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Ancient Monuments Laboratory
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PAKENHAM, SUFFOLK (PKM 027): ENVIRONMENTAL AND ECONOMIC STUDIES.

Dr P Murphy & P E J Wiltshire

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Summary

This report presents results from the study of carbonised plant remains from excavated features of late neolithic, Iron Age and Roman date and from sedimentary stratigraphy, pollen and macrofossil analysis at the adjacent infilled lake basin of Micklemere. A long-term reconstruction of environmental and economic change is presented, together with a more detailed discussion of Roman crop production and processing.

A late neolithic feature produced some carbonised Corylus nutshells. The local landscape from the Iron Age onwards was predominantly open grassland, and the sediments and pollen indicate two main phases of arable farming: in the Roman period and again from AD660, with a hiatus between. The Roman carbonised plant remains relate mainly to large-scale disposal by burning of cereal chaff (mostly Triticum spelta), weed seeds and straw. High frequencies of grassland taxa in some samples may indicate burning of waste animal fodder. Other crops included flax, pulses, fruits and nuts. Reports on marine mollusc shells and avian eggshell are also included.

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Pakenham, Suffolk (PKM 027): Environment and agrarian economy

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1. Introduction

The investigations undertaken at Pakenham between 1983 and 1985 in advance of road construction were in two phases. During 1983 trenches were dug into the colluvial deposits, peats and lake sediments at the margins of Micklemere. From the characteristics of the deposits and from the macro- and micro-fossils which they contained it has proved possible to reconstruct local environmental conditions from the pre-Roman period through to Saxon times, and to assess variations in the intensity of arable farming in the area. During 1984-5, when the main phase of excavation was underway, samples were collected from prehistoric and Roman contexts, primarily for the retrieval of carbonised and mineralised plant macrofossils. These have provided further, more detailed, information on the arable economy and environment of the site. In this report results from the two areas investigated are presented, and in a final section the results are integrated and discussed.

2. Investigations at the margins of Micklemere (1983)

a) Colluvial deposits in the excavated area

Towards the eastern end of the trenches excavated in August 1983 (see Fig. for location) the following section was exposed:

0-80cm	Thin modern topsoil over dumped layer of chalk, flint and brick rubble. Sharp boundary.
80-180cm	Brown to dark greyish brown (10YR 4/2-4/3) sand merging down into moist very dark greyish-brown. (10YR 3/2-3/3) sand near base with common large distinct brown and reddish brown mottles throughout; structureless (massive); friable; stony, with gravel to large subangular flints; rare marine mollusc shell fragments near base; rare fine fibrous roots near top; sharp, even boundary.
180cm+	Moist greyish-brown (10YR 5/2) sand with common large distinct brown and reddish-brown mottles; structureless; friable; extremely stony with gravel to large subangular flints.

Essentially similar deposits were present elsewhere on the site, thinning towards the west. At the western end the dark sand included very large flint nodules visible in the western section as a single 'string'. Drainage was better in this part of the site and iron in the subjacent sands was in an oxidised state.

Gleying, with redistribution of iron and humus, has obliterated the distinction between the original Roman soil profile and the deposits which overlie it, but Roman pottery was present at the base of the dark sand. From the unsorted character of this deposit and its position at the foot of a moderate slope it is clearly colluvial and is probably related to tillage further upslope.

b) Sediments and plant macrofossils

In October 1982 a machine trench was dug northwards for just over 8m in the direction of Nicklemere from the edge of the terrace-like feature produced by modern dumping (Fig. for location). The edges of this trench were unstable and its floor rapidly filled with water. In these circumstances prolonged field examination of the sections was inadvisable, and a monolith was therefore removed from the lower part of the section for description in the laboratory using a metal channel. The section in the southern part of the trench was as follows:

0-73cm	Thin modern topsoil over dumped layers of gravel, brick rubble and chalk. Sharp boundary.
73-144cm	Brown to dark greyish brown sand merging down into wet very dark grey (10YR 3/1) sand at base; common distinct large brown and reddish-brown mottles in upper part; structureless (massive); friable; stony, with gravel to large subangular and rounded flints; some fibrous and fleshy roots; very sharp, slightly undulating boundary.
144-164cm	Dark greyish-brown (10YR 4/2 to 5/2) mud (silt loam) with occasional sandy laminations; structureless; generally stoneless but with occasional gravel to medium rounded flints; some fleshy roots; mollusc shells locally abundant; fairly sharp even boundary.
164-192cm	Very dark reddish-brown fibrous peat; abundant monocotyledonous plant remains (leaves, stems, roots, rhizomes); fairly sharp even boundary.
192-203cm	Very dark reddish-brown fibrous peat; slightly sandy; rare flint chips and small pebbles; rare charcoal fragments; merging even boundary.
203-214cm	Sandy dark reddish-brown peat; slightly stony with flint chips and small pebbles and fired clay fragments up to 3cm; charcoal, bone fragments; fairly sharp, even boundary.
214-250cm+	Very dark reddish-brown fibrous peat with some roots and rhizomes. At 221cm small patch of shelly mud.

The section in the central part of the trench was disturbed by a gravel-and-peat-filled ditch, assumed to be modern. Beyond this the mud deposit could be followed northwards as a continuous layer, becoming less shelly and more organic.

In addition to the monolith from the lower part of the section, several bulk samples were taken from the uppermost sediments for macrofossil analysis and a peat sample was taken for C14 dating at 164-169cm. A date of 1290+100 b.p. or ad690 (HAR-5956) was obtained.

Laboratory Methods

Samples taken from the section during excavation and others subsequently obtained by sub-dividing the monolith were

examined after removing the small sub-samples at approximately 5cm intervals for pollen analysis. Part of each sample was used to estimate % dry weight (drying at 100°C for 24 hours) and % loss on ignition (ashing at 500°C for 4 hours in a muffle furnace). The results are shown in Fig. 2. These give a useful measure of the organic content of the deposits. Macrofossils were extracted from 0.5kg samples from the upper part of the section, though the sediment samples taken from the monolith were smaller. The extraction method was that of Kenward et al (1980, 8). Identifications of plant macrofossils and molluscs, with notes on the distribution of ostracods, insect remains and bone are given in Tables 1 and 2. The macro-botanical remains were generally well preserved, though specific identification of the less readily identifiable taxa (eg. Carex spp, Gramineae) has not been attempted unless this was thought to be of particular palaeoecological significance.

Discussion (sediments and macrofossils)

The section described is at the extreme southern margin of Micklemere, and for two main reasons does not include the full sequence of sediments filling the mere. Firstly it was not possible to see the base of the Flandrian sediments at this point and secondly it is very likely that the sedimentary sequence at the lake margin is condensed. Consequently any sequence of events inferred from this section will be incomplete. Nevertheless these marginal deposits are particularly interesting from an archaeological point of view, for it is here that evidence for human activity is most apparent.

There are two main phases of peat formation, separated by less organic deposits. The lowest peat sampled, between 214-227cm is a terrestrial peat formed mainly from the remains of small sedges, other Cyperaceae including Eleocharis sp. (spike-rush) and other monocotyledonous plants. The most abundant identifiable macrofossils are fruits and seeds of Ranunculus spp. (buttercups and crowfoots), Rorippa nasturtium-aquaticum (water-cress), Lychnis flos-cuculi, (ragged robin), Apium nodiflorum (fool's water-cress), Mentha arvensis/aquatica (water mint?), Urtica dioica (nettles), Juncus spp. (rushes), Carex spp. (sedges) and Eleocharis sp. (spike-rush). This mixture of grassland, wetland and aquatic plants appears to indicate a local environment of mixed sedge fen and wet grassland subject to periodic flooding. Flooding is also indicated by thin impersistent patches of mud with rare shells of Valvata sp.

The organic deposits above this peat, from about 192-214cm are much more sandy (% loss on ignition only 14% at 212cm compared to 50% at 225cm). Charcoal and burnt bone fragments are common, and the sample from 203-214cm produced a tiny chip of glass. Clearly these deposits represent movement of soil onto the peat surface as a consequence of human activity in the vicinity. This might have resulted from trampling by cattle, ploughing or simply soil

