AML REPORT 4862

1635

Hullbridge Survey Project (1985 season)

Blackwater Estuary

1. Site 3. Stratigraphy, plant macrofossil analysis.
2. Site 18. Stratigraphy, plant macrofossil analysis.
3. Site 8. Charcoal.
4. Site 24. Charcoal.
5. Sites 11,12,13,20,29 and 32. Cereals and crop weeds.
6. Site 28. Wood, plant macrofossil analysis.

Crouch Estuary

1. Site 29. Mollusca, other faunal remains and plant remains; wood.
2. Site 60. Charcoal and briquetage.

P. MURPHY

The Holocene sequence in the Blackwater Estuary

Examination of sections exposed at the edge of the salt marsh and on the foreshore along the south bank of the Blackwater in 1984 showed that the sequence is relatively straightforward, consisting predominantly of grey clays overlying a thin peat on head. Foreshore exposures of the lower sediments were however found to be of little value for palaeoecological studies due to disturbance and reworking by burrowing organisms. In 1985 the Holocene sediments at two sites were examined in greater detail (site 3 on the south shore and site 18 on the north bank) and sections exposed at some other sites were also recorded.

(1) Site 3

To obtain uncontaminated samples for macrofossil analysis a pit was dug on the foreshore (Section A) where the peat was sealed by deep deposits of clay. Samples were also collected for diatom analysis by S. Juggins from the clay in this section, and in a second section at the salt-marsh edge (B). Subsequently a further series of diatom samples was collected using coring apparatus. Together the two open sections give a complete section through the Holocene sequence at this point.

Section B

Salt-marsh ground surface at c. +2.11m. O.D. i.e. c. - 0.59m. below HWM.

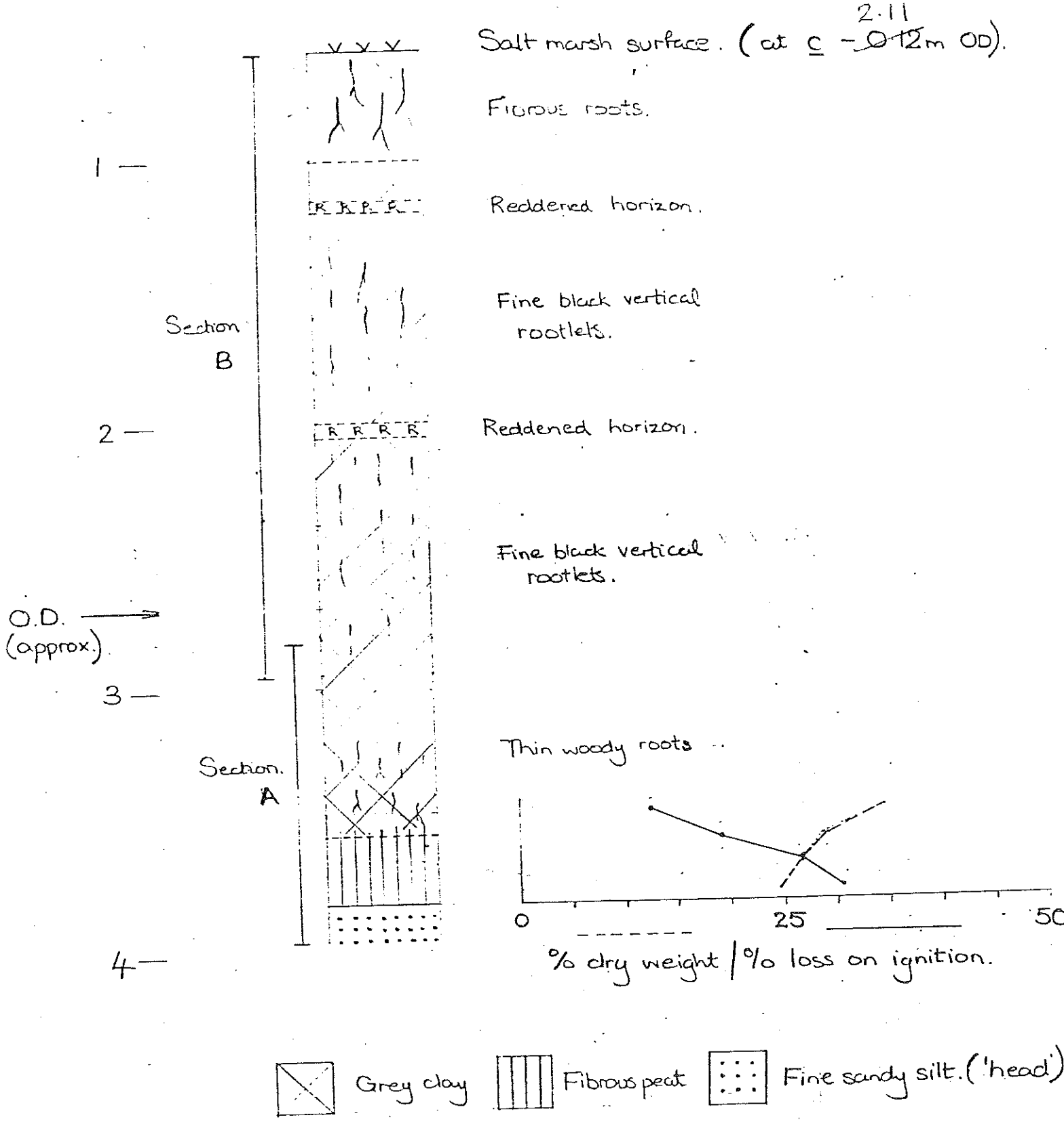
0-30cm.	Reddish-grey firm clay with abundant fibrous roots and incipient ped development; merging boundary.
30-40cm.	Pinkish-grey clay, firm. Merging boundary.
40-236cm.	Soft grey clay with black mottles and flecks. Dark roots common below 70cm. Reddened, slightly firmer horizons at 55-60cm. and 140-145cm.

Section A

Foreshore surface at c. - 0.12 O.D. i.e. c. - 2.82m. below HWM.

0-50cm.	Very soft light grey clay with some dark infilled burrows near top; faint reddish-brown mottling; merging boundary.
50-75cm.	Very soft light brownish-grey clay with rare thin discontinuous horizontal organic lenses and laminations; woody rootlets; organic content increasing with depth, merging boundary.
75-100cm.	Brown fibrous clayey peat with indeterminate monocotyledonous

SITE 3 (MAYLANDSEA).



plant remains; some darker-brown patches and woody rootlets; sharp boundary.

