

## EXCURSION TO BERKHAMSTED AND LITTLE HEATH.

SATURDAY, APRIL 26TH, 1919.

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REPORT BY C. J. GILBERT.

PLATES 3B, AND 4.

THIS Excursion, arranged in conjunction with the Herts Natural History Society, was primarily for the purpose of inspecting sections in the extensive deposits of High Level Sands and Gravels in this district, described by the writer in a paper read before the Geological Society on January 22nd, 1919.\*

Mr. T. W. Reader acted as Excursion Secretary.

In spite of the unpromising weather 29 members and friends took part in the Excursion. Passing the ruins of Berkhamsted Castle, the home of the Black Prince, with its three moats—the outcrop of Chalk Rock in three bands at White Hill, and the Clay-with-Reading-pebbles, and Clay-with-flints in the road cutting at Gravel Path, were pointed out. Thence there was a gradual incline to the hill top at Gutteridge Wood, capped with the high-level gravels, and on to Little Heath Common, which is pitted all over with old workings in the gravels at altitudes up to 560 feet. These are the only gravels of “High Level” type, hitherto found north of the London Basin which rest directly upon the Chalk. They overlap the north-eastern scarp of the Bulbourne valley.

This valley was described as pre-Glacial. It was carved out by a larger river than the Bulbourne, which formerly flowed through the scarp from the north-west, but this river was finally beheaded, owing to the eating away of the gault north of the scarp. There were considerable deposits of river gravels in the valley, towards the base of which flint implements had been found, and also a bone, now in St. Alban’s Museum, described by the late Sir John Evans as belonging to the three-toed horse. The River deposits also contain quartz-pebbles and fragments of iron concretions from the Greensand, probably brought in through the Bulbourne gap, and also blocks of puddingstone in great numbers.

The pit at Little Heath showed very fine sections of the High Level Sands and Gravels, about 20 feet in depth, and the various features mentioned in the Geological Society’s Proceedings were pointed out.

The upper Glacial deposits are represented by a pebbly clay, both matrix and pebbles being obviously derived from the

\* *Abs. Proc. Geol. Soc.*, London, No. 1032, p. 40.

Reading Beds. The pebbles are all bleached and highly water-worn, mostly in a vertical position, and sometimes crushed in situ. No rocks foreign to the district have been found. The entire absence alike of the chalk-flints which cover the surface of the surrounding country, and of the large waterworn flints, so abundant in the underlying gravels was pointed out, and the suggestion was made that the ice could not have derived its materials from the immediate neighbourhood, and that possibly only the upper layers of the glacier invaded this part of the Chiltern Hills. These Glacial beds are persistent all over the Common, often cutting into and disturbing the deposits beneath. This was well shown in a big glacial pocket on the south-western corner of the pit, which had bent down and compressed the loamy sands on which they rested, and cut through them into the underlying gravels. A disturbed mass of Glacial sands and clay occurs on the western side of the pit, underlying the pebbly clay. This is introduced in the form of a wedge or V-fault, about 20 feet in thickness, and its appearance seems to suggest an englacial origin. On the east side of the pit, a local fault was found to have thrown down the whole of the beds in the centre, letting in the pebbly clay to a depth of about 12 feet. (See plate 4.) As these glacial beds elsewhere only averaged two feet in thickness, it was obvious that they had suffered considerable erosion. The local faulting was due to the sinking of the beds into a solution hollow in the chalk, a process which was extremely common in the surrounding areas. These solution hollows were post-Glacial and in many cases had been the means of protecting the gravels from erosion.

The Glacial deposits were entirely different from the stratified Glacial sands and gravels containing far travelled rocks, which are so extensively developed at Bedmond, about five miles away to the south-east. The Bedmond deposits were apparently derived from an Ice Sheet, coming from an easterly or north-easterly direction, while the ice stream at Little Heath came from the west.

An inspection of the underlying High Level deposits showed them to consist of reddish brown loamy sands (about six feet), here resting upon about 17 feet of gravels. The sands, which contained abundant flakes of white mica, were interbedded throughout with partings of grey clay, very fine at the base, and becoming wider apart towards the top. These partings were very frequently sun-cracked, suggesting genial climatic conditions at the time of deposition. Well developed ripple-markings were often found; and several specimens were exhibited.

The gravels have an undulating surface, in places resembling small marine beaches. In such cases there is a slight local unconformity between the two deposits, and it was suggested that they were laid down during the period of subsidence; and



*Photo, J. T. Newman.*

SECTION AT LITTLE HEATH.

that the water periodically broke over the beaches, leaving its deposit of sand and clay, which became dry during the intervals. This would explain the ripple-marks and sun-cracks, while the sinking of the land would explain the increasing thickness of the periodical deposits in the upper beds. This theory of subsidence seemed to find support also in the position of the loamy sands above the highest beds of the gravels, and it was of importance in determining the age of the beds. It was also pointed out that the surface of the clay partings never showed evidence of sub-aerial erosion, indicating that the layers were deposited at fairly frequent intervals. The point was emphasized that the gravels have a distinct character from those further south, inasmuch as they consist to a great extent of large (often very large) waterworn and partially water-worn flints in addition to the usual Reading pebbles. It was noticed that in many cases the horns of the flints had not been worn off, the inference being that they were derived from the immediate neighbourhood, and had been subject to very little erosive water action.

