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Ancient Monuments Laboratory
Report 58/92

STONEA CAMP, CAMBRIDGESHIRE: PLANT MACROFOSSILS AND MOLLUSCS FROM IRON AGE FORT DITCH FILLS

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Summary

Basal organic deposits from the ditch fills indicated the following sequence of events:

1. Shallow standing freshwater in the base of the ditch, with dense woodland dominated by *Quercus* in the immediate vicinity (*cf.* Caesar's references to Iron Age fortifications in woodland);
2. Continued freshwater sedimentation; increased frequencies of aquatic plant remains suggest wetter conditions; indications of more open conditions; dismembered human bodies with sword-cuts dumped in ditches;
3. Plant macrofossils and molluscs indicate brackish-water flooding of the site from the nearby roddon channel. Given the suspected historical context of these deposits - capture of the fort by Roman forces - it is suggested that brackish-water flooding may have related to a deliberate breaching of the levees of the roddon.

The original basal deposits were de-watered and deteriorating prior to current management of the water-table locally : it is hoped this will arrest further degradation.

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Introduction

Stonea Camp is a fort of Iron Age date on a gravel island at c. 2m OD on the Cambridgeshire fen-edge. The earthworks were extensively damaged in the 1960s and the land drainage improved for arable farming. In 1990 the Archaeology Office of Cambridgeshire County Council initiated a management plan involving re-instatement of the damaged earthworks by digging out recent fill and monitoring of the water table. At the same time trenches were dug across the ditches to establish their original dimensions and investigate the basal deposits.

The first aim of the present study was to examine samples from these ditch fills to assess the state of preservation of organic materials. Previous work by Blackham et al (1982) was not encouraging : samples collected during the 1980 excavations by the British Museum produced only sparse and contaminated macrofossil assemblages, though pollen preservation seemed adequate. However in 1991, at the base of Ditch 5 (Trench A) on the south-western lower-lying part of the site structured basal organic deposits were found. They were largely de-watered but still included well-preserved plant material and insects. Their survival, despite drainage, was attributable largely to the highly compacted thick clay layers above them, excluding oxygen; but root penetration had begun and there was no doubt that unless water levels were raised aeration and biodegradation would follow. Similar deposits were encountered in Trenches X111-XV1 in 1992.

Analysis of samples from the site has been confined to little more than a "quantified assessment". The aims were to analyse sufficient samples to give a broad outline of habitat change at the site for interpretative purposes and to indicate the potential of the deposits for more detailed future investigations, now that the survival of the deposits by management of the water table is assured. The main sequence of events in Trench A was established by analysing four samples from the basal organic deposits, and additional samples collected by the excavator in 1992 were also examined. In this report results from studies of plant macrofossil and molluscs are presented and the potential of the deposits for insect and foraminiferal studies outlined. An assessment of the sediments in Trench A for pollen analysis has been prepared by Wiltshire (1992).

Methods

The clay-based largely de-watered sediments required prolonged soaking in water to re-hydrate and disaggregate them. Samples of 0.5-1.0 kg were examined. After disaggregation organic material was separated by wash-over, using a 0.25mm collecting mesh, then graded in a sieve bank prior to sorting under a binocular microscope at low power. Counts were made of macrofossils > 0.5mm, and notes made on smaller plant remains. The mineral fraction was wet-sieved over a 0.5mm mesh, dried and sorted to extract mollusc shells, bone etc.

Plant macrofossils

Trench A, Ditch 5

Samples from four contexts at the base of this ditch were examined : 9.6 (the basal organic fill), 9.5 (an organic lens

Fig 1 : Summary of 'seed' assemblage composition in samples from Trench A, Ditch 5.

This diagram is based on counts of macrofossils > 0.5mm. Five principal ecological groups are distinguished. Unidentified and incompletely identified macrofossils are excluded.