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ranunculus acris [illegible]-type	[illegible]	-	-	[illegible]	[illegible]	[illegible]	-	-	-	-	[illegible]
Ranunculus flammula L.	-	-	[illegible]	[illegible]	15	6	-	-	-	[illegible]	[illegible]
Ranunculus sceleratus L.	[illegible]	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ranunculus subg. Batrachium	-	-	3	-	-	-	-	-	[illegible]	[illegible]	3
cf. Nymphaeaceae (fragment)	-	-	-	-	-	-	-	-	-	-	-
Papaver argemone L.	-	-	-	-	-	-	-	-	-	3	3
Raphanus raphanistrum L. (siliqua frags)	-	-	+	-	-	-	-	-	-	+	-
Rorippa nasturtium-aquaticum (L.) Hayek.	1	-	-	-	-	-	-	-	-	-	52
Rorippa cf. microphylla (Boenn.) Hyl.	-	-	-	-	-	-	1	-	-	-	-
Rorippa sp.	-	-	-	-	-	-	-	-	-	1	-
Hypericum sp.	-	-	1	-	-	6	-	-	-	-	2
Lychnis flos-cuculi L.	2	-	2	-	2	-	1	-	-	-	19
cf. Agrostemma githago (testa frags)	-	-	-	-	-	-	-	-	-	+	-
Stellaria media-type	-	-	-	-	-	-	-	-	-	3	-
Stellaria sp.	3	1	5	2	3	2	1	-	-	-	-
Caryophyllaceae indet.	-	-	-	-	-	-	-	-	-	-	2
Montia fontana L.	-	-	-	-	-	-	-	-	-	-	2
Chenopodium cf. polyspermum L.	-	-	-	-	-	-	-	-	2	-	-
Chenopodium album L.	-	2	3	5	-	-	-	-	3	2	-
Chenopodium sp.	-	-	-	-	1	-	-	-	-	-	2
Atriplex patula/hastata	2	-	2	2	1	-	-	-	7	5	-
Chenopodiaceae indet.	-	-	-	3	-	-	-	-	1	4	-
Malva sp.	-	-	-	-	1	-	-	-	-	-	-
Trifolium sp. (carbonised seed)	-	-	-	-	-	-	-	-	-	1	-
Filipendula ulmaria (L) Maxim.	3	-	-	-	-	-	-	-	-	1 frag.	-
Rubus fruticosus agg.	-	-	-	-	-	-	-	-	-	-	1
Potentilla sp.	-	-	-	-	-	4	-	5	1	3	6
Aphanes arvensis/microcarpa	-	-	1	1	-	1	-	-	-	-	1
Epilobium sp.	1	2	5	2	1	-	-	-	-	-	-
cf. Hippurus vulgaris L.	-	1	3	-	-	-	-	-	-	-	-
Hydrocotyle vulgaris L.	-	-	-	1	-	-	-	-	1	1	1
Torilis sp.	-	-	-	-	1	-	-	-	-	-	-
Apium nodiflorum (L) Lag.	183	2	18	-	-	-	5	2	7	3	170
Apium sp.	-	-	-	7	-	-	-	-	-	-	-
cf. Berula erecta (Hudson) Coville.	-	-	1	-	-	-	-	-	-	-	-
Oenanthe aquatica (L) Poiret.	16	8	19	35	-	-	-	-	-	-	-
Aethusa cynapium L.	-	-	-	-	-	-	-	-	1	-	-
Umbelliferae indet.	-	-	6	-	-	-	-	-	2	-	-
Polygonum aviculare agg.	1	-	-	-	-	2	-	-	-	-	-
Polygonum lapathifolium L.	-	-	-	-	-	-	-	-	-	1	-
Polygonum persicaria/lapathifolium	-	-	-	-	-	-	-	-	-	-	3
Polygonum sp.	-	1	2	1	1	-	-	1	-	-	-
Rumex acetosella agg.	-	-	-	-	-	-	-	-	-	4	2
Rumex spp. (nutlets)	8	-	28	25	-	-	4	18	7	9	3
Rumex spp. (perianths/lamellae)	-	1	5	+	-	-	-	-	-	-	-
Urtica urens L.	-	-	-	-	-	-	1	-	4	1	-
Urtica dioica L.	5	1	9	3	2	3	4	28	42	6	22
cf. Cannabis sativa L.	-	-	-	-	-	-	-	-	-	1 frag.	-
Salix sp. (capsules/valves)	13	6	15	-	-	-	-	-	-	-	-
Primulaceae indet.	-	1	-	-	-	-	-	-	-	-	-
Menyanthes trifoliata L.	3	-	5	6	3	2	-	-	-	-	-
Solanum nigrum L.	-	-	-	-	-	-	-	-	1	-	-
Euphrasia/Odontites sp.	-	-	-	-	-	-	-	-	-	4	-
Mentha arvensis/aquatica	-	-	-	5	13	33	23	63	14	2	24
cf. Mentha sp. (calyx)	-	-	1	-	-	-	-	-	-	-	-
Lycopus europaeus L.	-	-	-	-	-	2	14	1	-	-	1 frag.
Galeopsis tetrahit/speciosa	-	-	-	-	1	-	-	-	-	-	-
Teucrium sp.	-	-	-	-	-	-	-	1	-	-	-
Ajuga reptans L.	-	-	1	-	-	-	-	-	-	-	-
Plantago major L.	-	-	1	-	-	-	-	-	-	1	-
Alnus glutinosa (L) Gaertner.	1	1	1	1	-	-	-	-	-	-	-
Corylus avellana L. (nutshell frag)	-	-	-	-	+	-	-	-	-	-	-
Sambucus nigra L.	-	-	-	3	-	-	-	7	1	1	2
cf. Achillea millefolium L.	-	-	-	-	-	-	-	-	-	-	1
Cirsium sp.	-	-	3	-	-	-	-	-	-	1	2
Sonchus asper (L) Hill.	-	-	1	-	-	-	-	-	-	1	-
Taraxacum sp.	1	-	-	-	-	-	-	-	-	-	-
Compositae indet.	-	-	2	-	-	-	-	-	-	-	-
Alisma plantago-aquatica L.	-	1	1	-	-	-	-	-	-	-	-
Alismataceae (embryos)	-	-	-	1	-	-	-	-	-	-	-
Potamogeton sp.	1	-	4	2	-	-	-	-	-	-	-
Zannichellia palustris L.	1	-	-	-	-	-	-	-	-	-	-
Juncus spp.	+	-	-	-	+	+	+	+	+	+	+
Sparganium erectum L.	3	1	7	9	1	-	-	-	-	-	-
Sparganium sp.	-	-	-	6	-	+	-	-	-	-	-
Eleocharis sp.	-	-	-	3	2	5	6	-	14	30	14
Scirpus/Schoenoplectus	-	-	1	-	-	-	-	-	-	-	-
Carex spp.	-	-	6	4	3	7	3	1	12	15	21
Gramineae indet.	112	3	17	1	10	8	1	-	2	13	25
Phragmites australis (Cav)Steudel(culm/leaf)	-	+	-	+	+	+	-	-	-	-	-
Ficus carica L.	cf.1	-	-	1	-	-	-	-	-	-	-
Indeterminate seeds, etc.	13	2	18	15	12	4	10	4	16	18	27
Wood	+	-	+	+	+	-	-	-	-	-	-
Twigs	+	-	+	+	+	-	-	+	+	+	-
Charcoal	-	-	+	-	+	-	+	+	+	+	-
Thorns	-	-	+	+	-	-	-	-	-	-	-
Buds/budscales	-	-	+	+	-	-	-	-	-	-	-
Deciduous leaf fragments	+	+	+	-	-	-	-	-	-	-	-
Mosses	+	-	+	-	-	-	-	-	-	-	-
Ostracods	+	+	+	-	-	-	-	-	-	-	-
Insects	+	+	+	+	+	+	+	-	-	+	+
Caddis larval cases	+	+	+	+	+	+	+	-	-	-	-
Molluscs	+	-	-	+	+	+	-	-	-	-	+
Fishbones	-	-	+	+	-	-	-	-	-	-	-
Amphibian/small mammal bone	-	-	-	+	-	-	+	+	-	-	-
Bone fragments	-	-	-	-	-	-	+	+	+	+	-
Sample weight (kg)	0.50	0.50	0.50	0.50	0.50	0.50	0.20	0.20	0.37	0.37	0.42

Table 1 : Macrofossils.

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

Depth (cm)	144-149	154-159	159-164	164-169	214-227
Valvata piscinalis (Müller)	3	-	-	-	-
Valvata sp., apices	18	-	-	-	1
Bithynia cf. tentaculata (Linne), opercula	-	1	5	1	-
Planorbis sp	1	-	-	-	-
Succineidae, apex	1	-	-	-	-
Limacidae	-	-	2	1	-
Sphaeriidae, juvenile valves	15	-	-	-	-
Indeterminate, apices	3	-	-	-	-

Table 2 : Mollusca.

disturbance associated with settlement. Seeds of wetland plants, notably of Ranunculus sceleratus, Mentha arvensis/aquatica, Carex spp. and Eleocharis sp. are fairly abundant, but seeds of weeds are also present. These include Papaver argemone, Raphanus raphanistrum, possibly Agrostemma githago, Stellaria media, Chenopodium album, C. cf. polyspermum, Atriplex sp., Trifolium sp. (a carbonised seed), Aethusa cynapium, Rumex acetosella, Rumex sp., Urtica urens, U. dioica, Solanum nigrum, Plantago major, Cirsium sp. and Sonchus asper. The macrofossil assemblages as a whole indicate poorly-drained disturbed ground. The sample from 203-214cm produced an abraded fragmentary fruit possibly of Cannabis sativa (hemp).

The proximity of the Roman settlement, the presence of a chip of glass and the vertical relationship of these sandy organic layers to the C14-dated peat at 164-169cm leave little doubt that these layers are related to Roman activity.

These partly artifical deposits are overlain by further peats, between about 164-192cm, indicating re-establishment of relatively undisturbed wetland vegetation. The sand content of the deposits decreases fairly steadily from 202cm (25% loss on ignition) to 178cm (55% loss on ignition) and this is thought to indicate a reduced intensity of soil disturbance at the edges of the mere. Nevertheless charcoal fragments and occasional weed seeds are present in the peats between 164 and 192cm. Most macrofossils from these peats, however, are of wetland plants. Below 174cm the most abundant taxa are Ranunculus spp., Mentha arvensis/aquatica, Lycopus europaeus, Urtica dioica, and Rumex sp. with rare seeds of aquatics and other wetland/grassland plants. The peat between 164 and 174cm includes stem and leaf fragments of Phragmites australis (reed) and the most common seeds are of Ranunculus acris/repens, Ranunculus flammula, and Mentha arvensis/aquatica.

Organic lake mud with shells overlies these peats. There is a very sharp transition between the two types of sediment at 164cm: at 168cm % loss on ignition is 52.9%, but at 163cm the loss is reduced to 13.6%.

Macrofossils from the lake muds between 144-164cm provide a good picture of local vegetation during this phase. Submerged and emergent aquatic plants identified include Ranunculus subg. Batrachium, cf. Hippurus vulgaris, Rorippa nasturtium-aquaticum, Apium nodiflorum, Oenanthe aquatica, Alisma plantago-aquatica, Potamogeton sp., Zannichellia palustris and Sparganium erectum. Other aquatic organisms are represented by ostracod valves, caddis larval cases, fish vertebrae and shells of Valvata piscinalis, Valvata sp., Bithynia sp., Planorbis sp. and Sphaeriidae. Plants growing at the margins of the mere and in adjacent marsh included Ranunculus flammula, R. sceleratus, Hypericum sp., Lychnis flos-cuculi, Filipendula ulmaria, Epilobium sp., Hydrocotyle vulgaris, Berula erecta, Urtica dioica, Menyanthes trifoliata, Mentha sp., Ajuga reptans, Eleocharis

sp., Scirpus/Schoenoplectus, Carex spp. and Phragmites australis. Macrofossils of Alnus glutinosa and Salix sp. are probably derived from waterside trees. There are, in addition, some remains of weeds (Raphanus raphanistrum, Chenopodium album, Atriplex patula/hastata, Aphanes arvensis/microcarpa, Polygonum aviculare, Rumex sp., Plantago major, Cirsium sp., Sonchus asper, Taraxacum sp.) and charcoal fragments.

The relatively rapid transition from peat formation to the deposition of organic lake mud indicates a rise in lake levels and an increase in the quantities of fine mineral sediment transported to the lake basin. This must be related to a major change in drainage within the catchment of the mere. The C14 date of 1290 ± 100 b.p. or ad600 (HAR-5936) from peat just beneath the lake mud at 164-169cm provides a terminus post quem for this event. Pollen analysis (see below) indicates that this change in sedimentation is related to a renewed phase of arable farming.

The uppermost deposit, overlying the lake mud is an unsorted stoney sand. This, and similar deposits elsewhere on the site, are thought to be of colluvial origin related to tillage further upslope (see above). These deposits must be of Saxon or later date.

In summary the sequence of habitat change indicated by this section is as follows:

1. Peat formation under mixed sedge fen and wet grassland.
2. Human activity in the vicinity, with associated soil disturbance. Soil movement onto wetlands at the margins of the mere. Almost certainly associated with the Roman settlement.
3. Lessening of soil disturbance. Renewed peat formation.
4. Deposition of organic lake mud from ad660. Higher lake levels. Related to renewed agricultural activity.
5. Spread of colluvial deposits over the edges of the mere.

