

derived from some deposit probably of Diestian or Anversian age. Mr. Harmer has in his collection a worn shell of the *V. Lamberti* group, showing distinctly broad and swollen ribs on the upper whorls obtained from the Felixstowe shore.

Very few invertebrate remains other than the Mollusca have been obtained in the East Anglian area. I have only noticed, or found recorded:—

Crustacea.

Cæloma sp. (? *rupeliense*, Strainer), and segments of a narrow lobster-like species.

Balanus inclusus (fide Lankester), *B. unguiformis*.

Radiata.

Cyphosoma tertiarium, Cotteau.

Diadema megastoma, A. Bell.

Solaster Reedi, n.sp.

[This unique example belongs to the Reed Collection in the York Museum. It exhibits the dorsal surface of a thick fleshy starfish, covered with bunches of short fasciculate spines scattered over the surface, as they are in the recent *S. furcifer*.

Mr. W. K. Spencer, F.G.S., has kindly furnished me with the following notes of dimensions: "Major radius 33 mm. (approx.), minor radius 13 mm., width of arm at base 14 mm., no. of arms six."]

Cœlenterata.

Flabellum cuneata, Goldfuss, and another species.

Solenastrea Prestwichii, Duncan.

Trochocyathus anglicus, Duncan.

Woods, fruits, and nuts are common in the Belgian Rupelian deposits, and our sub-Crags are rich in these. Mr. W. Carruthers told me many years ago that he had determined three Angiospermous Dicotyledons, one conifer, and two palms. Certain plants or fruits retain their forms when phosphatized both in exterior shape and internal structure, but whether these have any relations to either of the woods present is not yet known. Mus. Ipswich, Saffron Walden.

Amber has been obtained from the Cromer Forest Bed, and Mr. C. Reid has referred to a variety of spiders, insects, etc., in amber washed up on the East Anglian coast, *Trans. Norfolk and Norwich Nat. Hist. Soc.*, vols. iii-v. Mr. A. H. Foord, F.G.S., in vol. v, p. 92, figures many of these, including bees, beetles, cockroaches, and spiders, submitted to, and partly named by, Mr. C. O. Waterhouse and the Rev. O. P. Cambridge. Whether of the same age as the above woods has yet to be determined.

NOTICES OF MEMOIRS.

I.—ON MAMMALIAN BONES FROM EXCAVATIONS IN THE LONDON DISTRICT. By ARTHUR SMITH WOODWARD, LL.D., F.R.S.¹

IN an area so long populated as the London district the surface deposits are naturally very varied, and those of the historic period contain remains not only of the indigenous fauna but also of man's accidental importations. Even so late as the twelfth century William Fitzstephen wrote that the woods close to the city were well stocked with game—"stags, fallow-deer, boars, and wild bulls." Their bones and teeth are often found, besides the remains of other animals, perhaps partly of somewhat earlier date, among which the beaver is especially interesting. Bones of the beaver are indeed so

¹ Abstract of a lecture delivered to the South-Eastern Union of Scientific Societies at Burlington House, London, on June 7, 1917.

abundant in the marsh deposits of the Lea Valley, Essex, that this animal probably had much to do with the extension of the swamps in that region. A good skeleton of a beaver was found in 1911 when excavating at the Royal Victoria and Albert Docks.

Until comparatively recent times much of the land now covered with houses was occupied by market gardens, which it was customary to ornament with trophies brought home by sailors. Among these may be specially mentioned the ribs and jaws of whales, which were erected as arches or made into seats, and disappeared by burial as soon as building operations began. Remains of the oxen, sheep, and pigs used for food were also often buried, and heaps of them have been found in some places, such as Moorfields. They should be collected with care when circumstances allow of their being dated, because it is interesting to determine the successive breeds which they represent. Exceptional accumulations of bones are sometimes puzzling and less easily explained than one which I saw in the mud filling a former pond at Earl's Court House when it was dismantled in 1884. Here lived the eminent surgeon John Hunter, who thus disposed of the remains of many of the carcasses he dissected.

Below the very irregular surface deposits of London there are the old gravels, with associated sand, brick-earth, and peat, of Pleistocene age, occurring at different levels above the Thames, which laid them down before it had cut out the valley to its present depth. Excavations in these river terraces yield mammalian bones almost everywhere.

Sometimes a cold or Arctic fauna is met with. A fine large antler of reindeer and part of the frontlet of a bison were dug up in Buckingham Palace Road in 1891, and similar remains were again found associated at Twickenham in 1894. With the latter Dr. J. R. Leeson discovered a characteristic frontlet of the saiga antelope, which lives now only on the steppes to the east of the Volga. A still more Arctic animal, the musk-ox, is represented in the British Museum by fragments from Plumstead Marshes, Crayford, and Maidenhead. Remains of the mammoth (*Elephas primigenius*) occur abundantly, and some of the best specimens have been found at the bottom of the Thames deposits, directly on the London Clay. Several parts of the skeleton of a young mammoth were discovered thus in an excavation at Endsleigh Street, Bloomsbury, in 1892. More fragmentary remains of the same animal were dug up in 1903 and 1909 in a peaty bed on the London Clay beneath the *Daily Chronicle* office, Fleet Street, associated with very fine skulls of old and young individuals of the woolly rhinoceros (*Rhinoceros antiquitatis*), which were given to the British Museum by Mr. Frank Lloyd. More recently part of the humerus of a lion has been found in the same deposit.

