Swanscombe 1971
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SWANSCOMBE 1971

J. D'A. WAECHTER

THE finding of the conjoined flakes in the Lower Loam in B3 during the 1970 season (Waechter 1971) to a large extent determined the programme for 1971.

By the end of the 1970 season two activity horizons had been established, that represented by the knapping floor in B3 and the much more extensive midden on the surface of the Lower Gravel covering the Trench A series, B1 and part of B2. At the end of 1970 only part of B2 had been taken down to the Lower Gravel and B3 to just below the knapping floor.

The first consideration for 1971 was to extend the area of the knapping floor, so with this in view two trenches were opened, B4 to the west of B3, and C3 to the south, these directions chosen as there was no evidence of it extending east into Trench B2 or north into the A series. At the end of the 1970 season none of B3 and only part of B2 had been taken down to the surface of the Lower Gravel, so the object of this last season was to complete the excavation of the Loam in these two trenches and to take the two new ones down at least to the level of the knapping floor.

Trench B2. The eastern end of the midden in this trench consisted mainly of rather fragmentary bone and lacked the larger elements of the midden in the A series of trenches. The western part of B2 showed much the same lack of large material, the only exception being an elephant tarsal bone, a phalange of a rhinoceros and part of an unshed antler. Implements are represented only by a core and a flake, the latter in mint condition.

Trench B3. At the end of the 1970 season, B3 was left with two steps in the Lower Loam, the eastern at −2·08 m which extended into the western side of B2 and the higher on the west at −1·73 m below datum, 20 cm below the floor.

There were very few artefacts from the upper part of the unweathered Loam. There were, however, a group of small chips and a large flake, all fresh, 20 cm below the knapping floor, suggesting that there was a further activity horizon at −1·73 m.

In the lower part of the Loam was the shell-sand lens referred to in detail in the Geological report. From this sand lens came twenty-two flakes, ranging from mint condition to slightly glazed, the last suggesting the slight abrasive action of sand rather than rolling. As the majority showed this abrasion it is reasonable to suppose that they have been swept by the small stream from an adjacent surface in the Loam. Nine of the flakes show definite signs of use, in six the utilisation is associated with a notch, which in all cases seems to have been obtained by retouch rather than by a single flake technique (Newcomer 1971: fig. 8 *b-c*).

The surface of the Lower Gravel, the midden horizon, was much more productive in B3 than in the corresponding level in B2 with an almost complete skull of a rhinoceros, a complete calcaneum of an elephant and two pieces of antler, one with skull attached. The rhinoceros skull lay palate uppermost; the teeth as well as their sockets have been sheared off. Although not yet completely free from its matrix the vault appears to be in good condition with the condyles intact, though the zygomatic bones are broken. (An upper molar came from the midden in A2. (Waechter 1970. K on ground plan).)

Twenty-two artefacts were associated with the floor, of which four are cores and core fragments. These artefacts range from slightly rolled to fresh, a number of the flakes show signs of use and some have retouched notches; the complete core is unusually small, being only 4 cm across.

Trench B4. This, the western extension of B3, was opened to extend the knapping floor area of B3. Unlike the previous trenches there was a considerable amount of Lower Middle Gravel in place above the Lower Loam; on the southern side this reached a depth of nearly 80 cm, but on the northern it was reduced to nearly half through disturbance. The undisturbed gravel is clean and fairly well sorted, it contained no fauna but there were fourteen flakes, one a hand-axe finishing flake and the remainder, slightly rolled, are indistinguishable for the Clactonian material. The Gravel rested on the weathered surface of the Loam which in this trench showed no signs of channelling.

While the weathered Loam in the previous trenches, including Trench E (Waechter 1969: 84), produced some fauna, in B4 it was particularly abundant, though in a very crushed condition; the greater part is of deer, probably fallow. The major single unit consists of two antler beams with the brow tines intact attached to the frontal. Although they do not fit together they obviously belong to the same head; one beam appears to have extended to the bez-tine and possibly the other also, but until attempts are made to reconstruct them, this is uncertain. The remaining bones are part of a pelvis, two tibia, a metacarpal, the distal end of a humerus and part of a mandible with one molar; there was also a mass of crushed vertebrae; these were not separated and appear to have been coiled while still articulated. There were also two shed antlers, several isolated tines and numerous broken pieces of bone and antler. Until this material is studied in detail it is not possible to say how many animals are represented, but so far there is not more than sufficent for one deer as no single elements seem to be duplicated. Only five artefacts came from the weathered Loam, three flakes

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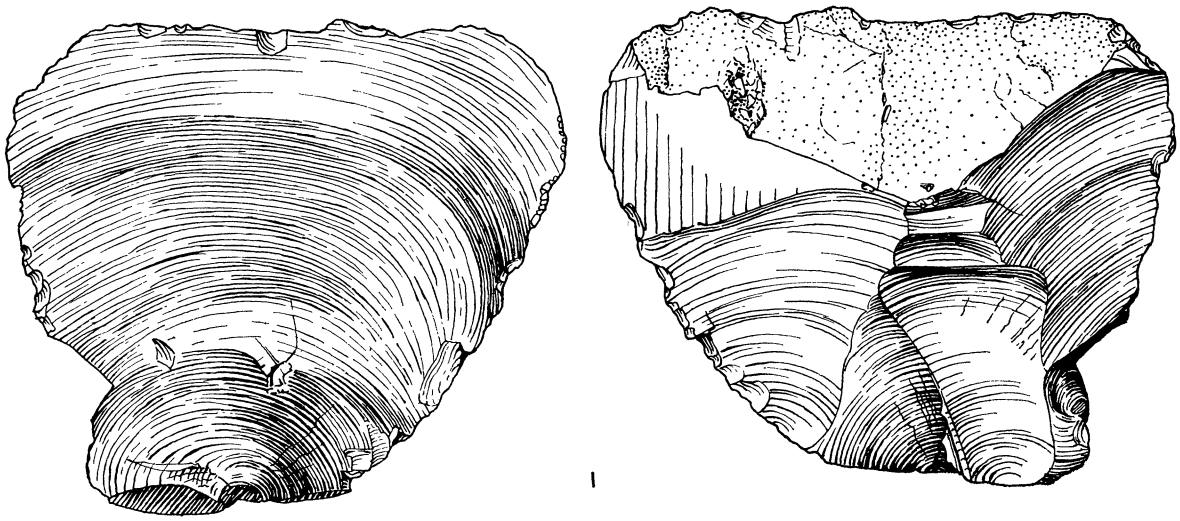

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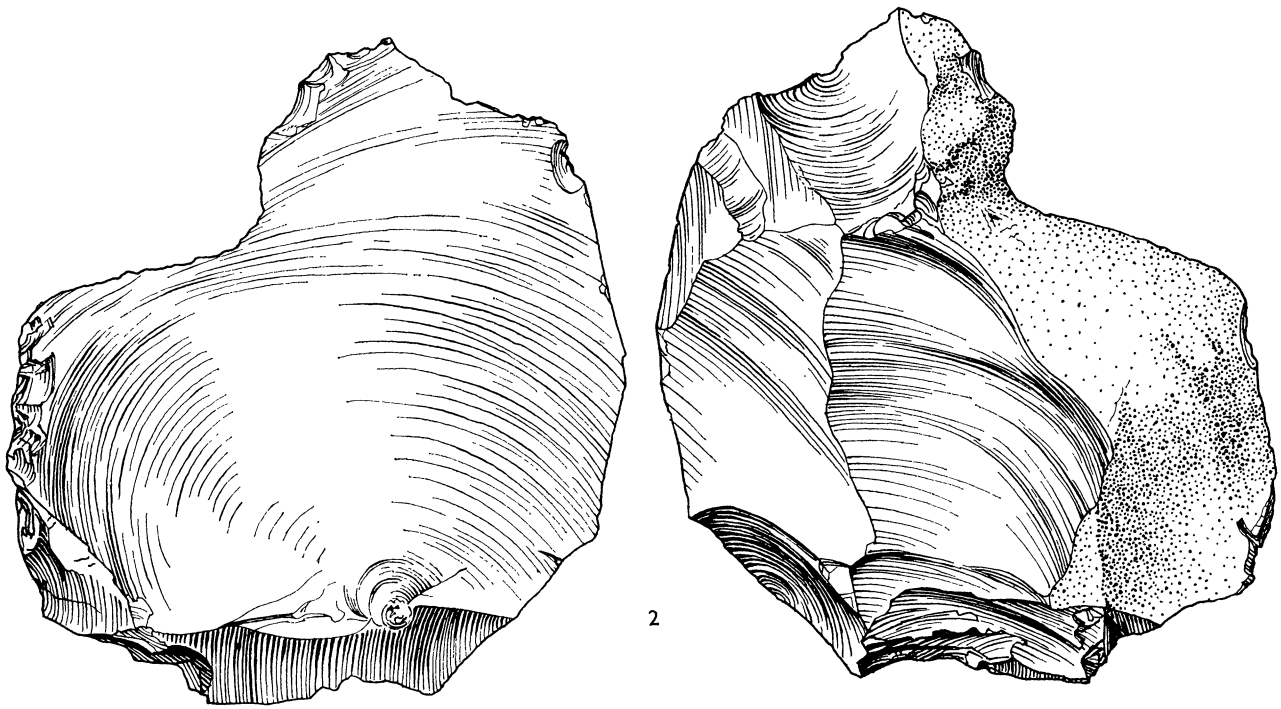

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FIGURE 1

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and two core fragments; two have white patina though not extensive, all are weathered rather than rolled.

