of parasites.

A card catalogue of the Vermes in the Museum collection is in course of preparation, and includes a generic list as well as a serial one.

The report on the Nemertines of the "Albatross" Expedition is well advanced, as is also a report on the Turbellaria of the Illinois State Survey.

The Assistant has published two papers on Turbellaria: see Contributions from the Zoölogical Laboratory, Nos. LXIII. and LXV.

REPORT ON THE DEPARTMENT OF VERTEBRATE
PALÆONTOLOGY.

By CHARLES R. EASTMAN.

THE work in this Department has been carried on in accordance with the lines laid down in the last Report. The greater part of the Assistant's time has been devoted to the care of the collections; incidentally a selection has been made of specimens to be placed on exhibition, and some attention has been given also to the detailed study of certain groups of fossil Fishes. The task of identifying, labelling, and cataloguing the collection has progressed uninterruptedly. As a record is kept of the transfer of each specimen from the study series to the Exhibition Rooms, or *vice versa*, the location of all catalogued material in the Museum is apparent from a mere inspection of the cards. A quantity of broken or oxidized specimens have been repaired, and numerous others have been put in readiness for exhibition.

The Mesozoic Exhibition Room having been placed in order during the winter, it was thrown open to the public in March. A suite of fossil Fishes and Amphibians will shortly be installed in the new Palæozoic Exhibition Room.

Some very notable additions have been made during the year. Certain interesting reptilian casts and one of *Dinotherium* were purchased in England, and the majority of them are now on exhibition. By its acquisition of the Whitney Collection the Museum was enriched with a large number of specimens possessing great intrinsic and historical value, many of them being types. No less than thirty-five boxes of fossils, besides twenty-five of minerals and books, were brought down from Northampton last fall, where they had been stored since the date of Professor Whitney's connection with the various State geological surveys. One box of Vertebrate fossils from California was accompanied by the manuscript determinations of Professor Leidy, but no description of the remains has ever been published.

The purchase of the Enniskillen and Worthen Collections also secured to the Museum some valuable material. The first named was sent in exchange by the Right Honorable the Earl of Ennis-

killen, of Florence Court, Ireland, to Professor A. H. Worthen in 1865; it is accompanied by a complete list of specimens. The Worthen Collection of fossil Fishes from Illinois admirably supplements the Wachsmuth and St. John collections from adjoining States. Lastly, some important material was acquired by the Assistant during a recent visit to Western New York and Ohio, where negotiations were opened for further additions. Excellent opportunities were enjoyed on this trip for the study of the principal fossiliferous horizons, as well as public and private collections.

Additions to the Collection during the Year.

1895. Casts of *Pareisaurus Baini*, *Cetiosaurus Oxoniensis*, *Dodo ineptus*, *Dinotherium giganteum*, and various other casts, principally of fossil reptiles. Purchased. Received September 10, 1895.

1896. Whitney Collection. A large and valuable collection of fossils, principally Invertebrates, accumulated by the late Prof. J. D. Whitney during his connection with the Wisconsin, Iowa, and California State Geological Surveys. Includes many types and figured specimens, also some rare forms from Central and South America. Presented by Professor Whitney, January 1, 1896.

1896. Enniskillen Collection. An interesting series of fossil Fishes from the Carboniferous Limestone of Armagh, Ireland, and Bristol, England, with original MS. catalogue. Purchased of the heirs of Prof. A. H. Worthen, and presented to the Museum through the Assistant. Received February 28, 1896.

1896. *Elephas primigenius*. An excellent molar tooth of large size, found at the Pebble Phosphate Company's works, Marvinia, Florida, and presented to the Museum by Mr. J. Everts Merrill of Jacksonville, Florida. Received June 4, 1896.

1896. Clark Collection. Interesting specimens of *Dinichthys*, *Cladodus*, *Mazodus*, and other genera of Devonian Fishes from Ohio. Purchased of Dr. William Clark, Berea, Ohio. Received September 15, 1896.

1896. Worthen Collection. An especially fine series of fossil Fishes, forming part of the private collection of the late Prof. A. H. Worthen. Purchased of Mr. T. A. Worthen, Warsaw, Illinois. Received September 16, 1896.