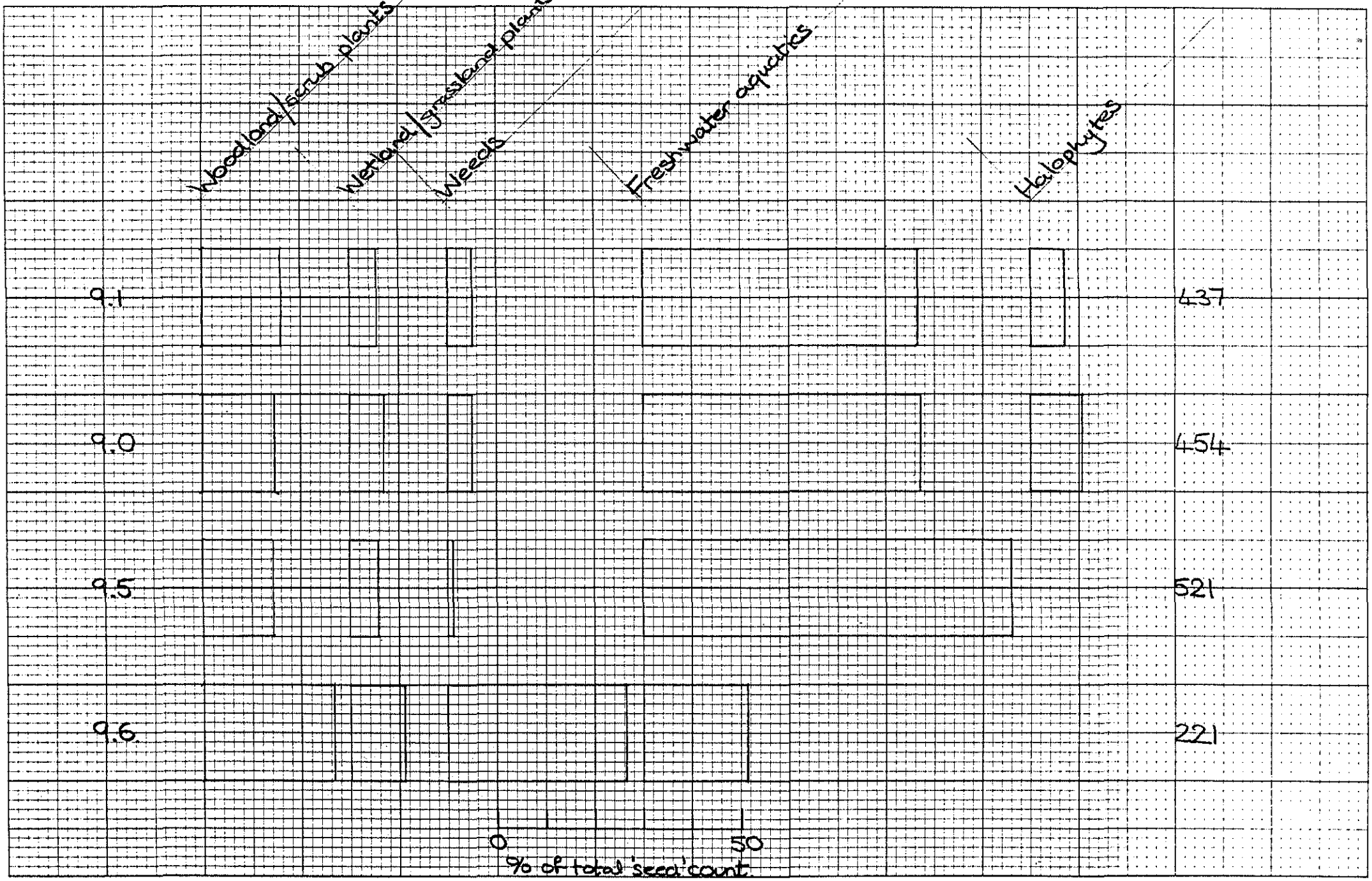
Woodland/scrub plants
Wetland/grassland plants
Weeds
Freshwater aquatics
Halophytes
9.1
9.0
9.5
9.6
437
454
521
221
0
50
% of total 'seed' count

