geology and mineralogy of Brazil. It is expected that additional assistants will be appointed in the near future.

The Brazilian people are to be congratulated upon the establishment of this important service. The development of the great mineral resources of that country and the growth of a healthy, hopeful and helpful interest in geology may now be looked for with confidence.

The character, the professional high standing and the unselfish patriotism of the men entrusted with the survey are a guarantee of the abundant and trustworthy results to be expected.

J. C. BRANNER
STANFORD UNIVERSITY, CALIFORNIA,
March 7, 1907

THE FAYÛM EXPEDITION OF THE AMERICAN MUSEUM

IN the Middle and Upper Eocene fluvio-marine formation of Northern Egypt most important paleontological discoveries were made between 1902 and 1905 by Mr. Beadnell, of the Egyptian Geological Survey, and Mr. C. W. Andrews, of the British Museum of Natural History. From being the terra incognita of paleontology Northern Africa suddenly sprang into prominence as the center of origin and evolution during the Eocene and Oligocene periods of four great groups of mammalia whose early history had previously been entirely unknown. These were, in order of importance, the Proboscidia or mastodons and elephants, the Sirenia or manatees and dugongs, the Hyracoidea or tree and rock conies and the Zeuglodontia or Archæoceti, or primitive toothed whales. Together with the primitive, or rather the early forms of these mammals, because certain of them are already highly specialized, occur a few members of two other faunæ, namely, of the upper Eocene of France, and secondly a purely African contingent including chiefly the giant horned quadruped appropriately named *Arsinoïtherium*. This animal held an adaptive position in the faunæ complex somewhat similar to that of *Dinoceras* in our western tertiaries. Large collections of these mammals were made by the Egyptian Survey for the Cairo Museum and by the British Museum, on which was based the admirable memoir by Dr. C. W. Andrews published by the British Museum some months ago.

This fauna has a peculiar interest for the department of vertebrate paleontology in the American Museum because three of these great African or Ethiopian groups of mammals sooner or later reached North America, namely, the Zeuglodontia in the Eocene of Alabama and Georgia, the Sirenia in the Miocene of the western coast, the Proboscidea in the Middle Miocene of the western tertiaries. The subsequent American phases are all represented in the museum collections, and it was obviously desirable to trace the ancestry back to the earliest known stages. A further cause of personal interest to Professor Osborn was the fact that in an address before the New York Academy of Sciences in 1900 he had predicted that three or more of these groups would most probably be discovered in Africa. The publication of Andrews's memoir made the field and the subject free for scientific research by other workers and after considerable correspondence and inquiry into the probabilities of success the project of an expedition was approved by the president and by the director of the American Museum. With his usual liberality President Morris K. Jesup decided to defray the chief expenses of a three or four months' expedition, and preparations were made to leave New York on January 5 and to begin work in the Fayûm as early as possible in order to take advantage of the cool months of the Egyptian winter. Professor Osborn selected as his assistants Mr. Walter Granger and Mr. George Olsen, of the museum staff. President Roosevelt, Mr. Joseph H. Choate and Director Charles D. Walcott sent letters to Lord Cromer and other officials of the English protectorate supporting the chief objects of the expedition.

The party reached Cairo on January 24, expecting to occupy ten days or more in outfitting with camels, water tanks, supplies and men. But Director H. G. Lyons, of the Egyptian Geological Survey, entirely altered this estimate by most liberally placing all the necessary equipment from the survey at Pro-

fessor Osborn's disposal and further facilitating the work of preparation in every possible manner. Captain Lyons cooperated still further by detailing Mr. Hartley T. Ferrar, formerly geologist of the British Antarctic Expedition, to accompany the party. Mr. Ferrar's experience in dealing with the natives subsequently proved to be of great service. Natives who had been out with Messrs. Beadnell and Andrews were engaged. The heavy equipment was sent round by rail to Tamia, on the northern edge of the Fayûm oasis, there to be transported by caravan two days' journey, or thirty miles, to the nearest of the bone-bearing localities. It thus came about that exactly one week from the time of arrival in Cairo the expedition started by caravan from the Gizeh pyramids a few miles west of Cairo.

On the journey south the caravan followed the line of the pyramids of Gizeh, Abusir, Sakkara, Deshûr and Lisht. This gave an opportunity of observing the methods of excavation on a large scale by native labor. At Gizeh Dr. Reissner is excavating for the Boston Museum of Fine Arts, with a very large force of men and boys, and at Lisht Dr. Lythgow, another American, is just beginning his explorations for the Metropolitan Museum of Art. The natives are believed to be direct descendants of the builders of the pyramids of five thousand years ago and the tools and carrying baskets have remained unchanged. Wages have risen rapidly in recent years and boys now receive from two to three piasters a day, while the skilled men receive five piasters, or twenty-five cents. At Sakkara are the workings of the Egyptian Museum under Dr. J. E. Quibell. The meeting here proved to be a most fortunate one because Dr. Quibell placed at the disposal of the American Museum party twelve of his best workmen, who were engaged at once to proceed to the bone beds.

