The Hullbridge Survey

Plant macrofossils from the top of the Lower Peat and base of the Middle Clay at site 8 (Clementsgreen Creek).

Site 8: Macrofossils from the Lower Peat and Middle Clay

At site 8 sediments at the base of the Middle Clay and the top of the Lower Peat are exposed on the foreshore on a surface gently inclined towards the main channel of the River Crouch to the south. Progressively lower layers outcrop in a southerly direction. The most conspicuous feature on the lower shore is the 'submerged forest' consisting of stools and fallen trunks rooted in, or resting on, the Lower Peat surface. No vertical sections are available, but by digging pits across the foreshore at low tide a short composite section was exposed for sampling. Column samples were taken for macrofossil analysis in order to examine vegetational change associated with the Lower Peat/Middle Clay transgression.

Katherine Manson has already reported on diatoms from these sediments. The column samples discussed here were not taken from exactly the same position as the diatom samples: the earlier pits could not have been re-located. However, a macrofossil sample had previously been taken from the top 5cm of the Lower Peat during sampling for diatoms, and seed counts from this sample will be compared below with results from the macrofossil column samples.

Sediments

0-12cm	Grey estuarine clay; small peat and wood fragments very rare in top 5cm; becoming common and including large (5cm) wood fragments in lowest 4cm; sharp boundary.
12-42cm	Dark brown wood peat. Top 10cm includes a relatively high clay content evenly distributed. Most wood fragments in the lowest 5cm are from roots.

Sampling and extraction

Samples were taken at approximately 5cm intervals, respecting layer boundaries, from the clay and top of the peat, in section 1 (0-17cm). From a second section, lower on the shore, samples were taken at 10cm intervals from the peat (17-42cm). Together these two columns of samples give a composite section across the Lower Peat/Middle Clay contact. 0.5kg sub-samples were disaggregated by soaking in NaOH solution. The disaggregated material was graded in a sieve bank with a finest mesh size of 250 microns, and the sieved fractions were sorted under a binocular microscope at low power. Macrofossils identified are listed in Table and the results are summarised in Fig . Small wood fragments in the samples were not identified, but in an earlier study a sample area of prostrate trunks on the Lower Peat surface was planned and wood identifications were made. (Interim Report No 1, Fig 7). These results are repeated below.

Discussion

Three samples were examined from the peats exposed in section 2, at 37-42cm, 27-32cm and 17-22cm. The lowest of these at 37-42cm produced a macrofossil assemblage of which nutlets of Carex spp (sedges) comprised 48%. Most of these were trigonous nutlets, but few could be determined to species, apart from some tentative identifications of Carex cf vesicaria, bladder sedge, characteristic of wet woods and swamps. Fruits and seeds of freshwater aquatics (Lemna sp, Alismataceae) made up 13% of the assemblage, and several wetland herbs (Ranunculus sceleratus, Epilobium sp, Oenanthe sp, Mentha arvensis/aquatica, Lycopus europaeus) were also represented. Fruits of alder (Alnus glutinosa) comprised 17% of the total, but much of the wood in this peat consists of woody roots penetrating from higher levels. Taken together this assemblage is thought to indicate wet mixed sedge fen in the process of colonisation by alder.

The peat at 27-32cm contained much higher frequencies of alder fruits (81%) and clearly represents the development of fen woodland. Remains of sedges, aquatic plants and wetland herbs are also present as are fruitstones of Rubus fruticosus (bramble).

Plant macrofossils were extremely sparse in the peat at 17-22cm, and most of those present are either woody fruitstones or seeds with tough testas. This suggests that there has been some destruction of the less resistant macrofossils. The presence of seeds of Suaeda maritima (herbaceous seablite) clearly demonstrates the presence of some intrusive macrofossils from later estuarine plant communities, probably as a result of the activities of burrowing organisms, which may also have been responsible for the destruction of all but the most durable plant macrofossils in the peat at this level.