Fig 1.

directly underlying the human skeletal remains), 9.0 and 9.1 (clayey fills post-dating deposition of the human remains). The samples all had a matrix of dark greyish-brown organic clay, laminated and highly compacted, with reddish-brown to brown mottling and brown amorphous organic inclusions. Leaf fragments and twigs were conspicuous in 9.6 and less so in 9.5. The samples were only slightly moist and difficult to re-hydrate for disaggregation. White inclusions and laminations of gypsum were noted, particularly in 9.1. Plant macrofossils are listed in Table 1 and the results are summarised in Fig 1.

The lowest sample, from 9.6, was characterised by abundant twigs and oak leaf fragments. Trees and shrubs (Rubus fruticosus, Prunus spinosa, Crataegus monogyna, Quercus sp, Corylus avellana, Solanum dulcamara, Sambucus nigra) were well-represented by fruits/seeds etc and there was a seed of the woodland herb Moehringia trinervia. The assemblage points to the immediate proximity of woodland and scrub, and is consistent with P. Wiltshire's pollen results indicating local dominance of oak woodland (Wiltshire 1992). The presence of freshwater aquatic plants (Ranunculus sceleratus, Oenanthe aquatica, Potamogeton sp, Lemna sp) similarly confirms the presence of standing water in the ditch. Weeds, wetland and grassland taxa were also represented, the most abundant weed species being Lapsana communis.

The sample from 9.5 relates to the local environment when the human remains were deposited in the ditch. The range of plant macrofossils present closely resembled that from 9.6 : again there was woodland and scrub locally with areas of weedy grassland and marginal wetland vegetation. Frequencies of seeds from aquatic plants (particularly Lemna) were markedly higher in this sample, however, indicating wetter conditions. The assemblage of mollusc shells from 9.5 was dominated by Anisus leucostoma, (see below), a 'freshwater slum' snail. There does seem, however, to have been sufficient depth of standing water in the ditch to support small fish, including sticklebacks. It is therefore likely that the human remains were dumped into shallow water in the ditch. This again would be consistent with the pollen results.

The samples from 9.0 and 9.1 again produced macrofossils of tree and shrub taxa with some weeds, marginal wetland plants and freshwater aquatics. They differed, however, in including macrofossils of halophytes (Suaeda maritima, Salicornia sp, Glaux maritima, Triglochin maritima, Scirpus maritimus, Juncus gerardii) and brackish-water aquatics (Ruppia sp., Zannichellia palustris) together with foraminifera. In view of the persistence of freshwater aquatic plants in these layers it does not seem probable that permanently brackish conditions were established in the feature nor that salt marsh vegetation developed in it. The macrofossils of halophytes and the foraminifera are more plausibly interpreted as material introduced during an episode or episodes of brackish-water flooding from the nearby roddon channel. This could perhaps account for the fact that pollen of halophytes was not noted by Wiltshire during her assessment of samples from these deposits, though she also notes that pollen was often poorly preserved.

Brackish water flooding could, however, be related to the reduced frequencies of pollen from trees and shrubs at higher levels in the pollen monolith. Trees growing at low elevations in the vicinity would have been killed if the groundwater became sufficiently saline following flooding, but those on higher ground, for example on the bank of the monument, would have been unaffected. This could explain the pollen results indicating a change from local dominance of woodland to open and patchy woodland and scrub, which therefore need not necessarily be related to human clearance of local woodland .

