THE HULLBRIDGE BASIN SURVEY

INTERIM REPORT No 4

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with contributions by
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ESSEX COUNTY COUNCIL

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APRIL - JUNE 1983

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WITH

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P. MURPHY

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CONTENTS

PAGE

HULLBRIDGE BASIN SURVEY 1983

FIGURE CAPTIONS

Fig. 1 Location of the investigated sites.

Fig. 2 Fenn Creek: location of site 2 and cleaned section. (salt working hearth located at B).

Fig. 3 a Site 2, general section.

b Site 2, plan of salt working hearth.

c Site 2, section through salt working hearth.

Fig. 4 Site 4 in relation to the buried Crouch channel. (N.B. the limits of the channel have been arbitrarily set by the 0m. O.D. contour on the Lower Peat; artefact densities are qualitative).

Fig. 5 Diagrammatic NW-SE section through the Crouch buried channel. (N.B. the valley side-slopes have been projected onto section line A-B; the floor of buried channel has been interpolated from I.G.S. boreholes).

Fig. 6 Site 22. Wooden structure in clays above Lower Peat.

Fig. 7 a North-South section showing site 60 in relation to site 29.

b East-west elevation of site 29 showing buried land surface.

Fig. 8 Plan of wooden platform at site 29: context 68.

Fig. 9 Sections and plans of the smaller sites.

a Site 34.

b Site 35.

c Site 14.

d Site 37.

e Site 38.

f Site 39.

g Site 54, plan

h Site 42.

i Site 54.

j Site 55, plan

k Site 58.

l Site 59.

Fig. 10 a Levelled section through site of oar, site 56.

b Plan of oar. N.B. before the final cut was made context 98 extended up to oar shaft.

c Stratigraphic sequence through site of oar.

Fig. 11 Post-Glacial changes in the geomagnetic field in Britain, as recorded in lake sediments.

Fig. 12 Palaeomagnetic results (NRM) from site 7 and site 19, River Crouch, with suggested correlation with the Holocene master curve (Fig. 11).

Fig. 13 Sedimentation rate plot for sites 7 and 19, using magnetic ages.

TABLES

Table 1 Preferred Time-Scale for declination and inclination features of the post-glacial Geomagnetic record.

THE HULLBRIDGE BASIN SURVEY : APRIL-JUNE 1983
INTERIM REPORT NO. 4 - T. J. WILKINSON

1.0 INTRODUCTION

The 1983 field season occupied six weeks between mid-April and mid-June. Reconnaissance continued, with emphasis being placed on the south bank of the Crouch estuary. Here, although exposures of old ground surface were rare, the policy of checking all sedimentary exposures paid off with the discovery of a prehistoric oar from an excellent stratigraphic context near Canewdon (site 56, below). The enlarged work force: Steven Godbold, Sandy Grey and Judy Wilkinson, enabled specific sites to be examined more thoroughly than previously and consequently descriptions of sites 2, 4, 23 and 29 have been amplified.

Peter Murphy and Timothy Austin undertook supplementary studies as part of the environmental and chronostratigraphic programmes. Other visitors included the Department of the Environment soil specialists, Richard McPhail and Helen Keeley. No laboratory studies have been initiated on palaeosols or palynology however, these will await the excavation of specific sites at which time more detailed palaeoenvironmental reconstructions will be attempted.

2.0 SITE GAZETTEER

SITE 1

Further section cleaning was attempted near the base of the exposure at the level of Fenn Creek. This revealed a large mass of waterlogged brushwood together with at least one NE to SW line of posts - 5-8 cm in diameter. No other work was attempted at this site, but it is clear that the evidence for wooden structures is more extensive than was originally noted in the first Interim Report.

This site shows potential for future investigation, which should in the first place, concentrate on more section cleaning with only limited excavation.

SITE 2

Following the discovery of more briquetage at this site during the December season, the section was selectively cleaned, levelled with respect to Ordnance Datum and finally a salt evaporating hearth was excavated.

The site was constructed on the old land surface fringing Fenn Creek which dipped gently to the SE into the precursor of the modern creek. At the time of salt production the land surface at context 96 (Fig. 3) was probably above the tidal limit which appears to have been just below the level of the hearth. To the SE of the hearth, a thick layer of grey silty clay accumulated within the inter-tidal zone. If the site was functioning at contemporary H.W.M. (high water mark), this indicates a relative rise of sea level H.W.M. of approximately 2 m.

General Stratigraphy in vicinity of Hearth:

From top to bottom; levels with respect to O.D.

c.3.00 m to 2.08 m	Grey clay, immediately below salt marsh.
2.08 to 1.92	Moderately humified Upper Peat. Includes 2 thin grey clay layers 1 - 2 cm thick.
1.92 to 1.20	Grey estuarine clay with dark grey mottled zone visible between 1.32 and 1.46 m O.D. above hearth and also 7 m further west.
1.20 to 0.85	Dark grey brown clay loam or loam containing charcoal and pulverised charcoal, bright red briquetage and occasional humic patches, c.10cm thick. Overlay c. 5 cm of hard, pink sandy clay (see context 106). Prior to excavation this overlay a variable zone with abundant red clay : context 107. 107 had a wavy interface with the head beneath.
	To the west of the hearth a thin, patchy buried humic horizon overlay a pale grey fine sandy loam horizon above the head. This is the pre-occupation soil which has been recorded elsewhere along the Crouch estuary.
Lower Peat to S.E. Top: 0.09 - 0.18 m	15 cm thick layer of moderately well humified Lower Peat dipping gently down to south. Overlay grey silty clay head containing occasional stones and calcined flints.

The Salt Evaporating Hearth: Description of excavated contexts (listed in numerical order: for location, see Fig. 3).

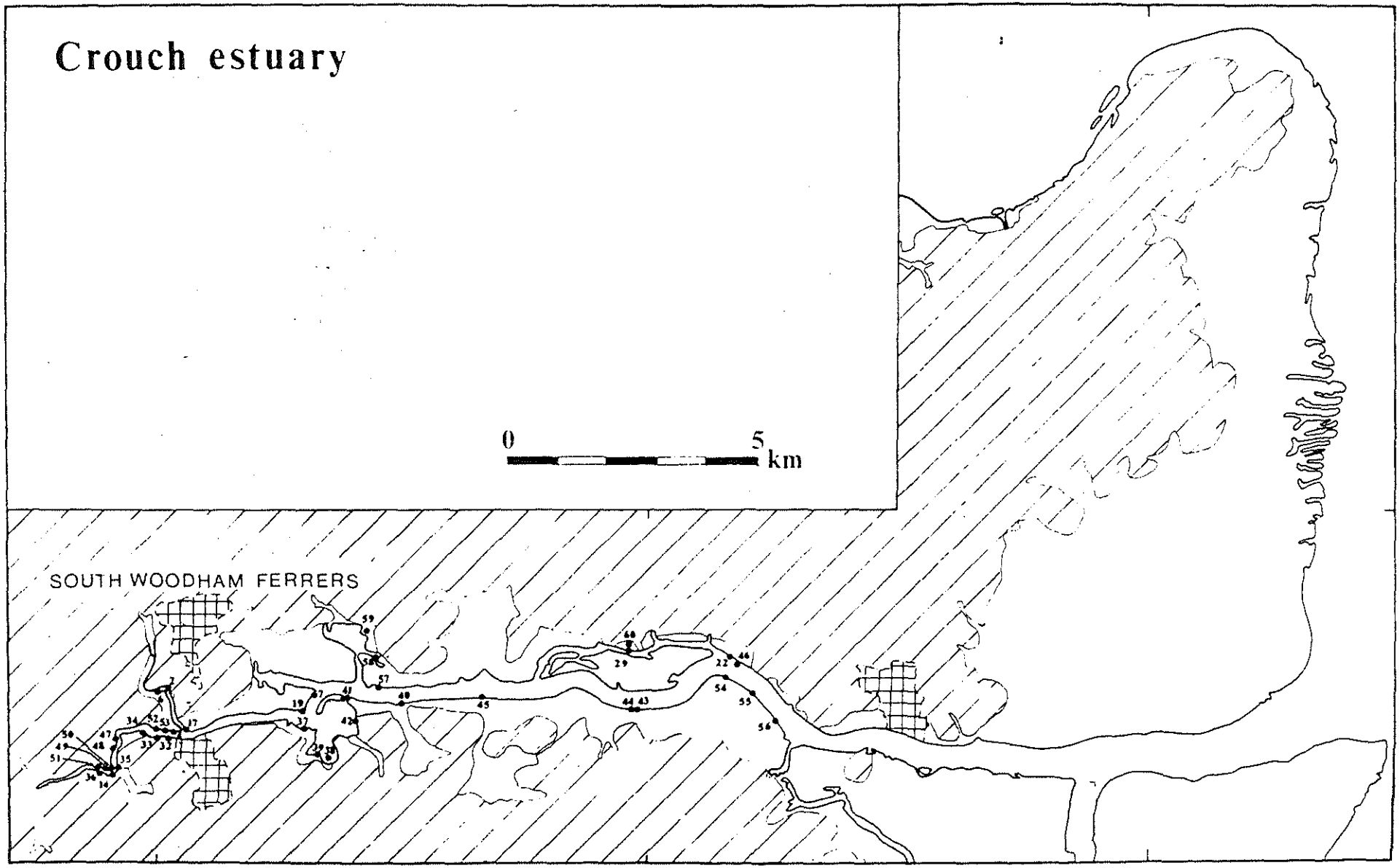

FIG 1

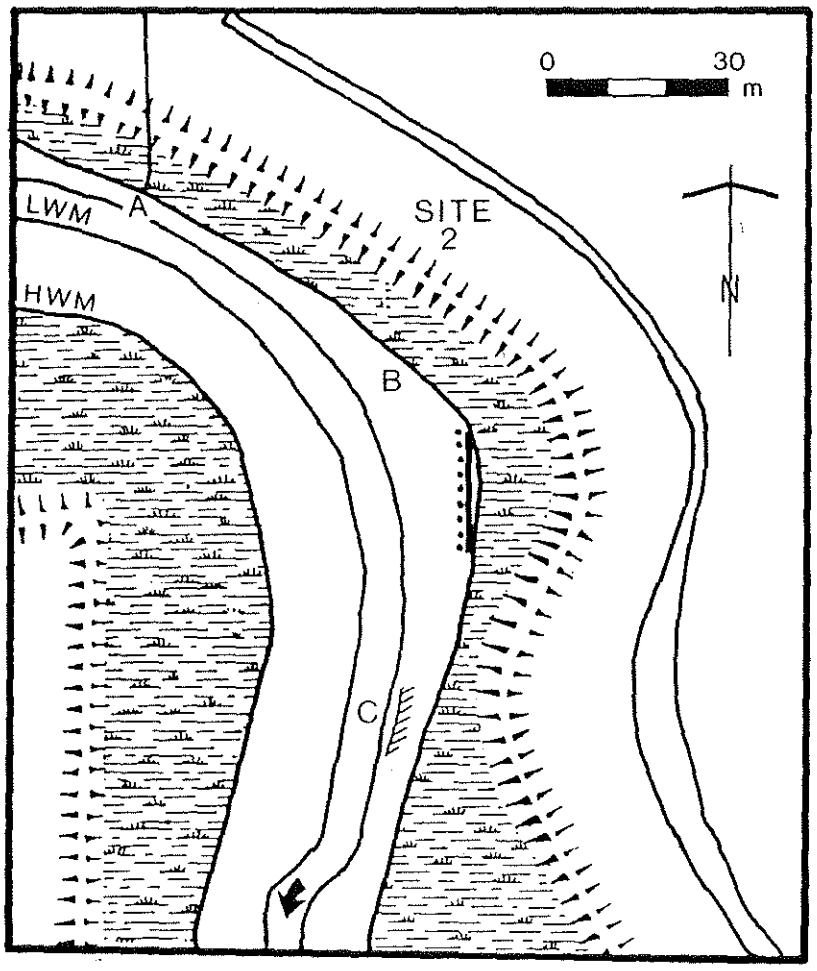

FIG 2

91 Fill contained within fired walls of hearth. Post dates use of hearth and in N.W. at least, overlay 110. Brown sandy loam with very slight dip towards hearth centre. Contains abundant fragments of small briquetage containers, pedestals, a flint-gritted pottery jar and charcoal. The last named increases in abundance towards the top. The sandy loam matrix became more clay-rich to S.E.

92 8 cm thick; below grey estuarine clay and above a similar clay, both of which contained small fragments of briquetage.

Dark grey with common small fragments of briquetage and occasional small fragments of wood charcoal. Contained within grey brown and red loam matrix. This layer was traced to context 91 within the hearth and probably resulted from the drift of waste products from the hearth onto the inter-tidal slopes in the vicinity of H.W.M.

93 Red and yellow mottled head of buried land surface.

94 'Belgic' pottery vessel excavated from crack at west end of site during June 1982 season. Not stratigraphically associated with the site.

95 Homogenous grey clay which completely sealed the hearth. Contained occasional charcoal and fired clay fragments. Above 91 and 108.