Section 1 provided four samples between 0-17cm. The sample at 12-17cm was from the top of the Lower Peat. Fruits of alder are common (36%) and are associated with Lemna seeds, Carex nutlets, fruits and seeds of wetland herbs, notably Oenanthe aquatica and Lycopus europaeus and remains of some shrubs (Rubus fruticosus, Prunus spinosa, Solanum dulcamara). These indicate brushwood peat formation beneath wet fen woods. However, almost 33% of macrofossils from this peat are from halophytes, including Spergularia media-type (sea-spurrey), Atriplex sp (orache), Suaeda maritima (herbaceous seablite), Salicornia sp (marsh samphire), Aster tripolium (sea aster), and Triglochin maritima (sea arrow grass). These fruits and seeds are clearly intrusive from the clay above: the peat has a high clay content which is thought to have been introduced by intertidal burrowing organisms during the Middle Clay transgression though no discrete clay-filled burrows could be discerned. It appears that there is some variability in the intensity of this disturbance: the macrofossil sample taken from the top of the Lower Peat at the sampling site for the diatom column,

nearby, contained only 11% of macrofossils from halophytes. Katherine Manson has noted the presence of brackish-water and marine diatoms in the top 5cm of the Lower Peat, and foraminifera were observed in the macrofossil samples at this level. The effect of this intrusive material is to blur the distinction between the plant communities of the Lower Peat and those of the Middle Clay.

Wood identifications of fallen trunks in a sample area of the Lower Peat surface about 100m x 30m, are given in Table . Sixteen trunks were identified: nine were of alder (Alnus sp), six of oak (Quercus sp) and one of elm (Ulmus sp). Fig shows the locations, orientation and approximate size of the trunks identified. Oak was not represented by macrofossils in the samples of peat examined, and these identifications are thus useful in showing that the final Lower Peat woodland was of mixed alder-oak fen woods.

The two samples of Middle Clay at 8-12cm and 5-8cm include a mixture of halophytes, predominantly salt-marsh species. Besides remains of the halophytes and other salt-tolerant plants already noted, Cochlearia cf anglica (long-leaved scurvy-grass) seeds, Limonium/Armeria (partly-degraded calyces of sea lavender or thrift), Plantago maritima (capsule lids and seeds of sea plantain) Scirpus maritimus (sea club-rush nutlets) and caryopses of Puccinellia distans (reflexed poa) were identified. These plants would have grown in a range of estuarine habitats varying widely in salinity, wetness and the frequency of tidal flooding. Consequently detailed reconstruction of types of vegetation present is difficult. Site 10 at North Fambridge, however, provides a modern analogue of conditions associated with the Middle Clay transgression. Here salt-marsh herbs can be seen growing on and around the stumps of trees killed by a late 19th or early 20th century marine incursion resulting from a breach in the sea defences.

The clays between 5-12cm included quite large quantities of wood fragments and the samples from them included alder fruits, and remains of freshwater, wetland and aquatic plants. These may in part be derived by erosion from the underlying peats, but equally could be from contemporary valley alder fen woods further upstream.

In the topmost clay sample at 0-5cm the dominant species is Salicornia sp (marsh samphire), seeds of which comprise 55% of the assemblage. Grasses, including Puccinellia maritima (common salt-marsh grass) make up 16% of the total and other halophytes occur at lower frequencies. The predominance of Salicornia suggests that most of the plant remains in this clay came from low salt-marsh or intertidal mud-flat communities as a result of the extension of tidal influence associated with the transgression.

The successive vegetation-types represented in these samples may be summarised as follows:

1. Mixed sedge fen, with some aquatic vegetation. Colonisation by alder.
2. Wet alder-oak fen woods with shrubs and wetland herbs.
3. Salt-marsh communities including halophytes with a range of salt-tolerance.
4. Lower salt-marsh and intertidal mud-flat vegetation, dominated by Salicornia.

The results from macrofossil analysis thus confirm the diatom evidence for a transition from freshwater to brackish/marine conditions and provide more detailed information on the structure and types of vegetation represented.

Fig : Summary diagram of plant macrofossil frequencies at site 8 (Lower Peat/Middle Clay contact).

Notes.

1. 'Other wetland herbs' includes Ranunculus sceleratus, Rorippa islandica, Montia fontana, Epilobium sp, Urtica dioica, Polygonum sp, Mentha arvensis/aquatica, Scutellaria cf galericulata, Eupatorium cannabinum.

2. 'Various halophytes' includes Cochlearia spp, Spergularia media-type, Apium graveolens, Rumex sp, Plantago maritima, Scirpus maritimus.

3. Puccinellia spp are indicated in black, other indeterminate grasses in white.

4. The sample at 17-22cm contained sparse macrofossils, too few for percentage calculations.

This diagram does not include unidentified macrofossils. Juncus spp were not counted and are thus not included in the totals.