100cm.+ Very firm light grey fine sandy silt with some small, rounded and sub-rounded flints. (Head.)

On the lower shore the peat contains some wood fragments and there is at least one in situ tree stool of oak (Quercus sp), context 41, rooted in the head surface.

A synthetic section based on results from sections A and B is shown in Fig . Bulk samples for macrofossil analysis were collected from the lowest 40cm. of the sequence in section A at 10cm. intervals.

Dating

A sample of wood from the oak stool 41 gave a radiocarbon date of 4190 ± 80b.p. or 2240b.c. (HAR -6623.)

% dry weight and % loss on ignition

Subsamples of the bulk samples from section A gave the following results.

Depth (cm)	% dry weight	% loss on ignition
60-70	34.6	12.5
70-80	29.2	19.1
80-90	26.6	26.7
90-100	24.7	30.5

These results confirm the impression from field observations that the peat/clay boundary is broad and merging and that the peat has a high mineral content.

Plant macrofossils

Results of macrofossil analysis are given in Table . The four assemblages are dominated by halophytes. Seeds and fruits of Salicornia sp. and Juncus spp. are particularly common, and other salt-marsh and mud-flat taxa present include Spergularia sp., Atriplex sp., Suaeda maritima, Armeria/Limonium, Glaux maritima, Aster tripolium, Triglochin maritima and Puccinellia spp. This clearly indicates that the peat at the base of the sequence was formed in estuarine conditions. There is no marked change in the species composition of the seed assemblages from successive levels though the absolute concentration of macrofossils

Depth (cm)	60-70	70-80	80-90	90-100
Spergularia sp (p)	-	1	5	13
Atriplex sp (p)	-	1	11	46
Suaeda maritima (L) Dumort	5	1	2	6
Salicornia sp	-	12	(180)	(412)
Chenopodiaceae indet (a)	-	2	7	4
Rubus fruticosus agg	-	-	-	1
Aphanes arvensis L	-	-	1	-
Urtica dioica L	-	-	1	-
Armeria/Limonium (b)	-	-	15	10
Glaux maritima L	-	-	1	-
Ajuga cf. reptans L	-	-	1	7
Aster tripolium L	-	1	4	25
Triglochin maritima L	3	1	27	46
Juncus spp (c)	7	(132)	(152)	(396)
Carex sp	-	-	-	1
Puccinellia spp (d)	-	6	31	50
Gramineae indet (e)	2	20	27	83
Gramineae indet (f)	+	+	+	++
Indeterminate seeds etc	3	8	22	27
Woody rootlets/rhizomes	+	+++	+++	+
Stem fragments	+	+	+	+
Buds/budscales	-	-	-	+
Charcoal fragments	-	-	+	++
Foraminifera	+	+	+	+
Insects	+	+	+	+
Sample weight (kg)	0.5	0.5	0.5	0.5
% dry weight	34.6	29.2	26.6	24.7
% loss on ignition	12.5	19.1	26.7	30.5

Table : Macrofossils from the lowest 40cm. of Section A at Site 3, Maylandsea.
Unless otherwise indicated plant taxa are represented by fruits or seeds.
Figures in brackets are estimates of total seed counts based on counts from a 25% sub-sample. Notes:

(a) Seeds without testas. Atriplex or Suaeda.

(b) Degraded calyces.

(c) Includes Juncus gerardii Loisel.

(d) Mostly P. maritima.

(e) Fragmentary caryopses or specimens obscured by sediment encrustation.

(f) Culm nodes and other fragments.

decreases towards the top. This trend could simply reflect increasing distances from sources of plant detritus and seeds related to the spread of the estuarine margin further upstream and laterally away from the valley axis as the transgression proceeded.

Terrestrial wetland and weed vegetation is represented by a few fruits and seeds of Rubus fruticosus, Aphanes arvensis, Urtica dioica, Ajuga cf. reptans and Carex sp. These macrofossils were presumably fluvially transported from further upstream.

(2) Site 18

The sequence of sediments was examined in four trial pits (sections A-D) dug between the salt-marsh and lower foreshore.

Section A. Level at 0-0.18m. below HWM.

0-25cm.	Soft greyish-brown clay with reddish mottling; abundant fibrous roots; merging boundary.
25-65cm.	Soft light grey clay with small black mottles; roots common at top, rare below; merging boundary.
65-85cm.	Soft light grey clay with common very large black mottles; merging boundary.
85-100cm.	Soft light grey clay with small black mottles and thin black vertical rootlets; merging boundary.
100-105cm.	Same matrix, but with some large yellowish-brown mottles; merging boundary.
105-120cm.	Soft light grey clay with small black mottles and black rootlets; merging boundary.
120-130cm.	Soft light grey clay with very large prominent yellowish-brown mottles and some plant material; merging boundary.
130-160cm.	Soft light grey clay with small black and occasional yellowish-brown mottles.

Section B. Level at 0=-1.76m. below HWM.

0-15cm.	Soft light grey clay with small black and yellowish-brown mottles; merging boundary.
15-45cm.	Soft slightly darker grey clay with small black mottles; merging boundary.
45-60cm.	Slightly firmer grey clay with brown rootlets and other plant material.

Section C. Level at O=-2.29m. below HWM.

0-5cm.	Slightly firm grey clay with common brown rootlets and other plant material; merging boundary.
5-17cm.	Soft light grey clay with rare very small black and yellowish-brown mottles; some plant material; sharp boundary.
17-18cm.	Band of plant debris associated with 3cm. diameter horizontal piece of unworked roundwood (context 92); sharp boundary.
18-130cm.	Soft light grey becoming slightly firmer, slightly darker grey clay (very gradual transition); rare small black mottles; some roots and other plant material including wood fragments, quantity increasing with depth; merging boundary.
130+cm.	Greyish brown clayey peat with some fibrous plant material.

Section D. Level at O=-3.15m. below HWM.

0-40cm.	Brown peat with light greyish-brown clay patches and dark mud-filled burrows; extensively burrowed by piddocks and annelids; woody roots (mostly small); sharp,even boundary.
40+cm.	Firm grey clayey silt including some fine sand; very rare small flints; rootlets penetrating from above.

At the occupation site there is a thin (1cm.) impersistent charcoal spread (context 83) at the peat/head interface. On the lower shore a denser charcoal deposit (context 90) occurs. Also in this area there are several in situ tree stools in the Lower Peat, which is more woody than at section D. The tree-roots penetrate the head. An isolated well-defined tree stool (91) was sampled for radiocarbon dating.

