brick-earth, probably the result of the wash of the hill. Many fossils were collected from the Oldhaven sand; but it is to be feared that few were successfully brought home, on account of their perishable nature.

A small unfinished cutting, a little further east, is in sand, which probably forms part of the bed beneath the shelly clay.

After a meat-tea we strolled into the combined cutting and pit at Higham Station, and noticed the junction of the Thanet Beds and the Chalk, thus continuing and completing the downward procession of the Tertiary Series. A persistent layer of flint through the midst of the chalk was also observed.

EXCURSION TO TOTTERNHOE, KENSWORTH, AND LUTON.

SATURDAY, 25TH JUNE, 1881.

Directors.:—PROFESSOR MORRIS, M.A., F.G.S., JAMES SANDERS, Esq., AND JOHN HOPKINSON, Esq, F.L.S., F.G.S.

(*Report by MR. HOPKINSON.*)

The Dunstable Downs form the most elevated tract of country north of London, within the area of the Chalk formation, in the trough of which lies the London Tertiary Basin, their highest point, Kensworth Hill, being at least 800 feet above sea-level. The Chalk here forms two escarpments, but the higher beds of the Upper Chalk are not represented, the main escarpment exposing the outcrop of the Lower Chalk and the lower beds of the Upper Chalk, and the secondary escarpment the lower beds of the Lower Chalk and the upper portion of the Chalk Marl, with the Totternhoe Stone forming its highest bed.

To gain a knowledge of the physical features of the Dunstable Downs and surrounding country, and to examine the Totternhoe Stone, which only occurs on the north-west outcrop of the Chalk Marl, the members of the Geologists' Association, the Hertfordshire Natural History Society, and the Luton Natural History Society assembled at Stanbridgeford Station at about half-past 11, and at once proceeded, some in carriages and some on foot, to the Totternhoe quarries, where a good section of the Totternhoe Stone is exposed.

Mr. Saunders here said that this bed usually occurred in two seams, each about three feet thick, and consisted of a compact arenaceous limestone, which, in working, separated into massive blocks. Its sandy nature suggested a break in the continuity of the physical conditions which accompanied the deposition of the other beds of the Chalk formation which were almost purely calcareous. The Totternhoe Stone played an important part in modifying the physical features of the district. At its junction with the overlying bed many springs took their rise, the long-continued action of which had been the primary agent in excavating those coombs or valleys which were so characteristic of chalk escarpments. Of these escarpments examples might be seen at Ivinghoe, Barton, Ravensbury Castle, and Pegsdon Barns. Of the rarer fossils found in this bed, Mr. Saunders mentioned that he had discovered part of the jaw, with teeth, of *Ichthyosaurus campylodon*, and a crustacean, *Palæga Carteri*, the first of its kind which exhibited the caudal appendages by which Dr. Henry Woodward was enabled to determine the affinities of the species.

Rain had fallen heavily in the morning, and now it again descended, rendering fossil-collecting not such a pleasant occupation as it would otherwise have been. A good many fossils were, however, found, including *Rhynchonella plicatula* and *R. octoplicata*, *Terebratulæ*, *Inocerami*, &c., teeth of *Ptychodus*, and a fragment of a large dorsal spine of a sauroid fish, the only important find. Some nodules of chert were also obtained.

The party then walked across the fields to Totternhoe Knoll, on the summit of which Professor Morris gave an address on the physiography of the district, explaining how some of the Chalk beds were more or less indurated than others, and how the varying degree of hardness and softness rendered them more or less liable to the effects of sub-aërial denudation, thus determining the physical features of the country. The Chalk, he said, once extended over a wide area in a north-westerly direction, and had been subsequently removed by denudation. Chalk escarpments, as thus left, which formed such a prominent feature in English scenery, had been inferred to be sea-cliffs, but that could not be the case, for the sea cuts indiscriminately through all classes of rocks, and would have left water-worn flints, pebbles, and sand at the base of the escarpment instead of the unrolled and unbroken flints here seen. After alluding in succession to the most interesting points con-

nected with the physical character and extent of the contiguous underlying strata, the Gault, Lower Greensand, and Purbeck beds, Professor Morris referred more particularly to the influence of the range of the Lower Greensand on the physical features and water-supply of the neighbourhood, illustrating his remarks with a geological map which, however, was partially sheltered from observation and rain by an umbrella. Before he could finish, heavy rain and a gale of wind drove the party down the hill, and into the village inn below for shelter and refreshment.