Lower down in the unweathered Loam were five flakes all within a depth of 8 cm of each other; four are fresh and one rolled. These flakes were nearly 50 cm above the knapping floor, and further down were three fresh flakes between 30 and 40 cm above the knapping floor.

Trench B4 was excavated to 20 cm below the knapping floor of B3, but at the floor level there was no positive trace of its continuance into B4.

Trench C3. This was to the south of B3 and like the other trenches was 5 × 5 m, and like B4 was intended to extend the knapping floor area of B3. As in B4 there was a cover of Lower Middle gravel about 50 cm thick. Above this gravel is a disturbed layer about 30 cm thick which forms the present surface. These gravels contained no fauna but there were forty flakes and five cores. It is not always possible to distinguish Clactonian flakes from Acheulian, particularly those from the early stages of hand-axe manufacture, though the hand axe finishing flakes are characteristic. The majority of the flakes and the cores are typical Clactonian and almost certainly belong to this stage. Some of the flakes are fresh, but the greater number are slightly rolled. Seven of the flakes are possibly Acheulian, one a typical hand-axe finishing flake. Four of the Clactonian are notched and one is a triangular flake with well-made retouch on both sides, though the piece is not formal enough to refer to as a point. The six cores are typically Clactonian, based on the bi-conical principle; one is almost flat on one side and resembles a Mousterian disc core. Some of the flakes are fresh and some slightly rolled; six have traces of white patina.

The base of the Lower Middle Gravel where it rests directly on the weathered surface of the Lower Loam contains large flint cobbles. Resting on the surface of the Loam and covered by the base of the Gravel was an antler beam with skull attached adjacent to a large block of flint.

The weathered part of the Loam contained the same crushed fauna as in B4; again the majority represent deer, including two mandibles with most of the teeth. Pig is an animal not found before in the present excavations, though previously recorded from the Lower Gravel and less certainly from the Middle Gravel (Sutcliff 1964: 93) and is here represented by isolated molars. The main group is an almost complete antler very badly crushed and resting almost on the surface of the unweathered Loam. There are only six artefacts from the weathered Loam, one is a large block of flint with one flake removed, another is a large flake which itself has been used as a core, one of the flakes has white patina.

As in the case of Trench B4, the main object was to trace the possible expansion of the knapping floor in B3. In B4 there was, with the exception of one small fresh flake, little evidence of the knapping floor in B4 within a range of 1·40 to 1·60 cm, the Floor in B3 ranging from 1·49 cm to 1·63 cm. In C3 within the range of 1·40 to 1·60 cm came three objects which probably represent an extension of the B3 floor. The most impressive of the three is a set of antlers with the facial part of the skull complete (pl. 24). Both the beams and the skull were in a very crushed condition, though it was possible to lift the whole complete. Part of the left beam appears to have been broken in antiquity since one of the upper tines is detached, as is the brow tine on the right side. The average depth of this group is −1·40. At −1·42 was a large flake, 11·6 cm long × 11·4 cm wide; a third of the upper face is cortex and from this face have been struck four previous flakes, two down the axis of the flake surface and two at right angles. The raw material is chalk flint, not river cobble, and is in mint condition.

The second flint associated with the skull is from −1·60; it is a thick triangular flake with cortex on part of the upper face.

The problem of the association of objects, not only between trenches but even within a trench, has always proved difficult since the land surfaces on which activities took place were probably of such short duration, possibly only seasonal, that no recognisable soil horizons are visible. It is therefore not always possible to relate one area with another on purely stratigraphical grounds; this is further complicated by the fact that these surfaces were probably very irregular. There is however a shallow horizon with the same sedimentology and the same land molluscs which links the floor horizons of the three trenches. The problem of association from varying levels in B3 is overcome to some extent by the fitting together of flakes. This is not possible with the two flakes from C3, nevertheless the cortex of the two C3 flakes is so similar that although they do not join there is a strong possibility that they came from the same block, though there is a difference of 18 cm in depth.

Two further objects, one from −1·46 and the other from −1·51 cm, are of interest. These are two small cobbles derived from the Tertiary deposits. They are, of course, out of geological context in the Lower Loam and must have been introduced. Both are of a suitable size for hammerstones, but neither shows signs of normal hammerstone wear; one, however, has a large flake taken out of one side.

Trench A3. During the 1970 season the greater part of this trench was taken down to the level of the midden on the surface of the Lower Gravel, but a small area one metre wide and 60 cm above the Lower Gravel was left on the west side. This was removed and extended the midden level by a further metre. The amount of material from this step was small as far as the Loam was concerned, consisting only of fragments of bone and four flakes.

At the junction of the Lower Loam and Lower Gravel was a continuation of the floor, though it added little more except for a piece of unshed antler

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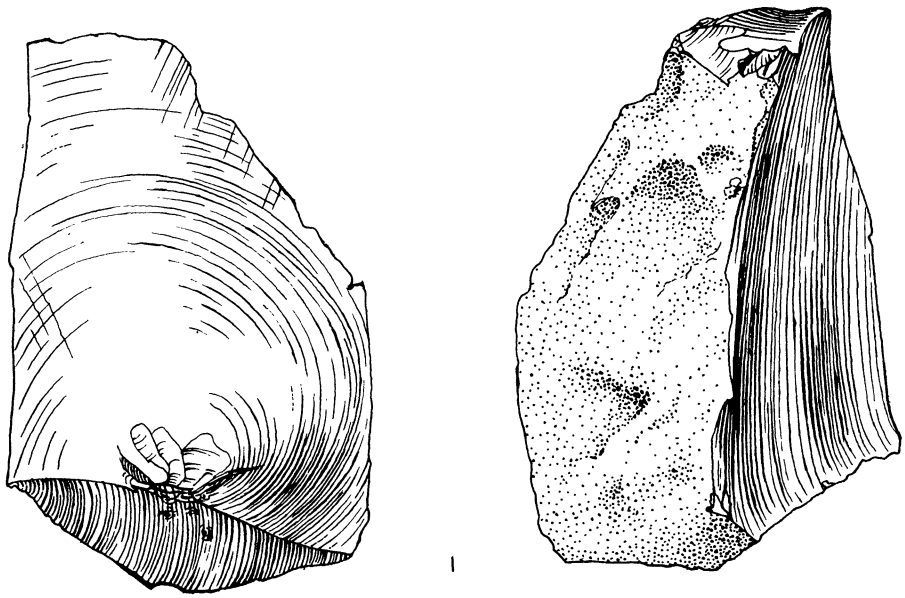