96 Charcoal sample from charred post or root in situ within small multiple depression in old land surface. In section charred wood occurred as thin undulating layer between head and overlying grey clay. Wood penetrated into head and was sealed by grey clay. Charred wood was extracted in large chunks which were apparently part of a single piece of wood. Matrix: black deposit of fine charcoal with occasional small fragments of bright red fired clay and one or two calcined flints. Elevation: 1.40 m O.D., 1.0 m E to W, probably 40-50 cm vertically above contemporary H.W.M.

105 Grey, fine sandy clay; moderately firm. Passed beneath fired hearth wall where it was replaced to SE by reddened zone 107. Layer continued to SE of hearth where it was immediately above the head.

2 m to the SE of hearth a 1-2 cm thick charcoal lens with fired clay overlay 105. This lens was separated from 95 by 10 cm of grey clay.

106 Hearth Floor : Mottled pale pink and red and hardened by firing; 2-3 cm thick. Sandy clay with occasional pale grey clay patches. Slight gradient towards NE, i.e. into section, and in general the hearth is slightly dished towards the centre. The black patch indicated on plan overlay the reddened zone 107. Altitude of NW part of hearth floor is 0.93 m O.D.

107 Reddened zone immediately beneath hearth floor. Bright red sandy clay variegated with grey brown sandy clay. Probably equivalent to 93 and 105 but fired <u>in situ</u> by conduction of heat from overlying hearth.

108 Black, slightly plastic humic deposit or fine charcoal dust; no sign of larger charcoal fragments. Contained relatively little briquetage. Layer continued up to hearth wall which it had accumulated against.

109 Grey clay between 108 and 110. Probably a marine flood horizon representing an exceptionally high tide or inundation of flood waters from inland.

110 As for 108. Continued up to hearth wall and a thin layer continued into hearth to overlie the hearth floor 106.

The Hearth

The exposed area of 115 cm x 75 cm comprised a fired clay floor (106) underlaid by a heat-reddened clay (107). The hearth wall was 2-4 cm thick and 7-8 cm deep. It did not appear to join with the hearth floor but was underlaid by the black layer 110. The intact rim was exposed in the HE by the centre of the NW - SE section where it exhibited a rounded interior face veneered in a thin very pale brown 'salt slip'. The wall was of bright red fired clay, possibly merely the local estuarine clay fired to a brittle state. Both the floor and the hearth wall were devoid of vegetable temper which immediately distinguished them from the pre-usage fired briquetage.

During the period of the hearths use the organic and clay layers 108, 109 and 110 accumulated on the landward side of the hearth. Following the hearth's abandonment the interior became filled with charcoal, fired clay vessels and fragments of pedestals. Finally it was covered by the estuarine clay 95.

Discussion:

The hearth was excavated to the point at which further excavation would have damaged the eroding bank of Fenn Creek thereby encouraging more destruction. Monitoring of the site during the month since excavation indicated that short term erosion is limited to the collapse of salt marsh above and the gradual disintegration of the clay slopes beneath. Although the hearth was not eroded significantly during the month following excavation it is certain that it would have been eroded away within a few years.

Finds:

Finds from the salt working hearth were mainly from 91 which was totally uncontaminated and well sealed by 95 above. Finds were mainly rim, base and body sherds of small evaporating vessels but also included several pedestal fragments, none of which was complete however. Sufficient fragments of a straight-sided, flint-gritted jar, to reconstruct a full profile but the form is not clearly diagnostic.

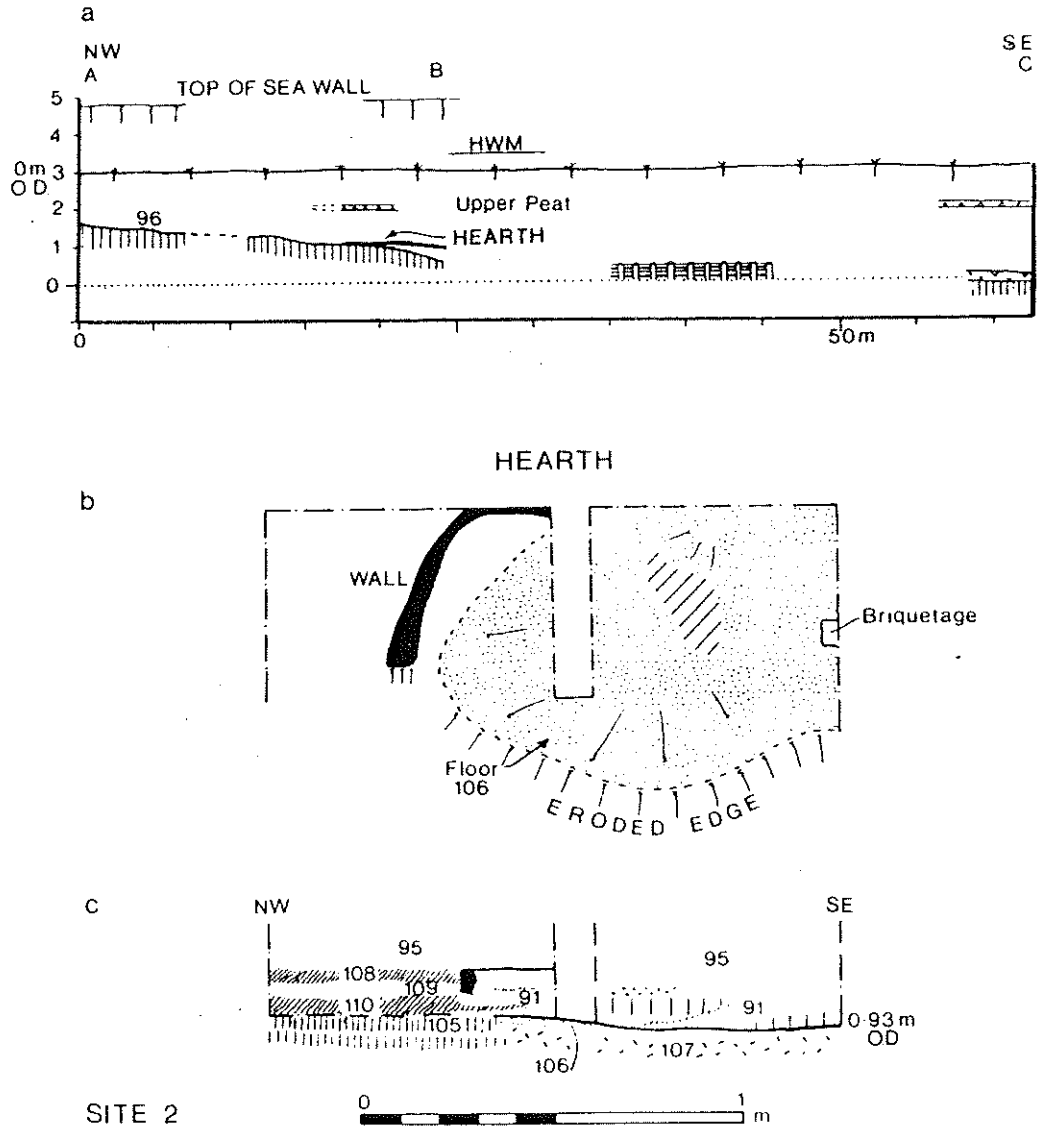
a
NW
A
TOP OF SEA WALL
B
SE
C
5
4
0m
OD
3
2
1
0
HWM
Upper Peat
96
HEARTH
0
50m
HEARTH
b
WALL
Briquetage
Floor
106
ERODED EDGE
c
NW
SE
95
108
109
110
105
91
95
91
0·93m
OD
106
107
SITE 2
0
1
m

FIG 3

Although probably of Early or Middle Iron Age date, greater reliance should be placed on the C14 sample from context 91.

Samples

The abundant temper of grass, chaff etc. within the briquetage should provide some evidence regarding contemporary land use and a sample of body sherds are being examined in detail by Peter Murphy.

Context 91 Wood charcoal from hearth. Submitted to determine wood species used for salt evaporation and to provide a C14 estimate of the hearth's age.

Context 96 Charred wood from 96. Wood species identification required and interpretation of whether the wood was root or part of a post.

SITE 4

Interim Report No. 1 included a preliminary assessment of the stratigraphic succession of the Crouch Estuary which noted a discrepancy between the elevation of the Lower Peats and the valley floor gravels. The discrepancy was evident on Figure 2 of the report which showed the Lower Peats 2 - 3 m above the valley floor gravels recorded from I.G.S. boreholes (Hollyer, 1978). Because the latter were aligned along the valley axis and the peats were recorded along the modern estuary the discrepancy could be explained by the presence of a buried channel located a little to the north of the present channel which in the vicinity of Hullbridge occupies the south edge of the valley.

The location of a buried channel was crucial to the interpretation of site 4 and its location was roughly determined by levelling the Lower Peat exposures and by judiciously placing auger holes along the valley axis, (Figures 4 and 5).

On Fenn Creek, levels on the top of the Lower Peat at site 5 show a clear southward dip, whereas northward dips are indicated for the top of the Lower Peat at sites 4 (E. end) and site 17. The main east to west exposure of Lower Peat at site 4 dips down slightly to the west, presumably because of the proximity at the west end, of the buried channel.

Two successful auger holes were completed :

BH a, inland of the sea wall intercepted the Lower Peat some 40-50 cm lower than at nearby site 4 whereas BH b, located further to the north, did not intercept Lower Peat but hit a possible gravel or head surface at -2.03 m O.D.

BH a Sequence in auger hole: in base of ditch immediately N of sea wall.

0.71 to 0.56 m O.D.	Soft, pale brown silty clay.
0.56 to -0.19 m	Soft, pale grey silty clay with occasional plant remains (estuarine clay).
-0.19 to -0.29	Transition to Lower Peat.
-0.29 to -0.64	Soft, brown and slightly fibrous peat.
-0.64 to -0.79	Grey clay with some plant remains, includes lenses of slightly fibrous peat.

BH b Located in floor of Fenn Creek:

- 0.63 to -0.83 m O.D.	Soft, dark grey brown silty clay.
- 0.83 to -0.98	Dark grey silty clay.
- 0.98 to -1.73	Soft grey silty clay with occasional plant remains (estuarine clay).
	Gravel detected at base of auger hole at -2.03 m but not collected in auger. Sediment becomes much firmer at this level and this deposit may be a head containing gravel or occasional stones.

The above data, combined with extrapolations from I.G.S. boreholes (Hollyer, 1978) suggests the presence of a buried channel immediately to the north of site 4. This is indicated somewhat arbitrarily on Figure 4 by the 0 m O.D. contour on the Lower Peat. The channel is situated where the present Fenn Creek takes a dogs leg to the east along what must be the later extension of Fenn Creek.

When the 'buried channel' was open - i.e. until around the time of the Lower Peat development at around 1800 bc - the junction of Fenn Creek and the Crouch must have been located to the north in the vicinity of site 5. Sites 4, 15 and 17 therefore probably occupied a continuous land surface which dipped northwards into the earlier Holocene Crouch estuary.

Qualitative densities of lithic tools sketched on Fig. 4 indicates that most tools occur at the lower W. end of site 4 in the vicinity of the buried channel. This the main focus of human activity during