The four pits show a very similar sequence to that at site 3, differing only in detail: approximately 3.4m. of grey clay overlies a clay-rich peat some 40cm. thick on head. The top of the peat surface undulates: in section C it is at -3.59m. below HWM, in section D at -3.15m. below HWM.

To obtain uncontaminated samples for macrofossil analysis from the peat and the peat/clay boundary a further pit (context 104) was dug on the foreshore.

In this area there was little evidence for disturbance by burrowing species, apart from a few small Mya arenaria.

0-30cm.	Soft light grey clay with 0.5cm. thick very dark brown woody rootlets; boundary very indistinct, merging.

30-65cm. Brown very clay-rich peat with some discrete grey clay patches; rare monocotyledonous plant remains and very small woody roots; narrow boundary.

65-75cm. Moderately soft grey clay with very rare small flint pebbles; some fine rootlets in top; narrow boundary.

75+cm. Firm light grey silty clay; rare small flints.

Dating

Samples have been submitted for radiocarbon dating from the charcoal spread, context 90, from the tree stool, context 91 and from a brushwood structure, context 86 exposed by erosion on the upper shore.

% dry weight and % loss on ignition

Subsamples of the bulk samples collected from the section, context 104, gave the following results:

Depth (cm)	% dry weight	% loss on ignition
10-20	36.9	11.5
20-25	37.8	10.7
25-30	32.9	17.7
30-40	30.2	24.1
40-50	29.9	24.4
50-60	35.5	15.7
60-65	36.7	17.5
65-75	72.7	1.7

As at site 3 the clay/peat boundary is merging and ill-defined, and the peat has a very high clay content, particularly towards its base. The sample at 65-75cm. probably represents the A horizon of the pre-transgression soil.

Plant macrofossils

Results of macrofossil analysis of peat and clay samples are given in Table . These samples produced very sparse assemblages, compared to site 3. Furthermore durable seeds, particularly Suaeda maritima and Juncus spp., are more common than delicate structures such as Salicornia seeds and grass fruits, at least in the lowest 50cm. of sediment. This could imply that the lower sediments periodically dried out with consequent humification and degradation of some macrofossils. However the restricted assemblages which survive are essentially similar to those from site 3. Mud-flat and salt-marsh taxa predominate, and

there is a small proportion of plant remains of terrestrial origin.

Soil samples from the charcoal spreads on the 'head' surface, contexts 83 and 90, were also examined: 2.2kg. and 1kg. respectively. Plant remains were extracted by water flotation, collecting the flots in a 500 micron mesh sieve. The dried flots contained charcoal and a few uncharred seeds and fruitstones of Sambucus nigra and Rubus fruticosus. Charcoal fragments larger than 6mm. were identified. In both samples there are some unidentified fragments of root and bark charcoal, but all the wood charcoal is of Quercus sp. (oak). 83 includes some fragments of charred oak twigs, but in the samples from 90 only mature wood is represented.

Wood samples from nine separate tree stools and fallen trunks on the head surface and sealed within the peat were identified. All are of oak (Quercus sp).

(3) Conclusions

The remains of oak trees rooted on the head surface, subsequently overwhelmed by the local transgression and sealed within estuarine sediments provide a t.p.q. for the base of the sequence: at site 3 a date of 2240b.c. was obtained and a further date will be available from site 18. Charcoal spreads on the head surface at other sites have also yielded dates in the 3rd millenium b.c.: 2040b.c. at site 7 and 2050b.c. and 2740b.c. at site 8.

After a phase of peat development when up to 40cm. of peat formed, predominantly mineral sediments - grey clays - were deposited. On the evidence of macrofossil analysis the lower sediments all formed in estuarine conditions: unlike the sequence in the Upper Crouch valley there is no evidence for any phases of freshwater sedimentation.

Sites in the Blackwater Estuary

(a) Site 8 Context 78

A 9.6kg. sample from this neolithic feature was examined. It produced only a few very small charcoal fragments and abraded fragments of fired clay.

(b) Site 24 Context 93

A 2.4kg. sample from a diffuse charcoal spread on the 'head' surface at this site produced a small quantity of charcoal. Fragments larger than 6mm. were mostly of oak (Quercus sp.) with one fragment of indeterminate diffuse porous charcoal.

(c) Sites 11,12,13,20,29 and 32. Cereals and crop weeds

Briquetage fragments were collected from these six 'Red Hill' sites in the Blackwater Estuary, and soil samples were taken from stratified deposits at sites 11,12,13 and 29, in order to gain information on cereal production and the use of cereal by-products in the salt-producing industry. With the exception of site 20, which produced medieval pottery, these sites are all considered to be of late iron age or Roman date.

The briquetage fragments were inspected for impressions of plant material and casts were taken of identifiable impressions. The fragments are all of very well-fired brick-red briquetage with blackened patches, sometimes with a surface encrustation of fused pale green material. Small rounded pebbles and soft white inclusions are also present. Impressions of cereal inflorescence bracts, spikelet forks and rachis fragments are very common and there are some impressions of cereal straw and occasional grains. 'Silica skeletons' of inflorescence bracts and awns occur in some fragments. No attempt has been made to quantify the results fully since a high proportion of the impressions could not be identified, being only partial impressions, or internal impressions of bracts. Furthermore the samples examined represent only a very small proportion of the hundreds of briquetage fragments visible at some of these sites. Taxa identified are listed in Table , together with some identifications by R.C. Alvey from other Red Hill sites along the Blackwater (De Brisay 1978, 54).

The soil samples from sites 11,12,13 and 29 contained large quantities of charcoal and those from sites 11&12 included a few carbonised remains of cereals and crop weeds (Table).

	Survey Sites						De Brisay (1978)		
	11	12	13	20	29	32	Osea Road	Peldon	Tollesbury
Triticum aestivum L (rachis)	+	-	-	+	-	-	-	-	-
(caryopses)	+	-	-	-	-	-	-	-	-
Triticum spelta L (spikelet forks)	+++	++	-	+++	-	+	+++	+++	+
(glume bases)	+++	++	-	+++	+	+	+++	+++	-
Triticum dicoccum Schübl (spikelet forks)	cf	+	-	+	-	-	-	-	-
Triticum spelta/dicoccum (caryopses)	+	+	-	-	-	-	-	+	+
(spikelet forks)	-	-	+	-	-	-	+	-	-
Triticum sp. (awns)	+	+	-	-	-	-	-	-	-
Hordeum sp. (hulled) (grains)	-	-	-	-	-	-	+++	-	-
(rachis internodes)	-	-	-	cf	-	-	-	-	-
Avena sp. (caryopses etc)	-	-	-	-	-	-	+++	-	+
Bromus sp. (caryopses)	+	+	-	-	-	-	-	+	+
Cereal straw/grass culm	+	+	+	+	+	+	?	?	+

Table : Impressions of cereals and crop weeds on briquetage from the Blackwater Estuary

+ - present; ++ - fairly common; +++ - abundant.