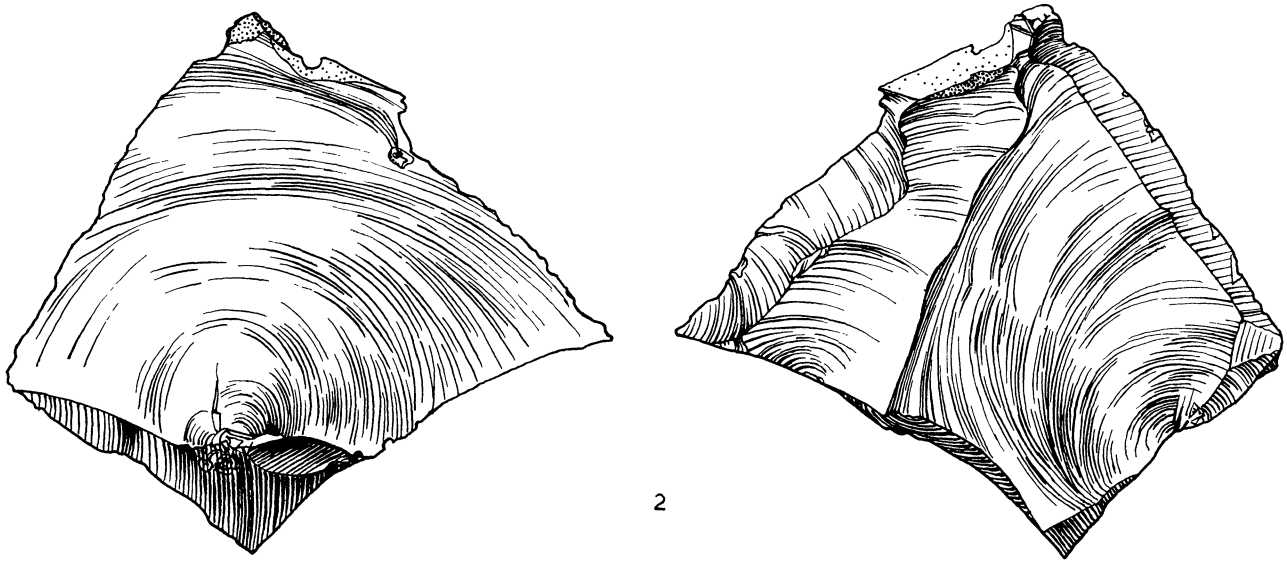

FIGURE 2

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with brow and bez-tine and part of the frontal bone and a large fresh flake.

As in the other trenches in the A series the Lower Gravel was excavated down to the Thanet Sand. As in the rest of the Lower Gravel there was a large number of artefacts, particularly in the upper part, the majority slightly rolled but little bone. The artefacts occurred throughout the Gravel including the surface of the Thanet Sand, which, as in the previous trenches, has poorly sorted gravel with large flint blocks on its surface. From the very base of the gravel came part of a long bone, probably Bos.

In view of the still limited amount of material from the Lower Loam it is not yet possible to make a meaningful comparison between the two deposits. The main feature of the Lower Gravel material is the wide range of raw material. Controlled excavation of the Gravels shows that the smaller flakes are much more abundant than Chandler's collecting methods would suggest (Chandler 1929), nor is it yet possible to demonstrate Marston's subdivision (Marston 1937) though the incrustation on his lowest flints is certainly confirmed, but this is not confined to the lowest level.

The duration of the Clactonian at Swanscombe is still uncertain. The Lower Middle Gravel undoubtedly contains Clactonian elements mixed with the Acheulian, but there is no solid evidence that the Clactonian survived into the second river cycle and was thus contemporary with the Acheulian as suggested by Hazzledine Warren (Warren 1938: 47). It would appear that the Middle Gravel river swept the old Loam surface and may possibly have planed off part of it.

More of Marston's 'White Clactonian' (Marston 1937) has been found at the very base of the Lower Middle Gravel, though whether this was from the final surface or an intermediate one is uncertain, Marston's material is more heavily patinated than ours, suggesting that they had been exposed for a longer time.

Two artefacts of some interest came from the section cleaning outside the Conservancy area (see geological report). One (fig. 3) is a small ovate hand-axe which came from the Upper Gravel. This belongs to a group of hand-axes more ovoid and generally more refined than those from the Middle Gravels. This type is generally considered to belong *in situ* in the Upper Loam, though Smith and Dewey suggest that it may also occur at the very top of the Middle Gravels (Smith & Dewey 1914: 187; Wymer 1968: 343). These hand-axes have been known since the time of Stopes and appear to represent a phase distinct from those in the Lower part of the Middle Gravel, though they have never been found under excavation conditions. The example illustrated probably came from the surface of the Upper Loam before being incorporated in the solifluction gravel.

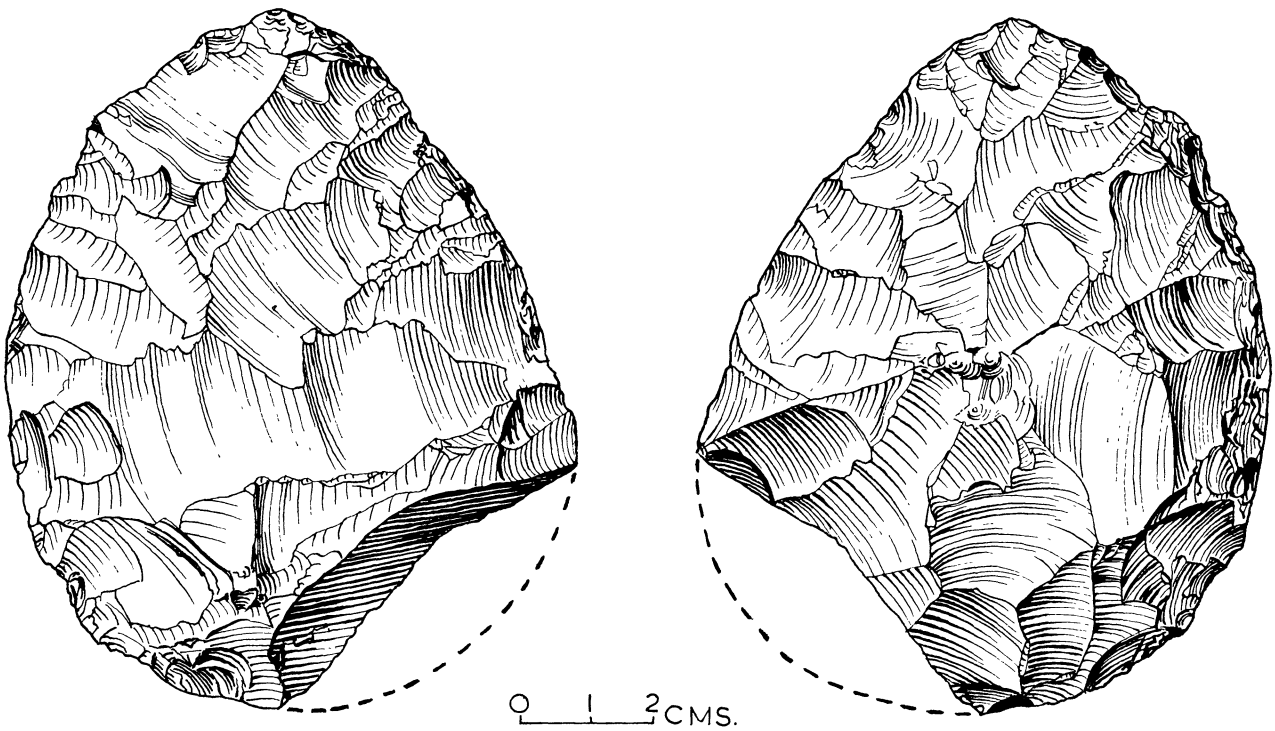

FIGURE 3

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The second artefact is from the base of the Middle Gravel in Trench J. This, a core, in a later context would be referred to without hesitation as a Levallois prepared core. The base is undercut, the platform roughly prepared and one flake removed from a surface slightly domed by flaking across the top.

The date of the adoption of the prepared core technique is still very uncertain. Claims for its use have been made for the Acheulian from the Middle Gravels (Tester 1952; Wymer 1964: 39, 41), but so far the material produced in support of this is not impressive though there is no doubt that it was used in the later stages of the Acheulian (Waechter 1968). As far as the early industries are concerned, both Acheulian and Clactonian cores and flakes can produce Levallois-type material as accidents and hand-axe finishing flakes have often been mistaken for Levallois flakes.

The core from Trench J has a striking resemblance to a specimen from Jaywick (Oakley & Leakey 1937: fig. 5, no. 5), rightly called by the authors a pseudo tortoise core. This specimen, like that from Trench J, is in effect a flat disc core with one large flake removed across one face.

Perhaps the most important contribution in the 1971 season has been the extraction of significant amounts of pollen from the Lower Loam. Many attempts have been made to obtain pollen from the highly calcareous loam without much success, but Hubbard's adaptation of Frenzel's techniques are beginning to prove fruitful. (See Hubbard, pollen report.)

The dating of the lower Swanscombe deposits in terms of the Great Interglacial has always been rather controversial, this dating being particularly important in relation to the Clactonian of Swanscombe and that from Clacton-on-Sea. The difference in age suggested by King and Oakley on geological grounds (King & Oakley 1936: 57) requires re-examination in the light of the present excavations at Swanscombe. So far the only recent attempt at correlation is that of Kerney using the molluscan fauna from the two sites, not only to establish changing environmental conditions but also using these changes as a means of correlation with the pollen sequences from other sites (Kerney 1971).