The land around the mere would clearly have remained a favoured area for settlement and farming at all periods, and indeed the presence of charcoal, weed seeds or crop plant remains in most samples implies continued settlement in the vicinity. However, on the present evidence the two main phases of activity appear to have been in the Roman period and again from the 7th century A.D. onwards, with an apparent reduction of soil disturbance in the intervening period.

c) Microscopic examination of sediments by Patricia E. Wiltshire

Introduction

Thirteen individual samples (at approximately 5.0cm intervals were taken by Peter Murphy from the monolith for pollen analysis, from 143cm to 225cm, each major horizon

Table 3

				PAKENHAM - SUFFOLK - PKM/027								
						PALYNOLOGY						
Depth (cm)	143	145	155	163	168	178	190	195	202	205	212	216	225
TREES & SHRUBS													
Alnus		2				1		1			1	4	4
Betula			1					1			1		
Pinus		1				1							2
Quercus		2		2	3	1			3		5		
Ulmus								1					
Corylus			1						4	2			
Salix		3	1	1	1			1	1		1	3	1
DWARF SHRUBS													
Calluna													3
AQUATICS													
Myriophyllum spicatum		1		1									
Typha angustifolium type		9		1				1					
HERBS													
Bidens type			1	1				2	1				
Capsella type												1	
Caryophyllaceae					1						1		
Chenopodiaceae			2				2						1
Cirsium										2			
Cyperaceae		1	1		1	5	5	1			1	1	6
Equisetum													1
Gramineae <40u	1	47	19	6	13	22	29	25	17	58	65	37	14
Gramineae 40-49u		1			1						5		
Gramineae 50-59u			3	1	1			1	1	1	6	1	
Gramineae 60-69u									1				
Gramineae >75u									1	3	5		
Lamium type				1									
Leguminosae							2			3	5	2	
Liguliflorae		1			1	4	1	1	4	4	6	3	4
Papaver												1	
Plantago lanceolata		4	1	1			2	2	3	1	6	1	
Polygala											1		
Potentilla type		1										1	
Ranunculus										1		1	
Rumex acetosa		1											
Rumex undiff				1				1	1			4	
Sinapis type				1		1	2	1	2		2	1	1
c.f. Spergularia									1				
Succisa													1
Trifolium type										3	1	1	
Urtica type		2	1										
Umbelliferae		6	3			1	1				6		1
Umbelliferae												31	2
(c.f. Berula erecta)													
Total Pollen Count	**1**	**82**	**34**	**17**	**22**	**36**	**44**	**39**	**40**	**78**	**118**	**93**	**41**
FUNGI	2	3	2	3	3	2	1	1	3	4	3	2	1
CHARCOAL													
Angular	1	3	1	1	1	2	2	2	3	4	3	2	1
Spherical		3	1	1									+
+ = Present													
1 = Frequent													
2 = Abundant													
3 = Very Abundant													

1+ = Exceedingly abundant.

being represented in the sampling.

It is unfortunate that the samples deteriorated during storage and, on examination, it was found that the sediments had developed a heavy growth of Actinomycetes. These bacteria are known to decompose pollen preferentially, but it was decided to proceed with the analysis since decomposition would, presumably, be relatively uniform; there is no evidence that Actinomycetes attack some pollen types in preference to others. However, it must be stressed that interpretation of such sparse data must be viewed with caution.

Methods

Each sample was ground with a rubber pestle and mortar and the matrix removed by standard techniques (acetolysis and hydrofluoric acid extraction). The concentrated remains were stained with safranin and mounted in glycerol jelly. Two slides were made for every sample and the total area of each slide was scanned for pollen, microbial remains and charcoal. All pollen and spores were counted and fungi and charcoal were given a score according to their abundance (see Table 3).

The pollen counts were too low for construction of a pollen diagram. However, the relationship between plant taxa (both pollen and macrofossils) and organic content of the sediments have been presented in graphic form.

Figure 1 is a plot of a simple species richness index (SR1) for both pollen and macrofossils:

$$SR1 = \frac{\text{No of taxa in a sample}}{\text{Total Taxa}} \times 100$$

Figure 2 shows the relationship between cereal pollen and organic content of the sediment. Organic content was determined by loss on ignition, and cereals were expressed as a percentage of Gramineae.

Figure 3 shows the relationship between cereal and Plantago lanceolata pollen. Both pollen types were expressed as a percentage of Gramineae.

The macrofossil and loss on ignition data were provided by Peter Murphy.

Results

The results are shown in Table 3. The pollen was very sparse, much was unidentifiable and only those grains that could be identified with confidence were recorded. However, meaningful patterns of distribution of some taxa, the analysis of the relationship of cereal and Plantago lanceolata pollen, species richness, and organic content of the sediments has enabled the recognition of two phases of human activity in the area.

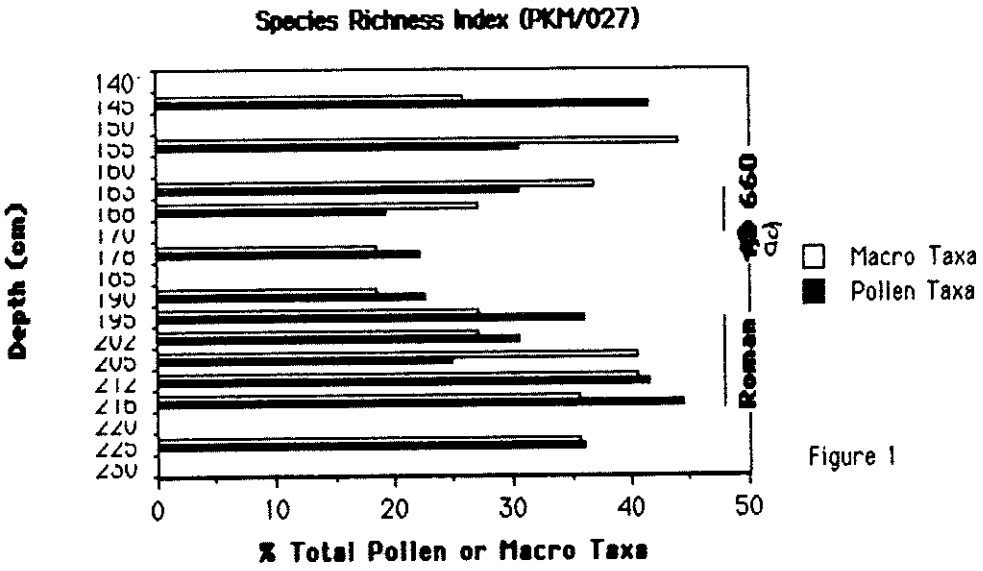

Species Richness Index (PKM/027)
Depth (cm)
140
145
150
155
160
165
170
175
180
185
190
195
200
205
210
215
220
225
230
0
10
20
30
40
50
% Total Pollen or Macro Taxa
660 a.d.
Roman
Macro Taxa
Pollen Taxa

Figure 1

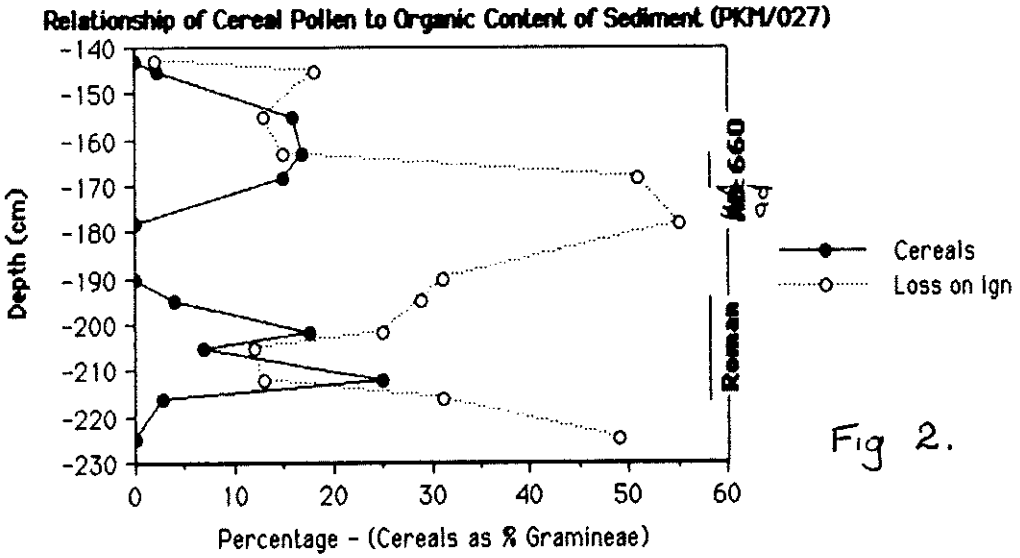

Relationship of Cereal Pollen to Organic Content of Sediment (PKM/027)
Depth (cm)
-140
-150
-160
-170
-180
-190
-200
-210
-220
-230
0
10
20
30
40
50
60
Percentage - (Cereals as % Gramineae)
660 ad
Roman
Cereals
Loss on Ign

Fig 2.

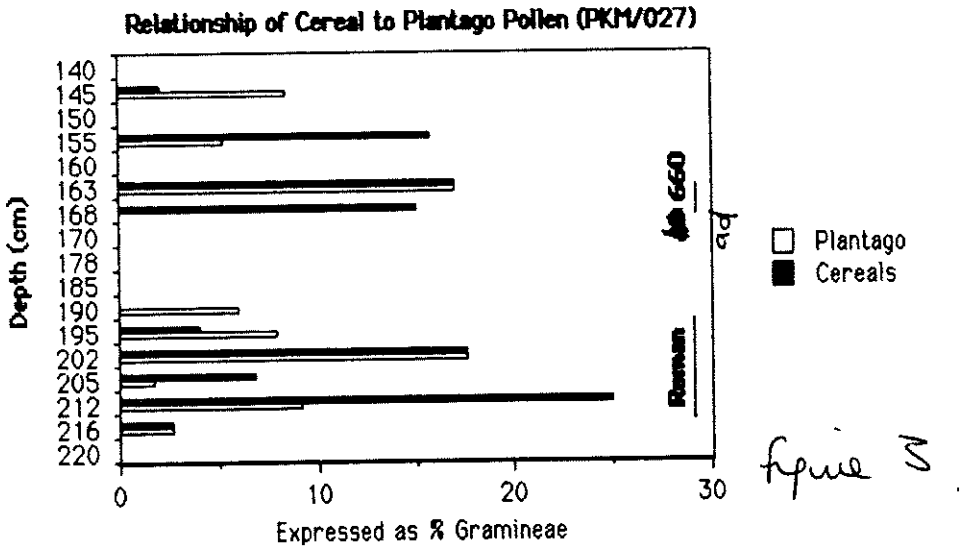

Relationship of Cereal to Plantago Pollen (PKM/027)
Depth (cm)
140
145
150
155
160
163
168
170
178
185
190
195
202
205
212
216
220
0
10
20
30
Expressed as % Gramineae
660
Plantago
Cereals

figure 3

Two periods of raised water table (at the beginning and the end of the sedimentary sequence analysed) were also indicated from the stratigraphy, and certain plant taxa. Black spherules in the pollen preparations were also thought to be indicative of a high water table: the exact nature of these is uncertain but they are invariably associated with palynomorphs indicative of standing water.

Microscopic charcoal was found in every sample so that the area was occupied to some extent throughout the period represented by the sediments, but both the charcoal and the fungal remains were markedly more abundant during the two major phases of human settlement.

Discussion

Throughout the period of history represented by the sediments analysed, the area was open and largely treeless. Pine, oak, elm, birch and hazel were growing in the vicinity but were probably represented by a few scattered trees. Alder and willow were growing at the water's edge but the paucity of alder pollen suggests that it was present in very low density. There is no evidence for dramatic woodland clearance at any point in the sequence, but alder does seem to have been a little more abundant before the first phase of human settlement.

