The Bone-Bearing Beds of Bethlehem: Their Fauna and Industry

By Elinor W. Gardner and Dorothea M. A. Bate

IN a note in 1934 (*NATURE*, Aug. 11, 1934, p. 219) one of us (D. M. A. B.) directed attention to an interesting discovery of elephant remains in a deposit at Bethlehem. This was the result of a cursory examination on the spot undertaken for the Department of Antiquities.

Shortly afterwards, the late Sir Henry Wellcome became interested in the site, and a concession was obtained by Mr. J. L. Starkey from the Department of Antiquities, Palestine, for the Wellcome Archaeological Research Expedition to the Near East. In the spring of 1935 the Geological Section of the above Expedition began its first season's work with E. W. Gardner as geologist and D. M. A. Bate as palaeontologist. It was continued in 1936 under the same auspices, and resumed in 1937, thanks to the enthusiastic support of the trustees of the late Sir Henry Wellcome and of Sir Robert Mond.

GEOLOGY

The bones were first found by the owner of a garden digging for water on the highest point of Bethlehem, 790 m. above sea-level. On all sides the ground falls away, on the east towards the Dead Sea Rift, on the west towards the Mediterranean.

The position of the deposit isolated on the highest part of the Judean arch at once, therefore, aroused interest, for the solution of the problem of its origin would certainly throw interesting light on the past physiography of the region and its relation with the Rift Valley and Transjordan.

In the original pit, elephant bones were seen *in situ* at 15 m. below the surface. On opening up the area they were found some 6 m. down in a coarse gravel with a stiff clay matrix, which makes their extraction a slow and difficult business. The gravel consists mainly of chert of all sizes, some blocks being half a metre or more big. Limestone is a minor constituent, but is locally abundant. A few iron nodules are also found. The materials are very little sorted, and are mostly derived from local Cretaceous rocks, with the exception of the iron nodules, which are more characteristic of the Eocene.

As the excavation was enlarged it seemed in the first season as though there were two gravels separated by a bed of pure clay, all dipping east, but later work showed that in depth the two gravels coalesce. They are both bone-bearing, in contrast to the pure clay, which has never yet yielded any remains.

Those in the western gravel are badly preserved, perhaps because they occur nearer the surface and are less protected by deposit of lime or nari towards the top. An interesting specimen found there was a

jaw of an elephant, and perhaps part of the skeleton. The mass of bone, 3 m. long, dipped, with the beds, steeply to the north-east; while some of the deposits in the north-east corner—the original area—dip as steeply ($\pm 40^\circ$) to the south.

In 1935 no junction of the gravels and clays with country rock was found, and therefore in 1936 the area was enlarged in the hopes of finding one.

On the east and south a white chalky rock, nari with lumps of limestone, had already been sporadically uncovered, and on cutting back the south side it increased rapidly both vertically and laterally. In places it arches over the gravel, sometimes with a

Fig. 1.

very clean junction. It is veined with red clay, which in places develops into pipes narrowing upward, and mostly dipping eastward. In depth blocks of limestone, some with fossils, become more and more abundant and of increasing size. The surface of these is weathered sub-aerially, and often shows characteristic carving and fretting.

The gravel in the west lies on this deposit, which may be called a cemented scree or breccia, at a steep angle, and sometimes penetrates into it as pipes. The approach of the scree is heralded by increasing numbers of limestone boulders in the gravel and by the reddening of the clay. In the east and south-east, on the other hand, the junction is sharp and vertical, or nearly so, the gravel and clay fall away under the pick in big masses, leaving a clean face of white rock. In the same area vertical or steep clay faces are exposed in the same way, and these, if not on the junction, are always very near it.

On the south the steep scree face has been followed down for 11 m., at which depth it flattens out into a small platform before plunging down again. From the northern edge of this platform a hard triangular mass of breccia rises two metres above the floor. The space between it and the southern wall was filled

with grey bone-bearing gravelly clay, which ended quite abruptly against the breccia block. A somewhat similar but smaller mass has been found in the north-west corner. The irregularity of the surface of the scree deposit, together with the nature of the junction with the bone-bearing beds, seems to indicate that it was formed before them and that they were laid down on and against it.

In the south-east corner yet another curious deposit was found. This consisted of a pipe—3 m. broad—in the nari and scree, filled with blocks of chert of all sizes, some more than a metre in all dimensions. In contrast to the chert in the gravel, which is more or less worn, these blocks of whatever size are sharply angular.

The pipe slopes in the north-east and ends some 6 m. down after narrowing slightly, and finally disappears in the narrow cracks of the cemented scree. On the south side of the pipe near the base the scree contained some remarkable polished cherts. They were found in pockets of red clay in the scree and were mixed with quite unworn and angular fragments. The polish is so high that it is more like a glaze. In some cases the cherts are intensively worn, in others and more frequently, they are less so and show numerous flake scars.