	Site 11 63	Site 11 81	Site 12
Triticum spelta L (glume base)	-	1	1
Triticum sp (glume base)	-	1	1
Triticum sp (spikelet fork)	-	1	-
Cruciferae indet (seeds)	1	2	-
Vicia/Lathyrus sp (cotyledon)	1	-	-
Bromus sp (caryopsis fragment)	-	-	1
Gramineae indet (caryopses)	1	2	1
Indeterminate (seeds etc)	1	10	-
Sample weight (kg)	4.6	3.8	1.3

Table : Carbonised cereals and crop weeds from Red Hill sites

The results from these sites are reasonably consistent. Spikelet fragment impressions of spelt (Triticum spelta) are clearly the most abundant impressions both on the briquetage examined from the survey sites and on the material described by Alvey (De Brisay, ibid). Emmer (Triticum dicoccum) and bread wheat (Triticum aestivum) were identified at sites 11,12 and 20. Impressions of barley (Hordeum sp.) and oats (Avena sp.) were common at only one site - Osea Road - and impressions of Bromus caryopses have been recorded from four sites.

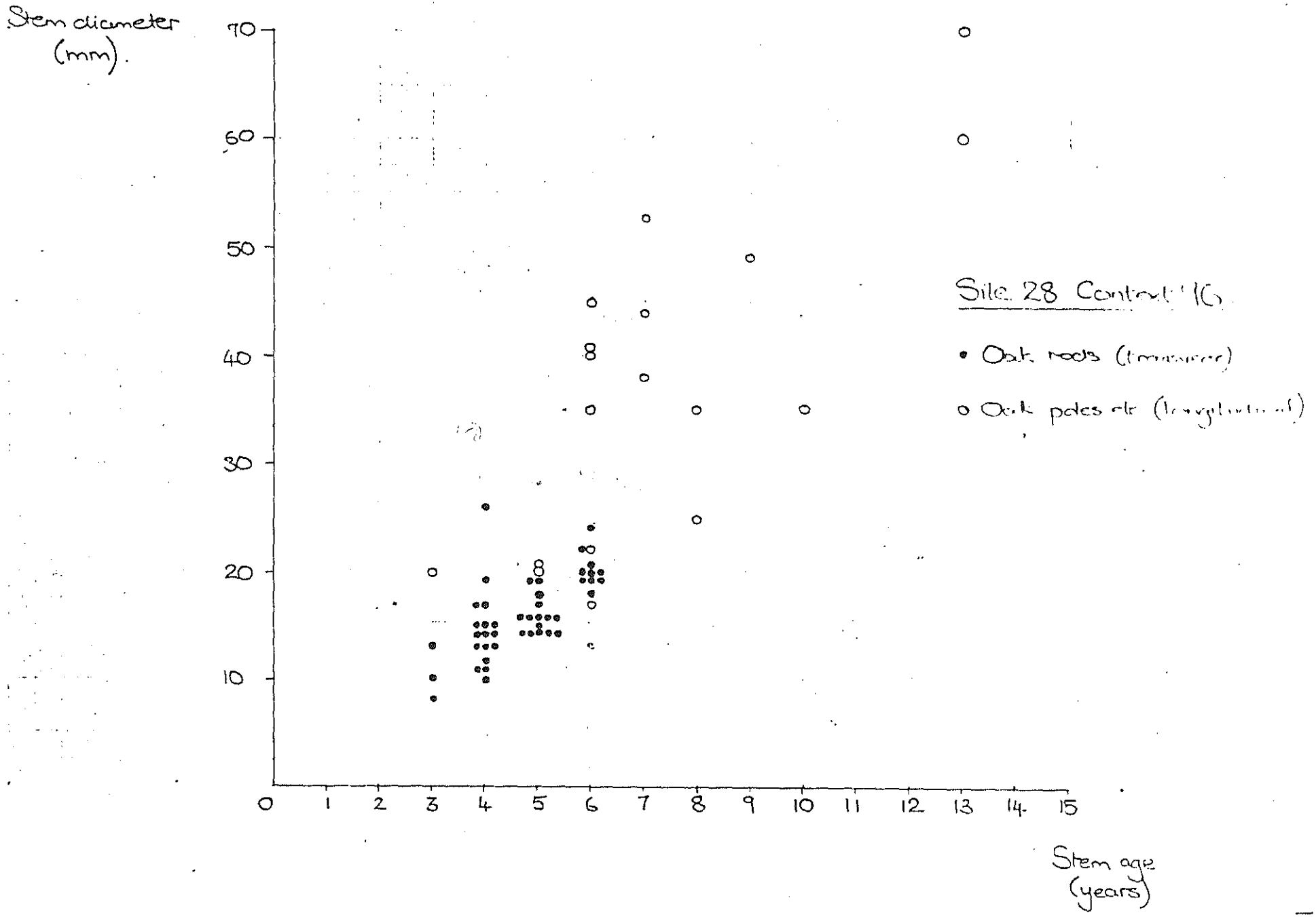
The presence of spelt and emmer impressions on the apparently medieval briquetage from site 20 is potentially of considerable interest, for these crops have not hitherto been recorded from a post-Roman site in Essex. However the material from this site was not recovered from a stratified context and there is therefore a possibility that the association of the briquetage and pottery is fortuitous. Nevertheless there is no doubt that spelt and emmer spikelet fragments were used as temper for briquetage over a very long period on the Essex coast. At site 2 in the Crouch Valley, for which a radiocarbon date of 3020 ± 90b.p. or 1070b.c. (HAR-5733) has been obtained, briquetage with spelt and emmer impressions was recovered, and the results from the Blackwater sites show that the use of chaff from these cereals as temper continued into the early Roman period. The same technique was thus used over a period of at least 1400 years. Given this extremely conservative technology there is no reason to reject the possibility that glume wheat growing continued into the medieval period in this area, though clearly some well-stratified medieval briquetage will be required before accepting this possibility without reservation.

