THE SANDWICH BAY WASTEWATER TREATMENT SCHEME ARCHAEOLOGICAL PROJECT, 1992–1994*

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SUMMARY

Between 1992 and 1994 Wessex Archaeology, in conjunction with the Trust for Thanet Archaeology, implemented a programme of archaeological works in response to the development of the Sandwich Bay Wastewater Treatment Scheme (WTS), by Southern Water Services Ltd. This report details the results from all the various areas of investigation. The development areas provide a north to south transect across the local landscape, encompassing the south side of the Isle of Thanet (including the Ebbsfleet peninsula), the former Wantsum Channel (including the Stonar Bank), and finally the Lydden Valley and Deal Spit. The sequence of geomorphological change in the area is intimately linked with the history of human occupation and the project has provided important archaeological data for this part of north-east Kent. The excavated evidence, observations and finds are integrated with an important pollen and diatom sequence through deposits infilling the Wantsum Channel.

INTRODUCTION

The development of the Sandwich Bay WTS, part of Southern Water Services Ltd. 'Operation Seaclean', involved construction of a new waste water treatment works near Ebbsfleet Farm (Weatherlees Hill WTW), pipelines from it to pumping stations at Ramsgate, Sandwich and Deal, and finally modifications to the pumping stations themselves (Fig. 1). The scheme was accompanied by a programme of archaeological work which was developed as part of the Environmental Assessment for the scheme and in accordance with Southern Water Services' Policy on Archaeology (SWS 1992). The preliminary evaluation work was undertaken during 1992 and the main phase of field-work took place during construction of the scheme between 1993 and 1994.

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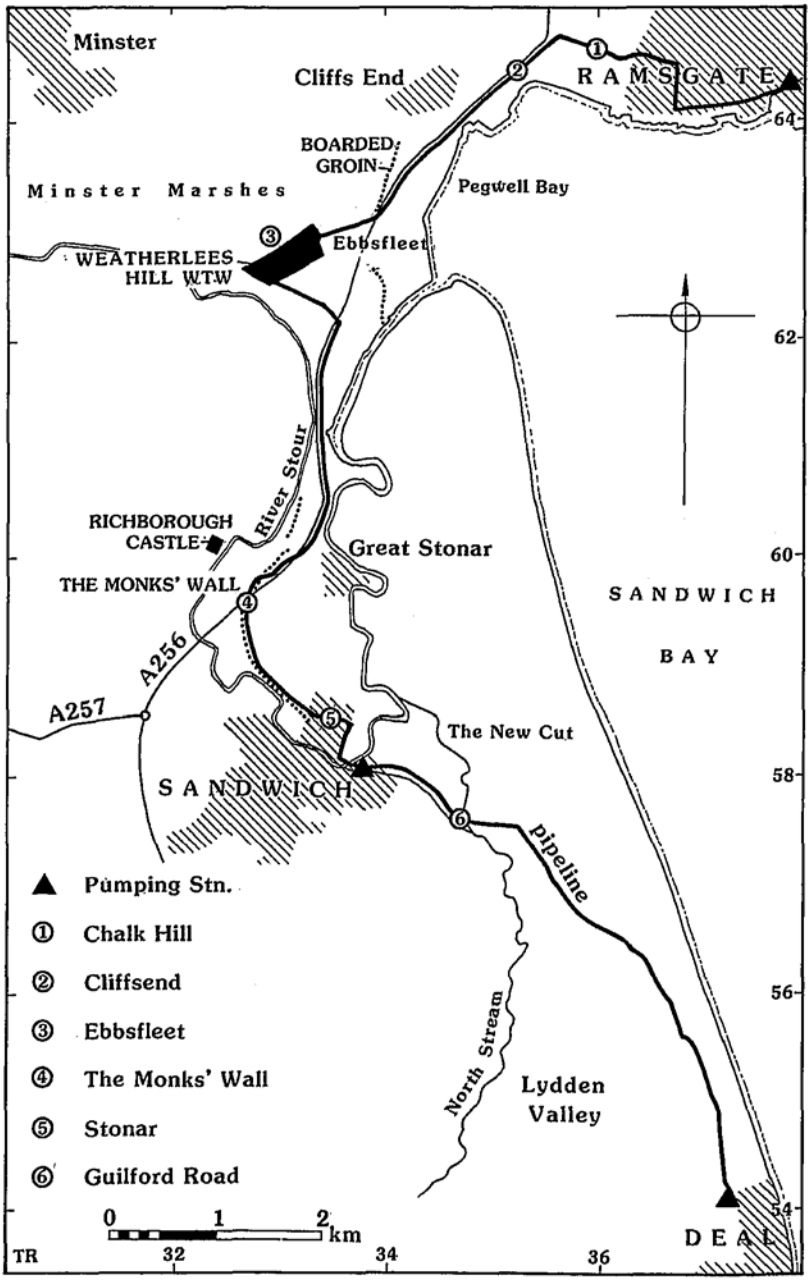

Fig. 1. The development areas and the main archaeological sites

The scheme lies within an area which has witnessed complex geological and geomorphological developments since the Devensian. Since many of these developments, including the 'joining' of the Isle of Thanet to the mainland, have occurred in relatively recent times (that is, during the last two thousand years or so) they are closely interwoven with the history of human occupation in the area and development of the local archaeological landscape. As a result, the geomorphological and the archaeological landscapes cannot be viewed in isolation; both are of national importance and interest and have been the subject of much debate and study.

Geomorphological background and human impacts (Fig. 2)

It is beyond the scope of this report to address the geological background in detail, but the later part of the sequence may be outlined. The Isle of Thanet was formed as a true island by the recovery of higher sea-levels in the post-glacial period: the syncline separating Thanet from the North Downs was inundated to create a channel of water – the Wantsum Channel. The evidence suggests that up to and during the Roman period the Wantsum was an open, navigable, channel. Its strategic importance as a route between the Continent and the Thames Estuary is reflected in the construction of the forts of Richborough and Reculver (on the mainland side of the channel) defending the eastern and western ends of the channel, respectively.

Opposite Richborough significant features of the coastline on the south side of Thanet are today marked by the three 'hills' of Cottington (15 m. O.D.), Ebbsfleet (8 m. O.D.) and Weatherlees (9 m. O.D.) which now rise out of a flat plain of alluvium. These 'hills' represent upfolds of the Tertiary Thanet Beds which directly overlie the Upper Chalk. At the time the Wantsum was open water, Cottington and Ebbsfleet would have formed a peninsula jutting south into the sea channel; Weatherlees was a small island to the west. The Ebbsfleet peninsula would, therefore, have afforded two natural havens, that to the east giving protection from the prevailing south-westerlies, while that to the west was sheltered from the easterly gales of mid-winter. The advantages of this situation are clear and no doubt related to the evidence for prolonged occupation of the peninsula. Tradition also cites Ebbsfleet as the landing place of Hengist and Horsa in A.D. 449, and St. Augustine in A.D. 597.

The silting up of the Wantsum Channel was partly caused and exacerbated by the development of a shingle spit – the Stonar Bank – which developed across the eastern mouth of the Wantsum Channel, blocking it to an increasing extent as it 'grew'. The origin and development of the Stonar Bank have been the subject of much debate,

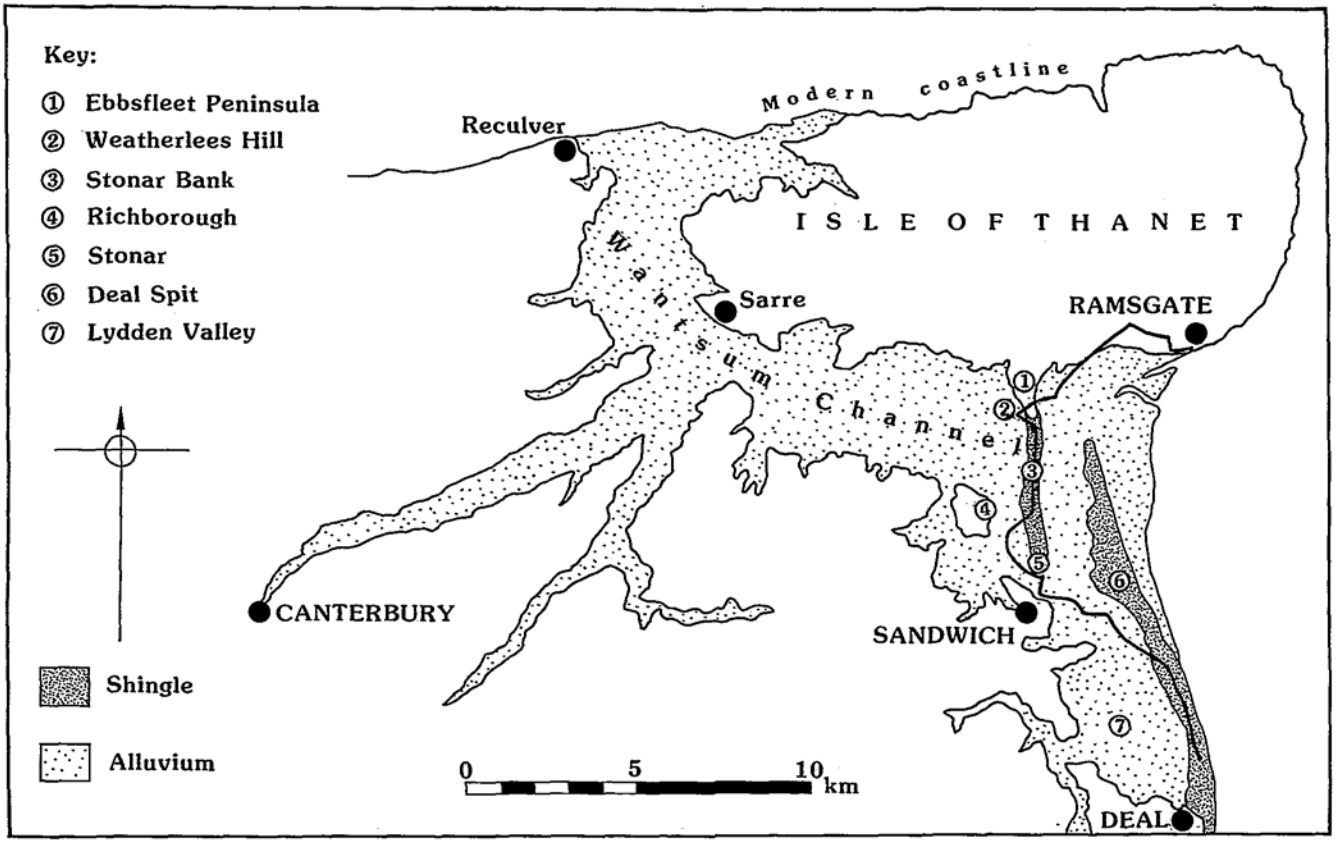

Fig. 2. Geomorphological background to the development area

but it is now generally accepted that the spit developed *northwards*, formed by material transported by longshore currents (Gallois 1965, 65) and augmented by the deposition of erosion products (from the Isle of Thanet) behind it. Archaeological evidence indicates Roman occupation of the Stonar Bank, but it was most intensively occupied in the medieval period when the town and port of Stonar was founded at the south end in the late eleventh century. The port (in commercial competition with Sandwich opposite) flourished during the later twelfth and thirteenth centuries but thereafter declined as its river approaches (the Stour/Sandwich Haven) silted up. The town's fate was sealed when it was destroyed by fire during the French raid of 1385.

Eventually, the Stonar Bank completely closed the mouth of the Wantsum Channel, blocking the former seaward exit of the River Stour and leading to increased alluviation of the river valley. The local topography was irrevocably altered and the River Stour was forced to wind a sinuous route to the south of the Stonar Bank, exiting via the Sandwich Haven – see Fig. 1 (Cloet and Robinson 1953; Cloet 1961). Human agency also capitalised upon the natural process of the alluviation of the Wantsum. Large scale reclamation was undertaken during the medieval period by the Monks of St. Augustine's, Canterbury who were major riparian landowners. The monks constructed a series of sea-defence banks, probably begun in the twelfth or thirteenth century. Stretches of these linear earthworks are still preserved, notably The Monks' Wall (to the east of the Stour, between the River and Stonar) and, further north, the Boarded Groin (see Fig. 1). The final draining and management of the alluvial plain were brought about by émigré expertise during the seventeenth century, by which time trading vessels could no longer take the Wantsum 'short-cut' from the English Channel to the Thames Estuary.

In addition, similar deposits and processes caused the development of a shingle spit north from Deal which eventually grew to a length of about 9 km. Present evidence suggests the Deal Spit had begun to develop in the pre-Roman period (Halliwell and Parfitt 1985, 42). The spit was extended dramatically during the late thirteenth century by the formation of a series of storm beach deposits following a major storm in 1287. This blocked the most recently created seaward exit of the River Stour and forced it to make a loop northwards to exit close to Ebbsfleet once again (see Fig. 1). Further silting of the River Stour followed, and this virtually ended the commercial importance of the ports of Stonar and Sandwich which now lay several kilometres by boat from the sea up a narrow and tortuous channel. As the spit extended it enclosed a large area of former open water to the south of Sandwich, which in turn became alluviated and was subsequently reclaimed. This

area, now known as the Lydden Valley, forms an important landscape zone in its own right.

From this summary and as illustrated on Fig. 2, it will be seen that the various installations of the wastewater treatment scheme coincide with the full range of geomorphological zones found in the area. The Weatherlees Hill WTW itself straddles the Ebbsfleet peninsula and the former Wantsum Channel, a crucial 'interface' zone from a geomorphological and archaeological point of view (see Fig.3). Overall, the configuration of the development areas provide an extremely useful north to south transect across the landscape. The chart below summarises the three main landscape zones:

LANDSCAPE ZONE	GEOLOGY	DEVELOPMENT AREA/S
South side of the Isle of Thanet, including the Ebbsfleet peninsula	Upper Chalk and Thanet Beds	– Ramsgate Main – Weatherlees Hill WTW: east half
Wantsum Channel (infilled), including the Stonar Bank	Alluvium/Shingle	– Weatherlees Hill WTW: west half – Sandwich Main
Lydden Valley and Deal Spit	Alluvium/Shingle/ windblown sands	– Deal Main

Archaeological background to the scheme

Some of the main archaeological sites and themes for the area have already been indicated in the preceding discussion from which it will be clear that the richness and complexity of the local archaeological landscape are beyond dispute. The following is a brief summary of the pre-existing archaeological information directly relevant to the development areas (ordered from north to south) to provide an introduction to the observations provided by the project, and to the discussion at the end of this report.

Much of the evidence for archaeological activity on the undeveloped land between Chilton and Cliffs End derives from aerial photographs. Chalk Hill in particular appears to contain a concentration of cropmarks including enclosures and groups of ring ditches (see Fig. 8). Although the majority of the ring ditches may be assumed to represent earlier Bronze Age burials the small size of some of them has been suggested to indicate an early medieval (Jutish) date. Despite the suspected wealth of archaeological remains on Chalk Hill there have been limited opportunities for systematic invasive fieldwork (field-walking surveys have been undertaken by TTA) so that the nature and sequence of activity is largely unknown. Similarly, at Cliffs End,

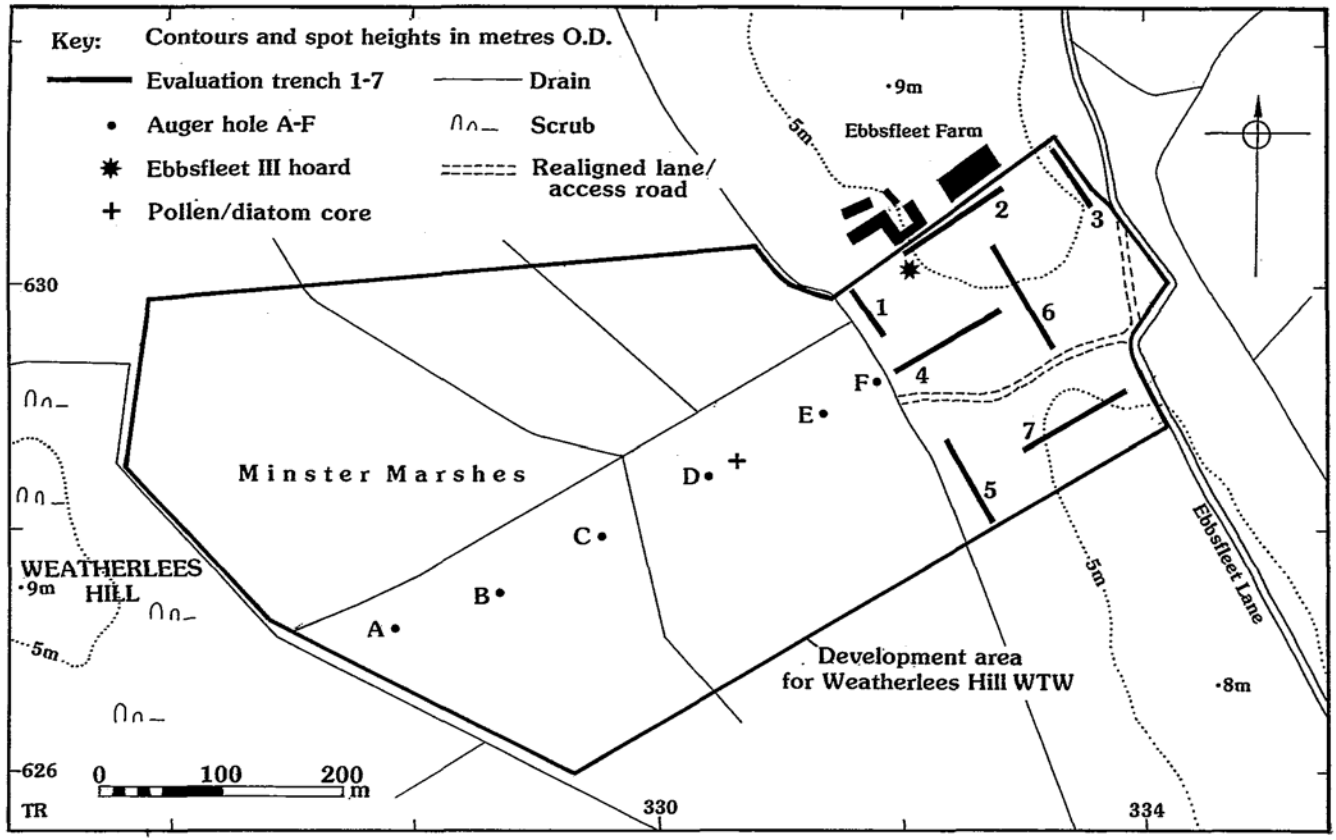

Fig. 3. Weatherlees Hill WTW

Roman finds have been recovered, but the actual nature and extent of occupation is unknown.

The Ebbsfleet peninsula has been the subject of much recent field survey (Jay 1990; Perkins 1990a; 1990b; 1992). Its archaeology and history have recently been detailed by Perkins (1992, 270–7, fig. 1) and are not repeated here. In summary, the various casual finds, field surveys and excavations on the peninsula to date suggest prolonged occupation from at least the later prehistoric period. The peninsula is most well known as the find-spot for the Ebbsfleet Hoard, consisting of at least 190 Late Bronze Age objects and weighing over 60 lbs., which was discovered on the farm in 1893, its exact location unknown (Hills 1895). A smaller hoard (Ebbsfleet II) was also recovered in 1991 (Perkins 1992, 303–304).

The Stonar Bank and the site of the medieval town and port (a Scheduled Ancient Monument) have been the subject of various observations throughout the twentieth century (see Perkins 1993 for a recent summary). Most of the early records arose from the extraction of shingle (now marked by the North Lake) but systematic excavations on the site were carried out between 1969 and 1972. The report on these excavations is eagerly awaited (Macpherson-Grant in prep.).

The southern part of the scheme, from Sandwich to the northern limits of Deal, across the silted and reclaimed Lydden Valley is an area of great interest which has been the subject of study and survey by the Dover Archaeological Group (see Halliwell and Parfitt 1985). It has been demonstrated that the Lydden Valley preserves a prehistoric land surface, producing later Neolithic and earlier Bronze Age material, sealed under alluvium. Inundation of the area is thought to have occurred after the Middle Bronze Age and well before the later medieval period (*ibid.*, 42). This part of the so-called East Kent Fens has also been the subject of a recent study on coastal sedimentation and sea level change (Long 1992).

Archaeological strategy

Following the desk-based assessment, the archaeological strategy included a field evaluation prior to construction at Weatherlees Hill WTW, by means of a two per cent sample, machine trenching survey (WA 1992a; Fig. 3, trenches 1–7). As a result of the discovery of Iron Age and probable Roman settlement remains on the periphery of the proposed development area (as described below) the proposals were modified to ensure the continued preservation of these deposits. A programme of work was developed in response to other deposits identified on the site (WA 1992b). As noted above, the western half of the WTW site coincides with the former Wantsum Channel. Here, the evaluation took the form of an auger survey forming a north-east to

south-west transect, 500 m. long, between the Ebbsfleet peninsula and Weatherlees Hill (Fig. 3, augers A-F). The results were used to formulate a mitigation strategy for this important area (WA 1993).

During construction itself (August 1993 to August 1994) a strategy of advance investigation and advance topsoil stripping under supervision was implemented in all archaeological sensitive areas which had been identified in the Environmental Assessment. These areas were denoted *Special Archaeological Sections* and included the whole of Weatherlees Hill WTW and various sections of the pipelines (e.g. Chalk Hill, The Monks' Wall crossing). The aim of this strategy was to allow an uninterrupted period for archaeological excavation and recording prior to further ground works or pipe stringing and trenching. In the remaining areas topsoil stripping and trenching were monitored, the former was accompanied by a controlled metal detector scan of the pipeline easement (generally 15 m. wide). All finds recovered during the metal detector scan were archaeologically recorded and added to the overall project archive. The pipe trench itself was about 2 m. wide and was generally excavated to between 2 m. and 2.50 m. below ground surface.

The field and post-excavation records for the project comprise three subdivisions and these are referred to in some sections of the report, notably the finds reports: W516 is the reference code for all records relating to Weatherlees Hill WTW; W619 the code for the Ramsgate Main; W646 that for the Sandwich and Deal mains. These three components have been accommodated within a single, integrated project archive. The archive has been deposited at the Powell-Cotton Museum (Quex Park), Birchington, Thanet. A full list of the archive contents is available from Wessex Archaeology on request.

WEATHERLEES HILL WTW

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Although, as described above, the archaeological works at WTW comprised a series of different phases, when the archaeological features recorded from each are collated they can be seen to fall into distinct chronological groups, each focused on a different topographical zone.

Late Bronze Age/Early Iron Age features (Fig. 4)

With the exception of a small Late Bronze Age hoard, features of this period were confined to an area coinciding with the junction of Ebbsfleet Lane and the new access road for the site (see Fig. 3). This

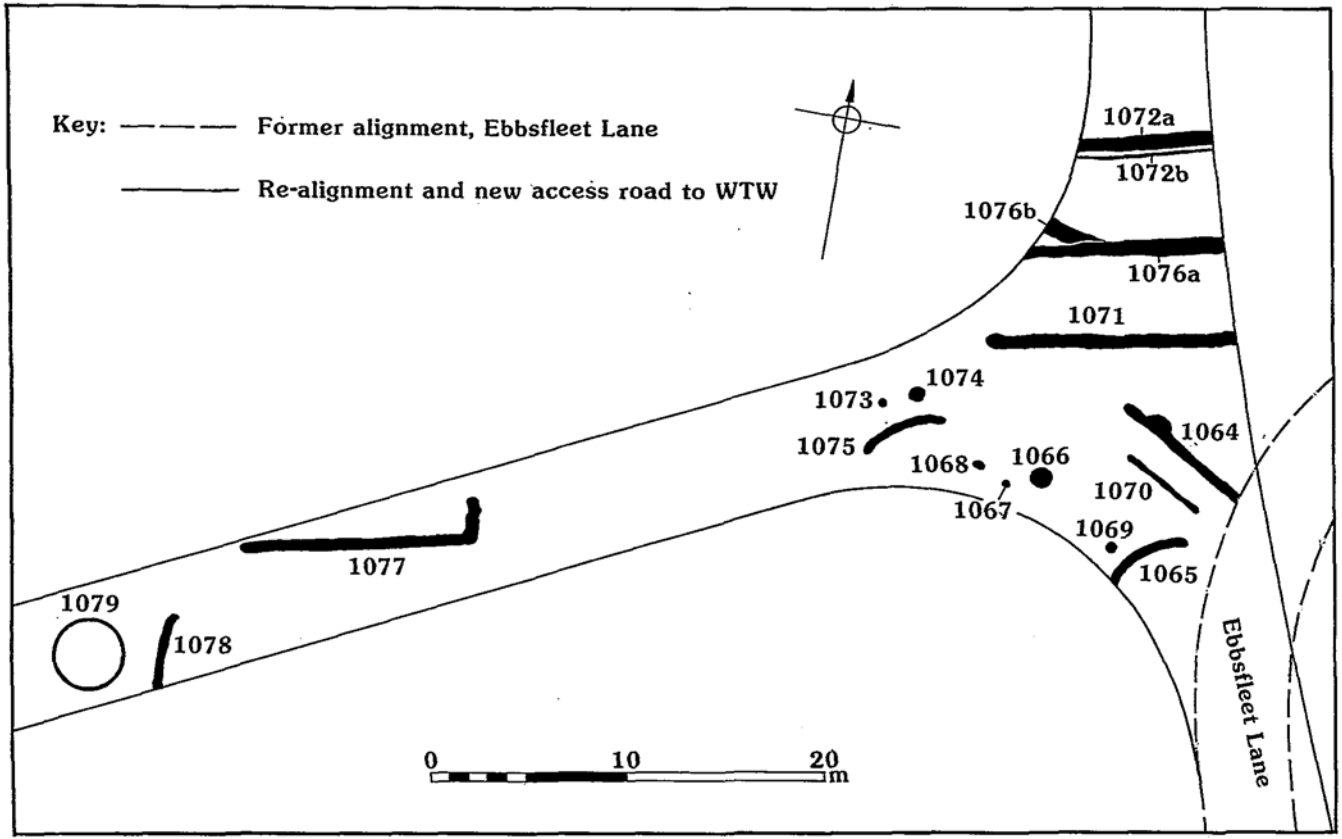

Fig. 4. Weatherlees Hill WTW – Plan of Late Bronze Age/Early Iron Age features

zone represents the low-lying ground, which once formed the eastern shore line of the Ebbsfleet peninsula. The artefactual evidence also suggests that pre-Bronze Age activity may be represented. This part of the development site had not been identified as of particular archaeological potential from the preceding phases of work and was therefore subjected to a watching brief. A group of subsoil features was recorded during and after topsoil stripping, all clearly defined by their dark grey brown sandy silt fills against the light surface of the Thanet Beds sand. In most cases the subsoil features became evident in plan during the penultimate or final machine scrapes to the required construction level, so that whatever their depth may be, they remain preserved more or less intact beneath the new access road. The features comprised a series of linear and curvilinear features, pits and post-holes; summary descriptions are provided, by type, below. Where features produced pottery they were almost wholly of Late Bronze Age/Early Iron Age date and, given that this area clearly represents a focus of activity, the remaining features which produced no finds have been assigned a similar date.

Linear Features

A total of nine linear or curvilinear features was recorded. *Feature 1064* was a length of ditch aligned north-west to south-east with a rounded end extending for 8 m. adjacent to Ebbsfleet Lane. Of the eight sherds recovered from its surface, four have tentatively been identified as Late Neolithic/Early Bronze Age, *c.* 2500–1800 B.C. (see Macpherson-Grant, below). *Feature 1070* was a shorter length of ditch (4 m.), parallel to 1064 and some 2 m. to the south-west. It was about 0.40 m. wide and did not produce any finds. *Feature 1065* was located nearby. It was curvilinear, 0.30 m. wide and evidently continued beyond the limit of the road cutting (4 m. length observed). It may represent a section of 'drip trench' under the eaves of a hut. *Feature 1075* was very similar in nature to 1065 and lay some 12 m. to the north-west of it. A 5 m. length of this curvilinear feature was observed. It was 0.60 m. wide and produced one sherd of Late Bronze Age/ Early Iron Age pottery.

Immediately to the north of these features a group of three parallel and evenly spaced (*c.* 6 m. apart) features was observed, aligned east—west: features 1071, 1072a and 1076a. *Feature 1071* was the southernmost feature. It was about 0.90 m. wide and was seen to terminate within the excavation area. *Feature 1072a* was the northernmost feature and was about 1.50 m. wide. Immediately adjacent on its south side an insubstantial *Feature 1072b* was observed, only 0.20 to 0.30 m. wide. The central feature, *Feature 1076a* was 1.70 m. wide. One sherd of Early-Middle Iron Age pottery was picked

from the fill surface. At the western end of the observed length of this ditch the remnants of an earlier linear, or curvilinear, feature were recorded – *Feature 1076b*, 0.60 m. wide. There was sufficient difference in the colour of the fills to demonstrate that 1076b had been cut by 1076a.

The remaining linear features in this area was a group of three (1077, 1078, 1079) which lay some 40 m. to the west of the concentration represented by the features described above (see Fig. 4). *Feature 1077* was a length of ditch with rounded ends, aligned east—west over a length of 12 m. At the eastern end it turned north at right angles for 2 m. The width of this feature, perhaps the corner of an enclosure, ranged between 0.80 and 1.10 m. *Feature 1078* was a length of ditch with a rounded end aligned north—south and observed over a distance of 4 m. It was about 0.50 m. wide. The most interesting and enigmatic feature, *1079* was the westernmost of the features observed in this part of the site. It took the form of a ring ditch with a clearly defined dark fill. It was about 4 m. in diameter, about 0.25 m. wide. It was so nearly perfectly circular in plan that it was at first interpreted as a modern machine cut feature. A small sector of the feature was excavated revealing it to be 0.20 m. deep with a V-shaped section. This very limited investigation yielded a small polished axe which appeared to have been laid along the base of the gully (Fig. 14, see Harding, below). The only other find was a single sherd of probable Late Bronze Age – Early Iron Age pottery from the surface of the fill. The feature was first observed at the close of a winter afternoon with neither photography or further investigation possible in the gathering dusk. Arrangements were made with the sub-contractor to allow further investigation early the following morning. Unfortunately, when the archaeological team arrived the feature had already been buried under the road make-up. It, therefore, remains for archaeologists of some future generation to establish whether or not the finding of the polished axe was coincidental.

Pits and post-holes

A group of six pits and/or post-holes was recorded (1066, 1067, 1068, 1069, 1073, 1074). These all lay within the main area of activity adjacent to Ebbsfleet Lane and were spread between the curvilinear features 1065 and 1075 (see Fig. 4). The two larger features, probable pits, were 1066 and 1074, 1.50 m. and 1.20 m. in diameter, respectively. They both produced single sherds of pottery. *Feature 1068* was of oval plan, 0.30 X 0.40 m. in dimension. The remaining three discrete features were all of small size: Feature 1067 (0.25 m. diameter); Feature 1069 (0.43 m. diameter); Feature 1073 (0.45 m. diameter). The last of these produced four sherds of Late Bronze Age/Early Iron Age pottery.

Late Bronze Age Hoard

Approximately 200 m. north-west of the cluster of features described above, two other important subsoil features were recorded during the topsoil strip: features 1088 and 1089. The latter produced a small Late Bronze Age hoard which has been termed 'Ebbsfleet III'. *Feature 1088* was a pit showing as a darker fill of sandy silt in the yellow brown stripped surface of Thanet Beds sand. Its plan, section and dimensions could only be estimated approximately because of worm action, but a diameter of about 0.80 m. and a depth of 0.30 m. seemed indicated. The fill contained calcined flints, two flint flakes, and one sherd of probably Late Bronze Age/Early Iron Age date.

Deposit 1089 represents a Late Bronze Age hoard, or possibly plough-disturbed components from a larger hoard, found at N.G.R. TR 33206300 during the metal detector survey (location shown on Fig. 3). No stratigraphy could be distinguished, the objects being distributed over an area of about one square metre in a uniform matrix of Thanet Beds sand. The objects were at roughly the same level, at about 0.80 m. below the original (pre-stripped) ground surface. After excavation and when no further metal detector signals were registered, an area of about 4 X 12 m. centred on the hoard find-spot was excavated by machine to a depth of 1 m. The subsoil was removed under close scrutiny in 0.05 m. scrapes, with a detector scan every 0.10 m. As spoil was removed it was spread thinly on a cleared surface and searched by detector. No cultural material was found during this process. Because of the proximity of the bronzes to one another, and the negative result of the subsequent search, it is considered most likely that these bronzes form a specific, deliberate deposition. It remains possible, however, that they are a remnant of the Ebbsfleet I hoard (Hills 1895). A full report on the five objects is contained below (Lawson, Fig. 13, 1–5).

Early–Middle Iron Age features (Fig. 5)

Early–Middle Iron Age features were confined to the higher ground in the northern part of the development area. The bulk of the evidence was recorded from evaluation trench 2, a 100 m. long trench, aligned south-west to north-east, adjacent to Ebbsfleet Farm (see Fig. 3). This trench was deliberately targeted to test that part of the (then proposed) development area closest to the previously recorded archaeological evidence north of the Farm. Trench 3 (50 m. long) to the north-east, close to Ebbsfleet Lane, also produced Iron Age material. These features lay within the peripheries of the development area and in light of the evaluation results Southern Water Services modified their construction proposals to ensure the continued preservation of these deposits. The evaluation data are, therefore, the only evidence for these features (Wessex Archaeology 1922a) and this is summarised below.