It is still too soon to discuss the origin of all these materials, but there can be little doubt that the gravel and clay bone-bearing series is a water-laid deposit, and that the bed against which it rests is a sub-aerial one.

The gravels are rapidly contracting in area as they go down and this, in conjunction with the inward dip, points to the filling of a roughly funnel-shaped hole, or alternatively to the collapse of the original floor on which they were laid. Whatever may be the ultimate decision, the impossibility of any such deposit forming in its present position indicates wide physiographic changes, which in their turn point to a great age. More exact dating must be left to the palaeontologist.

ARCHAEOLOGY

It is possible, however, that some help in the dating problem may be obtained from implements. Throughout the work a close watch has been kept for human worked flints, but until this year nothing definite was found. Now, however, a number of possible tools have been obtained, in the bone-bearing gravel, and these, if accepted, will be invaluable not only in dating, but also in helping to trace the deposits elsewhere.

Miss Caton-Thompson, who saw them *in situ*, and has kindly consented to work them out, contributes the following note:

"The cherts in the deposit have a wide variation in size, ranging from huge blocks to small chips and pebbles. Both tabular and nodular varieties are present. The former is mainly represented by a pale greenish chalcedonic chert with a rough or corrugated cortex; the latter by a dark grey-to-black 'chalk flint'. A peculiar local variety, favoured on certain sites by Acheulean man for hand axes, is also included; it has the appearance of an angular pudding-stone, and is known as brecciated chert.

"The play of mechanical forces on the flints is strikingly evident. Striations, shattering, bruising, crushing, rolling and thermal action are all visible. Taken as a whole, however, rolling is very slight compared with normal gravel constituents, and a

considerable proportion of the material is relatively fresh.

"The danger of claiming humanly-fashioned tools from such an assemblage and so vast a selection is obvious. Nevertheless, we think that a certain number of pieces are difficult to explain in other terms. They will provoke healthy controversy as acute as that which has beset the 'artefacts' from the Red Crag of Foxhall, or the sub-Crag detritus bed flints at Bramford. Many of the Bethlehem 'artefacts' resemble the latter, in so far as both, when of tabular flint, conform closely in shape and edge trimming to the classic type of Harrisonian eolith. This is the first time they have been found in a sealed deposit in Palestine or the Near East, though Mr. Starkey has long known them from the bed of Wadi Ghuzzah. Flakes, though rarer, are also present, and display 'striking platform' and/or bulb.

"Balancing the probabilities, we think the type of flaking and edge trimming exhibited on these admittedly selected specimens is less easy reasonably to explain as the accidental work of natural forces, than as the deliberate experimental work of man in remote pre-Chellean times." E.W.G.

PALAEONTOLOGY

The first discovery of fossil elephant remains in Palestine was announced in *NATURE* of August 11, 1934, p. 219. Subsequent finds have been made in the Wady Mughara caves and in the bed of the River Jordan not far from its exit from Lake Huleh, but both these are of later date than the deposit at Bethlehem which yielded the first remains. In fact, with the possible exception of a single specimen which I hope to describe shortly, the Bethlehem deposit has yielded a mammalian fauna of earlier geological age than any so far known from Palestine. As yet it has been possible to make only a preliminary examination of the animal remains obtained during the three seasons' work; this has revealed the presence of the following vertebrates:

<i>Felis</i> sp. (size of <i>Panthera leo</i>)	<i>Rhinoceros</i> cf. <i>etruscus</i>
<i>Hippopotamus</i> sp.	<i>Stegodon</i> sp.
<i>Bos</i> sp.	<i>Elephas</i> sp.
Antelope	<i>Testudo</i> sp. (of gigantic size)
Giraffoid	<i>Testudo</i> sp. (of very small size)
<i>Hipparion</i> sp.	

Besides the above species there is known to be a small carnivore, but its remains are extremely fragile and have not yet been extracted from the matrix. With, perhaps, the exception of the large *Felis*, the *Bos* and the tiny tortoise, all these species are new to Palestine, and without doubt represent extinct forms.

Among the mammals the name *Bos* is used in a broad sense, since the species is known only from portions of horn cores. Likewise the antelope and the Giraffoid are only represented by a small number of skeletal remains. The discovery of *Hipparion* is of special interest, both chronologically and geographically. Species are known from many Tertiary deposits in Asia, including India, and are generally considered to be typical of the Pliocene. Last year (1936) Father Teilhard de Chardin and Prof. de Terra recorded *Hipparion* remains from the Basal Pleistocene of India, although they themselves did not wish to claim this dating as proved conclusively. The find at Bethlehem seems to suggest that further corroboration may be forthcoming from India. In

East Africa, on the other hand, *Hipparion* remains are well known from Pleistocene deposits, and have been recorded from Oldoway, Beds I-IV, from Kaiso and from Lake Rudolf.