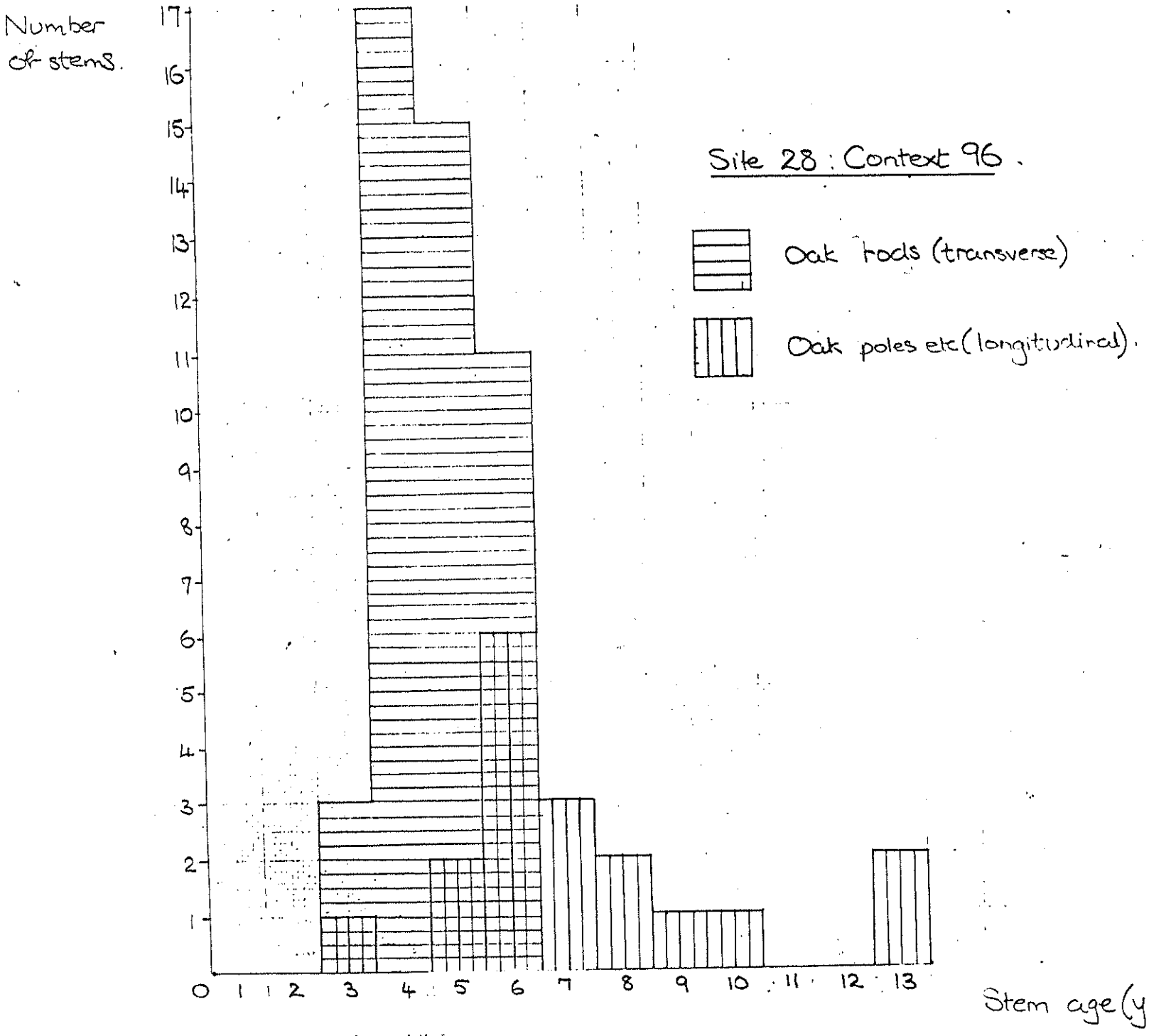
(d) Site 28: Wooden structures and associated deposits

(1) Context 96

This hurdle structure, exposed by current erosion on the foreshore, was cleaned and partly excavated. Seventy samples of roundwood from three areas were collected for identification and recording. Since the structure was not completely dismantled and much of the wood was still embedded in sticky grey estuarine clay it was difficult to ensure that samples were collected in all cases from the oldest, lower, parts of the stems. This has probably led to some errors in the ageing of particular stems, but the coherence of the results indicates that the overall picture is reliable.

The samples were examined in the laboratory, recording the features discussed by Morgan (1982, 264-5): species, stem diameter, numbers of growth rings and the width of the outer ring. Full results are given in Table . Most of the wood is of oak (Quercus sp.), and it was thus usually possible to record these


Stem diameter (mm).
70
60
50
40
30
20
10
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Stem age (years)
Site 28 Control 16
• Oak roots (transverse)
o Oak poles etc (longitudinal)


Number of stems.
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13
Stem age (years)
Site 28 : Context 96.
Oak rods (transverse)
Oak poles etc (longitudinal).

Site 28. Context 96: Wood

Sample no.	Taxon	Stem diameter (mm)	No. of rings
1	Corylus	46	23
2	Quercus	60	13
3	"	49	9
4	"	35	10
5	"	21	5
6	"	17	6
7	"	20	3
8	"	38	7
9	"	53	7
10	"	35	6
11	"	40	6
12	"	41	6
13	"	44	7
14	"	70	13
15	"	45	6
16	"	35	8
17	"	25	8
18	"	22	6
19	"	20	5
20	"	18	5
21	"	24	6
22	"	13	3
23	"	26	4
24	"	19	4
25	"	14	4
26	"	17	5
27	"	15	4
28	"	19	5
29	"	20	6
30	"	16	5
31	"	14	4
32	"	15	4
33	"	16	5
34	"	19	6
35	"	17	4
36	"	16	5
37	"	15	4
38	"	17	4
39	"	16	5

Sample no.	Taxon	Stem diameter (mm)	No. of rings
40	Quercus	14	5
41	"	8	3
42	"	13	4
43	"	11	4
44	"	14	5
45	"	12	4
46	Corylus	15	3
47	Quercus	19	6
48	"	14	4
49	Corylus	12	3
50	Quercus	15	5
51	"	20	6
52	Corylus	14	5
53	Quercus	10	4
54	Corylus	12	3
55	"	15	3
56	Quercus	21	6
57	"	11	4
58	"	13	6
59	"	18	6
60	"	10	3
61	"	19	6
62	"	14	5
63	"	13	4
64	"	20	6
65	"	13	4
66	"	22	6
67	"	19	5
68	"	14	5
69	"	14	5
70	"	16	5

features from transversely snapped stem surfaces. Samples of diffuse porous wood were identified and recorded from thin sections examined by transmitted light at high power.

