THE GEOLOGICAL AND PALEONTOLOGICAL COLLECTIONS IN THE AMERICAN MUSEUM OF NATURAL HISTORY.*

THIS informal paper was prepared by the author (in the absence of Professor R. P. Whitfield, who has been curator of the Geological Department of the Museum for more than twenty-three years) at the request of the officers of Section E, so that members in attendance at the meeting of the Association might know in a general way what to look for on visiting the Museum.

The first series of valuable fossils to be acquired by the American Museum of Natural History was the Holmes collection from the Tertiary deposits of South Carolina. This included the types of the species described in Tuomey and Holmes' works.† The second important series to be put on exhibition was the set of eight mounted skeletons of moas from New Zealand, constituting the De Haas types of those birds. There are eight unmounted skeletons in the same collection, thirteen species being represented in all.

The main portion of the department's specimens is composed of the James Hall collection, the acquisition of which in 1875 placed the Museum in the lead among American institutions in respect to Paleozoic fossils, on account of the great number of types and figured specimens contained therein, such specimens being numbered by the thousand.‡ Especially noteworthy in the Hall collection, aside from the wonderfully rich New York series, are the Potsdam fossils from Minnesota and Wisconsin; Trenton forms from Wisconsin and Iowa, the unfigured types of which have been republished by Professor Whitfield with figures in the Memoirs of the Museum; Niagara fossils from Waldron, Indiana; corals from the Falls of the Ohio river; crinoids from Burlington, Iowa, and the remarkable Lower Carboniferous fauna of Spergen Hill, Indiana, both of which last have been republished by Professor Whitfield with figures from the original types, the former in the Memoirs and the latter in the Bulletin of the Museum.

Other collections which may be mentioned are the Chazy and Fort Cassin fossils from the vicinity of Lake Champlain, containing types which have been described by Professor Whitfield in the Bulletin of the Museum; a complete set of the Vermont and New Hampshire rocks illustrating the geological survey of those States by Professor C. H. Hitchcock, and the types of the Tertiary plants from Brandon, Vermont; an excellent series of Paleozoic fossils from Illinois and neighboring States; fossils from the Cretaceous marls of New Jersey, collected and presented to the Museum by Professor Whitfield, and fine sets of fish remains from the Triassic of the Connecticut valley and the Tertiary beds of Wyoming. The most recent noteworthy addition is one of the Tyrrell collections of placoderm fishes from the Devonian rocks of Ohio.

The arrangement of the collection is that devised by Professor Whitfield when he came to the Museum, and it is worthy of careful consideration on account of the way it has stood the test of time and use. Beginning at the northeast corner of the hall (because that is beside what was originally the only entrance to the room and was understood to be the permanent main entrance thereto) the specimens are arranged stratigraphically in ascending geological order. Under the stratigraphic arrangement, the grouping is by geographical or lithological provinces, first New York, or eastern and

* Read before Section E of the American Association for the Advancement of Science, June 26, 1900.

† Pleiocene Fossils of South Carolina, by M. Tuomey and F. S. Holmes. 4to. Charleston, S. C., 1857; Post-Pleiocene Fossils of South Carolina, by F. S. Holmes. 4to. Charleston, S. C., 1860.

‡ Published principally in the reports of the State Geological Surveys of New York, Iowa, Wisconsin and Indiana.

then western. Under this again the arrangement is strictly biological, beginning with plants, where present, and then taking the animals in ascending scale. This scheme has been carried out most definitely in the upright cases, while the desk cases contain many of the best specimens and fit into the classification as well as is practicable. A part of each of twelve of the desk cases is occupied by specimens comprising the Dana's Manual series. These illustrate the figures in that standard work on geology and form an epitome of the historical side of the science. Many of the figures are represented by the very specimens from which the originals were drawn. Large specimens showing ripple marks, footprints, concretions, and other phenomena are placed on the tops of the cases and in other places out of series.