The bone beds lie exactly forty miles in a southwest direction from Cairo. The route taken by the party, following the southward line of the pyramids and then turning due west, covered seventy miles, or twenty-eight hours' caravan. A freighted caravan moves so precisely at the rate of 2½ miles, or 4 kilometers, an hour that all desert distances in Egypt are estimated in caravan hours. On the evening of February 5, one month from the date of departure from New York, the party reached the most easterly 'bone pits' as indicated on Mr. H. E. Beadnell's admirable survey map of the Fayûm district. Some of the Egyptians had arrived two days before and had already begun excavation. Two days later the Sakkara force of natives arrived and the camp presented the most picturesque and imposing aspect. Stretched out on the gradually shelving bench of upper Eocene sand were eleven tents. Twenty-six camels were traveling to and fro on the three days' distant water supply. Their groans filled the early morning air.

The topography is extremely interesting. The Fayûm is a very ancient, perhaps late Pliocene, depression, lying closely contiguous to the Nile, which in Pleistocene times converted the basin into a great lake substantially similar in outline to the Lake Moeris of the Ptolemies. Control of the inflow and reclamation of the alluvial bottom began under the ancient Egyptians until now the shallow and brackish Birket el Kurun (Lake of the Horns) stretches 41 meters below sea level and 15 miles east and west as the last and ever-diminishing vestige of the ancient lake. It is fed by the waste of the irrigation waters. The easterly end of this lake is twenty-six miles west of the Nile. Rising from the north shore of the lake and overlooking it like the tiers of an amphitheater are the benches of Middle and Upper Eocene age, the lower steps purely marine, the upper littoral and fluviatile, which finally rise tier above tier, 341 meters, to the summit platform of the Libyan desert. In a gentle northeasterly and southwesterly direction these benches extend for a distance of 45 surveyed miles, beyond which the Eocene is unsurveyed. This noble section has long attracted the attention of German geologists and the fossils of its lower marine members, as studied by Schweinfurth, Blanckenhorn and Zittel, afford proof of a close synchronism with the Middle and Upper Eocene of the Paris Basin. In the southwest is the famous 'Zeuglodon Valley' full of the skeletons of

these ancient and aberrant whales. These animals as well as the Sirenians from the lower members of this great formation have been known since 1879. In 1898–1901 Messrs. Beadnell and Andrews discovered a number of land mammals in these marine or littoral beds, and in the latter years a turning point in the history of paleontology was reached by the discovery of *Palæomastodon* teeth in the upper fluviatile beds. The working of this level between 1901 and 1904 by the Cairo and British Museum parties, and less thoroughly by collectors for other museums, has been principally on a bench 160 meters above sea-level, about 40 meters in thickness, and with a fossiliferous exposure of not over ten miles east and west. Evidence of very thorough prospecting and of excavation on a large scale is everywhere apparent. The bone-bearing stratum is evidently of fluviatile origin, consisting of cross-bedded and often brightly colored sands, sometimes intermingled with clay concretions. All can be worked with a light pick and shovel or with the broad-edged mattox which the natives prefer. Bones are often found broken, more seldom entire; they occur in pockets from 30 to 100 feet in diameter. Several of these pockets or 'bone pits' are reserved by the Egyptian survey but the privilege to work them further was kindly extended by Director Lyons to the American Museum. The conditions of deposition are altogether unlike anything in the American Western Eocene, but resemble as closely as possible the Lower Pleistocene, Sheridan or Equus Beds of our west.

While Professor Osborn and Mr. Ferrar were engaged in a survey of the whole region, simultaneous excavation of two of these 'bone pits' was begun at once under the direction of Mr. Walter Granger and Mr. George Olsen, of the museum party. It soon became apparent that the six workmen from the Helouan stone quarries who had previously been out for the Cairo and British Museums were too impatient to find large bones and too careless with delicate objects, whereas the twelve workmen from Sakkara entered into the search with great care and intelligence, and although they had never hunted for fossil bones before showed an enthusiastic reverence for a delicate object which was delightful to watch as expressed in the display of smiling rows of ivory white teeth at a word of encouragement. The labor question was solved and the problem now became one of extensive excavation, of handling and removing great quantities of sand, of uncovering and taking up the sometimes firm, sometimes extremely delicate and fragile bones, of keeping a very sharp lookout for small objects, and especially for the smaller animals of the period which have thus far not been discovered. Coarse river-deposited sands are evidently not favorable for the preservation of very small objects, but very careful methods of search were soon rewarded by the discovery of small jaws of the creodonts or primitive carnivora of the period, and even more interesting rodents, which had hitherto not been found. At the end of ten days the system of stripping and quarrying was thoroughly established and progressing as rapidly as the slower work of treating the bones with solutions of gum arabic and shellac could follow. Limb bones, teeth and jaws of *Arsinoïtherium, Palæomastodon, Saghatherium, Ancodus, Pterodon* began to appear in encouraging numbers and in fairly good condition.

