13. GRAVEL *at* MORETON-IN-THE-MARSH (GLOUCESTERSHIRE).
By S. S. BUCKMAN, Esq., F.G.S. (Read February 1st, 1899.)

[Abstract.]

THE Author describes certain gravels of Triassic débris and flints at Moreton-in-the-Marsh, with special reference to an upper bed wherein the fragments are mostly in a vertical position, some of them having their heavier ends uppermost. He theorizes that the vertical materials were the droppings from melting ice floating down a large river. This river, formed out of one or more of the original consequents of the Thames system, existed before the valley of the Warwickshire Avon had been excavated. By one branch, possibly the upper Trent, it drained the Pennine range; by another, possibly the upper Severn, the Welsh hills. Ice formed in the upper waters—in these highlands—enclosing débris, and when a thaw occurred, it floated down to the lower parts of the river.

The Author notices certain flints obtained from the gravels. Those from the upper bed are sharply angular, even most finely pointed, and are quite unabraded. They strengthen the theory of ice-transport, and it is evident that they have not been moved by stream-action since their deposition, otherwise they would show signs of wear. The flints from the lower bed do seem to point to some such condition of subsequent removal: they have their edges worn, and are in some cases battered, and peculiarly flaked as if artificially worked.

The Author surmises that the date of the gravel, if formed by a river-system as supposed, is Pliocene.

14. *On the OCCURRENCE of PEBBLES of SCHORL-ROCK from the SOUTH-WEST of ENGLAND in the DRIFT-DEPOSITS of SOUTHERN and EASTERN ENGLAND.* By A. E. SALTER, Esq., B.Sc., F.G.S. (Read February 1st, 1899.)

[Abstract.]

A SET of twelve representative specimens, consisting essentially of quartz and tourmaline, have been examined by Prof. Bonney, who informs the Author that they consist mainly of felspathic grits, schorl-rock, etc., similar rocks to which occur in the South-west of England. The most westerly point at which the pebbles have been detected is on Great and Little Haldon Hills, 800 feet above Ordnance datum, where they are of larger size, more abundant, and coarser-grained than elsewhere. Thence they are traced to the north and south sides of the Thames Basin, and into East Anglia at Walton-on-the-Naze, Aldeburgh, etc. There is a general decrease in height in the deposit in which the pebbles occur, in passing from west to east, and the pebbles appear to have taken two main

courses—one along a peneplain west to east from Dartmoor, the other from south-west to north-east across England. The pebbles are absent from the Weald and from the district around Bagshot, from the Hampshire Basin and its bounding hills (with the exception of the extreme south), and from the highest and presumably oldest gravels north of the Thames.

DISCUSSION (ON THE TWO FOREGOING PAPERS).

Mr. C. REID pointed out that irregular decalcification or settlement in gravels tends to cause the longer axes of the stones to become vertical, and that this vertical position, therefore, must not be taken as evidence of glacial action. With regard to Mr. Salter's specimens of schorl-rock, he was sorry to see that the Author still insisted on confounding gravels of Eocene age, at Haldon, Hardy's Monument, and Dorchester, with much later Drift-deposits of other areas.

Mr. MATLEY considered Mr. Salter's record of the distribution of schorl-rock pebbles more valuable than the theory put forward to account for that distribution. Schorlaceous pebbles occurred not uncommonly in the Birmingham Drift, as shown by some specimens which the speaker exhibited, but it did not need a peneplain from the South-west of England to bring them to the Midlands, for they were clearly derived from the Bunter Conglomerate. Mr. Waller had described (and his microscopic slides were on the table) the petrology of tourmaline-bearing pebbles both from the Bunter and the Midland Drift. Similarly, the pebbles farther south, instead of proving a north-eastern peneplain, were Bunter pebbles, which may have originally come from Cornwall but had not seen their parent-rocks since Triassic times. The Author's own statement bore this out, when he said that, while schorl-rock pebbles were absent in the Wealden area, they occurred, associated with northern rocks, at Kingston Hill, Dartford Heath, and Crayford.