Although the amount of pollen from the Lower Loam is small, it is only a matter of time before a significant series becomes available, but what is so far available seems to confirm the environmental evidence obtained by Kerney and greatly augmented by Conway both from the molluscan and sedimentological studies. Certainly long-range correlations would at this stage be premature since the counting is still in progress but there is enough evidence to make this a major advance in the study of the Swanscombe deposits.

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AN INTERIM REPORT ON THE POLLEN RECORD AT SWANSCOMBE

R. N. L. B. HUBBARD

THE detailed chronology of the Middle Pleistocene deposits in the Swanscombe gravel pits has long been of great interest to archaeologists, in view of the stratigraphical succession of Clactonian and Acheulian industries. These usually have been placed within the Hoxnian interglacial period on geological and archaeological grounds, but uncertainty exists about the duration and nature of the stratigraphical discontinuities between the Lower Loam and Middle Gravels; and between the Lower and Upper Middle Gravels. Another major chronological problem lies in the exact nature and date of the so-called 'solifluxion deposit' between the Thanet Sands and the Lower Gravels.

Chronological division and comparison of interglacial deposits are normally carried out on the basis of the successive changes in tree-cover, as revealed in pollen analysis; in some cases, the occurrence of certain trees can, in addition, suggest the interglacial to which the deposits may be ascribed. Thus in England, the presence of *Taxus* and *Abies* is characteristic of the Hoxnian interglacial, while high proportions of *Corylus* and *Carpinus* are indicative of stages of the Ipswichian (West 1963). Swanscombe, however, affords extremely poor prospects for pollen preservation, as the soil is fairly open-textured and calcareous: traditional methods of soil-pollen analysis have in fact failed to find anything, and up to now the only comparable information has come from Kerney's study of the Molluscan populations of the Lower Gravel, Lower Loam and Middle Gravels (Kerney 1971: 69 sqq.). In this paper, he concluded that the bases of the Lower Loams and of the Middle Gravels were both laid down when the dry land was forested, but that the forests might have been of different character in the different periods. From the occurrence of temperate species, he argued that the base of the Lower Loam was unlikely to be earlier than the Ho IIb pollen zone; and from the associations of certain molluscan species he predicted that within the period in which the Lower Loams accumulated, a woodland containing hazel gave way to dry grassland.

Application of a technique of pollen concentration by flotation on a dense liquid, essentially the same as that described by Frenzel (1964) and used in this country only by Campbell (1971: 204-6), is in the process of yielding statistically acceptable results from the Lower Loam. Work is at present, however, at a very early stage: only two samples have been studied, and counting is still in progress.

One sample, from the base of the Lower Loam, contains *c.* 60 per cent. pollen of woody species, mainly *Corylus,* but with *Alnus, Pinus* and *Quercus* as the commonest forest trees. The herbaceous pollen is dominated by grasses. Another sample, from the top of the clayey profile in the top of the Lower Loam, contains *c.* 20 per cent. arboreal pollen, mainly *Quercus*; the non-arboreal pollen is again dominated by grasses (*c.* 50 per cent. of all pollen), but includes a wide range of herbaceous plants, the most common being *Plantago lanceolata.* The pollen concentration is low in both cases, as expected (10-30 grains/gram of soil, representing a very high destruction rate).

It will be seen that Kerney's prediction of Hazel woodland for the base of the Lower Loam is apparently entirely fulfilled, as is his conclusion that grassland was dominant in the upper regions—although his sample column appears not to have extended into the clayed region of the Lower Loam. On the other hand, a marsh flora is notably absent from the pollen in the sample at the base of the Loams, where Kerney found abundant mollusca of swamp and fen habitats.

On the basis of two out of some thirty samples, the only chronological conclusions that can yet be drawn is that the base of the Lower Loam is probably not earlier than the Ho IIb sub-stage, in view of the presence of *Alnus* and the absence of *Betula,* corroborating Kerney's deduction. The AP count for the sample from the top of the Lower Loam is at present too low to permit any chronological speculation; and in fact, neither sample has yet yielded pollen of specifically Hoxnian occurrence. It is of interest, however, that this upper sample contains among the Gramineae pollen, two grains which under different circumstances would be instantly classified as 'Cerealia': the better preserved example (plate 26) measured 59 × 46μ, and had an annulus external diameter of 14μ. Lest a Clactonian Neolithic be claimed, it should be remembered that several wild British grasses have similar pollen—in particular, members of the genus *Hordeum.*

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GEOLOGICAL INVESTIGATION OF BOYN HILL TERRACE DEPOSITS AT BARNFIELD PIT, SWANSCOMBE, KENT, DURING 1971

B. W. CONWAY

DURING the 1971 season, trenches A3 and B3, commenced in 1970, were further developed and new trenches B4 and C3 were started. The section in A3 (4·7 m) showed the full thicknesses of the Lower Loam and Lower Gravel resting on Thanet Sand; B3 (2·8 m) showed the lower part of the Lower Middle Gravel and the full thickness of the Lower Loam resting on the Lower Gravel. Trenches B4 and C3 (1·7 and 2·0 m respectively) showed the lower part of the Lower Middle Gravel and the upper part of the Lower Loam only. Two additional sections were cut within the Conservancy area, trench Q (3·3 m) at the extreme southern side of Barnfield Pit under the slope below houses on Milton Street, and trench H (1·8 m) cut into the low bluff on the east side of the main excavation area. Trench Q showed the lower part of the Lower Middle Gravel and the full thickness of the Lower Loam resting on Lower Gravel; trench H showed the lower part of the Lower Loam resting on the Lower Gravel.

Outside the Conservancy area six trenches, J, K, L, M, N and P, were cut by mechanical excavator in and below the east-west cliff face below allotment gardens north of Alkerden Lane, to the west of trench G, cut during the 1970 season. The section revealed by these trenches showed a thickness of at least 10 m of deposits representing most of the Boyn Hill terrace sequence—Upper Gravel, Upper Loam, Upper Middle Gravel, Lower Middle Gravel, Lower Loam and the upper part of the Lower Gravel.

Lower Gravel

New sections showing the full thickness of the Lower Gravel were exposed in trench A3 only (fig. A) and presented several features not previously noted. The lower 0·4 to 0·5 m, bed 1B, consisted of a medium gravel in a silty sand matrix and its upper surface was defined by a horizon of flint cobbles. As in previous seasons, flint cobbles and boulders were found at the base of this bed resting on, and embedded in, the top of the Thanet Sand. Mammalian remains recovered included a shed antler of fallow deer, horse tooth and a fragmentary *Bos* metacarpal. Shells were rare and only a few small worn fragments of a large lamellibranch species were found. The orange brown gritty gravel, bed 2, above the basal 'dirty' gravel yielded several fragments of *Potomida*.

Shells are present in small numbers scattered throughout most of the Lower Gravel. Above the horizon with chalk pebbles, bed 4, they are well preserved, below this horizon they are fragmentary and partially decalcified. So few shells are present that frequency counts have no significance; the following species were identified from the Lower Gravel (excluding the upper part, bed 7, associated with the 'Midden' level): *Lymnaea peregra* (Müller), *Bithynia* sp. (opercula), *Pisidium amnicum* (Müller), *Pisidium* sp. (small) and *Potomida littoralis* (Cuvier).

Bed 5 yielded a number of derived fossils, including a (?) Jurassic *Gryphaea* and several Chalk belemnites, the latter being partially decalcified. In bed 4, chalk constitutes about 50 per cent. of the pebbles which also include London Clay (containing shark teeth and gastropods). The chalk pebbles range in size up to 15 by 10 by 4 cm, their surfaces are usually armoured with coarse sand grains and there are often concave facets on them. This later feature appears to result from the compaction of the gravels with flint pebbles in contact with the surface of the chalk pebbles; occasionally flint pebbles are found impressed in the surface. Some chalk pebbles show fractures radiating from the concave facets and are the result of point loading during compaction. The sand grain armouring of the surfaces may also be due to compaction, although it is possible that it occurred during deposition on the river bed. Some of the London Clay pebbles appear to be rather worn joint blocks and to have sand-filled shrinkage cracks on their surfaces. Bed 4 is only 10 cm in thickness and represents a very temporary increase in water flow, perhaps coupled with lateral erosion of the river channel.

The channel or depression, in the top of which the Midden' level was found to occur in the 1970 season (Conway 1971: 60, and fig. 11), was further defined. In the south-west faces of trenches A2 and A3 it was seen to have a width of 10 m and a maximum depth of 0·8 m; in the north-west and north-east faces of A3 the channel is absent. The bone material of the 'Midden' level occurs on the top of the channel filling, but apparently is not confined to it; a narrow strip excavated along the foot of the north-west face of trench B3 revealed an extension of the bone horizon (with rhinoceros skull, pl. 25) beyond the limits of the infilled channel.