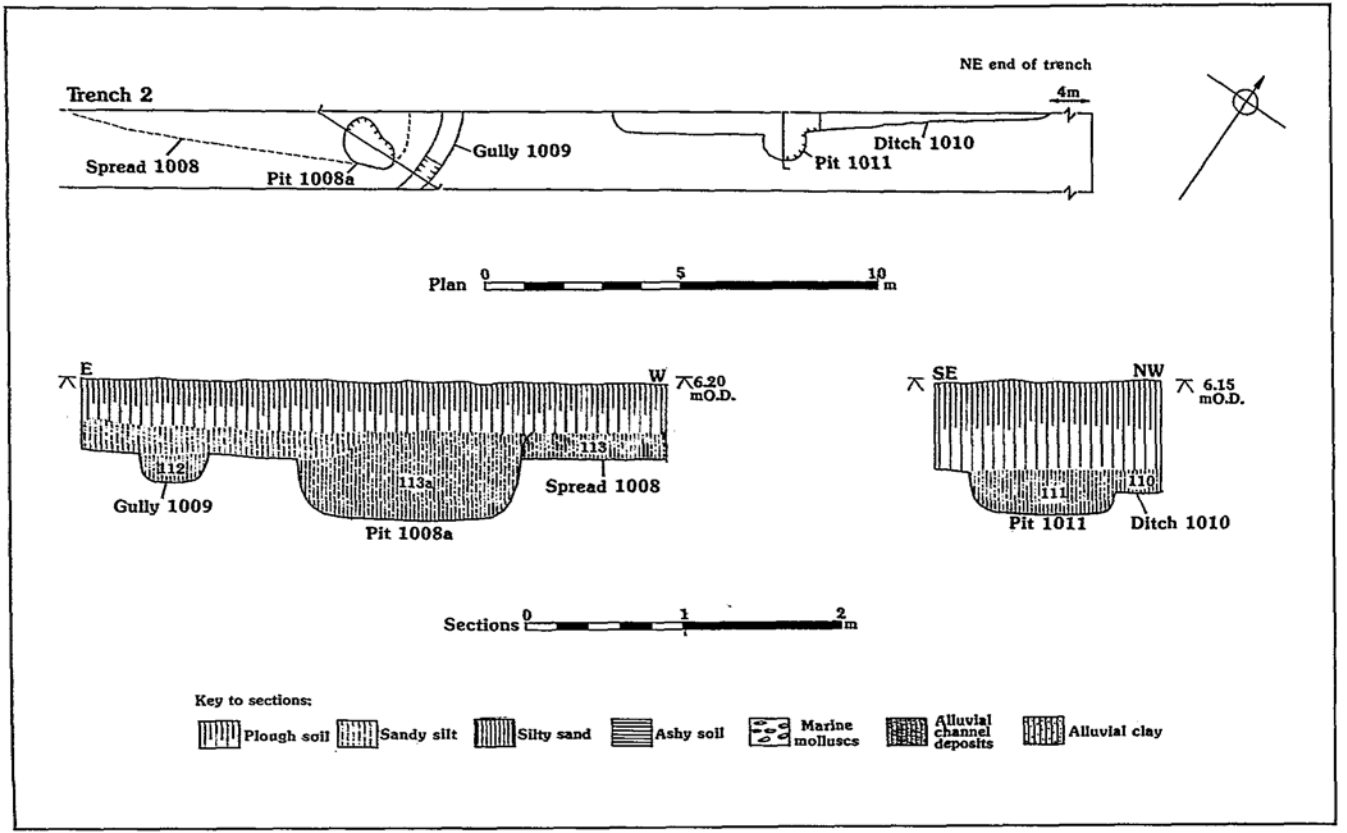

Fig. 5. Weatherlees Hill WTW – Evaluation trench 2 (Early–Mid Iron Age features)

Spread 1008, Pit 1008a and Gully 1009 comprised a group of deposits in the central area of the trench (Fig. 5 – plan and sections). This area was initially defined as a spread of material (context 113) containing large amounts of pottery and other occupation debris. Excavation revealed that this spread (1008) was cut by a large pit (1008a) and was associated with a curvilinear gully (1009) immediately to the east. The stratigraphic relationship between spread 1008 and gully 1009 was not established, but the finds from this area indicate that this group is contemporaneous, dated Early - Middle Iron Age. A small component (five sherds) of earlier pottery (Late Bronze Age/Early Iron Age) was also recorded and these may be assumed to be residual. Other categories of finds from spread 1008 included calcined flint nodules, shells, animal bones, and fragments of daub, some bearing wattle impressions.

Pit 1011 and Ditch 1010 were recorded in the north-eastern end of the trench (Fig. 5 – plan and section). Ditch 1010 was a partially-exposed length of ditch which intersected pit 1011, the latter approximately 0.90 m. in diameter. Both features were shallow: probably a reflection of topsoil loss and truncation through ploughing. Although the stratigraphic relationship between the two features was not clearly defined during excavation, analysis of the ceramic contents of the features suggests that ditch 1010 is probably the later feature since the pit contained Iron Age sherds, while the ditch produced a single sherd of medieval date.

Other features recorded in Trench 2 took the form of a ditch or elongated pit (116) and a pit (1012) – both only partly exposed in the trench, and two animal burials – a sheep and a horse. A small section was excavated across the feature 116 and a single sherd of post-medieval pottery was recovered. Feature 1012 appeared to be a pit of estimated diameter 0.75 m. Its depth could not be established, as it had been disturbed by a modern drainage trench. It contained one sherd of medieval pottery, dated to the later thirteenth/earlier fourteenth century. Cleaning around the sheep burial produced three sherds of Early-Middle Iron Age pottery (context 115). However, the burial had been heavily disturbed by plough damage and the bones were not seen to be an obvious cut feature. The horse skeleton was ascertained to be of modern date and was not pursued further.

Romano-British features

Roman activity was perhaps least coherently defined at Ebbsfleet, both in terms of securely dated features and quantities of datable finds. Structural remains were recorded in evaluation trench 3, adjacent to Ebbsfleet Lane (see Fig. 3). On the basis of the form of this structure, in particular its similarity to a securely-dated structure excavated on

Cottington Hill (Perkins 1992, site 9a) it has been assigned a Romano-British date. As with Trench 2, the area was taken out of the development to ensure the continued preservation of the features.

Structural remains (features 1004–1006) were recorded in the central area of the trench (Fig. 6 – plan). These features survived as two probable wall foundations, aligned east to west and 3.50 m. apart (1004 and 1005). They were composed of water-worn flint nodules. No traces of mortar were observed. Between the walls was a floor of compact chalk-flecked earth (1003). Abutting the southern wall (1004) was an area of flint cobbles (1006) which may represent some form of external yard surface. The structural elements revealed in this part of the trench were cleaned by hand and recorded in plan but not further examined (i.e. all walling and floor levels remain *in situ*). Cleaning directly above the components of this group of features (context 103) produced a multiperiod assemblage comprising Iron Age, Roman and medieval material. A possible later feature associated with this group was a small pit (1007), which had been cut through wall 1004 and may represent a robber pit of some kind.

Pit 1002 some 5 m. north of Wall 1005, was a flat based pit, approximately 0.85 × 0.75 m. in diameter and only 0.20 m. deep (as surviving). The feature contained a small group of medieval pottery. *Features 105 and 106* (not illustrated). These survived as very shallow parallel, linear soil marks to the south-east of the structural remains described above. Both soil marks were approximately 1 m. wide and aligned north-east to south-west. The features probably represent the basal remains of ditches, severely truncated by plough attrition. Abraded sherds of Late Iron Age and Romano-British pottery were recovered from feature 105.

Medieval features

Medieval features and finds were located across most parts of the site but were principally concentrated in an area to the north of the new access road on the western part of the site. This coincides with the low ground parallel to the Wantsum Channel shore line on the west side of Ebbsfleet peninsula. These features were identified both in the evaluation phase (trench 4, see Fig. 3) and during topsoil stripping for the creation of reed beds. Summary information on these features is contained below, more detailed descriptions and plans are held in the project archive.

Ditch 1015 was revealed at the western end of evaluation trench 4 (Fig. 6 – plan and section). Excavation revealed the ditch to be 2 m. wide and 0.50 m. deep, with a shallow U-shaped profile and a slight dip at the base. The ditch contained a lens of midden-like fill containing a small number of sherds of varying date. The ditch also produced a

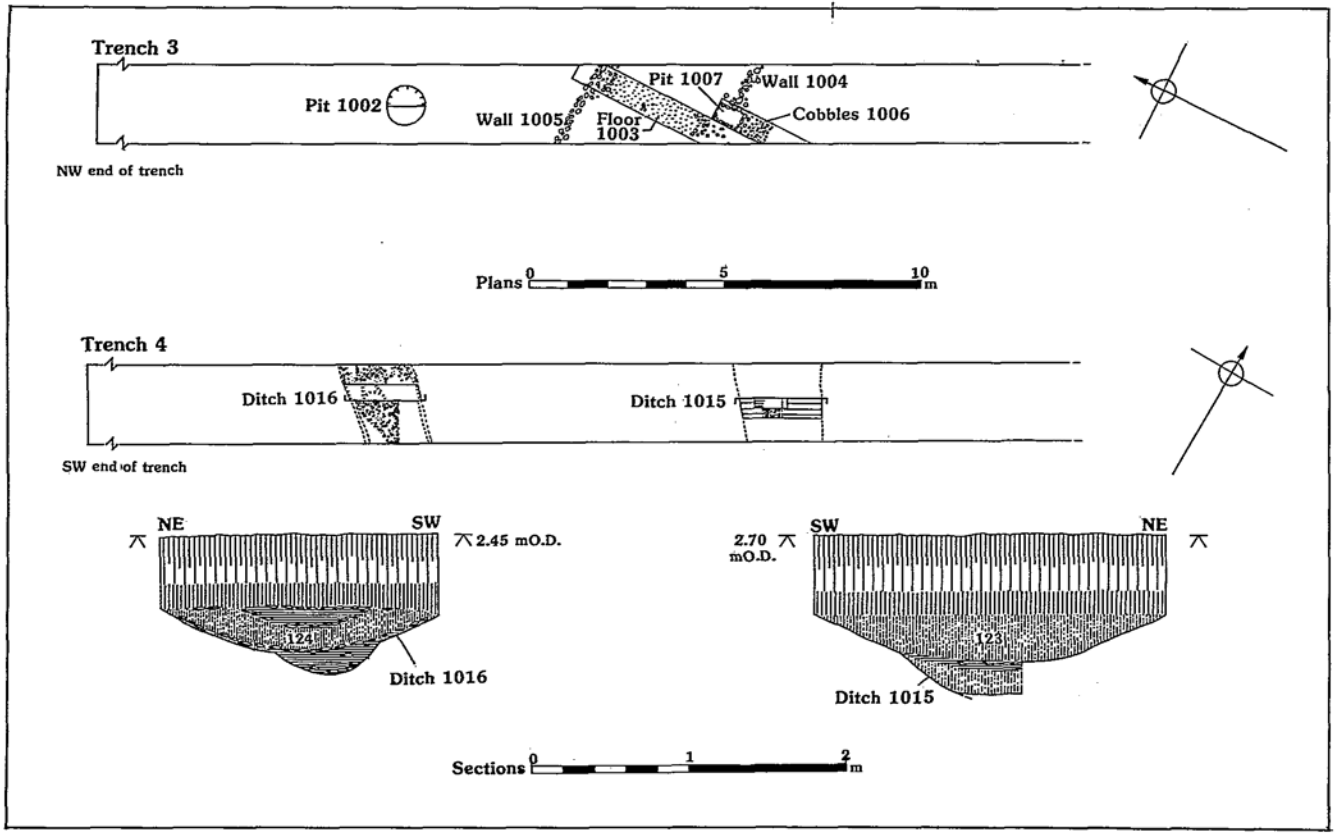

Fig. 6. Weatherlees Hill WTW – Evaluation trenches 3, 4 (Roman and medieval features)

ceramic spindle whorl and a whetstone, both possibly of medieval date. The likely continuation and terminal of this feature were recorded during the topsoil stripping (Feature 1085). *Ditch 1016* lay 8 m. to the south-west of Ditch 1015 and was similar in nature (Fig. 6 – plan and section). The ditch was initially defined by a small midden of marine molluscs. A sequence of fills was evident including layers of ashy soil containing further oyster shells, bones and daub. Only one sherd of pottery, of medieval date, was found within this feature (later thirteenth/early fourteenth century). *Feature 1013* was partially exposed in the north-eastern end of the trench (not illustrated) and appears to represent a pit of diameter *c.* 1.80 m. Excavation revealed a flat-bottomed feature only 0.03 m. deep. Two sherds of abraded pottery were recovered from the fill: one of Iron Age date and one Roman. *Posthole 121* lay 6 m. south-west of pit 1013 (not illustrated). It was exposed in the trench as a sub-circular area of burnt soil, approximately *c.* 0.50 m. in diameter. The feature was not excavated but probably represented a post-hole. *Post-hole 1014* (not illustrated) was 0.40 m. in diameter. Excavation produced sherds of Iron Age, Romano-British and medieval pottery, along with charcoal, calcined bone and daub.

During and after topsoil stripping a further two ditches (1082, 1084) and five pits (1080, 1081, 1083, 1086, 1087) were recorded to the north of evaluation trench 4. *Feature 1082* was a length of ditch (8 m. observed), including a terminal, aligned north-west to south-east. It was of maximum depth 0.40 m. with a V-shaped section, 1.75 m. wide. The fill was of yellow brown layers of sandy silt alternating with layers of grey black material containing oyster shells, bones and pottery. Of the eleven sherds, one was of Iron Age date (presumed to be residual) and the other 13 early medieval – medieval (*c.* A.D. 1150–1225). *Feature 1084* was a length of ditch (or an elongated pit) running east to west for 3.40 m., some 30 m. south-west of 1082. It was about 0.80 m. wide and of maximum 0.30 m. depth. The fill was of layers of grey-brown sandy silt alternating with black ashy layers containing very many oyster shells and a few early medieval sherds (*c.* A.D. 1125).

Features 1080 and 1081 were adjoining dark patches of silty sand with ashes and midden material recorded to the south-west of ditch 1082. Each about 0.80 m. in diameter and 0.05 m. deep, they are presumed to be the vestigial remains of ploughed out pits. They contained early medieval sherds *c.* A.D. 1150–1175. *Feature 1083* was a pit of circular plan, 1.10 m. in diameter and 0.47 m. deep with sloping sides and a flat base. It lay to the north-east of ditch 1084. The fill was of sandy silt a little darker than the surrounding subsoil. It contained a flint boulder, small fragments of bone and iron, and 11 sherds, mostly of early medieval date. *Feature 1086* was an oval, bowl-shaped, pit about 1.50 m. in diameter and 0.30 m. deep. The fill of slightly ash-

darkened sandy silt contained sandstone slabs, shells, bones, and 21 sherds of which 17 were Iron Age in date. *Feature 1087* was another round, bowl-shaped, pit of 2.50 m. diameter and maximum depth 0.60 m. The fill was grey brown sandy silt with black patches. It contained shells, bones, calcined flints and seven sherds, mostly early medieval in date. Finally, *Feature 1060* was of unknown dimensions and form. It was destroyed by drainage trenching work beside the access road cut. Pot-sherds from the disturbed fill were in late medieval and post-medieval fabrics.

Limited evidence for medieval activity was also recorded further east in the form of a small cluster of pits located some 50 m. north of the Late Bronze Age/Early Iron Age features adjacent to Ebbsfleet Lane. *Feature 1061* was a semicircular feature, partly exposed and of projected diameter *c.* 2 m. Pottery recovered from the scraped surface between this feature and Feature 1063 were late medieval, *c.* A.D. 1375. *Feature 1062* was of elongated oval plan, its long axis running east to west. A line of building debris composed of large flints, sandstone slabs, and fragments of peg-tile coincided with the centre of the feature and a small number of medieval/late medieval sherds were recovered from the surface of the feature. *Feature 1063* was a round pit of diameter 1.30 m. The surface held shells, bones and fragments of peg-tile.

Palaeostratigraphic deposits

Towards the south-western end of Trench 4 and in Trench 5 (that is, in the zone of interface between the Thanet Beds and the Wantsum Channel, see Fig. 3) palaeostratigraphic deposits were recorded. In this zone the surface of the Thanet Beds dropped away gradually and was covered by grey-brown alluvial clay. At a point 7 m. from the western edge of trench 4 the Thanet Beds was truncated and the alluvial clay was seen to overlay a layer of grey-green clay representing alluvial channel deposits or possibly estuarine clay. The interface between these two horizons was about 1 m. below ground level in the south-eastern baulk section. At this interface was evidence of a former surface of some sort, presumably of an intertidal nature, on which was found a variety of marine shells including the sand gaper (cf. *Scrobicularia plana*, D. Perkins *dett.*), apparently *in situ*, and rounded chalk nodules bored through by molluscs such as piddocks (e.g. *Pholas dactylus*). It should be noted that these species are not edible and that, in contrast to the medieval midden deposit recorded further to the east in Trench 4 (see above), they are unlikely to represent human domestic debris. Short lengths of wood were visible in the north-east facing section of the trench within the alluvial deposits. These did not prove to be of a structural origin but were merely a series of tree roots.

In Trench 5 the surface of the Thanet Beds was sealed by a deposit of grey-brown alluvial clay and was cut by three channels filled with grey-green deposits similar to those recorded at the south-western end of Trench 4 (see above). Of these three features, one (1051) was about 1.5 m. wide and was not excavated. Within 1052 and 1055, the fill was machine-excavated to a depth of 1.20 m. from ground surface. At a depth of 0.80 m. below ground level several sherds of pottery were recovered, comprising parts of two separate vessels of medieval date (later twelfth/earlier thirteenth century) along with a single worn sherd of early Roman date (first century A.D.). At the lowest depth reached, the grey-green clay contained marine shells, mostly oyster. Worked flint and burnt flint was also present at this point. A sample of this grey-green channel fill was taken for sedimentological analysis and was shown to be a stone-free silty clay/clay with localised gleying represented by common ferruginous mottles. The clay was massive and structureless with 0.5 per cent micropores, and rare acrorpores (roots). These are typical alluvial silts and probably represent either *in situ* fluvial deposits or overbank (flood) deposits which have accumulated in ditches/channels.

The full configuration of these features in plan is not known. They may represent ancient stream channels cut into the Thanet Beds (along a terrace) or man-made ditches. Some of the channels appear to be orientated north–south and they thus drain along the 'terrace' rather than from it. It is, therefore, considered more likely that the channels are of natural rather than human origin. The channels are undated, but several sherds of medieval pottery (late twelfth/early thirteenth century) were recovered from the upper profile (at 0.80 m. below ground surface) within the alluvial clay of channel 1052. This only indicates, however, that the channel was extant at this date.

The Wantsum Channel (Fig. 7)

The whole of the western part of the development area comprises part of an alluvial 'plain', the eastern extremity of the Minster Marshes (Fig. 3). This zone is characteristically open and flat. It lies at *c.* 2 m. above O.D., is about 0.50 m. below the sea level of spring tides and is crossed by a series of streams and drains. This area represents the infilled former Wantsum Channel.

The results of the evaluation auger survey across the infilled, former Wantsum Channel are presented diagrammatically in Fig. 7 (see Fig. 3 for location of auger transect). Overall, the augering revealed that the alluvial plain between the Ebbsfleet peninsula and Weatherlees Hill was infilled by two main sedimentary units below the current topsoil.

With the exception of Auger C in the central part of the plain, all the augers reached the top of the Thanet Beds. In augers A, B, D and E the

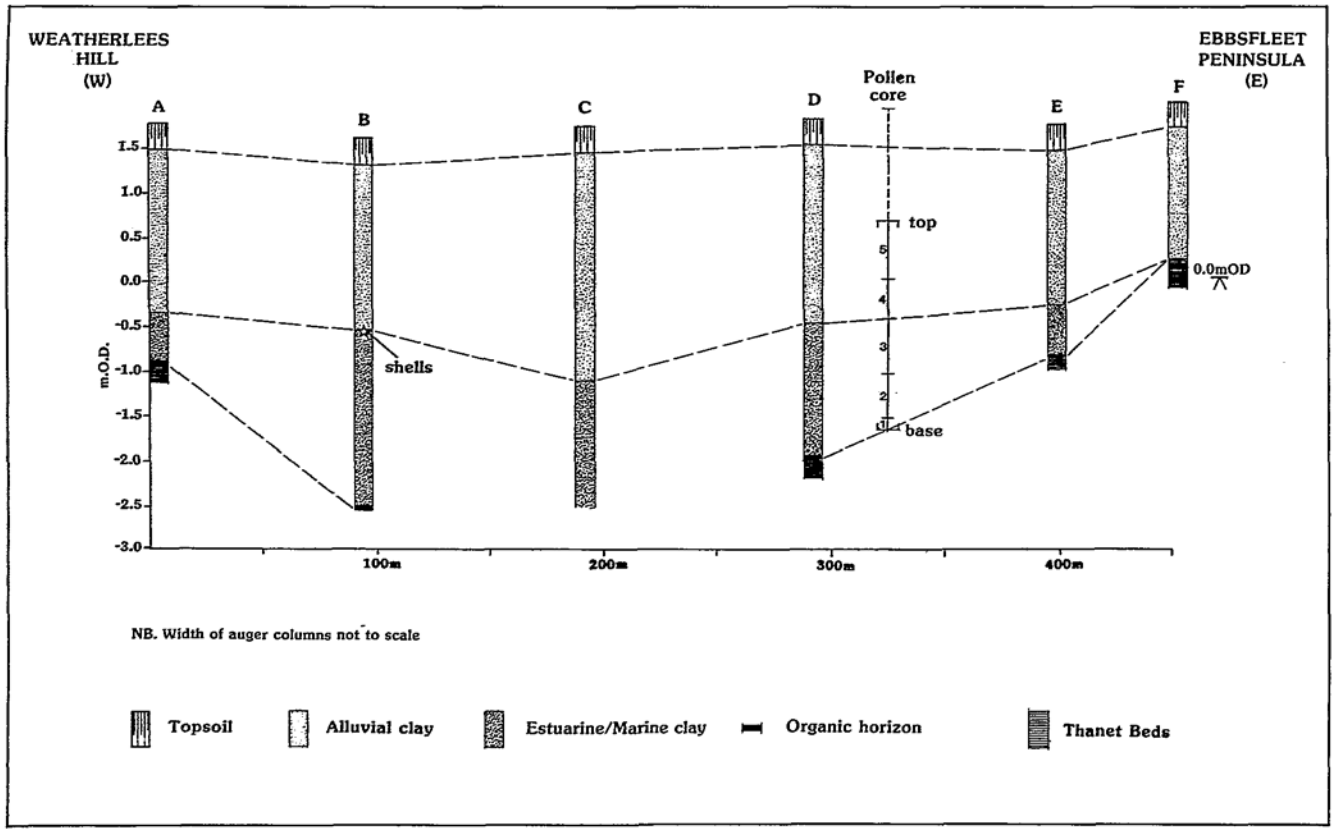

Fig. 7. Wantsum Channel – Auger transect showing location of pollen core and pollen zones (1–5)

Thanet Beds were directly overlain by a distinct but thin organic horizon (generally only 50 mm. thick) of very dark grey, moist, stone-free and fine humic clay with vague humic/fibrous laminations. This horizon was noted to contain waterlogged wood and shells.

Above the organic horizon the main basal sedimentary deposit recorded was a stone-free blue-grey to grey-green clay up to 1.80 m. thick. This horizon was wholly confined to the level below 0.0 m. O.D. Occasional flecks of charcoal and fragments of the sand gaper or 'soft shelled clam' (cf. *Scrobicularia plana* – D. Perkins *dett.*) were identified at the top of this deposit in Auger B. The clay is interpreted as of estuarine/marine origin and the presence of marine shells support this hypothesis. The junction of the estuarine deposits and the overlying clays/silty clays (described below) was also possibly that recorded in the extreme south-western end of evaluation Trench 4 (see above) which appears to mark the interface of the alluvial plain and the higher ground to the east. The upper sedimentary unit was a grey-brown clay/silty clay, up to 2.50 m. thick with occasional fine sand lenses up to 0.05 m. thick. The greater part of this horizon lies above 0.0 m. O.D. This upper horizon is interpreted as being of alluvial origin and is the same deposit as that which overlies the channels in Trench 5 and the basal layer at the south-west end of Trench 4.

As a result of the archaeological, palaeostratigraphical and palaeoenvironmental potential of the deposits infilling the Wantsum Channel, as identified by the evaluation auger survey, a mitigation strategy was formulated. This involved the extraction of a continuous core between auger holes D and E (see Fig. 3, Fig. 7 for location) for the purposes of detailed pollen and diatom analyses. It was also hoped that a further sample of the basal organic horizon would be obtained, suitable for scientific dating. The results of the analyses are presented below (Scaife, Cameron). Full reports on the methodology of the Stage 2 sampling and laboratory descriptions of the stratigraphic sequence are held in the project archive.

RAMSGATE MAIN

D. Perkins and C. Hearne

The total length of the Ramsgate Main was 5.8 km. of which the western section from the Weatherlees Hill WTW to Pegwell had archaeological potential, some 3.6 km. in total (Fig. 1). From the WTW the pipeline ran a north-east course to join the A256 Ramsgate–Sandwich Road close to the Boarded Groin (which was unaffected by the pipeline). From here the pipeline ran south of and

parallel to the A256 through Cliffsend to Chalk Hill. From the first rise from near sea-level just east of the Sportsman Inn to the junction with Chalk Hill almost the whole course of the pipeline ran through deep deposits of the Thanet Sands capped with brickearth. The only feature of interest in this section was a WWII underground fire control bunker and magazine which was intercepted by the pipe trench. The above geology was interrupted in only one place, immediately south-west of the approach road to the former hoverport at Cliffsend. Here, an upfold of the Upper Chalk was exposed for about 40 m. and archaeological features were encountered in an area of known archaeological potential.

From Cliffsend to Chilton the pipeline ran parallel to and south of the road across Chalk Hill (Fig. 8). The road passes along the crest of a downland promontory separating the Hollins Bottom and Nethercourt Chilton valleys as they run south east to the present cliff line. At the base of the hill the Upper Chalk is deeply masked by colluvium associated with the Hollins Bottom valley, but this quickly gives way to an overburden no more than 0.40 m. in depth, most of this being modern agricultural topsoil. The line of the road is quite level at about 30 m. O.D. until the sudden dip down to Chilton.

Two main areas of archaeological interest were defined along the route of the Ramsgate Main, along with other, seemingly more isolated features. The evidence is summarised below.

Multiperiod occupation on Chalk Hill (centred on N.G.R. TR 36006460)

A group of nine subsoil features was recorded over a distance of some 200 m. on Chalk Hill (Fig. 8). The associated ceramic assemblage suggests multiperiod occupation, including Neolithic, Late Bronze Age/Early Iron Age and Late Iron Age/Early Roman. The features were all contained within two major north–south ditches (4 and 113) and for convenience are described as a group here, ordered chronologically where the dating is certain or reasonably certain.

Neolithic Pit 12 (Fig. 9, S.1)

A bowl-shaped pit 0.80 m. in diameter, and of maximum depth 0.30 m. The homogeneous fill (context 13) was of dark grey brown sandy silt, with a few flint nodules. The pit contained a group of 35 Neolithic sherds, mostly later Neolithic, and a small collection of struck flint (15 pieces). It seems likely that the pit was cut down through a brickearth overburden, now eroded, perhaps originally to exploit the flint band exposed in the surface of the Upper Chalk at this point. The pit was cut on its north eastern edge by ditch 7.

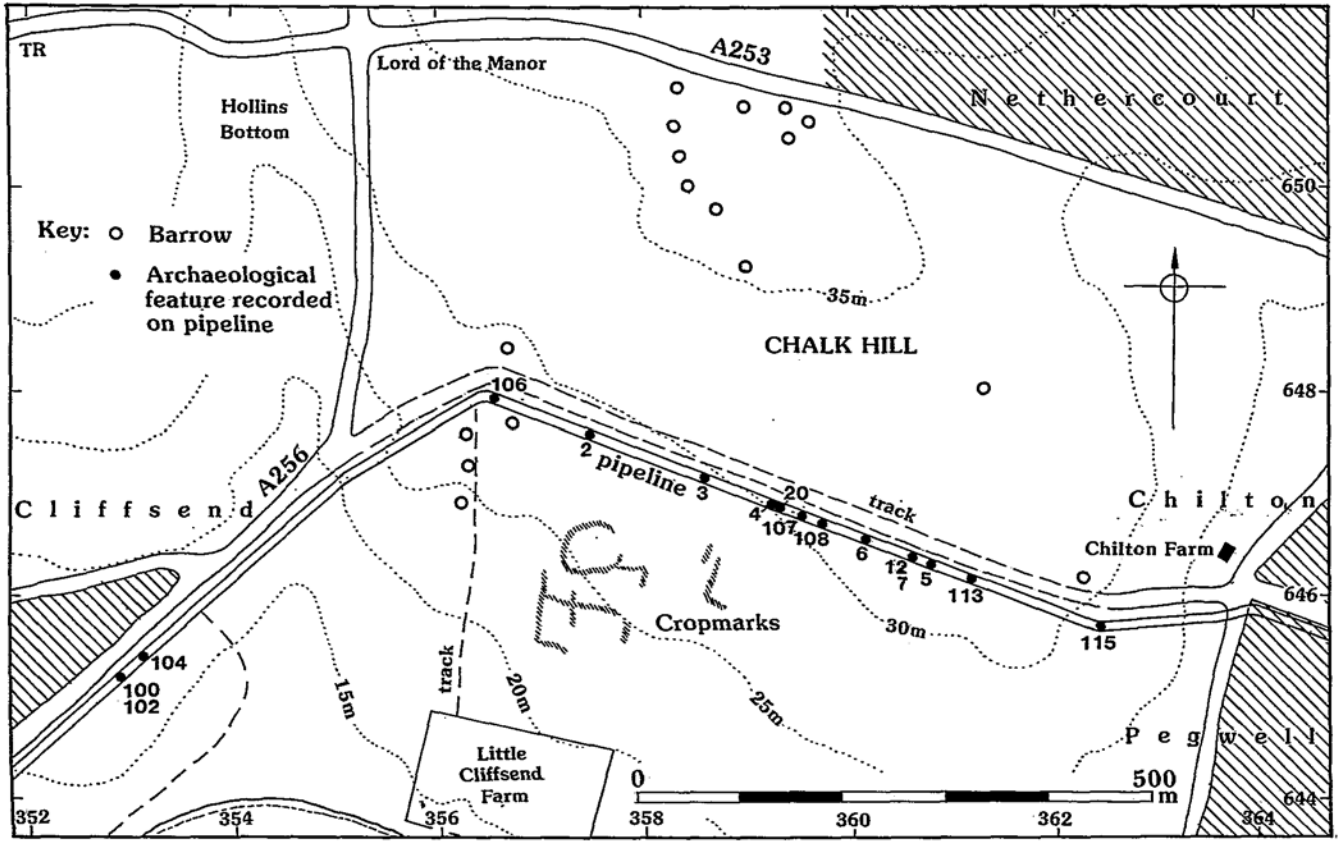

Fig. 8. Ramsgate Main – Archaeological features at Chalk Hill and Cliffsend

Late Bronze Age/Early Iron Age Ditch 7 (Fig. 9, S. 1)
This shallow ditch was revealed running obliquely across the easement for some 20 m., aligned north-west to south-east. There were indications that it turned north-east to form a corner, presumably of an enclosure of some sort. The average width of the ditch was 1.30 m. It was 0.30 m. deep with a V-shaped section, presumably truncated. The fill of red brown sandy loam contained flints and small boulders of local sandstone. Three sections were cut (fill contexts 14, 17, 18) each yielding sherds of Late Bronze/Early Iron Age pottery, 51 sherds in total.

Late Bronze Age/Early Iron Age Pits 5, 6, 107, 108
Four pits of varying sizes were recorded within the concentration of features on Chalk Hill. The ceramic contents suggest they are broadly contemporaneous, dated Later Bronze Age/Early Iron Age, *c.* 900–550 B.C. *Pit 5* was a small bowl-shaped pit which could not be fully investigated. Its dimensions are estimated as diameter 1.10 m., depth 0.20 m. The fill of sandy loam (context 10) was discoloured black and pink by burning. The pit contained calcined flints and animal bones, and a single sherd dated Late Bronze Age to Late Iron Age. *Pit 6* was a shallow bowl-shaped pit showing as a darker red brown fill (context 19) in a lighter matrix. It was of irregular plan, 1.40 m. long, 0.60 m. wide and of maximum depth 0.20 m. It contained large flint nodules, slabs of local sandstone, a fairly large collection of animal bones (78 fragments). The pit also contained two Late Bronze/Early Iron Age sherds and two intrusive sherds of early medieval date. *Pit 107* was another bowl-shaped pit. It was first observed when it was sectioned by the pipe trench over a length of 3.50 m. Its plan is unknown. The fill of grey brown sandy loam (context 109) contained many flint nodules, slabs of local sandstone, shells. Eleven sherds of Late Bronze Age/Early Iron Age date were recovered. *Pit 108* was revealed in section by the pipe trench and, like 107, was of unknown plan. It was the deepest of the pits exposed on Chalk Hill being 1.40 m. wide and 1.90 m. deep. It had vertical sides and a flat base. The fill (context 110) was of dark grey brown loam containing flints and sandstone nodules, bones and shells, and two small pot-sherds, again dated Late Bronze Age/Early Iron Age, *c.* 700–400 B.C.

Late Iron Age/Early Roman ditches 4, 113
As noted above, the group of features on Chalk Hill were delimited by apparently major north—south ditches: ditch sequence 4a/b/c to the west, and ditch 113 to the east. The ceramic contents of these ditches indicate contemporaneity (see Macpherson-Grant, below).