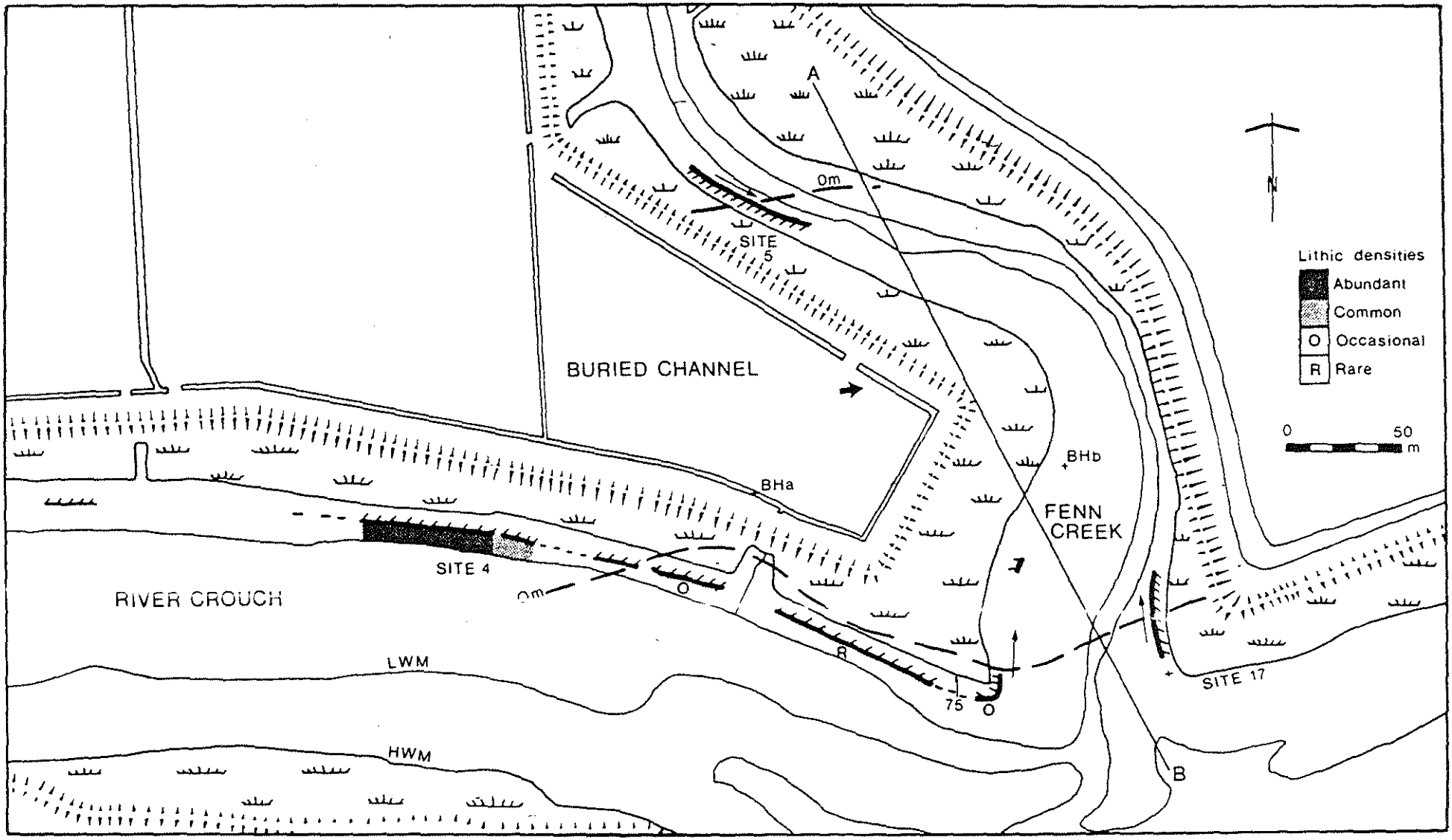
A
0m
SITE 5
BURIED CHANNEL
BHa
BHb
FENN CREEK
SITE 4
RIVER CROUCH
0m
O
R
LWM
HWM
75
O
SITE 17
B
N
Lithic densities
Abundant
Common
O Occasional
R Rare
0
50
m

FIG 4

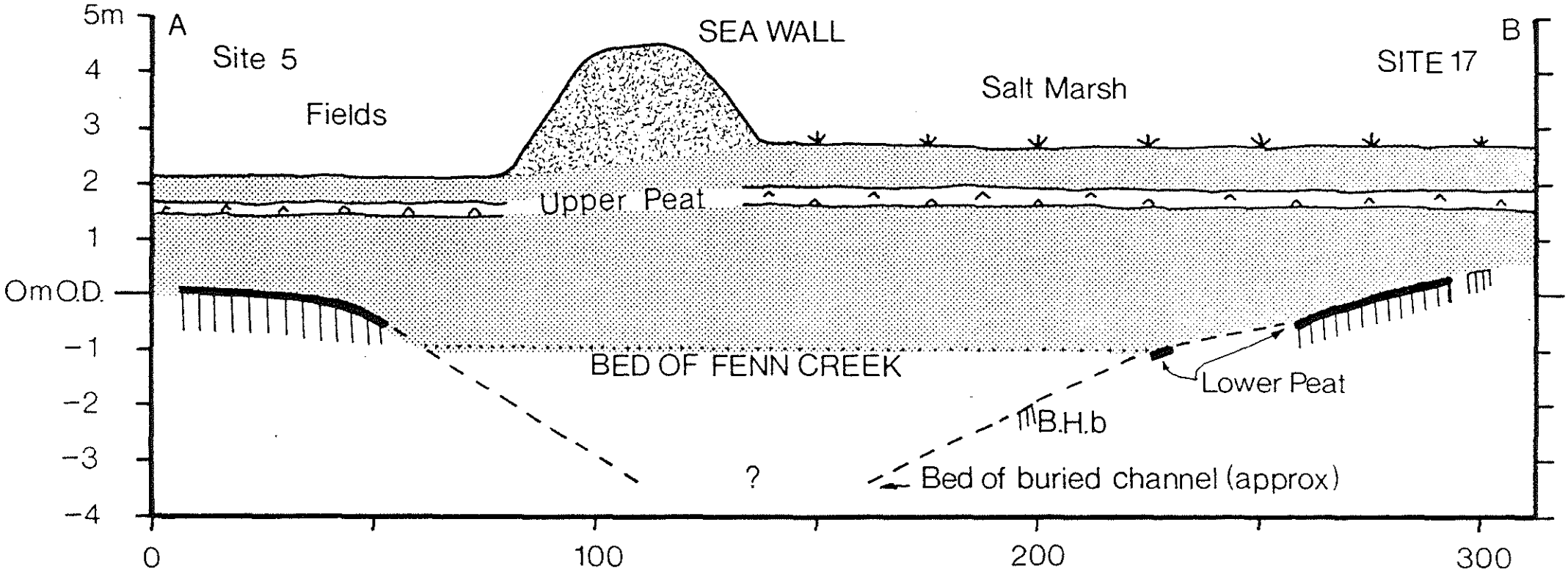
5m
4
3
2
1
OmO.D.
−1
−2
−3
−4
A
Site 5
Fields
SEA WALL
Salt Marsh
B
SITE 17
Upper Peat
BED OF FENN CREEK
Lower Peat
B.H.b
?
Bed of buried channel (approx)
0
100
200
300

FIG 5

the Mesolithic/Neolithic periods was probably on the lower southern valley-side slopes overlooking a relatively narrow channel which progressively became estuarine during the Flandrian transgression.

The Lower and Upper Peats

C14 assay of the Lower and Upper Peats at site 4 demonstrated the former to have developed around 3,750±80 bp (c.1800 bc) and the latter at 1580±70 bp (c.370 ad). A second date for the Upper Peat at site 9 was very similar at 1510±70 bp. The two peats are indicated on the projected section, Fig. 5 which indicates the clear dip of the Lower Peat in contrast to the essentially horizontal attitude of the Upper Peat.

Drying out of the soils inland of the sea wall has produced shrinkage and an associated drop in elevation of the Upper Peats by approximately 20 cm since embanking and drainage took place.

Additional samples of the Lower Peats (context 74) were taken for macro-botanical analysis but owing to recent worm action these have become totally contaminated. This was not the case for the Upper Peat which is currently being studied by Peter Murphy and which was described in the field as follows :

Context 75 (Upper Peat) 0 cm = salt marsh surface.

0 - 69 cm Grey marsh clay, becoming brown above with prominent red mottles and reddened ped faces. Many fibrous roots, 1 or 2 rounded flint pebbles. Distinct boundary at base. (Upper Clay).

69 - 70 cm Very dark grey clay, forms thin 1 cm band. Either reduced iron-rich layer or thin humic band.

70 - 76 cm Grey brown clay with black mottles, very soft at top, merges down into :

76 - 88 cm Dark reddish brown peat. Highly humified at top, becoming less humified fibrous peat below. Elevation of top = 2.00 m O.D.

88 - 89 cm Band of light grey brown clay. Distinct upper and lower boundaries.

89 - 98 cm Peat: Top, quite well humified fibrous peat; merges down into Phragmites peat, barely humified and in excellent state of preservation. Sample for macro-botanical analysis taken from the lower portion.

98 - 102 cm Grey brown clay with some fibrous plant material.

102 - 103 cm Thin layer of phragmites leaves. Sharp boundary above and below.

103 - 124 cm Greyish brown clay containing some fibrous plant material.

below 124 cm Grey clay, black on ped faces with black mottles; cf. horizon below Upper Peat at site 56. Probably estuarine 'Middle Clay'.

Bulk Samples: 95 - 98 cm from Phragmites peat.
110 - 115 cm from grey brown clay.
135 - 140 cm from grey clay.

Diatom Samples: (below salt marsh surface)
10 cm : From top of Upper Clay.
30 cm : From middle of Upper Clay
50 cm : From lower part of Upper Clay
70 cm : From grey brown clay with black mottles.

Samples for palaeomagnetic dating were taken by Timothy Austin of the University of East Anglia, from site 4 and 17. (Figure 4 contexts 80 and 81), and the results are discussed below.

The detailed interpretation of the Upper and Lower Peats has been left for the final report but the information currently available indicates that following the inundation of the Lower Peats by the rising Flandrian sea, marine/brackish conditions prevailed in the Upper and Middle reaches of the Crouch estuary. Then a freshwater environment, subsequently colonised by Phragmites beds, became established around the end of the Roman occupation. This was followed by inundation, again probably of estuarine conditions, at some time after the 4th century ad.

Recommendations

This rather more detailed picture of the immediate environment of site 4 aids considerably the understanding of the artefact distribution at the site. It is suggested therefore, that a sample survey and excavation be undertaken in 1984 along the 300 m E to W stretch of Lower Peat and head exposed along the Crouch channel. This can take place in conjunction with more detailed augering to determine the exact route of the buried channel. Pollen analysis of the

sediment and peats exposed may prove unreliable owing to the gross contamination of all sub-aerial exposures within the inter-tidal zone. Such examination may prove more valuable from sites such as site 8 where the peat remains beneath the worm burrowed zone.

SITE 6

Re-examination of Lower Peat

Lower Peat is a dark brown humic silty clay which rests upon a grey silty clay of uncertain origin. No wood fragments were observed. In grey silty clay small charcoal fragments were found together with rare small fired clay fragments.

SITE 14 (additional data)

A 10 - 20 cm thick silty sandy loam horizon occurred immediately above the head and formed the top horizon of the buried land surface (Fig. 9C).

It was overlaid by a discontinuous layer of pulverised charcoal which included abundant small fragments of red fired clay. The latter were mainly less than 1 cm across and were probably briquetage. The layer, which varied from a thin line of fired clay, up to a deposit 50 cm thick, occurred at the interface between the buried land surface and the overlying estuarine clay.

Approximately 80 cm of grey, estuarine clay intervened between the cultural deposit and the overlying monocotyledonous Upper Peat. Assuming a date for the Upper Peat of around 1500 bp (see site 4 report)* the depth of the cultural horizon implies a prehistoric date for its accumulation.

The most likely interpretation of this site is that it represents salt working waste accumulated at or a little above contemporary H.W.M.

Recommendations

The site is currently undergoing erosion. Section cleaning is recommended and might reveal salt working hearths and debris diagnostic of salt working as well as datable artefacts. Site 14 represents the most upstream example of salt working recorded

*N.B. Two housebricks of 18/19th century date were found immediately above the Upper Peat. Although they appeared to be overlaid by grey clay it is likely that they were in fact intrusive from a later stratigraphic level.

during the survey and it would be useful to establish at what period estuarine conditions had penetrated to this point.

SITE 22

The site was cleaned, planned and photographed and it is now possible to describe the structure in more detail.

The structure comprised 5 posts, 8 - 14 cm in diameter, which dipped 10-15° to the horizontal into a moderately firm blue-grey estuarine clay. To the south a 1.25 m long pole, c.3 cm in diameter and cut obliquely at the east end lay horizontally east to west within the top of the clay. Thin stakes, 1 - 3 cm in diameter which dipped between 5 and 20° to the south were ranged along the pole on either side, apparently to secure the horizontal in place. Further to the south, thin brushwood was aligned east to west and parallel to the pole, but did not appear to be interwoven with the oblique stakes.

The entire structure measured 1.50 m E to W by 1.30 m N to S. It was contained within an oval area of blue grey estuarine clay surrounded by a grey brown clay which in turn lay against an eroded face of the Lower Peat as recorded in Interim Report No. 3. A preliminary interpretation is that the structure formed part of a wattle or hurdle fixture which subsequently collapsed into the intertidal muds to be eventually inundated by still later accumulations. No artefacts were found but part of the westernmost oblique post has been submitted for C14 assay. The only other cultural evidence noted was a single calcined flint from beneath the Lower Peat to the NW of the structure.

SITE 29 (Figs. 7 and 8)

The site was re-examined in detail during the spring of 1983. This led to the discovery of more artefacts, an additional wooden structure (context 68) and some possible features cut in the old land surface. Furthermore, to the north of site 29 and inland of the sea wall, scatters of briquetage have been exposed beneath estuarine clays along a N - S drainage ditch (site 60).

Context 67

This mass of brushwood and an associated wooden structure were cleaned and photographed but yielded no additional data. A sample taken from the brushwood at the west end of context 67 has been submitted for C14 assay.