Of the seventy samples examined, sixty four are of oak (Quercus sp.). The oak rods are from stems between 8 and 26mm. in diameter and 3 to 6 years old. The longitudinal oak poles etc. show a much wider range in size and age: 17-70mm. in diameter, 3 to 13 years old. Size and age distributions are summarised in Fig. . The final, outer, rings are frequently narrower than the preceding rings but none of the larger stems shows growth terminating with the large spring-grown vessels. The width of the outer ring of the smaller stems is, however, often difficult to determine partly due to erosion since the structure became exposed on the foreshore.

The rather narrow age/size range of the transverse oak rods seems to indicate deliberate selection though there is as yet insufficient evidence to interpret this in terms of woodland management. The complete or near-complete outer rings indicate cutting in winter.

The remaining wood is of hazel (Corylus sp.). There is one large longitudinal pole of this species and at the north-eastern end of the structure five small transverse rods, 12-15mm. in diameter with 3-5 rings. The outer rings are complete or nearly complete, though the latest three rings of sample 52 are very narrow.

The structure differs in two main respects from the hurdle trackways recorded in the Somerset Levels (Morgan et al 1978; Morgan 1982). Firstly its construction is quite different: the main poles run longitudinally. Secondly it is constructed mainly of oak roundwood with some hazel, in contrast to the Somerset Levels hurdles which consist mainly of hazel, alder, ash and birch roundwood. Further work on the other wooden structures at this site, once radiocarbon dates are received, should help to clarify whether a distinctive local tradition of wood-craft is represented, or whether this structure is atypical.

(2) Contexts 96 and 97: Mats of woody plant material

Associated with the wooden structures 96 and 97 were densely compacted mats of thin woody plant stems. Two samples were collected for examination (Table). The stems are irregular in form, up to about 5mm. in diameter, with nodal swellings. Seen in transverse section the vascular bundles are regularly arranged in with an approximately concentric distribution. These stems compare closely in both macroscopic features and histology with reference stems of

Context no.	96	97	114(f)	116
Spergularia sp(p) (a)	9	4	-	-
Halimione-type (stems) (b)	+++	+++	+	-
Suaeda maritima (L) Dumort	53	55	-	54
Salicornia sp	8	3	-	148
Chenopodiaceae indet (c)	4	4	-	4
Quercus sp (twigs)	-	+	-	-
Quercus sp (charcoal)	-	-	+	-
cf Quercus sp (leaf fragments)	+	-	-	-
Limonium/Armeria (calyces)	23(d)	7	2	6
Plantago maritima L (capsule lids)	1	-	18(g)	-
Plantago maritima L (seeds)	-	-	1	-
Aster tripolium L	5	14	-	5
Triglochin maritima L	2	1	-	-
Ruppia maritima L	-	-	-	3
Juncus sp (capsules)	-	-	7(h)	-
Juncus sp (seeds)	1	-	-	-
Triticum dicoccum Schübl (glume bases)	-	-	2	-
Triticum sp (glume bases)	1(e)	-	-	-
Triticum sp (rachis nodes)	-	-	2(i)	-
Gramineae indet (stem fragments)	-	-	+	+
Gramineae indet (fruits)	5	6	3	3
Indeterminate seeds etc	5	6	45(j)	10
leaf fragments	-	-	-	+
buds	-	+	-	-
thorn	-	-	-	+
wood	-	-	-	+
stem fragments	+	-	+	+
Foraminifera	+	+	-	+
Hydrobia ulvae (Pennant)	9	-	-	1
Beetle elytra etc	+	+	-	+
Fly puparia	+	+	-	+
Small fired clay fragments	+	+	+	+
Sample weight (kg)	0.7	1.9	4.4	0.5

Table : Macrofossils from Site 28

Plant taxa are represented by fruits or seeds except where indicated. Notes: (a) Mostly S.media-type with broad scarious border. (b) Small woody stems with nodal swellings. These were compared with stems of the main species in the modern salt marsh. In TS. distribution and form of vascular bundles closely matches reference material of H.portulacoides. (c) Testas absent. Suaeda or Atriplex. (d) Includes some calyces definitely of Limonium sp. (e) Not carbonised. (f) All material from this sample carbonised. (g) These include some seeds fused with the capsule lids during charring. (h) Capsules with aggregates of carbonised seeds. (i) Tough-rachis free-threshing wheat. (j) Mostly elongate forms with poorly-preserved surface detail.

Halimione portulacoides (sea purslane). Macrofossils of halophytes from the matrices of these deposits are of Spergularia sp., Suaeda maritima, Salicornia sp., Limonium/Armeria, Plantago maritima, Aster tripolium and Triglochin maritima. The assemblages as a whole seem to represent salt-marsh rather than mud-flat vegetation: seeds of Salicornia spp. are not common, occuring at much lower frequencies than in most of the 'natural' estuarine assemblages so far examined (cf. Site 3). When these wooden structures are fully excavated and dismantled it will be important to establish whether these mats of Halimione-type stems represent plant material collected on the salt-marsh and laid down on an unstable muddy surface to give a firm footing or whether they represent in situ vegetation growing up through and around the wooden structures. This will indicate whether the hurdle structures were laid down on a salt-marsh or mud-flat surface.

The samples also produced an uncharred glume base of either spelt or emmer (Triticum sp.), twigs and leaf fragments of oak (Quercus sp.), foraminifers, insect remains, shells of Hydrobia ulvae and some very small fired clay fragments.

(3) Context 99

A 5kg. sample from this spread of heat-shattered stones in a dark greyish-brown silty clay matrix on the 'head' surface was examined. A small quantity of small abraded charcoal fragments was recovered by flotation. The heat-shattered stones in the deposit are mainly of flint with some quartzite. Rounded and sub-rounded pebbles up to about 45mm. are represented.