Ditch sequence 4a/b/c (Fig. 9, S.2) appears to represent the

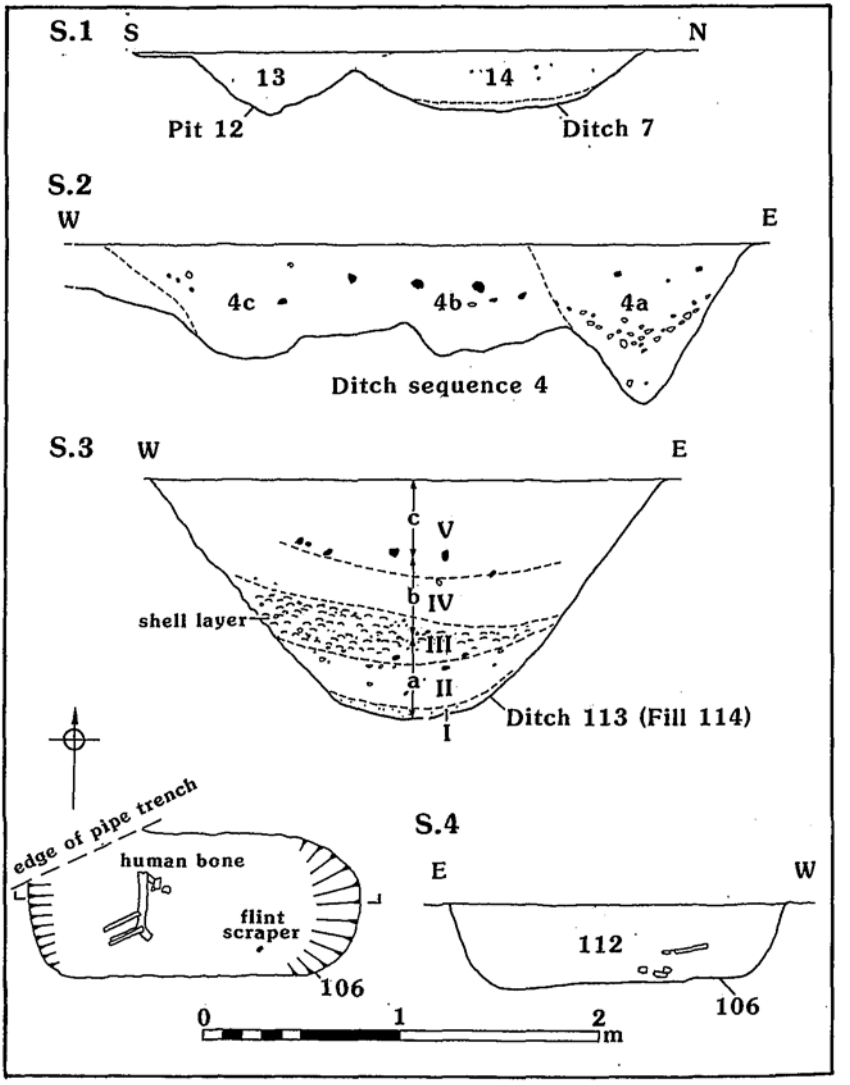

Fig. 9. Chalk Hill, sections (S.1–S.4) and plan of features

establishment and re-use of a ditch alignment over a period of time. The stratigraphical relationship of elements 4b and 4c could not be determined because of their homogeneous fills but 4a was clearly defined as a later element in the sequence, cutting through 4b. Ditch 4a was of V-shaped profile, 1 m. wide and 0.80 m. deep. Its fill (context 8) was of dark brown sandy loam and contained 30 pot-sherds in the date range: Early Iron Age to Roman, *c.* 400 B.C.–*c.* A.D. 150/175. The ditch also produced two metal objects: a probable bracelet fragment of copper alloy and an iron fibula brooch (see Fitzpatrick below).

Feature 4b had an ill-defined profile. The fill (context 15) was similar to that of Ditch 4a. The 40 sherds obtained from this feature had a similar date range to 4a but an earlier quantitative bias. The form of Feature 4c could not be established with certainty since it (and its neighbour 4b) were partly cut through the fill of a periglacial feature. The fill (context 16) was similar to 4b and sherds recovered were generally dated Early Iron Age to 'Belgic', *c.* 550 B.C.–*c.* A.D. 25/75. This might indicate that 4c is the earliest of the three ditches in this sequence.

Ditch 113 (Fig. 9, S.3), also aligned north–south 2.55 m. wide and 1.20 m. deep. The fill (context 114) was light brown loam with flint nodules and slabs of local sandstone. A distinct stratigraphy was revealed with tip lines of fragmented chalk evident in the lower part of the fill. The tip lines were partly sealed by a layer composed of very many land mollusc shells. A sequence of mollusc samples were taken through the ditch fills and these are reported below (Allen). Above these horizons the upper two-thirds of fill were without apparent strata. The section yielded 24 sherds, including Late Bronze Age/Early Iron Age and later material of Belgic/Early Roman date.

Other features – 20

Feature 20 was a well cut, apparently sub-rectangular, feature with a very flat floor and vertical sides. It was situated 0.20 m. east of the eastern side of Ditch 4a. Its overall length could not be determined since it was seen to continue beyond the extent of the stripped area for the easement. The feature was 1.15 m. wide and 0.25 m. deep. It had been back-filled with a sandy loam darkened by ashes (context 21). This fill contained flint flakes, bones, and many mussel shells (*Mytilus edulis*). Among this was a mass of large pot-sherds probably representing two vessels, 'Belgic', *c.* A.D. 25/75.

Roman features at Cliffsend (Fig. 8; N.G.R. TR 35306450)

Three features were recorded during monitoring of pipe trenching. This group of features was not evident in plan after topsoil stripping being sealed by a substantial depth of overburden. The features were only

apparent as the lowest part of the pipe trench was being excavated by which time they had already been heavily disturbed by the machining. Salvage recovery of finds and recording was undertaken.

Grave 100 A rectangular (apparently) cut into the chalk with steep, near vertical sides. As exposed in the pipe trench it was 1.2 m. wide and 2 m. deep from the upper surface of the chalk. The long axis of the grave was aligned north-west to south-east. The skeletal material recovered (context 101) was in good condition and is that of an older/mature adult (McKinley, below). Other finds from the lower levels of the grave were an iron nail and a fresh, basal sherd from a Belgic/Early Roman vessel, possibly representing a grave good. The feature is interpreted as a Romano-British inhumation.

Pit 102 This feature cut grave 100 on its north-east side. Its plan and width could not be established, but as exposed by the pipe trench it was 3.60 m. long with a maximum depth of 0.90 m. and a bowl-shaped profile. The fill (103) was a fine sandy loam with patches discoloured grey black with ashes. The pit contained a 'Belgic' sherd, slabs of local sandstone, animal bones and shells. Roughly central in the pit at a depth of about 0.40 m. within a layer of ash-darkened soil and midden material were fragments of human lower limb. These bones could represent remains disturbed from the adjacent burial (100), or perhaps a disturbed second burial.

Feature 104 This cut was sectioned by the pipe trench over a distance of 4.50m., its plan and width could not be determined. It was of maximum depth 0.60 m. with a flat base and sloping sides. The fill (105) was of grey brown sandy silt similar to the surrounding Thanet Beds sand with patches discoloured black with ashes or organic material. It contained slabs of local sandstone, two flint flakes and Roman sherds. The pottery includes a mixture of fabric types of general second century A.D. date.

Chalk Hill, other features

Outside the main focus of activity identified on Chalk Hill, several other features were recorded, the most important being a grave of possible Saxon date (N.G.R. TR 35686478). These features are briefly summarised below and their location is shown on Fig. 8; further details are contained in the archive.

Grave 106 (Fig. 9, plan; S.4). This grave cut into the chalk was 1.70 m. long, of maximum width 0.70 m. and maximum depth 0.40 m. It was sub-rectangular in plan with vertical sides and sloping ends, and it was orientated east–west. The grave appeared to have been disturbed in antiquity since the long bones of the legs and many small bone fragments were scattered through a fill of blackish sandy loam (context 112). The

only other finds were struck flint flakes and an end scraper. Analysis of the human bone indicates that two individuals may be represented (McKinley, below) and this may account for the disturbed nature of the grave, that is a secondary insertion into an earlier grave. The burial(s) are essentially undated but the form of the grave, its orientation and the fact of its disturbance, combine to suggest that it is Anglo-Saxon (Jutish).

Feature 2 90 m. east of grave 106 a pit, 0.70 m. long, 0.50 m. wide and with a maximum depth of 0.35 m. was recorded cut into the chalk. The sides of the pit were nearly vertical and the floor bowl-shaped. In plan it was a waisted oval; this could be accidental, or could suggest that it constitutes two pits or large post-holes cutting. The fill of sandy loam (context 9) contained a single broken flint flake.

Feature 3 lay some 120 m. east of Feature 2. It was a chalk-cut linear feature of bowl-shaped sectional profile running north–south across the easement. In width it varied between 0.40 and 0.70 m., with a maximum depth of only 0.20 m. It may be presumed that this feature represents the last vestiges of a ditch truncated by a major loss of overburden through plough attrition and erosion.

Feature 115 This feature was encountered on the crest of the descent into the Nethercourt Chilton valley. When sectioned by the pipe trench it was apparent that the chalk had here been terraced to a depth of 2 m. and over a distance of 12 m. The surface created had been cobbled with flints over rammed chalk. Fragments of brick and tile of seventeenth/eighteenth century type and fabric were recovered from the surface. Chilton Farmhouse (seventeenth century) is situated 90 m. to the north-east, and these remains are probably associated with the farm.

SANDWICH AND DEAL MAINS

P. Andrews

The route of the two mains from Weatherlees Hill WTW to Sandwich Pumping Station and from there on to Deal Pumping Station is shown on Fig. 1. The pipeline to Sandwich crosses the complex sequence of deposits associated with the infilling of the Wantsum Channel and the development of the Stonar Bank. The Deal pipeline was for the most part across the infilled Lydden Valley and the spit of shingle, with its overlying windblown sands, north of Deal. Topsoil stripping of the pipeline easement only entailed the removal of topsoil down to superficial deposits of windblown sand or alluvium which generally sealed any horizons of archaeological interest. Ten sections were defined along the length of the two mains. Descriptions on the soil profiles observed within each section, and interpretations relating to

their formation are held in the project archive. The three main areas of archaeological discoveries (The Monks' Wall, Stonar, Guilford Road) along with other minor observations of interest are summarised below, ordered north to south. Again, more detailed reports on each are held in the project archive.

The Monks' Wall (Fig. 10; N.G.R. TR 32685953)

The Monks' Wall is the most conspicuous of a series of medieval and later sea-defence banks lying to the east of the River Stour between the river and the medieval port of Stonar (see Fig. 1). Construction of these banks was probably begun in the twelfth-thirteenth century by monks from nearby Sandwich as part of a large-scale reclamation scheme in the Wantsum Channel during a period of extensive silting. This probably followed closure of the northern entrance to the Wantsum between the north end of the Stonar Bank and Ebbsfleet, possibly during the twelfth century.

The pipeline crossed the line of the Monks' Wall in three places but in two of these the bank had already been levelled or removed by the A256 Sandwich by-pass and by a recent extension to a modern compound fence-line (Fig. 10, plan). Where the bank was still extant and was crossed by the pipeline it survived to a height of approximately 1.20 m. and is almost 6 m. wide. An open ditch 2 m. wide runs parallel to the bank on its east side. As a pre-defined *Special Archaeological Section* the easement was stripped in advance to allow a section through the extant Monks' Wall to be cut back, cleared and recorded, and a small trench to be dug into the deposits sealed by the bank.

The section through the bank (Fig. 10, section) revealed two slightly differing layers of silty clay (contexts 57 and 58) overlain by approximately 0.20 m. of humic topsoil (context 56). Individual 'clods' were evident within 57 after the section had been allowed to weather for a week. The clods measured approximately 0.15 to 0.20 m. square, 0.20 to 0.30 m. long and were arranged vertically. An indistinct pale white deposit sometimes defined these clods, particularly towards the centre of the bank. There was no evidence for any buried soil beneath the bank: layer 58 directly overlying undisturbed 'natural', finely laminated alluvial deposits (context 59). The base of the bank was at approximately 0.50 m. O.D. No post-bank deposits survived overlaying either its north-west or south-east side. The ditch to the south-east of the bank is approximately 1 m. deep, but because of the method of pipe-laying it was not possible to examine the section closely for any evidence of recutting. The condition of the ditch indicates that it has been fairly regularly cleaned-out and kept clear of undergrowth up to the present day.

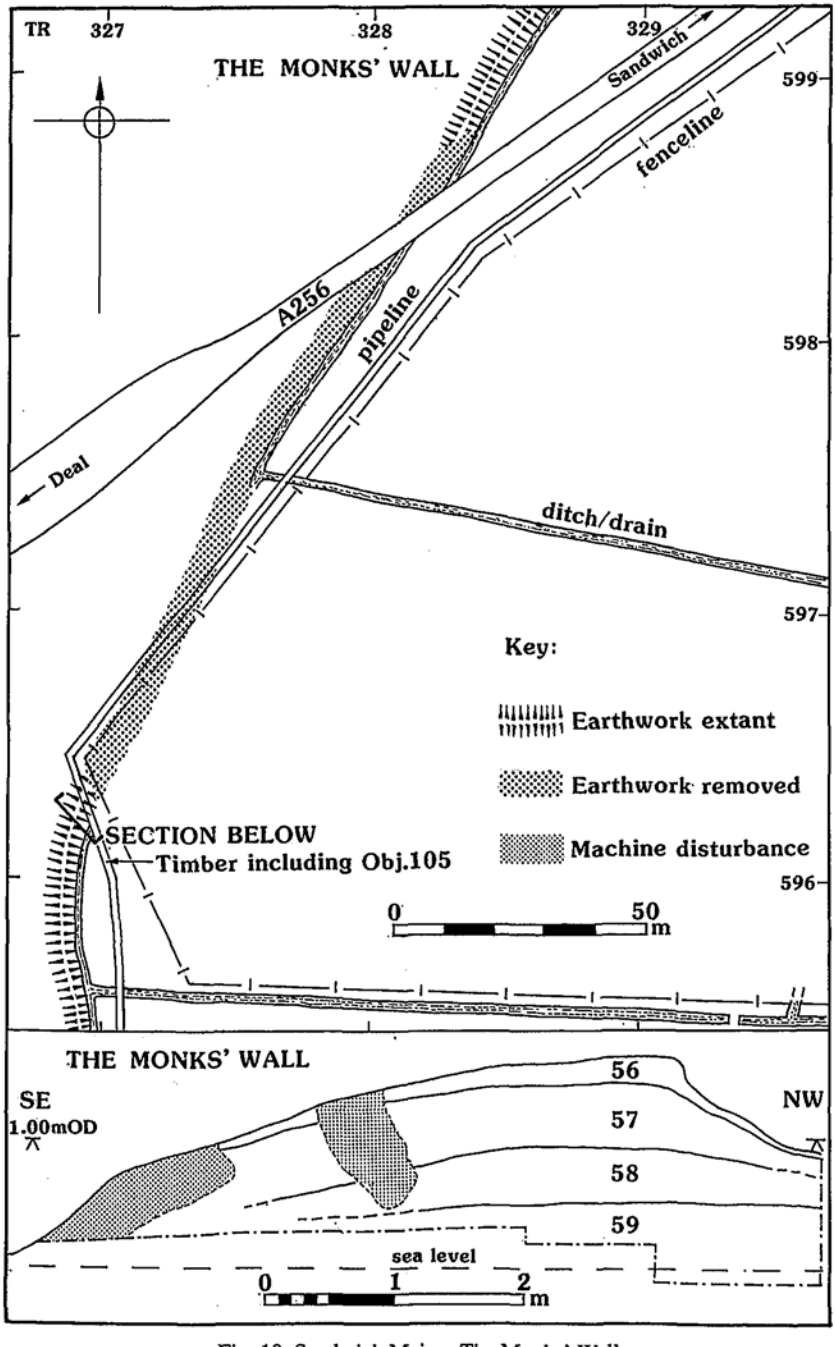

Fig. 10. Sandwich Main – The Monks' Wall

During pipe-laying 20 m. to the south-east of the cutting through the Monks' Wall a substantial, squared timber was recorded in the alluvial deposits at a depth of 0.80 m. below the ground surface (not retrieved). A 0.50 m. length of 0.16 m. square timber was exposed lying upright at an angle of approximately 45°. The top had rotted, but there was an 80 mm. projection at the end on one face. A further small fragment of squared timber (object 105, identified as alder) lying adjacent to the larger piece was retained.

Stonar (Fig. 11; N.G.R. TR 33365855 to 33575821)

The Stonar section of the Sandwich main ran immediately to the south of the site of the medieval port. This section extends north from the River Stour/Sandwich Haven (opposite the north-east corner of the medieval defensive circuit of Sandwich) to a point close to the presumed southern edge of Stonar, and then west to the Sandwich-Ramsgate road (Fig. 11, plan). It was anticipated that the north–south section of the pipeline from the Stour would cut through alluvial deposits associated with the extensive silting-up of this part of the Wantsum Channel. As the pipeline ran east–west adjacent to the known limit of the medieval port there was a possibility that evidence for quays or quayside structures along the Stonar shoreline might be uncovered.

Results

A fairly simple sequence of deposits was recorded across the north–south section. A thin layer of topsoil overlay some 2 m. of virtually undifferentiated pale brown silty clays – no banding was visible in the latter deposits. At a depth of 2.30 m. there was an abrupt change to a dark greenish grey silty clay, presumably reflecting the extent of water-logging to a height just above sea-level. Further to the north the texture of the deposits gradually changed from silty clays to slightly clayey sandy silts. The upper clays changed imperceptibly from pale brown to grey and the lower clays from dark greenish grey to dark grey, with the upper surface of the latter rising to 0.50 m. above sea-level, and many thin bands of varying hue apparent. Occasional oyster and other marine shells were present, but no other finds were noted.

The east–west section was similar to that described above but there was a slightly greater depth of overburden. The lower, dark grey layer continued to rise to 0.70 m. above sea-level. Twelve timber stakes were recorded (four retained, objects 101–104) from this layer, over a distance of some 50 m. (see Fig. 11 for location). Some of the stakes were not observed *in situ* and several were damaged during machining, but the complete examples ranged from 0.88 to 1.39 m. in length, and were circular with diameters from 50–70 mm. The bottoms had been

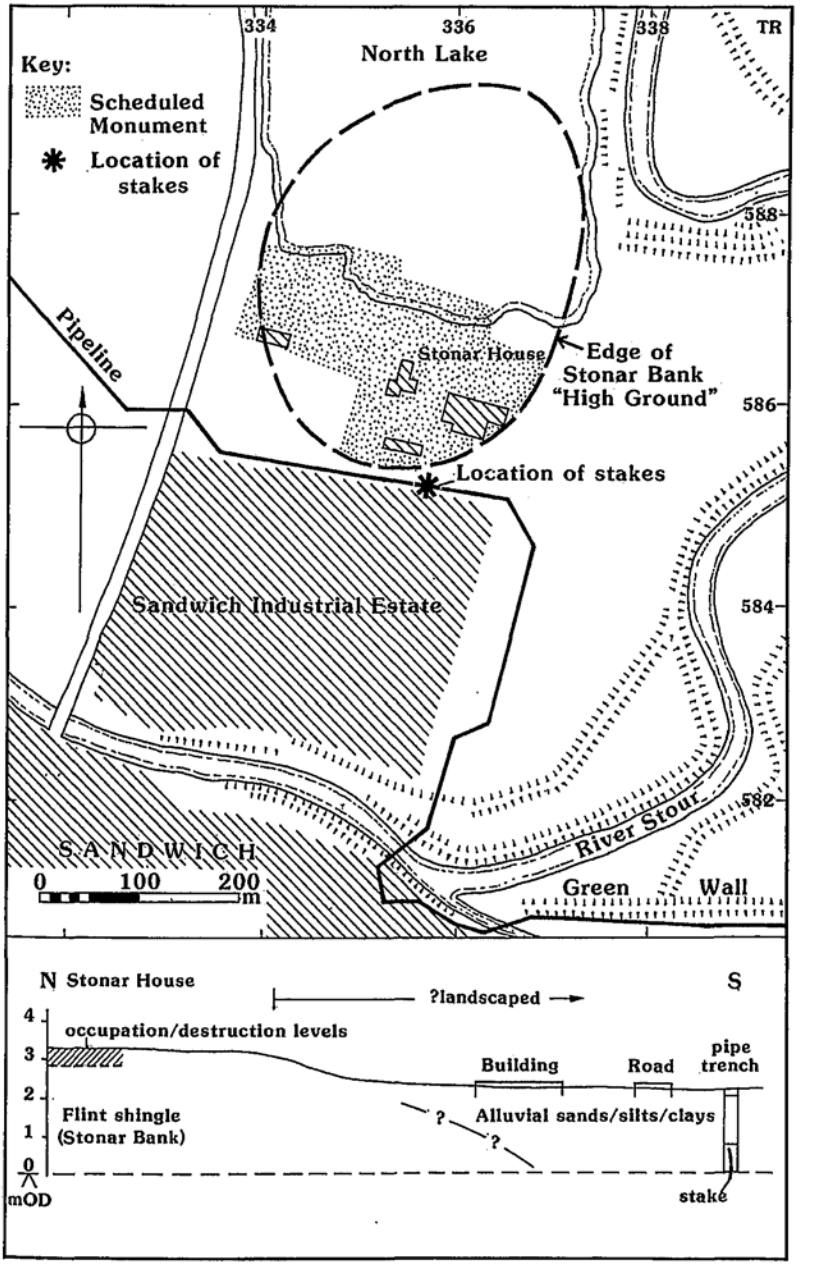

Fig. 11. Sandwich Main – Stonar (edge of Stonar Bank "high ground" after Perkins 1993)

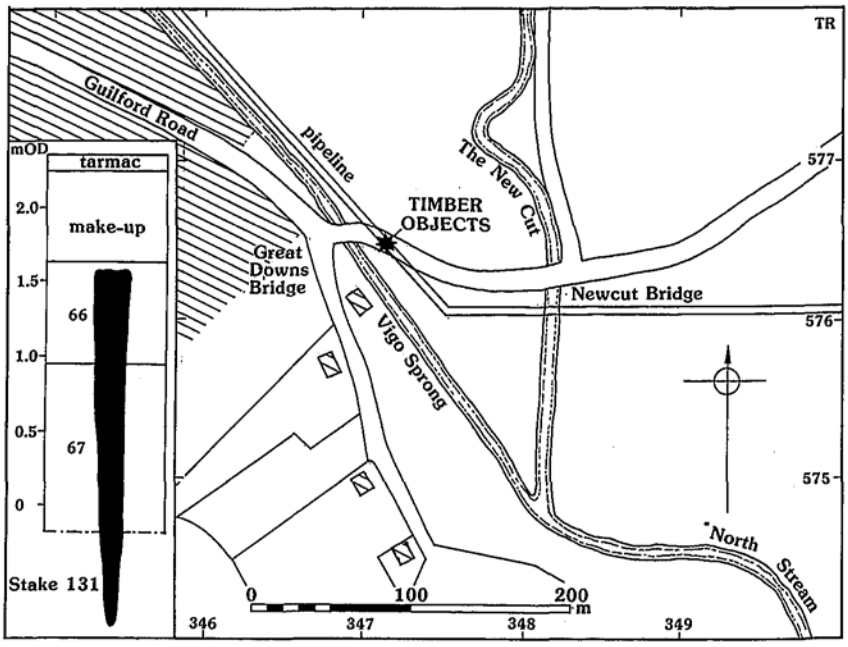

Fig. 12. Deal Main – Guilford Road crossing

trimmed to points which had been driven probably between 0.30 and 0.60 m. into the ground. They survived up to the top of the dark grey sandy silt, with one example having a possible sawn end; the tops of the others had rotted away. One larger, sub-rectangular timber was recovered, but not from a secure context. No pattern was discernible in the layout of stakes, and no other finds were recovered. Samples from two stakes, submitted for radio-carbon dating, Object nos. 101 and 103, produced calibrated dates of A.D. 1650–1950 and A.D. 1670–1955 (GU–4360), respectively (see Appendix 1).

Guilford Road, near Newcut Bridge (Fig. 12; N.G.R. TR 34725763)

This location was known to be of archaeological interest. In 1936 'whilst digging a trench for a sewer, a dug-out canoe was found in estuarine deposits on the bank of a small stream. The boat was made from an oak-tree trunk, with clear tool marks. It has since been lost and is undated' (SMR TR35NW44). The recorded find-spot coincides with Vigo Sprong (the old course of the North Stream), close to its convergence with The New Cut – a diversion of the North Stream.

Guilford Road (*c.* 2.40 m. O.D.) has been raised above the surrounding ground surface to the north and south by up to 1 m. During the excavation of the pipe trench across the Guilford Road four substantial timber posts or stakes were encountered *in situ* (Fig. 12, plan). Close archaeological examination of these was not possible for health and safety reasons and because the central section of the road crossing was tunnelled. The stakes appeared to lie in a line below the centre of the road, parallel to it. They were approximately 0.25 m. in diameter and spaced at roughly 1 m. intervals. All were sealed beneath some 0.75 m. of modern make-up, lying within a deposit of alluvial silty clay in which two distinct horizons were evident (Fig. 12, section – layers 66, 67). The stakes appear to have been driven into the lower layer (67), though from what level was uncertain. One of the stakes was removed during pipe-laying (object 131). This was 2.35 m. long and up to 0.27 m. in diameter, and had been trimmed at the bottom to a point. The top had probably rotted, but there was clear evidence of several side branches having been removed with an axe or adze (see Mepham, below).

Five other timber fragments (objects 132–136) were recovered from approximately the same location as the stakes. Their exact location and relationship to each other could not be ascertained (for the reasons outlined above). However, they probably came from the south side of the line of stakes, at around 0.20 m. O.D. (2.20 m. below the present ground surface) within layer 67. The depth of the fragments in relation to the stakes suggests that the former are earlier. All of the fragments appeared to come from a hollowed out tree-trunk of beech, though no clear tool-marks were apparent. Conclusive interpretation of the fragments is not possible, but they may derive from a logboat (see Mepham, below for further discussion). A sample, submitted for radio-carbon dating, produced a calibrated date of A.D. 970–1160 (GU–4361; see Appendix 1).

Other archaeological observations on the Sandwich and Deal Mains

Apart from the three main areas of interest a series of minor deposits, features and finds were recorded. These are summarised below, ordered north to south; more detailed accounts are held in the project archive.

The Green Wall, Sandwich (N.G.R. TR 33425808)
The Green Wall, part of the medieval and later sea-defences of Sandwich was crossed by the pipeline. The cutting revealed a bank of clay loam 1.20 m. or more high, 10 m. wide. The earthwork runs due east of Sandwich on the north side of the Vigo Sprong and probably pre-dates the New Cut.

Worked flints, near Dicksons Corner (N.G.R. TR 35635700)
A small collection of undiagnostic worked flint flakes was recovered from a location some 750 m. west of Dicksons Corner. These were retrieved by Mr Halliwell of the Dover Archaeological Group from the pipeline spoil dump after trenching. The finds probably indicate prehistoric activity along the eastern edge of the Lydden Valley and it may be noted that other worked flints have been found in the vicinity, some 500 m. to the south (SMR TR35NE8).

Blackhorse Wall (N.G.R. TR 37025520)
A shallow east–west ditch was recorded in the pipe trench, sealed below 0.80 m. of wind-blown sand. This feature is on the line of the Blackhorse Wall, a dyke running east—west and is likely to represent an earlier continuation of the 'wall' to the east.

Buried soils, Golf Road, Deal (N.G.R. TR 37125473 to 36775571)
South of Mary Bax's Stone and North of Walnut Tree Farm three discrete lengths of buried soils, comprising brown loamy sands up to 0.30 m. thick were encountered. Each lay at a depth of 0.80 m. below the current ground surface and extended over distances of between 100 m. and 300 m. The northern two lengths are considered to be of medieval date, perhaps related to manuring of the fields around the medieval settlement (DMV) of Sprukelham. A few fragments of animal bone and sherds of pottery, probably of medieval date, might support this contention. The southernmost of the buried soils did not produce any dating evidence but is conceivably of Roman date since Roman finds are reported less than 100 m to the south-west near Walnut Tree Farm (SMR TR35SE63).

A hollow way was also recorded directly below the topsoil at the north end of this section of the pipeline, along the line now followed by the so-called Ancient Highway between Sandwich and Deal. It was 4 m. wide and 0.75 m. deep, and perhaps represents continued use of this route over several hundred years following the higher ground of the shingle spit extending northwards from Deal.

BRONZE AGE METALWORK (Ebbsfleet III Hoard, N.G.R. TR 33206300)

A.J. Lawson

The circumstances of the discovery of this small group of objects, found near Ebbsfleet Farm, are reported above. The objects are illustrated in Fig. 13 (1–5). All five objects are apparently of copper alloy and although they have not been analysed metallographically,

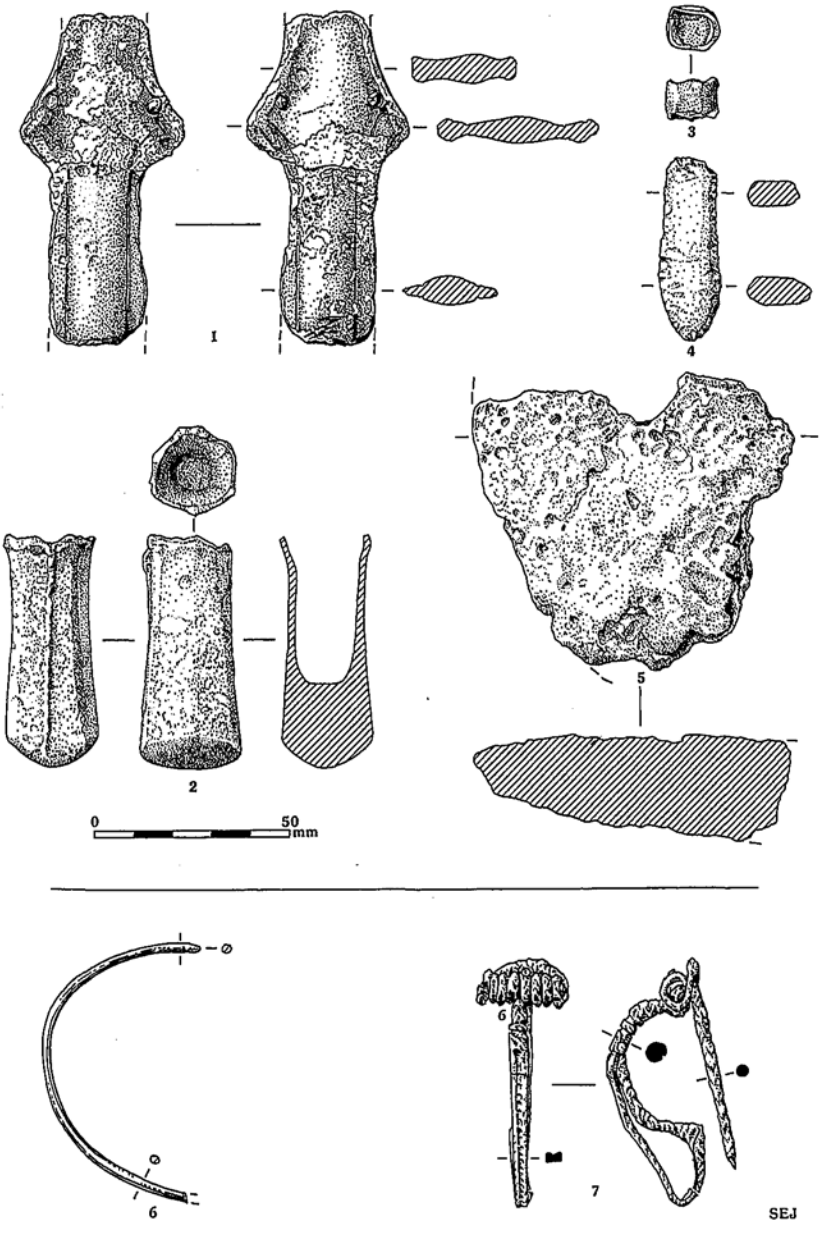

Fig. 13. Ebbsfleet III hoard (1–5), object of copper alloy (6), object of iron (7)

are assumed to be of cast bronze. They are in a similar condition. The surfaces have an incoherent, but smooth, green patina with areas of pale green copper carbonate corrosion and some patches of reddish copper oxide. The pieces all have a solid metal core and have now been stabilised and lacquered by Salisbury Conservation Laboratory.

Fig. 13, 1 – Sword fragment (85 mm. long; 42 mm. max. width; 25 mm. max. width of blade; 75 gm weight) comprising the lower part of the cast hilt with concave sides and eroded 'beak-like' shoulders. The ricasso notch beneath is so eroded as to be indefinable. Within the raised flanges which border the hilt are the shanks of two small (3.3 mm. diam.) lateral rivets which lack heads. The upper part of the blade is parallel-sided with a rounded mid-rib flanked by a groove on each side which continues onto the hilt, curving in an arc beneath the rivet. On one side a short groove runs parallel to the flange between the end of the curving mid-rib groove and the rivet. On the reverse a short straight groove crosses the end of the shoulder, beneath the curving mid-rib groove. The mid-rib continues through the surviving part of the hilt plate. The blade edges are too eroded to preserve any bevel. (W516, context 1089, Obj. No. 3).

Fig. 13, 2 – Socketed hammer (58 mm. long; 26 mm. max. width; 133 gm weight). The rounded cross-section of the body has flat sides, one of which bears a distinct, slightly oblique casting flash. The other side is heavily corroded. The expanded mouth bears traces of single indistinct moulding. The striking face is rounded, slightly asymmetrically. (W516, context 1089, Obj. No. 4).

Fig. 13, 3 – Cylindrical band (13 mm. by 11 mm. diam.: 12 mm. high; 6 gm weight) with thin walls, apparently filled with granular corrosion products. Two opposing faces have been flattened, possibly by hammering. Possibly a fragment of the socket of a small tool or weapon. (W516, context 1089, Obj. No. 5).

Fig. 13, 4 – Flat ingot fragment (47 mm. long; 16 mm. wide; 7 mm. thick; 27 gm weight) with unshaped rounded edges, and pointed at one end. (W516, context 1089, Obj. No. 6).

Fig. 13, 5 – Bun ingot fragment (78 mm. × 83 mm; 29 mm. thick; 567 gm weight) with plano-convex section and containing many vesicles and larger horizontal voids. (W516, context 1089, Obj. No. 2).

Discussion

Although these five objects were not discovered in a discrete feature, their distribution is within a confined space, beneath ground which has been subject to a rigorous and erosive ploughing regime. Because none of the objects would be out of place in a Late Bronze Age context, it would seem reasonable to assume that they were probably deposited

simultaneously as a hoard (context category 1a, Needham 1985, vi) and possibly later disturbed by agricultural sub-soiling. No other objects were found in the immediate area, despite thorough metal detection and, therefore, it is probable that the hoard was no larger than the recovered items.

The most distinctive component of the hoard is the sword fragment (Fig. 13, 1) which, by virtue of its broad shoulders, groove-defined rounded mid-rib and parallel sided blade, is of the distinctive Carp's Tongue type (Needham 1986, 47; Colquhoun and Burgess 1988, 108). The socketed hammer (Fig. 13, 2) also finds parallels in the hoards of south-east England which belong to the Ewart Park tradition with Carp's Tongue affinities. Such hammers may have elaborate mouth mouldings, such as those from Hatfield Broad Oak, Essex (Davies 1979, 156, No. 38) or Thorndon, Suffolk (*Inv. Arch.* GB11, No. 4), but others may be relatively simple, such as one of the pair from the Isle of Harty, Kent hoard (*Inv. Arch.* GB 18, No. 23), while that from the Minnis Bay, Kent hoard (Worsfold 1943, P1 X1, No. 18) is similarly without a strong mouth moulding. A simple socketed hammer also accompanies a rod-like ingot amongst the finds from Burgess's Meadow, Oxford (*Inv. Arch.* GB 6, Nos. 6 and 7) and it may be possible that the small ingot from Ebbsfleet is related to the latter, especially if the association of these two Oxfordshire items with Middle Bronze Age metalwork is insecure.