Trenches XIII-XVI (Table 2)
The basal fill of the ditch terminal, 2.5, in Trench XIII was an organic brown to greyish-brown laminated organic clay with abundant wood and leaf fragments. On disaggregation a large organic fraction almost entirely composed of Quercus leaf fragments and twigs was obtained. Other plant macrofossils were well-preserved but very sparse. They included some tree and shrub remains (Quercus cupules, Acer fruits, Prunus/Crataegus-type thorns), seeds of the woodland herb Moehringia trinervia and a few fruits and seeds of aquatics, weeds and wetland plants. Although the 'seed' count obtained was very low there is no doubt that local dominance of oak woodland, as in the basal fill of Trench A, is indicated.

From Trench XIV, a sample of greyish-brown organic clay, 5.1, was examined. Macrofossils were both sparse and poorly preserved but the small assemblage extracted included mainly fruits/seeds of freshwater aquatics, and wetland plants with some weeds, a Rubus fruitstone, oak leaf scraps, Moehringia seed and a single seed of the halophyte Glaux maritima (as well as an abraded ? hydrobiid apex: see below). Reliable interpretation of the depositional environment is difficult.

24, from Trench XV, was a greyish-brown organic laminated clay. The seed assemblage, dominated by Ranunculus subg. Batrachium and Potamogeton spp, was composed largely of freshwater aquatic species with wetland plants. The low frequency of Rubus fruitstones and Alnus fruits, and rarity of Quercus leaf fragments implies fairly open conditions in the vicinity whilst it accumulated.

The two samples from Trench XVI were quite different in lithology, with a high fine sand context, indicating deposition in higher energy conditions, though with clay laminations in 4.19. Freshwater aquatics and marginal wetland species again predominated in 4.19 but brackish water aquatics (Ruppia, Zannichellia, Potamogeton pectinatus), marginal plants (Scirpus maritimus) and the salt-marsh plant Triglochin maritima were present. The sample also produced a mollusc assemblage dominated by the estuarine gastropod Hydrobia ventrosa (see below). It is probable that in the laminated sand/clay sediments of this layer both brackish and freshwater deposition was represented, producing a mixed allochthonous plant macrofossil assemblage. However, there is quite clear evidence for brackish-water flooding at an equivalent stratigraphic level to layers 9.0 and 9.1 in Trench A, Ditch 5.

Layer 4.17, at a higher level, was an organic sand with abundant wood. Leaf fragments were not preserved but remains of Rubus fruticosus, Prunus spinosa, Alnus glutinosa and Sambucus nigra indicated that the wood came from alder trees and scrub plants growing nearly. Freshwater aquatics were common. The single fruit of Triglochin was the only indication of proximity of brackish conditions : overall the deposit seems to represent a reversion to freshwater deposition.

Samples were also inspected from the latest, undated, recut of the ditch in Trench XV (layers 4 and 15). 4 was highly humified peat, 15 a greyish-brown clay. Both included intrusive roots and following disaggregation of samples were not thought to be worth detailed examination.

Samples from a buried soil (1.1, 1.2) in Trench XXII included only low density scatters of small charcoal fragments.

Wood

The wood from the site was inspected by Richard Darrah, who found that most of it was Quercus (oak). This is unsurprising given the above evidence for proximity of oak-dominated woodland. Two other wooden items were submitted for identification.

Trench XIII.	2.5 2.	70cm diam. roundwood stem with bark Fraxinus sp. (ash).
Trench XVI	4.32. 6	30mm diam. roundwood stem with bark. Oblique chisel point at one end - 2 main facits, one minor. Corylus sp. (hazel).

Mollusca

Mollusca shells were extracted from all samples examined for plant macrofossils by wet-sieving the disaggregated sediment on a 0.5mm mesh. Most samples produced either no shells or only a few abraded scraps. This is probably due to preservational factors. As has been noted above, inclusions and laminations of white powder were frequent in the deposits. Aqueous suspensions of this powder were examined under transmitted light at high power and proved to consist of non-siliceous elongate and fibrous small crystals, thought to be gypsum. MacFadyen (1970) suggests that gypsum formation in fenland clays resulted from oxidation of pyrite to give sulphur acids which reacted with calcium carbonate. Mollusc shells, ostracods etc., would have formed the main $CaCO_3$ source. However, two samples did produce interpretable assemblages (Table 3).