Papers published during the Year.

Remarks on *Petalodus alleghaniensis* Leidy (Journal of Geology, Vol. IV. pp. 174-176), March, 1896.

Review of Unter-Tertiäre Selachier aus Süd-Russland, by Dr. Otto Jaekel (Amer. Geol., Vol. XVII. pp. 245-247), April, 1896.

Preliminary Note on the Relations of Certain Body-plates in the Dinichthyids (Amer. Jour. Sci., Vol. II. pp. 46-50), July, 1896.

Textbook of Palæontology. Translated and edited from the German of Prof. Karl A. von Zittel. Vol. I. Part I. Protozoa to Mollusca. August, 1896.

Observations on the Dorsal Shield in the Dinichthyids. Read before the Amer. Assoc. Adv. Sci., August 26, 1896. (Abstract in Amer. Geol., Vol. XVIII. pp. 222, 223), October, 1896.

Review of paper On the Vertebral Column, Fins, and Ventral Armoring of Dinichthys, by Dr. Bashford Dean (Amer. Geol., Vol. XVIII. pp. 316, 317), November, 1896.

REPORT ON THE FOSSIL INVERTEBRATES.

BY ALPHEUS HYATT.

THE Ammonitinæ of the Inferior Oölite have been carefully studied and relabelled, to accord with the publications of S. S. Buckman, whose extensive researches on the fossils of this formation in England have made this revision very desirable.

Researches upon the remarkable and ill understood group of Cretaceous Ammonitinæ of the Bucheceratidæ have been begun, and are partially completed. During the summer vacation several weeks have been expended upon the revision of the Palæozoic Cephalopods preparatory to the picking out of sets for exhibition in the Stratigraphic Collection.

The Department is indebted to R. T. Jackson for selecting materials for exhibition in the Stratigraphic Collection from the fossil Sponges, Hydroids and Corals. The collection of Crinoids has been consulted by Mr. Frank Springer. A paper "On the Validity of the Family Bohemillidæ Barrande," *Am. Geol.*, Vol. XVII. pp. 360-362, 1896, has been published by Prof. C. E. Beecher of Yale University, based on the materials studied last year by him.

Forty-seven Palæozoic Starfishes have been loaned to Mr. Charles Schuchert of the National Museum for study.

Four specimens of Palæozoic Echini have been received from Dr. R. T. Jackson.

A small but valuable collection of Silurian Sponges and some Tertiary Fossils from Texas have been purchased from Henry A. Ward, of Rochester.

A small collection of Tertiary Corbiculidæ have been transferred to this Department from the Temple Prime Collection.

The following papers have been published:—

"Lost Characteristics," by Alpheus Hyatt. *American Naturalist*, January, 1896, pp. 9-17.

"The Meaning of Metamorphosis," by the same. *Natural Science*, Vol. VIII. No. 52, June, 1896, pp. 395-403.

“The Development of Oligoporus,” by R. T. Jackson. *Science*, II., November, 1895.

“Studies of *Melonites multiporus*,” by the same and T. A. Jaggar, Jr. *Bull. Geol. Soc. America*, Vol. VII. pp. 135–170.

“Studies of *Palæchinoidea*,” by R. T. Jackson. *Ibid.*, Vol. VII. pp. 171–254, Plates II. to IX.

REPORT ON THE LIBRARY.

 BY MISS F. M. SLACK.

DURING the year ending September 1, 1896, the Library has received 573 volumes, 2,134 parts, and 118 pamphlets.

	VOLUMES.	PARTS.	PAMPHLETS.
Gift	35	81	17
Exchange	224	963	72
Purchase	37	258	0
A. Agassiz	78	832	29
Binding Parts	199	0	0
	<u>573</u>	<u>2,134</u>	<u>118</u>

The number of volumes now in the Library (exclusive of pamphlets and the Whitney Library) is 22,744. There are 16,735 pamphlets bound in 2,811 volumes, making the total number of volumes 25,555.

To this should be added the Whitney Library, containing about 5,000 volumes and 1,500 pamphlets, making the total volumes 30,555, and about 1,800 pamphlets not yet arranged by subjects for binding.