Evidence of a warmer Pleistocene fauna occurs in several places, and the collection of bones and teeth obtained in 1879 from the foundations of Drummond's Bank, Charing Cross, may be mentioned in illustration. I am indebted to Mr. Charles Drummond and the Manager of the Bank for the opportunity of examining this collection, which is still preserved there. The lion is represented by three

vertebræ, part of a sacrum, the middle piece of a humerus, and a calcaneum. There is a characteristic molar tooth of the southern elephant, *Elephas antiquus*, while three fragments of tusk and some portions of limb-bones may well belong to the same species. Two bases of shed antlers evidently represent the large extinct fallow deer, *Cervus browni*, and other bases of antlers are characteristic of *Cervus elaphus*. Numerous bovine limb-bones are very variable in size and proportions, and may belong either to *Bos primigenius* or to a *Bison*. Fragments of limb-bones of a small *Rhinoceros* are not specifically determinable. The absence of *Hippopotamus* is curious, but remains of this animal have been found not far away in Cockspur Street and beneath the Admiralty Offices.

In the London district, as in other parts of Southern England, there is thus some evidence that the typically warm and typically cold members of the Pleistocene mammalian fauna were not altogether contemporaneous.

II.—A GEOLOGICAL THEORY OF THE ORIGIN OF MAN.

PROBABLE RELATIONS OF CLIMATIC CHANGE TO THE ORIGIN OF THE TERTIARY APE-MAN. By Professor JOSEPH BARRELL. *The Scientific Monthly* (New York), vol. iv, pp. 16–26, 1917.

LAST year (Bull. Geol. Soc. America, vol. xxvii, pp. 387–436) Professor Barrell pointed out that recurrent periods of semi-arid conditions might have had much influence on the evolution of vertebrate animals. As a dry season advanced, rivers would be reduced in flow, stagnant pools would result, and any fishes which endured these changed conditions would have to become much modified. The primitive sharks, for instance, found in the earliest Palæozoic freshwaters, having no air-bladder, would be driven to the seas. The freshwater fishes which remained were ganoids and dipnoans, with an air-bladder efficient for the direct use of air. From the crossopterygian ganoids, under the stimulus of the semi-aridity of the Devonian period, there arose the amphibians capable of existing as land animals; and so on.

The question now arises as to whether a similar climatic change in the Tertiary period, acting on species of large-brained and progressive anthropoid apes, isolated from forest regions, might not cause them to advance and become adapted for life on plains or die out. Professor Barrell thinks it would be so, and mentions that at the close of the Miocene period climatic conditions were such that this latest evolution may actually have occurred. There were at that time numerous apes in the warm forests south of the Himalayan region. As the mountains rose and the temperature was lowered some of the apes may have been trapped to the north of this area. As comparatively dry plains took the place of forests, and as the apes could no longer migrate southwards, those that survived must have become adapted for living on the ground and acquired carnivorous instead of frugivorous habits. The Miocene or early Pliocene ape-man may therefore be more hopefully sought in deposits of the open and temperate regions of Central Asia than in the alluvial deposits of the more southern tropical forests.

III.—GLASTONBURY LAKE-VILLAGE.

THE second volume of Messrs. Bulleid & Gray's report on the Glastonbury Lake-Village is just published. It is most valuable, and reflects the highest credit on the authors. This volume contains much matter of geological interest in addition to the archæology. There are reports on the plants by Clement Reid, on the bird remains by C. W. Andrews, on the wild and domestic mammalia by W. B. Dawkins & J. W. Jackson, and on the humans by W. B. Dawkins. The illustrations are profuse and excellent, and the report as a whole is as complete an account of such a site as has yet been made available.

Among the vertebrates the bird *Pelecanus crispus* is the most interesting, for although remains have been previously found in the Fens, Dr. Andrews has examined portions of five individuals and many fragments from Glastonbury, clearly indicating that the birds bred in the neighbourhood, and possibly pointing to a source of food for the inhabitants. The report closes with an exhaustive index, most wisely provided, which greatly enhances its value.

REVIEWS.

I.—MICROSCOPICAL DETERMINATION OF THE OPAQUE MINERALS. By JOSEPH MURDOCH. pp. viii + 165, with 9 figures in the text and 1 coloured plate. New York, John Wiley & Sons, Inc.; London, Chapman & Hall, Ltd., 1916. Price 9s. 6d. net.

WHY the microscope, while holding so predominant a position in the determination of rocks by means of the characters revealed in a thin slice and in the study of transparent substances generally, has hitherto been so little used in the study of metals and alloys and in the identification of opaque substances, is perhaps not difficult to understand. It is not at first sight by any means obvious that this instrument is at all suitable for the purpose, and so vast was the vista opened out by the application of the microscopical method to petrological work that the equally important field of research lying fallow in the case of opaque substances for a long time almost entirely escaped notice. It was, in fact, not till the discovery of different kinds of hardened steels and the consequent necessity for determining and explaining their various characteristics that metallurgists began to pay general attention to the microscopic study of polished sections. Yet more than half a century has elapsed since the gifted Sorby, to whom we are likewise indebted for drawing general attention to the advantage of the microscopic study of thin slices of rocks, had made use of practically all the devices in vogue among metallurgists of to-day; while it is only within the past four or five years that anything like a systematic study of the opaque minerals has been attempted. Mr. Murdoch's book marks the beginning of a new epoch. Previous writers and workers had confined their attention to some particular mineral group or some isolated problem. He is the first to make a systematic study of the opaque minerals, and above all to think out and develop