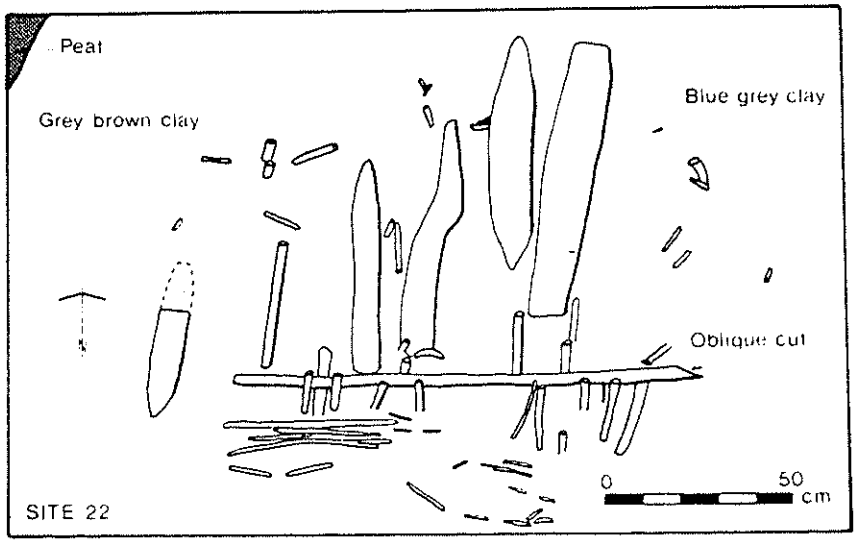
Peat
Grey brown clay
Blue grey clay
Oblique cut
0
50
cm
SITE 22

FIG 6

Context 68

A wooden structure discovered towards the west end of the site, it comprised the following elements :

a) A group of parallel, horizontal timbers set on the head of the buried land surface. The outer members were well squared (marked Sq. Figure 8 : between 10 and 15 cm square) whereas those towards the interior were more roughly trimmed. The timbers were contained within and covered by a grey estuarine clay similar to that which overlay the Lower Peat at context 69.

b) Continuing the line to the south were 16 upright or oblique wooden posts; some roughly squared, others rounded. Most were grouped about 1.5 m to the south of the horizontals. No verticals could be seen beneath the horizontals either because the horizontals rested directly upon the head or because the verticals were obscured by the overlying timbers. All posts indicated on Figure 8 were set in head and the single post hole was cut in head.

Because of its poor stratigraphic context (it was not well sealed by any datable layer) and lack of associated cultural deposits dating evidence is tenuous. Judging by its elevation with respect to sea level (approximately Om. O.D.) and the nearby artefacts a prehistoric, proba bly Neolithic date seems most likely. The dating question must however remain open until the C14 results from one of the horizontal timbers has been received (location indicated on figure 8).

Although not fully exposed, this appeared the most coherent structure found during the survey. Its most likely function was as a platform to gain access to the estuary. Alternatively it might have been a trackway which crossed from N to S the low area of wet land which existed between two low, but dry islands.

Context 69 (Figs. 6 and 7)

Situated between 20 and 30 m west of context 68. A very dark greyish brown humified Lower Peat layer 5-6 cm thick which lay directly upon a firm, fine sandy silty clay head. The Lower Peat was overlaid by c.2.7 m of grey estuarine clay in which there was no evidence of Upper Peat.

A total length of c.200 m E to W of the buried land surface was levelled with respect to Ordnance Datum to determine if the structures, artefact scatters or peats could be related to the microtopography of the buried land surface (Fig. 7b). They could not be, and it would seem that artefacts and structures were associated with an undulating land surface, locally truncated, which was covered by gently transgressive estuarine sedimentation. Two depressions within the surface appeared to be filled with estuarine clay and may represent feature 5 dug in the old subsoil, (see x on Fig. 7b at 10 m and 113 m W of the site reference point). These may be worthy of investigation at some future date.

Finds

Artefacts were occasionally present on the muds where they had evidently been washed out of the old land surface. They were in excellent condition and had clearly been transported only a very short distance.

Finds included: A Neolithic leaf-shaped arrowhead from c.20 m E on Fig. 7). A blade core from adjacent to context 68, and a body sherd with a cord impressed chevron design - probably Peterborough Ware - from context 100. The complete assemblage is illustrated in the site archive.

Conclusions and Recommendations

The site occupied a broad depression between two low islands which today rise above the estuarine flood plain. It is not clear whether this represents the centre of habitation or its periphery but it evidently became inundated by the rising Flandrian sea. Subsequently, to the north salt working, also probably of prehistoric date, was established in the inter-tidal zone at site 60.

Sites 29 and 60, when viewed together, may provide an excellent example of changing site function during the Flandrian transgression. The wood at 29 may be contemporary with the Neolithic occupation but no further work is recommended until the C14 results have been received. If the wooden structures prove to be prehistoric, further cleaning and localised excavation is recommended, specifically in the vicinity of contexts 67 and 68 but also of the possible features mentioned.

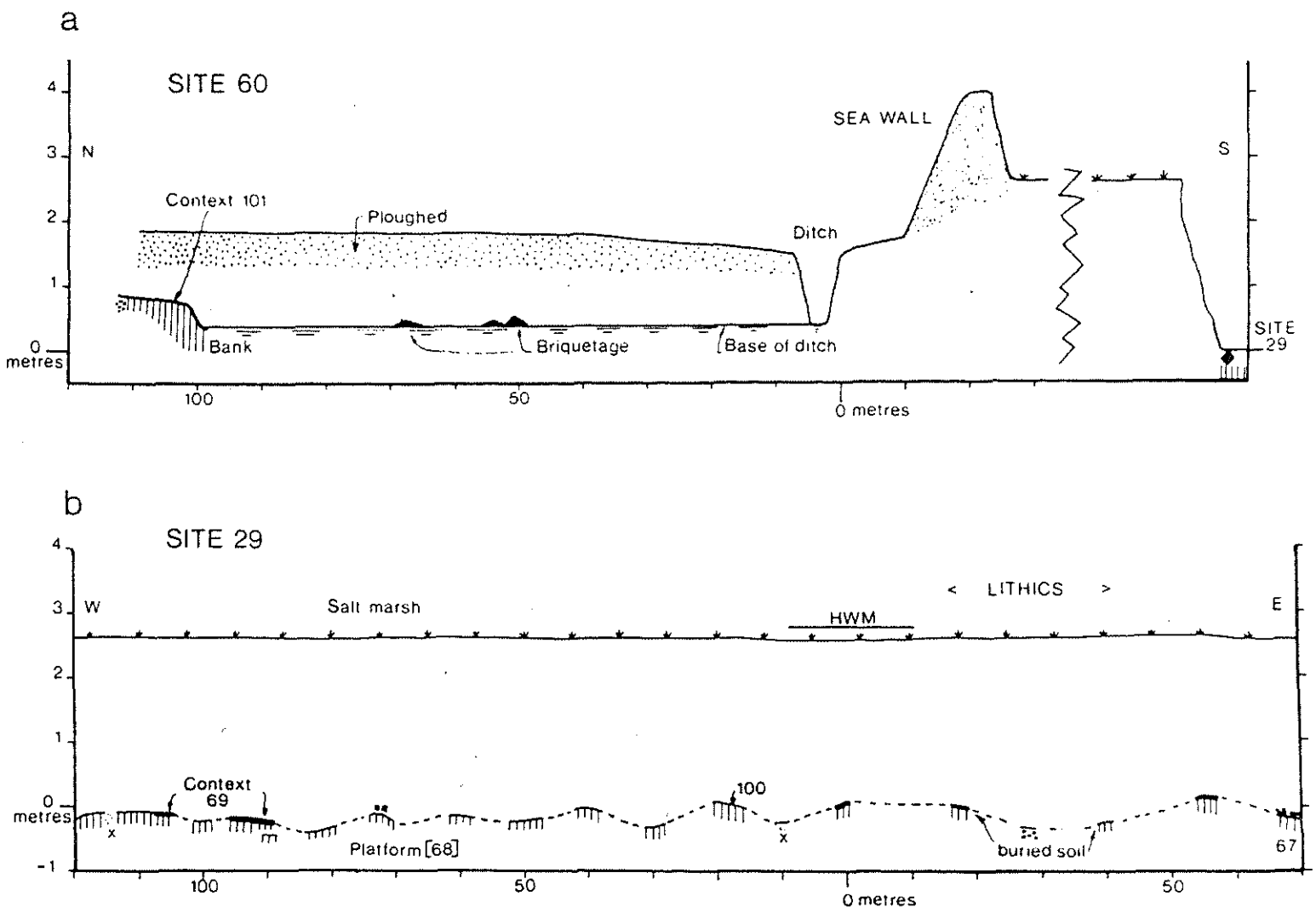
a
SITE 60
N
S
SEA WALL
Context 101
Ploughed
Ditch
Bank
Briquetage
Base of ditch
SITE 29
4
3
2
1
0
metres
100
50
0 metres
b
SITE 29
W
E
Salt marsh
HWM
< LITHICS >
Context 69
Platform [68]
100
buried soil
67
4
3
2
1
0
metres
-1
100
50
0 metres
50

FIG 7

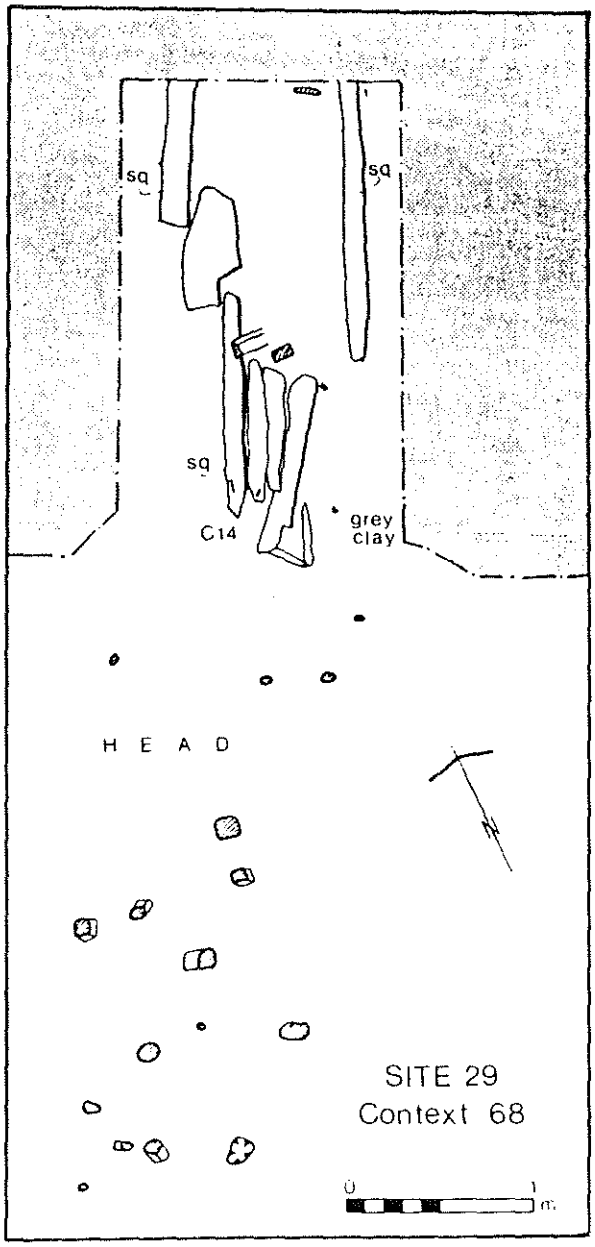

FIG 8

SITES FOUND DURING SPRING 1983 SEASON

N.B. Only abbreviated sequences are described; only where important sequences were exposed are full profile descriptions given.

SITE 32

8018 9551 Rawreth Parish

Located 100 m W of site 15. Exposure of Upper Peat overlaid and underlaid by estuarine clay.

SITE 33

8006 9551 Rawreth Parish

Depression in buried land surface visible in eroded face of south bank of Crouch. Drifted wood fragments, twigs and small branches visible as roughly horizontal band at equivalent level to Upper Peat with which it is probably contemporary.

Context 70: c. 80 m to W of site 33. Old sea wall revetment indicates c.13 m of erosion since construction of earlier phase of sea wall.

Context 85: Flake tool, in excellent condition found within upper part of head.

SITE 34 (Fig. 9a)

7968 9567 Rawreth Parish

Exposure of Upper Peat (measurements below salt marsh surface).

0 - 70 cm	Grey brown water laid clay.
70 - 90 cm	Very dark brown, moderately humified peat with occasional remains of monocotyledonous plants.
90 - 110 cm	Very well preserved monocotyledonous peat.
below 110 cm	Grey estuarine clay.

N.B. This exposure is very close to the valley axis i.e. where the valley is probably deepest.

SITE 35 (Fig. 9b)

7915 9495 Rawreth Parish

Exposure of fibrous Upper Peat with well preserved plant remains, adjacent to and above dipping old land surface. Situated on outside of meander bend at edge of valley.

The head becomes gravelly towards the south. In upper part of dipping land surface towards south, two calcined flints and two possible worked flints noted but not collected.

SITE 36

7889 9484 Rawreth Parish

Exposure of Upper Peat between beds of grey, estuarine clay. The peat is black and humified above and fibrous with abundant monocotyledonous plant remains below.

SITE 37 (Fig. 9d)

8295 9566 Rochford R.D.

Fired clay/briquetage contained within a dark grey, apparently estuarine clay. Exposure followed for c.35 m E-W along eroded edge of salt marsh. To the east the Upper Peat fades out and is replaced by waterlaid clay.

The briquetage includes fragments of up to 4 cm long axis and the layer also includes occasional fragments of charcoal. The layer is situated below the Upper Peat and within 20 cm of it vertically. If the Upper Peat is, as elsewhere, a freshwater deposit dating from c.1500 bp it would appear that freshwater conditions replaced an estuarine environment immediately after salt working ceased. This radical change in the environment was probably towards the close of the Roman period.