Many of the Reading-pebbles were shown to have the nodding marks caused by beach-hammering still intact. In other cases the nodding was wholly or partly worn off by water action, and in others again the pebbles were bleached, showing that the beds from which they were derived had been disintegrated for some time before the gravels were deposited.

Several waterworn pebbles of puddingstone had been found distributed throughout the gravels, and these and the waterworn flints alike often bear the marks of beach-hammering. Quartz-pebbles were found in considerable numbers throughout the gravels, and small fragments of lydite were also met with. These had been traced in considerable abundance along the gaps in the Chiltern Hills, and were derived from the Greensand which crops out to the north and north-west. The presence of the puddingstone and the bleached and abraded condition of the Reading pebbles precluded the possibility of the deposit being of Eocene age, while the nodding of some of the flints and puddingstone pebbles showed that they were deposited under conditions which produced beach-hammering.

Another feature of the gravels was seen in the close packing of the large pebbles, the infilling of all interstices with sand and small pebbles, and the almost entire absence of any evidence of strong current action. It was pointed out by the writer that he had found this to be a feature of marine shore deposits where the beaches remain within reach of the tide, and accumulate gradually. Taken in conjunction with the fact that these gravels over the entire area always presented the same characteristics alike as to composition and structure, it was difficult to resist the conclusion that they were of marine

origin ; and if of marine origin, they could not well be other than of Pliocene age. They were quite unlike fluvial deposits in which we looked for the materials to be sorted out, and to show evidence of current action.

The absence of any exhaustive classified description in the text books of the characteristics of sands and gravel beds produced by different agencies, was dwelt upon, and the suggestion was made that this was a promising field for original investigation.

Regarding the extent and thickness of these deposits, old workings on Little Heath and Berkhamsted Commons were observed over about a mile of the ground traversed, and evidence was adduced to show that they were in places at least 30 feet in thickness, and probably much more. The thinning out of the beds towards the north-west was clearly marked, the Glacial beds there resting directly upon the Chalk. No far-travelled rocks had been found in the gravels.

Fortunately a large accumulation of pebbles extracted from the pit had been left on the Common, the examination of which gave visual evidence of the constituents of the gravels, and the size of the pebbles of which they were composed.

The materials which had been extracted from the Bull-head bed at the junction with the Chalk were examined. These consisted of a dark greenish clay and contained unworn black coated flints, fragments of tabular flints, small Reading pebbles, small smooth rounded pebbles, often polished, pieces of ferruginous concretions, and silicified fragments of *Inoceramus* from the Chalk. In another pit this bed was seen, in situ, resting upon the Chalk and overlain by the gravels.

It was explained that the fragments of *Inoceramus* had also been found in the gravels and loamy sands, and as they were unworn they could not have been subject to much water action, and like the large unworn flints, they must have been of comparatively local origin.

Regarding the correlation of these gravels with the high-level gravels further south, Mr. Barrow repeated the conclusions founded upon his exhaustive examination of these deposits, which established their existence over a wide area. The gravels at altitudes of about 400 feet, consisted very largely of quartz-pebbles, and the Reading and flint-pebbles were comparatively small. At Stanmore, where they are found at an altitude of 500 feet, the pebbles are much larger, though not as large as at Little Heath. The quartz-pebbles at Stanmore are also less abundant than they are at the lower levels. The infilling of sand between the pebbles at Stanmore is of the same character as at Little Heath and suggestive of a similar origin.

A very considerable interval in time had elapsed between the deposition of these beds, and those of glacial origin, sufficient

indeed to allow of the evolution of the present valley-system. Mr. Barrow exhibited the map of the district, which he had prepared, showing the extension of the gravels, and the erosion which had taken place. He was convinced that they all belonged to the same system, and the increasing size of the pebbles at the higher altitudes, where we are nearer the maximum submergence, is what would naturally be looked for.

By the courtesy of the Berkhamstead Golf Club, the party took tea at the Club House, when the following note from Mr. G. MacD. Davies, M.Sc., regarding the mineral composition of the Little Heath beds, was read.

#### NOTE BY G. MACD. DAVIES.

The loamy sand and gravel beds have a mineral composition closely resembling that of the supposed Pliocene beds of Surrey (Netley Heath, Ranmore, Headley, and Chipstead). The points of resemblance are (1) micaceous sands, with a little glauconite and rare flint and felspar, (2) presence of andalusite and monazite in striking amount, (3) occasional grains of sillimanite and green spinel, (4) absence of garnet. The Bull-head bed contains a good deal of garnet, which is generally abundant at the base of the Eocenes to the north-west of London. It may be Eocene material or rearranged Eocene. The Glacial clays and sand are all sufficiently different in composition, although they contain the peculiar "Pliocene" minerals. The proportion of these minerals is different in the Glacial deposits, and there is an addition of other minerals not found in the "Pliocenes," such as garnet.

If you had sent me your samples, without suggesting their age, I should certainly have claimed them as of similar origin to the beds at Headley, etc.

#### EXPLANATION OF PLATES.

PLATE 3B.—Loamy sands with clay-partings frequently ripple-marked or sun-cracked; pit at Little Heath.

PLATE 4.—Gravel beds with loamy sands above; in centre glacial beds let down by a superficial fault.

#### REFERENCES.

- Geol. Surv. Map, New Series, in. Sheet 238.  
1919. *Abs. Proc. Geol. Soc.*, London, No. 1032 (Jan. 31st).