The microfossil assemblage at 225cm indicates that the immediate environs of the edge of Micklemere had a vegetation dominated by weedy grassland. The relatively high level of Cyperaceae, the presence of cf Berula erecta, and the occurence of carbonaceous spherules indicate that the water table was high. These findings agree with those from the macrofossil and mollusc evidence obtained by Murphy who recognised periodic flooding at the base of the sequence. There were areas of both acid heath and flushed soils in the vicinity, evidenced by Calluna, Pinus and Succisa respectively, whilst the Alnus and Salix were probably growing at the water's edge.

At 216cm, Cyperaceae were less abundant and no carbonaceous spherules were found. This might indicate that the water table had dropped a little. The area was still dominated by weedy grassland with only alder and willow growing locally. Cereal pollen was recorded for the first time and the number of pollen taxa rose. When the taxa are inspected, it is fairly easy to envisage a fairly rich pasture with plantains (Plantago lanceolata), dandelions (Liguliflorae), buttercups (Ranunculus type), docks (Rumex) and clovers (Trifolium type), with sedges (Cyperaceae), lady's smock (Sinapis type), and narrow-leaved water parsnip (cf Berula erecta) growing at the water's edge in and amongst willow and alder. Open, disturbed soil might also be indicated by the poppy (Papaver).

A period of intense land use is indicated between 212 and 205cm. Figure 1 shows that there was a marked increase in species richness during this phase of activity which was

maintained up to 195cm. The pollen assemblage indicates a mixed pastoral and arable economy being practised, with both cereal pollen and pollen of the weedy pasture in evidence. Figure 2 shows that the agricultural activity (indicated by the cereal curve) behaves in a more-or-less reciprocal fashion to the organic content of the sediment. This is interpreted as mineral soil being washed into the peat due to the erosive effects of tillage and general soil disturbance. As the cereal pollen declined at the end of the settlement phase, so soil disturbance lessened and the organic content of the sediment increased.

It is interesting that high values for the fungal remains appear to be correlated with cereal pollen. The spores and hyphal fragments might have been derived from fungi associated with the crops and been disseminated by practices associated with crop husbandry. Indeed, many of the fungal spores resembled the two-celled teleutospores of Puccinia graminis. These spores are produced in increasing numbers from midsummer onwards as the cereal ripens, and they would certainly be dispersed by threshing and winnowing. The remains of conidial fungi were also abundant, as would be expected where crops are being grown.

It is also interesting that a pastoral economy might have continued after arable farming had been abandoned. Figure 3 shows the relationship between cereal and plantain pollen, the latter being an indicator of pasture. Plantains seem to have been less abundant during the maximum period of arable farming, but they increased and were in evidence after corn growing had ceased. It must be stressed, however, that it is possible that plantains were able to spread into old fields after abandonment. But there is no doubt that both grazing and cereal-growing were carried out during the settlement phase.

The samples at 190 and 178cm indicate that there was a cessation of mineral inwash into the growing peat. The Species Richness Index is low during this phase and cereals and weeds were absent or sparse. This seems to indicate that farming activity was abandoned in the area, and the lands surrounding Micklemere were relatively undisturbed; but charcoal shows that people were still active in the vicinity.

At 168cm, fungal remains and species richness increased. The surroundings became dominated by weedy pasture once again and cereal growing was started. The stratigraphy shows that conditions became very wet indeed, to the point where the level of the lake rose and flooded the surrounding area, resulting in a shelly lake mud being deposited over the peat. Aquatic plants such as lesser reedmace (Typha angustifolium type) and spiked water - milfoil (Myriopyllum spicatum) grew in the shallow water at the edge of the mere. Flooding is also indicated by the abundance of carbonaceous spherules i.e. water-borne charcoal.

Cereal growing continued up to a point represented by the

sediments at 145cm. Figure 2 shows again that this period of human settlement corresponds to an inwash of inorganic material into the sediment while Figure 3 shows a similar relationship of cereal and plantain pollen to that seen in the earlier settlement phase. It is possible, therefore, that renewed agricultural activity resulted in soil erosion and inwash as before. However, the lake levels must have risen quite considerably for such a depth of mud to accumulate, and this suggests either a very intensive land use to the extent that there was a marked change in local hydrology, or that there was a worsening in climate.

The sediments between 164-169 cm (just below the lake mud) have been radio-carbon dated to 1290+100 bp or ad660 (HAR-5936). Thus, the second phase of agriculture was Saxon which means that the earlier phase must have been Roman.

3. The excavations of 1984-5

a) Methods

It was not possible to apply a random sampling strategy at this site since, due to constraints of time and resources, not all features were excavated and those which were chosen for excavation were not selected on a random basis. However, an attempt was made to obtain samples from a wide range of context-types (pits, post-holes, ditches, layers, ovens etc.) and from all site phases. A standard sample of one bucket of soil, approximately twelve litres, was used; in some cases more than one sample was taken, but analysis of these duplicate samples proved to be unnecessary. The samples were processed in a bulk sieving/flotation tank (Kenward et al 1980) using 0.5mm meshes throughout. The non-floating residues were subsequently re-floated manually to complete extraction of carbonised plant material. Depending on the quantities of 'flot' collected, either the entire sample or a sub-sample was examined and sorted under a binocular microscope at low power, picking out all carbonised and mineralised plant remains, apart from charcoal. The non-floating residues were sorted without magnification, extracting bone, shell and large mineralised plant macrofossils. It is likely that small mineralised seeds which had not floated off were overlooked during the residue sorting, but it was not practicable to sort the large quantities of residue under the microscope: counts given for mineralised macrofossils therefore represent only minimum numbers of specimens. Specimens extracted were identified by comparison with modern reference material.

b) Results

Full lists of identified plant macrofossils from Roman contexts are given in microfiche (Tables 4-7), and the results are summarised in Table 9. Plant remains from prehistoric contexts are listed in Table 8. One of the most striking features of the samples from Roman contexts (Phases II-V) is the massive variation in the quantities of plant material between samples of the same phase: the sample from 4161 (Phase IV), for example, contained many thousands of cereal chaff fragments, whereas some other samples from phase IV included few or no cereal remains. In these circumstances calculations of mean 'seed' numbers or

	0271	4110	4114	4126
Cereal indet (caryopsis)	-	-	-	1
Triticum sp. (glume base)	-	-	1	-
Hordeum sp. (caryopsis)	-	-	1cf	-
Ranunculus acris/repens/bulbosus	-	-	14	-
Chenopodium album L.	-	-	1	-
cf. Medicago sp.	-	-	1	-
Rumex acetosella agg.	-	-	5	-
Polygonaceae indet.	-	-	1	-
Corylus avellana L.	+++	-	-	-
Calluna-type (floret and capsule)	-	-	1+1	-
Prunella vulgaris L.	-	-	3	-
Plantago lanceolata L.	-	-	22	-
Galium sp.	-	-	4	-
Hypochaeris sp. (fragment)	-	-	+	-
Carex spicata/divulsa-type	-	-	3	-
Carex spp.	-	-	1+1cf	-
Sieglingia decumbens (L) Bernh.	-	-	3	-
Gramineae indet.	-	-	2	-
Gramineae/cereal (culm node)	-	-	+	-
Charred ? moss fragments	-	-	+	-
Stem/rhizome fragments	-	-	+	-
Indeterminate seeds etc.	-	1	48	1

Table 8 : Carbonised plant remains from pre-Roman (Phase I) contexts

Contexts 0268 and 4120 produced no identifiable seeds etc.

mean 'seed' concentrations per unit volume of soil would be meaningless. The results are therefore summarised in Table 9 simply in terms of frequencies of taxa and plant elements.

c) Plant macrofossils from pre-Roman contexts (Phase I)

Samples were collected from two late neolithic pits (0268 and 0271). 0268 contained no identifiable seeds, but 0271 produced abundant fragments of charred hazel-nut shells (Corylus avellana).

Several iron age linear features (4110, 4114, 4120 and 4126) were sampled, but of these only 4114 contained an informative assemblage of material. The sample included a wheat glume base and a poorly-preserved grain (possibly of barley) but most seeds in this sample were of weeds and grassland plants, notably Ranunculus sp(p) (buttercup), Prunella vulgaris (self-heal), Hypochaeris sp (cat's ear) and Sieglingia decumbens (heath grass). A carbonised floret and capsule from the sample were tentatively identified as Calluna (heather).

d) Plant macrofossils from Roman contexts (Phases II-V)

i) Cereals

The two main genera of cereals in these samples are Triticum (wheats) and Hordeum (barley). The cereal grains are generally in a very poor state of preservation, both fragmentary and deformed. This is in part a result of the fact that many grains had germinated prior to carbonisation: a few retain attached plumules and primary roots, others show furrows where 'sprouts' were formerly present, and detached fragments of cereal plumule and primary root occur frequently.

For this reason even those grains determinable to genus are rarely identifiable specifically. The better-preserved wheat grains are mainly elongate forms of Triticum spelta type though some short-grained hexaploid types are also present at low frequencies. Fortunately the wheat spikelet fragments include a higher proportion of well-preserved specimens. These comprise isolated glume bases, spikelet forks, spikelet bases (forks with only the extreme basal portions of glumes surviving), rachis internodes and rachis nodes. They have been identified (where possible) using unpublished criteria defined by Mr G.C.Hillman. The vast majority of spikelet fragments are of Triticum spelta. The main characteristic features of this species used in identification are: presence of veins on the outer face of the rachis internode; glume bases wide and robust; primary keels prominent; angle of glume faces on either side of keel greater than 90°, secondary keel scarcely distinguishable from tertiary nerves; glume faces forming a smooth curve on either side of secondary 'keel'. There is also a small proportion of glumes and spikelet forks of emmer, Triticum dicoccum. The glume bases are in general slender with a well-defined primary keel on either side of which the glume faces meet at an acute angle. Subsidiary nerves are not well-developed and consequently the secondary keel is conspicuous, with the glume faces forming an obtuse angle on either side of it. Intact emmer spikelet forks show a wide angle

between the glume bases, viewed from the front. Glume bases and spikelet forks listed in Tables 4-7 as 'Triticum sp' were either fragmentary or damaged. The samples also include a few rachis nodes of wheat. 4006 contains a node with two intact internodes. These have veins on their outer surfaces but retain attached poorly-developed glume bases, and are thought to be non-fragmented spelt internodes from the base of an ear. The nodes from 0936 (Phase II), 0124, 0698 and 4012 (Phase III) are of free-threshing hexaploid type (cf. Jones 1978, Fig. 69, f) with no clear trace of the glume bases and with venated internode fragments.

Wheat awn fragments are preserved in a few samples, usually in the form of "silica skeletons". They show conspicuous small groups of barbs, irregularly distributed on their surfaces.

The barley grains also include a high proportion of poorly preserved specimens but there are some grains showing dorsal ridges and slightly angular cross-sections. Asymmetrical grains from lateral spikelets occur in a number of samples. The presence of six-row hulled barley, Hordeum vulgare, can thus be established. Barley rachis internodes are uncommon and usually fragmentary, though some of them show lateral glume bases diverging sharply from the rachis axis.

Elongate, slender grains tentatively identified as Secale cereale occurred in two contexts but the presence of this species at low frequencies is definitely established by rachis node and internode fragments from contexts 0698 and 4012 (Phase III) and 4161 (Phase IV). These consist of flat, slender internodes with some trace of marginal pubescence, with rather enlarged areas of the node below the glume inserts.

