Rhynchonella cuvieri-zone. A large number of typical fossils were obtained, in addition to a fine tooth of *Polyptychodon*, *Pecten Beaveri* (both valves replaced by iron pyrites), scales of *Prionolepis angustus*, and a jaw of *Elasmodectes willetii*.

Finally the grand exposures at Blue Bell Hill were visited, Mr. Butler meeting the members on behalf of the proprietor.

Since the last visit of the Association to this locality the quarrying operations in the upper pit have been discontinued, work being confined to zones of *Rhynchonella cuvieri*, and downwards to the chalk marl.

A good supply of fossils were at hand, and a visit to the upper pit enabled the members to examine the flints, which rewarded them for their exertions.

The walk to Aylesford, *viâ* "Kits' Coty," a substantial tea at "The George," and a subsequent examination of the masses of "Kentish Rag," quarried from the Hythe beds of the Lower Greensand close at hand, brought a delightful day to a close. The return journey was made by the 7.55 p.m. train from Aylesford.

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EXCURSION TO SELSEY AND CHICHESTER.

JULY 9TH, 1904.

Directors: J. VINCENT ELSDEN, B.Sc., F.G.S., and
 W. WHITAKER, B.A., F.R.S.

(*Report by* J. VINCENT ELSDEN.)

THERE was a good muster of members of the Association at Victoria Station, and brilliant weather enabled the party to appreciate fully the fine scenery of the Mid-Sussex route to Chichester, passing in succession the chalk escarpment at Dorking, over the Wealden plain and through the beautiful Arun Gorge at Amberley. From Ford the railway runs nearly parallel with the chalk outcrop along the Sussex coastal plain, which here consists mainly of Pleistocene deposits terminated northwards by an ancient buried cliff of chalk which skirts the downs between Arundel and Lavant. Near Chichester some

good sections of Coombe Rock are exposed in gravel pits seen from the railway. These angular gravels have been dug to a depth of 15 ft. for railway ballast, but only derived fossils have been found here. At Chichester, where our President joined the party, the Selsey steam tram was taken, and for some miles the route lay along the extensive spreads of brickearth and alluvium which, under rich cultivation, extend to the very edge of the low cliffs forming the promontory of Selsey Bill. From this deposit bricks are manufactured near Sidlesham, close to the tramway, which, on approaching Selsey, passes through a cutting exposing good sections of the marine gravel, or raised beach, underlying the Coombe Rock mentioned above.

Arriving at Selsey the party proceeded at once to the shore, and glancing for a few minutes at the wide spread of beach sand and sea occupying the site of the old Saxon Cathedral, and still known as the Park, no time was lost in descending the cliff for the purpose of examining the Eocene floor, which is here typically exposed under favourable circumstances of the tide.

The uncertainty of this exposure is well known. On the present occasion the conditions were unfavourable ; for a spell of fine weather had permitted the accumulation of large spreads of sand, which effectually concealed the greater part of the Bracklesham beds. Isolated patches of Eocene clay were here and there exposed, but the fossiliferous beds were nowhere uncovered, and the tide was not low enough to permit the party to see the Mixen ledge, the site of which is marked by a beacon nearly a mile away from the shore. This ledge is formed of the *Alveolina* Limestone, which is the highest exposed bed of the Bracklesham series in this locality, and is accessible only at low spring tides. The successive outcrops of fossiliferous beds between this and the London Clay strike east and west, between the Mixen and a line between Chichester Channel and Pagham Harbour. Taking a westerly course along the sands, in the direction of Bracklesham Bay, the party then examined the few exposed patches of clay, and, off Medmery, looked for the fossil colony of *Pholas crispata*, in the valves and borings of which are the lowest Pleistocene remains at Selsey. Partly, however, owing to the incoming tide, and still more to the accumulation of beach sands, by which they were hidden, this interesting feature was not discovered. The only early Pleistocene relics actually seen were some of the famous erratic blocks, which protruded in places through the sands. The relation of these to the Eocene floor, so well described by Mr. Clement Reid, was unfortunately hidden from view.

Several of the boulders proved to be of igneous origin. Red and grey porphyritic granite, syenite, greenstone, schist, slate, quartzite and sandstone boulders occur, and some of them are of large size, weighing several tons ; but the majority are of

decidedly local origin, having possibly been carried by floating ice from neighbouring parts of the south coast. Very similar boulders occur also at Hayling Island. Mr. Clement Reid has shown that the mode of occurrence of some of these boulders, embedded in Pleistocene beds, proves conclusively that they are not derived, as has been suggested, from the ballast of wrecked vessels.