The rain soon ceasing, Totternhoe was left for Kensworth Hill. At the foot of the hill a spring was examined, and a discussion ensued as to the stratum which retained and threw out the water on the hill-side, for its position appeared to be above the line of junction of the Chalk Marl (or its highest bed the Totternhoe Stone), with the more porous chalk overlying it. The water from the spring had carved out for itself a valley in the chalk, affording an example of the mode of formation of the coombs which are so characteristic of chalk escarpments.

A steep climb soon brought the party to the summit of Kensworth Hill. Here a splendid view of the surrounding country was obtained. On the south the ground was seen to slope gently in the direction of Kensworth, while to the north was the steep escarpment which had just been climbed, with the lesser, Lower Chalk escarpment of Totternhoe Knoll and the Maiden's Bower below it, and here and there an outlier of the Chalk might be seen forming a slight elevation on the gault plain beyond. The height of this hill is generally given on maps of the district, &c., as 904ft. above the sea-level, but Mr. Hopkinson stated that, from aneroid measurements he had made from beach-marks on the Dunstable road, he believed the summit was about 810ft above Ordnance-datum.

The route now lay by Kensworth Green, through Kensworth churchyard, and across the St. Albans and Dunstable road, to Caddington. Here the carriages were waiting to convey the party to Farley Hill, Luton, where Mr. Henry Brown, President of the Luton Natural History Society, had kindly offered to provide tea at his residence, "Highfields."

After a substantial meal had been partaken of, in a marquee erected for the purpose, Mr. Hudleston, as President of the Geologists' Association, proposed a vote of thanks to Mr. and Mrs. Brown, which was seconded by Mr. Hopkinson, as Secretary of the

Hertfordshire Natural History Society, and heartily carried. Professor P. Martin Duncan, F.R.S., then expressed the thanks of the party to the Directors, specially mentioning the wide extent of knowledge of the local geology of England possessed by Prof. Morris.

Before separating, the members of the three Societies had an opportunity of inspecting a fine collection of local fossils made by Mr. Saunders, and some artistically-executed diagrams, illustrating the geology of the district, prepared by Mr. A. Ewen.

(Postponed Paper.)

ON CONIFERÆ.

BY J. STARKIE GARDNER, F.G.S.

(Read May 6th, 1881.)

Viewed apart from what geology has made known of their history, the Gymnosperms or Gymnogens appear to form the simplest and a rather abnormal group of Dicotyledons (presenting some affinities with Monocotyledons and certain resemblances to ferns). When, however, their past history is taken into account, they are seen to so far exceed in antiquity the rest of Dicotyledons and the Monocotyledons, and to be of such importance in the study of the evolution of the vegetable kingdom as to demand a separate division in any system that claims to be a natural one.

The Gymnosperms, indeed, present in many respects an intermediate group between the highest form of organization and the lowest. Their chief distinction lies in the fact that the naked ovule is fertilised directly by the pollen without the intervention of stigma, style or ovary. Lindley* considered them, in this respect, analogous to reptiles in the animal kingdom, their ova being fertilised by direct contact with the male principle. Darwin† contrasted the method of reproduction among Gymnosperms with the admirably ingenious contrivances by which many other plants are fertilised by insect agency. "Can we consider," he says, "as equally perfect the elaboration by our fir trees of dense clouds of pollen, in order

* "Veg. Kingdom," p. 221.

† "Origin of Species," 3rd edit., p. 223.