The members of the excavating party were ever stimulated by the hope that the much-desired skull of one of these mammals might come to light. Skulls are, however, very rare. Of the primitive elephants only two fragmentary skulls of *Palæomastodon* and two of the more primitive *Mœritherium* have been found after many years' work. One of each was found by accident while surface prospecting. Two skulls of *Palæomastodon* are reported to have been found by a collector who did not understand how to preserve them. Of *Arsinoïtherium* six skulls have been secured; three of these, all very perfect, are in the Cairo Museum, one in the British, a fifth is in the Stuttgart Museum, a sixth, said to be the largest and finest, was destroyed in transit. Of these six skulls four were found in surface prospects and two in quarrying.

The region has been so thoroughly prospected since 1901 that the chances of easily

securing fine surface prospects are very remote. The bones weather out in pure white color, are very conspicuous and can be seen a long distance. In fact, the halcyon days of easy collecting have passed, just as they have passed in our western tertiaries. A party will only succeed through thorough, systematic and prolonged search and excavation. On these lines and with this expectation the work of the American Museum has been established by Professor Osborn on a two or three months' footing or as long as the weather is tolerably cool. A train of eight camels is constantly moving to and fro, keeping the camp supplied with water, a three to four days' round journey. Mr. Walter Granger, assisted by Mr. George Olsen, is left in charge. It is hoped that with the aid of fifteen selected workmen, not only a representative collection of these very important mammals may be secured, but considerable additions may be made to our knowledge, especially of the smaller mammals of the Upper Eocene period in Northern Africa.

H. F. O.

Cairo, February 25, 1907

SCIENTIFIC NOTES AND NEWS

M. Pierre Eugène Marcellin Berthelot, the eminent chemist, died in Paris on March 18, at the age of eighty years. M. Berthelot was permanent secretary of the Paris Academy of Sciences. He was a life member of the French senate and had been minister of public instruction and minister of foreign affairs. The Chamber of Deputies, after making an appropriation for a public funeral, adjourned in his memory.

Mr. C. G. Abbot, who had been for a number of years Secretary Langley's principal assistant in the Astrophysical Observatory of the Smithsonian Institution at Washington, and latterly its acting director, has been appointed director of the observatory, and Mr. F. E. Fowle, Jr., hitherto junior assistant, has been appointed aid.

Professor W. K. Brooks, of the Johns Hopkins University, will join Dr. A. G. Mayer, the director of the Tropical Marine Laboratory of the Carnegie Institution, at Nassau in April, for zoological research in the deep waters of the Bahamas.

The organizing secretary of the Section on Embryology of the Seventh International Zoological Congress is Professor E. G. Conklin, of the University of Pennsylvania. Pending his return from a short trip to the Bahama Islands, he desires to call the attention of workers in the fields of normal and experimental embryology to the opportunities which will be offered for the presentation of important papers in these subjects, and to request their cooperation in making the meetings of this section highly successful.

Dr. Francis Henry Smith, professor of natural philosophy in the University of Virginia since 1853, has retired from active service.

Professor Gætano Lanza, head of the department of mechanical engineering of the Massachusetts Institute of Technology, has received a decoration from the king of Italy, conferred by the Italian consul at Boston, Dr. Gustavo Tosti, at a banquet given in his honor.

The London Society of Dyes and Colors has founded in honor of Sir William Perkin a Perkin medal to be conferred for scientific and industrial work connected with the dyeing industries.

The centenary of the Imperial Operating Institute, a department of the University of Vienna, was celebrated on March 15. Many distinguished surgeons attended the evening proceedings, which took the form of a Lister festival, in honor of Lord Lister's eightieth birthday.

M. Henri Poincaré has been appointed a member of the council of the Observatory of Physical Astronomy at Meudon, in the room of the late M. Moissan.

The Technological Institute in Vienna has conferred an honorary doctorate of engineering science on Baron Auer von Welsbach.

The University of Glasgow will confer its doctorate of laws on Sir George Watt, author of the 'Dictionary of the Economic Products of India'; M. Emile Boutroux, professor of philosophy and director of the Fondation