Grains and carbonised awn fragments of oats (Avena sp(p)) were found at low frequencies in samples of phases II-IV. The two floret bases from 0273 and 4063 are damaged, and do not clearly show the character of their articulation scars.

In summary, spelt (Triticum spelta) and six-row hulled barley (Hordeum vulgare) are the two main crops in all phases in these samples: the former is represented by abundant spikelet fragments and some grains; the latter by grains and rare rachis internodes. Emmer (Triticum dicoccum) occurs at lower frequencies in samples of phases II-IV; free threshing hexaploid wheat occurs as a trace in phases II-III; rye (Secale cereale) as a trace in phases II-IV and wild or cultivated oats (Avena sp.) as a trace in phases II-IV.

ii) Pulses

Isolated leguminous cotyledons of irregular hemispherical form, 4.3mm in length, from 4100, and a fragment of a similarly-sized cotyledon from 0694 are listed in Table 9 as Pisum-type. They could be from peas, but no trace of their hila survive. A damaged and deformed seed, c.6.0mm long, from 4044 is tentatively identified as Vicia faba var minor.

	II	III	IV	V
Triticum spp. (grains)	12	40	18	3
Hordeum vulgare (grains)	3	3	3	1
Hordeum sp. (grains)	4	29	7	1
Avena spp. (grains)	3	2	-	-
Secale cereale (grains)	-	(1)	(1)	-
Indeterminate cereal (grains)	16	57	31	5
Indeterminate cereal (plumule/primary root frags)	7	15	7	1
Triticum spelta (glume bases/spikelet forks)	14	47	30	2
Triticum diococcum (glume bases/spikelet forks)	1+(3)	6+(4)	5+(3)	-
Triticum spp. (glume bases/spikelet forks)	14	44	27	2
Triticum spp. (brittle rachis internodes)	5	28	17	-
Triticum spp. (rachis nodes)	2	2	-	-
Triticum spp. (awn fragments)	2	6	2	-
Hordeum sp(p) (rachis internodes/fragments)	2	5	2	-
Avena sp(p) (floret bases)	-	2	-	-
Avena sp(p) (awn fragments)	3	3	2	-
Secale cereale (rachis nodes)	-	2	1	-
Indeterminate cereal (rachis fragments)	-	1	1	-
Cereal/grass (culm nodes/frags/bases)	8	21	9	1
Vicia faba var minor (abraded seed)	-	-	(1)	-
Pisum-type (seeds/cotyledons)	-	1	1	-
Linum sp (seed)	-	-	1	-
Ficus carica (mineralised seeds)	-	1	1	-
Juglans regia (nutshell fragments)	-	1	-	-
Pteridium-type (pinnules)	1	1	1	-
Ranunculus acris/repens/bulbosus	1	1	-	1
Ranunculus sp.	-	3	-	-
Papaver cf. rhoeas L.	-	1	-	-
Papaver argemone L.	-	1	-	-
Papaver sp.	-	1	-	-
Brassica sp.	-	-	1+(1)	-
Raphanus raphanistrum L.	3	7	-	-
Thlaspi arvense L.	-	1	-	-
Cruciferae indet.	-	2	-	-
Silene sp.	1	5	-	-
Agrostemma githago L.	1	3	-	-
Stellaria media-type	1	4	-	-
Stellaria cf. graminea L.	2	1	1	-
Caryophyllaceae indet.	1	3	2	-
Montia fontana L. subsp. chondrosperma	2	3	-	-
Chenopodium album L.	6	17	5	-
Atriplex sp.	2	7	1	-
Chenopodiaceae indet.	5	16	7	-
Malva sp.	-	1	-	-
Medicago/Trifolium-type	6	12	5	1
Lathyrus nissolia L.	-	3	-	-
Vicia/Lathyrus spp.	3	11	7	1
Leguminosae indet.	1	4	1	1
Rubus fruticosus agg.	-	-	1	-
Prunus spinosa L.	-	1	1	-
Prunus sp. (frags and mineralised stones)	2	3	4	1
Malus sylvestris/domestica (mineralised)	-	-	2	-
Apium-type (mineralised)	-	1	-	-
Umbelliferae indet.	-	1	4	-

Rumex acetosella agg.	3	5+(2)	3	-
Rumex sp(p)	5	20	10	2
Polygonum aviculare agg.	3	2	2	-
Polygonum lapathifolium/persicaria	1	1	1	-
Polygonum convolvulus L.	6	12	7	-
Polygonum sp.	4	3	2	1
Polygonaceae indet.	-	3	-	-
Corylus avellana L. (nutshell fragments)	4	23	6	1
Calluna vulgaris (L) Hull (florets/capsules)	-	1	-	-
Primulaceae indet.	2	2	-	-
Lithospermum arvense	4	4	2	1
Euphrasia/Odontites sp.	-	-	1	-
Rhinanthus sp.	(1)	-	1+(1)	-
Prunella vulgaris L.	-	4	-	-
Plantago lanceolata L.	6	11	3	1
Galium aparine L.	4	7	2	-
Galium sp.	-	1	-	-
Sambucus nigra L.	(1)	-	1+(1)	-
Anthemis cotula L.	-	(1)	-	-
Tripleurospermum maritimum (L) Koch	2	5	4	-
Chrysanthemum segetum L.	-	1	-	-
Cirsium/Carduus sp.	-	-	1	-
Compositae indet.	4	1	2	-
Eleocharis sp(p)	4	13+(1)	5	-
Carex sp(p)	5	7	5	-
Cladium mariscus (L) Pohl	-	-	-	1
Cyperaceae indet.	1	-	-	-
Sieglingia decumbens (L) Bernh.	-	1+(1)	3+(1)	3
Anisantha sterilis (L) Nevski	-	-	1	-
Bromus mollis/secalinus	15	48	23	2
Arrhenatherum elatius var bulbosum (Willd) Spenn. (tuber)	-	1	-	-
Gramineae indet.	9	26	11	3
Total no of samples	16	66	44	7

Table 9 : Frequencies of taxa and plant elements in Roman samples, Phases II - V

Unless otherwise indicated taxa are represented by fruits or seeds. Tentative identifications in round brackets.

iii) Flax

The phase IV context 4162 produced a small seed of Linum sp., 2.8x1.3mm, and a second damaged seed also probably of this genus. Specific identification is not possible, but this could be an underdeveloped seed of a cultivated flax.

iv) Nuts and fruits

Fragments of carbonised hazel nutshell (Corylus avellana) are frequent: in phase III they were found in 36% of samples. Walnut (Juglans regia) is represented by a single fragment of carbonised endocarp with its characteristic grooved surface from the phase III context 0281.

Remains of edible fruits are also preserved in a carbonised form and these include a carbonised fruitstone of Rubus fruticosus and stones of Prunus spinosa (sloe). In addition mineralised seeds and fruitstones of Ficus carica (fig), Malus sylvestris/domestica (apple) and Prunus sp. are present. The specimens of Prunus consist of the mineralised internal tissues of the endocarp; they cannot be identified to species but are of P. spinosa/avium-size.

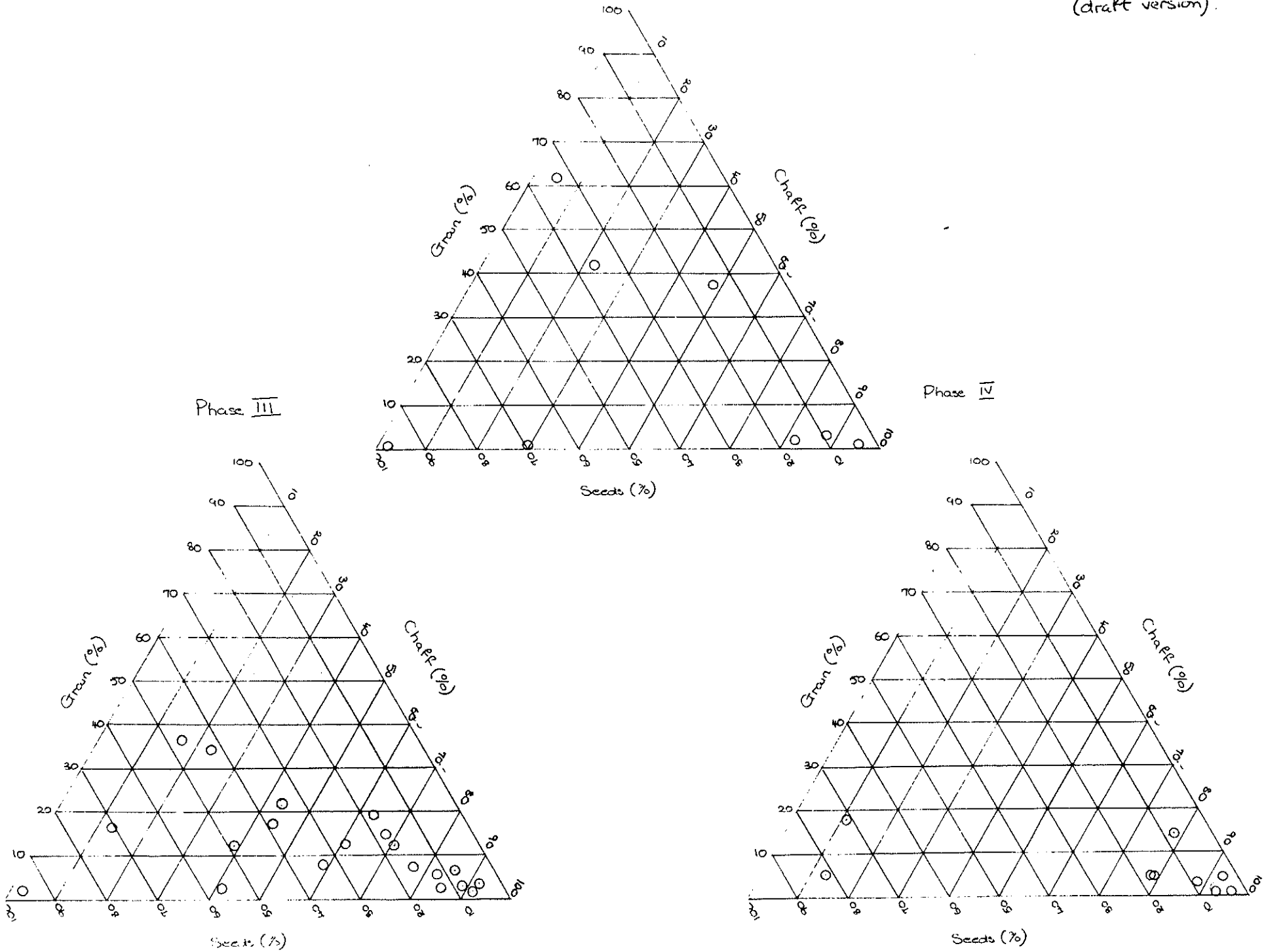
e) Seeds of the wild flora

The seeds of non-edible wild plants in these samples include a range of species characteristic of arable fields, grassland, wetlands and heaths. Some, perhaps most, of them are thought to represent plants originally growing in the arable fields, whilst others could have become mixed with crop cleaning waste after cereal processing. In particular there are grounds for thinking that cereal waste was intentionally mixed with hay as animal fodder and litter (see below). Distinguishing seeds derived from these different sources clearly presents problems. However, it is possible to sub-divide the taxa identified into several main ecotypes.