Mr. H. W. MONCKTON, referring to the paper by Mr. Salter, first expressed a doubt as to the relationship between the gravel at the Hockett, 350 feet above the sea, and the valley or gap at Goring. Secondly, if he understood aright, the Author accounted for the presence of the schorl-rock pebbles in Suffolk and Essex as follows: 1st. They had been carried by river-action from the far south-west to, say, the Bedford district; 2nd. They had been subsequently re-drifted through gaps in the Chalk into Suffolk, etc. If that were so, the speaker thought that there should be remains of the deposit near Bedford, formed during the first of these stages, and he asked whether any such remains had been found. Thirdly, the speaker had himself found schorl-rock in the Bunter of Nottinghamshire; and he asked whether the Author could point to any distinction between the schorl-rock pebbles of the Suffolk, etc. gravels and those of the Bunter Beds.

Mr. R. S. HERBIES thought that, before Mr. Salter's theory could be accepted, he ought to show that the specimens of tourmaline-rock

could not have come from any other quarter except the south-west.

Mr. E. A. MARTIN referred to a paper read in 1887 by the Rev. A. W. Rowe, in which he stated that he had found quartz-tourmalines, containing schorl in abundance, in the neighbourhood of Felsted in Essex. He alluded to the wide range over which Mr. Salter's researches had taken him, and from which specimens had been gathered, and complimented him upon the work that he had accomplished.

Dr. HICKS said that the evidence produced by Mr. Salter seemed to show that the pebbles of schorl-rock in the Drift on and near the shore of the English Channel had come from the south-west; but he could not agree with his conclusions that the pebbles of schorl-rock in the Drifts of Hertfordshire and North Middlesex had also come from the same direction. The associated pebbles in the latter areas were of northern derivation; therefore it was more reasonable to suppose that the schorl-rock had also come from some northern source.

Mr. O. A. SHRUBSOLE said that the gravel at Moreton-in-the-Marsh was interesting, but its level was comparatively low. He had obtained from it one flint-flake which might be regarded as a 'scraper.' He did not, however, recognize signs of chipping in any of the specimens exhibited.

Prof. W. W. WATTS also spoke.

The CHAIRMAN (Prof. BONNEY) said that, before calling upon Mr. Salter to reply, it was only just to him to say that he (the speaker) happened to be fairly well acquainted with the Bunter pebbles of the Midlands and with the tourmaline-bearing rocks, both of igneous and of sedimentary origin, in Devon and Cornwall, in the latter of which, so far as he knew, they were more abundant. In the Midland Bunter tourmaline occurred in pebbles, which might be called felstones, and in sundry dark, rather compact, quartzose sedimentaries. These, however, so far as he knew, were rather markedly different from the tourmalinized sedimentaries of the south-west, which also occurred as pebbles in the Budleigh Salterton conglomerate. The pebbles described by Mr. Salter, as a rule, resembled the latter and not the former type.

Mr. SALTER thought that the chief points in Mr. Buckman's paper were not new. He agreed with the Author in regarding the deposit as fluviatile, probably of Pliocene age. The presence of Triassic debris and flint, coupled with the absence of Drift composed of Jurassic rocks, was due, in his opinion, to the fact that the Jurassic rocks were covered up by Cretaceous strata, which have since been denuded. The action of floating ice and the indications of a cold period, noted by the Author, were in accord with the speaker's experiences in Southern England. He did not see any trace of man's work in the flints exhibited.

Replying to the remarks on his own paper, he said that he did not agree with Mr. Reid in assigning an Eocene age to the high-level Drifts of Dorset and Devon. If that were so, the Chalk escarpment would, he thought, have been cut back much

farther. In reply to Mr. Matley, he did not deny the presence of Bunter pebbles from the Midlands in the Drift. They occur plentifully in the Lea valley, but differ from those described in the paper. The peneplain required by his argument existed in Pliocene or earlier times, and was probably much broken up during the Glacial period. In reply to Mr. Monekton, he said that the gravels at the Hockett were deposited when the escarpment was not cut so far back, and when the Thames flowed at a higher level, where the Goring gap now is. Similarly there are no remains of the old peneplain and its associated gravels in the Midlands, because the cutting-back of the Chalk escarpment has destroyed them. The finding of these pebbles over so wide an area could not be called negative evidence. He thanked the Fellows for their reception of his paper.