The sample from 9.5 (Trench A) produced an assemblage of freshwater snails dominated by the 'freshwater slum' snail Anisus leucostoma, tolerant of periodic desiccation and wide temperature fluctuations (O'Connor 1988). This is consistent with the plant macrofossil evidence, indicating tranquil freshwater conditions. The assemblage from 4.19 (Trench XVI) included abundant shells of the estuarine snail Hydrobia ventrosa with H. ulvae, some juveniles probably of the freshwater species Lymnaea peregra and individual shells of the freshwater Armiger crista and terrestrial Vallonia sp. This again fits with the plant macrofossil evidence for phases of both fresh- and brackish-water deposition in this layer.

Other animal macrofossils

Notes on the distributions of foraminifers, insects, cladocerans, ostracods and fish bones are given in Table 3. Detailed work on the first two groups may well be profitable in defining more closely salinity and current velocity and providing additional information on local terrestrial and freshwater habitats.

	9.5	4.19
Hydrobia ventrosa (Montagu)	-	95
Hydrobia ulvae (Pennant)	-	2
Succinea sp	1	-
Aplexa hypnorum (Linné)	1	-
Lymnaea truncatula (Müller)	4	-
Lymnaea cf. peregra (Müller)	11	13
Lymnaea sp(p)	24	-
Anisus leucostoma (Millet)	102	-
Armiger crista (Linné)	27	1
Vallonia sp	-	1
Ostracods	+	+
Cladoceran ephippia	+	-
Fly puparia	+	-
Beetles	+	-
Small fishbones inc. stickleback spine	+	-
Sample wt (kg)	0.5	0.5 : 25% sorted

Table 3 : Animal macrofossils from Trench A 9.5 and Trench XVI 4.19

Notes on other samples: Trench A

Mollusca were rare in 9.6 (1 Anisus sp; 1 Punctum pygmaeum; 1 indet) and 9.0 and 9.1 produced only rare shell fragments. Fly puparia, beetles and cladocerans present in all four samples. 9.0 included foraminifera. 9.6 contained fishbones.

Trenches XIII-XVI; All samples included beetles and Trench XV 24 fly puparia. Cladocerans were present in 2.5, ostracods in 2.5, 5.1. Mollusc fragments came from 2.5 and 5.1 (including an abraded ? hydrobiid apex) Fishbones occurred in 5.1 and 24 (including a stickleback spine).

Conclusions

The lowest fills in Trenches A and XIII produced plant macrofossil assemblages clearly indicating standing water in the ditches and dense oak woodland in the vicinity. At first sight this might seem to indicate that these deposits formed when the site was abandoned, but the references by Caesar to fortifications in dense woodland in south-east England show that this need not necessarily have been the case (Trans. Handford 1951, 139). There is evidence from Trench A and XV for continued deposition of freshwater muds in the ditches, (above the basal fill), perhaps in more open conditions. Deposition of the human remains seems to have been associated with these freshwater deposits. Overlying the human bones in Trench A were deposits with plant macrofossils indicating a phase or phases of brackish-water flooding, and similar brackish-water conditions were indicated by plant remains and molluscs from 4.19 in Trench XVI. In this trench a later woody deposit indicated a subsequent reversion to freshwater deposition.

The dumping of human bodies in the ditches, followed abruptly by brackish-water flooding leads to speculation that the two events were related. It is thought that Stonea may have been the site of a battle during a rebellion by the Iceni in AD 47 (Paterson 1992). Clearly a Roman detachment would have been capable of breaching the levees of the nearby roddon channel, or diverting its course, so as to flood the site with brackish water and make it unusable.