Characteristically annual and perennial arable weed taxa at this site include Papaver cf. rhoeas, Papaver argemone, Brassica sp., Raphanus raphanistrum, Thlaspi arvense, Silene sp., Agrostemma githago, Stellaria media-type, Chenopodium album, Atriplex sp, Malva sp., Vicia/Lathyrus spp., Rumex acetosella, Rumex spp., Polygonum aviculare, P.lapathifolium, P.convolvulus, Lithospermum arvense, Galium aparine, cf. Anthemis cotula, Tripleurospermum maritimum, Chrysanthemum segetum, Cirsium/Carduus, sp., Avena sp., Anisantha sterilis and Bromus sp(p). It is notable that weeds characteristic of acidic soils, often rather light and sandy, are fairly frequent in these samples. They include such species as Raphanus raphanistrum, Rumex acetosella and Chrysanthemum segetum. (Ellenberg 1988). Anthemis cotula, a weed particularly common on heavy clay soils in East Anglia (Petch and Swann 1968, 210) and confined to such soils elsewhere (Kay 1971) is represented by only a single tentatively-identified fruit. Apart from this, the arable weed flora includes both summer crop weeds (Chenopodiatea) and weeds of autumn-sown crops (Secalietea): (Ellenberg, ibid).

The grassland and wetland element in the flora comprises

fig 4.
(draft version).



Ranunculus acris/repens/bulbosus, Stellaria cf graminea, Montia fontana, small-seeded Leguminosae, Rhinanthus sp., Prunella vulgaris, Plantago lanceolata, Sieglingia decumbens, Eleocharis spp, Carex spp) and Cladium mariscus. With the exception of the last-named species, which is a reedswamp plant, these plants could all have grown in damp grassland in the vicinity. Jones (1978) has interpreted the association of such taxa with cereals as indicating that arable fields extended onto damp ground where damp grassland plants could colonise the field margins. It is possible that some seeds of these species are derived from plants growing in such situations: however, the very high frequency of these taxa in some samples (see below) does imply that in some cases seeds of grassland and wetland taxa are derived from hay. Sieglingia decumbens, apparently formerly a major arable weed at sites in the north and west of Britain (Hillman 1981, Van der Veen 1987) is present in the samples from Pakenham but only at low frequencies; its status as a weed or a plant harvested with hay from acid grassland or heath is doubtful. A few carbonised fern pinnules, probably of bracken (Pteridium aquilinum), and florets and capsules of heather (Calluna vulgaris) provide further evidence for heathland in the vicinity.

Sample composition and taphonomy

1) Carbonised macrofossils

The samples from Roman contexts have three main components: cereal grain, chaff and seeds of wild taxa. Their composition is summarised in the form of triangular diagrams in Fig. 4, following Jones (1985). In calculating the percentages each element (grain, seed or chaff component) has been counted as a unit; thus glume bases and internodes count as one, whilst spikelet forks and spikelet bases (composed originally of two glume bases and an internode) as three. Mineralised seeds, carbonised culm nodes and bases, awns, carbonised remains of fruits and nuts, pulse and Linum seeds were excluded from the calculation.

Samples containing less than 100 elements are arbitrarily considered to represent a 'background scatter' and are excluded from this analysis. Though reducing the data, this precaution was thought to be necessary at this site because the rich samples clearly indicate that substantial quantities of cereal waste were being burnt on-site. Material from these refuse fires could easily have been dispersed across the site and incorporated into contemporary features and, subsequently, into features of later site phases by reworking of deposits, to give a low-density background scatter of material.

For this reason the late Roman cereal samples (Phase V) are not considered to be informative: only seven samples were available and these produced only very thin scatters of cereal remains, which could easily be residual from earlier site phases. However, the composition of the larger samples from Phases II-IV does show some fairly clear patterns. Only from Phase II are there samples including a relatively high proportion of cereal grains; in phases III and IV grains rarely comprise more than 20% of the total assemblage. It is apparent that most samples from

these two phases and some from Phase II include a high proportion of cereal chaff and seeds of wild taxa. Samples comprising more than about 60% chaff are thought to consist of more-or-less 'pure' threshing and winnowing waste from cereal processing. Each of the three phases also produced samples with more than 70% seeds of wild taxa (contexts 0807, 0820 (Phase II); 0568, 4063 (Phase III); 0337, 4104 (Phase IV). These all include seeds of arable weeds, but in 0568, 0807 and 4104 a high proportion of the seeds consists of small grass caryopses and small leguminous seeds (Medicago/Trifolium-type). Grass culm fragments are consistently present and seeds of other grassland taxa (eg. Ranunculus acris/repens/bulbosus, Prunella vulgaris. Eleocharis sp(p) and Carex sp(p) occur at low frequencies. These results seem to indicate that at least some of the 'seed-rich' samples represent a mixture of cereal waste and hay used as animal fodder or litter.

Jones (1985) makes use of triangular diagrams of this type to assess the status of sites as 'nett producers' or 'net consumers' of cereals. At Pakenham, however, it is probable that the role of the settlement in the agrarian economy of the area was rather complex, probably involving some local production, but perhaps also providing centralised facilities for processing and storage for a wide area of countryside. This question is discussed in more detail below.

Total counts of grains and of chaff fragments which are directly comparable for the different genera of cereals are given in Table 10. The results are very consistent for phases II-IV. Wheat grains are two-three times as abundant as barley grains in the first three phases, but wheat internodes are much more common than barley internodes. Oats and rye occur only sporadically in small numbers. Samples of phase V contexts produced very little material.

Taking these results together the following conclusions may be made:

1) There is no clear chronological variation in the samples of phases II-IV. The relative proportions of barley and wheat grains and internodes are similar in all three phases. Other cereals occur only at low frequencies and probably represent no more than contaminants of barley and wheat crops.

2) The composition of samples in terms of relative amounts of grain, chaff and seeds is also similar between phases. Most of the larger samples are composed principally of wheat chaff and weed seeds, representing threshing and winnowing waste burnt as refuse though the high proportion of seeds of grassland taxa in some samples implies that they include charred animal fodder - a mixture of cereal waste and hay. A few samples from phase II contained a relatively high proportion of grain, perhaps related to other cereal processing activities.

ii) Mineralised macrofossils

For reasons outlined above the retrieval of mineralised

	II	III	IV	V
Triticum spp.	122	185	55	3
Hordeum sp(p)	58	60	21	5
Avena sp.(p) grains	5	2	0	0
Secale cereale	0	(2)	(1)	0
Indeterminate cereal	146	206	66	7
Triticum spp (brittle rachis internodes)	74	390	151	1
Hordeum sp(p) (rachis internodes)	2	15	1+(1)	0
Secale cereale (rachis nodes)	0	1	1	0
Totl no of samples	16	66	44	7

Table 10 : Total counts of cereal grains and equivalent cereals spikelet fragments from phases II - V

Triticum internode counts comprise loose internodes and one internode per spikelet base/spikelet fork.

Hordeum internodes includes fragments.

macrofossils at this site was incomplete, and all counts given in Tables 5-7 are merely minimum numbers of specimens present. The distribution of mineralised material retrieved is summarised in Table 11

The sieved residues from the samples commonly contained concretions. Many of these were ferrimanganiferous or clay concretions, but others are thought to represent faecal concretions and coprolites. These fell into two broad categories:

i) Irregularly-shaped hard, brittle concretions with holes and projections, greyish-green to brown in colour. They often have sand grains and sometimes pebbles as inclusions, sometimes show impressions of plant stems and ?epidermal tissue and occasionally (eg. in context 579) include a high proportion of small fishbones.

ii) Soft pale buff porous concretions, some (e.g. in 4164) in the form of small ovoid coprolites, sometimes including fragments of plant tissue.

Mineralised arthropods (mostly fly puparia and woodlice) were associated with concretions in many of the deposits.

The mineralised plant macrofossils consist of stem fragments, scraps of indeterminate epidermal tissue, seeds and fruitstones. A high proportion of the seeds could not be identified even to family, since they showed no surface detail, but species in the families Chenopodiaceae, Umbelliferae, Polygonaceae, Compositae and Gramineae are present. In addition, mineralised macrofossils of Ficus carica (fig), Prunus sp. (internal 'casts' of endocarps), Malus sylvestris/domestica (apple) and Apium-type (?celery) have been identified.

Mineralisation of plant material is thought to occur as a consequence of the reaction between biogenic phosphate and lime, used as a sterilising agent, or calcareous groundwater in refuse pits and latrine pits (Green 1979). The association of faecal concretions, arthropods and mineralised plant material in some of the large pits strongly suggests that these were, indeed, latrine pits.

4. Environment and agrarian economy: discussion and conclusions

At this site it proved possible to examine samples from excavated archaeological features and also from wet sediments in the area of Micklemere, immediately adjacent to the settlement. The combined evidence from sedimentary stratigraphy and analysis of micro- and macro-fossils has provided an unusually full picture of agriculture and environment in this area, between the late neolithic and Saxon periods (see Table 12 for summary).

The earliest archaeological features sampled were late neolithic pits, one of which produced abundant fragments of carbonised hazel nutshells (Corylus avellana) but no remains of crops. Features of this date commonly contain remains of wild fruits and nuts, sometimes associated with cereals, and Jones (1980)

		Faecal concretions/ coprolites	Mineralised arthropods	Mineralised plant macrofossils
Phase III	0113 (pit)	+	+	+
	0139 (pit)	-	-	+
	0290	-	-	+
	0565 (layer)	-	-	+
	0579 (pit)	+	-	+
	0615 (post hole/pit)	+	-	-
	0647 (pit)	+	-	-
	4032 (pit)	+	-	-
	4035 (linear feature)	-	-	+
	4040 (pit)	-	-	+
	4049 (pit)	+	- -	-
	4095 (pit)	-	+	+
	4118 (linear feature)	+	-	-
	4119 (pit)	+	-	-
Phase IV	0037 (pit)	+	-	+
	0114 (pit)	+	+	+
	0125 (pit)	+	+	+
	0129 (pit)	+	-	-
	0337 (pit)	-	+	+
	0709 (layer)	-	-	+
	4044 (pit)	-	+	+
	4067 (layer)	+	+	+
	4101 (pit)	+	+	+
	4105 (pit)	+	+	+
	4125 (pit)	+	+	+
	4164 (pit)	+	-	-
	4166 (pit)	+	-	+
	0172 (pit)	+	+	+

Table 11 : Synopsis of the distribution of mineralised macrofossils

Unphased features are omitted

	Mere stratigraphy pollen analysis plant macrofossils	Carbonised plant remains from archaeological features
?Medieval and later	Sandy colluvial deposits - intensive tillage in immediate vicinity	
Middle Saxon (post ad 660)	Calcareous lake mud. Peak in cereal pollen. Renewed arable farming probably on calcareous clayey soils	
Early Saxon	Peat. Pollen of cereals and weeds rare. Little or no arable farming in vicinity	-
Roman	Sandy peat. Peak in pollen of cereals and weeds. Charcoal and weed seeds common. Intensive arable farming, probably mainly on light sandy soils. Areas of grassland	Large scale processing of cereal crops, mainly spelt. Disposal of waste by burning. Some cultivation of ?flax, pulses, fruits and nuts. Deposits of burnt animal fodder.
Iron Age	Peat. Local vegetation of wet, weedy grassland, with some heathland in vicinity. Landscape largely cleared of woodland	Deposit of macrofossils of weed, grassland and heath taxa - derived from local acidic grassland
Late neolithic		Carbonised hazel-nut shells - collection of wild nuts

Table 12 : Summary of environmental and economic results

suggests that this indicates that woodland foodstuffs formed a significant part of the late neolithic diet. The earliest sediments seen in the section cut at the edge of Micklemere post-date the Neolithic, so pollen data for this period are not available.