(4) Context 114

This was an area of fired clay on the wooden structure 98. The sample examined consisted of very porous, friable, lightly-fired, pinkish-grey clay including patches of unfired grey clay and charcoal flecks. After drying, this material disaggregated readily on immersion in hot water, releasing carbonised plant material which was collected in a 500 micron mesh sieve. The residue included irregular small fragments of bright red well-fired clay and slag-like material. Carbonised plant remains from the sample are listed in Table . They include oak charcoal, charred Halimione-type stems, carbonised calyces of Limonium/Armeria, capsule lids and seeds of Plantago maritima, capsules of rushes (Juncus sp.) containing seed aggregates, grass caryopses and cereal remains: glume bases of emmer (Triticum dicoccum) and rachis nodes of a free-threshing tough-rachis wheat. Apparently salt marsh plants and crop processing waste were used to temper the clay before it was partly fired. More of this fired clay should be collected to recover further carbonised cereals.

(5) Context 116

This context consisted of plant material in a grey clay matrix, associated with the wooden structure 98. On disaggregation a sample from the deposit was found to include indeterminate monocotyledonous stems and woody stems with some grass culm fragments, small wood fragments and a thorn (Table). Seeds of Salicornia sp. and Suaeda maritima are common. Fruits and seeds of other halophytes including the brackish-water aquatic Ruppia maritima are also present. The high frequency of Salicornia seeds suggests deposition in a low salt marsh or mud-flat environment.

Crouch Valley sites re-investigated in 1985

(a) Crouch Site 29

(1) The oyster bed

The estuarine sediments visible along the Crouch Estuary are in general decalcified and contain no calcareous fossils. At Site 29, however, grey estuarine clay containing mollusca is exposed: shells of burrowing bivalves including Scrobicularia plana, Cerastoderma edule and Mya arenaria and hydrobiid gastropods are common in the upper part of this clay, and at the base, on the interface between the head surface and the estuarine clay, there is an in situ bed of oysters in life position. This oyster bed is in a stratigraphically equivalent position to the later Bronze Age wooden structures, contexts 67 and 68.

Unfortunately the sections are badly obscured by slumped sediment and there is some re-working by modern burrowing organisms. In these circumstances it would be difficult to obtain samples entirely free of recent contaminants without fairly extensive excavation. However, by cutting back the section close to 67, block samples of the oyster bed were collected for laboratory analysis. The samples were initially sorted through, removing all paired oyster valves and subsequently a 4kg. clay sample was disaggregated and examined for other macrofossils. The taxa identified from this sample are listed in Table . Full quantitative analysis was not undertaken since the accessible parts of the deposit were not well-sealed by undisturbed later sediments and traces of green filamentous algae indicated a slight degree of contamination by recent material. Nevertheless the macrofossils present give a useful indication of the sedimentary environment contemporary with the Later Bronze Age structures at this site.

Amongst the faunal remains identified estuarine intertidal and shallow sublittoral species predominate: the oyster bed itself would not have extended above low water mark. Foraminifera and shells of the estuarine snail Hydrobia ulvae are abundant, shells of Littorina spp, Retusa sp, Ostrea edulis and Cerastoderma spp. are common and a range of other predominantly estuarine invertebrates including worms, molluscs, bryozoans and crustaceans is represented. Fruits and seeds from plants characteristic of salt marsh and mud flat communities including Spergularia sp(p), Suaeda maritima, Salicornia sp, Armeria/Limonium, Aster tripolium and Triglochin maritima are present. There is also an unusually high proportion of seeds from freshwater aquatic and wetland plants particularly Ranunculus subgenus Batrachium, but also Alisma plantago-aquatica, Typha sp, Eleocharis sp. and Carex sp: such species commonly occur in the assemblages examined from estuarine clays in the

Foraminifera:	(gen et sp indet)	a
Annelida:	Polydora sp (borings in oyster shell and clay concretions)	p
Mollusca:	Gibbula sp	p
	Littorina littorea (L)	c
	Littorina saxatilis (Olivi)	c
	Hydrobia ventrosa (Montagu)	p
	Hydrobia ulvae (Pennant)	a
	Nucella lapillus (L)	p
	Buccinum undatum L	p
	Nassarius incrassatus (Ström)	p
	Retusa sp(p)	c
	Turbonilla sp	p
	Mytilus edulis L	p
	Ostrea edulis L	c
	Cerastoderma sp(p) (immature valves)	c
	Venerupis sp(p) (abraded)	p
	Macoma balthica (L)	p
	Scrobicularia plana (da Costa)	p
Bryozoa:	(gen et sp indet) (encrusting forms)	p
Arthropoda:	Cladocerans (ephippia)	p
	Balanus sp(p) (encrusting shells etc)	p
	Crab cheliped fragment cf Carcinus maenas L	p
	Insect remains including beetle elytra etc	p
Vertebrata:	Anguilla anguilla (L). Vertebra of an elver	p
	Indeterminate fish bones	p

Table : Systematic list of macrofossils (>500 microns) associated with the basal oyster bed at Site 29

Abbreviations: p - present; c - common; a - abundant.
Fish bones kindly examined and identified where possible by Andrew Jones.
Plant taxa are represented by fruits or seeds except where indicated.

Plants:	Ranunculus subg Batrachium	c
	Spergularia sp(p)	p
	Suaeda maritima (L) Dumort	c
	Salicornia sp	p
	Polygonum aviculare agg	p
	Urtica dioica L	p
	Armeria/Limonium (calyces)	p
	Aster tripolium L	p
	Anthemis cotula L	p
	Alisma plantago-aquatica L	p
	Triglochin maritima L	p
	Typha sp	p
	Eleocharis sp	p
	Carex sp	p
	Triticum sp (carbonised grain)	p
	Gramineae indet	p
	Gramineae indet (rhizome and stem)	p
	Indeterminate (stem fragments)	p
	Indeterminate (small charcoal fragments)	p

Crouch and Blackwater Estuaries but usually at much lower frequencies. Taken together these results seem to indicate deposition in an estuarine creek, which was receiving plant material from freshwater habitats further upstream. Another unusual feature of the assemblage is the presence of seeds from weed plants (Polygonum aviculare, Urtica dioica, Anthemis cotula) in association with charcoal fragments and a carbonised grain of wheat (Triticum sp). This clearly points to human activity in the vicinity.

The sample also gives an indication of the range of estuarine food resources available to coastal communities. In this sample edible species include Littorina littorea (winkle), Buccinum undatum (whelk), Mytilus edulis (mussel), Ostrea edulis (oyster), Cerastoderma sp. (cockle) and Anguilla anguilla (eel) represented by a very small vertebra of a young elver. There is no direct evidence for food collection at this site and indeed the oyster bed at this point in the section had a fairly short life: the oysters are all young specimens, under about 50mm. from hinge to gape, and were apparently smothered by sediment before reaching maturity. Elsewhere on the head surface in the vicinity closer to 68, however, larger oysters up to about 90mm. in size can be seen.