The Bethlehem *Rhinoceros* has been compared with *R. etruscus*, since some of the upper cheek teeth appear to be similar; the height of the crowns is, if anything, slightly less in the Palestine specimens. In this connexion it is of interest to remember that the late Dr. W. D. Matthew compared the Indian *Dicerorhinus platyrhinus* with *R. etruscus*.

The discovery of the *Stegodon* remains is of outstanding moment. This is essentially an Asiatic genus, though Dr. A. T. Hopwood allows me to mention that its occurrence in African deposits is now known and will shortly be published. India during the Pliocene appears to have been the great centre for the adaptive radiation of the *Stegodon* group. Here the genus lingered on into the Middle Pleistocene; in Java it is known from an even later horizon. As might be expected, the *Elephas* from Bethlehem is represented by a primitive form with low-crowned cheek-teeth.

The gigantic tortoise is known from a considerable number of plates from the bony carapace and plastron. Most of these were collected early this year and have not yet been examined critically. It will be remembered that remains of a gigantic tortoise were discovered by Dr. Leakey in East Africa in 1935.

Many of the animal remains have been subjected to pressure, and this corroborates the geological evidence that movements must have taken place after their inclusion in the deposit. Frequently it has seemed evident that complete carcasses have been embedded in the deposit, notably in the case of the elephant quoted above by Miss Gardner. Likewise it may be mentioned that so far the animal remains have given no indication of a difference of fauna from different parts of the excavation.

Unfortunately, owing to local conditions, specimens are generally very fragile, and always difficult to extract. It is hoped, however, that further work next spring may result in the acquisition of still larger collections, which will enable us to extend our knowledge of this new fauna.

In conclusion, it is suggested for the Bethlehem fauna that its origin is Asiatic, and that its age is not later than Early Pleistocene, using this term palaeontologically as indicating the time of arrival of true *Bos*, *Elephas*, and *Equus*. The fauna also indicate a warm climate, with a more liberal supply of permanent water than is found in the country at the present day. Further, it is claimed for this fauna that it will provide a faunistic link for this period between Asia and East Africa, enabling a better understanding to be reached regarding the migrations and centres of dispersal of various mammalian groups.

D. M. A. B.

The Lake District as a National Park

THE question of the afforestation projects which are being carried out by the Forestry Commissioners has been the subject of considerable controversy and alarm among residents of the Lake District and those who have an admiration for this beautiful piece of England.

The Friends of the Lake District have recently published a pamphlet entitled "Make the Lake District a National Park" (Ambleside: Friends of the Lake District. Sec., 2 Midland Bank Chambers, 1937), which is, in effect, an appeal to all lovers of the Lake District based on a new method of treating and preserving this unique region without involving any of the upset to local agricultural methods which is one of the strong objections offered to the Forestry Commission's activities. The pamphlet opens with the sentence, "Regions of great natural beauty have a lasting value for the refreshment and inspiration of man." The object of the proposal to create the area a national park is to preserve for the future the outward aspect of the district as at present seen "with the grand and the beautiful in splendid harmony". The formation of a national park does not necessarily entail the nationalization of ownership. "The policy has no quarrel with the essentials of the present system of land holding, or with the enjoyment of private property as such. It can be achieved inside the traditional framework."

One of the great objections to the afforestation proposals of the Forestry Commission has been the disturbance involved to local methods of agriculture, and especially to the famous strain of Herdwick sheep. The fells of the Lake District are rough grazing, occupied by Herdwick sheep; and, since

there is no conflict of interest between sheep and the pedestrian, the local agricultural system and free access, it is said, are good partners.

The valley bottoms are not arable, but grass land with a generous lay-out of footpaths on the 'inside land'; the meadows do not run far up into the dale-heads, nor do the 'intakes' run far up on to the hill-sides. The whole configuration and covering of the land is, given moderately free access, ideal for the formation of a national park. The tourist industry, second in importance only to the sheep, will greatly benefit and thus assist the local hardy inhabitants to enjoy a greater prosperity.

The Lake District extends over parts of the three counties of Lancashire, Westmorland and Cumberland. There are seven planning authorities in the Lake District and half a dozen highway authorities, while the Forestry Commission possesses full powers overriding most of these. In order to secure uniformity, the proposal made by the Friends of the Lake District is that a National Park Commission should be appointed by the Government with statutory powers for protective purposes to override other bodies; that the Commission should receive a grant from the taxpayers' money and that it would be responsible to Parliament only. In return for the outlay the public, by arrangement with the land-owners and commoners, would acquire a right to utilize all paths, etc., which have for long been frequented by the courteous permission of such proprietors and commoners. Any other national parks created in the country would be placed under the general control of the National Park Commissioners.