EXCURSION TO WATFORD,

APRIL 13TH, 1872.

Directors :—WILLIAM WHITAKER, Esq., B.A., F.G.S., of Her Majesty's Geological Survey, and JOHN HOPKINSON, Esq., F.G.S.

(*Report by Mr. Hopkinson.*)

A numerous party of ladies and gentlemen assembled at Watford Station at three o'clock, and proceeded northwards along the main line of the London and North Western Railway, under the guidance of one of the Company's Inspectors, to the cutting leading to a tunnel which is now being constructed to take two additional lines of rails. The new cutting, which diverges slightly from the old one at about half a mile from the station, exposes a section of the Chalk overlaid very irregularly by a thick bed of gravel, composed of sub-angular flints derived from the Chalk; of rounded flint pebbles also originally derived from the Chalk, but owing their present form to the attrition they have undergone in the older Tertiary rivers and seas; and of pebbles of very ancient rocks, some of which again were not originally derived from the parent strata, but from the conglomerates of the New Red Sandstone. Here and there also, in the gravel, more or less regularly stratified beds of sand, divided by layers of pebbles, are seen.

Before leaving this section Mr. Whitaker explained, in a few words, some of the chief features of this gravel, which he considered to be of "Middle Glacial" age, and referred to a few of the most interesting problems connected with it. He stated that although we have in the section here exposed no certain data to determine the age of the gravel, we find elsewhere lying upon it patches of Boulder Clay, showing that as this gravel was deposited before the Boulder Clay or "Great Glacial" period, the Chalk, which here was originally some 100 feet (or more) thicker than now, was denuded to this extent before, or during, the Boulder Clay period. The sub-angular flints were not considered to have been derived from the chalk upon which they immediately lie, but to have been drifted, most probably partially at least by the action of ice, from other localities, being here deposited, together with the Tertiary flint pebbles, and the pebbles of quartz and other rocks ice-borne from the conglomerates of Worcestershire and Warwick-

shire, in shallow water where the currents were shifting.* After the chalk had been, as it were, planed down to its present thickness, the gravel was deposited pretty regularly upon it; the present uneven surface being in great part due to the dissolving away of portions of the chalk by the percolation through the overlying porous bed of water charged with carbonic acid, the carbonate of lime being carried off in solution as a bicarbonate. Thus are formed in the Chalk what are called "pot-holes" or "pipes." Wherever the water can get away, as through cracks in the chalk, it is evident that this decomposition will take place, the gravel sinking into the hollows thus formed.

At the conclusion of Mr. Whitaker's address, of which the above is but a brief summary, the party left the cutting at the mouth of the tunnel and proceeded direct over the old tunnel and through the woods to Cassiobury Park, entering through the nearest private gate, permission to pass through the private grounds of the Earl of Essex having been received through the kindness of Mr. C. F. Humbert, F.G.S.

In the park carriages were waiting to convey the ladies to Watford Heath, a distance of three or four miles, and the rest of the party took the nearest path across the park and over the fields. On re-assembling at Watford Heath Kiln Mr. Whitaker described the section there exposed, and a few fossils were found; Mr. W. T. Stone, the owner of the pit, also very kindly distributing several fossils which he and his workmen had obtained. These principally consisted of shark's teeth, which occur in considerable abundance in the upper of two pebble beds forming part of the Basement-bed of the London Clay; a few only being found in the lower bed. There were also a few oyster shells which are here only known to occur in the lower pebble bed.

Since this section was last visited by the Association† a well has been sunk through the Woolwich and Reading beds to the Chalk, just on the edge of the Mottled-clay, which here ends abruptly, its place being taken by the bed of sand on which it rests; the Basement-bed reposing in one part of the pit immediately on the Mottled-clay, and in another on the sand.

After a short walk across the fields, Bushey Kiln, the last section

* The presence in these Post-Pliocene gravels of the remains of some animals indicating a warm, and others an arctic climate, renders it probable that they were not entirely deposited by the agency of ice.

† For a description of the section, see *Proc. Geol. Assoc.*, vol. ii., page 43.

visited, was reached. The chief point here noticed was the great difference of the section of the Woolwich and Reading beds from that exposed at Watford Heath, showing how very irregularly these beds were deposited. A small section, exposing several layers of pebbles in sand, showed how this difference might be partly accounted for. Not only were these layers very irregularly distributed, but between each more or less horizontal layer were to be seen thin connecting layers of pebbles passing through the sand at various angles, showing how, subsequently to the deposition of each layer of sand, strong counter currents tore up the underlying pebbles and re-deposited them at various angles. So it is, and so we should expect it to be in fresh water or estuarine strata—here sand deposited, there pebbles—at one place clay, at another loam. How very different this from the uniformity over large areas frequently presented by marine strata, such as the London Clay above, and the Chalk below.

On arriving at the Bushey end of Watford the party separated, some walking to Watford Station to catch a quick train to London, and others leaving by a later train from Bushey Station.

EXCURSION TO HAMPSTEAD,

APRIL 27TH, 1872.

Directors :—S. R. PATTISON, Esq., F.G.S., and CALEB EVANS, Esq., F.G.S.

(*Report by Mr. Evans*).

A considerable number of ladies and gentlemen assembled at four o'clock in the afternoon at the Swiss Cottage Railway Station, and proceeded to examine the geological character of the neighbourhood of Hampstead.

On reaching the fields by the shaft of the Midland Railway tunnel near Belsize Lane, Mr. Pattison addressed the party and explained that the lower parts of the district consisted of the stiff clay known as the London Clay, and that the upper part of the hill was composed of sand, which was an outlier of the lower part of the Bagshot Sands of Surrey. This porous sand acted as a kind of sponge and the water which percolated through it, being upheld by the impervious London Clay below, appeared as springs on the