There was no evidence of Lower Peat in the vicinity and it is assumed to be some distance beneath the lowest exposure of estuarine clays.

SITE 38 (Fig. 9c)

8348 9500 Rochford R.D.

Exposure alongside drain cutting through salt marsh contained within large flooded embayment. The embayment was a result of a breach of the sea wall which resulted in the inundation of previously drained lands.

Sequence from top to bottom: salt marsh surface = 0.00 m.

0 - 55 cm	Grey brown clay, probably estuarine, with abundant root hairs.
55 - 80 cm	Very dark grey brown to black clay loam horizon with abundant organic staining or dark grey reduced iron. This may be a buried Ah horizon similar to that recorded at site 10 near Stow Creek.
80 - 140 cm	Grey clay, probably estuarine.
140 - 145 cm	Dark grey brown horizon with charcoal and many small fragments of fired clay; no large briquetage fragments however. Layer appears slightly humic. Stretches over 20 m N to S and is between 5 to 15 cm in thickness.

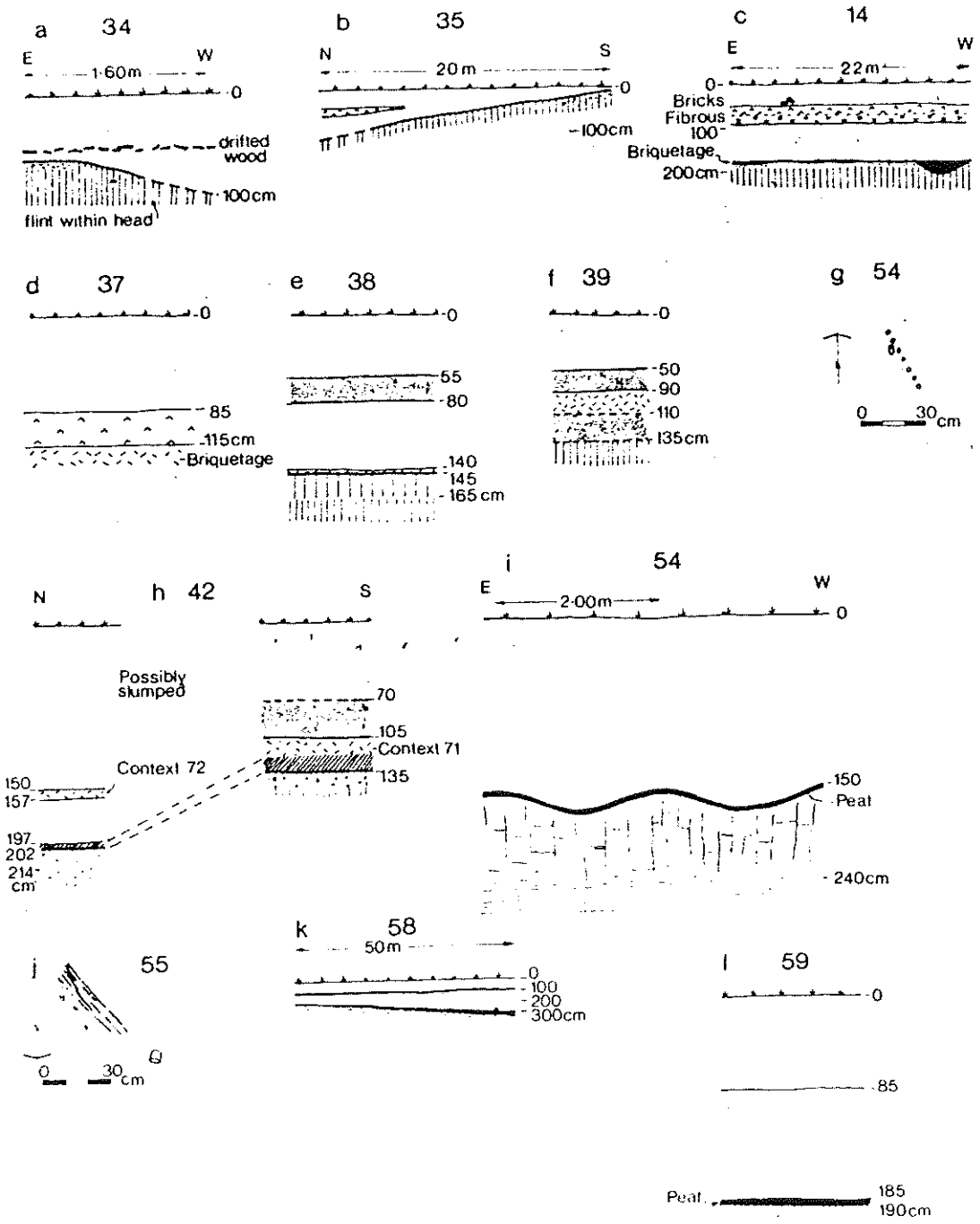
a 34
E
W
1·60m
0
drifted wood
100cm
flint within head
b 35
N
S
20 m
0
100cm
c 14
E
W
22m
0
Bricks
Fibrous
100
Briquetage
200cm
d 37
0
85
115cm
Briquetage
e 38
0
55
80
140
145
165 cm
f 39
0
50
90
110
135cm
g 54
0
30cm
h 42
N
S
Possibly slumped
70
105
Context 71
135
Context 72
150
157
197
202
214
cm
i 54
E
W
2·00m
0
150
Peat
240cm
j 55
0
30cm
k 58
50m
0
100
200
300cm
l 59
0
85
Peat
185
190cm

FIG 9

Appears to be a thin spread of cultural debris or briquetage across top of buried land surface.

145 - 165 cm — Pale grey silty clay. Quite different from clay between 80 - 140 cm which exhibited well developed angular blocky structure.

This layer is smooth and creamy in consistency and appears to be the upper horizon of the buried land surface. Grades down into :

below 165 cm — Reddish yellow, firm silty clay. Appears to be a 'colour B' horizon developed in the upper part of the head.

The chronological sequence is uncertain. There is no Upper Peat at this site nor in the vicinity and the genesis of the horizon from 55 - 80 cm is unclear. It may have formed before the sea wall breach and merely be a flooded meadow soil but alternatively it may be a lateral equivalent of the Upper Peat and therefore be considerably older than such a meadow soil.

SITE 39 (Fig. 9f)

8332 9511 Rochford R.D.

0 - 50 cm — Grey brown water laid clay.

50 - 90 cm — Dark grey brown humic horizon which contains sparse, small fragments of fired clay which appear to have been derived from the underlying horizon.

90 - 110 cm — Layer containing abundant briquetage with some fragments of charcoal. Briquetage fragments occur up to 1 cm thick and up to 6 cm long axis.

110 - 135 cm — Brown clay of uncertain origin.

below 135 cm — Brown clay containing occasional stones, probably head.

Site located on edge of salt marsh within flood basin. No evidence of date of briquetage and absence of clearly diagnosed Upper Peat means the sequence is stratigraphically floating. Briquetage layer exposed in drainage ditch over a length of 100 m E to W.

SITE 40

8489 9614 Ashingdon Parish

Upper Peat visible in cut along edge of channel to W of S.Fambridge.

SITE 41

8391 9621 Ashingdon Parish

Lower Peat, well humified and more than 20 cm thick. One charcoal fragment c.1 cm across was observed.

No Upper Peat in this locality.

SITE 42 (Fig. 9h)

8406 9585 Ashingdon Parish

Two sections exposed some 30 m apart on the east side of a broad tidal basin in a position similar to that of sites 38 and 39. Situated on edge of basin where the London Clay/head, slopes down beneath the salt marsh.

South Section, (Salt Marsh surface = 00 cm).

0 - 70 cm	Grey clay of salt marsh.
70 - 105 cm	Black mud, possibly containing dispersed humus. Creamy and unripe and probably of recent deposition. Pipe bowl extracted from section between 100 and 105 cm (context 71).
105 - 135 cm	Mixed sandy humic clay with rare stones and fired clay and some flint gritted pottery in a totally disintegrated state. Resembles occupation deposit; merges down into humified peat.
below 135 cm	Stony head evidently an extension of the land surface to the east.

North Section (Salt marsh surface = 00 cm)

0 - 150 cm	Grey clay of salt marsh. This did not form a single vertical section and its morphology suggests that it might have been subjected to slumping.
150 - 157 cm	Dense layer of fired clay fragments, usually small but one or two larger fragments up to 2 cm long axis. Context 72. One sherd.
157 - 197 cm	Grey waterlaid clay. Apparently <u>in situ</u> and separating the fired clay from the underlying humic horizon.
197 - 202 cm	Dark grey humic horizon c.5 cm thick. Resembles a buried soil Ah horizon and includes rare, very small fragments of fired clay. This is correlated with the humified peat between 125 and 135 cm in the south section.

202 -c212 cm — 10 - 15 cm thick soil horizon.

Firm, slightly sandy silty clay over reddish head. Probably a mineral soil A horizon over a colour B horizon as at site 38, below 135 cm.

Finds

Context 71 — Pipe bowl with ball and loop below.

Context 72 — Wheel thrown body sherd. Black throughout. Slightly soft with weakly laminated fabric. Slight external grooves. Date uncertain but probably medieval or post-medieval.

This pair of sections is difficult to interpret. Certainly, the upper 1 m of both sections is recent, probably post-medieval.

The status of the fired clay horizon is unclear; that with flint gritted pottery fragments in the south section might be prehistoric but the northern layer, which included context 72, would appear to be medieval or post-medieval. In general none of the fired clay layers within this basin (sites 38 - 42) is securely dated but the basal humified peat in both sections might be equivalent to the Lower Peat elsewhere and be of prehistoric date. None of these sites are currently threatened but clearly further research is required.

SITE 43
8991 9601 Canewdon Parish
Section exposed approximately 200 m E of Raypits farm.
0 m = salt marsh surface.

0 - 95 cm — Unripened, sticky very plastic grey clay with distinct interface to layer beneath.

95 - 100 cm — Very dark grey humified peat with only occasional plant fibres visible. Much thinner and more humified than Upper Peat in the upper estuary although found at similar stratigraphic location. Even more humified peats were found in equivalent positions to the east and in general a similar layer can be traced intermittently down to site 56 at Canewdon.

100 - 265 cm — Firm clay, upper parts exhibit blackened ped faces possibly as a result of mobilisation and re-deposition of organic matter. Very coarse blocky structure, provides a stark contrast to the unripened upper clay.

at c.350 cm — That is at approximately low water mark. Humified Lower Peat; very thin and patchy, sometimes merely

SITE 44

8977 9600 Canewdon Parish. Vincent & George Site 30.

Outcrop of briquetage approximately 100 m NE of Raypits Farm. Here the London Clay crops out on the edge of the estuary and is exposed in the inter-tidal zone. Near the high water mark, briquetage, classified below into types (a) and (b), was exposed on the London Clay surface which dipped down towards the north. Layer thickness c.40 cm, maximum depth below salt marsh surface, c.1.2 m.

(a) Briquetage matrix: Weak red 10YR4/3-4/4, moderately firm silty clay, very plastic. Contains abundant small flecks of red, 10YR 4/8 fired clay; fragments of 1-3 mm long axis, also contains small black patches of amorphous carbonised material.

Best example of type a) material found on inside of a large body sherd of briquetage vessel.

(b) Large slabs of red (10YR5/8) briquetage vessel. (see illustration).

1. 14 mm thick, 20 mm thick at top of rim. Abundant organic temper throughout.

2. Large clay slab with very slight curvature. 16-17 mm thick. Abundant plant impressions throughout including some of cereals. Curved interior face shows wiping, mainly oblique. Wiping on exterior mainly horizontal. Outer convex surface variegated pale yellow towards base, some pale yellow blisters and concretionary material towards base resembles either calcium carbonate or salt compound; possibly a 'salt glaze'. Some large pores within fabric, coated with grey material. Blisters less common on interior. Blisters may result from growth of salt crystals or efflorescences. Upper part of interior has characteristic purplish or dusky red (10R 3/4) colour

SITE 45

8655 9625 Ashingdon Parish

Sedimentary sequence associated with former estuary channel.

(a) To east: c.2-3 m below salt marsh surface and 1 m above low water mark. Drifted twig-like fragments in grey matrix of estuarine clay. Presumably represents slack water deposit at edge of channel.

(b) To west of a) and at same elevation. Drifted plant material absent instead, silts and very fine sands form deep sequence, usually laminated but locally cross bedded. Evidently deposited in relatively high energy channel.

If levelled and subject to C14 assay this sequence could be related to other stratigraphic units in the area, e.g. site 20. 100 m to east, old sea wall revetment enables erosion of bank to be estimated at c.10 m since the revetment's construction.

SITE 46

9180 9693 Althorne Parish

Vertical stone situated near L.W.M. Dressed very square but with rounded top. 21 cm wide, 18 cm thick, 44 cm high (above surface of mud).

Undecypherable letters appear to be inscribed on both sides. During survey appeared to be a late or intrusive feature but requires re-examination. Possibly a marker.