Whatever the specific interpretation of these ditch fills it is clear that prior to the beginning of the present management plan their organic components were degrading due to de-watering. The deposits in Trench A, particularly, were only slightly moist and intrusive root penetration had begun. It is hoped that the proposed management of water tables in the southern area of the site will reverse or arrest this trend, for the deposits are significant and should be protected to permit more detailed study in future than has been possible now.

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Context	9.6	9.5	9.0	9.1
Charophyta (oogonia)	–	–	+(d)	–
Ranunculus acris/repens/bulbosus	–	–	–	1
Ranunculus sceleratus L (e)	7	11	141	160
Ranunculus subg. Batrachium	–	1	2	8
Moehringia trinervia (L) Clairv	1	1	–	–
Caryophyllaceae indet	–	–	–	1
Chenopodium album L	2	–	–	–
Atriplex patula/hastata	21	2	16	14
Suaeda maritima (L) Dumort	–	–	1	2
Salicornia sp	–	–	5	2
Chenopodiaceae indet	3	2	–	3
Rubus fruticosus agg (e)	26	62	66	69
Rubus-type (thorns)	+	–	–	–
Prunus spinosa L	2	5	–	1
Crataegus monogyna Jacq.	1cf	1cf	–	–
Myriophyllum sp	–	–	1	–
Hydrocotyle vulgaris L	–	4	39	17
cf. Torilis sp (frags)	+	+	–	–
cf. Apium sp	–	–	3	–
Oenanthe aquatica (L) Poiret	5	46	–	6
Oenanthe sp	–	–	6	–
Umbelliferae indet	–	–	–	5
Rumex sp	1	–	1	1
Polygonum sp	–	3	–	–
Polygonaceae indet	–	–	1	–
Urtica dioica L	–	–	5	3
Corylus avellana L	frags	–	–	–
Quercus sp (imm. cupules) (leaf frags) (leaf galls)	5+fr + –	1+fr + –	– – –	– + +
Glaux maritima L	–	–	21	7
Menyanthes trifoliata L (e)	–	2	11	7
Solanum dulcamara L	18	2	1	–
Mentha sp	3	1	9	3
Lycopus europaeus L	–	19	8	9
Plantago major L	–	–	1	–
Sambucus nigra L	3	3	–	–

Eupatorium cannabinum L	7	4	3	-
Cirsium/Carduus sp	9	-	-	3
Lapsana communis L	37	-	-	-
Sonchus asper (L) Hill	7	-	-	-
Compositae indet	-	1	-	1
Alismataceae indet	-	1	16	5
Triglochin maritima L	-	-	19	16
Potamogeton sp (a)	1	6	19	23
Potamogeton sp (b)	-	-	11	8
Ruppia sp	-	-	1	-
Zannichellia palustris L	-	-	2	3
Juncus spp (c)	-	-	+++(d)	+++(d)
Lemna sp(p)	35	325	12	9
Typha sp	-	-	+(d)	-
Eleocharis palustris/uniglumis	-	-	1	1
Scirpus maritimus L	-	-	-	3
Scirpus/Schoenoplectus sp	-	1	6	13
Cladium mariscus (L) Pohl.	-	2	11	7
Carex echinata-type	14	-	-	-
Carex sp	-	5	-	4
Gramineae indet	1	-	3	6
Indet seeds etc	10	9	12	16
Mosses	-	-	-	+
Twigs	+++	++	+	+
Thorns	-	-	+	-
Buds/budscales	++	+	+	+
Charcoal	-	-	-	+
Monocot stem frags	+	+	+	+
Sample wt (kg)	0.5	0.5	0.5	0.5
% sample sorted	100	100	c50	100

Table 1 : Plant macrofossils from Ditch 5, Trench A.
Taxa are represented by fruits or seeds except where indicated. Notes : (a)- c 3mm, no appendages surviving; (b) 1.4-1.6mm (c) includes Juncus gerardii. (d) Counts given refer to propagules > 0.5mm only. These taxa in finer fraction largely or exclusively. (e) Counts partly estimated from fragments.