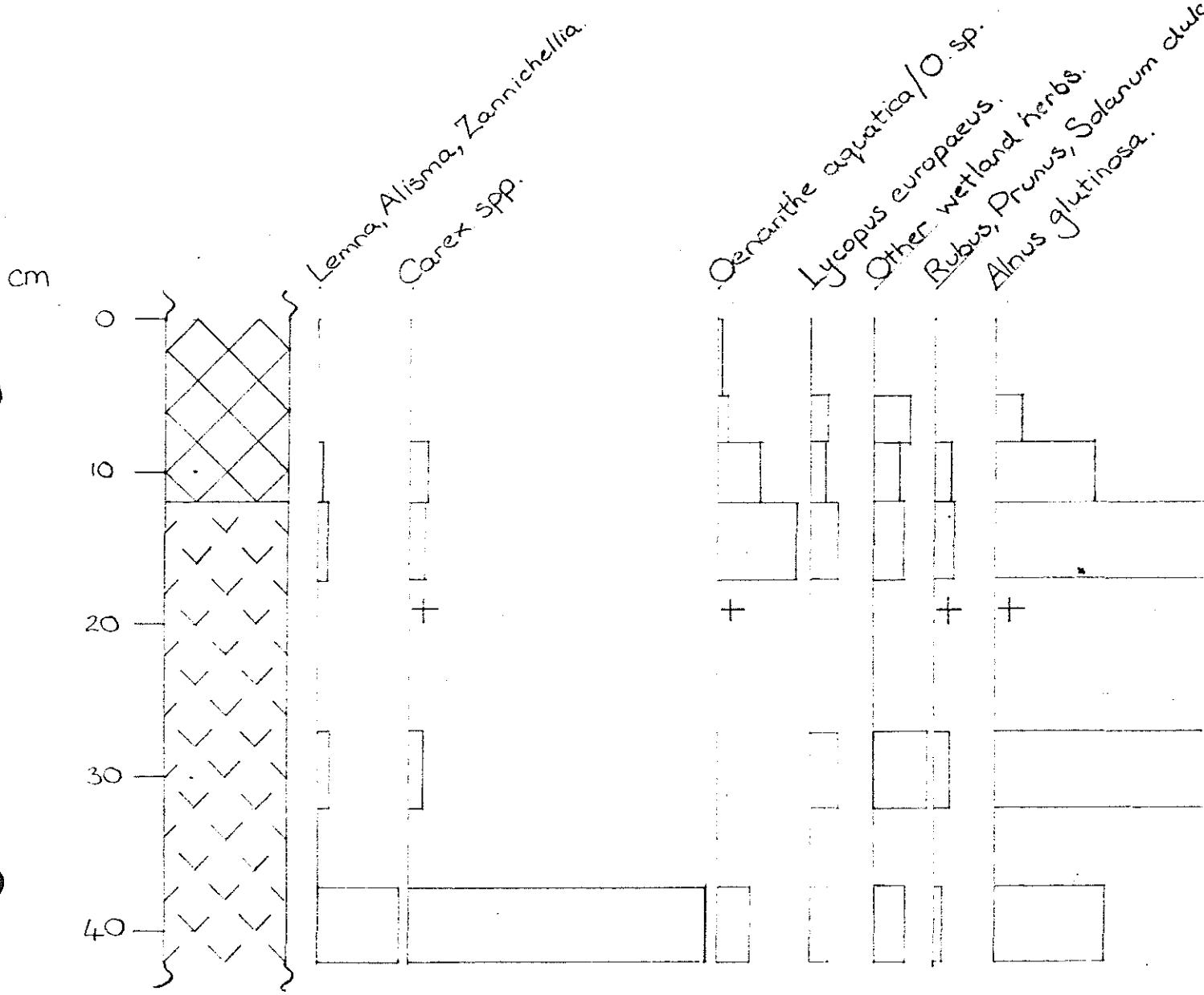