SITE 47

7920 9540 Rettendon Parish

10 cm of humified Upper Peat situated where old land surface on head slopes down towards valley axis.

SITE 48

7917 9530 Rettendon Parish

30 cm + of well developed monocotyledonous peat with abundant plant remains at base. More humified towards top. Total extent indicated on field map.

SITE 49

7902 9481 Rettendon Parish

Site located on old ground surface at L.W.M. opposite site 14. Grey clay overlay old land surface developed on brown head with occasional stones. At west end of exposure a 10 cm wide feature was cut in old land surface and contained a charcoal-rich clay loam fill.

At east end of exposure (exposure c.10 m long E-W), occurred a group of branches. These were horizontal or slightly oblique and set in the base of the grey, estuarine clay.

SITE 50

7909 9481 Rettendon Parish

'Old Tree Point' approximately 50 m downstream of site 49. Fibrous monocotyledonous peat near L.W.M. No sign of the head which is exposed at site 14 on opposite bank therefore site 50 must be close to old

valley axis. N.B. This is an anomolously low position for a monocotyledonous peat and its status is therefore uncertain; it could be either monocotyledonous Lower Peat, which would be unusual, or an Upper Peat slumped out of its original position.

SITE 51 Rettendon Parish
7880 9486 Rettendon Parish
Gravel floored channel. Gravel matrix usually black and heavily polluted - age uncertain. Locally the gravel was overlaid by drifted wood contained in a peaty matrix. This was around L.W.M. and may be stratigraphically equivalent to the Lower Peat.

SITE 52
7994 9564 Rettendon Parish
Large quantities of brushwood, located in depression within monocotyledonous Upper Peat. Can locally be seen to overlie the Upper Peat and seems to be stratigraphically later than it. N.B. The monocotyledonous Upper Peat continues up to site 12 to the north west.

SITE 53
8005 9562 Rettendon Parish
Located a little beyond the west end of site 4. Small patch of tree roots of submerged forest bed rooted in a humified Lower Peat.

SITE 54 (Fig. 9g)
9141 9670 Canewdon Parish
Wooden structure within stiff blue grey estuarine clay. Comprised 7 upright rods c.1.5 cm diameter each and one oblique of same diameter. Rods projected only a few centimetres above clay surface. A single substantial post c.10 cm diameter was set upright in clay 60 cm to NE of main group. Group located approximately 70 cm above L.W.M.

Sedimentary sequence at site 54 (Fig. 9i) 0cm = salt marsh surface.

0 - 165 cm	Grey estuarine clay; became blue grey, creamy and unripened immediately above organic horizon.
165 - 168 cm	Humic layer 3 - 4 cm thick. Very dark brown containing numerous fine fibres. Not like the Upper Peats of the upper estuary but stratigraphically equivalent to them. Similar to the organic layer at site 43, 95 - 100 cm and also that at site 56, 130-135 cm.

168 - 258 Ripened grey brown clay, slightly firm becoming weakly bedded silty clay below 258 cm.

N.B. The wooden structure was below 258 cm. 200 m SE of the sequence described above the stratigraphy became clearer: (see Figure 9i).

a) Blue grey unripe clay, very soft and creamy.
b) Humic layer, 3-5 cm thick as at site 54. Top of layer undulates as shown with 1.50 m between trough crests and 20 cm between top of rise and base of trough.
c) Moderately firm grey brown blocky silty clay, c. 80 cm thick.
d) Grey brown silty clay with weak horizontal bedding becoming moderately developed below.

This sequence appears to be present along much of the southern bank of the estuary between at least Ray Pits Farm and site 56. It is likely that the firm, blocky silty clay, results from drying out following deposition. This could have occurred in the intertidal zone. The layer beneath has retained its horizontal sedimentary bedding possibly because it was not exposed to wetting and drying in the inter-tidal zone. Samples of the organic horizon (b) submitted from site 56 should enable the environment of deposition and pedogenesis to be described with greater precision.

SITE 55 (Fig. 9j)
9195 9638 Canewdon Parish
Brushwood, 2 animal bones and a scatter of oyster shells found in grey clay at approximate level of buried organic horizon (b, at site 54). One patch included what appeared to be matting and nearby several thin vertical rods of wood projected from the clay.

Two patches of the above material were found. Neither was associated with a subaerial surface and both appeared to have drifted into their present position.

SITE 56
9244 9591 Canewdon Parish
Introduction
The oar was discovered on Saturday 7 May during reconnaissance along the south bank of the Crouch within the Parish of Canewdon. Although outcrops of buried land surface were not expected, the entire exposed

length of channel shore was investigated to ensure a comprehensive survey coverage.

When found, only the oar blade protruded from the section and in order to establish its form the section was cut back c.10 cm to expose the oar shaft. The oar was horizontal and the blade was rotated very slightly with a dip towards the west. The stratigraphic context was excellent (99 Fig. 10b). The north end of the blade was covered in bright green ribbon-like sea weed which implies several weeks exposure. At the time of excavation the oar was located some 80 cm above L.W.M. which resulted in a daily exposure of about 6 hours, that is 3 hours per tide. The location on the foreshore near Burnham-on-Crouch was vulnerable to yachts which occasionally beach or ground in the vicinity and consequently prompt excavation was required. The Crouch harbour master and the owner of the adjacent land, Mr. Garren of Sutton Place, Prittlewell, were notified and excavation commenced.

Removal was effected by cutting a 70 cm wide trench into the clay bench formed immediately beneath the Upper Peat (context 97 on Fig. 10a). In the first instance this involved the excavation of approximately 1.0 m^3 of clay. Because the oar shaft was longer than anticipated, a second narrower cut was made to expose the final length of shaft. When exposed it could be seen that the entire 145 cm length of shaft had been contained within the clay.

Context

The clay layer which contained the oar was soft and creamy and apparently had not been subjected to the incipient pedogenesis or soil ripening which had produced the blocky structure and abundant iron oxide coatings characteristic of the clays above..

A 1 cm thick band of drifted plant material, later sampled by Peter Murphy for macro-botanical examination, occurred on each side of the oar shaft. Its elevation coincided with the top of the shaft and it appeared to have drifted against the oar, presumably when it came to rest at contemporary high water mark. To the east of the shaft a grey brown silhouette c.8 cm wide and again containing drifted plant material occurred as shown on figure 10c . The origins of this silhouette are unclear but it may relate to post-depositional mobilization or fixation of chemicals within the sediments. It was not a feature fill nor did it result from post depositional disturbance.

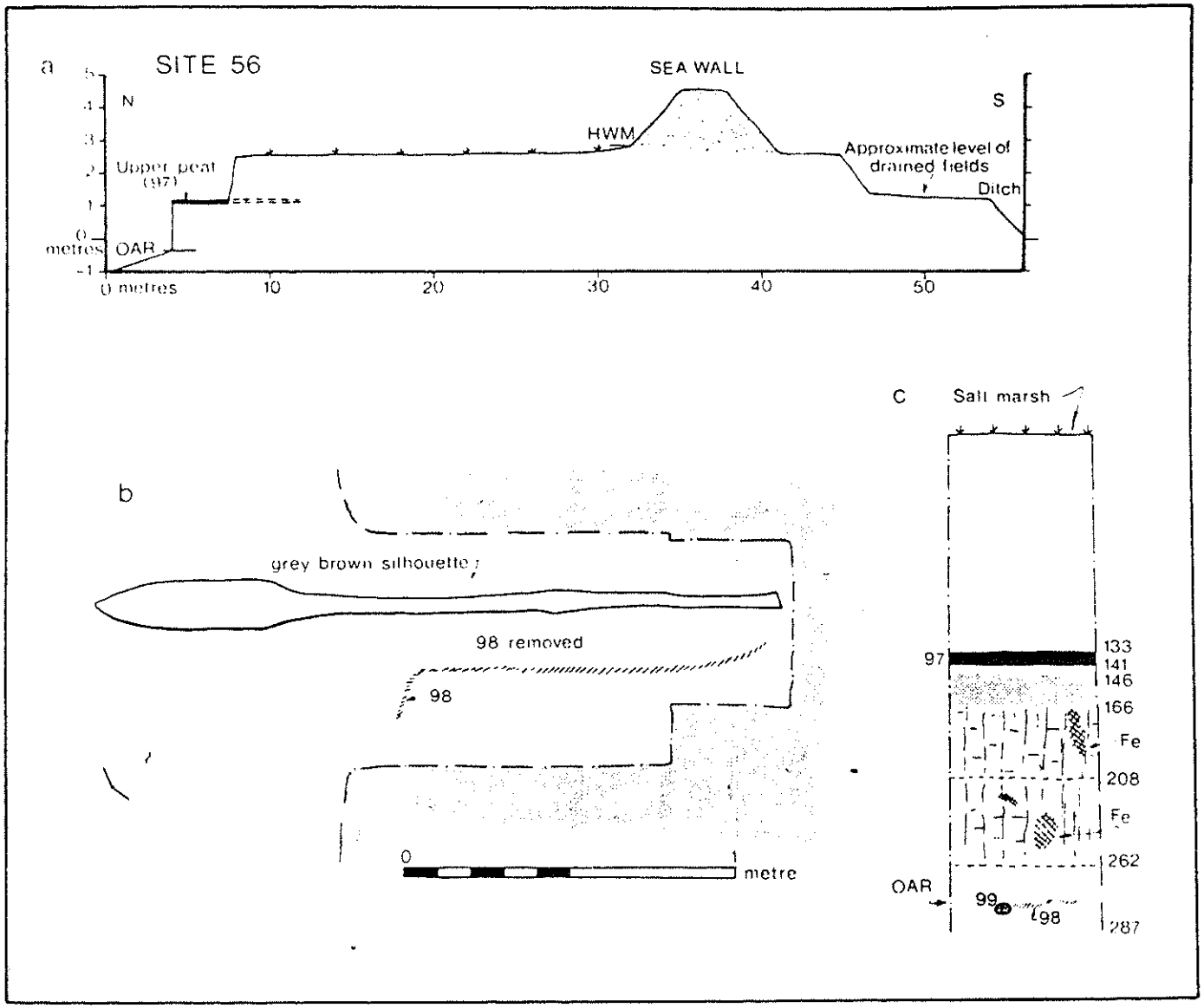
a
SITE 56
SEA WALL
N
S
HWM
Upper peat
(97)
Approximate level of
drained fields
Ditch
OAR
metres
0 metres
10
20
30
40
50
b
grey brown silhouette
98 removed
98
0
1
metre
C
Salt marsh
97
133
141
146
166
Fe
208
Fe
262
OAR
99
98
287

FIG 10

Following its initial exposure the oar shaft was wiped clean with bare hands, photographed, planned in situ at 1:10 and removed into a galvanised steel trough. During cleaning a hairline fracture was observed to cut the shaft transversely; this opened during lifting and consequently the entire 208 cm long oar could be transported in the steel trough. The oar was then immersed in water except during its transport to Chelmsford. During the second trip another hairline fracture opened up.

No artefacts were associated with the oar and it is most likely that the oar had been lost or abandoned. There was no sign of a boat in the area. Interestingly, later in the season, a modern oar of the same length was found at modern high water mark at the junction of the Crouch and Fenn Creek. The loss of an oar and its subsequent drifting to high water mark should not therefore be viewed as a unique event and if the Canewdon oar can be shown to have drifted to high water this will provide an excellent fix on the contemporary high water mark.

Figure 10a shows the levelled cross section through the site. Because the nearby bench mark had been grubbed out the instrumentally levelled elevations are relative. They have been adjusted to conform approximately with the elevations of the top of the sea wall (between 4.3 and 4.6 m O.D.) and the top of the salt marsh (c.2.6 m O.D.). This yielded an elevation for the top of the oar of 0.32 m±15 m O.D.

This is approximately 2.90 m below modern high water mark. Any attempt to date the oar from its elevation would be unwise but, if the Upper Peat (context 97) is contemporary with the Upper Peat of the upper estuary (it is of the same elevation) then the oar was 1.40 m below a level dated by C14 (2 determinations) at c.1500 bp. This argues in favour of a prehistoric date for the oar.

The Sedimentary Sequence (Fig. 10c).

0.00 m	Salt marsh surface. c.2.54 m O.D.
0 - 133 cm	Soft, grey, unripened clay, slightly firmer above.
133 - 141 cm	Context 97. Dark grey brown fibrous peat but not a monocotyledonous peat like the Upper Peat of the upper estuary. Sampled for C14 determination and macrobotanical examination. Elevation of top: 1.18 m O.D.
141 - 146 cm	Soft, grey clay.
146 - 166 cm	Black, 7.5YR 2.5/0 with pale grey variegations apparently along root holes. Firm silty clay with many vertical fine root holes. Black staining may

be a result of translocation of organic material from 97 above or from the reduction of iron. Merges down into :

166 - 208 cm Dark greyish brown, 10YR 4/2, firm silty clay, some vertical cracks and a tendency towards prismatic structure although this might be partly a result of drying out of the vertical face. Common bright orange coatings, sometimes segregated into vertical bands,, veneer ped and crack faces. Merges down into:

208 - 262 cm Dark yellowish brown, 10YR 4/4 and grey, 10YR 6/1. Firm silty clay with some prismatic structure and iron oxide sheets and coatings on ped and crack faces as with layer above. Merges down into:

262 - 287 cm Greyish brown, 10YR 5/2, clay. Smooth, soft and very sticky; without structure. Top of oar at 0.32 m OD. Immediately to west and east of shaft occurred a band of drifted plant material. This was more common to the west where the strands appeared to be roughly parallel to the shaft and had probably accumulated against it. Sampled for macro botanical examination.