Bun ingot fragments, such as Fig. 13, 5 are commonplace in Late Bronze Age hoards (for example, Shuart: Perkins 1988). The typology of the Ebbsfleet finds would, hence, suggest a date in the ninth or eighth century B.C. (O'Connor 1980, 188; Colquhoun and Burgess 1988, 111). The discovery adds further to the marked concentration of Carp's Tongue hoards already recorded on the shores of the Isle of Thanet and the former Wantsum Channel, which includes Minnis Bay, Shuart, Monkton and Minster, summarised by Perkins (1991, 259–61). At Ebbsfleet itself two other hoards are known: that found in 1893 but not precisely located (Hills 1895), and that found on Cottington Hill, referred to as Ebbsfleet II (Perkins 1991a, 260, no. 6; Perkins 1992, 303) only 500 m. north of the latest find. The former contained, amongst other pieces, fragments of Carp's Tongue swords, a socketed hammer and bun ingots, as does the latest find (British Museum 1920, Pl. III). These hoards form part of the evidence of an efficient industry on the north Kent coastal plain and on either side of the Thames estuary which produced prolific quantities of weapons and tools, but which also incorporated a system for the collection and recycling of scrap metal probably both from England and the Continent (Coombs and Bradshaw 1979, 188; Champion 1982, 37, fig. 14).

LATE IRON AGE METALWORK FROM CHALK HILL

A.P. Fitzpatrick

These two objects were both stratified, derived from the same context filling Ditch 4a on Chalk Hill (context 8).

Copper Alloy object (Fig. 13, 6)
A fragment of a pennanular wide bracelet or anklet, one terminal of which survives. The simplicity of the form makes dating difficult, and bracelets of copper alloy rather than iron are not particularly common on British Iron Age sites (Stead 1979, 75–7). However, examples are known throughout the Iron Age (e.g. Jope and Cunliffe 1984, 343–5, fig. 7.6, 1.33) and there is no reason why the bracelet should not be contemporary with the associated iron brooch. The wire is round 2 mm. in diameter and in its current state the bracelet measures *c.* 65 mm. × 40 mm. externally (W619, Context 8, Obj. No. 2.).

Iron brooch (Fig. 13, 7)
A complete La Tène II brooch which appears to be made in one piece. The spring has seven coils and an external chord, while the return of the open catch-plate is held to the bow by a thin clasp which also serves as a decorative collar. The upper surface of the bow has a central groove and what may be the remains of tool marks, perhaps from a chisel or punch. The presence of an axial rod or hinge within the spring suggests that the brooch may have a mock spring disguised within the spring.

The brooch falls within Hull's Type 3B group of La Tène II brooches and is unusual in being of iron rather than copper alloy (Hull and Hawkes 1987, 171, 173–8, Pl. S1). Hawkes was minded to seek a north-eastern French source for the introduction of this type to Britain, but found difficulties in reconciling this with the predominantly south-western distribution then known. Although the Chalk Hill find now complements a piece from Maidstone (*ibid.*, no. 2251) the number, and distribution, of British finds is too small to place much emphasis on. The clasp on the bow of the Chalk Hill find also occurs on the type which succeeded it, Hull's type 3C, suggesting that this brooch belongs relatively late in the manufacture of the type, perhaps in the later second or early first century B.C. Length 63 mm., width of spring 23 mm. (W619, Context 8, Obj. No. 1.).

ROMAN SILVER COIN FROM EBBSFLEET

John Davies

A single Roman coin was recovered from the project, an unstratified find discovered after topsoil stripping at Weatherlees Hill WTW near Ebbsfleet Lane. The coin is a silver Roman *denarius* of the Republican period: C. Marcius Censorinus (88 B.C.). Type Crawford 346/1. Rome mint. The coin is very worn on both faces. (W516, context 2000, Obj. No. 7).
Obv.: Jugate heads of Numa Pompilius, bearded, and Ancus Marcius, not bearded, right.
Rev.: Desultor right; C CENSO below.

OTHER METAL OBJECTS

R. Montague (coin identifications by Nicholas A. Wells)

In addition to the various objects described above, a total of 41 other metal objects was recovered during the course of the project: ten from Weatherlees Hill WTW (W516), six from the Ramsgate Main (W619) and 25 from the Sandwich and Deal Main (W646). Of these 41 objects, two are of silver, 24 are of copper alloy, five are of lead and ten are of iron. Only nine of these objects were from stratified contexts, most of the remainder being recovered during the controlled metal detector scan. Brief notes on the objects are provided here; details on the provenance of each find, reference nos. and full catalogue descriptions are held in the project archive.

The stratified material consists of nine iron objects; seven from Weatherlees Hill WTW and two from the Ramsgate Main. These objects are all nails or nail fragments and none are closely datable. The nails from Weatherlees Hill WTW were derived from four contexts, mostly medieval pits and ditches (feature nos. 121 – 2 objects; 1080 – 1 object; 1082 – 1 object; 1087 – 3 objects). The two other stratified objects consist of a single nail each from Roman grave 100 (context 101) and Late Iron Age ditch 4c on Chalk Hill (context 16). The nail from the grave 100 can be compared with coffin nails from the Romano-British cemetery at Poundbury in Dorset, of Mills' Type 1a, small flat-headed nails with a circular head less than 20 mm. in diameter. This was the commonest nail type from the cemetery (Mills 1993, 115, fig. 79.1). The occurrence of a single nail does not preclude the presence of a coffin in the grave, for as mentioned by Mills, coffins may have been built using a jointed construction which rendered nails

largely redundant (*ibid.*, 114). The nail from ditch 4c cannot be closely dated, as hand-made nails of this type are common right up to the nineteenth century.

The unstratified objects from Weatherlees Hill WTW comprise two of copper alloy and one of lead. The former consist of a Scottish twopence of Charles I and a small fragment of casting waste. The lead object, a large, perforate, tapering object of sub-square section is probably a weight or net sinker of post-medieval date. Unstratified objects from the Ramsgate Main comprise three of copper alloy and one of lead. The copper alloy objects include a cast vessel rim fragment, which may be compared with an example from St. Peter's Street, Northampton, from a context dating to the years around 1500 (Oakley and Webster 1979, 258, fig. 111.95). Such vessels, probably cooking-pots, became common only in late medieval times. The other two objects are a gilded, riveted fitting and a bell fragment neither of which can be dated more closely than post-medieval to modern. The lead object is in the form of a perforated circular disc decorated with a raised cross and possible raised rim. It can be compared with two examples from Sandal Castle from contexts dating from *c.* 1485–1600 (Goodall 1983, 235, fig. 2.107–8) and an example from Battle Abbey from a context dating to the sixteenth to seventeenth century (Geddes 1985, 156, fig. 48.6). Such objects were possibly used as weights or tokens.

Of the 25 objects from the Sandwich and Deal Mains, 24 were metal-detector finds from the windblown sand below the topsoil (contexts 3 and 8) at the Royal Cinque Ports Golf Course. Two of the objects are of silver, 19 are of copper alloy, two are of lead and one is of iron. The bulk of the objects probably represents casual losses by visitors to the seaside, and all those that are datable belong to the post-medieval and/or modern periods, with one exception: a star rowel (spur disc) which could be of earlier date since this type was used on spurs throughout the medieval and post-medieval periods (Ellis 1993, 223). The other objects include coins (seventeenth to nineteenth century), buckles and mounts, a copper alloy wedding ring with an inscription on the inner surface and a candle snuffer. A lead disc, similar to that from the Ramsgate Main (above), may be similarly dated. Two spoons, one silver and one copper alloy were also found. The silver spoon has a decorated bowl and a drop where the handle is affixed to the bowl. Drops were first introduced around 1715 (Moore 1987, 16), although as the hallmark is incomplete it is not possible to date this piece accurately. A lead disc was recovered from alluvial deposit 64, near Richborough power station. This piece cannot be more closely dated than to the post-medieval to modern periods. Finally, four small fragments (49 g) of iron slag were recovered from medieval Ditch 1085 at Ebbsfleet and may possibly be derived from smithing hearth fragments.

WORKED FLINT

P. Harding

The project produced a small worked flint assemblage – 98 pieces in total. The majority of this collection comprises flakes and broken flakes (89 pieces). The remainder consists of a small number of cores/broken cores (two), retouched flakes (two), scrapers (three) and other tools (two). The material is summarised below; full details and quantification by context are held in the project archive.

Ebbsfleet (W516) produced 31 pieces of unpatinated worked flint, plus a ground axe (see below). About two-thirds (21 items) of the material was from stratified contexts in features of varying date (Late Bronze Age/Early Iron Age to medieval) and the majority may be assumed to be residual. The raw material includes nodules of heavily abraded flint possibly from a gravel source. Retouched tools comprise a semi-discoidal scraper made on a flake with irregular, semi abrupt, direct retouch from spread 1008, and an end scraper made on a broken flake of Bullhead flint (this distinctive flint is found locally where chalk is overlain by Thanet sand and is characterised by a green cortex above an orange rind). The latter, well-made implement derives from the same context as the Late Bronze Age hoard (context 1089). It has direct, semi-abrupt retouch at the distal end forming a convex scraping edge. There was no other flint from this context.

The flint axe from the base of ring ditch 1079 measures 106 mm. long, 46 mm. wide and 21 mm. thick (Fig. 14). It has a slightly convex blade and irregular straight edges which taper to a narrow butt. One side has grinding which extends to the edges and truncates most of the original flaking; however, the other side has flake scars which are fresh indicating that the axe has been reworked from a larger implement. The main body of the axe has a matt surface from grinding on a coarse abrasive grind-stone. The blade by contrast has been honed to a fine polish. Ground axes are diagnostic implements of the Neolithic period and formed the basic wood working tool of the period. It is probable that the implement was made locally. The occurrence of the axe does little to date the ring ditch. The use of ground flint axes extends throughout the Neolithic period. However, it is not inconceivable that this implement was recognised and collected and/or curated by Bronze Age occupants of the area. The small group of five worked flints from the same context as the axe are all flakes: two are unbroken, two are broken and one is burnt.

Chalk Hill (W619) produced nearly all of the worked flint from the Ramsgate Main (53 of the 55 stratified pieces). The material is unpatinated, except for the small group from context 112 and individual

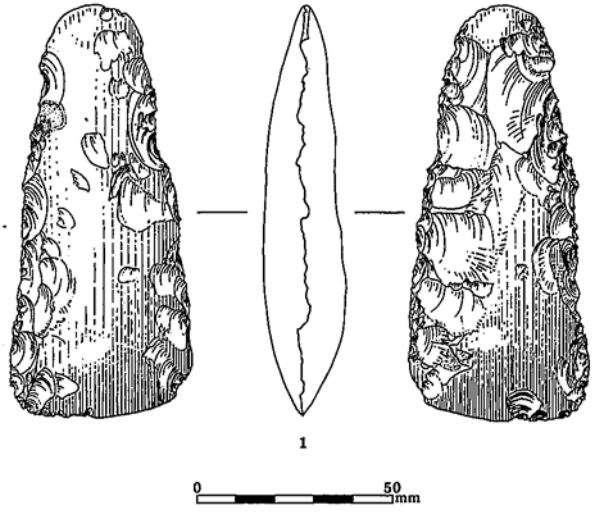

Fig. 14. Flint axe from Ebbsfleet peninsula

pieces from three other contexts. Raw material was principally black flint with a grey cherty interior below off-white chalky cortex. Two flakes of Bullhead flint were also present. None of the material from the Ramsgate Main shows diagnostic technological features.

A group of 15 pieces comprising a broken core and 14 hard hammer-struck flakes was recovered in direct association with the Neolithic pottery from Pit 12 (context 13). Their condition and the fact that two pieces refit suggest that they are not derived. The quantity is, however, insufficient to allow further conclusions. The disturbed grave 106 produced 12 patinated pieces (contexts 111, 112) including a single undiagnostic end scraper made on a flake with irregular, semi-abrupt, continuous retouch. The rest of the flints from these contexts were flakes. The remainder of the flint from Chalk Hill was generally recovered as small groups of flakes from Late Bronze Age/Early Iron Age and Late Iron Age features. Two, presumably residual, flakes were recovered in a Romano-British pit at Cliffsend.

The only material from the Sandwich and Deal main (W646) was a small group of flakes and broken flakes (nine pieces in total) of undiagnostic flint, including four of Bullhead flint. These were retrieved from the easement spoil dump after pipe trenching some 750 m. west of Dicksons Corner.

WORKED STONE

M. Laidlaw

A small quantity of worked stone was recovered from Ebbsfleet, consisting of one whetstone and five very small, possible quern-stone fragments. The whetstone is in a characteristically fine grained stone with smooth, rounded edges and worn surfaces, sub-rectangular in shape. It was recovered from medieval Ditch 1016 (context 124) along with a ceramic spindle-whorl (see below). Mr D. Perkins has commented that the whetstone is comparable to other examples found at Thanet, in particular from Grave 8 in the Ozengell cemetery, which has been described as having a Scandinavian origin (A. Oddy, British Museum, pers. comm. DRP). The five coarse sandstone fragments, two of which are conjoining, may be derived from a quern-stone, as one surface is smooth and worn. The fragments were recovered from spread 1008, and are therefore likely to be of Early/Middle Iron Age date.

NEOLITHIC POTTERY FROM CHALK HILL

R.M.J. Cleal

Thirty-five sherds, weighing a total of 305 g, are identifiable as earlier prehistoric. All were recovered from Pit 12 on Chalk Hill (W619, Context 13). Of these thirty-five sherds, six (59 g), probably belonging to a single vessel, are identifiable as earlier Neolithic; the remaining twenty-nine belong to the Peterborough tradition of the middle to late Neolithic. The sherds were examined using a binocular microscope at ×20 magnification, following standard Wessex Archaeology procedures. Frequency of inclusions is given as a percentage of surface area, estimated by eye using comparative charts, and the measurement given is of maximum dimension. Four other very small sherds from Ebbsfleet are of possible later Neolithic date; these are reported below (Macpherson-Grant).

Earlier Neolithic (not illustrated)
The earlier Neolithic vessel is in a slightly micaceous fabric with sparse to moderate (10–15 per cent), angular flint (2 mm.), and sparse (*c.* 5 per cent) quartz sand (<1.0 mm., most <0.5 mm.). There are some dark reddish to black grains present (sparse, <1.0 mm., most 0.5 mm.); these are likely to represent either iron oxides, or glauconite, or both, and are likely to be naturally occurring inclusions in the clay, as are the mica fragments (which are too small to measure at ×20 magnification).

The rim and plain body sherds are likely to belong to a single vessel, although there are no conjoins along ancient breaks. The rim is simple, and probably everted, although the angle of lie is not certain. All the sherds are worn, both on the surfaces and on the edges. The vessel is fired to shades of pale orange and pale brown on the surfaces, an indication of partial oxidisation, and the core is dark grey.

Peterborough Ware (Fig. 15. 1–3)

All three vessels assignable to this tradition are in a flint-tempered fabric with moderate flint (*c.* 10 per cent), well-calcined, angular, and ill-sorted (<5 mm.). The distribution of fragments is uneven. There is some glauconite or iron oxides, rare fine quartz sand and some fine mica, all of which are almost certainly natural inclusions in the clay. The form, decoration and condition of the sherds/vessels are given in the descriptions to accompany the illustrations below.

Fig. 15, 1 Six decorated body sherds and one plain body sherd (not all illustrated) belonging to a vessel with horizontal rows of non-plastic single oblique fingernail impressions, at least two of which are arranged in opposing directions to form a chevron pattern. The exterior surfaces are orange-brown, the interior grey-brown, and the core black, with the appearance of a carbonised deposit within the core, caused presumably by the clay having a high carbonaceous content, or of the vessel wall having absorbed some organic material which then carbonised during firing or use of the vessel. The sherds are all worn.

Fig. 15, 2 Four body sherds, all decorated, two of which are conjoining along an ancient break, and one basal sherd. The sherds are from the lower body of a round-bottomed bowl covered with rows of twisted cord impression. Two lengths of twisted cord were used to form the impressions, a finer length for the upper part, and a coarser one for the lower. The two sets of impressions are separated by an incised line. The exterior is pale brown, the core dark grey to black, and the interior pale brown to pale grey-brown. The sherds are in a worn condition. Two coil breaks are visible, one on the upper part of the decorated body, and one above the rounded base.

Fig. 15, 3 One decorated body sherd and one decorated sherd from the neck of a vessel with a well-defined shoulder angle and a deeply concave neck. The decoration is of twisted cord impressions, with one deep finger-nail pit in the neck, and a hole in the body sherd, probably made before firing but when the vessel was already quite dry. The hole lacks the characteristic hour-glass form of post-firing drilled holes, but is very clean at the edges, with no lip visible such as is often the case with holes made when the clay is still plastic. The hole lies within one of the cord impressions. The exterior is dark grey, the core black, and the interior black to pale orange. The condition of the sherds is fair, that is, with no marked wear on the surfaces, although the edges show some abrasion.

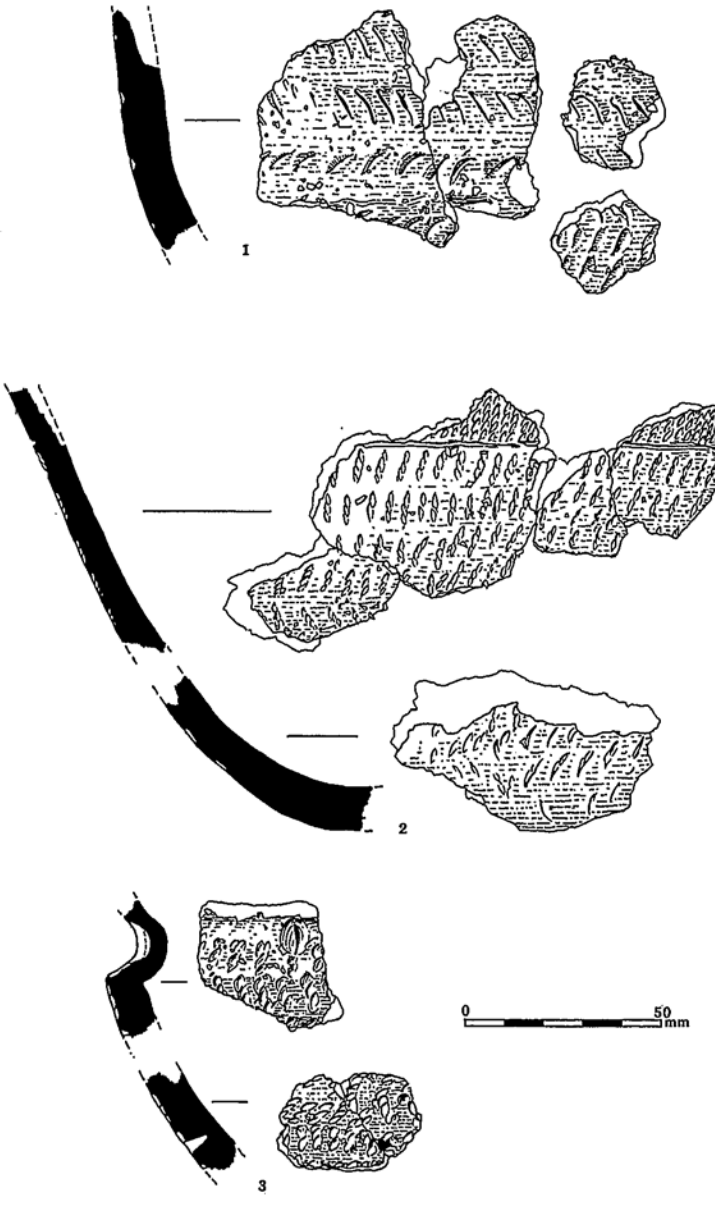

Fig. 15. Later Neolithic pottery from Chalk Hill (Pit 12)

Discussion

The earlier Neolithic rim is plain, and it is not possible to identify the form of the vessel to which it belonged. The earlier Neolithic pottery of eastern Kent has been summarised by Dunning (1966) and includes both plain and decorated vessels. Pottery of this type is not more closely datable than to the fourth, or possibly even the early third, millennium cal B.C.

The three Peterborough Ware vessels represented are in such similar fabrics that it seems justifiable to regard them as a single assemblage, probably made and used within a short time-span. They could belong to either the Ebbsfleet or Mortlake sub-styles, as these two sub-styles are separable mainly on their rim morphology, and no rims are present in the assemblage. The fairly thin wall of Fig. 15, 2 is slightly more likely to belong to an Ebbsfleet than to a Mortlake bowl, but the deeply concave neck of Fig. 15, 3, with its finger-nail pit decoration and thick body wall would be typical of the latter style. As there are very few reliable radiocarbon dates for the tradition, and certainly not enough to support a developmental sequence, the attribution to Ebbsfleet or Mortlake has no bearing on likely date, which in any case can only be ascribed to the late fourth or early third millennium cal B.C. (*c.* 3500–2500 B.C.).

There are few notable collections of Peterborough Ware from the county, apart from the well-known collection of Ebbsfleet Ware from the eponymous site at Northfleet, which is the type site for that sub-style (Burchell and Piggott 1939), and there is little ceramic evidence for pre-Beaker activity on the Isle of Thanet (see report discussion below). This renders the present find of some importance, despite its small and limited nature.

LATER PREHISTORIC, ROMAN AND LATER POTTERY

N. Macpherson-Grant

An overall total of 926 sherds (11.762 kg.) was recovered from Ebbsfleet (W516) and the Ramsgate Main (W619). Both areas produced evidence of multi-period activity: fairly intensely localised at Ebbsfleet, more topographically spread, between Cliffsend and Chilton on the Ramsgate Main. The material from each area is summarised and assessed separately below. One small Early–Mid Iron Age ceramic group from Ebbsfleet has been isolated for more detailed discussion and illustration and this is appended to the area summaries. The overall dating and quantification of the material is summarised in Table 1, more detailed descriptions and quantification of the pottery from each

context are held in the archive. Detailed comment on fabric types and trends are not included in this report; these are reserved for future broader-based inter-regional synthetic research programmes.

Ebbsfleet peninsula

A total of 475 sherds (5.219 kg.) was recovered from the various phases of work on the WTW, spanning an overall date range of Later Neolithic to post-medieval (Table 1). The multi-period nature of this assemblage is self-evident and amplifies the relatively extensive range of prehistoric and early historic occupation already noted during previous archaeological evaluations on the former Cottington and Ebbsfleet peninsulas (Perkins 1992). These earlier surveys indicated that, with the exception of some assemblages from deeper contexts, few features of any period were free of intrusive or residual material, a by-product of long-term occupation and the highly reductive nature of recent agricultural practice; these factors resulted in a high proportion of small and abraded sherds (Macpherson-Grant 1992, 287). The same general trend is evident amongst the present assemblage and is particularly reflected in the totals for pre-'Belgic' material where, in the absence of diagnostic form/fabric characteristics, smaller worn elements could be placed anywhere between the later phases of the local Deverel-Rimbury tradition or the native Late Iron Age/'Belgic' transition (i.e. between *c.* 1200–50 B.C. and A.D. 50); for this material, allocations indicate the preferred intuitive/likely period emphasis.

Despite these limitations the present assemblage not only extends the topographic range of the previously recognised phases of activity, but in two particular instances has added chronological depth to the occupation of the Ebbsfleet peninsula. Ditch 1064, in the group of features at the junction of Ebbsfleet Lane and the new access road, produced fragmentary but fairly fresh body sherds with fabric characteristics very similar to some regional later Neolithic Peterborough-type assemblages (in particular a confirmed Mortlake style group from Castle Hill, Folkestone; Gibson forthcoming), and atypical of other third–second or first millennium B.C. ceramic traditions. It is worth noting that Ditch 1064 lay in the same area as ring ditch 1079 which produced the flint axe; occupation of mid–later Neolithic date in the area is more than a reasonable likelihood. The present data, coupled with the locations of the 1990 finds of Beaker pottery (Perkins 1992, 274, 277, sites 7 and 9), indicate that activity of at least Late Neolithic/Early Bronze Age date, on this peninsula, is likely to have been fairly extensive, encouraged perhaps by the landmark nature of the peninsula (projecting southward at the eastern entrance to the former Wantsum Channel) with probably sheltered beaching-points on its western side.

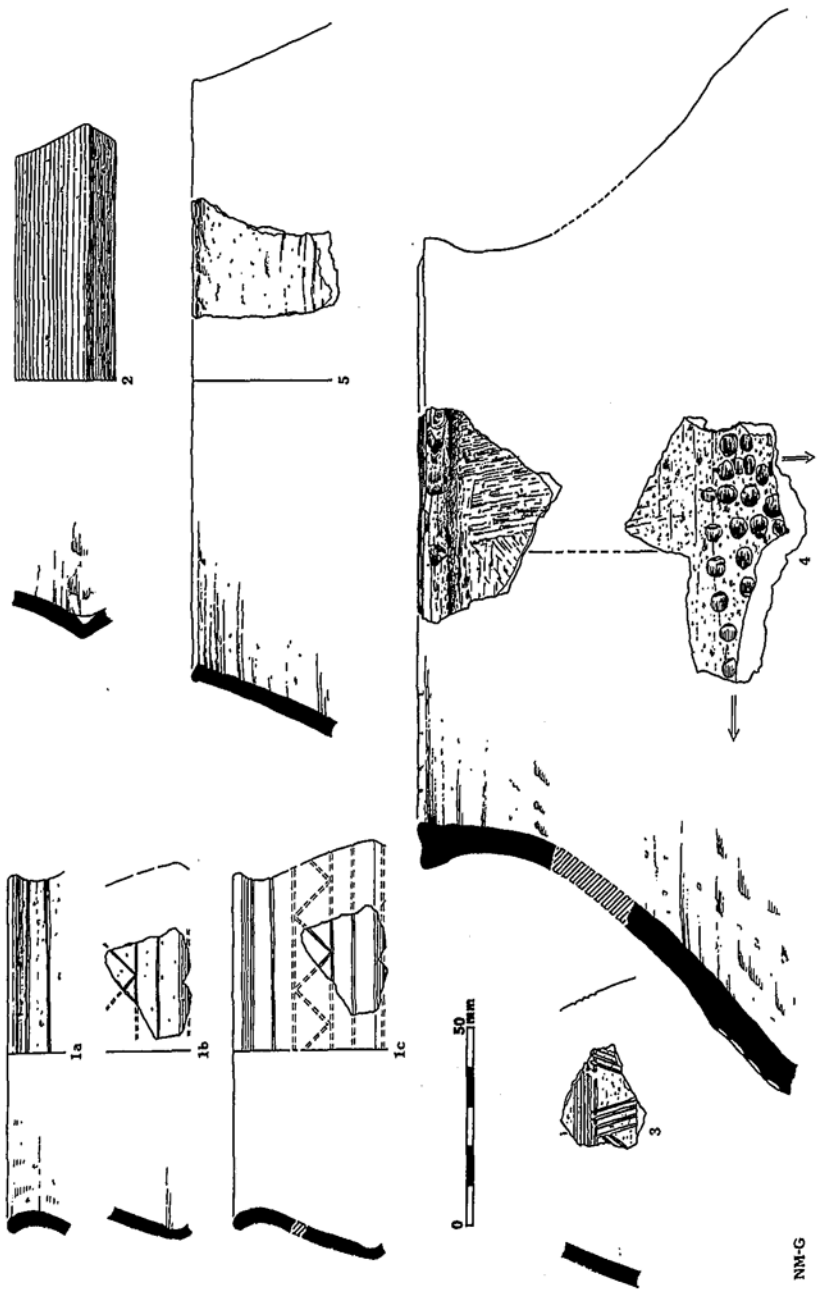

Fig. 16. Early–Mid Iron Age pottery from Ebbsfleet peninsula (1–5: Pit 1008a/Spread 1008)

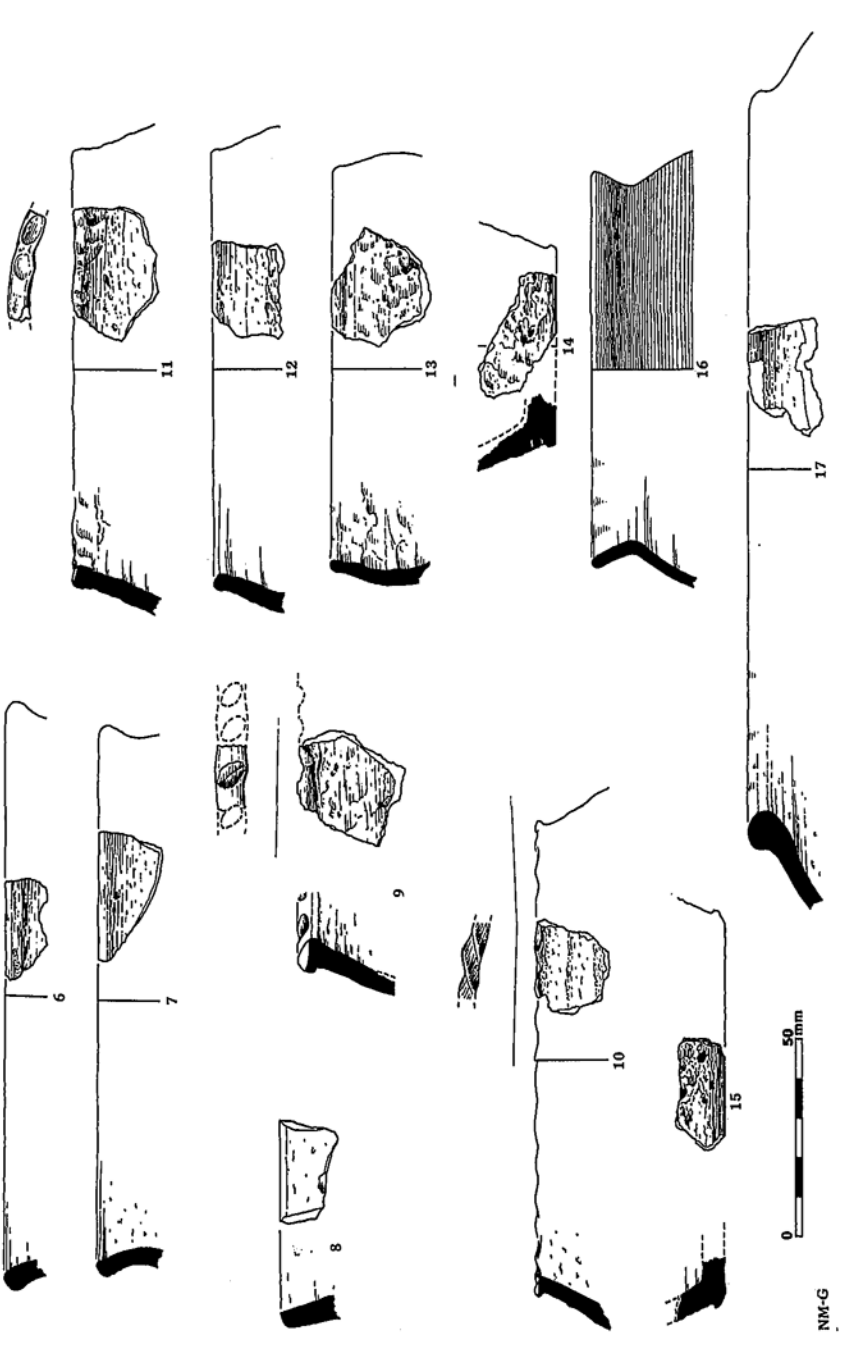

Fig. 17. Early–Mid Iron Age pottery from Ebbsfleet peninsula (6–17: Pit 1008a/Spread 1008); Late Iron Age pottery (16–17)

TABLE 1. POTTERY QUANTIFICATION BY DATE RANGE AND FEATURE

CODE/ AREA	Context	Feature/Trench	FLINT	FLINT TEMPERED			FLINT/ MIX	GROG	NON GROG	MOSTLY SANDY	
			Neolithic	LBA/ EIA	E-MIA	IA-general	LIA/ Belgic	'Belgic'	Belgic/ E Roman	Roman	Med/ PM
W516-	102	Pit 1002 (Tr 3)									10
W. Hill	103	u/s cleaning (Tr 3)			1	7	11		1	2	8
	105	Ditch 105 (Tr 3)					2			3	
	110	Ditch 1010 (Tr 2)									1
	111	Pit 1011 (Tr 2)			1	2				1	
	112	Gully 1009 (Tr 2)		3	1						
	113	Spr'd 1008 (Tr 2)			201						
	113A	Pit 1008a (Tr 2)		2	66					1	
	115	An. burial (Tr 2)			3						
	116	Feat. 116 (Tr 2)									1
	117	Pit 1012 (Tr 2)									1
	120	Pit 1013 (Tr 4)				1				1	
	122	Ph 1014 (Tr 4)				5				4	3
	123	Ditch 1015 (Tr 4)				2				2	1
	124	Ditch 1016 (Tr 4)									1
	1062	Pit 1062									2
	1064	Ditch 1064	4	4							
	1066	Pit 1066		1							
	1072	Ditch 1072		5							
	1073	Ph 1073		4							
	1074	Ph 1074		1							
	1075	1075		1							
	1076A	Ditch 1076A			1						
	1079	Ring Ditch 1079		1							
	1080	Pit 1080									7
	1082	Ditch 1082				1					13
	1083	Pit 1083				2					9

	1084	Ditch 1084									3
	1085	Ditch 1085 (=1015)			1					3	1
	1086	Pit 1086		1	17						3
	1087	Pit 1087		2						1	4
	1088	Pit 1088		1							
	u/s				2					2	31
W516 TOTAL			4	26	294	20	13	0	1	20	97
W619 – Chalk Hill	8	Ditch 4a				16	3	7	1	3	
	10	Pit 5				1					
	13	Pit 12	35								
	14/17/18	Ditch 7		51		2					1
	15	Ditch 4b			2	23	4	10		1	
	16	Ditch 4c				9		1			
	19	Pit 6		2							2
	21	Feature 20					1	173			
	23	Ditch 4a/b					9	32	1	1	
	109	Pit 107		11							
	110	Pit 108		2							
	114	Ditch 113		4			2	16	2		
W619 – Cliffs End	101	Grave 100							1		
	103	Pit 102						1			
	105	Pit 104								6	
	u/s									7	8
W619 TOTAL			35	70	2	51	19	240	5	18	11
W646 TOTAL	10/51										2
OVERALL TOTAL	39	96	296	71	31	240	8	37	110		

The 1992 report highlighted the possibility of Late Bronze Age/Early Iron Age transition occupation north of Ebbsfleet Farm (Perkins 1992, Site 9, 288–9, fig. 5), but allocation was tentative. The present small corpus of definite identifications, principally from the northern and eastern parts of the WTW confirm occupation within the period *c.* 850–550 B.C. in the general area of Ebbsfleet Farm. This material should, in part, be contemporaneous with the three bronze hoards Ebbsfleet I–III, and Ebbsfleet III (from this project) may have been deposited within the settlement. There are insufficient ceramic data to suggest a likely chronological emphasis for this occupation, so that though the metalwork dating for these hoards centres around *c.* 800 B.C., it is uncertain whether they represent abandonment hoards or ones deposited during the occupation of the settlement. This point is important because the selection of this location, on a low-lying exposed peninsula easily attainable both from land and sea, indicates establishment during relatively peaceful conditions, with choice of position governed more by trade considerations than defence. One of the key points of the ceramic sequence from the contemporary Highstead settlement (at the western end of the Wantsum Channel) is that, though there was a major change in ceramic traditions between *c.* 600–500 B.C., it was not apparently associated with a significant break in occupation (Couldrey forthcoming). The implication there is that, although the change is represented by the introduction of specifically Continental ceramic types, the replacement process is likely to have taken place via essentially gradual adoptive processes (i.e. trade and immigration) rather than sudden conquest and impressment. Since the Highstead evidence implies a generally peaceful social milieu, there is no reason to suspect a radically different situation only 19 km. further east at Ebbsfleet.