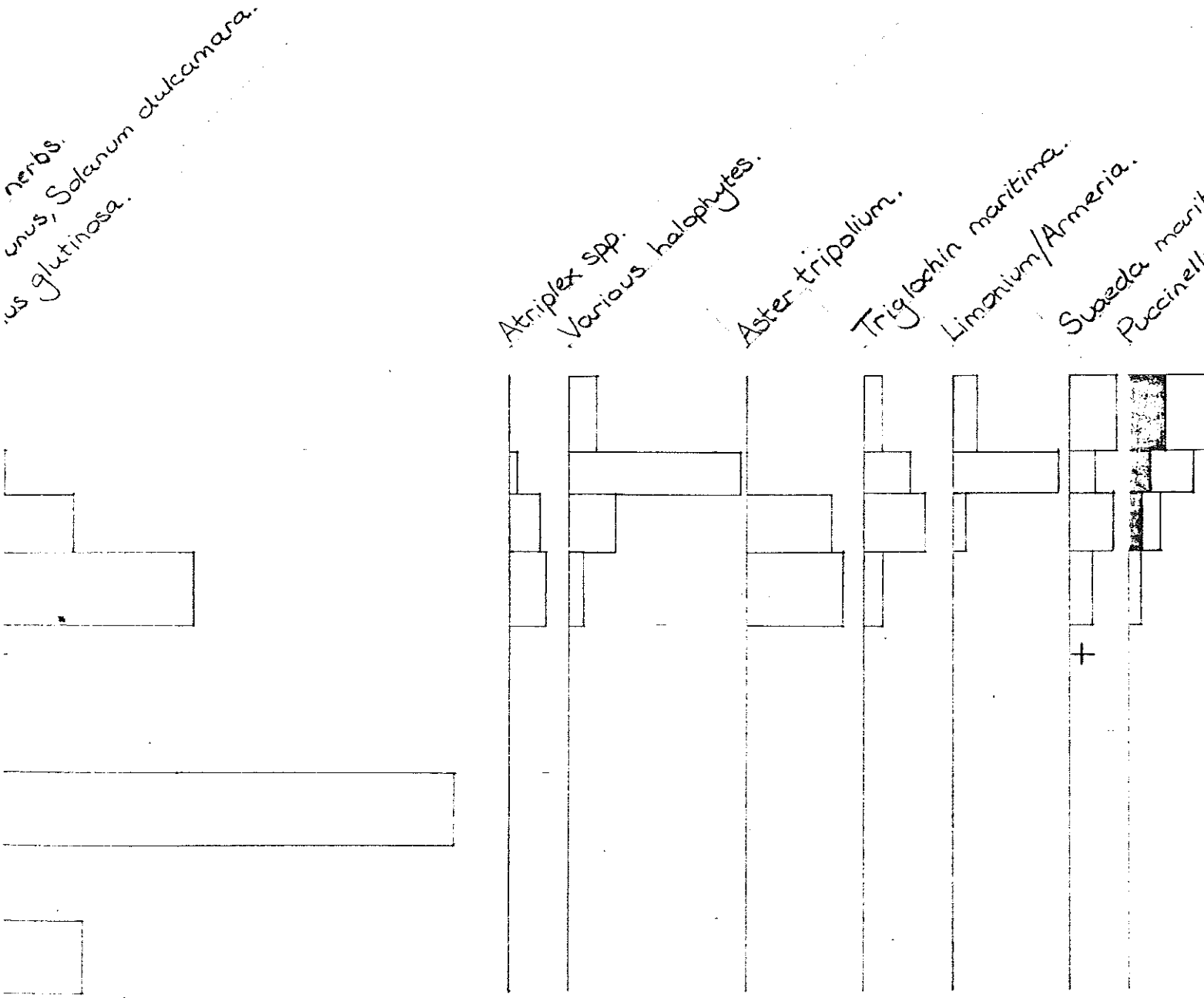
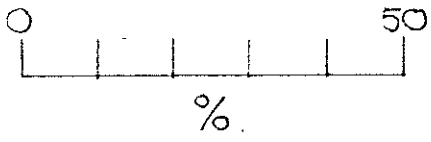