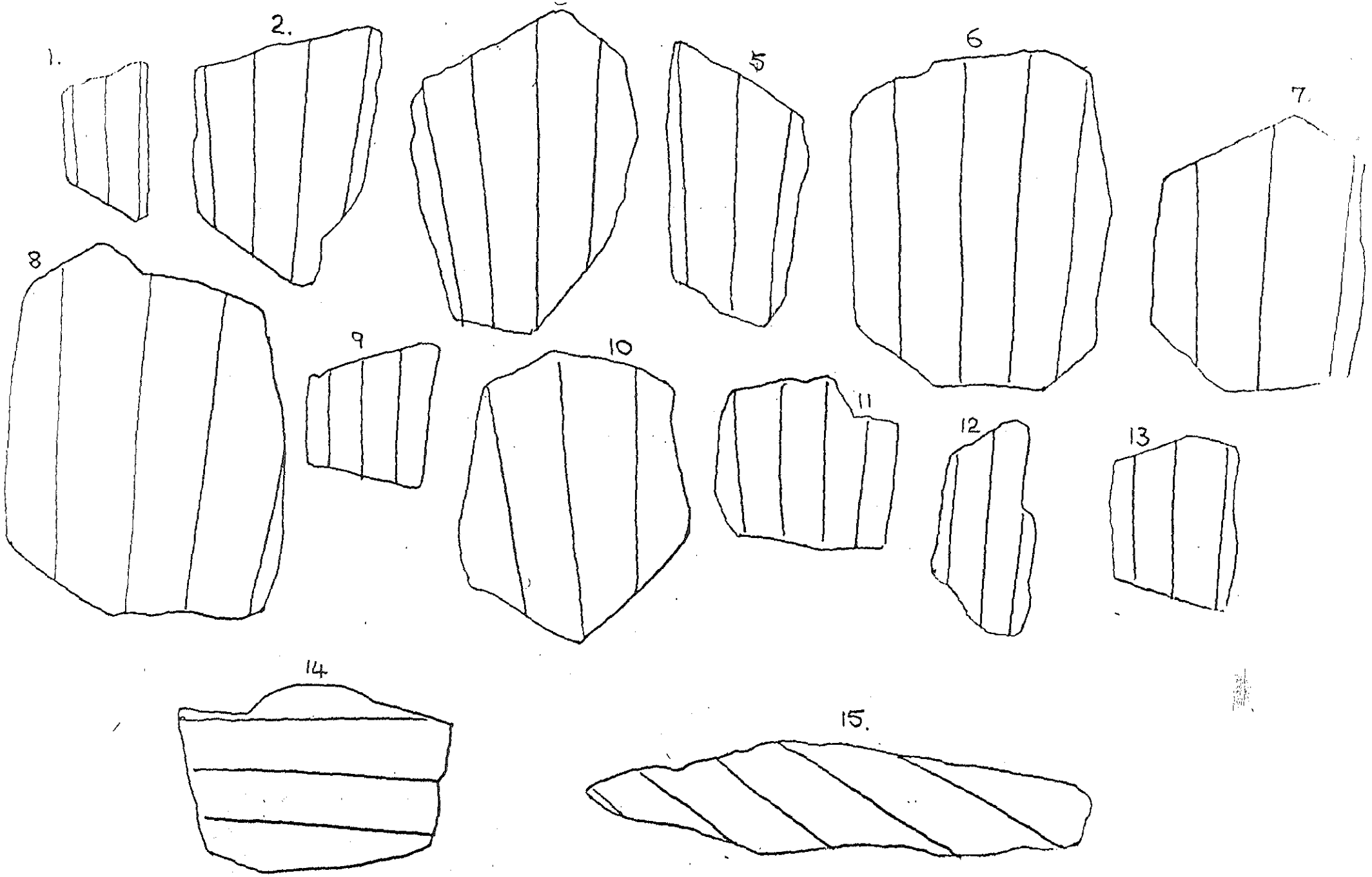
(2) Context 68

During the 1983 season after initial cleaning and recording a single piece of horizontal wood was removed for dating and identification. This was of ash (Fraxinus sp.), a split segment from a large branch. It gave a date of 3250 ± 90b.p. or 1300b.c. (HAR-5735). The site was re-investigated in 1985 and further wood samples were collected for identification and description. These are all of oak (Quercus sp.) from mature wood. The cell structure is heavily mineralised with iron compounds. Drawings of cross-sections of the samples are given in Fig. .

With the exception of sample 15 these pieces of oak wood appear to have been produced by splitting radial segments of a trunk tangentially. In most cases the surfaces are poorly preserved but further trimming is visible on some of them: sample 7 in particular has been trimmed to an irregularly 6-sided cross-section towards its tip. The horizontal plank or beam, sample 15 is not tangentially split.

(3) Brushwood structure, context 67

This poorly-defined and partly eroded brushwood structure was re-examined in 1985 and thirty samples from the larger twigs and branches of which it was composed were collected for examination. Small twigs under about 5mm. in



Crouch Site 29 Context 68

Cross-sections of oak wood samples, showing orientation of medullary rays. Scale 1:1.

diameter were also present but have not been examined. Of the samples collected, thirteen are of oak stems (Quercus sp.) 14-41mm. in diameter with 6-12 rings and the remainder are stems of diffuse porous woods including Prunus sp. (sloe?) and the Crataegus-group (hawthorn etc.), 7-40mm. in diameter with 4-15 rings. Many of the samples are from forked and branched stems, and some are from stems of very contorted form.

Compared to the wood from the hurdle structure, context 96 at Site 28, this material shows no apparent signs of having been selected for size, age or even in some cases straightness. It seems to represent a haphazard collection of brushwood.

(b) Crouch Site 60

The ditch section, now overgrown, was cut back and a 9.9kg. sample of soil containing fired clay fragments and charcoal was removed for laboratory examination and possible radiocarbon dating.

The sample produced only a small quantity of charcoal on flotation, insufficient for dating. The residue contained abundant fired clay fragments, up to about 40mm. These vary in colour from grey through pinkish grey to bright red, reflecting variations in the intensity of firing and degree of oxidation. The proportion of organic material in this clay is low and no identifiable impressions of plant material have been noted. The fragments are weathered and abraded. Small off-white concretions of fused material similar to concretions commonly associated with briquetage are also present.

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