As noted in previous years, the main bone horizon was found to be covered by a pebble sand with abundant *Potomida littoralis* (Cuvier) and other shells and succeeded by the Lower Loam in trench B3. However, in the north-west and north-east faces of trench A3 a lenticular mass of gravel and sand 0·6 m thick overlies the bone horizon. The upper surface

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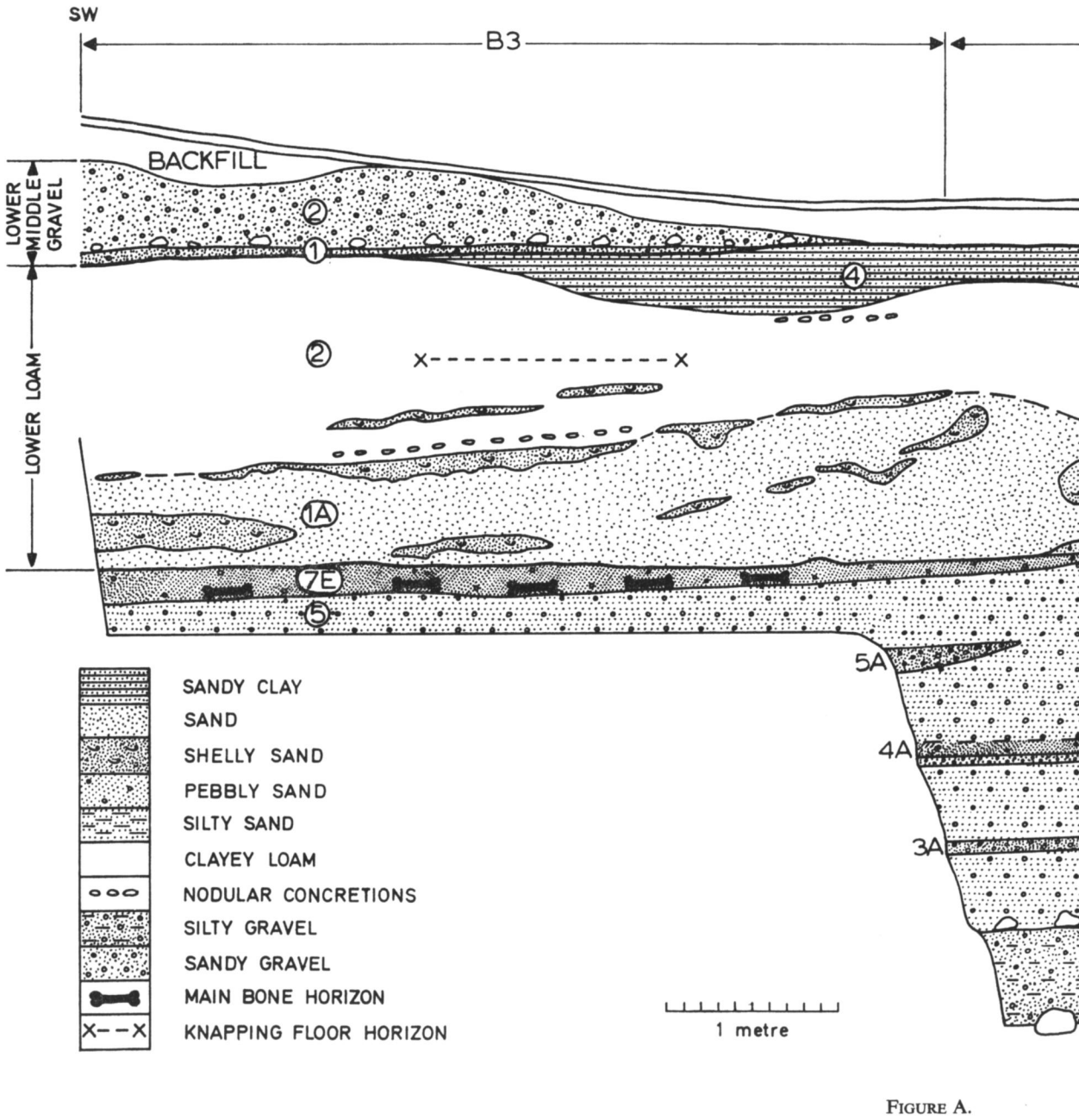

FIGURE A.

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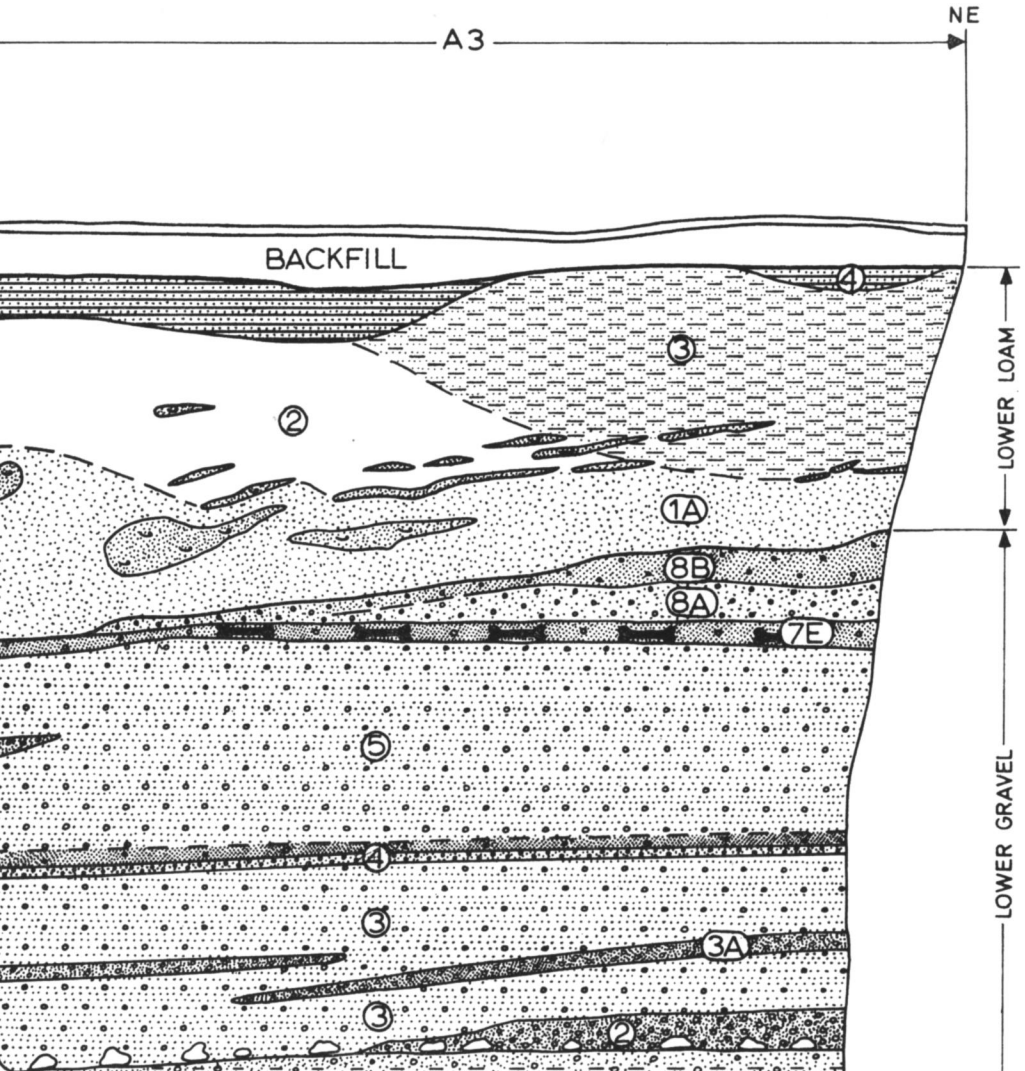

Lower Gravel

3A. Dark yell yellowish gravel wi Large flin bedded in

2. Light bro (10YR 6/ ments of base.

3. Pale yello (10YR 8 scattered bedded.

3A. Dark yel medium s

4. Moderate yellowish gravel wit

4A. Pale yell with fine some curr

5. Greyish medium/ well-sorte

5A. Dark yel sand with

7E. Pale ora pebbles, cluding l bone hori base of th

8A. Greyish gravel wit

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Notes on sections, Barnfield Pit, Swanscombe, Kent.
1971 excavations

wer Gravel

. Dark yellowish orange (10YR 6/6) to coherent yellowish orange (10YR 6/6) medium sandy gravel with some silt and clay, poorly sorted. Large flint boulders at base resting on and embedded in the surface of the Thanet Sand.