A very valuable feature of the installation is that of separating the biological units from one another, so that the individuals, species, genera, families, etc., which belong together can be distinguished on the most rapid inspection. This is effected by means of narrow strips of wood of different colors placed between the trays holding the fossils, single black strips separating different species, red ones genera, white ones families, two white ones limiting orders and two black denoting the boundaries of classes and higher subdivisions. The specimens, furthermore, are arranged so that one naturally examines them from left to right and from below upwards, except that the upper shelves of the upright cases are occupied by large and small specimens showing the grouping of the fossils in the rocks and the geological features of the beds. More than nine-tenths of the hall is devoted to the American forms, the rest being given up to a synoptic series of European fossils and fossils from other foreign localities.

The mineral collection, which is under the immediate care of Mr. L. P. Gratacap, has grown to large proportions and well repays careful study. About five hundred species are represented by nearly ten thousand specimens which are arranged according to the sixth edition of Dana's System of Mineralogy. The specialty of an institution like the American Museum is large, showy specimens, and we have a great many such which are worthy the notice of the scientific as well as the popular visitor. Especially conspicuous among these are specimens of quartz, gypsum, barite, calcite and fluorite, but above all the unrivaled malachites, azurites and stalactites from the Copper Queen Co.'s mines at Bisbee, Arizona. The collection of gems and gem material, too, should not be overlooked, since it contains many unique and beautiful specimens.

The Museum collections of the fossil remains of mammals and reptiles are in the Department of Vertebrate Paleontology, and being thus outside of my province, I refer to them with the permission of the curator of the department, Professor Henry F. Osborn. The exhibition series is to be found in the hall of the east wing of the Museum building, on the same floor with the collections of the Geological Department, and it includes many wonderful specimens, the like of which are to be found in no other institution in the world. The department was organized and the work of collecting begun in the year 1891 with Professor H. F. Osborn as curator, Dr. J. L. Wortman as assistant curator in charge of the field work, and Adam Hermann as head preparator. Thanks to the ability and energy of this corps of workers and their assistants, the collection has grown with great rapidity and substantiality, while the installation is a model.

The amount of exhibition material on hand and mounted in 1895 was sufficient to warrant the opening of the hall, and the public obtained the first view of these col-

lections in October of that year. One of the constant aims of the curator has been to obtain complete skeletons for the exhibition cases; and an inspection of the cases will show the extent to which this aim has been attained. Pains and expense have not been spared in the effort to make the collection attractive in appearance, as well as useful to the student. The primary idea in the arrangement of this collection is to show the evolution of the various types of animals represented, while the geological association is secondary. Thus on the south side of the room we have the perissodactyls, beginning with the titanotheres and passing on through the tapirs, lophiodonts, rhinoceroses and paleotheres to the horses. On the north side of the room, and beginning, as before, at the west end of the hall, we have the amblypods (pantolambdas, coryphodonts and uintatheres), the elotheres, the oreodonts and the ancestors of the llamas and the camels.

Among the sets just mentioned are some specimens that deserve more than the passing notice that can be given them here. Cope's type specimen of *Phenacodus primævus*, the collateral ancestor of the hoofed animals, was acquired with the purchase of that famous scientist's collection of fossil mammals in 1895. It has been worked out of the matrix since it came to the Museum and mounted, so that every bone on one side can be removed readily for the purpose of examination or study. *Hophlophoneus primævus* Leidy, the ancient saber-toothed tiger, is represented by an absolutely complete skeleton, even the smallest bones of the tail having been preserved. This, too, has been mounted so that every bone can be readily removed for study. *Patriofelis ferox* Marsh, the ancient aquatic tiger-cat, *Coryphoden testis* Cope and *Palæosyops paludosus* Leidy are represented by specimens which are almost equally good. An immense Titanotherium skeleton, which has been made up from but two individuals, shows an interesting fracture of one of the ribs on the right side which was healed during the life of the beast. Four rhinoceros skeletons show the long-legged, agile and short-legged, sluggish types. These have been described by Professor Osborn in a Memoir of the Museum. The bones of one of these skeletons are so perfect that they hardly look like fossils. The evolution of the horse is represented by a series of skulls as well as by the more familiar series of leg bones.