This change in ceramic tradition is epitomised by the Early-Mid Iron Age assemblage from the 1990 survey at Ebbsfleet (Site 9; Macpherson-Grant 1992, 289–293). In the current assemblage it is represented by the rusticated coarse ware jar base (Fig. 17, 15). A date of *c.* 500–400/350 B.C. was suggested for the 1990 assemblage on the basis of the recovered material, but the ceramic types that characterise this change (red-finished and polychrome-decorated fine wares and rusticated coarse wares) could have arrived earlier, around *c.* 600/550 B.C., if the Highstead evidence represents a regional norm. For Ebbsfleet the hard evidence confirming continuity is lacking, and there may well have been a break in occupation; but the evidence for much more extensive Late Bronze Age/Early Iron Age activity than previously realized, followed by confirmed Early-Mid Iron Age occupation in the same area, does imply that settlement on the peninsula was continuous (as a topographically convenient landing-/trading-point) for up to 400/450 years, commencing *c.* 750 B.C., if not before.

The assemblage from Pit 1008a/Spread 1008 adjacent to Ebbsfleet Farm (summarised below, Fig. 16, 1–5; Fig. 17, 6–15) tends to confirm the previously suggested *c.* 350/300 B.C. end-date for the material recovered from north of Ebbsfleet Farm, but there is still no genuine evidence for Mid Iron Age activity so that, in this part of the peninsula at least, there may have been either a genuine third-century B.C. break in occupation or a significant shift in settlement location.

Confirmation of the fairly extensive nature of Late Iron Age re-occupation is represented by the two pieces illustrated from evaluation trench 2 (Fig. 17, 16 and 17). No. 16 is similar to elements from 1990 Site 9 and can be given a similar (but still arguable) date of *c.* 125/75–50 B.C. The large coarse ware jar, No. 17, has a diameter and form closer to traditional 'Belgic'-style material and might be more specifically of earlier–mid first-century B.C. date. However, compared with the 1990 locations, the recovered quantities are low, so that the present material is likely to be on the fringes of the main settlement area. Previous finds indicated that from this initial pre-'Belgic' Late Iron Age ?re-occupation, settlement on the peninsula was maintained throughout the first century B.C. and up to at least the later fourth century A.D. The same trend is represented in the current assemblage from Ebbsfleet, but the significantly lower quantities of material again imply activity peripheral to the main settlement focus.

As with the previous assemblage there is no evidence for Early to Late Saxon activity. However, the small quantities of early medieval pottery from evaluation trench 4 (35 sherds) may be seen alongside that from Site 2B (a 1977 location), the two locations being less than one km apart. Both groups have mid-later eleventh-century start dates and the indications are for fairly widespread occupation during this period, even if only at humble level. An earlier, late Saxon foundation for this activity is not an unreasonable expectation (although the peninsula would have been an exposed shore during the Viking raids of the later tenth/earlier eleventh century). What is new for this general period is the evidence in the current assemblage for twelfth-century occupation (from *c.* A.D. 1125/1150), with an increase in Canterbury sandy and North Kent shell-filled 'kitchen wares'. The single sherd from an imported Andenne-type pitcher (Feature 1084) reflects the general period trend noted for Canterbury, with a mid-later twelfth-century rise in North French/Flemish 'kitchen' and quality wares, but in this instance may only be a chance acquisition/purchase from a passing vessel rather than an indicator of relative community wealth.

There is a marked quantity fall-off in the assemblage from *c.* 1250/1275, with only a later minor late medieval surge, principally between *c.* A.D. 1475–1525/50.

Early-Mid Iron Age pottery (Fig. 16, 1–5; Fig. 17, 6–15)

Pit 1008a (context 113A) and the directly overlying spread 1008 (context 113) produced a fairly large assemblage: 267 Early-Mid Iron Age sherds (4.285 kg.), accounting for approximately 90 per cent of the earlier Iron Age pottery from the whole site. The two contexts produced conjoining sherds and the material from each context is identical in character with a mixture of some large, mostly small to moderate sized flint-tempered sherds with a mixed wear-pattern: some fresh sherds, a moderate quantity with fairly heavily abraded edges and a small number with marked unifacial wear. There are no complete vessels and the bulk of the material comprises body sherds representing coarse wares. The assemblage should represent a clearance-deposit drawn from various broadly contemporaneous domestic sources but with significantly different individual sherd histories. This likelihood is amplified by the presence of a number of fairly heavily re-fired sherds (including jar rim Fig. 16, 4) along with a number of large calcined flints from the pit fill. In addition, a small quantity of sherds are markedly more worn than the assemblage bulk; these include at least two pieces with fabric characteristics suggesting the inclusion of residual Late Bronze Age/Early Iron Age material.

Briefly summarising the illustrated material (Figs. 16 and 17): Nos. 1a–1b are from the same fine ware bowl with incised decoration comprising above- and below-shoulder spaced horizontal lines framing an upper-body panel of incised chevrons (1c is the likely reconstruction of this vessel); No. 2 is a rather coarsely-finished simple carinated fine ware bowl; No. 3 is probably from a sub-fine ware beaker form but with a still unexpectedly coarse fabric and rather crude deeply incised (probably combed) linear decoration. No. 4 is from a very large thick-walled coarse ware storage-jar with (probably overall) lower-body impressed finger-tip decoration – a more specifically decorative variant of the contemporaneous trend for haphazard rusticated finishes on some coarse ware storage and cooking vessels; there is sufficient of the decoration to determine that the body area to be decorated was first outlined by both vertical and horizontal lines of impressions (arrowed in illustration), the enclosed 'panel' then infilled with further finger-tipping. No. 5 is another essentially storage-jar form, but smaller and better-finished; nos. 6 to 12 represent coarse ware shouldered jars with simple closed-form or everted rims (nos. 9 to 11 with impressed cable or simple finger-tip decoration). No. 13 is a simple bowl with formative finger-work barely smoothed over. No. 14 is a small-diameter jar base with rusticated lower-body treatment (and fracture along a weakly united constructional ring-coil).

There is a distinctly relatively crude feel about this assemblage that is apparent despite the negative effect of the refired and more

fragmentary elements, a feeling amplified by the rough finish of bowl no. 2 and the essentially fine ware beaker no. 3. Ability is certainly represented by the size of storage-jar no. 4 and the reasonably neat bowl no. 1, but overall the quality of this assemblage is below par compared with the broadly contemporaneous material from 1990 Site 9 and other sub-regional assemblages for this period.

On the basis of the dating applied to regional Highstead Period 3B-type assemblages, the presence of the rusticated jar base no. 15 and several rusticated coarse ware body sherds guarantee an initial *c.* 550/500–400 or 350 B.C. placement for this group. Coarse ware elements nos. 12 to 14 (and the basal plinth of no. 15 – context 103) are all formally linked to pieces in the published Site 9 assemblage; these pieces together with bowl no. 2, the remainder of the coarse ware types (with the exception of no. 6), together with the finger-fluted finishing on some body sherds, are all well-paralleled in the Highstead assemblage itself. Similarly the relatively straight neck of jar no. 5; this piece was probably also rusticated below the shoulder and as such would be related to Barham Downs 10 (Macpherson-Grant 1980, 140, fig. 5). The thickened rim of no. 4 also has a close parallel in a probable storage jar and a number of other coarse ware forms from Highstead. All of these elements fall adequately into the date range indicated above.

Two un-illustrated body sherds from a thin-walled fine ware bowl have traces of combed rectilinear decoration; body position is uncertain, but there is at least one horizontal band with one, almost certainly more, spaced vertical bands drawn above/below the latter. This type of decoration is normally associated with shouldered coarse ware jars, cf. Hamilton Road, Deal (Parfitt 1985, fig. 7, no. 36) or Avion La République, Pas-de-Calais (Hurtrelle *et al.* 1990, 116, fig. 16) with, in the latter instance a date of *c.* 400–350 B.C. There is a single coarse ware example within the Highstead Period 3B assemblage. The narrow French dating refers to the particular site quoted (not to the Continental longevity of the style itself) and need not apply here, but does give an indication of the date range that could be given.

The form of beaker no. 3 and the use of horizontal/diagonal multiple-line decoration is well-paralleled in a fine purely grog-tempered beaker from Castle Hill, Folkestone (Site CT.F72, 1991; Macpherson-Grant forthcoming), though on the latter the lines are separately incised, not group-combed. The fine quality of this piece, together with other associated good-quality grog (chamotte)-tempered fine wares with good Pas-de-Calais area parallels, suggested either direct importation and/or (more probably) production by a local potter with regular close links across the Channel/production by an immigrant within one generation of arrival. The dating suggested for the Folkestone beaker

was *c.* 450–400 B.C.; though not necessarily so, the quality of the Ebbsfleet beaker suggests derivation, and a more extended date range up to *c.* 350 B.C. might initially be more applicable.

The rounded lip, general profile and fairly weakly shouldered form of bowl no. 1 is similar to a number of undecorated fine ware bowls from the Pas-de-Calais area, but most have a much shorter neck-shoulder span. The use of incised horizontal lines as borders to decorated panels or as form highlighters is a common trend in north French assemblages but usually in paired or multiple line groups rather than singly as here. Panels of incised single/multiple-line chevrons are a feature of Castle Hill, Folkestone, fine wares but, other than these aspects, there are no close parallels in the available Continental literature and no close published regional parallels.

Similarly, there are no precise parallels for the large jar no. 4. As noted, however, its form can be paralleled at Highstead and the trait of all-over below-shoulder finger-tip rustication is a fairly frequent occurrence on Continental coarse wares, cf. Houplin-Ancoisne (*c.* 450–400/350 B.C.), Avion La République (*c.* 400–350 B.C.), Hornaing (Hurtrelle *et al.* 1990, 89, fig. 3; 100, fig. 6; 150, fig. 3) and in a more ordered and elegant manner, occurs on a local fine ware bowl from Manston with a *c.* 450–400 B.C. date (P. Couldrey, *pers. comm.*; Clarke and Couldrey forthcoming).

The above points suggest that whilst this assemblage is clearly within the currency of the same ceramic tradition characterised by Highstead Period 3B (*c.* 550/550–400 B.C.), the parallels quoted indicate a rather later emphasis of *c.* 450–350 B.C., overlapping the upper limit suggested for the Ebbsfleet Site 9 material (*c.* 500–400/350 B.C.). The quality of the latter assemblage is much closer to the productional norm for the region and is in marked contrast to the present group. Clearly no great temporal distance separates these two assemblages, so that the quality difference is either a reflection of social position, simply just poorer-quality potting, or a genuine chronologically-related downgrade in traditional standards. Intuition would like to place Pit 1008a nearer to *c.* 350/300 B.C., but confirmation must await the recovery of stratified and firmly interlinked assemblages that adequately embrace the period *c.* 350–250 B.C.

Ramsgate Main

In addition to the Neolithic pottery reported above, a total of 416 sherds (6.543 kg.) was recovered from Cliffsend and Chalk Hill, the bulk of the material (94 per cent by number) being recovered from the latter (see Table 1). As with the assemblage from Ebbsfleet the chronological range of the material is broad.

Some comment may be made on the small discrete Neolithic assemblage from Pit 12 on Chalk Hill (Cleal above, Fig. 15). The earlier and later elements within it are both welcome additions to a region still under-represented by ceramic finds of this period, though it is worth noting the recent (1994) recovery of plain earlier Neolithic bowls from just south of Hillborough (near Herne Bay) and of later Neolithic Peterborough-type pottery from near Chislet (Parfitt *et al.* forthcoming), and the already mentioned small Peterborough assemblage from Castle Hill, Folkestone.

Ditch sequence 4a/b/c is an interesting entity in terms of site longevity with, if the clearly redeposited nature of the recovered assemblages *does* represent uninterrupted occupation, usage and refurbishment spanning *c.* 600 years. This activity appears to have commenced in the Early Iron Age (represented by two probably redeposited rusticated sherds from Ditch 4b), probable continuity throughout the Mid-Late Iron Age (represented by the base from a pedestalled foot-ringed fine ware jar, though some associated coarse wares suggest this piece may be more specifically placed between *c.* 150/125–50 B.C.), and confirmed continuity through to the Conquest period A.D. (with 'Belgic'-style grogged wares).

One of the more stimulating aspects of the ditch sequence is its relationship to Ditch 113, approximately 250 m. to the east (see Fig. 8). There are at least two instances of sherds from the same 'Belgic'-style comb-finished bead-rim jars (one with a mixed-temper fabric) distributed between both features; in both cases the sherds from these vessels are essentially fresh and of moderate-fairly large size. In addition there are same-vessel sherds between Ditch 4 and Feature 20. Rather more convincing of overall contemporaneity, one of the above bead-rim jars is spread between all three features. Much of the grogged pottery from these contexts consists of fresh and frequently moderate- to large-sized sherds. Collectively these include comb-finished Thompson C3-type bead-rim jars (Thompson 1982), several Thompson B2–1/B2–4 jars with corrugated necks, a jar with spaced and inverted tooled multiple-line chevrons hanging from the shoulder, and a large rim sherd from a fine Thompson G5–6 butt-beaker copy, with upper-body panel 'pitch-stained'. The distribution of the latter does not suggest application as a sealant, rather that the whole panel was deliberately painted black. The obvious implication of the above observations is that both ditches are contemporaneous; the overall assemblage can be placed between *c.* A.D. 25–50/75 and strongly indicates farmstead/settlement site-clearance or dismantlement deposits.

The few sherds (5 in total) of Roman date from Ditch sequence 4 are all small (one very worn) and of later first to broadly mid second-

century date. The condition, quantity and size of these pieces is in marked contrast to the 'Belgic' Conquest-period material, and should indicate intrusive post-clearance arrivals, either as stray rubbish or via subsequent agricultural manuring. The presence of Roman material in Ditch 4, and not in Ditch 113, may indicate different area histories, with the former perhaps nearer to a shifted occupational focus, the latter being left as a field-boundary to infill naturally. Overall the evidence suggests a change in settlement-position/land-management around *c.* A.D. 75/100, possibly slightly earlier.

FIRED CLAY AND CERAMIC BUILDING MATERIAL

M. Laidlaw

A total of 172 fragments (1776 g) of fired clay and a small quantity of ceramic building material (17 fragments/136 g) was recovered from the project. Nearly all of this material derived from Ebbsfleet: the remainder comprising a single piece of daub with wattle impressions from Ditch 4a on Chalk Hill and a tile fragment from Pit 104 at Cliffsend. Full identification and quantification of the material by context is held in the project archive.

Three fired clay objects were recovered from Ebbsfleet: one loom-weight fragment; one spindle-whorl and one small fragment of a perforated object. The loom-weight fragment, recovered from Gully 1009 is in a fine slightly micaceous, sandy fabric. Half of one oblique perforation, measuring 12 mm. in diameter, and one outer surface survive; the original form is likely to have been triangular, with perforations through one, two or all three corners. Triangular loom-weights are found in southern England from the Early Iron Age through to the Roman period; on the basis of associated pottery this fragment is assigned an Early-Mid Iron Age date. This part of the site also produced a small fragment of a perforated object with an unknown original form and function, found within spread 1008. The fragment is in a slightly micaceous, sparsely flint-gritted fabric. It has a surviving finger impressed outer edge, one third of a circular perforation and is 12 mm. thick. Again, the associated pottery would suggest an Early-Mid Iron Age date.

One complete bun-shaped spindle-whorl was recovered from the Ditch 1016. It is in a micaceous fine sandy fabric, bun-shaped with concentric wheel-made grooves around the outer surface, measures 37 mm. in diameter and has a central perforation (10 mm. in diameter). The ubiquitous spindle-whorl occurs in southern Britain from the Iron Age period and continues into later Romano-British and medieval

periods. Although not closely datable on morphological grounds this example is likely to be of medieval period on the basis of associated thirteenth/fourteenth-century pottery.

Apart from these objects the bulk of the fired clay assemblage from Ebbsfleet consisted of small featureless fragments (156 in total; 1279 g). These are probably structural in origin, from wattle-and-daub structures or from hearth linings. A further twelve pieces (337 g) were identified as daub fragments with traces of wattle impression surviving. The largest concentration of fired clay and daub fragments came from spread 1008, associated with structural remains in this area. The remaining fragments occurred in small quantities dispersed in various Iron Age features.

Most of the 16 pieces of ceramic building material from Ebbsfleet are small tile fragments; five fragments are small and featureless and cannot be assigned to specific forms. The fragments were dispersed in small quantities. The bulk of the fragments have been attributed to the post-medieval period on the basis of fabric type, manufacture and associated pottery.

TIMBER OBJECTS

Lorraine Mepham

Timber objects were recovered from three locations: stakes from Stonar; one large stake and worked fragments from Guilford Road; and one worked fragment from near The Monks' Wall.

Four stakes were recovered from Stonar (Obj. nos. 101, 102, 103, 104), out of an original total of 12 observed during trenching. Most were observed *in situ* and have been interpreted as the remains of post-medieval waterfront piles. All were of similar form, roundwood timbers ranging in surviving length from 0.88 m. to 1.39 m., with diameters of 0.05 m. to 0.07 m., and had been worked from between 0.25 m. to 0.40 m. at one end to pencil points, each with four relatively regular, flat facets giving a square section at the point. Lateral twigs had been roughly trimmed. All four stakes had suffered some damage, ranging from slight abrasion to severe abrasion and splitting; the tops had rotted in each case. All four stakes were identified as oak (see Gale, below). Radio-carbon dating of two of the stakes produced post-medieval dates (see Appendix 1 for details). Photographic records, together with notes and sketches, may be found in the archive, but the timbers themselves have not been retained.

One very large stake (Obj. no. 131) was recovered from the Guilford Road/North Stream crossing; this was one of four stakes observed *in*

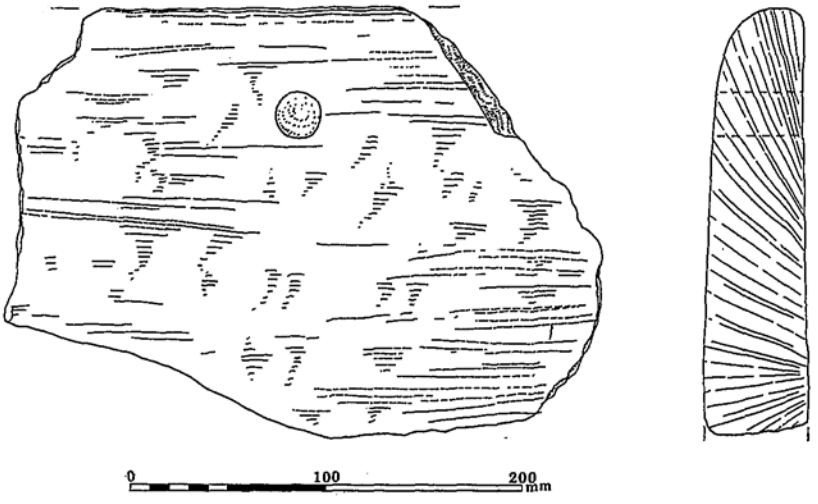

Fig. 18. Timber object from Guilford Road

situ during trenching across the Guilford Road, which may have formed part of a medieval causeway. This was an oak roundwood timber, slightly twisted and irregular, with a surviving length of 2.35 m. and a diameter of 0.27 m. The bottom had been worked to a pencil point, with three, possibly four flat facets giving a roughly rectangular section at the point. Lateral branches and twigs had been roughly trimmed and the top was abraded and rotted. A sample of this timber has been retained, and photographic records and notes are held in the archive.

From roughly the same location came five fragments of worked timber (Obj. nos. 132–136; Fig. 18), all of similar form and almost certainly deriving from the same object, although none could be fitted together. Each fragment is flattish and roughly rectangular (maximum surviving dimensions 0.31 m. by 0.20 m.), with one rounded edge. Thicknesses are fairly constant, ranging from 35 mm. to 50 mm. No definite tool-marks are visible, but the fragments have obviously been fairly carefully shaped. In each case, the rays of the wood reveal that these are transverse sections, the rays running obliquely to the flat surfaces. One piece (Obj. no. 134) has a shallow notch on the rounded upper edge, which may be deliberate or may merely represent post-depositional damage. Another fragment (Obj. no. 135) has a rounded peg-hole just below the rounded upper edge, with a wooden peg still *in situ* – Fig. 18. All timbers have been identified as beech (see Gale, below).

The original object from which these worked pieces derived is not clear and several different interpretations can be put forward. The proximity of the find to the 'dugout canoe' found in 1936 is notable and perhaps significant. The pieces from Guilford Road may well derive from a log-boat; groups of such finds have been recorded (D. Goodburn, *pers. comm.*). The timber itself is another attribute to consider in discussing function. Beech is documented as a timber for dugouts in Denmark and north Germany but not (yet) in Britain where 98 per cent are of oak, the remaining 2 per cent being of ash and pine (D. Goodburn, *pers comm.*). It could, therefore, be argued that the timber weighs against the argument for the object being a dugout. Alternative suggestions are that the fragments derive from a culvert, drain, trough, millshoot or boat (D. Goodburn, *pers. comm.*). These are all feasible, although it is considered unlikely that the fragments represent an *in situ* culvert or drain of some sort, associated with the causeway since this would imply a rather elaborate structure. Overall, the matter is irresolvable. One sample, submitted for radio-carbon dating (Object no. 135), produced a date-range of A.D. 970–1160 (see Appendix 1). Some of the fragments have been retained for conservation.

Finally, two squared timbers were observed in alluvial deposits during pipe-laying near the Monks' Wall of which one, the smaller of the two, was retained (Obj. no. 105). The latter object is a short section of a squared timber with a rectangular section, rather worn all over and broken at both ends. The wood species has been identified as alder (see Gale, below). This object has now been discarded, but a photographic record with notes is held in the project archive.

HUMAN BONE

Jacqueline I. McKinley

Bone from six contexts was analysed: three from the Roman grave 100 (context 101) and associated features (Pit 102, context 103; pit 104, context 105) at Cliffsend; two from ditch sequence 4 on Chalk Hill (Ditch 4a, context 8; Ditch 4b, context 15); and one from the undated grave 106 at Chalk Hill (context 111). Age was assessed from the stage of tooth development and eruption (Van Beek 1983), ossification/epiphyseal bone fusion (Gray 1977, McMinn and Hutchings 1985), tooth wear patterns (Brothwell 1972), and the general degree of cranial suture fusion and degenerative changes to the bone. Sex was assessed from the sexually dimorphic traits of the skeleton (Bass 1987). Platycnemic index was calculated (*ibid.*). Pathological

TABLE 2: SUMMARY OF HUMAN BONE

context/feature	recovery	skeletal elements	age	sex	pathology
8/15 – Ditch 4a/b	<1%	axial	mature adult	?	Schmorl's node – T; o.a. – costo-vertebral
101 – Grave 100	*c.* 4%	axial upper limb lower limb	older mature/older adult	?	o.a. – costo-vertebral, T; fracture – 1.11th rib; o.p. – T, p.ulnae; exo. – l.d. humerus; pitting – p.radius
103 – Pit 102	*c.* 3%	lower limb	adult	?	exo. – tibia shaft
105 – Pit 104	*c.* 1%	skull lower limb	adult (?s)	?	
111 – Grave 106	*c.* 1%	skull axial lower limb	1? adult ?2) juvenile/subadult	?	

KEY TO PATHOLOGY: o.p. – osteophytes; o.a. – osteoarthritis; exo. – exostoses; p. – proximal; d. – distal; r. – right; l. – left; T – thoracic.

KEY TO AGE CATEGORIES USED – juvenile 6–12 years; subadult 13–18 years; adult 18 years +; mature adult 26–45 years; older adult 45 years +

lesions and morphological variations/non-metric traits were recorded, and diagnoses suggested where appropriate. The archive report includes Skeleton Record Sheets showing skeletal elements recovered, measurements taken and text descriptions of morphology and pathological lesions. The results are summarised on Table 2.

Cliffsend

Most of the bone from context 101 (Grave 100) was in good condition, though there were several fragments of lower limb bone which were heavily eroded and root marked. The bone from contexts 103 and 105 was slightly worn and root marked, that from 103 showing fresh breaks with no adjoining fragments suggesting that more bone was present in the context than was collected. The bone from these three contexts may all have originated from one burial (i.e. Grave 100). The grave was cut, apparently at the distal end, by Pit 102. It is probably significant that the bone from 103 and most of that from 105 represents lower limb fragments. It may also be significant that the bone from these two

contexts was worn and root marked, as were the fragments of lower limb bone from 101, whilst the rest of the bone from 101, presumably that which remained *in situ*, was in fairly good condition. The small fragment of vault from 105 may represent a second individual, the bone being somewhat too small and gracile to correspond with the rest of the skeletal elements.

Pathological lesions noted in bone from 101 and 103 were mostly indicative of degenerative joint disease, the poor level of recovery and condition of the bone precluding further comment. A well-healed fracture was noted in the lateral portion of the left 11th rib shaft in 101. Such fractures are most commonly the result of a fall against a hard object or a direct blow (Adams 1987).

Chalk Hill

The bone from context 111 (Grave 106) was in very poor condition, being heavily root marked, worn and fragmented. The bone represents the remains of an adult, a second, possibly younger, individual probably being indicated by an unworn maxillary molar and duplicate femur fragment.

The bone from the two contexts infilling adjoining Ditches 4a and 4b comprises a vertebra from each. These bones are clearly redeposited and probably represent the same individual. Pathological lesions were noted on the vertebrae indicative of degenerative joint disease.

POLLEN ANALYSIS FROM THE WANTSUM CHANNEL

R.G. Scaife

The evaluation auger survey at Weatherlees Hill WTW and a preliminary assessment of potential (Scaife 1994) indicated pollen preservation in the cores obtained from the marine/estuarine sediments filling the Wantsum Channel. There is a paucity of pollen data available from Kent as a whole (Sheldon 1982) and particularly from the east Kent fens, from which vegetation and environmental history could be constructed. This is somewhat surprising, given the extent of sedimentation in this region and is unfortunate in terms of our understanding of the archaeology and environment. The only available data which exist for the region come from the Little Stour at Wingham, and Frogholt near Folkestone (Godwin 1962) and more recent work at Hacklinge, Marsh Lane and Sandfield Farm in the east Kent fens by Long (1991; 1992). These latter contributions provide useful information on the vegetation of the middle Holocene and are related to

changing sea-levels of this period. Other regional data relevant to this present study are those of Devoy in the Thames estuary (Devoy 1979, 1980), East Sussex (Waller 1993, 1994; Smythe and Jennings 1988; Scaife and Burrin 1992; Tooley and Switsur 1988; Long and Innes 1993 in press) and at East End Ash on the southern edge of the east Kent fens (Scaife unpublished). Late-Devensian and early Holocene material from the Channel Tunnel excavations to the south at Folkestone give evidence for early Holocene environmental change (Kerney *et al.* 1980).

Because of the proximity of occupation remains on the Ebbsfleet peninsula, and the available sediment archive in the Wantsum Channel from which an environmental record might be obtained, pollen examination was undertaken and a pollen sequence produced. This contribution discusses the data obtained and provides an insight into the local vegetation of the east Kent fens during the late prehistoric to early historic period. Radiocarbon dating of the basal organic horizon has produced dates 4640 ± 60 BP (GU–4363) and 4630 ± 70 BP (GU–4367) – see Appendix 1. Discussion of the radiocarbon dates and the implications for relative sea-level movements is provided below (Long and Scaife). Because of the mineral character of the marine sediments throughout most of the profile, it was not possible to date, radiometrically, the upper levels of the pollen profile. The likely date for the upper part of the profile is attributed, on the basis of ordnance datum heights, to the Romano-British or early medieval period, prior to reclamation of this area. The Holocene sea-level record from the later prehistoric onwards in this region in uncertain.

Methodology and techniques

Samples for pollen and diatom analysis were obtained using a standard 500 mm. chamber, Russian/Jowsey corer. The upper 1.20 m. of dry sediment (under agricultural pasture) was removed by mechanical excavator before coring. Although sampled, these upper sediments (marine) were above the water-table, oxidised and not suitable for pollen analysis. Two cores were obtained and the one possessing a basal organic unit was selected for detailed analysis (see Fig. 7). A sampling interval of 20 mm. in the basal organic deposit, 40 mm. in the lower profile and 80 mm. for the upper section was adopted (the latter at this interval because of poorer pollen preservation). Pollen was extracted using standard procedures (Moore *et al.* 1991) but because of the predominantly mineral nature of the sediment, micromesh sieving (10μ) was also used for removal of the clay fraction. Pollen was identified at magnifications of X400 and X1000 in bright field and phase contrast. A standard pollen sum of 300 total land pollen (TLP)

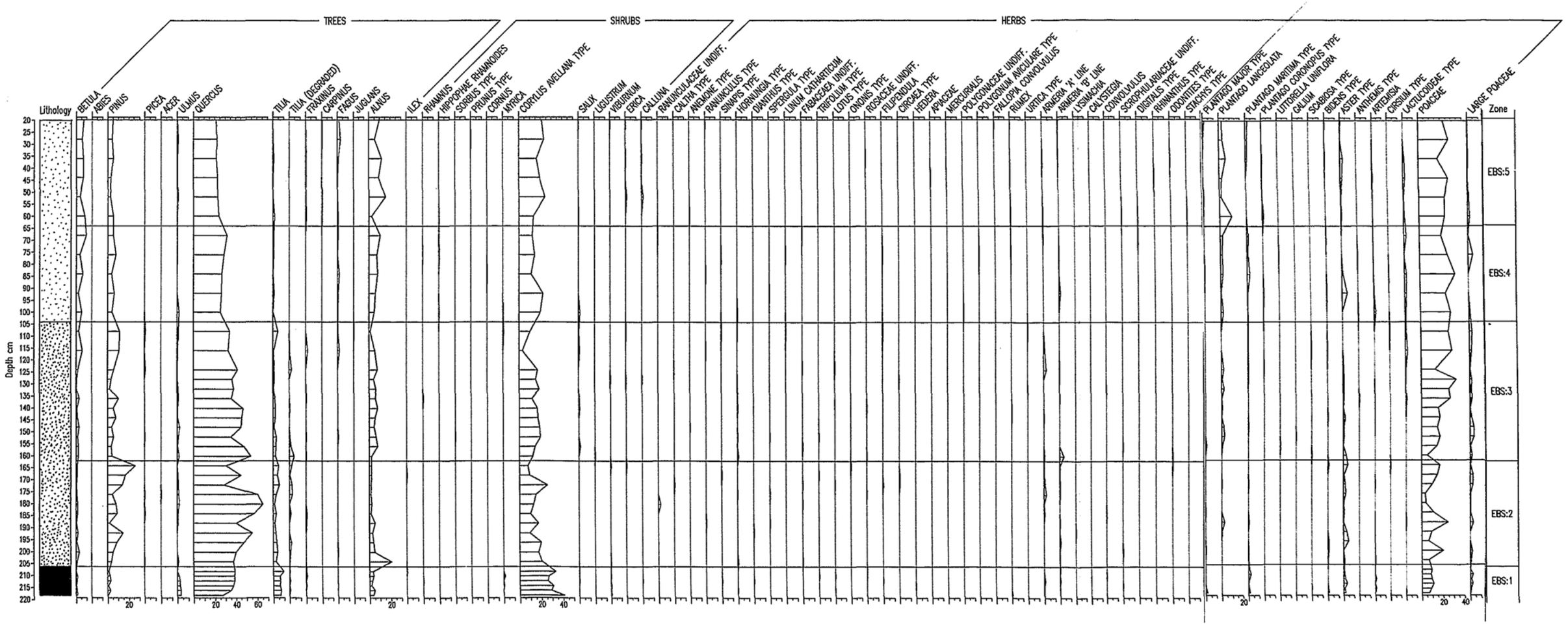

Fig. 19a. Wantsum Channel – Percentage pollen diagram

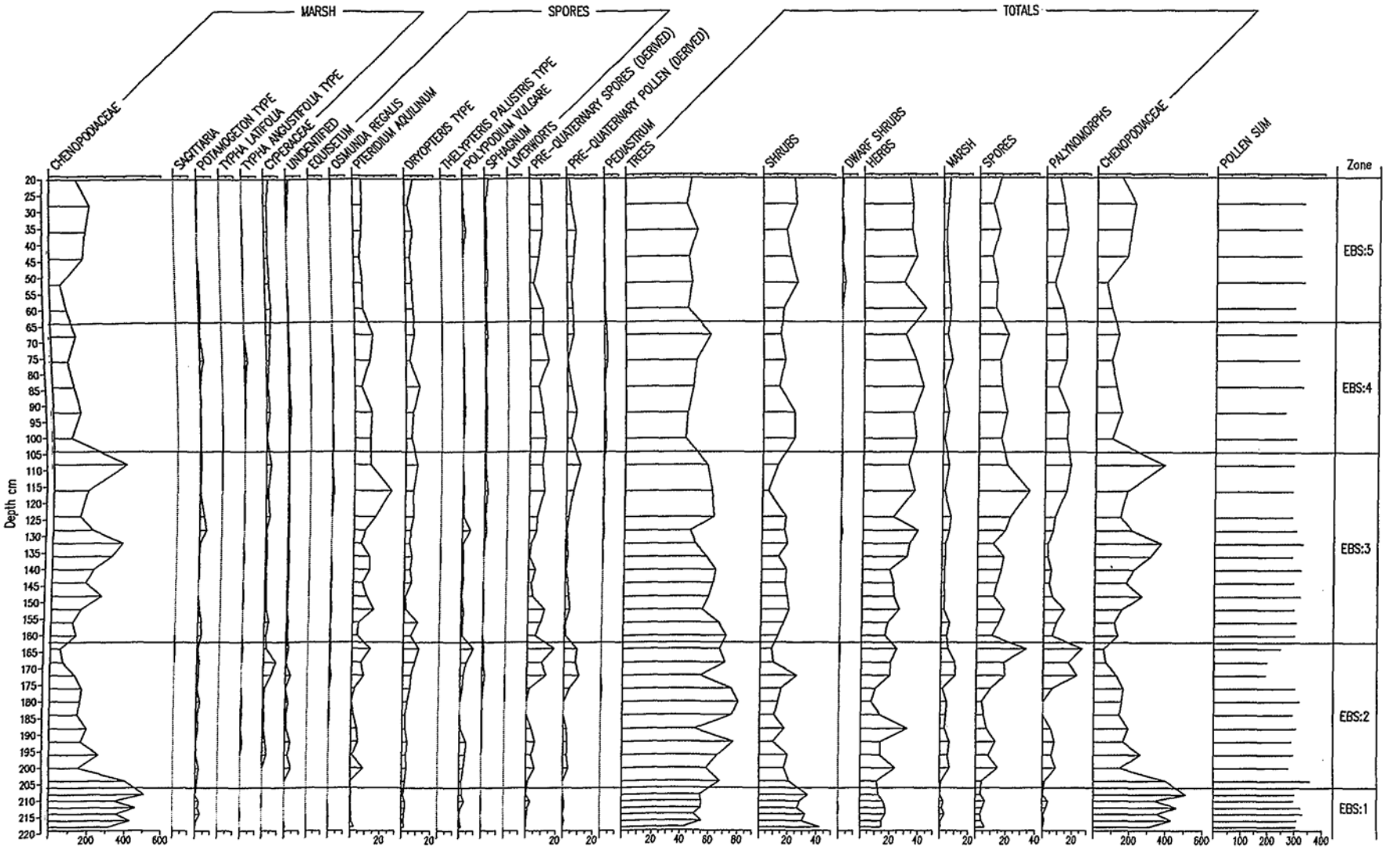

Fig. 19b. Wantsum Channel – Percentage pollen diagram

was counted. This excluded spores, pre-Quaternary palynomorphs, aquatic and autochthonous Chenopodiaceae. Total numbers of pollen grains counted usually attained 700–900 grains. These data are presented in pollen diagram form (Fig. 19) with TLP pollen calculated as a percentage of their total and other sums as a percentage of the sum of TLP. Nomenclature follows that of Stace (1991).