Light brown (5YR 5/6) to dark yellowish orange (10YR 6/6) fine/medium gritty gravel with fragments of *Potomida*. Scattered flint cobbles at base.

Pale yellowish brown (10YR 6/2) to pale orange (10YR 8/2) loose medium sandy gravel with scattered shells; well-sorted and horizontally bedded.

. Dark yellowish orange (10YR 6/6) coherent medium sandy gravel.

Moderate yellowish brown (10YR 5/4) to dark yellowish orange (10YR 6/6) coherent fine sandy gravel with chalk and clay pebbles.

. Pale yellowish brown (10YR 6/2) loose sand with fine gravel and shells; well-sorted and with some current-bedding.

Greyish orange (10YR 7/4) loose sandy medium/coarse gravel with scattered shells; well-sorted and horizontally bedded.

. Dark yellowish orange (10YR 6/6) loose silty sand with some fine gravel and shell debris.

. Pale orange (10YR 7/2) medium sand with pebbles, well-sorted, with abundant shells including large numbers of *Potomida*. The main bone horizon of the 'Midden' level occurs at the base of this bed.

. Greyish orange (10YR 7/4) medium sandy gravel with many shells.

8B. Greyish orange (10YR 7/4) fine/medium sand with some fine gravel and shell debris.

Lower Loam

1A. Moderate yellowish brown (10YR 5/4) fine/medium silty sand with shell debris and lenses of pale sand with abundant shells.

2. Dark yellowish orange (10YR 6/6) to moderate yellowish brown (10YR 5/4) clayey silty sand ('loam') with shells and shell debris and nodular calcareous concretions.

3. Yellowish orange (10YR 7/6) to moderate yellowish brown (10YR 5/4) fine/medium silty sand with shell debris and sand lenses with shells.

4. Moderate brown (5YR 4/4) to light brown (5YR 5/6) silty clay with some sand and scattered pebbles; shells and shell debris together with localised concentrations of broken bone, antler and teeth.

Lower Middle Gravel

1. Dark yellowish orange (10YR 6/6) coarse sand with pebbles.

2. Pale orange (10YR 7/2) medium/coarse sandy gravel with scattered flint cobbles at base; sandy patches with abundant shells, particularly *Unio*.

2A. Dark yellowish brown (10YR 5/6 medium/coarse sandy gravel.

3. Moderate yellowish brown (10YR 5/4) medium/coarse sand with some medium gravel.

[facing p. 80

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of this lenticular mass is continuous with the surface of the shelly pebble sand overlying the bone horizon elsewhere and represents an erosion surface which developed prior to the deposition of the Lower Loam. An antler and several flakes were found on this surface in the north-west face of trench B3. In the north-west face of A3 the erosion surface, though somewhat irregular, has an apparent dip of 7 to 8 degrees south-west, but following a change of slope it is approximately horizontal in the north-west face of trench B3 (fig. A).

Section H, cut into the low bluff on the east side of the main excavation area, again showed the erosion surface at the junction of the Lower Gravel and the Lower Loam as irregular and with an apparent dip of 2 to 3 degrees south-east. The Lower Gravel was exposed to a depth of 0·5 m and no bone horizon was found. Towards the south-east end of this section some irregularities in the surface of the Lower Gravel are occupied by lenses of current-bedded sand, 3·0 m wide and 20 cm thick, and indicating an apparent direction from south-east to north-west.

Lower Loam

Sections in the Lower Loam were exposed in trenches A3, B4, C3 and H and showed the same kind of lithological variations as recorded in previous seasons. The problem of the origin of the reddish clayey surface layer of the Lower Loam was further examined. Kerney (1971: 70) considers this layer as probably due to post-depositional leaching caused by water percolating through the gravel above; and the irregular patches and thicknesses of the surface layer have also been explained as caused by the root systems of trees and bushes which colonised the site after the cessation of commercial activities. In previous seasons the upper part of the Lower Loam was found to be disturbed by recent quarrying operations, but in trenches B4 and C3 (figs. A and B) the irregular and intermittent nature of this layer was seen to continue under a cover of *in situ* Lower Middle Gravel. It seems highly unlikely that the Lower Middle Gravel is selectively permeable to the extent of allowing leaching to a maximum depth of 1 m at one point, while two or three metres away allowing no leaching to take place at all. The continuation of the irregularities in extent and thickness under *in situ* Lower Middle Gravel is consistent with the origin of the bed being by sub-aerial weathering processes. The weathered irregular land surface was eroded to a more or less horizontal level by river flow which resulted in the partial or total removal of the surface layer of the Lower Loam. Lower Middle Gravel was subsequently aggraded on this erosion surface. Under these circumstances a clearly developed soil profile would not be expected to have survived.

In trenches B4 and C3 the surface weathered layer of the Lower Loam contained concentrations of broken and decalcified bone, antler and teeth. Molluscan remains also occur both as partially decalcified debris and as localised concentrations of well-preserved shells, often with colour banding intact. Among the latter, the commonest forms are *Cepaea nemoralis* (Linné) and *Hygromia hispida* (Linné); in trench C3 a 1 m square, 10 cm below the top of this layer, yielded fifty-two examples of the former and ten of the latter. Other species found include *Ena montana* (Draparnaud), *Clausilia* sp., *Cochlicopa Lubrica* (Müller) and *Arianta arbustorum* (Linné). These perhaps indicate the presence of dry grassland with some open woodland or scrub.

The main body of the Lower Loam was much the same as found in previous seasons, the most noteworthy feature being an extensive shell-sand lens which occurred about the middle of the Loam in trench B3 and covered in area about 20 sq. m. It showed a maximum thickness of 20 cm, the lower half consisting of well-bedded sand with shells overlain by sandy fine gravel. The lower surface of the lens was irregular in cross-section, and when the sand was brushed away showed, in plan, a large number of roughly circular, often intersecting, depressions (pl. 29) on a surface dipping from 5 to 8 degrees SSE. The depressions ranged in diameter from 10 to 30 cm and were up to 15 cm deep with sectional profiles varying from simple concavities to vertical-sided or undercut pits. On part of the surface, devoid of depressions, a number of narrow, shallow, linear channels up to 2 cm wide extended for distances of 50 to 60 cm in a direction parallel to the steepest slope and showed a simple dendritic pattern (pl. 28). These features have the appearance of rain-water runnels.

The depressions were filled with shell-sand and individual cavities frequently contained one or more examples of *Potomida littoralis*, usually with both valves in juxtaposition. Explanation of the origin of these depressions presents a problem; the sloping surface on which the rain-water runnels occur developed sub-aerially, but unfortunately their relationship to the depressions could not be determined. The normal stream processes of cavitation and potholing seem unlikely in view of the soft nature of the bed material and the often vertical or undercut profiles; puddled or water-modified animal footprints are a distinct possibility. Steadily flowing water deposited very well-bedded sand in and over the depressions; the thickness of the lens is variable and some adjacent thicker parts show cross-bedded sets. Rather stronger and less steadily flowing water finally deposited sandy fine gravel, a feature not previously noted in the Lower Loam sand lenses.

A second substantial shell-sand lens, a few centimetres above the base of the Lower Loam, in the west corner of trench B3 showed a width of 2·5 m and a maximum thickness of 25 cm; the lower surface was uniformly regular. This lens was particularly rich

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in mollusca and a preliminary examination yielded the following species:

	%	
Bithynia tentaculata (Linné)	52	Aquatic species (96%)
Lymnaea peregra (Müller)	20	
Ancylus fluviatilis (Müller)	2	
Valvata piscinalis (Müller)	1	
Succinea pfeifferi (Rossmassler)	1	
Planorbis carinatus (Müller)	1	
Potomida littoralis (Cuvier)	13	
Sphaerium corneum (Linné)	2	
Pisidium sp. (small)	4	
Cepaea nemoralis (Linné)	1	Land species (4%)
Hygromia hispida (Linné)	3	

(The shell count was 1,014 complete or substantially complete individuals from a sample of approximate volume 5,000 ml.)

Lower Middle Gravel

The lower part of the Lower Middle Gravel was exposed in trenches B4 and C3 and attains a maximum thickness of 1 metre; it consists of a medium/coarse sandy gravel, well-sorted and horizontally bedded, and with some thin discontinuous iron stained bands. The basal 5 to 10 cm consists of coarse gritty sand with flint cobbles (up to 25 by 15 by 10 cm) and occasional chalk and clay pebbles resting on the eroded surface of the Lower Loam. Some small irregularities in the surface of the Lower Loam are filled with shell-sand.