The subject of reptiles is now receiving much attention and some remarkable specimens have been placed on exhibition, the most noteworthy of which is the nearly entire skeleton of a mosasaur (*Tylosaurus dispelor* (Cope)) from the Upper Cretaceous of Kansas. The individual must have been originally more than thirty feet in length. About twenty-eight feet of it have been preserved in this specimen, which has been mounted in the original matrix in which it was found and placed in a shallow case against the wall near the entrance to the hall. *Diplodocus*, *Camarasaurus* and other herbivorous and carnivorous dinosaurs from the western Jurassic and Cretaceous beds are represented in the cases by sets of vertebræ, pelvic bones, ribs and legs which give the visitor a very good idea of the immense size and the proportions of these ancient lizards.

In 1895 the mammal remains in Professor Cope's famous collection were purchased by the Museum, and in 1898 the remainder of his collection was acquired. These acquisitions brought to the Museum a large number of invaluable type specimens and established the position of the institution as one of the most important, if not the most important, place in the world for the study of vertebrate paleontology. Aside from these types, the collection contains, as a matter of course, all the material de-

scribed and illustrated in the Bulletins and Memoirs of the Museum by Messrs. Osborn, Wortman, Matthew (W. D.), and Earle.

A description of this department of the Museum would be very incomplete without mention of the life-like water-color restorations of mammals and reptiles which have been made by Charles R. Knight, under the direction and with the advice and assistance of Professors Osborn, Cope and Scott. These pictures are, without question, the best attempts that have ever been made to represent the animal life and the scenery of Mesozoic and Cenozoic time in this country or Europe. The collection is very thoroughly labeled, with elaborate descriptive as well as individual labels and photographic transparencies of many of the western fossiliferous localities occupy some of the windows.

Edmund Otis Hovey.

SCIENTIFIC BOOKS.

Evolution by Atrophy in Biology and Sociology. By Jean Demoor, Agrégé of the Free University of Brussels; Jean Massart, Chargé de Cours of the Free University of Brussels; Emile Vandervelde, Professor at the Institute des Hautes Études of Brussels, translated by Mrs. Chalmers Mitchell. The International Scientific Series. New York, D. Appleton & Co. 1899.

An eminent American economist has declared the bankruptcy of biological sociology. The authors of 'Evolution of Atrophy,' have assumed the receivership of a section of biological sociology, namely, that dealing with degeneration. Realizing that "biosociological investigations have hitherto been conducted either by naturalists with a limited knowledge of social questions, or by sociologists whose training was incomplete and superficial," their researches on degeneration "have been made separately from the social side and from the biological side, and have now been coordinated and combined." The volume is divided into three books, dealing respectively with 'Universality of degenerative evolution,' 'The path of degenerative evolution,' and 'Causes of degenerative evolution.' Each book is divided into three parts, the third of which gives a summary and conclusions of the first two. The result of the collaboration of several authors has resulted in a well-systematized arrangement of topics and an attempt at balancing a part, chapter, or section in Biology with a similar one in Sociology. Thus Part I. of Book I. deals with 'Degeneration in the development of institutions and organs.' Chapter I. 'In the evolution of organs all modification is necessarily attended by degeneration.' Chapter II. 'In the evolution of institutions all modification is necessarily accompanied by degeneration,' and of Part I., Chapter I., 'All organisms exhibit rudimentary organs.' Chapter II. 'Survivals exist in all kinds of societies.' Or in Book II., Part II., Chapter I., we have: *Section I.* 'Disappeared organs.' *Section II.* 'Disappeared institutions.' There is thus a constant interlarding of fat with lean.

Book I. is essentially a statement of facts from which the authors conclude that "degenerative evolution exists everywhere * * * in the evolution of organs certain facts may disappear completely * * * in the evolution of organisms certain organs may also disappear. * * * Not only may a larval stage or an adult stage be completely suppressed, but a multicellular organism may even lose its power of dying." Degeneration is not an accident and is not confined to unusual, abnormal or pathological cases. Living and superior civilizations drag behind them a trail of débris from dead civilizations.

Book II. is an examination of the question whether the degeneration of individuals and of organs proceeds by successive atrophies occurring in the order opposite to that of ontological formation. In considering the series of pineal eyes offered by various animals they "cannot refrain from the conclusion that in this series degeneration retraces to a large extent the steps of original advance." This, however, is not a universal application, and "although the most recently acquired features may disappear first, degeneration is not an actual retracing of steps until the point of departure is reached. The degenerate condition is a new point, and really the term retrogres-