Results

Five pollen assemblage zones (paz, numbered EBS:1 to EBS:5) have been recognised in the 2200 mm. of sediment analysed. These zones are characterised below from base (EBS:1) to top (EBS:5). The depths of deposits and pollen zones within the pollen sequence relative to pre-existing ground levels and Ordnance Datum may be summarised as: (see also Fig. 7)

Pollen Assemblage Zone (paz)	Depths within Pollen sequence	Thickness of deposit	Depths m OD (pre-existing ground surface at + 1.80 m OD)
–	n/a (above)	1200 mm.	+ 1.80 m. to + 0.6 m. O.D. (removed by machine)
–	n/a (above)	20 cm.	+ 0.60 m. to + 0.40 m. O.D. (upper level of pollen sequence)
EBS:5	20–64 cm.	44 cm.	+ 0.4 m. to – 0.04 m. O.D.
EBS:4	64–104 cm.	40 cm.	– 0.04 m. to – 0.44 m. O.D.
EBS:3	104–162 cm.	58 cm.	– 0.44 m. to – 1.02 m. O.D.
EBS:2	162–206 cm.	44 cm.	– 1.02 m. to – 1.46 m. O.D.
EBS:1	206–218 mm.	12 cm.	– 1.46 m. to – 1.58 m. O.D. (base)

paz EBS:1 218–206 cm. Basal organic/peaty silt and clay. This zone is dominated by *Quercus* (to 40 per cent), *Corylus avellana type* (to 42 per cent) but is characterised by higher values of *Ulmus* (to 5 per cent) and *Tilia* (to 10 per cent). There are also sporadic records of *Betula, Pinus, Fraxinus* and *Fagus*. Shrubs in addition to *Corylus avellana* type include *Myrica, Salix* and *Viburnum*. Herbs are dominated by Chenopodiaceae (to 500 per cent of TLP) and Poaceae (10–12 per cent). A range of other herbs includes halophytic *Armeria* 'A' line and 'B' line and *Plantago maritima* type.

paz EBS:2 206–162 cm. Changing stratigraphy to grey marine/saltmarsh sediments. *Quercus* (to 66 per cent) and *Corylus avellana* type (to 30 per cent) remain dominant. The zone is delimited

by reduced *Tilia* and *Ulmus* values whilst *Pinus* values expand (to 25 per cent). *Alnus* has slightly higher percentages (5 per cent) in the lower half of this zone declining to <5 per cent. In the top of the zone, degraded *Tilia* becomes more frequent. Herbs remain dominated by Chenopodiaceae (to 300 per cent TLP+Chenopodiaceae) but with values less than in paz EBS:1. Fluctuating Poaceae values are slightly higher than in the preceding zone. Halophytes remain with Chenopodiaceae, *Armeria* 'A' and 'B' line types, *Aster* type but with fewer *Plantago maritima* type. Freshwater marsh and aquatic types expand with *Potamogeton* type, *Typha angustifolia/Sparganium* and especially Cyperaceae (to 10 per cent). Spores similarly show a substantial increase with values of *Pteridium aquilinum, Polypodium* and pre-Quaternary palynomorphs becoming important. Note also *Osmunda regalis* and *Sphagnum* which become more important.

paz EBS:3 162–104 cm. *Quercus* (to 48 per cent) and *Corylus avellana* type (to 120 per cent) remain dominant. *Tilia* declines further (to <5 per cent). *Pinus* also shows some reduction with average values of *c.* 10 per cent. *Alnus* expands to 10 per cent with greater numbers of *Salix. Ulmus, Fraxinus,* and *Betula* occur sporadically. Of note is a single record of *Juglans regia* at 108 cm. Chenopodiaceae (to 400 per cent) are similar to values noted in paz EBS:1 and Poaceae similarly show some expansion. Whilst the halophytic and freshwater marsh elements remain, there is a clear expansion of *Plantago lanceolata* (to 5 per cent) and Lactucoideae (to 4 per cent) and large Poaceae (cereal types). Spores of ferns remain similar with some expansion of *Pteridium aquilinum* (to 27 per cent at 118 cm.).

paz EBS:4 104–64 cm. Charactised by further increases in anthropogenic indicators (*Plantago lanceolata*, Lactucoideae, *Artemisia, Rumex*) and an overall increase in the diversity of herb taxa. In the AP and shrub categories, *Quercus* (to 30 per cent) and *Corylus avellana* type (to 20 per cent) remain dominant. *Juglans* (recorded in earlier assessment at 84 cm.), *Fagus, Betula* (to 10 per cent) and *Hippophae rhamnoides* are noted. Of the herbs, Poaceae and Chenopodiaceae remain important. Halophytic taxa continue upwards with *Armeria* 'A' and 'B' line, dominant Chenopodiaceae, *Aster* type and *Plantago maritima.* Spores types remain unchanged. *Pediastrum* freshwater algal cysts are present in low but consistent values from this zone.

paz EBS:5 64–20 cm. This upper zone is delimited by the slight but significant increase in secondary woodland elements including *Fagus, Fraxinus, Carpinus* and dwarf shrubs, *Calluna* and *Erica* and an expansion of *Plantago lanceolata. Quercus* and *Corylus avellana* type remain dominant in the AP category and Chenopodiaceae and Poaceae in the herbs. Halophytic elements are present to the top of the profile.

Discussion of vegetation and change

Although salt-marsh communities are often recorded in pollen diagrams, it is rare on the basis of pollen data alone, to identify pollen assemblages peculiar to upper, mid or low salt-marsh environments. In this study, however, the absence of substantial thicknesses of organic sediment has necessitated the analysis of predominantly inorganic deposits. As a result, the identification of sub-environments within the salt-marsh and mud-flat continuum is of some importance. This is attempted here by reference to certain salt-marsh pollen types indicative of differing marsh habitats, the relative abundance of pollen derived from extra local sources as well as the organic composition of the sediments themselves. It should be stressed that because of the paucity of contemporaneous pollen data from inter-tidal environments, the identification of such sub-environments should be treated with caution.

The basal pollen zone paz EBS:1 comprises organic sediments resting on the Tertiary Thanet Beds. This deposit appears to have formed under the influence of a rising water-table caused by positive sea-level tendency. This resulted in water-logging and conditions suited to organic accumulation. It is clear from the high values of Chenopodiaceae to the bottom of the profile that there were direct marine influences providing habitats for development of halophytic vegetation communities which also included *Armeria* 'A' and 'B' line (*Armeria* and *Limonium*), *Plantago maritima* and possibly *Aster (Aster tripolium). Potamogeton* may also include *Triglochin maritima.* Chenopodiaceae comprise *Atriplex* spp., *Chenopodium* spp. and *Salicornia* spp. Unfortunately, it is not possible to separate these pollen taxa and no macro-fossil evidence (seeds) was found to clarify these types. However, the high turfa/peat character suggests that these may be *Chenopodium* types of the upper salt marsh zone rather than *Salicornia* types, which are more typical of the lower, muddy salt-marsh zone. The latter are perhaps more important in subsequent zones.

This basal pollen zone provides a clear indication of evidence of the dry land vegetation prior to marine inundation. It is proposed that this represents the local vegetation of the Middle to Late Bronze Age. Unlike subsequent pollen zones in salt-marsh sediments, there is the greater likelihood of pollen incorporation via airborne pollen rain from the near region. This is evidenced by the range of tree and shrub types recorded. *Tilia*, although only present to 10 per cent TLP, nevertheless indicates the importance of lime on better drained soils. The widespread importance of lime woodland until well into the late prehistoric period is now widely recognised for southern England (Moore 1977; Greig 1982; Scaife 1980, 1987; Waller 1993, 1994). Its demise during the later prehistoric period occurred asynchronously and

hence it is not clear whether there had been an earlier decline from such high values as 20 per cent TLP recorded from East End Ash (Scaife unpublished) at an earlier date shown by Waller (1994) in East Sussex at *c.* 3700 BP. Overall, the range of tree taxa present shows a diversely wooded landscape dominated by oak and hazel woodland but with elements of lime, ash and elm with lower trees and shrubs including *Viburnum, Rhamnus* and *Betula*. In terms of human interference and activity, small numbers of large Poaceae may be attributed to cereals. However, certain pollen of halophytic grasses have similar size and morphology and thus arable activity cannot be confirmed for this period since there are no other diagnostic segetal indicators present.

With increasing sea-levels, this landscape was progressively inundated. This had the two-fold effect of (i) increasing the distance between the dry land and the core site and (ii) creating extensive areas of salt-marsh. This environmental change may have significantly influenced the environment of prehistoric and early historic occupation through changing patterns of riverine communication.

In paz EBS:2 the change in stratigraphy from the organic basal unit (*turfa herbaceae*) to the grey homogeneous marine sediments is reflected in the changing pollen flora and the taphonomy of the pollen assemblages. Expansion of pre-Quaternary pollen and spores (palynomorphs) and of Holocene ferns, *Pteridium, Polypodium* and *Dryopteris* type reflect the typical over-representation of these taxa in fluvially derived sediments (Peck 1973). This implies that there has been erosion and transport of soils from the surrounding landscape and further up the Wantsum catchment. Marine influence may also have carried and redeposited pollen elements from adjacent river systems discharging into the near coastal zone. This effect is also strongly evidenced from the increasing numbers of degraded and probably reworked *Tilia* grains noted in this and the subsequent pollen zone (EBS:3). However, in spite of these taphonomic problems, it is apparent that we are, in paz EBS:2, seeing evidence both for the autochthonous vegetation, in this case probably middle salt-marsh and the terrestrial environment of the local region. In the former, the level of Chenopodiaceae noted in paz EBS:1 is reduced in paz EBS:2 and this is attributed to a change of the zonal marsh vegetation from upper to middle salt-marsh, that is, away from those elements such as *Salicornia* which can contribute markedly to these pollen spectra. The consistent presence of *Armeria* 'A' and 'B' line implies the importance of *Armeria* and/or *Limonium* in the salt-marsh flora because of the small pollen productivity of these genera. *Aster* pollen may also be an important element of this halophytic community and although from its pollen morphology it is not possible to separate to lower taxonomic level, it is likely that we are here

dealing with *Aster tripolium*, a common constituent of middle salt-marsh.

The terrestrial vegetation portrayed in paz EBS:2 poses a number of interpretative problems. In addition to the importance of *Quercus* and *Corylus avellana* woodland, which must have been the dominant primary elements of the catchment, the consistently high values of *Pinus* are interesting. Whilst consistently small percentages of pine are normal in middle and late Holocene assemblages and reflect long distance anemophilous dispersal, the values noted here appear to be above this general level. The numbers found suggest that an alternative explanation is required. Over-representation of pine in marine sediments is widely known and, given the marine/salt-marsh origin of the sediments here, this is the likely cause and thus the pollen is derived from extra regional sources. Interestingly, Godwin (1962) at Wingham similarly shows important pine values. This site was not, however, under marine influence although Godwin postulated that rising base levels may have been responsible for this organic accumulation at this site. The pine was attributed by Godwin to growth on the poorer sandy soils of the Weald. Given our more detailed knowledge of vegetation history of south and south-east England, the possibility of middle and later Holocene pine growth has also been suggested for other regions having poor, sandy soils, such as the areas of Tertiary sands in the Hampshire Basin (Haskins 1978; Scaife 1980, 1991; Scaife and Macphail 1983). The pollen evidence along with charcoal evidence in Sussex and the Wessex region (Allen 1994; Allen and Scaife in prep.) is increasingly suggestive of local growth of small, isolated stands of pine remaining in suitable ecological niches in southern England.

A second aspect is that of *Tilia* which, as noted in paz EBS:1, was probably an important element of the middle to later Holocene woodland. The decline of *Tilia* percentages at 205 cm. (the lower boundary of paz EBS:2) is unlikely to be the traditional *Tilia* decline caused by anthropogenic deforestation for agriculture (Turner 1962). Such reduction in *Tilia* woodland was not synchronous, as suggested by Godwin (1940, 1956) as being caused by climatic change, but reflects varying degrees of human pressure on the environment. Although data from a range of sites place the decline as early as the later Neolithic (Scaife 1980) or as late as the Saxon period (Baker *et al.* 1978) the majority of dates seem to be of late Bronze Age and may reflect the substantial changes in land allotment and social changes of that period. Whilst the suggested date of this zone (Middle to Late Bronze Age) is commensurate with this period of increased land pressure, the marine inundation increased the distance of the sample site from dry land. As shown by Waller (1994), this may similarly give an apparent decline

and this cause is invoked here. This factor, coupled with the small pollen productivity and dispersion of *Tilia*, suggests that lime remained an important constituent of the local woodland at this site in paz EBS:1 and EBS:2. The occurrences of *Fraxinus, Fagus, Acer*, and *Ulmus*, also with small pollen production and limited dispersion, may imply a diverse range of woodland types in the region.

In paz EBS:3, the further reduction in *Tilia* and the increasing importance of agricultural weeds, including *Plantago lanceolata*, Asteraceae taxa and *Pteridium* plus cereal pollen, perhaps reflect true clearance of woodland for agriculture. However, the reduction in *Tilia* may be a statistical function of the expansion of other taxa within the pollen sum (e.g. *Alnus, Plantago* and Poaceae). It seems likely that we are here dealing with increased anthropogenic activity. Although radiocarbon dating was not possible for these mineral sediments, the O.D. heights relative to known past sea-levels (Long 1991; see Long and Scaife below) suggest an Iron Age date. This is commensurate with the record of *Juglans* above at 108 cm., and also recorded at 84 cm. in the pollen assessment study, which, as a Roman introduction, may provide a useful dating point (see below). Although woodland clearance is suggested for this period, *Quercus* and *Corylus* dominated woodland apparently remained, but within an agricultural environment of arable and pastoral activity (*cf.* Poaceae and associated herbs).

Alnus and *Salix*, as noted above, are more important than in the preceding pollen zone. The values remain relatively small and are not suggestive of local growth of alder-willow carr woodland. It is most likely that the pollen reflects alnetum communities growing in river valleys furthur up the river catchment and associated tributaries. Along with marsh fen taxa (*Typha/Sparganium*, Cyperaceae *Potamogeton*), these pollen have been fluvially transported (along with other terrestrial elements noted) and deposited in the estuarine zone.

Juglans at 108 cm. and in the assessment study at 84 cm. may provide a useful age indication for these levels. Whilst the possibility of long-distance transport must be considered, it is generally accepted that walnut was a Roman introduction into Britain and Europe as a whole. This, therefore, suggests an earliest date of Romano-British period at top of paz EBS:3. This period is also associated with changes in woodland type and structure with some reduction of *Quercus*, but with expansion of *Corylus, Fraxinus, Fagus* and *Carpinus. Fraxinus* and *Fagus* are largely under-represented in pollen spectra due to entomophily and relatively high specific gravity, respectively. Thus, their real importance may have been substantial in the terrestrial environment. As noted above, because of the taphonomic problems, it is not possible to specify whether transport was by normal airborne means or via fluvial transport from the Ebbsfleet catchment. Dating has

not been possible, but in paz EBS:5 these taxa reflect an expansion of secondary woodland elements which may relate to further human activity and some remains of the oak/hazel and lime woodland. Certainly in this zone (EBS:5), there is a substantial expansion of *Plantago lanceolata*. This zone may be attributed to the post-Roman period or Saxon expansion of woodland.

Discussion

In the absence of deep peat and/or freshwater lake sediments normally used for pollen analysis, the marine sediments filling the Wantsum Channel were considered as a possible source of micro-fossil (pollen and diatoms) data. Although rarely used for pollen analysis, the sampling of these marine, inorganic sediments was undertaken in spite of the possibility of problems involved with pollen taphonomy. This attempt has proved successful in producing a picture of the vegetation during the late prehistoric to late Romano-British and possibly Saxon periods. Because of the dating problems encountered with these largely inorganic sediments (excepting the basal units) comparison has been made with the few available pollen data from Wingham (Godwin 1962), East End, Ash (Scaife unpublished) and the sea-level change studies carried out in the east Kent fens (see Long and Scaife, below).

Godwin's (1962) sequence at Wingham near Canterbury and unpublished data from East End, Ash (Scaife unpublished) provide comparable information to that postulated here. Godwin's sequence yielded two radiocarbon dates of 3105 ± 110 BP (Q–110) and 2340 ± 130 BP (Q–106), thus providing evidence for local vegetation during the late prehistoric period. These sites typically show the importance of *Tilia* during the early part of the period in basal soils, but with marked decline taking place in this region during the Middle to Late Bronze Age. As noted above, the decline in *Tilia* may be attributed to woodland clearance. In the subsequent period all pollen data seem to show the importance and continuity of mixed oak and hazel woodland throughout the late prehistoric and early historic period. However, there is little doubt that from the Late Bronze Age there is evidence of deforestation and increased agricultural activity in the pollen records described by Godwin and in the spectra from the east Kent fens. This reflects the increasing human pressure/population numbers from the Middle to Late Bronze Age and possible agricultural reorganisation during the Late Bronze Age. Such environmental impact resulted in secondary woodland elements which include what now appears to be the increasing importance of ash, beech and possibly hornbeam in east Kent.

Rising sea-levels profoundly influenced the palaeogeography of the east Kent fens. There has been much interest in the palaeogeography of

the region in relation to the archaeological evidence and the changing marine/salt-marsh environment. Studies by Dowker (1900), Robinson and Cloet (1953), Evans (1953), Burchell (1957) and Halliwell and Parfitt (1985) all illustrate the significance of the coastal development to prehistoric and later activity ranging from salt production to the distribution of archaeological sites in relation to coastal development. Long (1992) has compared the record of vertical sea-level changes recorded in east Kent with that found in south-east England. During much of the mid-Holocene, east Kent and elsewhere in the region experienced a broadly similar pattern of long-term sea-level change. However, a chronology of sea-level tendencies (a positive tendency indicating an increase in the proximity of marine conditions and a negative tendency the reverse), has shown that coastal evolution varied considerably, despite the regional consistency in vertical changes in sea-level. This suggests that local processes strongly influenced patterns of coastal evolution. In the Wantsum Channel, such local processes would include development of coastal spits as well as reclamation of former salt-marshes in the Wantsum itself. In addition, changes in the course of the tidal channels occupying the former channel may also have caused local changes in the proximity of marine conditions which would be responsible for some of the observed changes in the pollen data described here. Changes in sediment supply to the Wantsum Channel system, perhaps encouraged by prehistoric activity within the catchment, may also have encouraged silting of the Wantsum and consequently changes in the proximity of marine conditions. In the pollen profile, there is no clear evidence for a negative sea-level tendency towards the top of the sediments analysed. Therefore, the uppermost part of the profile probably records local environments prior to the final phase of infilling and reclamation of the Wantsum Channel itself. Evidence for human activity in the study area may, therefore, be more apparent in the uppermost sediments, but the poor pollen preservation has hindered the detailed analysis of these sediments.

In terms of the detailed archaeological chronology and evidence from this region, the pollen data do not generally show phases such as the period of more intense occupation in the later Bronze Age. However, it can be broadly postulated that the expansion of human activity and the cereal/arable cultivation seen in paz EBS:3 and EBS:4 may relate to the more extensive occupation activity in the later Iron Age and Romano-British periods. It is apparent that woodland remained with some areas of secondary woodland expansion occurring in previously agriculturally abandoned areas. Exotic *Juglans* attests to this period along with increased cereal pollen and ruderal types. It is unfortunate that the sediments in the upper levels are degraded through

recent arable agriculture and drainage. This has negated any pollen evidence for the period of earlier medieval activity, that is immediately prior to reclamation of the local marshes. Evidence from charred cereal remains (Scaife, this report) from medieval (twelfth/thirteenth century A.D.) ditch fills shows clearly, however, that cultivation of wheat, barley and rye was being undertaken on the interfluves of the Wantsum Channel.

DIATOM ANALYSIS FROM THE WANTSUM CHANNEL

N. Cameron

Diatom analysis was carried out, alongside the pollen analysis to provide information on past environment and conditions, relevant for an understanding of the nature of human activity in the local areas (e.g. the Ebbsfleet peninsula). In particular it was hoped that diatom analysis would enable the dominant salinity regimes and depositional environments to be determined, including tidal inputs associated with the Wantsum Channel.

Methodology and techniques

Samples were taken directly from the pollen core and sample depths equate to those given in the pollen report. Diatom sample and slide preparation followed standard techniques (Battarbee 1986). Counting was carried out under magnifications of X1000 and X1250. Where necessary identifications were made with the aid of a range of diatom floras and taxonomic publications (Cleve-Euler 1951–1955; Hendey 1964; Hustedt 1930–1966; Werff and Huls 1957–1974).

A total of 38 samples was prepared for diatom analysis, of these 35 were suitable for diatom counting. Diatom preservation was adequate in most samples, but there was significant breakage and dissolution in all samples and low diatom concentrations and poor preservation in the basal organic horizon of the core. Diatom diversity and species richness was relatively low (87 taxa were recorded) when compared with many freshwater lacustrine diatom assemblages. Therefore, a strategy of counting fewer valves per sample, but increasing the number of samples analysed was adopted. In the upper part of the core a total of *c.* 170–220 valves per sample was counted. In the lower levels of the core the counting sum was reduced to *c.* 120–150 valves per sample and efforts were directed towards counting a greater number of samples (i.e. smaller sampling interval). At one level (172 cm.) valves were in exceptionally low concentrations and here a sum of only 77 valves was counted. Given the low species richness and the specific aims of the analysis the relatively low counting sum is adequate to determine

dominant taxonomic composition. Diatom counts were made at 8 cm. intervals from 40 cm. to 104 cm., and at 4 cm. intervals from 104 cm. to 212 cm. Although diatoms were not countable in the samples from 24 cm. and 32 cm., fragments of marine diatoms, particularly the coastal tychoplanktonic species *Paralia sulcata*, were seen in both. The data, slides and cleaned valve suspensions are available for examination at the Environmental Change Research Centre (ECRC), University College, London. Details of the data processing methods are held in the archive report.

Diatom species' salinity preferences were summarised using the halobian groups of Hustedt (1953, 1957: 199):

1. Polyhalobian: >30 g 1^{-1};
2. Mesohalobian: 0.2–30 g1^{-1};
3. Oligohalobian – Halophilous: optimum in slightly brackish water;
4. Oligohalobian – Indifferent: optimum in freshwater but tolerant of slightly brackish water;
5. Halophobous: exclusively freshwater;
6. Unknown: taxa of unknown salinity preference.

Diatom halobian groups are indicated above the percentage diatom diagram (Fig. 20) and these groups are the basis of the classification presented in the composite diatom diagram (Fig. 21). The principal source of data on species ecology used was Denys (1992).

The dendrogram produced from the cluster analysis (in archive) serves to confirm distinct changes seen in the composition of diatom assemblages. However, diatom assemblage zones derived either from this numerical zonation, or from qualitative zonation, have not been drawn on the diatom diagram. This is to avoid the possible confusion of having different zonation schemes derived both from pollen and diatom analyses. Diatom stratigraphy is, therefore, discussed with reference to the results of pollen analysis and the pollen assemblage zones derived from these analyses (Scaife above, paz EBS:1 to EBS:5).

Results (Figs. 20, 21)

The base of the core has high percentages of mesohalobous and halophilous diatom taxa present (>40 per cent). These brackish water and salt-marsh taxa include *Scoliopleura* spp., *Diploneis didyma,*

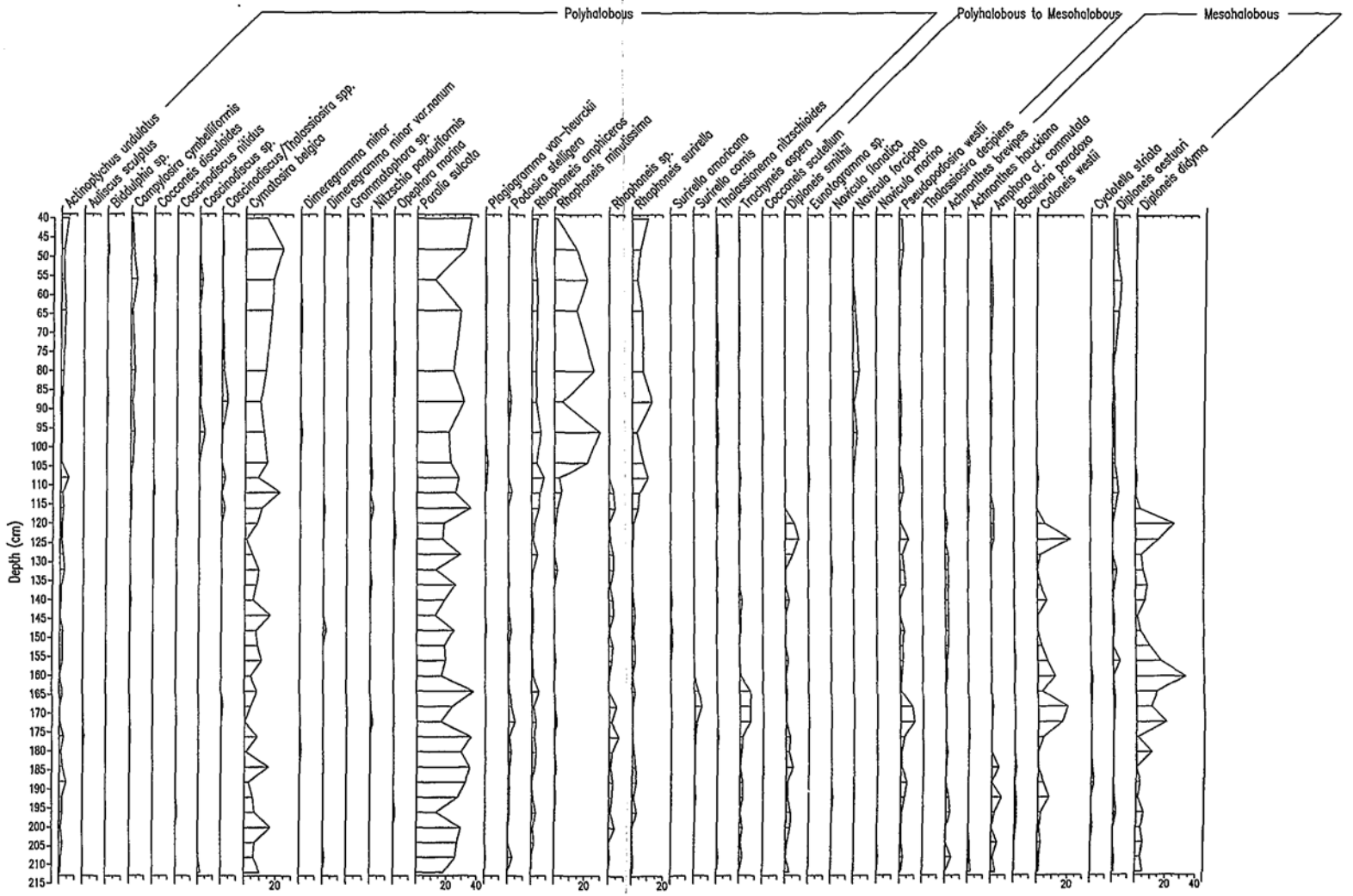

Fig. 20a. Wantsum Channel – Percentage diatom diagram

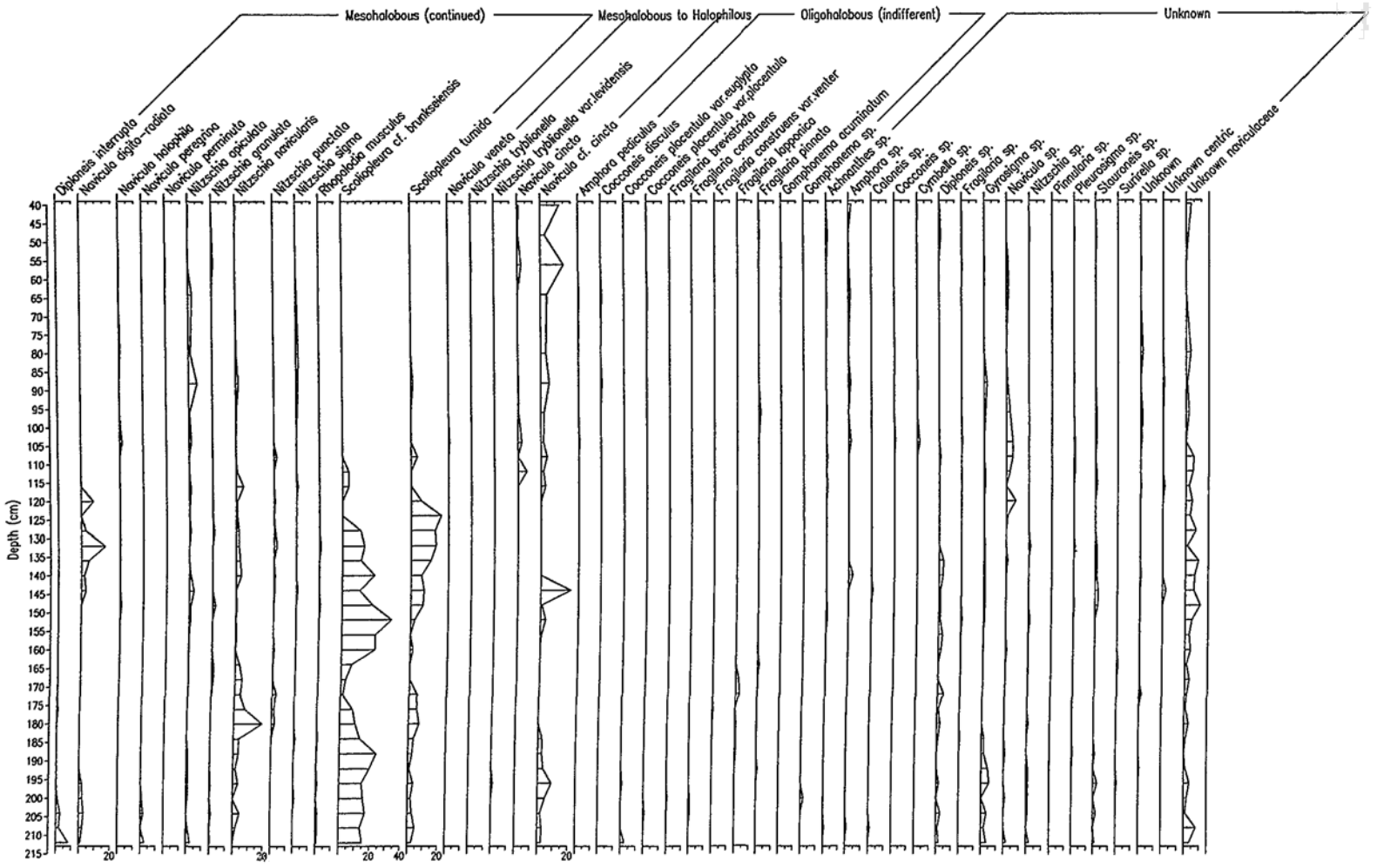

Fig. 20b. Wantsum Channel – Percentage diatom diagram

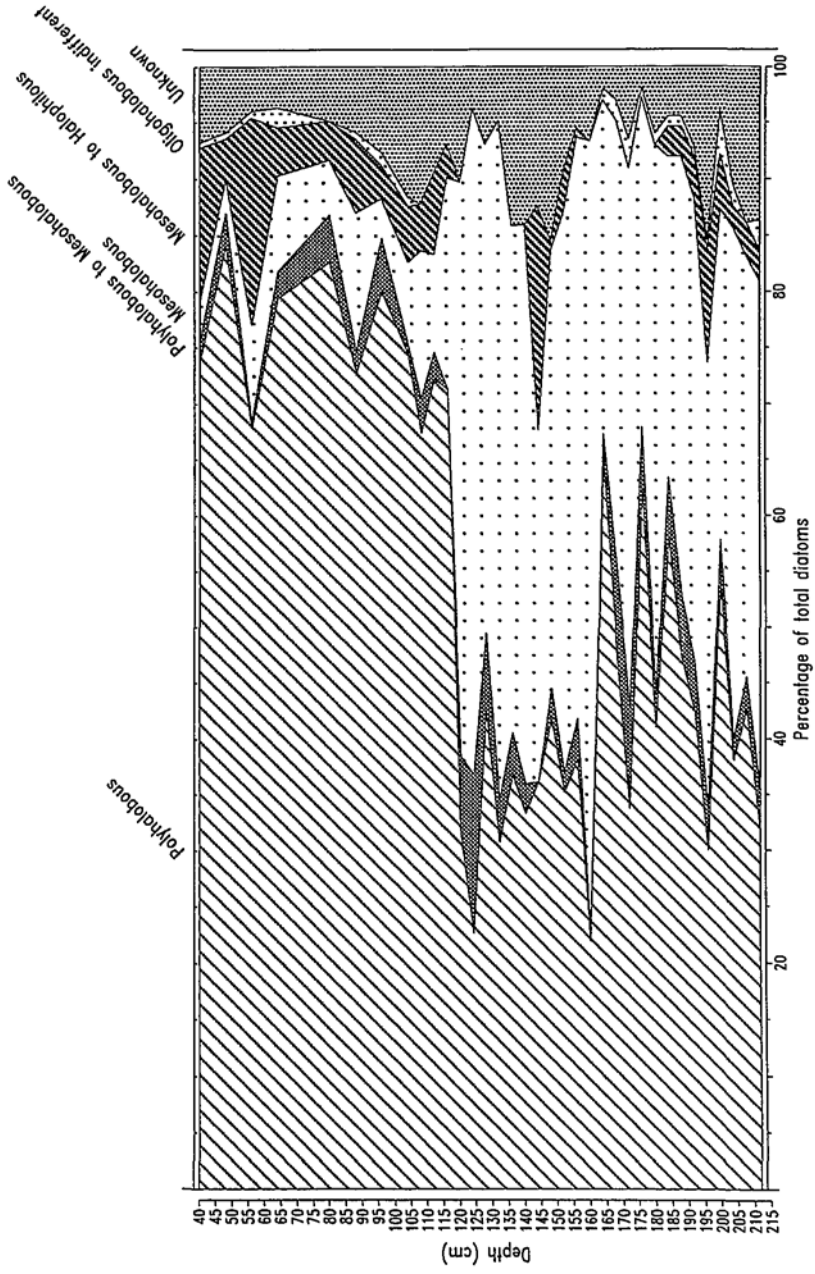

Fig. 21. Wantsum Channel – Diatom salinity classification (based on Hustedt 1953)

Navicula cf. *cincta* and *Nitzschia navicularis*. There is also a maximum of *Diploneis interrupta*, a species tolerant of aerial environments. The polyhalobous species *Paralia sulcata* and *Cymatosira belgica*, however, form a substantial component of the diatom assemblage.