Below 287 The sediments became slightly coarser and if exposed would probably resemble the bedded silts at site 54.

Survey of flood basin to west of N. Fambridge.

Between road at N. Fambridge waterfront and site 57 a deep sequence of estuarine clay crops out. Upper Peats were poorly developed or absent and there was no sign of Lower Peat which is probably below low water mark.

SITE 57

8445 9648 North Fambridge Parish

Exposure of Upper Peat. Total thickness 30 cm with a thin monocotyledonous layer in bottom 5 cm. Upper Peat appears to thin and disappear to east but thickens somewhat to west.

To the NW, on the left (east) bank of Stow Creek, the Upper Peat with monocotyledonous plant remains, is still present.

SITE 58 (Fig. 9k)

8454 9703 North Fambridge Parish

Exposure within new Marina. The marina was originally dug 10 years ago using draglines and the spoil heaps still remain along the south side. Now the basin is dredged, approximately every 5 years, by means of a submersible sludge pump suspended from a dragline; the basin is due to be dredged later in 1983 but the informant considers that it removes little but the more recent muds. Maximum suspended sediment occur 3 hours after the tide turns following low water. The dredged sediments will be used to reclaim the saltings in the vicinity.

Exposure of Upper and Lower Peats along N-S section in basin.

Upper Peat : Humified layer. Thickness could not be determined but quite thin.

Lower Peat : Approximately 5 cm thick and humified to north where it overlay head. To south, thickens rapidly where it attains a thickness of c.30 cm. Here it is quite fibrous and contains some wood fragments which includes a single 20 cm dia-log which projects from eroding section. The Lower Peat clearly dips to the south and clearly developed upon a dipping valley side.

SITE 59 (Fig. 91)
8433 9763 North Fambridge Parish
Exposure within flooded saltings area to east of site 10.

0 - 85 cm	Grey clay. Soft, creamy and unripened. Distinctive interface at 85 cm with :
85 - 185 cm	Firm, grey brown clay; ripened.
185 - 190 cm	Humified peat.
Below 190 cm	Mottled head.

There are no good chronological or stratigraphic markers within this section and the Upper Peat is absent. The deposit from 0 - 85 resembles that above the Upper Peat elsewhere and equally the layer 85 - 185 might represent the ripened soil usually exposed beneath the Upper Peat. Also the humified peat layer could be the Lower Peat.

Because this is a flooded basin however and in view of the evidence cited for site 10 (see Interim Report No. 1) the correlation of these layers must remain tentative.

SITE 60
8691 9734 Latchingdon Parish
The site is situated inland of the sea wall approximately 150 m north of site 29. Three patches of briquetage were observed along a north south drainage ditch which has been recently cleaned. The ditch cuts through an embayment of estuarine flood plain situated between two low spurs of London Clay. These deposits of estuarine clay overlie both site 29 and site 60.

Site 60 consisted of two main areas of briquetage.

(a) A southern area which formed a double mound with an exposed height in section of 15 cm. It is cut through by a linear depression, very roughly east-west, of unknown origin. Elevation of briquetage layer : 0.39 (base), 0.54 m O,D. (top).

(b) The northern area formed a low mound some 10 cm thick and with base elevation as for (a).

Both areas were buried beneath 120-130 cm of estuarine clay which, owing to drainage and embanking is now 80 - 100 cm below the salt marsh surface (see figure 7a).

No briquetage or charcoal was collected but localised excavation, as was conducted at site 2, may yield sufficient charcoal for a C14 determination.

The old ground surface appeared clearly, some 40 m north of (b), as a bank sloping between 20-30° to the horizontal (see Fig. 7a) where it appears too steep because of the vertical exaggeration). A single-flint-gritted body sherd was found in situ on this bank on the west side of the ditch. The sequence through the buried soil on the bank was :

0 - 105 cm	Grey estuarine clay.
105 - 113 cm	Pale grey sandy clay loam. Occasional small fragments of fired clay and 1 or 2 calcined flints occur at the 105 cm interface.
Below 113 cm	Mottled head.

Apart from the tenuous evidence provided by the body sherd no date can be offered for this site but it is tentatively suggested to be of prehistoric date.

The most likely sequence of events for sites 29 and 60 is :

I Occupation of site 29 during at least the Neolithic.

II Site 29 becomes waterlogged and finally flooded and eventually salt winning is practised in the inter-tidal zone up to HWM or a little above in the embayment in the vicinity of site 60.

III A bank is eroded in the valley side slope, probably during prehistoric time and this in turn is blanketed by transgression clay. The fired clay on the buried soil indicates that this was a ground surface during the salt working stage.

There is no evidence of Upper Peat at the site and although the upper mottled clay present above 1.25 m O.D. at site 60 may correspond to the uppermost clay elsewhere the correlation is poorly founded.

Clearly however, when viewed in conjunction with site 29, site 60 should provide an excellent opportunity to reconstruct one stage of the changing economy of the estuary during the pre-historic period.

3.0 PRELIMINARY PALAEOMAGNETIC RESULTS (by T.J.F. Austin)

3.1 Background to Palaeomagnetic Technique

Palaeomagnetic dating is based on the known fact that the direction and intensity of the Earth's magnetic field vary through time.

Suitably fine-grained, homogeneous sediments can record these changes as a post-depositional remnant magnetisation (PDRM). Small magnetic particles magnetised during their previous histories, are free to move in the water-filled voids of a newly deposited sediment, and their magnetic axes align with the ambient magnetic field. During compaction and subsequent drying, these magnetic particles become locked in position, giving the sediment an overall magnetic moment parallel to the geomagnetic field at the time. Thus a long core, or section of fine-grained sediment can carry a stratigraphic record of changes in the geomagnetic field direction. Unfortunately the intensity of this remanent magnetisation does not directly record the geomagnetic field intensity: its signature is often controlled more by sediomentological effects.

A detailed, dated record of the post-glacial changes in the direction of the geomagnetic field in Britain has been developed using lake sediment cores (Turner & Thompson 1981; Creer 1982). This secular record (Fig. 11; Table 1) can be used, by comparison of the magnetic signatures, as a dating method of other British and European Holocene sediments.

3.2 Sample Collection

Samples for palaeomagnetic analysis were taken from 4 sites (sites 4, 17, 19 and 7) along the R. Crouch estuary from estuarine clays which were exposed in a relatively vertical section. Samples were taken from the Upper, Middle and Lower clays, although only results from the Middle clays will be discussed here.

A vertical section in the clays was carefully cleaned and 8 cm^3 cubic perspex boxes were pressed into the sediment face by means of a sampling device designed and built for this purpose (Austin in prep). The heights of the boxes are noted and their horizontal orientation measured with a compass. The errors in sampling orientation are less than $\pm 3^{\circ}$. The boxes were dug out and sealed and kept in a container with a damp cloth to prevent drying before measurement.

3.3 Magnetic measurement

The natural remanent magnetisation (PDRM) of the samples was measured on a Digico spinner magnetometer (Molyneux 1971) in the UEA. Environmental Sciences Non-Magnetic Laboratory.

3.4 Results

The magnetic results from two of the sections in the middle clay are shown in Fig. 12 plotted alongside the diagrammatic sedimentary section. The magnetic directions recorded in the sediments average within a few degrees of the present day geomagnetic field direction at the site (present day field DEC 354°, INC 67°), and within the limits of the secular variation for post-glacial times from the lake records. It is therefore probable that the PDRM of the clays is of geomagnetic origin.

There is a distinct secular trend in the declination results and a less marked trend in inclination. These swings, when compared to the British post-glacial magnetic record, can be correlated in a number of ways depending which magnetic features are assumed synchronous. The archaeological evidence from unit 3, the buried soil, and pollen analysis of the lower peat (Godwin 1943) suggests that the Middle Clays can be no older than 5000 years. Using this lower limit the most likely magnetic correlation is suggested in Fig. 12. Using the ages obtained from this correlation for the secular swings a sedimentation rate curve can be drawn up (Fig.13). This suggests a relatively constant sedimentation rate for the clays of 30 $cm/10^3$ yrs. and 100 $cm/10^3$ yrs. for sites 7 and 19 respectively. Using this curve, projected ages for the upper and lower peats can be estimated at about 1500 years BP and 3500 yrs BP.

Further work is underway studying the palaeomagnetism of the other clay units and also testing the stability of the PDRM results.

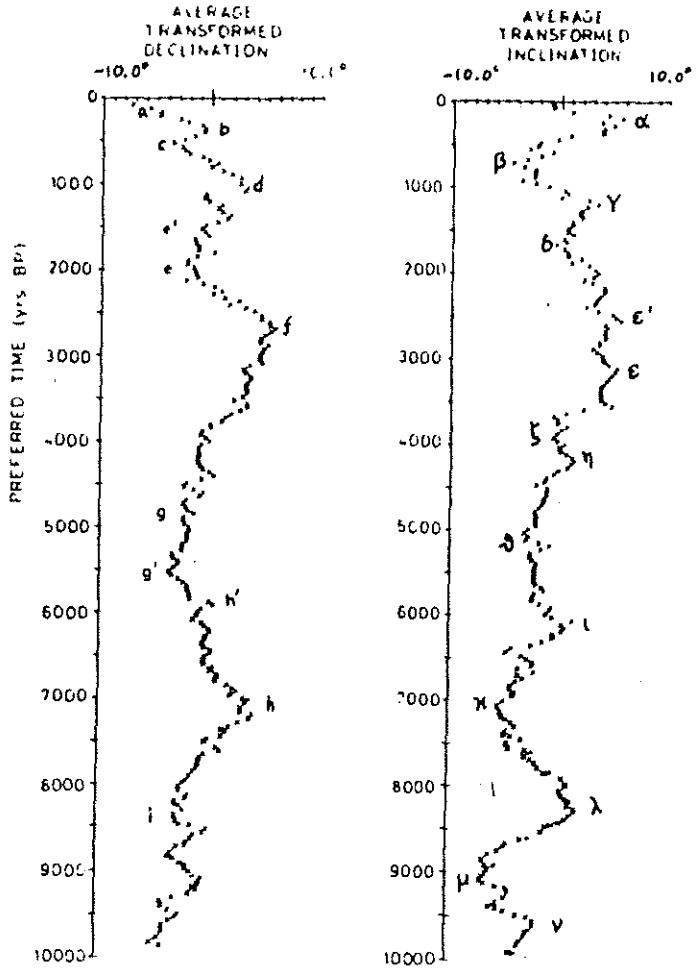

FIG 11 : Post-Glacial changes in the geomagnetic field in Britain, as recorded in lake sediments.

(Note: The transformed Declination & Inclination records are averaged using data from 10 British lake cores (Turner & Thompson 1981). The amplitude of the declination record is reduced both by the rotation of the individual records to a mean inclination, and by the averaging procedure. Thus the amplitudes of the swings are much smaller than those of the geomagnetic swings they represent, as they are influenced by the recording ability of each sediment, and the similarity between the records and timescales of the cores. Features of the individual records caused by anomalous sedimentological effects are substantially reduced by the averaging. The averaged records retain all features of the geomagnetic field longer in duration than the resolution of the dating control (ie:150-200yr).)