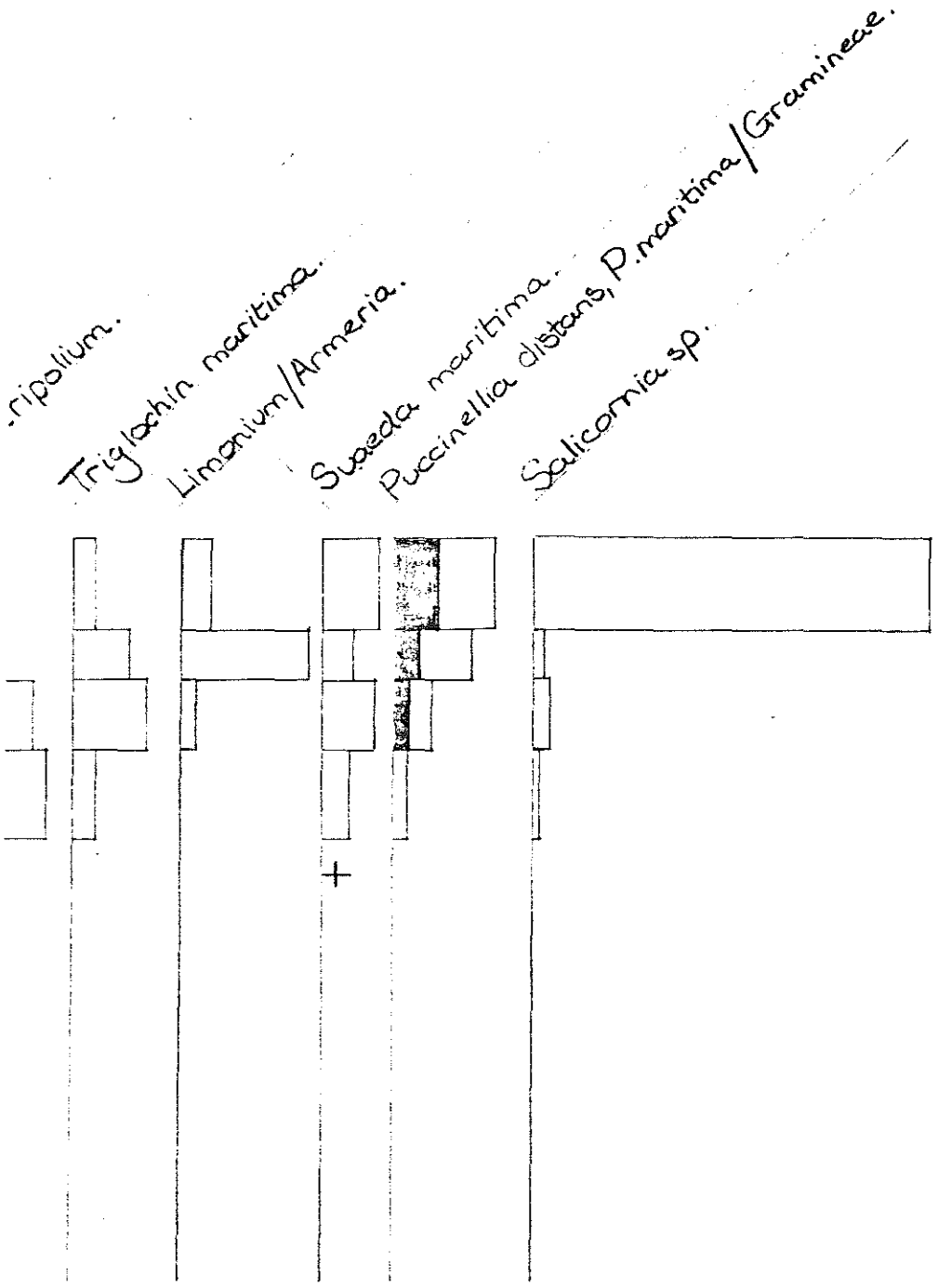