Mesohalobous and halophilous diatoms remain dominant in the lower section of the core, up to a depth of about 120 cm., but there are fluctuations in individual species abundances, notably peaks in the percentages of both *Caloneis westii* and *Diploneis didyma* at *c.* 160–170 cm. and 120–124 cm. There are also associated peaks of *Nitzschia navicularis* at 180 cm. and *Scoliopleura tumida* at 180 cm. and 124 cm. Both *Navicula* cf. *cincta* and *Scoliopleura* cf. *brunkseiensis* reach maxima in the intervening levels, at *c.* 188–196 cm. and 144–152 cm. These fluctuations of brackish water taxa suggest variations in local conditions rather than factors such as lags in species colonisation or 'noise' as a result of the lower counting sum adopted. Without sampling living mud-flat and salt-marsh diatom assemblages in the locality such differences are difficult to interpret, but it seems reasonable to suppose that they are associated with various levels of salt-marsh to mud-flat development or erosion.

The most significant and clear change in the diatom diagram and also the strongest dissimilarity indicated by the cluster analysis are the division between the essentially brackish water assemblages of the lower section, below *c.* 120 cm., of the core to a flora which is almost entirely dominated by polyhalobous taxa, above *c.* 120 cm. Although there is a large component of polyhalobous, tychoplanktonic diatoms in the lower part of the core, these are allochthonous diatoms and the autochthonous flora is more likely to be represented by the benthic diatom taxa (Sherrod *et al.* 1989, Vos and de Wolf 1988, 1993). By contrast, in the upper section of the core there is only a small component (generally <10 per cent) of mesohalobous or halophilous diatoms (notably *Navicula* cf. *cincta*) and the planktonic species are interpreted as being representative of the autochthonous flora. This shift in species composition, occurring at around 120 cm. is indicative of a change from a (periodically tidal) salt-marsh in the earlier period, with greater abundances of benthic brackish water taxa, to a tidally dominated environment such as a mud-flat where marine tychoplankton is often the dominant component of diatom assemblages.

Comparison with pollen zonation

The diatom data provide a high degree of consistency with the pollen and lithological based zonation scheme (Scaife, above):

paz EBS:1 218–206 cm.: The diatom assemblages in the lower part of the core are compatible with the pollen-based interpretation of an upper salt-marsh environment. Diatom preservation was relatively poor

and robust, allochthonous, marine, tychoplanktonic species (*Cymatosira belgica* and *Paralia sulcata*) are over-represented. There are high abundances of raphid, autochthonous, mesohalobous taxa in this lower part of the core. In particular, *Diploneis interrupta*, an aerophilous as well as a brackish water species, reaches maximum abundances. Similarly the high abundances of *Scoliopleura* cf. *brunkseiensis* are consistent with an upper salt-marsh environment.

paz EBS:2 206–162 cm.: Diatom assemblages are consistent with the pollen-based environmental interpretation of a middle salt-marsh location, though the diatoms do show some variability within this pollen zone, and up to 120 cm. There are maxima in mesohalobous taxa such as *Diploneis didyma, Caloneis westii* and *Nitzschia navicularis*. There are also maxima in the polyhalobous to mesohalobous taxon *Psuedopodosira westii* and the benthic marine taxon *Trachyneis aspera. Scolioplera* cf. *brunkseiensis* declines in abundance. The variability in the dominance of mesohalobous and halophilous taxa may be related to variations in salinity regime and position on the salt-marsh overall or in local topography (upper, middle, lower, creek, surface) or mud-flat. As well as the mechanism of general relative sea-level increase processes such as seasonal or annual variation in diatom communities and channel migration would result in such variation in diatom assemblages.

paz EBS:3 162–104 cm., paz EBS:4 104–64 cm., paz EBS:5 64–20 cm.: The most significant diatom species shift occurs at about 120 cm.: its significance has been discussed above. Pollen analysis across this transition, despite its taphonomic problems reveals the increasingly marine nature of the depositional environment simultaneous with records of anthropogenic pollen types and disturbance derived from the locality.

Discussion and conclusions

Freshwater (oligohalobous indifferent) diatoms are rare or absent in most samples throughout the profile, reaching a maximum of less than 4 per cent in a single sample at 200 cm. Diatom inputs from freshwater sources such as streams or rivers are insignificant. In contrast marine tychoplanktonic species (e.g. *Cymatosira belgica, Paralia sulcata* and *Rhaphoneis* spp.) are dominant or common throughout the profile indicating the consistent tidal nature of the depositional environment, whether affected by each tide as on a mud-flat (cf. top of the core) or sporadic, as at the higher levels of an upper salt-marsh (cf. base of the core).

Species tolerant of tidal exposure and common on salt-marshes (e.g. *Diploneis interrupta, Amphora* cf. *commutata* and *Achnanthes brevipes*) have maximum abundances at the base of the core. The high allochthonous component of for example undifferentiated *Rhaponeis* sp. (composed of the two larger *Rhaphoneis* taxa *R. surirella* and *R.*

amphiceros) below 110 cm. is a qualitative reflection of the higher level of breakage of *Rhaphoneis* valves in the lower part of the core resulting from the tidal transport of valves. A significant change in diatom assemblages is seen at approximately 120 cm. with a general decline of the brackish water elements (e.g. *Caloneis westii, Diploneis didyma, Nitzschia navicularis* and *Scoliopleura* spp.). These species are replaced by marine taxa in the upper part of the core (*Rhaphoneis minutissima, R. surirella, Cymatosira belgica, Paralia sulcata*). There is, however, also an increase in the brackish water to salt-loving species *Navicula cincta* and *Navicula* cf. *cincta.* The identity of the latter is not certain, but it is almost certainly within the range of morphologies of *Navicula cincta* and has, therefore, been given the same halobian classification as this cosmopolitan and highly tolerant species.

Overall, the diatom sequence accords well with the zonation derived from the pollen analysis. The diatom assemblages in paz EBS:1 and paz EBS:2 are compatible with the interpretation of upper and middle salt-marsh environments, respectively. A hiatus in the diatom sequence is evident at 120 cm. (within paz EBS:3). The earlier part of the sequence (below 120 cm.) is characterised by its essentially brackish nature, representing periodically tidal salt-marsh. The later part of the sequence (above 120 cm.) is indicative of a tidally dominated environment, such as mud-flat. Increasingly greater marine influences are also evident in the pollen profile (paz EBS:3 to paz EBS:5).

There is a great deal of variability within the broad upper and lower part of the core (as defined by the apparent hiatus at 120 cm.). This variability is shown to be systematic by the consistent trends seen in the populations of many species and cannot be accounted for as 'noise' resulting from a low-counting sum. The variability within the lower section of the core is caused by varying degrees of salinity and immersion as well as taphonomic factors.

Allowing for variation in taxonomic nomenclature, the general nature of the diatom assemblages has much in common with those recorded by Long (1992) at Sandfield Farm in the east Kent marshes. This in itself is interesting given the usual inter-site variability of diatoms in many coastal deposits.

LAND MOLLUSCA FROM THE WANTSUM CHANNEL

M.J. Allen

A small spot sample was recovered from the organic horizon at the base of the Wantsum Channel sequence during the evaluation (augerhole B, see Fig. 7). This sample occurred at a depth of 4.10 m. below the ground surface, representing a height of –2.50 m. O.D. A

TABLE 3: WANTSUM CHANNEL - LAND MOLLUSCA DATA FROM THE BASAL ORGANIC HORIZON

(+ denotes non-apical fragment/s present)

MOLLUSCA	Evaluation Augerhole B	Pollen Core – paz EBS:1
Lymnaea truncatula (Müller)	2	
Acicula fusca (Montague)	+	+
Carychium minimum (Müller)	5	
Carychium tridentatum (Risso)	1	
Succinea/Oxyloma	4	
Vertigo pusilla Müller	2	+
Vertigo spp.	–	+
Acanthinula aculeata (Müller)	3	+
Punctum pygmaeum (Draparnaud)	3	
Aegopinella pura (Alder)	+	
Aegopinella nitidula (Draparnaud)	2	
Zonitoides nitidus (Müller)	3	
Clausilia spp.	2	+
Trichia hispida (Linnaeus)	+	
Taxa	10	–
Shanon Index *H'*	2.22	–
Total	27	–

further sample was obtained during coring for the main sequence analysed for pollen and diatoms; it only contained small non-apical shell fragments but, notably, was the only horizon from the sequence which, in the field, was seen to contain shell fragments. All the species present as fragments, including the rare species, were also recorded from the initial spot sample (Table 3). The spot sample from augerhole B can, therefore, confidently be equated with the organic horizon analysed for pollen and diatoms in the main sequence between -1.46 and -1.58 m. O.D., (paz EBS:1), dated 4640 ± 60 BP (GU-4363) and 4630 ± 70 BP (GU-4367) – see Appendix 1.

The sample from the augerhole B was only 160 g when moist, it was processed following standard methods (Evans 1972). Only 27 shells were recovered and identified (Table 3); all of the shells were thin and fragile and apical fragments were small (<1 mm.). The presence of *Acicula fusca* as non apical fragments in both samples, and the rare Vertiginid, *Vertigo pusilla*, may indicate an ancient woodland while *Zonitoides nitidus, Carychium minimum, Succinea/Oxyloma* spp. suggest damper marshy habitats. The assemblage is considered autochthonous, the Shannon diversity index (Magurran 1988) of 2.22 is relatively high and suggests a mature assemblage.

The assemblage indicates open damp woodland conditions, which have probably not been severely affected by human activity. The low shell numbers, lack of a molluscan sequence, and more importantly the fact that the Weatherlees sample does not reflect a chalkland environment, mean that it is not possible to correlate this small assemblage with the key sequences in Kent at Brook (Kerney *et al.* 1964) and Holywell Combe (Kerney *et al.* 1980). Although this assemblage has some affinities with chalkland sub-boreal to Atlantic sequences and can therefore be compared with the radiocarbon date of *c.* 3600–3100 cal B.C. (see Appendix 1) it may also relate to specifically local, non-chalkland environments at Weatherlees and the Ebbsfleet peninsula. The mollusc data may, therefore, indicate that in the locality the ancient post-glacial woodland was not completely cleared by the later Neolithic, but persisted in a slightly modified form until a later date. This may be due to the more marginal nature of the low-lying environment at Weatherlees/Ebbsfleet.

RADIOCARBON DATES FROM WEATHERLEES HILL WTW – IMPLICATIONS FOR RELATIVE SEA-LEVEL MOVEMENTS

A.J. Long and R.G. Scaife

The two radiocarbon dates were obtained from the humic acid content of the basal organic horizon. This horizon was recorded at a depth of 206 cm. to 218 cm. in the sequence which equates to –1.46 m. O.D. to –1.58 m. O.D. (pollen assemblage zone EBS:1). The radiocarbon determinations of 4640 ± 60 BP and 4630 ± 70 BP (see Appendix 1) are statistically indistinguishable.

These radiocarbon dates provide new information regarding the timing of sea-level movements in the study area during the mid-Holocene. The closest site previously dated is the Sandwich bypass, where a sample of peat from a depth of between –4.00 and –4.30 m. O.D. was dated to 5315 ± 100 BP (Shephard-Thorn 1975). Further south, 14 radiocarbon dates have been described by Long (1992) from a sequence of marine and freshwater sediments found between Deal and Hacklinge. These dates have been compared with other sea-level data from the Thames estuary (Devoy 1979). Both records show similar altitudinal trends which reflect regional changes in sea-level (Long 1992). Together the Thames and east Kent fens dates provide a strong base for comparison with the new radiocarbon dates from the Sandwich Bay WTS project.

For a radiocarbon date to be of value as a sea-level indicator, one must know its altitude relative to O.D., and the altitudinal relationship between the dated sample and sea-level at the time of its formation.

The latter is known as the 'indicative meaning' of a sea-level index point. The pollen and diatom data which accompany the dated horizon from Weatherlees enable an assessment of the indicative meaning of this index point. Both microfossil data suggest a salt-marsh environment, with sediment deposition probably occurring somewhere below Mean High Water of Spring Tides (MHWST).

To aid comparison with the regional sea-level record, the altitudes of all index points are generally lowered to mean sea-level (MSL). This is because the tidal range varies around the south coast of England. For transgressive and regressive contacts (top and bases of peats), which are the commonest sea-level index point from the study area, MSL is estimated by subtracting the altitude of MHWST from the observed altitude of the index point. This procedure assumes that the tidal range has not changed significantly through time and that the indicative meaning of the index points is MHWST. The latter has been established for the east Kent fens and Thames estuary index points through the use of microfossil data.

If, as a first approximation, we assume that the Weatherlees index point formed at MHWST, by subtracting the altitude of MHWST from its observed altitude we obtain a minimum estimate of the altitude of MSL. The index point is recorded at -1.50 m. O.D., and by subtracting the height of MHWST recorded at Deal (+2.70 m. O.D.), the estimated position of MSL at the time at which the index point accumulated is –4.2 m. O.D.

Comparison with sea-level index points collected from the Thames and east Kent fens indicates that the Weatherlees index point from *c.* 4600 BP plots approximately 1 m. above similarly aged index points from these other areas. Two explanations are offered for this discrepancy.

1. The radiocarbon dates have been contaminated.
The dated material consists of a silt with detrital organic material from a 12 cm. section of core. There is a strong possibility that this organic material is derived from older, reworked peat which would have been in abundance in the study area during the late Holocene. This would produce an artificially old date for the index point. Alternatively the sample dated may include old carbon, perhaps from a former soil horizon which developed above the influence of the sea, or perhaps from charcoal which has been transported to the site.

2. Differential sediment compaction.
The Weatherlees date is from a sample of sediment which directly overlies bedrock (Thanet Beds). Many of the other index points from

east Kent and the Thames estuary are from intercalated peats, which have all been affected by compaction of the sediments which underlie them to varying degrees. This will tend to cause an over-estimate of the altitude of MSL, and such differential sediment compaction may well explain the altitudinal differences observed. However, the nearest basal peat sample to the Weatherlees sample is from Marsh Lane, near Deal, where the top of a peat at –1.65 m. O.D. has been dated to 3500 ± 130 BP (Long 1992). The index point is from a near-identical altitude and is 1,000 years younger than the Weatherlees index point.

On balance it is difficult to determine which of the above is responsible for the difference observed between the Weatherlees index point and others from the region. It should be stressed that there is always a certain degree of uncertainty in reconstructing vertical changes in sea-level, and small height differences between individual index points should not receive undue attention. However, what is interesting here is that the Weatherlees index point clearly plots above all other index points from east Kent and the Thames estuary, suggesting that the radiocarbon date may indeed be an over-estimate of the true age of the deposit. This argument is further supported by the pollen data, which also suggests that the dated horizon is younger than the age indicated by the radiocarbon date.

In conclusion, the dated basal organic layer may be contaminated by old carbon. Differential sediment compaction may be a complicating factor when comparing the Weatherlees index point with others from the region. The pollen and diatom data suggest only salt-marsh and mud-flat sediments accumulated at the site, although the possibility that some soil was inwashed from the adjacent interfluves cannot be discounted. Such inwashed material might include pollen and molluscan remains indicative of more terrestrial conditions. Clear evidence for a basal palaeosol at this site is, however, lacking. For example, pollen diagrams from palaeosols in this region show much higher values of *Tilia* pollen (Scaife unpublished). The apparent absence of an *in situ* palaeosol may reflect the effects of oxidation, aeration and biotic activity within the terrestrial soil prior to or accompanying marine inundation. Alternatively, it is possible that such a palaeosol was eroded by marine processes. The radiocarbon determinations from the Weatherlees horizon provide some intriguing anomalies that only further research can address. In particular, high precision AMS dating of *in situ* organic matter from the base of the sequence would be of value.

OTHER ENVIRONMENTAL EVIDENCE

Land Mollusca (Chalk Hill, Ditch 113)

M. J. Allen

Three spot samples (a–c) were taken from fills of Late Iron Age/Early Romano-British Ditch 113 (context 114) by D. Perkins. The samples were analysed in an attempt to characterise, broadly, the nature of the local landscape after the ditch was cut and during its infilling. The three bulk samples, however, were sampled at very crude intervals (see Fig. 9, S.3, for location of samples) and, unfortunately, the basal sample (a) appears to have incorporated at least two and possibly three archaeological contexts. This is far from ideal (cf. Evans 1972, 41–4) as the resultant assemblage may represent more than one palaeo-fauna with different ecological requirements. Nevertheless, a very crude indication of the local environment can be obtained.

The field drawing (see Fig. 9, S.3) clearly delimits and describes at least five distinct layers within the sequence of filling for the ditch and these have been assigned numbers I to V. The primary wash (I) was described as a thin lens of primary silts and 'pea-grits' in the base of the ditch. The primary fill (II) was composed of a brown sandy loam with few medium stones. Above this lay a lens (III) of layered small and medium chalk pieces in a sandy loam matrix and containing large numbers of shells, including *Pomatias elegans*. This in turn was sealed by an almost stone-free, brown sandy loam (IV). The uppermost fill (V) was a brown sandy loam with rare medium stones and occasional bone fragments. The lower mollusc sample (a) embraces layers I, II and III. The middle sample (b) includes both the upper part of layer III and the whole of layer IV. The upper sample (c) coincides with layer V only.

Results

Due to the paucity of shells, large samples of 200 g were processed by S. Wyles following standard methods (Evans 1972). The snails were identified under a ×10–×30 stereo-binocular microscope and the results are presented in Table 4. Only the basal sample (a) produced significant numbers of shells (672), the samples of the upper fill contained less than 30 shells per kilogram. Because of the paucity of shells from the brown sandy loam upper fills, it is assumed that the majority of shells in the basal sample came from layer III, the chalky lens which was observed in the field to contain a number of shells. For the purpose of this report, therefore, it is assumed that the assemblage from the basal

TABLE 4: CHALK HILL – LAND MOLLUSCA DATA (DITCH 113)

(Figures in brackets = operculum)

Sample Wt (g)	a 2000	b 2000	c 2000
MOLLUSCA			
Pomatias elegans (Müller)	116(35)	9(2)	1(1)
Carychium tridentatum (Risso)	213	–	7
Cochlicopa lubrica (Müller)	4	–	–
Truncatellina cylindrica (Férussac)	28	2	8
Vertigo pygmaea (Draparnaud)	3	–	–
Pupilla muscorum (Linnaeus)	30	–	6
Vallonia costata (Müller)	64	4	25
Vallonia excentrica Sterki	15	–	5
Acanthinula aculeata (Müller)	24	–	1
Punctum pygmaeum (Draparnaud)	21	–	–
Vitrina pellucida (Müller)	21	–	–
Vitrea contracta (Westerlund)	12	–	1
Nesovitrea hammonis (Ström)	5	–	–
Aegopinella pura (Alder)	15	1	–
Aegopinella nitidula (Draparnaud)	8	–	–
Oxychilus cellarius (Müller)	3	–	–
Limacidae	26	2	–
Cecilioides acicula (Müller)	75	124	388
Cepaea nemoralis (Linnaeus)	2	–	–
Cepaea hortensis (Müller)	–	1	1
Cepaea spp.	14	2	3
Taxa	19	7	10
Shannon Index	2.21	1.64	1.77
TOTAL	672	21	58
Shade	46	5	15
Int	24	67	9
Open	30	28	76

sample originated from this deposit. Despite the limitations of interpretation indicated above, and the relatively low numbers of shells from the upper fills, there is a distinct change in the mollusc faunas through the ditch fills.

The rich assemblage from the lower chalky fills is certainly autochthonous as the very high numbers of *Pomatias elegans* are accompanied by their operculum (see Table 4). The assemblage is a mixture of which 46 per cent are shade-loving species as defined by Evans (1972, 194–6), but contains a relatively large number of the obligatory xerophile *Truncatellina cylindrica*. The open country species (*Vallonia costata, Pupilla muscorum, Truncatellina cylindrica* and *Vertigo pygmaea*) indicate that the ditch existed in an open dry

grassland. The high numbers of *P. elegans* and the presence of *T. cylindrica* may indicate open dry habitats of loose earth within or in the vicinity of the ditch. The shade-loving species (*Carychium*), are, however, species tolerant of long grassland habitats (Cameron and Morgan-Huws 1975), and include *Punctum pygmaeum, Nesovitrea hammonis* and *Vitrina pellucida* of Evans's Punctum Group, characteristic of vegetation colonisation of ditches.

The presence of *T. cylindrica* here is noteworthy. It is an obligatory xerophile and does not like shaded places. It is common in the early second millennium B.C., especially in the Stonehenge area (Evans 1972, 140) and is recorded on a number of Bronze Age barrows in Hampshire and the Isle of Wight, occurring after extensive deforestation. However, today it is extinct in Wiltshire (*ibid.*) and is only recorded in Kent as a subfossil (Kerney 1976, map 65).

The two assemblages from the main fill of the ditch are impoverished, but the shade-loving species represent about 10 per cent while the open country species rise to 76 per cent. Some intrusive modern shells were recorded; a number of specimens of *V. costata* retaining their periostricum were noted.

Conclusions

Some caution must be exercised with the interpretation of these assemblages in view of the crude nature of the samples and the lack of contiguous sampling at standard intervals. In summary, however, the chalky fills in the ditch occurred in an open, established and probably dry grassland landscape. Some longer grasses and vegetation had regenerated in the ditch, on ditch sides or ditch edges. This vegetation was cleared and when the main fills of the ditch accumulated the environment seems to have been of open dry grassland with little vegetation regeneration. This vegetation may have been purposely cleared, or maintained by grazing.

Charred Plant Remains

Rob Scaife

Three bulk plant macrofossil samples were analysed. Two midden-type fills from medieval (twelfth/thirteenth century) ditches at Ebbsfleet (Ditch 1082 and 1084; 10 litre sample from each) had the potential for examination of charred food remains. The fill of the undated, possible Saxon, grave at Chalk Hill (Grave 106; 15 litre sample) had the potential to provide evidence of local agriculture and environment. The samples were processed using standard Wessex Archaeology procedures. For the ditch samples a minimum sieve size of 500μ was

used for both the flot and residue. Both elements were sorted and extracted and the seeds identified under a low power binocular microscope (Wild M3c). For the grave sample a nest of sieves down to 500μ was used to catch both the flot and residue of the flotation procedure and the extracts were examined under a low-power binocular microscope. Only a very small number of charred remains was present in the grave sample. The results of the analyses are presented in Table 5 and discussed further below.

Medieval ditch fills from the Ebbsfleet Peninsula

Of the two ditch samples examined, context 1082 produced the largest number of charred crop and seed remains. In both cases the grain is highly fragmented and distorted through burning and context 1082 produced in excess of 500 fragments of grain. Both assemblages are essentially similar, containing largely grain of *Triticum aestivum* type and, with the exception of a single indeterminable glume base, no chaff. Other cereal grain present include *Triticum dicoccum/spelta, Hordeum* sp. (in 1082), *Avena* (in 1085) and *Secale cereale* (in 1085). Non-cereal crop remains comprised *Pisum sativum* and *Vicia faba* L., the former present in both samples but in higher numbers (16) in context 1082. With the exception of substantial numbers of *Anthemis cotula* in context 1082 (a species which grows on heavy soils), weed seeds were relatively few and where present, were of *Vicia* and *Lathyrus* spp. Woody taxa include *Corylus avellana* nut fragments and *cf. Quercus* fruit.

The assemblages of cereal types recovered are, in general, typical of medieval contexts and reflect the importance of free-threshing hexaploid wheats of *Triticum aestivum* type (bread and club wheat), *Hordeum* (hulled barley), *Secale* (rye) and *Avena* (oat). This importance reflects the agricultural preference of the medieval period and contrasts with earlier periods for which there is now a corpus of evidence which shows during the Romano-British period, spelt and emmer wheat were predominant. The evidence also suggests that by the end of the Roman period the predilection for *Triticum spelta* L. was waning and free-threshing hexaploid wheats were becoming the predominant crop type (Jones 1981; Green 1981; Monk 1978). However, a small number of *Triticum spelta* type (including spelt and emmer) was identified in the samples from Ebbsfleet, from the same contexts in which club and bread wheats predominated. This must be regarded as unusual since there are no archaeobotanical records for spelt/emmer at this late (medieval) date. Two explanations may be postulated. Firstly, it is possible that some continuity of the crop occurred at a local level. Green (1981) for example, has noted that spelt remained an important element in some regions such as the post-Roman and Saxon environs of Gloucester. Murphy (1985) at West Stow Anglo-Saxon village similarly

TABLE 5: QUANTIFICATION OF CHARRED SEEDS

(+ = present)

		Ebbsfleet Peninsula (W516)		Chalk Hill (W619)
		Ditch 1082 (101)	Ditch 1085 (101)	Grave 106 (151)
GRAIN	*Triticum aestivum* type	30	14	1
	cf T. aestivum type	14		1
	T. spelta type	8		
	cf T. spelta type		1	
	Triticum indet	50	4	1
	Hordeum sp.	17		1
	cf Hordeum sp.	12	1	
	Avena sp.		5	
	cf Avena sp.	1		
	Secale	3	3	
	Indet large	194	1	4
	Indet frags.	>500	141	
CHAFF	Glume base indet		1	
	Secale cereale rachis	1		
	Hordeum sp. rachis	3		
	Culm nodes	+		
OTHER CULTIGENS	*Vicai faba*	1		
	Pisum sativum	9	1	
	cf P. sativum	7		
SEEDS	*Vicia/Lathyrus*	25		
	cf Vicia	12		
	cf. Lathyrus		5	
	Raphanus raphanistrum	2		
	Polygonum aviculare	1	1	
	Rumex sp.	1		
	Anthemis cotula	181		
	Poaceae	13		
	Malva sp.	1		
	Quercus frag.	1		
	Corylus avellana frags.	24		1
MISC.	*Fungal sclerotia*			1

records *T. spelta* to at least the mid-fifth century. This seemingly illustrates continuity of spelt cultivation between the Romano-British and Saxon periods. However, its absence in other and later East Anglian sites suggests that cultivation of the crop had ceased between this date and the late seventh century. It is possible that spelt/emmer cultivation may have continued into the medieval period in this region

of Kent. Secondly, given the long continuity of occupation on the Ebbsfleet peninsula, it is possible that at least some of the charred grain may be older, reworked, material. Considering the widespread dominance of spelt/emmer recorded from many sites of Iron Age and Romano-British date in the south of England and the unusual nature of the record from Ebbsfleet, this must be regarded as a strong possibility. The problem remains unsolved but there is, however, little doubt that free-threshing hexaploid wheat varieties were in common cultivation from the late Roman and Saxon periods and subsequently formed the mainstay of the wheat crop. The occurrence of *Hordeum* sp., *Avena* sp. and a single *Secale cereale* grain is also typical of medieval contexts and while the quantity of *Hordeum* recovered indicates cropping, the small numbers of *Avena* and *Secale* might be viewed as contaminants of the wheat (or barley) crops.

The taphonomy of the cereal, pea and celtic bean remains and the extant weed seeds found are questionable but, given the extent of midden material filling the ditch, this is undoubtedly a dumped waste deposit. The paucity of crop weed seeds and cereal chaff debris recovered suggest that the grain had been previously cleaned and had suffered accidental burning. Since the hexaploid wheats do not require parching to release the grain as in spelt, it is not possible to surmise the cause of burning. As peas are also present, it is likely that this is an assemblage of burned waste. The presence of *Vicia* (e.g. *V. sativa*), although sometimes cultivated for its seeds and its foliage used for animal fodder, is problematic. Here there is a range of small indeterminable *Vicia/lathyrus* to larger types which may represent specific utilisation; this, however, remains unclear. The likelihood is for these types and the *Anthemis cotula* seeds to have been weeds of the cereal crop or from additional material similarly dumped in this feature.

In summary, the principal crop types recovered are typical of the medieval period and include grain of bread or club wheat, barley, oats and rye. The small quantity of emmer and spelt wheat type grain in a medieval context is problematic and may be derived from an earlier period of occupation on the site. Since no diagnostic wheat chaff remains were found, identification to more specific levels was not possible. Pea and celtic bean are present and, along with hazel, may have been food debris.

Undated Grave at Chalk Hill

Three grains of *Triticum* and two of *Hordeum* sp. were recovered. Only one grain of *Triticum* was identifiable to *T. aestivum* type (club and bread wheat), although a second was tentatively assigned to this taxon. Similarly only a single definite grain of *Hordeum* sp. was identified. A single nut fragment of *Corylus avellana* (hazel) was the only other

identifiable plant remain found. Because of the few remains recovered, little interpretation can be made. However, the presence of free-threshing bread wheat is comparable with the assemblages recovered from the medieval ditch midden deposits obtained from the Ebbsfleet peninsula.

Charcoal and Timber Identification

Rowena Gale

Charcoal

Charcoal samples from three samples were examined and identified: the undated, possible Saxon, grave at Chalk Hill (context 112, grave 106); a medieval midden ditch fill at Ebbsfleet (context 1082) and ditch fill (context 1085 = ditch 1015) at Ebbsfleet. The charcoal fragments were fractured to expose transverse, tangential longitudinal and radial longitudinal surfaces. These were supported in sand and examined using an incident-light microscope at magnifications of up to ×400. The anatomical structure was matched to reference material.

The following taxa were identified: *Corylus* sp., hazel; *Fagus* sp., beech; *Fraxinus* sp., ash; *Quercus* sp., oak. A fragment of stem from an unidentified herbaceous plant was also recorded in the sample from ditch 1082. The results may be summarised as:

Site/Feature	*Corylus*	*Fagus*	*Fraxinus*	*Quercus*
Chalk Hill – grave 106 (context 112)	1	–	–	4 (heartwood)
Ebbsfleet midden ditch fill 1082	–	3	1	6
Ebbsfleet ditch fill 1085	12	2	–	4

These trees identified frequently grow in mixed deciduous woodland in southern Britain. Hazel is also common as a tall shrub as understorey (particularly in coppiced woodland) or in more open glades and clearings. Oak, ash and hazel grow on clay soils or clays overlying chalk, but beech is more usually associated with calcareous soils.

Waterlogged timbers from the Sandwich and Deal Mains

Timbers from three locations: Stonar (objects nos. 101 to 104), Guilford Road (object nos. 131 to 136) and near The Monks' Wall (object no. 105) were examined and identified. The samples were rather waterlogged and well-preserved. Thin sections were prepared using a double side razor blade. The sections (from transverse, tangential longitudinal and radial longitudinal surfaces) were mounted in 70 per cent glycerol on microscope slides and protected with cover slips. The anatomical structure was examined using a stereo light transmitting

microscope at magnifications of up to ×400. Diagnostic features were matched to reference material.

The four slender stakes from Stonar were from lengths of oak (*Quercus*) round wood. Oak wood is strong and very durable and ideally suited to use in quayside structures, as may have been the case here. The large stake from Guilford Road which may have been a post from a causeway was also made from oak roundwood. The five worked fragments of unknown function from Guilford Road were of beech (*Fagus*). Beech wood is strong, even grained and easy to work but rather too perishable for most outdoor purposes (Edlin 1949). It has, however, been widely used in the manufacture of tools, furniture and household and boat fittings. The single worked fragment from near The Monks' Wall was identified as alder (*Alnus*).