Trench	XIII	XIV	XV	XVI	XVI
Context	2.5	5.1	24	4.17	4.19
Charophyta (oogonia)	–	–	9	–	1
Ranunculus sp	–	–	–	2	3
Ranunculus sceleratus L (c)	–	11	7	1	1
Ranunculus subg. Batrachium (c)	6	2	109	97	28
Papaver argemone L	–	–	–	1	–
cf. Viola sp	–	frag	–	–	–
Cerastium sp	–	–	–	–	1
Stellaria media-type	–	–	–	1	–
Moehringia trinvervia (L) Clairv.	3	1	–	–	–
Chenopodium ficifolium Sm	–	–	–	–	1
Atriplex patula/hastata	–	2	–	–	4
Acer campestre L	2	–	–	–	–
Rubus fruticosus agg (c)	–	1	8	25	9
Prunus spinosa L	–	–	–	1	frag
Prunus/Crataegus-type (thorns)	+	–	–	–	–
Myriophyllum sp	–	–	1	13	7
Hydrocotyle vulgaris L	–	–	1	–	–
Torilis japonica (Houtt) DC	1	–	–	–	–
Oenanthe aquatica (L) Poiret	–	–	–	6	–
Umbelliferae indet	2	–	–	–	1
Rumex sp	4	–	–	1	1
Urtica dioica L	1	1	1	–	1
Alnus glutinosa (L) Gaertner ('cones') (fruits)	– –	– –	– –	4 2cf	– 3
Quercus sp (cupules) (leaf frags) (leaf galls)	1 +++ –	– + –	– + +	– – –	– – –
Glaux maritima L	–	1	–	–	–
Menyanthes trifoliata L	–	–	–	1	–
Mentha sp	–	2	1	7	5
Lycopus europaeus L	–	2	–	–	1
cf. Stachys sp	–	frag	–	–	–
Sambucus nigra L	–	–	–	1	–
Cirsium/Carduus sp	–	–	–	–	1
Sonchus asper (L) Hill	–	–	–	–	1
Sonchus sp	1	–	–	–	–
Compositae indet	–	1	–	–	–

cf.Sagittaria sagittifolia L	-	-	1	-	-
Alismataceae indet	-	2	3	5	3
Triglochin maritima L	-	-	-	1	2
Potamogeton sp (a)	-	3	28	60	50
Potamogeton sp (b)	-	-	2	15	6
Ruppia sp	-	-	-	-	3
Zannichellia palustris L	-	-	4	-	1
Juncus spp	-	-	-	-	+
Lemna sp	-	-	8	-	-
Sparganium sp	-	-	-	1	4
Eleocharis palustris/uniglumis	-	-	-	3	3
Scirpus maritimus L	-	-	-	-	9
Schoenoplectus cf. lacustris (L) Palla	-	-	-	18	-
Scirpus/Schoenoplectus sp	-	4cf	7	-	53
Cladium mariscus (L) Pohl	-	3	1	-	9
Carex spp	1	4	1cf	6	5
Gramineae indet	-	3	7	-	-
Indet seeds etc	3	4	5	13	9
Mosses	+	-	-	-	-
Twigs/wood	+++	+	+	+++	+
Water-worn wood frags	-	-	-	-	+
Buds/budscales	++	+	+	++	-
Charcoal	+	+	-	-	-
Monocot stem frags	-	-	-	+	+
Rhizome frags	-	-	-	-	+
Sample wt (kg)	0.5	1.0	0.5	0.5	0.5
% sample sorted	100	100	100	25	25

Table 2 : Plant macrofossils from Trenches XIII-XVI
Notes as for Table 1, except (a) Large fruitstones including at least some P. pectinatus L in 4.19 (b) Small fruitstones; (c) Counts partly estimated from fragments.