

approximately 2 feet by 1 foot 6 inches, together with a shale boulder of similar size, is incorporated in the Socorro Series of shales and sandstones of Upper Eocene age, immediately overlying the Clay Pebble Bed of Ancon. The inference is that the Clay Pebble Bed was in existence and subject to denudation when the Socorro Series was deposited, while the evidence goes to show that the tectonic disturbances in the region did not begin until after the Oligocene rocks had been deposited.

A rolled mass of Clay Pebble has been also recorded in the Oligocene sandstones of the neighbourhood.

We await with interest the full results of Mr. Baldry's researches, and we congratulate him on the publication of the first record of the Clay Pebble in north-west Peru.

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ANCON,
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10th February, 1932.

THE PLEISTOCENE SUCCESSION IN ENGLAND.

SIR,—We have read Dr. Sandford's paper on "The Pleistocene Succession in England" with very great interest, and we wish to attempt a small constructive contribution to the synthesis therein suggested. One of the chief gaps in the evidence seems to us to concern the great mass of drift deposits in the northern part of the London Basin, stretching from Goring Gap past Henley to the Vale of St. Albans and Essex. Few writers on Pleistocene chronology make any reference to this area, for little has been published about it, and palaeontological evidence is scanty. There is, however, a large body of explicit physical or morphological evidence which tells a story not widely at variance with that outlined by Dr. Sandford.

In the first place we may note that the gravels bordering the Thames between Goring Gap and the Colne Valley form a series of terraces ranging from 300 feet to 50 feet above present river level. The higher terraces are often fragmentary, but there are two which appear to mark important stages in the evolution of the Thames Valley. The first, about 200 feet above river level, has been named by one of us (B. R. R.) the Binfield terrace, from its occurrence at Binfield Heath, near Reading. It appears to correspond with the Bucklebury stage in the Kennet Valley, and the "200 feet Platform" in the east of the London Basin. The gravels from which Mr. Overy obtained primitive Chellean implements form part of a second terrace about 140 feet above river level, which we have named the Winter Hill terrace, from its occurrence at Winter Hill above Bourne End. It is equivalent to the "Silchester stage" of the Kennet Valley, and is traceable as far east as Wimbledon Common. On other evidence, we may regard this terrace as contemporary with the Middle Glacial Sands and Gravels of the

Vale of St. Albans, which underlie the chief spread of boulder clay—almost certainly the Chalky-Jurassic Boulder Clay.

In the Vale of St. Albans there is an older sheet of gravels separated from the Middle Glacial gravels by an erosion interval of 60–70 feet. It contains Triassic *débris* and far-travelled igneous erratics. Recently we have discovered a small patch of thoroughly decalcified boulder clay resting on these gravels at Mardley Heath near Welwyn. Both its lithological character and its physiographic situation separate it clearly from the “normal” boulder clay at a lower level. It may well be contemporary with the Oxford Plateau Drift and the Norwich Brickearth. It may be noted that quite independently of this evidence the drainage development of the district points strongly to the intervention of glaciation, before the advent of the main boulder clay spread.

We may add that the lower Lea Valley has been excavated through the main mass of the glacial deposits. Near Broxbourne, gravels regarded by us as river gravels *rest on the glacial deposits*, forming a terrace about 100 feet above the present Lea. Neither fossils or implements have yet been found, but the relations imitate those of the famous Hornchurch section in Essex. Farther south the same terrace has been regarded as equivalent to the Boyn Hill terrace of the Thames. On the floor of the Lea Valley occur the thoroughly Arctic beds of the Ponder’s End stage, which, whether or not they were contemporary with local land ice, invite correlation with one of the Northern boulder clays.

These facts indicate a three-fold glaciation of the district, the sequence of events reading as follows:—Early glaciation (Mardley Heath) → Binfield terrace and 200 feet platform → Winter Hill terrace and Middle Glacial outwash → Chalky-Jurassic Boulder Clay → Upper and Middle terraces of Thames and Lea → Ponder’s End stage.

No proof is at present to hand of any third boulder clay in the district which might be coeval with the Ponder’s End beds, but so far as lithology is any guide, both typical Chalky-Jurassic Boulder Clay with mixed Oxford and Kimmeridge Clays as its basis, and also highly Chalky Boulder Clay without the Jurassic elements are present in the district, though included on published maps under the same colour. The chalky variant, well seen at Harlow in the Stort Valley, may prove to be the local representative of the Upper boulder clay at Hoxne, and its relations to the Ponder’s End stage are clearly a matter of great interest.

We have, perforce, stated our conclusions in brief summary form here, but it is hoped that the details will be published in due course.

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10th March, 1932.