cm
0
10
20
30
40
Lemna, Alisma, Zannichellia.
Carex spp.
Oenanthe aquatica/O. sp.
Lycopus europaeus.
Other wetland herbs.
Rubus, Prunus, Solanum dulc
Alnus glutinosa.

Fig : Sun





: Summary diagram of plant macrofossil frequencies at site 8. (Lower Peat/M



at site 8. (Lower Peat/Middle Clay contact)

1. Quercus sp.
2. Quercus sp.
3. Quercus sp.
4. Alnus sp.
5. Alnus sp.
6. Quercus sp.
7. Alnus sp.
8. Quercus sp.
9. Alnus sp.
10. Quercus sp.
11. Ulmus sp.
12. Alnus sp.
13. Alnus sp.
14. Alnus sp.
15. Alnus sp.
16. Alnus sp.

Table 2 : Site 8 Wood identifications (trunks)

	Section 1				Section 2			
Depth (cm)	0-5	5-8	8-12	12-17	17-22	27-32	37-42	12-17*
Ranunculus sceleratus L	-	1	1	4	-	5	2	3
Cochlearia cf anglica L	4	3	-	-	-	-	-	-
Cochlearia sp	-	-	3	-	-	-	-	-
cf Rorippa islandica (Oeder) Borbas	-	1	-	-	-	-	-	-
Spergularia media-type	2	12	6	5	-	-	-	-
Caryophyllaceae indet	-	-	1	-	-	-	-	-
Montia fontana agg	-	1	1	1	-	18	-	-
Atriplex spp	-	1	10	25	-	-	-	5
Suaeda maritima (L) Dumort	14	4	13	14	13	-	-	12
Salicornia sp	101	1	4	3	-	-	-	1
Chenopodiaceae indet (immature)	-	-	1	-	-	-	-	2
Rubus-type (thorns)	-	-	-	-	-	+	-	+
Rubus fruticosus agg	-	-	4	6	19	7	-	8
Prunus spinosa L	-	-	1	3	-	-	1	2
Epilobium sp	-	-	-	-	-	-	1	-
cf Apium graveolens L	2	-	-	-	-	-	-	-
Oenanthe sp	1	-	6	-	2	-	4	25
Oenanthe aquatica (L) Poiret	-	1	7	54	-	-	-	-
Rumex sp	-	-	1	3	-	-	-	-
Polygonum sp	-	-	-	-	-	-	-	1
Urtica dioica L	-	1	1	4	-	-	-	1
Alnus glutinosa (L) Gaertner	-	4	32	152	4	267	13	115
Alnus glutinosa ('cones')	-	-	2	4	-	1	1	3
Limonium/Armeria (calyces)	7	16	3	-	-	-	-	-
Solanum dulcamara L	-	-	-	3	-	-	-	3

Mentha arvensis/aquatica	-	-	1	1	-	2	1	-
Lycopus europaeus L	-	2	4	16	-	14	2	15
Scutellaria cf galericulata L	-	-	-	-	-	3	-	-
Labiatae indet	-	-	-	-	-	1	1	-
Plantago maritima L (capsule lids)	-	2	3	-	-	-	-	-
Plantago sp	cf1	9	-	-	-	-	-	-
Aster tripolium L	-	-	29	69	-	-	-	3
Eupatorium cannabinum L	-	-	4	11	-	-	-	7
Compositae indet	3	4	-	-	-	-	-	-
Alisma plantago-aquatica L	-	-	-	-	-	-	-	4
Alismataceae indet (embryos)	-	-	-	-	-	-	1	-
Triglochin maritima L	5	7	20	12	-	-	-	-
cf Zannichellia palustris L	-	-	1	-	-	-	-	-
Juncus spp	+	+	+	-	+	-	-	-
Lemna sp	-	-	-	6	-	5	9	-
Scirpus cf maritimus L	-	-	2	-	-	-	-	-
Scirpus sp	-	-	2	2	-	-	-	-
Carex spp	-	-	5	10	1	5	35	21
Carex cf vesicaria L	-	-	-	-	-	-	2	-
Carex cf sylvatica Hudson	-	-	-	-	-	1	-	-
Puccinellia maritima (Hudson)	11	-	-	-	-	-	-	-
Puccinellia distans (Jacq.) Parl	-	-	4	-	-	-	-	-
Puccinellia sp	-	3	-	-	-	-	-	-
Gramineae indet	16	7	7	7	-	-	-	-
Gramineae indet (culm frags)	-	+	-	-	-	-	-	-
Indeterminate seeds etc	16	11	21	10	3	-	5	24
Wood fragments	+	+	+	+	+	+	+	+
Leaf fragments	+	+	+	+	+	+	-	+
Buds/budscales	-	+	+	+	+	+	-	+
Mosses	-	+	-	+	-	-	-	-

Foraminifera	+	+	+	+	+	-	-	+
Cladoceran ephippia	+	+	+	+	+	+	+	+
Insects	-	-	+	+	+	+	+	+

Table : Plant macrofossils and other biological remains from the Lower Peat and Middle Clay at Site 8.

Unless otherwise indicated plant taxa are represented by fruits or seeds.

*This sample was included in Interim Report No 2 as 'Lower Peat 0-5cm'. It is equivalent here to the peat sample at 12-17cm.