Shells and shell debris are scattered throughout the gravel and there are shell-rich, more sandy, patches at three levels—0 to 10, 60 to 65 and 90 to 100 cm above the base. A preliminary examination shows no great variations in species or their frequencies at the three levels. The shells are partially decalcified and very fragile, particularly the freshwater mussel *Unio crassus*. A sample from the highest level yielded the following species:

	%	
Lymnaea peregra (Müller)	5	Aquatic species (91%)
Ancylus fluviatilis (Müller)	23	
Valvata piscinalis (Müller)	24	
Valvata macrostoma (Möch)	2	
Unio crassus (Philipsson)	8	
Corbicula fluminalis (Müller)	1	
Sphaerium corneum (Linné)	1	
Pisidium amnicum (Müller)	2	
Pisidium sp. (small)	25	
Hygromia hispida (Linné)	3	Land species (9%)
Vallonia excentrica (Sterki)	2	
Vitrea crystallina (Müller)	4	

(The shell count was 448 complete or substantially complete individuals from a sample of approximate volume 2,000 ml.)

This list suggests an environment of somewhat deeper, more swiftly flowing, weed-free water than is indicated by the fauna from the Lower Loam shell-sand lens.

Trenches J to P

A series of trenches was excavated outside the Nature Conservancy area for the purpose of obtaining sections of the full thickness of the Boyn Hill terrace deposits still remaining. The undisturbed part of the terrace is located beneath disused allotment gardens to the north of Alkerden Lane. Six trenches were cut

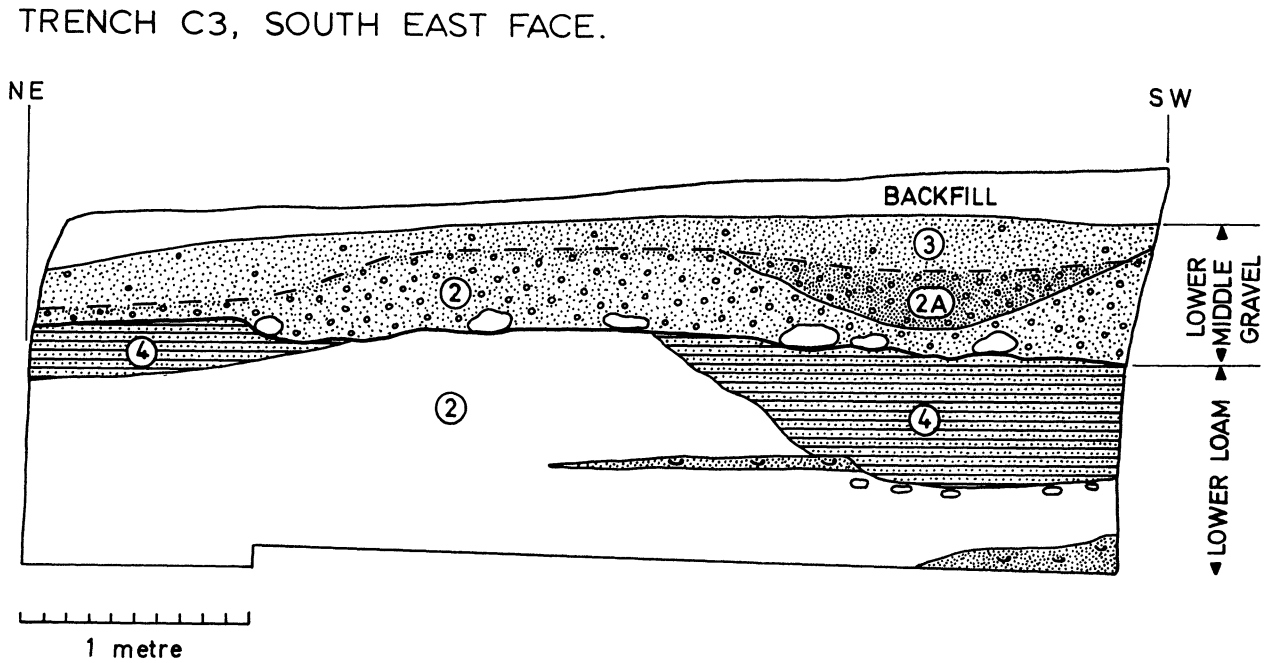

FIGURE B.

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by mechanical excavator in and below the east-west cliff face on the north side of the allotments and together with a trench (G) cut in the 1970 season provide some 70 metres of section (fig. C).

Although there is some detailed information on the deposits in the area immediately surrounding the find positions of the skull fragments, very little is known of the nature and extent of the various subdivisions of the sequence that was established by Smith and Dewey (1913) and modified by Marston (1937). During the commercial working for gravel, Chandler (1929; 1931; 1935) summarily recorded about 300 metres of the then south face of Barnfield Pit. In 1937 Marston recorded an erosional channel cutting through the Lower Middle Gravel, Lower Loam and most of the Lower Gravel and infilled with current-bedded sands (Upper Middle Gravel). The skull fragments, found in an obliquely-bedded layer in the lower part of the Upper Middle Gravel, were never shown to be associated with the channel. Unfortunately the channel was not photographed, its exact position was not recorded and scale sections were not drawn.

Unpublished notes and a photograph by Dewey (1959) have recently come to light which may have some bearing on the channel. The photograph, taken in 1913, shows the middle of the north face of Barnfield Pit and a diagram based on it is given in fig. D. This shows a solution cavity in the chalk, the roof of which collapsed during the deposition of the Boyn Hill terrace deposits. The beds up to and including the Lower Middle Gravel dip into the cavity which was subsequently filled with current-bedded sands (Upper Middle Gravel) and overlain by undisturbed Upper Loam and Upper Gravel. It is possible that a section of a solution hollow, similar to this one, was mistaken by Marston for an erosional channel. Furthermore, Wymer (1964) excavating in the skull area in the period 1955 to 1960 records an area of 'slumping' which most probably resulted from collapse into a solution cavity.

The best assessment of the rather generalised information available suggested that the channel, if it existed, should intersect the east-west cliff face below the Alkerden Lane allotments. The section derived from the trenches (generalised in fig. C) present the most extensive east-west section in the Boyn Hill terrace deposits extant. The main points to be noted are:

1. The 'established sequence' of deposits does not hold good over even the limited extent (70 m) of the section. In particular the Lower Loam thins westwards from trench G, and disappears altogether between trenches M and N.
2. Channelling on the scale suggested by Marston ('to within one foot of the Thanet Sand', i.e. 4 to 5 m) was not confirmed.
3. The upper part of the current-bedded sands of the Upper Middle Gravel is replaced, in trenches K and L, by horizontally-bedded sands.