[A]

PUBLICATIONS

OF THE

MUSEUM OF COMPARATIVE ZOOLOGY

FOR THE ACADEMIC YEAR 1895-96.

Of the Bulletin:—

Vol. XXVII.

- No. 5. Reports on the DREDGING OPERATIONS off the WEST COAST of Central America to the GALAPAGOS, etc., by the U. S. Fish Commission Steamer "ALBATROSS," in charge of Alexander Agassiz. XIX. Die OSTRACODEN. Von G. W. MÜLLER. pp. 16. 3 Plates. October, 1895.
- No. 6. STUDIES in MORPHOGENESIS. IV. A Preliminary Catalogue of the PROCESSES concerned in ONTOGENY. By C. B. DAVENPORT. pp. 28. November, 1895.
- No. 7. The Early EMBRYOLOGY of *CIONA INTESTINALIS* Fleming (L.). By W. E. CASTLE. pp. 78. 13 Plates. January, 1896.

[Vol. XXVII. is complete.]

Vol. XXIX. (March-June, 1896.)

- No. 1. Reports on the DREDGING OPERATIONS off the WEST COAST of Central America to the GALAPAGOS, etc., by the U. S. Fish Commission Steamer "ALBATROSS," in charge of Alexander Agassiz. XX. The FORAMINIFERA. By Axel GoëS. pp. 104. 9 Plates and Chart. March, 1896.
- No. 2. Contributions from the Zoölogical Laboratory. LV. The REACTIONS of METRIDIUM to Food and other Substances. By G. H. PARKER. pp. 14. March, 1896.
- No. 3. Contributions from the Zoölogical Laboratory. LVI. The Anatomy and Histology of *CAUDINA ARENATA* GOULD. By J. H. GEROULD. pp. 68. 8 Plates. April, 1896.
- No. 4. Contributions from the Zoölogical Laboratory. LVII. Further Studies on the SPERMATOGENESIS of *CALOPTENUS FEMUR-RUBRUM*. By E. V. WILCOX. pp. 12. 3 Plates. June, 1896.
- No. 5. Contributions from the Zoölogical Laboratory. LIX. The DEVELOPMENT of the WING SCALES and their Pigment in BUTTERFLIES and MOTHS. By A. G. MAYER. pp. 28. 7 Plates. June, 1896.
- No. 6. Contributions from the Zoölogical Laboratory. LXV. Report on the TURBELLARIA collected by the MICHIGAN STATE FISH COMMISSION during the Summers of 1893 and 1894. By W. McM. WOODWORTH. pp. 6. 1 Plate. June, 1896.

[Vol. XXIX. is complete.]

Of the Memoirs:—

Vol. XXII.

Reports on the Results of DREDGING under the supervision of ALEXANDER AGASSIZ in the GULF OF MEXICO (1877-78), in the CARIBBEAN SEA (1878-79), and along the ATLANTIC COAST of the UNITED STATES (1880), by the U. S. Coast Survey Steamer "BLAKE," Lieut. Com. C. D. SIGSBEE, U. S. N., and Com. J. R. BARTLETT, U. S. N., commanding. XXXVI. OCEANIC ICHTHYOLOGY, a Treatise on the DEEP SEA and PELAGIC FISHES of the World, based chiefly upon the Collections made by the Steamers "BLAKE," "ALBATROSS," and "FISH HAWK" in the NORTHWESTERN ATLANTIC. By GEORGE BROWN GOODE and TARLETON H. BEAN. pp. xxxvi + 26 + 553, and Atlas of 123 Plates. September, 1896.

[Published in Connection with the National Museum and the Smithsonian Institution.]

[B]

INVESTED FUNDS OF THE MUSEUM.

IN THE HANDS OF THE TREASURER OF HARVARD COLLEGE, SEPT. 1, 1895.

Sturgis-Hooper Fund	\$100,000.00
Gray Fund	50,000.00
Agassiz Memorial Fund	297,933.10
Teachers and Pupils Fund	7,594.01
Permanent Fund	117,469.34
Humboldt Fund	7,740.66
Virginia Barret Gibbs Fund	5,000.00
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	\$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 \$300) 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.