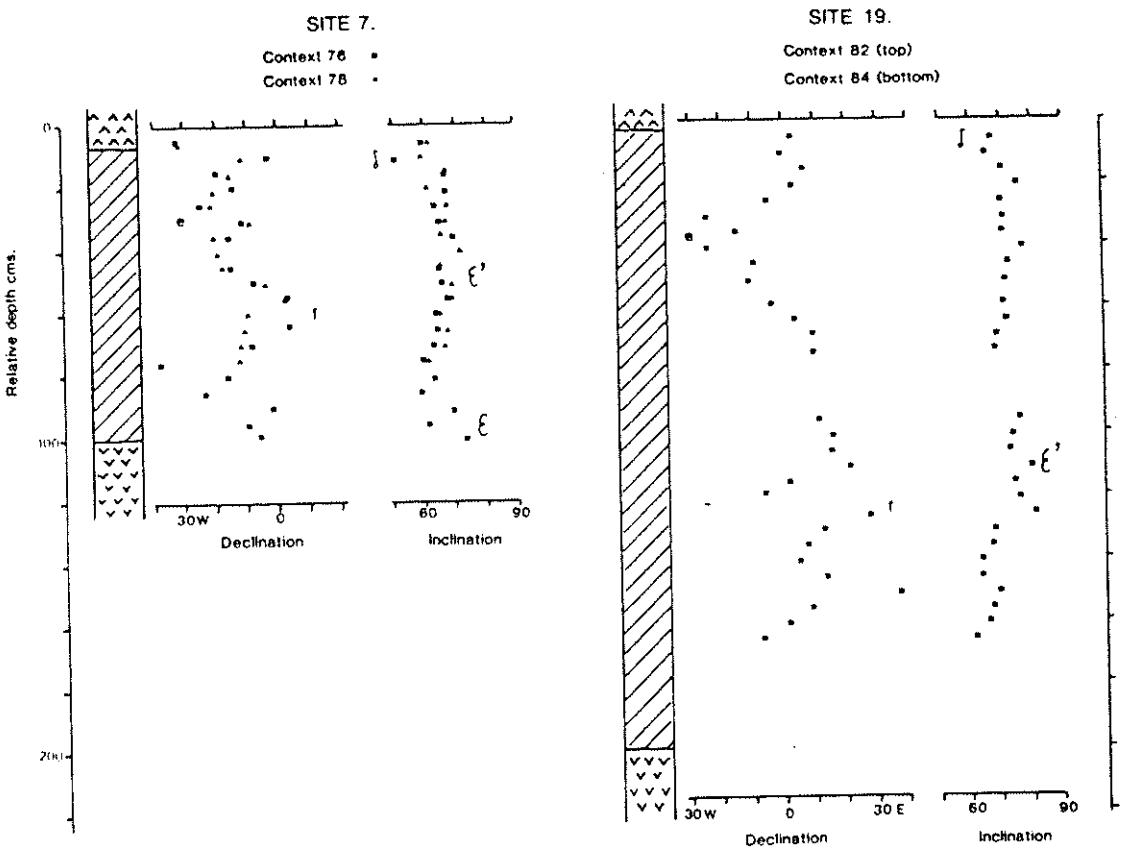
SITE 7.
Context 76
Context 78
Relative depth cms.
0
100
200
30W
0
Declination
60
90
Inclination
SITE 19.
Context 82 (top)
Context 84 (bottom)
30W
0
30 E
Declination
60
90
Inclination

FIG 12

Initial results suggest that the remanent magnetism is very stable, with a mean destructive field of 250-400 oe.

It thus appears that palaeomagnetic techniques may be a very useful dating tool for these sequences, enabling these otherwise undatable clay units to be dated.

TABLE 1: PREFERRED TIME-SCALE FOR DECLINATION AND INCLINATION FEATURES OF THE POST-GLACIAL GEOMAGNETIC RECORD. (From: Turner & Thompson 1981).

DECLINATION		INCLINATION	
Feature	Age* yrs bp.	Feature	Age* yrs bp.
a	150	α	250
b	450	β	650
c	600	γ	1250
d	1150	δ	1650
e	1950	ϵ	3270
f	2705	ζ	4000
g	4860	η	4200
h	7165	θ	5200
i	8400	ι	6000
j	10600	κ	7000
		λ	8300
		μ	8800
		ν	9700

* Calendar years before present.

4.0 CONCLUSIONS AND RECOMMENDATIONS

During this, the first year of the project, emphasis has been placed upon the discovery of cultural material within its stratigraphic context. By being contained within sedimentary bodies, rather than exposed to subaerial agencies, sites within the estuary have been less disrupted than contemporaneous dry land sites. Within the estuary, however, processes of bank erosion and modern development are destroying some sites or exposing hitherto buried sites.

Although sediment type varies slightly between the upper and lower estuary, the stratigraphic sequence is consistent throughout. Using the few available dates (both artefactual and radiometric), three stratigraphic stages can be suggested:

I Before c.1750 bc - That is below the Lower Peat.

II Between c.1750 bc and 450 ad - Between the Lower and Upper Peats.

III Post 450 ad. - Above the Upper Peat.

Further refinement can be obtained within Stage II by the relative positioning of sites with respect to the Upper or Lower Peats although it should be emphasised that the Lower Peats may prove to vary slightly in date throughout the estuary.

It follows that archaeological sites, when viewed in their stratigraphic context, fall into a similar pattern.

(a) Sites beneath the Lower Peat included for example site 4 - the lithic scatter at Hullbridge (Reader et al 1911) and site 29 which included the wooden platform. Both the above sites were closer to the valley axis than those that followed and they occupied sites that later became inundated by the rising Holocene sea. Occupation phases vary through Mesolithic to Middle Neolithic or a little later.

(b) Sites stratified between the Lower and Upper Peats. These are more common and tend to be closer to the valley edge than those of (a). Also most show some evidence of salt working. Excellent examples of such sites are provided by site 2 - the salt working site excavated along Fenn Creek and site 60, an area of briquetage buried beneath estuarine clay which stratigraphically overlies site 29. Until results of C14 determinations are received these sites can only be described as of the later prehistoric period with site 2 for example, being approximately Early Iron Age. During this phase, when the main recorded economic activity was salt working, the estuary probably also developed as a transport artery although the only direct evidence of this function has been the one found at site 56, Canewdon.

One or two sites which include briquetage are situated immediately below the Upper Peat and would appear to relate to the closing stages of Stage II. If so, they are probably Romano-British although no stratified artefacts have yet been found on these sites.

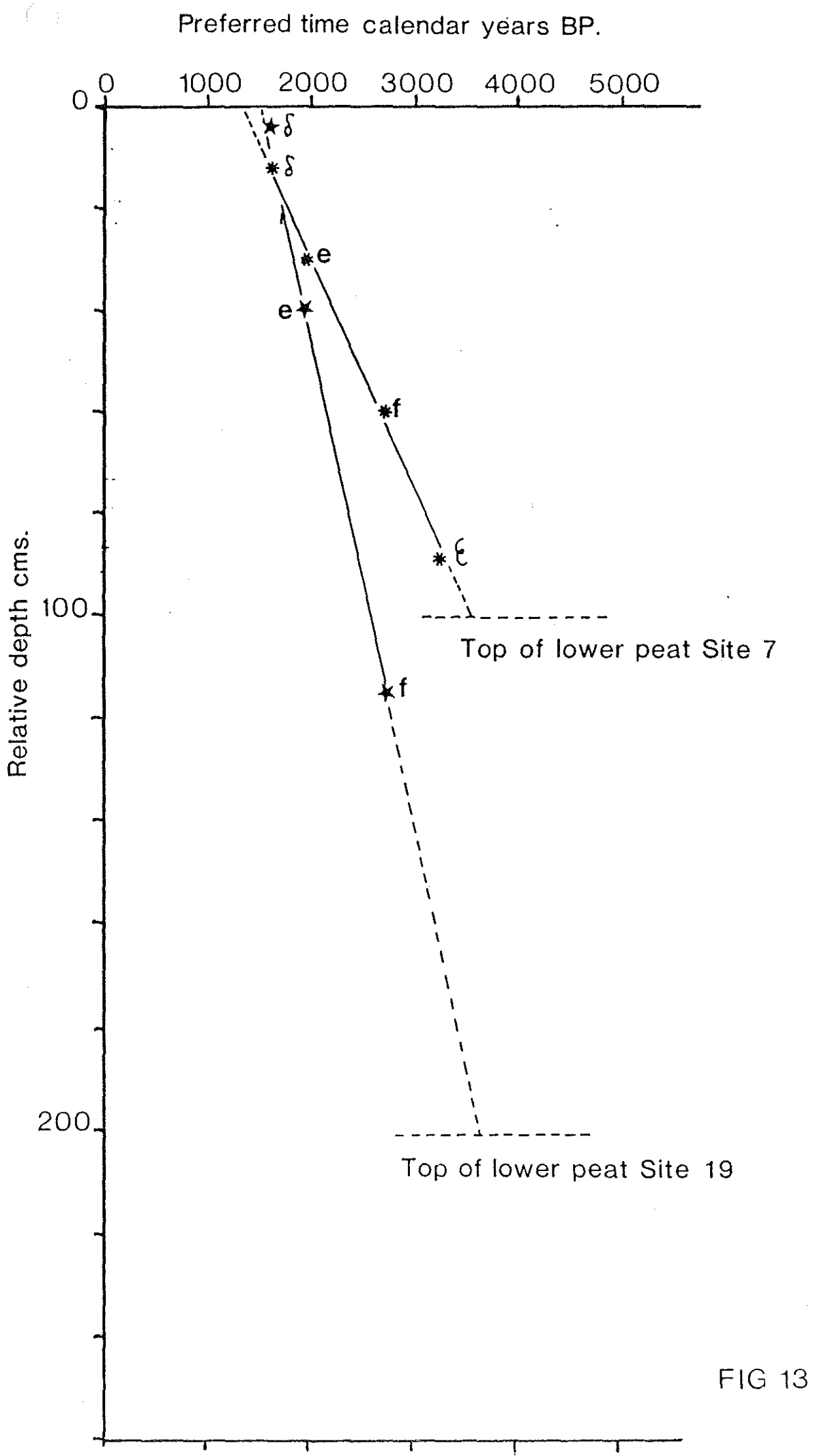
Preferred time calendar years BP.
0
1000
2000
3000
4000
5000
0
100
200
Relative depth cms.
δ
δ
e
e
f
ε
f
Top of lower peat Site 7
Top of lower peat Site 19

FIG 13

(c) One or two sites, associated with a distinctive type of coarse briquetage, appear to occur above the Upper Peat, but because they occupy poor stratigraphic positions and contain few artefacts they can only be suggested to be of medieval or post-medieval date.

The results of the survey can be seen to extend beyond the mere cataloguing of sites, their morphology or the artefact scatter. Each cultural site occupies a context which relates to both a stratigraphic phase and a prevailing local environment. This in turn allows the integration of cultural and environmental information in a manner not normally possible and in the final report of the survey, this integration will be attempted well beyond the bold statements presented in Interim Reports 1 to 4.

The proposed strategy for future work is as follows :-

1) Extension of the coastal survey: This is recommended as a first priority. It has been demonstrated by the discovery of several sites which include wooden structures, notably the Canewdon oar, that detailed survey within a stratigraphic framework is producing material of national importance. Evidence from elsewhere in Essex suggests that a similar stratigraphic framework exists around other sections of the coast and consequently future work can be streamlined.

The extension of the survey should primarily be directed towards those areas of coastline where the buried land surface is acceptable at the present coastline. That is, not where it is buried by deep Flandrian accumulations or eroded away by marine action. An exception to the first point would be to survey the red hills of the Dengie Peninsula which appear to be related to early creek patterns in the Flandrian alluvium and which are threatened by ploughing. Obvious future areas of investigation are as follows :-

1. Lion Point and vicinity. This has already been investigated but certainly requires re-examination in the light of the results of the Crouch Estuary Survey.

2. The south bank of the Blackwater which has produced notable lithic sites at Maylandsea and wooden structures off Bradwell on Sea (Othona).

3. The north bank of the Thames with special emphasis on the Tilbury area to establish if the structures and extensive Roman occupation initially reported in VCH 1963, 190-1 still remain.

2. The detailed investigation of sites already known from the Hullbridge Basin Survey: Specific tasks could include :

Sample excavation of site 4 (The Hullbridge site) which is now better understood than previously.

Trial pits at site 11, within the Woodham Ferrers flood basin, would yield information on the type of cultural debris present, its stratigraphic context and distribution.

Cleaning and localised excavation of briquetage sites, such as site 60, can be performed quickly without incurring substantial costs.

Site 29 could benefit from additional investigation of wooden structures, possible excavated features, and could be examined in tandem with site 60.

Alternatively, excavation of site 1 on Fenn Creek by cutting back the salt marsh and possibly erecting some water exclusion structures would be expensive and the results would probably not justify expenditure.

Threats such as bank erosion at sites 1, 4 and 29 or drying out at site 11 although present are not yet critical, although the main sites should be checked during the next few years of survey. If any of the above tasks are attempted 'guerilla' excavation tactics between tides are more expedient than grandiose schemes.

Of the two options, in the light of the Hullbridge Basin Survey (1) is of highest priority. It would be unwise to commit a large budget to excavating sites of unknown or moderate importance when sites of outstanding merit may exist elsewhere around the Essex coast.

Pollen analysis has not yet been attempted. Apparently a complete succession of waterlogged clay and peat dating from c.2000 bc to the present day exists in easily sampled locations. Peter Murphy has demonstrated however, that in some exposed sections, contamination by marine worms is such as to make macro-botanical - and presumably palynological - interpretation impossible. Sample columns must therefore be selected with care. The state of pollen preservation is unknown and feasibility tests must be run on a small number of samples. In view of the above factors and pressure of work on the Department of the Environment palynologist it is proposed that pollen analysis be delayed until a suitable site has been selected for archaeological and palaeoenvironmental investigation. Palynology must be viewed as of top priority and steps should be taken in the next financial year to find a suitable site and to ensure that pollen analysis can be undertaken.

APPENDIX

Notes taken along course of new Woodham Ferrers-Battlesbridge road.

Exposure of head: for comparative purposes.

Location TQ 7944 9713 c.200 m east of Grange Nurseries.

0 - 110 cm	Head : Pale brown clay with rare stones, very similar to London Clay.
110 - 140 cm	Horizontal layer, c.30 cm thick, of medium gravel in brown clay matrix.
Below 140 cm	Brown London Clay, stone free, in situ.

N.B. Small features with some evidence of very small fragments of flint-gritted pottery found in vicinity of where Tabrum's Lane is cut by new road.

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