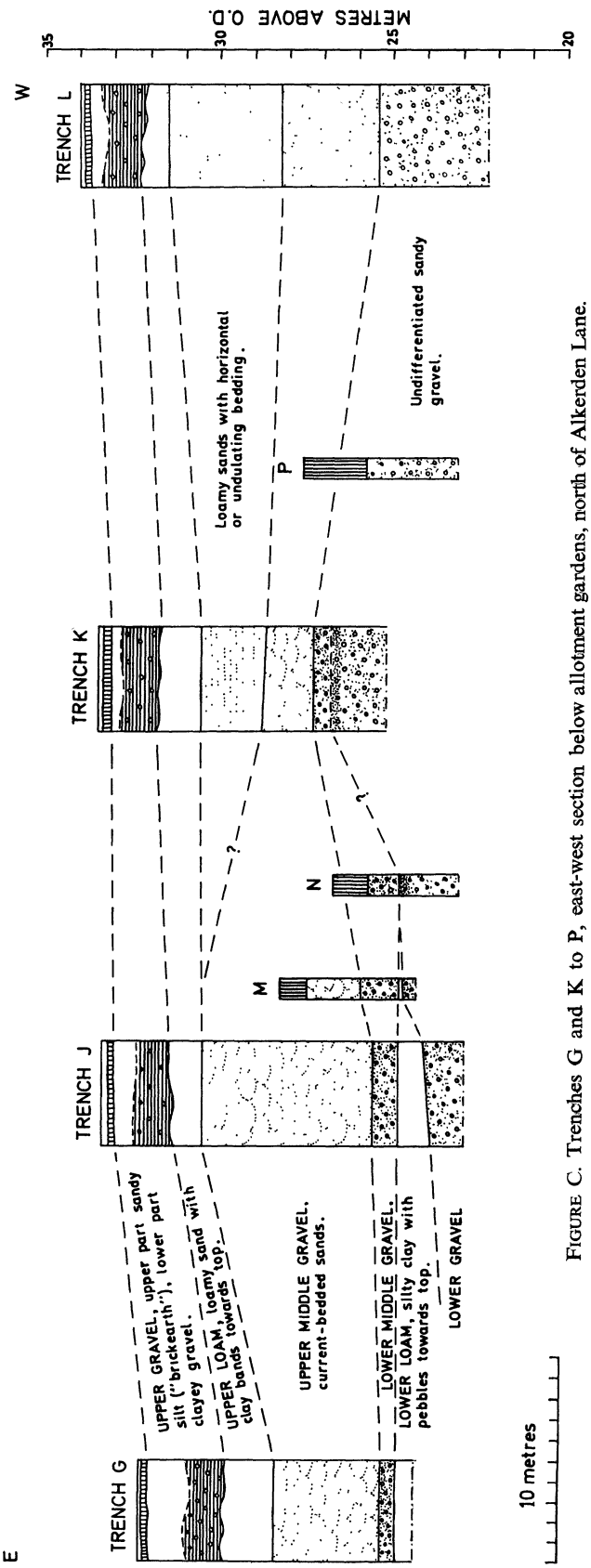

FIGURE C. Trenches G and K to P, east-west section below allotment gardens, north of Alkerden Lane.

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The implications of these points are of importance both locally and in the wider context of the Holstein interglacial period in the Thames valley province. The Lower Loam was deposited in a flood-plain basin of limited extent; outside the boundaries of this basin it has not been possible so far to distinguish Lower Gravel from Lower Middle Gravel. This may call into question the period of time represented by the surface-weathered layer of the Lower Loam, found towards the middle of the basin. Although established on several lines of evidence, the length of time involved (during which King and Oakley (1936) would claim that the deposits at Little Thurrock and at Clacton were laid down) may be much shorter than has hitherto been supposed. The western margin of the basin in which the Lower Loam was deposited lies between trenches M and N; Chandler's notes (1929) suggest that it extends about 200 m eastwards. Within the Conservancy area trench Q, at the southern side of Barnfield Pit, showed 1·85 m of Lower Loam and trench B (1968 season) 2·10 m. These trenches lie 65 and 25 m respectively south-east of the main excavation area. Kerney (1971) found a thickness of *c.* 2·0 m at a point approximately 120 m north-west of the current excavation area. This would appear to indicate that in a direction north-west/south-east, through the main excavation area, the thickness of the Lower Loam is more or less uniform over a distance of 185 m.

The failure to confirm Marston's erosional channel suggests that the structure he saw was probably a solution hollow. Solution hollows are not usually linear features and this would account for the fact that the structure was localised to the immediate skull area. It would appear rather too coincidental that the same beds are involved in both Marston's channel and in Dewey's solution hollow. The change in river regime indicated by horizontally-bedded loamy sands coming in from the west, replacing the current-bedded sands of the Upper Middle Gravel in part, suggests that the final stage of the fluviatile aggradation represented by the cold climate flood deposits of the Upper Loam was more prolonged than would be deduced from the 'established sequence'.

Due to the unstable nature of the unsupported sides of the trenches the time available for examination of the deposits was necessarily very limited. A summary of the lithology of the deposits in trench G has already been given (Conway 1970: 62-3) which applies generally to the new trenches; the following notes indicate some of the faunal and archaeological material recorded.

Upper Gravel (upper part 'brickearth'). The silty upper part of the Upper Gravel yielded a number of examples of *Pomatias elegans* (Müller), a molluscan species characteristic of dry open woodland on calcareous soils. However, since it is subterranean in habit it may not be contemporaneous. The upper part of this 'brickearth' has also yielded quantities of neolithic flint material together with fragments of *Ostrea* and *Mytilus* which are clearly intrusive.

Upper Gravel (lower part). The clayey gravel has yielded a metatarsal shaft of an adult *Bos* which compares closely with *Ovibos* (musk ox). If the identification is confirmed by further finds it will be one of the earliest securely dated examples in England. The lower part of the Upper Gravel can be shown on lithological and structural grounds to be a solifluction deposit; the presence of *Ovibos,* characteristic of tundra and steppe habitats would support this. A few inches above the base of the Upper Gravel, and close to the metatarsal, a white patinated ovate hand axe of late Middle Acheulean type was found; this confirms Marston's discovery of similar handaxes at this

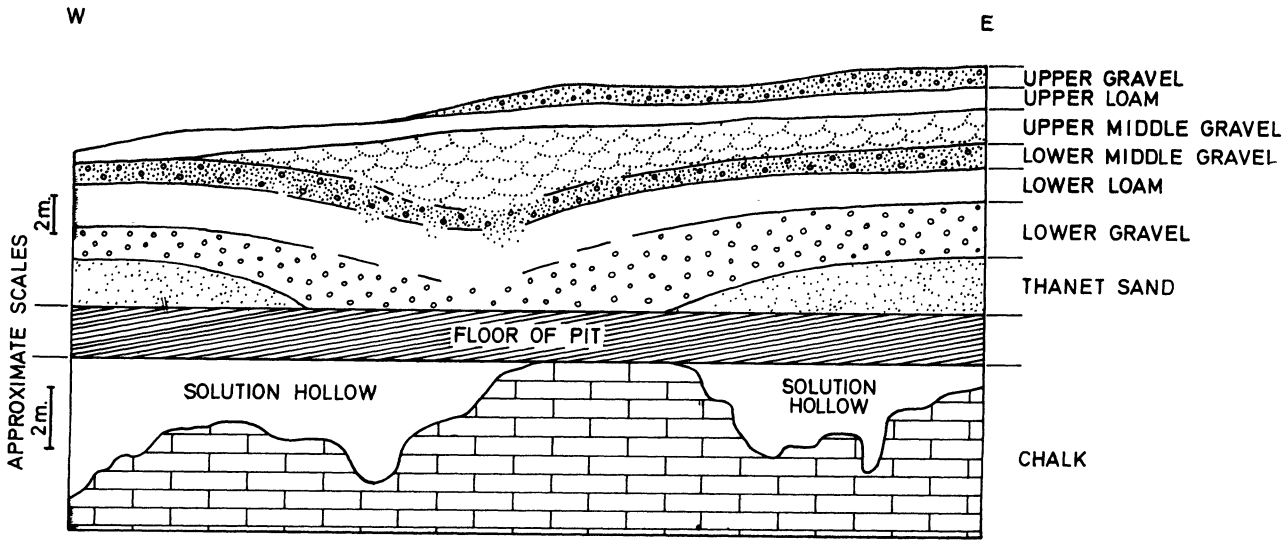

FIGURE D. Section of the middle of the south side of Barnfield Pit in 1913, based on photograph by Henry Dewey.

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horizon—apparently caught up in the solifluction sludge which moved over a land surface at the top of the Upper Loam.

Upper Loam. No faunal or archaeological material was recovered.

Upper Middle Gravel. No faunal material was recovered. However, two pointed handaxes of early Middle Acheulean type were found together with five handaxe finishing flakes. One of the current-bedded lenses towards the bottom of the Upper Middle Gravel contained a thin clay horizon with charcoal fragments; the source of the charcoal has not yet been identified.

Lower Middle Gravel. No faunal material was recovered, and only two indeterminate flint flakes.

Lower Loam. Several large Clactonian cores were found in the upper 10 cm of the Lower Loam together with six flakes. No faunal remains were recovered.

Lower Gravel. In those sections where the Lower Loam is present the gravel beneath has yielded a number of Clactonian flakes. No faunal material has been found.

Undifferentiated gravel. In those sections where the Lower Loam was absent the lower part of the gravels yielded a number of flakes of indeterminate type together with a *Bos* horn core.

It is unfortunate that the nature of the trenches was very temporary since it was not possible to differentiate Lower Middle and Lower Gravels westwards of trench M. Chandler's claim (1931) that the two gravels could be separated on the basis of their contained flintwork could not be tested. Variations of texture, composition and colour in the undifferentiated gravels were observed in the isolated trenches; but it will be necessary to cut continuous sections in order to correlate them with any certainty.

A detail of Chandler's section (1929) shows a horizon of *Theodoxus cantianus* (syn. *serratiliniformis* Geyer) about 1·5 m above the base of the undifferentiated gravels. If confirmed this would raise the problem of how much, if any, of these gravels can be correlated with the Lower Gravel. Conversely perhaps the Rhenish element in the molluscan fauna, hitherto believed to appear first at Swanscombe in the Lower Middle Gravel (Castell 1964), really occurs in the Lower Gravel.

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