Animal Bone

Sheila Hamilton-Dyer

Animal bones were recovered from the three areas of the scheme: Weatherlees Hill WTW, Ramsgate Main and Sandwich and Deal Main. Preservation varies greatly from good to very poor and, while most fragments could be identified to species or group, very few surface details could be observed. Identifications were made using the modern comparative collections of the author. Fragmented bones were joined and counted as single bones where possible. Undiagnostic fragments were divided into cattle/horse sized and sheep/pig sized only. The methodology relating to measurements follows von den Driesch (1976). Withers heights are based on factors recommended by von den Driesch and Boessneck (1974). The archive gives full details of anatomy, butchery, measurements and other details not in text. A total of 264 bones were recorded from the three components of the project. Most of the bones are of cattle, horse and sheep/goat, together with some pig, dog, and a single bone of cod. Full quantification of the distribution by species within each context is held in the project archive.

Weatherlees Hill

The 55 fragments recovered are variable in condition, the most well preserved material being derived from Iron Age features (notably pit 1008a) which also contained charred bones. Three Early-Mid Iron Age features produced bone (Spread 1008, Pit 1008a, Gully 1009), representing 25 fragments in all. Cattle and sheep/goat were predominant. A single pig bone was also recovered from Spread 1008 and Gully 1009 included a charred dog radius. The latter also contained a complete cattle tibia which gives an estimated withers height of

1.042 m., a small animal typical of Iron Age material. Four ditches (1015, 1016, 1082, 1084) and one pit (1080) of medieval date produced a small collection of bones (nine pieces), nearly all identifiable as sheep/goat. Ditch 1016 also contributed the only fish bone from the total assemblage, a cod vertebra.

Ramsgate Main

Most of the 156 animal bones recovered are badly eroded, but despite this many could be identified to species. All except two pieces derived from features of various dates on Chalk Hill. Three Late Bronze Age/Early Iron Age features (Ditch 7 and Pits 5 and 6) produced a total of 34 pieces and these are almost entirely of horse, a single fragment of pig being the only other species. Pit 6 contained the badly eroded and fragmented remains of an adult horse. The withers heights estimated from the reconstructed metacarpus and metatarsus are 1.295 m. and 1.263 m. respectively. Bone from later features comprised that from Ditch sequence 4, Ditch 113 and feature 20. Most of this group derived from Ditch sequence 4 (mostly 4a and 4b) and largely comprised cattle and sheep with small numbers of horse and canine. The horse remains are of jaw and teeth including an animal under four years at death. One of the two canid bones is a fragment of maxilla from a large animal, though comparable with dog rather than wolf. Two cattle bones were recovered from the Roman Pit 102 at Cliffsend.

Sandwich and Deal Main

Nearly all of the 53 bones from this area derived from a single context, 64, found at a depth of *c.* 1 m., sealed within the alluvial clays near Richborough power station. The 40 fragments of at least ten ribs are probably of cattle and are likely to represent the carcass of an animal which died and was subsequently buried under the build up of alluvial deposits. Two other contexts produced horse and cattle bones, both buried soils of probable medieval or later date at Golf Road, Deal. A complete horse radius from one of these contexts gives an estimated withers height of 1.267 m.

Discussion

These are very small assemblages, insufficient for detailed analysis. A number of general observations can be made, however, Fish remains are rarely recovered from Iron Age material but are common in later material, cod is frequent in medieval pits and other features. The general lack of fish at these coastal locations is likely to be due to the soil conditions, which are not conducive to the preservation of small and fragile bones, indeed even the usually resistant mammal teeth are eroded in these assemblages. There is a bias in the remains in favour of

the most robust and largest elements, teeth are frequent and phalanges few. The relative proportions of the main domestic animals are, therefore, likely to be unbalanced with the smaller species, sheep and pig, under-represented (Maltby 1985). Similarly the absence of bird bones may be largely taphonomic. The few measurements are of typically small animals, other than the dog from the Iron Age ditch on Chalk Hill. Dogs from Late Iron Age and Roman deposits are variable in size (Harcourt 1974) and this animal would have been a useful hunting or guard dog.

Marine Mollusca

S.F. Wyles

Small quantities of marine shells were recovered from Weatherlees Hill WTW and from the Ramsgate Main: 128 fragments were recovered in total. The shells were predominately oyster (88 per cent by count). Four other species were represented in much smaller quantities: cockle (6 per cent); periwinkle (5 per cent); mussel (<1 per cent); whelk (<1 per cent). Over half of the marine shells (64 per cent) were derived from the midden-like filling of medieval ditch 1015 at Ebbsfleet, although it may be noted that the contents were entirely oyster. The other main feature producing shells was the contemporaneous, and nearby, ditch 1082. One feature on the Ramsgate Main produced shells in small quantities: pit 104 at Cliffsend. Full identification and quantification of the shells by context is held in the project archive.

DISCUSSION

As already noted in the introduction, the Sandwich Bay WTS has provided an extremely useful transect across the local landscape encompassing the main zones associated with the former Wantsum Channel, its infilling and the land on its margins. The discussion below attempts to collate and review the newly-obtained data in the light of pre-existing information by reference to the main landscape zones:

1. The south side of the Isle of Thanet, including the Ebbsfleet peninsula. The latter, as a topographically distinct unit and important landmark on the coastline has witnessed particularly intensive occupation. The nature and chronology of its settlement and use is therefore addressed in more detail;
2. Wantsum Channel and deposits associated with its infilling, including the Stonar Bank;

3. The Lydden Valley and Deal spit. The Lydden valley may be considered alongside the evidence from the preceding zone since it forms an extension to it.

South side of the Isle of Thanet, including the Ebbsfleet peninsula

Early, prolonged and intensive occupation and settlement of the south side of the island was suspected from the wealth of crop-mark data and the range of investigated features and finds. The project has made a very significant contribution to Thanet's archaeology by demonstrating this beyond doubt, by allowing important insights into the date and nature of occupation (which both reaffirm and extend the pre-existing data), and by providing very important new evidence for Neolithic activity.

Neolithic/Earlier Bronze Age

The distribution of Neolithic ceramic finds in that part of south-east England now encompassed by Kent is sparse. There has been notable progress since Dunning's collation, 30 years ago, of only 13 sites in the county yielding Windmill Hill pottery (Dunning 1966). In his review some 16 years later A.F. Clarke's distribution map of finds and sites in Kent totalled about 130 'sites'. Clarke himself was aware of the neglect the period had received and urged research into the Neolithic as a priority for Kent archaeologists (Clarke 1982).

The Neolithic ceramic assemblage from Pit 12 on Chalk Hill, comprising a single vessel of earlier Neolithic morphology and three Peterborough Ware vessels (Fig. 15), with its associated worked flint, is, therefore, an important contribution to the current very limited overview of Neolithic settlement in Thanet and east Kent, and is also significant on a regional basis. Previously, Thanet's Neolithic ceramic evidence was limited to only four finds:

1. A fragmented round-bottomed bowl associated with a crouched burial in a large chalk cut pit at Grummock Avenue, Nethercourt, Ramsgate (Dunning 1966). This site is located about 900 m. north-east from Pit 12 with a valley intervening;
2. Remains of two round-bottomed bowls from a site in the intertidal zone at Minnis Bay, Birchington (Macpherson-Grant 1969);
3. Sherds from a small midden pit found during excavation of the Jutish cemetery at St. Peter's, Broadstairs, in 1969. These are described as Peterborough ware type, sub-type Mortlake (Hogarth 1973);
4. A single sherd from a midden pit at Hoo, Minster (Perkins 1985).

Flint tools as single finds and assemblages are now much more

widely recorded than when Clarke's review was published (1982). In the immediate and near vicinity of the Ramsgate Main are two areas yielding quantities of lithic evidence indicative of occupation. Some 200 m. east of Pit 12 on the crest and western slope of the Nethercourt/Chilton valley very limited trenching, along with finds from gardening, at Chilton Farm, has produced an assemblage of hundreds of waste and worked flakes, along with scrapers and other tools. This site is conceivably the origin for the source of the Neolithic flakes found in alluvium in the Pegwell Bay cliff line. (Weir *et al.* 1971). Further away, about 1200 m. north-west of Pit 12, on the western rise of Hollins Bottom, similar material has been recorded over an area of about six hectares.

The material evidence for later Neolithic/earlier Bronze Age activity on the Ebbsfleet peninsula is slight, consisting of a small group of flint-tempered sherds and a ground axe (Fig. 14) from features close to Ebbsfleet Lane. It is, nevertheless, important in that it further supports the previous indications for occupation of the peninsula during this period. Scatters of worked flint have been identified all over Cottington Hill and the Ebbsfleet peninsula, with in addition the Beaker flat grave and Beaker sherds found north of Ebbsfleet Farm (Perkins 1992, Sites 9a, 9b).

Overall, the evidence from Chalk Hill in particular, and its immediate environs, is that it suggests a far higher level of Neolithic occupation than previously indicated or suspected, perhaps a level more in keeping with the later Beaker and Early Bronze Age barrows densely scattered through the area, including the Ozengell Chilton barrow cemetery (Perkins and Macpherson-Grant in prep.).

The pollen evidence from the basal organic horizon in the Wantsum Channel sequence (EBS:1) provides an insight into the local environment around this time, prior to inundation of the channel and the creation of extensive areas of saltmarsh. The evidence indicates a diversely wooded landscape dominated by oak and hazel, but also including lime, ash and elm. Lower trees and shrubs include buckthorn and birch.

Late Bronze Age/Early Iron Age

Clusters of Late Bronze Age/Early Iron Age features were recorded on both Chalk Hill and the Ebbsfleet peninsula. The ceramic evidence suggests that occupation in the two areas, some 3 km. apart, was broadly contemporaneous, that is *c.* 850–550 B.C. At each location the features themselves and the associated finds are indicative of settlement remains, suggesting at least a farmstead, or perhaps larger settlements.

The site on Chalk Hill, manifested by an apparent enclosure ditch and associated pits, is not known from crop-marks. This is no doubt due to the shallowness of the preserved features (generally only 0.20 m.

to 0.30 m.) with the exception of one larger pit. It may be noted that the site lies very close to the find-spot (in 1990, by metal detecting) of a remarkably well preserved Late Bronze Age spearhead (Perkins in press). The exact nature and range of activities carried out on the site cannot really be gauged from the evidence from the pipeline. The relatively large amount of pottery from one shallow ditch may be noted. Horse and pig bones provide the only other economic indicator.

The contemporaneous features on the Ebbsfleet peninsula may be considered in association with previous finds to the north of Ebbsfleet Farm, some 200 m. away, including a small Late Bronze Age hoard (Ebbsfleet II – Perkins 1992, site 9). Previously, ceramic evidence for the occupation at Ebbsfleet was slight (*ibid.*, 288–9) and the identification of securely-dated features, including structural remains, is, therefore, an important addition in furthering an understanding of the sequence and duration of occupation of the peninsula. The small metalwork hoard recovered (Ebbsfleet III, Fig. 13, 1–5) lies some 200 m. to the north-west of the occupation remains and appears to have been deposited beyond the peripheries of the settlement.

Remarkably, 11 Late Bronze Age hoards have now been discovered in Thanet with at least as many more single finds datable to the period. Most of the hoards have 'Carp's Tongue' elements and socketed axes with decorational motifs of northern French style as well as those of the Ewart Park tradition. Occupational evidence has been found at four of the hoard sites, Ebbsfleet, Minnis Bay, Manston and Monkton, the last being a settlement of major proportions (Perkins in press). Excavations at another site, St. Mildred's Bay, Westgate, have identified Late Bronze Age settlement although the hoard from the site is of Middle Bronze Age date (Perkins 1988). The consistent location of these settlements either on the shoreline or on the edge of the downland escarpment above it may also be noted (only Manston is inland). The evidence from Chalk Hill also conforms to this pattern.

Early–Mid Iron Age

Settlement remains and associated ceramics and occupation debris were recorded on the Ebbsfleet peninsula on the high ground immediately south of Ebbsfleet Farm. These findings reaffirm previous evidence for occupation of the peninsula during this period. As with the Late Bronze Age/Early Iron Age, the earlier discoveries were to the north of the farm and again the data from the Sandwich Bay WTS project, therefore, suggest more extensive settlement. Having said this, the very localised occurrence of Early–Mid Iron Age remains from the project suggests that it represents the southern limits of occupation on the peninsula for this period. This is itself is a useful addition to existing records.

The cultural material obtained from the evaluation trenches is fairly wide and provides useful data relating to the nature and range of activities on the site. Structural evidence in the form of a ring gully with an associated occupation level is supported by the recovery of fired clay derived from wattle-and-daub. Weaving is indicated by the loom-weight fragments and cattle, sheep/goat and pig all appear to have been linked to the agricultural economy of the site. Although no direct environmental remains for arable activity were recovered in the form of charred seeds, the pollen record (EBS:3) provides important background information. The sequence suggests increased anthropogenic activity, probably linked to the clearance of woodland for agriculture. The latter is demonstrated by the increasing importance of agricultural weeds plus cereal pollen. Woodland, dominated by oak and hazel, still existed but, apparently, within an agricultural environment comprising arable and pastoral components.

Late Iron Age and Romano-British

Evidence for Late Iron Age and Roman settlement was encountered on the Ebbsfleet peninsula and on Chalk Hill. In addition, earlier Roman features were located at Cliffsend. On Ebbsfleet the settlement had its origins in the earlier Iron Age period (as discussed above) whereas at Chalk Hill the evidence suggests a new establishment – only two sherds of earlier Iron Age date were recovered from the whole of the Ramsgate pipeline. On Chalk Hill the intercutting ditches are presumed to represent the periodic refurbishment of a long established ditch line. This ditch appears to equate to a crop-mark evident on an old aerial photograph, which shows a ditch cut by the modern road at this point, and running south of it to a poorly defined ?sub-rectangular enclosure (TSMR 585). These north to south ditches appear to be closely associated with the adjacent sub-rectangular feature with its midden-like fill. The evidence suggests actual settlement and associated agriculture: artefactual structural remains (wattle-and-daub) and personal ornaments (Fig. 13, 6–7) were recorded. Evidence for farming is, unfortunately, restricted to the faunal assemblage which includes cattle and sheep. The occurrence of oyster shells is also a reminder of the importance which marine resources must have played in the diet (at all periods), even though the shells and bones do not survive in great quantities. The mollusc data from the larger north–south ditch are also useful in indicating the presence of open, established grasslands during this period.

The Roman grave and associated features at Cliffsend coincide with an area of known archaeological potential, the farmland here having been heavily prospected by metal detectorists during the last decade,

with finds of Roman coins, fibulae, and a well-moulded silver head from a figurine, thought to represent Apollo (TTA archives).

At Ebbsfleet ceramic material from the project suggests Later Iron Age/Romano-British occupation, but as at Chalk Hill, associated features are somewhat elusive. Those features which do appear to date from this period, including the structural remains adjacent to Ebbsfleet Lane should be considered in association with the features and evidence from the same periods recorded on the hilltop and 200 m. to the north (Perkins 1992). The evidence, spanning circa 700 years, is more or less superimposed and suggestive of continual occupation. All the features are found high on the Ebbsfleet Farm hill, or on its northern and eastern slopes. The total evidence to date suggests a fairly extensive settlement area even if occupation was not of an intensive nature. An area of some 10 ha is indicated although it is not known how much of this was in occupation at any one time.

Exactly what the features at all three sites – Ebbsfleet, Cliffsend and Chalk Hill – represent in terms of former occupation and the range of activities is difficult to gauge but together they conform to the emerging pattern of Thanet's Belgic and Roman archaeology. As presently understood, the evidence suggests quite dense late Iron Age and Belgic occupation of a coastal strip all around the Isle of Thanet with small farmsteads interspersed by a series of larger, defended hill-top settlements. Of the latter class of site three have been investigated, at Sarre, North Foreland, and Fort Hill, Margate – the last two have been established as having been between eight and 16 hectares in extent. In the case of almost all the sites, large and small, ceramic evidence indicates a consistent pattern. Between 150 B.C. and the mid first century A.D., there is evidence for a flourishing community on Thanet with Romanising influences and wide European and Mediterranean trade links. From the end of this period to the mid second century there is very marked post-Conquest Romanising influence at the sites. This trend is particularly marked by the appearance in large quantities of smooth grey ware (Upchurch ware), whether imported from the Upchurch area, or a local product very much in the same tradition (pers. comm. Jason Monagham). Following this period there is evidence for the abandonment of all these settlements.

This is not to say that after the mid second century A.D. Thanet became a deserted wilderness. Ceramic and coin finds from all over the island attest to continuing occupation, although present evidence suggests it was much less populated. The coin evidence from Ebbsfleet (Wren 1992) and at a villa site at Abbey Farm, Minster (Perkins 1991b) confirms occupation continuing at these locations through the second and third centuries and apparently flourishing in the fourth.

Intriguingly of all periods in Thanet's archaeology the Romano British is (at present) the least well understood, so that without more sites being encountered no overview is yet possible. The features encountered at Ebbsfleet, Cliffsend and Chalk Hill during the course of the project are, therefore, welcome additions to the archaeological record.

Early Medieval (Saxon/Jutish)

The project has not produced any clear evidence for Saxon/Jutish activity. One of the writers (D.R.J.P.), however, considers that although grave 106 is essentially undated it may add to the evidence for a Jutish cemetery on the crest of Chalk Hill. This possibility was first suggested by the occurrence of ephemeral crop-marks of up to three ring ditches, in a linear arrangement, aligned north to south, immediately south of Grave 106 (see Fig. 8). These ring ditches appear to be small in size (4–6 m. diameter), which is considerably smaller than the smallest examples of Early Bronze Age round barrows excavated in Kent. As a result, the ring ditches have been tentatively identified as the ploughed-out remains of Jutish barrows. A polychrome 'cane bead' found on the site of one of the ring ditches may add further support to this hypothesis since such beads are occasionally encountered in well furnished Jutish graves of the sixth and seventh centuries. If grave 106 was Jutish, then it represents a flat grave, and had evidently been disturbed in antiquity possibly as a result of a secondary interment into an earlier grave, or by grave robbing (see Perkins 1987).

At Ebbsfleet, as with previously recorded ceramic assemblages, there is no evidence for Early to Late Saxon activity. Evidence for woodland expansion appears to be attested in the pollen sequence (EBS:5).

Medieval

Medieval ceramics were notable by their near absence from the Ramsgate Main (nine sherds), perhaps indicating that Chalk Hill was merely utilised for grazing animals at this time. On the Ebbsfleet peninsula occupation remains were of a non-intensive nature but were fairly widespread (that is, occurring in all the areas examined). They may be viewed alongside pre-existing information for medieval utilisation of the peninsula including a small settlement some 200 m. to the south (TSMR 312a) and another on the south side of Cottington Hill, to the north-east (Perkins 1992, site 2). The ceramics from the project indicate a start date of mid–later eleventh century and this is consistent with the evidence from Cottington Hill. The occurrence of twelfth-century material (from 1125/1150) in the Sandwich Bay WTS

assemblage is a new addition to the pre-existing information for medieval occupation on the peninsula.

Overall, the limit and nature of medieval occupation on the Ebbsfleet peninsula are not known. Specific information pertaining to the arable economy at this time, however, is provided by the midden-like fillings in two of the ditches. These produced a range of charred cereal grains, dominated by bread/club wheat but also including barley, oats and rye. Peas, celtic bean and hazelnuts were also recorded and all are likely to have provided dietary supplements, along with the contemporaneous evidence for oyster and fish.

Occupation of the Ebbsfleet peninsula

There can be little doubt that the location and extent of former settlement on and utilisation of the Ebbsfleet peninsula was directly related to prevailing conditions (including sea-levels) and the local topography. It is beyond the scope of this report to discuss sea-level changes although some comments are provided (Long and Scaife). A regional synthesis of sea-level data for south-east England, with particular reference to the east Kent Fens has recently been published by Long (1992) following on from earlier studies by Devoy (1979; 1982). Relative sea-level is recorded to have risen by at least 10 m. over the last *c.* 5,000 years. Long's study draws attention to the highly variable nature of chronologies for sea-level tendencies within the region, with alternating periods of positive and negative tendencies linked to the nature of local processes such as coastal sedimentation. The extent of land loss around Ebbsfleet and Weatherlees through marine inundation cannot be quantified. It may be noted, however, that at Minnis Bay, Birchington, on the north coast of Thanet Neolithic settlement remains have been discovered 500 m. seaward of the modern high water mark (TTA archives).

In some respects the Ebbsfleet peninsula must have offered a rather vulnerable settlement base, the imperceptible marine encroachment being punctuated every generation or so by dramatic, sometimes no doubt catastrophic, flooding. During the Neolithic and earlier Bronze Age periods the occupation areas would have been well in from the shores and wind-blown sea spray so that the friable, well drained soil would have been attractive to early farmers. By the later Bronze Age, it is estimated that the habitable area of the peninsula cannot have been much wider than what is today confined between the lines of the drainage dykes.

It is notable that the Late Bronze Age/Early Iron Age settlement remains coincide with the eastern side of the peninsula and that the

later Iron Age and Romano-British occupation areas all occur on the higher ground of Ebbsfleet or its northern and eastern slopes. An explanation is that during the time that the Wantsum Channel was open as a major sea-way, the western shore of the peninsula was too inhospitable to attract settlement. The prevailing winds of the English Channel and Dover Strait are the south-westerlies, so that when the south mouth of the Wantsum Channel was 2 km. or more wide (as it was into the Roman period) the peninsula's west coast would have been a lee shore. Open to the full force of the weather for ten months of the year, it would have been faced with storm beach deposits backed by dunes, an exposed, unstable and unwelcoming prospect. The more sheltered eastern shore would have been far more favourable for settlement and the archaeological evidence appears to bear this out.

Later, when the northern advance of the Stonar Bank had closed the Wantsum's south mouth to a few hundred metres, much more pleasant conditions would have prevailed. The western shore would then have become what amounted to the eastern bank of a wide tidal estuary. On ebb tides the flow of the River Stour would have been augmented by the waters of the Thames Estuary coming in through the Wantsum north mouth. This strong tidal flow is likely to have stripped away the ancient storm beach deposits, leaving a well scoured but ever narrowing channel.

North-east of the peninsula, the shallowly curving bay between Cottington Hill and Cliffsend would eventually have been cut off by the Stonar Bank as it closed the Wantsum's south mouth. That this area was still salt marsh in medieval times is attested by the two lines of 'boarded groins' that mark its 'inning'. How recent and perhaps how impermanent is man's claim to the Wantsum was demonstrated during the great floods of 1952–53, when Ebbsfleet became once again a peninsula, and Weatherlees Hill an island.

Against such a background of marine encroachment and often harsh conditions, the landmark location of the peninsula must have provided a strong incentive for its colonisation. The gently sloping sandy shores would have been ideal for beaching, and the north–south axis of the peninsula meant that eastern or western safe havens were available, depending on whether the prevailing south-westerlies or the north-easterlies of mid-winter prevailed. The traditional landing place of Hengist and Horsa and St. Augustine may then have had its origins as an entreport in the later prehistoric period. The favourable position of the Wantsum in cross-Channel navigation may also be noted although it is beyond the scope of this report to consider this in detail (see Johnstone 1980; McGrail 1983 for discussion).

The Wantsum Channel and the Stonar Bank

The route of the pipeline between Weatherlees Hill WTW and Sandwich pumping station has provided an important north–south transect across the infilled Wantsum Channel, particularly since part of the route coincided with the Stonar Bank (see Fig. 2). Associated archaeological features, artefacts and deposits were recorded at localised points along the route. Beyond this the systematic and detailed characterisation of the observed soil profiles in all sections of the route are an important addition to the archaeological archives for the area and will be of most use when assessed alongside excavated archaeological deposits such as those of the medieval port of Stonar itself.

The southern section of the pipeline between Sandwich and Stonar has provided the first opportunity to examine a transect through the upper deposits in this area which lie between 1.80 and 2.50 m. O.D. The deposits recorded largely represent alluvial infill within the Wantsum Channel. Although the transect observed extended only a maximum of 0.50 m. below present sea-level, it seems clear that the deposits above this, varying slightly in texture and colour, represent gradual silting with no fossil river or stream channels apparent. The greenish grey/dark grey deposits which lie 1.30 m. or more below the present ground surface are probably permanently waterlogged, and the potential for organic preservation is high. The wooden stakes preserved over a length of some 50 m. demonstrate this, though no other finds were made, perhaps because the trench was of insufficient depth along most of its length to reach contemporaneous river-bed levels.

The stakes are considered to represent possibly the remains of post-medieval piles along the Stonar waterfront. No pattern was distinguished in the narrow trench investigated, but they may have formed part of a quayside or related waterfront structure. The stakes were recovered less than 20 m. from the postulated edge of the Stonar Bank 'high ground' to the north (see Fig. 11), at a point where the channel between Stonar and Sandwich was approximately 400 m. wide. The gravel making up the Stonar Bank apparently did not extend as far south as the section observed, unless it sloped down fairly steeply and lay at greater depth. The stakes may represent part of the final phase of post-medieval quayside at Stonar which perhaps advanced southwards as silting-up took place. No evidence was found of later occupation of this marginal area, nor any salt pans.

It is not clear when silting began in this part of the Wantsum Channel, but it was probably during the fourteenth century, towards the end of the period when Stonar was an important port. Earlier, the closure of the northern entrance to the Wantsum between the north end of the Stonar Bank and Ebbsfleet, possibly in the eleventh century,

would have accelerated silting by the sluggish flowing River Stour in the upper part of the Wantsum. The river eventually forced a passage to the sea further to the south via Sandwich Haven between Sandwich and Stonar. Reclamation of extensive areas of marshland along the edges of the channel (e.g. The Monks' Wall, see below) in the twelfth-thirteenth century would have caused increasing silting elsewhere. This is likely to have been exacerbated by the great storm of 1287, which further built up the large shingle bank, which extended north from Deal, and thereby moved the exit of the River Stour/Sandwich Haven further to the north. The inside of the great loop now formed by the River Stour/Sandwich Haven around the south edge of the Stonar would have been particularly prone to silting. By the time of the French raid in 1385, silting of Sandwich Haven on the Stonar side was probably well under way, and it is recorded that after the raid the waters forsook Stonar so that it remained no longer a port (Hasted 1800, 412). In Sandwich, trade already in decline sank to its lowest ebb about 1500 because of the silting up of its river approaches (*ibid.*, 158–60).

Against this background it seems clear that, if the French raid of 1385 had not caused the abandonment of Stonar, then the choking of its waterfront by mud and silt would have hastened its demise, at least as an important port, shortly after. A bridge across the river at Sandwich was built in 1759, replacing the ferry, and indicates that the present banks were more or less then as they are today. A reproduction of a mid-seventeenth century map of Thanet (Busson 1985, 20) shows a similarly narrow channel. However unreliable such maps may be, they would support the suggestion that the width of the River Stour/Sandwich Haven was progressively and rapidly narrowed between the late fourteenth and mid-seventeenth centuries, most probably mainly in the latter part of this period.

Between Richborough and Sandwich the opportunity to record a section through The Monks' Wall is a useful addition to the archaeological record since to date the series of medieval reclamation earthworks do not appear to have been the subject of published study. The prominent, though low bank which survives to a height of 1.20 m. and a width of approximately 6 m. has probably been subject to a certain degree of erosion though this has perhaps not made a marked difference to its original profile. The adjacent ditch is likely to have been an original feature. Some detail of the bank's construction survived. Individual 'clods' could be discerned, the pale white deposit noted perhaps having formed in the interface between the clods. There was no evidence of any subsequent raising or rebuilding of the bank which appears to be of single phase construction, nor of any deposits which might represent later inundations of the area.

No dating evidence was obtained from any of the deposits associated

with The Monks' Wall. The stratigraphic location of the substantial squared timber (a possible ship's timber?) in the alluvial deposits sealed beneath the bank would suggest a pre-thirteenth century date, and conceivably the timber might be of much earlier date, possibly even Roman. This area of the Wantsum Channel would have been open water in Roman times, and the site of Richborough fort (*Rutupiae*) lies less than 1 km. to the north (see Fig. 1).

The construction of the A256 and the extension of a modern works compound have obliterated or obscured some 300 m. of the Monks' Wall towards the north although almost 1 km. survives to the south. The line of the earthwork broadly mirrors the 'teardrop' shape of the Stonar shingle bank to the east, with the present course of the River Stour up to 500 m. to the west.

Within the overall north–south transect across the Wantsum Channel provided by the project, the pollen and diatom sequence through the deposits of the infilled channel, along with the associated C^{14} date, are a most important addition for regional studies. The vegetational sequence, spanning some 4,000 years, provides an important back-drop to the environment in which past activity and settlement took place. It also charts episodes of human impact on the local environment. A further recent opportunity to study the infilled Wantsum Channel and associated excavated archaeological evidence has been provided by the construction of the A257 Ash bypass, west of Sandwich (Panton and Bennett 1993, 375–7). The full report on this project will be of great interest when viewed alongside the data generated by the Sandwich Bay WTS.

The Lydden Valley and Deal Spit

In many respects the Lydden Valley forms a direct extension to the sequence of events recorded in the Wantsum Channel. As already noted, however, this zone has, additional attributes which make it of particular importance and archaeological potential. The project has not been able to characterise this landscape zone in as much detail as the other two but the data provide a useful addition to the ongoing work in the area by the Dover Archaeological Group (see Halliwell and Parfitt 1985). Work by the D.A.G. has revealed the existence in places of a buried prehistoric land surface, sealed by up to 1 m. or more of alluvium, which was deposited following inundation at some time probably after the Middle Bronze Age. This buried land surface was not present or recognised in the pipeline transect but some worked flints were recovered from near Dicksons Corner. Perhaps the main concentration of buried sites lay further west along the edge of the Lydden Valley, with a smaller number to the east along the edge of the Deal Spit.

The stakes recorded under Guilford Road appeared to form part of a single line, though owing to the narrowness of the trench this could not be confirmed. It is possible, therefore, that other associated alignments, groups or individual stakes lay outside the area observed. The observed arrangement and their substantial size makes it likely that the oak stakes formed either part of a causeway (perhaps across a precursor to the North Stream), or an embankment associated with land reclamation, or both. The former is considered most likely given the similarity and extent of the alluvial layers to the east and west of the stakes, and the absence of any deposits which might have formed part of a bank.

If the interpretation of the stakes as part of a causeway is correct, then its location is not surprising. A medieval date is proposed. Before reclamation, probably beginning in the twelfth century, this area to the south-east of Sandwich was open water and marshland referred to in a charter of 1023 (Sawyer No. 959) as *Meacesfloete*, today the Lydden Valley. What is now the Guilford Road may have developed during silting and reclamation as a track following a slight ridge of higher ground across the northern part of *Meacesfloete*, perhaps linking Sandwich with the large shingle bank which had grown northwards from Deal. The stakes may have formed part of a causeway across a lower lying, perhaps marshy section of this track, or a stream – now the North Stream.

The interpretation of the Late Saxon/early medieval worked beech fragments from the same location is unresolved. If they are derived from a logboat, there remains the possibility that they represent fragments of the same vessel recorded in 1936, and perhaps damaged during recovery. The earlier find is recorded as of oak but mis-identification cannot be ruled out. Alternatively the 1994 find may represent a separate vessel from the same location (or very near by); this would not be unusual (D. Goodburn, pers. comm.).

Conclusions

The results of the Sandwich Bay WTS project are another example of the worth of linear archaeology (see Cox and Hearne 1991, 221–2). The benefits of the project for the archaeology of this part of north-east Kent are considerable and far outweigh the limitations of the sample, that is, primarily, a series of narrow pipeline easements. The pipelines and installations of the project have been viewed as a north to south archaeological transect, encompassing three defined landscape zones associated with the former Wantsum Channel and its margins. The environmental data, and radio-carbon dating, from deposits infilling the channel combined with excavated evidence and observations make a significant contribution to our understanding of the former local landscape and associated human activity. As made clear in the introduction to this

report the sequence of geomorphological change in the area is intimately linked with the history of human occupation; the relationship between the two forces (i.e. natural and anthropogenic) is symbiotic and dynamic and an understanding of either or both cannot be divorced from the other. It is these very aspects which make the archaeology of this part of Kent so fascinating, and it is hoped that the attempt to integrate the two in this report will be welcomed by both the archaeological and geological 'sides' of the debate.

APPENDIX 1 – RADIOCARBON DATING

G. Cook and P. Naysmith (SURRC)

Five samples were submitted for radiocarbon dating to the Scottish Universities Research and Reactor Centre (SURRC), East Kilbride: three timber objects from the Sandwich and Deal Main and two organic samples from the Wantsum Channel augerhole. Details of the samples and the determinations are presented in the chart below.

Ref.	Site/Sample	Radiocarbon age (BP)	Calibrated date BC/AD (1σ)	Calibrated date BC/AD (2σ)
GU-4359	Stonar timber stake (W646 Obj. No. 101)	150±50 BP	cal AD 1666–1955	cal AD 1650–1950
GU-4360	Stonar timber stake (W646 Obj. No. 103)	100±50 BP	cal AD 1682–1955	cal AD 1670–1955
GU-4361	Guilford Road timber object (W646 Obj. No. 135)	990±50 BP	cal AD 998–1039	cal AD 970–1160
GU-4363	Wantsum Channel – basal organic horizon (205–118 cm)	4640±60 BP	cal BC 3505–3350	cal BC 3620–3140
GU-4367	Wantsum Channel – basal organic horizon (204–118 cm)	4630±70 BP	cal BC 3505–3343	cal BC 3630–3100

Notes

(1) The above radio-carbon ages C^{14} are quoted in conventional years BP (before A.D. 1950). The errors are expressed at the one sigma level of confidence.
(2) The calibrated age ranges are determined from the University of Washington Quaternary Isotope Laboratory, Radiocarbon Dating Program, 1987. The 20-year atmospheric calibration curve is used throughout and the calendar age ranges, obtained from the intercepts (Method A), are expressed at both the one and two sigma levels of confidence.

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The later prehistoric pottery drawings (Figs. 16, 17) were produced by Nigel Macpherson-Grant. All other figures are by Liz James (Figs. 13–15) and Julian Cross (all other figs.) of Wessex Archaeology.

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