Attention was next paid to the low cliffs of Pleistocene deposits at Medmery Farm. Mr. Whitaker here drew attention to the way in which the present beach had been swept by storms to the top of the cliff, where it forms a considerable deposit overlying the brickearth, exactly simulating an older raised beach. A comparison was here made between the present line of the cliff and that shown on the six-inch Ordnance sheet, considerable denudation having taken place in the interval. The farm build-

FIG. 35.—SECTION OF THE CLIFF AND FORESHORE AT SELSEY BILL.
6. Coombe Rock. 5. Shingle. 1. Bracklesham Beds.

ings were extensively undermined by the gales of the autumn of 1891, and Mr. Clement Reid states that as late as 1889 the cliff extended 20 yards beyond its present termination. Erosion is here rapidly removing the Pleistocene cover from the Eocene floor. Even as late as the middle of the fourteenth century a deer park was in existence about a mile off the eastern corner of Selsey Bill. On the present occasion there was an opportunity of witnessing the futility of an effort which had been made near Medmery to protect the coast by a zig-zag palisade running parallel to the cliff. The result had been to intensify the erosion at each of the entering angles of the palisade.

The cliff itself was now investigated. The exposed beds consisted of a raised pebble beach, covered by Coombe Rock with angular flints, passing insensibly into brickearth. The brickearth is believed by Mr. Clement Reid to be merely a modified form of the Coombe Rock, into which it merges both vertically and horizontally between Selsey and Chichester. The junction of the marine pebble beach with the overlying deposit of Coombe Rock was observed to be very uneven, looking as if local disturbances

had caused the pebbles to be pushed up into the Coombe Rock, as figured by Prof. Prestwich (Fig. 36).^{*} Mammalian remains, similar to those found in the Brighton raised beach, have been found in the marine pebble gravels of Selsey, and these are said by Mr. Goodwin Austen to occur in greater quantity in the underlying beds, known as the "mud deposits." The large accumulation of modern beach at Selsey usually conceals the lower deposits, lying between the raised beach and the Eocene clays, and there was no indication of these beds on the present occasion, the modern beach completely covering the base of the raised beach (Fig. 35).^{*} No one was fortunate enough to find any fossil remains in this deposit, but a good collection from Selsey was afterwards inspected in the museum at Chichester.

Walking next round the Bill towards Pagham Harbour, the locality was reached where the fossiliferous Eocene beds occur nearer the shore. Here the *Nummulites* beds, the *Turritella* beds, and the *Cardita* beds are usually well exposed, but the tide

FIG. 36.—SECTION IN CLIFF NEAR PAGHAM.

a. Brickearth. a¹. Flint gravel.

had by this time risen too high, and it was not possible to examine them.

From the point of view of fossil collecting from the Bracklesham beds the day was a failure. The only interesting specimens obtained were fragments of the *Alveolina* limestones from the Mixen Rocks. These were to be picked up in fair quantity amongst the beach shingle. Some of the party, however, prolonged their walk westward towards Bracklesham, and brought back some specimens of *Cardita* and other shells.

It was now time to proceed to the Station Hotel at Selsey, where it had been arranged to have tea. The chair was taken by the President.

Returning to Chichester a visit was paid to the City Museum, where the curator, Mr. J. Anderson, kindly pointed out objects of interest, amongst which were a large collection of mammalian remains from the Selsey Pleistocene Beds, and some interesting specimens of Sussex fossils presented by Dr. Mantell. The remaining time was occupied in visiting the Cathedral, which dates from the thirteenth century, the Market Cross, built at the end of the fifteenth century, and St. Mary's Hospital founded A.D. 1229.

^{*} Figs. 35 and 36 by kind permission of the Council of the Geological Society.

The return journey afforded an opportunity for the realisation of Mr. Clement Reid's theory of the origin of the Coombe Rock, which he believes to be a subaerial deposit due to floods caused by the disturbance of natural drainage conditions owing to a frozen land surface at the time of the Glacial Period. Chichester and Selsey stand upon a flat subaerial delta formed in this way, and it was easy to understand why the Coombe Rock near Chichester is a coarse angular gravel, which towards Selsey graduates into a flinty loam and brickearth.

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EXCURSION TO UPMINSTER, GREAT WARLEY, AND BRENTWOOD.

JULY 16TH, 1904.

Director : HORACE B. WOODWARD, F.R.S.

Excursion Secretary : A. H. WILLIAMS.

THE party (about twenty in number) left Fenchurch Street Station at 1.15 p.m., and arrived at Upminster about 2 p.m. The village, distant about five miles from the Thames, lies near the northern margin of the broad belt of gravels and brickearths which constitute the older deposits of the river, and rest locally on the London Clay. These valley deposits are intersected by streams flowing from the north, that known as the Ingrebourne River cutting down to the London Clay on the west of the road leading to Upminster Hall. The neighbourhood is one which supports fine oak, ash and elm trees, with much pasture and crops of beans on the stiff London Clay, while turnips, potatoes, cabbages and other vegetables are cultivated on the lighter loamy and gravelly soils.