The basal peats sampled (below 214cm), though not directly dated, were overlain by less organic deposits thought to be related to Roman activity: these lowest peats are therefore considered to be of Iron Age date. Stratigraphy and microfossils indicate a relatively high water table, perhaps subsequently dropping a little. Pollen analysis shows that vegetation at the margins of Micklemere was composed predominantly of wet grassland prone to flooding, with alder (Alnus) and willow (Salix) growing at the water's edge, associated with aquatic and marsh plants. Pollen of weed taxa indicates some disturbed ground, whilst heather (Calluna) pollen demonstrates the proximity of acid heathland. Pine (Pinus), birch (Betula), oak (Quercus), elm (Ulmus) and hazel (Corylus) were growing in the area, but the landscape was largely open. Cereal pollen is first recorded at the top of this basal peat. Plant macrofossils from this basal peat are also largely of wetland and grassland plants.

Within the excavated area an Iron Age linear feature produced an assemblage of carbonised seeds including some cereals and weeds, but consisting mainly of grassland plants (Ranunculus spp : buttercups; Prunella vulgaris : self-heal; Plantago lanceolata : ribwort plantain; Hypochaeris sp : cat's ear and Sieglingia decumbens : heath grass) with some remains of heather. This evidence for acidic grassland at the site is obviously consistent with the pollen results. It is not clear what this assemblage of carbonised seeds represents in terms of human activity: it might relate to a grassland fire or the burning of waste hay and litter.

The intense and extensive activity associated with the Roman fort and settlement is marked in the sedimentary stratigraphy by inwashing of mineral soil to give layers of sandy peat, some 22cm thick, containing stones, fired clay and glass fragments, charcoal and bone. The increased influx of mineral sediment must have been related in part to disturbance of soil at the site itself, though there is a clear correlation between the percentage of cereal pollen in the sediments and their mineral content (Fig. 2). This indicates an increase in the area under arable production within the drainage catchment of the mere, resulting in increased soil erosion. The vegetation of the area, as indicated by seeds and pollen from the mere sediments, became more diverse largely because of the development of a rich weed flora in response to disturbed and nutrient-enriched soil conditions.

Carbonised plant remains from the excavated site show that the main field crops throughout the Roman period were spelt (Triticum spelta) and six-row hulled barley (Hordeum vulgare). Other crops present in the samples, perhaps representing no more than contaminants of spelt and barley crops, are emmer (Triticum dicoccum), a free-threshing wheat (Triticum aestivum s.l.), rye (Secale cereale) and wild or cultivated oats. Pulses, probably

including peas (Pisum sativum) and horsebeans (Vicia faba var minor) were also grown, and small seeds of a species of flax (Linum sp.) may indicate some flax cultivation, perhaps on the damper soils close to Micklemere.

Cereal crops were clearly being processed on a very large scale in all Roman site phases: most of the larger assemblages of carbonised cereal remains are composed mainly of cereal chaff and weed seeds discarded and partly burnt after threshing and winnowing (Fig. 4). The high frequencies of fungal spores in the mere deposits of Roman date may also have been related to crop processing activities.

The results from the mere sediments clearly show that at least some of the crops being processed at the site were grown within the drainage catchment of the mere. The relatively high frequency of cereal straw fragments and culm bases also implies local production: Hillman (1981) considers the presence of straw-waste to be an indication of local arable farming. A question of some significance in assessing the economic status of the site is whether, in addition, the site provided centralised facilities for crop processing, storage and re-distribution for a wider area of country. One approach to this question is to consider the soil-types surrounding the site in relation to the weed ecotypes associated with the cereals in an attempt to establish probable locations of arable areas.

The site is located close to the western margin of the Boulder Clay plateau of mid-Suffolk, characterised by heavy, often poorly drained soils, where it meets the Breckland with its freshly-draining calcareous and sandy soils. Consequently a wide range of soil types is found in the immediate vicinity (Hodge et al 1984). These fall into three main groups:

1) Soils in valley locations, affected by groundwater levels. Around the site they comprise sandy and peaty soils of the Adventurer's and Isleham 2 Associations.

2) Soils developed on chalky till.
These include very heavy, poorly-drained, stagnogley soils (Beccles I Association) which extend for large areas over the till plateau, as well as better-drained calcareous clay soils (Hanslope series), which are rarely seriously waterlogged, at the edges of the till plateau.

3) Well drained soils on sand, chalk, loamy head or thin till. In the vicinity of the site these include soils of the Newmarket 2 Association (mainly calcareous loamy soils on chalky drift) the Ludford Association (non-calcareous soils on loamy head) and the Worlington Association (deep acid sandy soils).

The soils of the area thus comprise a complex pattern of light and heavy soil-types. However, as has been noted above, carbonised seeds of weed taxa characteristic of light acid soils are fairly frequent in the samples, whereas species particularly common on clay soils are virtually absent. In particular there is only one tentative identification of Anthemis cotula (stinking

mayweed). This weed was certainly established in East Anglia by the Roman period: it has been identified in association with carbonised cereals from a Roman site at Southery, Norfolk (Murphy, unpublished). Its extreme rarity here must indicate that the cereal crops being processed at the site had not been grown on Boulder Clay soils. The arable areas were more probably located on the lighter soils around, and to the south of, the site. This evidence does seem to imply that the crop-processing taking place at the site, to which most of the samples are related, had to do with relatively local production. This does not mean to say that the site had no role in re-distributing cereals imported from a wider area ready-processed as grain, but this type of activity would leave no clear archaeological trace.

In addition to the arable economy the pollen and macrofossil results provide evidence for pastoral farming. Peaty sediments from the Mere, considered to be of Roman date, contained relatively high levels of Plantago (plantain) pollen, which together with other pollen taxa, indicates the existence of weedy grassland, presumably largely on the poorly-drained valley-floor soils. Carbonised seeds of grassland and wetland plants occur frequently, and in a few samples from Roman features are very common. It is suggested above that samples containing many seeds of these taxa with cereal crop-processing waste represent residues from animal fodder.

The remaining crop plants identified - walnut, fig, Prunus sp and apple - may represent locally-produced fruits and nuts or imported foodstuffs. Some collection of wild fruits and nuts is also indicated, notably of hazelnuts, but also bramble, sloe and elderberry.

Above 192cm in the Mere section the mineral content of the sediments decreases markedly, and between 164 and 192 cm there is a dark fibrous peat. Macrofossils and pollen indicate re-establishment of relatively undisturbed wetland vegetation. Charcoal fragments and weed seeds occur at very low frequencies indicating a low level of human activity in the area, and there is a very marked reduction in the level of cereal pollen, implying an abandonment of arable farming in the catchment of the Mere in the post-Roman period. There is no evidence, however, for significant woodland regeneration.

The top of this peat is dated to ad 660, and overlying it there occurs a 20cm thick layer of calcareous lake mud. This sediment indicates a rise in lake levels and an increased influx of fine mineral sediment, correlated with a new peak in cereal pollen. Whilst climatic factors cannot be excluded, it is likely that this represents a phase of intensive arable farming during the Saxon period, resulting in increased soil erosion and surface run-off. The fact that the inwashed sediment at this level is fine-textured and calcareous, in contrast to the sandy mineral component of sediments thought to be related to Roman activity, must indicate a different sediment source; in other words different types of soils were under cultivation - calcareous clayey soils, perhaps including some of the heaviest clay soils.

Around the Mere itself macrofossils and pollen seem to indicate

fairly undisturbed aquatic, marginal and wet grassland vegetation with some alder and willow trees, with traces of weeds and charcoal.

In a final, undated, but post-Saxon, phase unsorted stoney sand was deposited over the lake mud. This colluvial deposit relates to intensive tillage immediately up-slope.

Marine molluscs

Shells and fragments recovered by bulk sieving are listed in Table 13. In the Roman features of phases II-V the two main species were Ostrea edulis (oyster) and Mytilus edulis (mussel). Shells of Cerastoderma sp (cockle), Littorina sp (winkle) and Buccinum undatum (whelk) occurred sporadically in contexts of phases III and IV. Three phase IV contexts produced valves and fragments of Venerupis decussata (carpet shell), a shellfish species known to have been eaten in Roman times: at Culver Street, Colchester it was one of the more frequent marine molluscs in Roman deposits (Murphy, in prep.). Most of the marine mollusc shells came from contexts of phases II-IV, but this simply reflects the larger numbers of samples from these phases.

Avian eggshell

Eggshell fragments were recovered by bulk sieving from all Roman phases, most of the material coming from contexts of phases II-IV. Contexts which produced eggshell are listed in Table 14.

	Phase	Ostrea	Mytilus	Other taxa
0037	IV	1	-	-
0038	IV	1	-	-
0113	III	+	1	Littorina 1
0114	IV	+	-	-
0124	III	-	-	Indet frag.
0128	IV	+	+	-
0129	IV	-	1	Balanus +
0131	IV	-	+	-
0133	III	2	1	-
0134	V	3	1	-
0136	III	3	1	-
0139	III	2	9	-
0145	III	2	+	-
0152	IV	2 (juv)	2	Venerupis decussata +
0172	V	1	15	-
0180	V	3	1	Gastropod frags
0222	IV	2	+	-
0271	I	+	1?	-
0273	III	3	+	-
0275	III	-	+	Cerastoderma +
0281	III	1(+1 juv)	1	-
0290	III	2	1	-
0304	III	2	-	-
0337	IV	1	-	-
0349	V	+	-	-
0471	IV/V	+	+	Indet. (abraded) 1
0494	IV	+	+	-
0519	IV	10(+4 juv)	+	V.decussata + cf. Buccinum (abraded) +
0528	IV	-	5	Balanus + Cerastoderma +
0541	IV	8(+2 juv)	1	Cerastoderma 1 Balanus + Buccinum 2
0551	III	+	+	Balanus +
0552	IV	4	3	-
0580	III	+	-	-
0605	IV	21(+13 juv)	11	Balanus + Cerastoderma + V. decussata 2 Indet. bivalve frags
0608	II	11(+1 juv)	2	-
0659	III	+	1	-
0709	IV	+	+	-
0711	III	+	+	Cerastoderma +
0724	II	+	+	-
0929	II	-	+	-
4001	III	2	-	-
4003	III	1	+	-
4006	II	2	-	-
4009	III	18(+3 juv)	-	-
4010	III	1(+2 juv)	+	-
4012	III	1 juv	-	-
4016	III	+	+	-
4017	III	+	-	-
4020	III	+	+	-

4022	IV	+	-	Cerastoderma + Balanus +
4024	III	1	+	-
4027	III	+	-	-
4032	III	1	-	-
4044	IV	1	-	Balanus +
4049	III	+	-	-
4051	III	2	-	-
4056	III	+	-	-
4067	IV	5(+2 juv)	-	-
4098	III	3(+1 juv)	+	-
4100	III	2(+2juv)	4	Gastropod columella
4104	IV	-	+	-
4105	IV	1	+	-
4106	IV	+	+	-
4125	IV	+	+	-
4131	II	-	1	-
4164	IV	1	+	-
4165	IV	-	+	-

Table 13 : Marine molluscs and other invetebrates

The shells from the Late Neolithic pit 0271 must be intrusive.

	Phase		Phase		Phase
0038	IV	0304	III	4009	III
0124	III	0337	IV	4012	III
0127	III	0494	IV	4016	III
0129	IV	0519	IV	4017	III
0133	III	0528	IV	4022	IV
0136	III	0541	IV	4044	IV
0139	III	0551	III	4063	III
0152	IV	0605	IV	4098	III
0172	V	0659	III	4100	III
0180	V	0686	III	4106	III
0222	IV	0711	III	4164	IV
0271	I	0737	?	4209	IV
0274	III	0770	II		
0275	III	0807	II		
0281	III	4004	III		

Table 14 : Contents from which avian eggshell fragments were retrieved

The fragments from the Late Neolithic puit 0271 must be intrusive.

TABLES

Acknowledgement

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References

Clapham, A.R., Tutin, T.G. and Warburg, E.F. (1962) Flora of the British Isles. Cambridge University Press.

Ellenburg, H. (1988) Vegetation ecology of Central Europe. 4th edn, trans. G.K. Strutt, Cambridge University Press.

Green, F.H. (1979) 'Phosphatic mineralisation of seeds from archaeological sites'. J. Archaeol. Sci. 6, 279-284.

Hillman, G.C. (1981) 'Reconstructing crop husbandry practices from charred remains of crops', in Mercer, R. (ed.) Farming Practice in British Prehistory. pp.123-162. Edinburgh University Press.

Hodge, C.A.H., Burton, R.G.O., Corbett, W.M., Evans, R. and Seale, R.S. (1984) Soils and their use in Eastern England. Soil Survey of England and Wales. Bulletin No.13. Harpenden.

Jones, M.K. (1978) 'The Plant Remains'. In, Parrington, M. (ed.) The excavation of an iron age settlement, bronze age ring ditches and Roman features at Ashville Trading Estate, Abingdon (Oxon) 1974-6, pp.93-110. CBA Res. Rpt. 28. London.

Jones, M.K. (1980) 'Carbonised cereals from Grooved ware contexts' PPS 46, 61-64.

Jones, M.K. (1985) 'Archaeobotany beyond subsistence reconstruction'. In, Barker, G. and Gamble, C. (eds) Beyond domestication in prehistoric Europe pp.107-127. Academic Press.

Moore, P.D. and Webb, J.A. (1978) An illustrated guide to pollen analysis. Hodder and Stoughton.

Petch, C.P. and Swann, E.L. (1968) Flora of Norfolk Jarrold, Norwich.

Kay, Q.O.N. (1971) 'Anthemis cotula' J.Ecol. 59, 623-35.

Kenward, H.K., Hall, A.R. and Jones, A.K.G. (1980) 'A tested set of techniques for the extraction of plant and animal macrofossils from waterlogged archaeological deposits'. Science and Archaeology 22, 3-15

Punt, W. and Clarke, G.C.S. (eds) (1984) The Northwest European Pollen Flora IV. Elsevier

Stanier, R.Y., Adelberg, E.A. and Ingraham, J.L. (1977) General Microbiology. Macmillan.

Van der Veen, M. (1987) 'The Plant Remains'. In, Heslop, D.H. The Excavation of an Iron Age Settlement at Thorpe Thewles, Cleveland, 1980-1982 pp.93-99. CBA Res. Rpt. No.65

Notes on Tables 4-8 microfiche

Abbreviations:

afr	-	awn fragments of Triticum (usually 'silica skeletons') and Avena (usually carbonised)
bri	-	rachis internodes of brittle rachis wheat
ca	-	caryopses (whole grains and fragments including embryo area)
cafr	-	caryopsis fragments not including embryo area
cb	-	culm bases of cereals/grasses
cn/cfr	-	culm nodes and culm fragments of cereals/grasses
co	-	isolated cotyledons of Leguminosae
flor	-	floret
fb	-	floret base of Avena
fr	-	fragments
gb	-	glume bases
indet	-	indeterminate
m	-	mineralised (all other plant material is carbonised)
pi	-	pinnules (fern)
ri	-	rachis internodes
rn	-	rachis nodes
s	-	seed
spb	-	degraded spikelet fork (spikelet base)
spf	-	spikelet fork
spr	-	cereal 'sprouts' (plumule/primary root fragments)
tu	-	tuber

The flot fractions were not all sorted fully. Where a large volume of flot was available a sub-sample was initially sorted. In some cases this produced so little material that further sorting was unnecessary, in others the sub-sample produced an adequate assemblage, and in others further sorting was needed. From some very rich cereal flot samples only very small (2.5ml) sub-samples were examined and other portions of the flot were scanned over, to check that they were representative of the whole.

Quantification of the richer samples presented some difficulties since the samples commonly contained variably-preserved material ranging from intact grains, seeds and spikelet fragments through to very fragmentary and abraded specimens. In samples with large numbers of small seeds there were always many small carbonised objects of elongate to sub-spherical form which probably (but not certainly) represent badly-preserved seeds. In these cases the 'indet' seed count is inevitably tentative.

	0608	0724	0770	0807	0820	0829	0832	0841	0929	0936	0938	0958	4006	4010	4076	413
Cereal indet. (ca fr)	+	+	+	+	+	+	+	+++	+	+	+	+	+	+	+	-
Cereal indet. (ca)	-	2	15(a)	2(a)	-	3	4	35	-	42	1	4	-	-	1	37(a)
Cereal indet. (spr)	-	1	-	-	-	-	-	-	+	5	3	-	2	1	-	3
Triticum spp (ca)	-	-	4	-	-	2	3	67(c)	2	10(a)	2(a)	3	2(a)	2(a)	2	23
Triticum spp (gb)	-	3	2	20	-	1	-	5	2	12	27	1	15	20	5	10
Triticum spp (bri)	-	-	-	3	-	-	-	-	-	-	18	-	4	6	-	4
Triticum spp (rn)	-	-	-	-	-	-	-	-	-	2	-	-	2(f)	-	-	-
Triticum spp (spb/spf)	1	-	1	4	-	-	-	1	-	-	10	1	3	8	-	2
Triticum spp (afr)	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+
Triticum spelta L. (gb)	1	7	2	11	2	-	-	1	3	54(e)	105(e)	7	42(e)	41	3	11
Triticum spelta L. (spf)	-	-	-	1	-	-	-	-	-	-	3	-	4	-	-	-
Triticum dicoccum Schubl (gb)	1cf	-	-	1	-	-	-	1cf	-	-	3cf	-	-	-	-	-
Hordeum vulgare L. (ca)	-	-	-	-	-	-	-	45	-	4	-	-	-	1	-	-
Hordeum sp. (ca)	-	-	3	-	-	-	1	-	-	-	-	3	-	-	-	1
Hordeum sp. (ri/fr)	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-
Avena sp. (ca)	-	-	1	-	-	-	-	1+2cf	-	-	-	-	-	-	1	-
Avena sp. (a fr)	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	+
Pteridium-type (pi)	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Ranunculus acris/repens/bulbosus	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Raphanus raphanistrum (si fr)	-	-	+	-	-	-	-	2fr	-	-	-	-	-	-	1	-
Silene sp(p)	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Agrostemma githago L	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Stellaria media-type	-	-	-	17	-	-	-	-	-	-	-	-	-	-	-	-
Stellaria cf graminea L	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-
Stellaria/Cerastium	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Montia fontana L. subsp. chondrosperma	-	-	-	7	3	-	-	-	-	-	-	-	-	-	-	-
Chenopodium album L	-	-	1	1	20	-	-	3	-	1	-	-	-	-	-	1
Atriplex sp	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
Chenopodiaceae indet.	-	-	-	-	16	1	-	4	-	-	-	-	-	1	1	-
Medicago/Trifolium-type	-	-	2	3	2	-	-	2	3	-	-	-	-	-	-	2
Vicia/Lathyrus sp	-	-	-	-	-	-	-	1s+2co	-	1s+1co	-	-	-	-	1co	-
Leguminosae indet.	-	-	-	-	-	-	-	-	1(d)	-	-	-	-	-	-	-
Prunus sp	-	-	1cf(b)	-	-	-	-	-	-	-	-	-	-	1fr	-	-
Rumex acetosella agg	-	-	1	1	2	-	-	-	-	-	-	-	-	-	-	-
Rumex sp.	-	-	1	-	2	-	-	8	-	1+1fr	-	-	-	1	-	-
Polygonum aviculare agg	-	-	-	-	4	-	-	-	-	-	-	-	-	-	1	5
Polygonum lapathifolium L	-	-	-	1fr	-	-	-	-	-	-	-	-	-	-	-	-
Polygonum convolvulus L.	-	-	-	-	2	-	-	1	-	3	1	-	3	-	-	3
Polygonum sp	-	-	-	-	5	-	-	2	-	-	-	-	-	-	1fr	1
Corylus avellana L.	-	-	-	-	-	-	-	+	-	+	-	+	-	-	-	+
Primulaceae indet.	-	-	-	4	-	-	-	1	-	-	-	-	-	-	-	-
Lithospermum arvense L.	-	-	2	-	1	-	-	1fr	-	-	-	-	-	-	-	1+1f
cf Rhinanthus sp	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Plantago lanceolata L	-	-	1	-	-	1	-	1	1	-	-	1	-	-	-	1
Galium aparine L.	-	-	1fr	-	14	3	-	2fr	-	-	-	-	-	-	-	-
Sambucus nigra L	-	-	-	-	fr(cf)	-	-	-	-	-	-	-	-	-	-	-
Tripleurospermum maritimum(L) Koch	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-
Compositae indet	-	-	-	3	-	-	-	1	1	-	-	-	-	-	-	-
Eleocharis sp(p)	-	-	-	2cf	10	-	-	2	-	1	-	-	-	-	-	-
Carex sp.(p)	-	-	-	-	1	-	-	1	1	-	-	1	-	1	-	-
Cyperaceae indet	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
Sieglingia decumbens (L) Bernh	-	-	-	-	-	-	-	-	1	-	-	1	-	1	-	-
Bromus mollis/secalinus	-	2fr	12	16	1+1cf	1	1	13	1	10	5+1cf	5+1cf	13	5	3	26
Gramineae indet.	-	-	2	28	2	-	-	3	1	-	2	1+1cf	-	1	-	3
Gramineae/cereal (cn/cfr)	-	-	2	3+fr	fr	1	-	fr	-	-	-	-	fr	1	-	1
Gramineae/cereal (cb)	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	1
Rhizome fragment	-	-	+	+	-	-	-	-	-	-	-	-	-	-	2	-
Catkin fragment	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Indeterminate seeds etc.	-	-	4	38	34	2	1	30	2	-	-	2	1	-	-	7
% flot sorted	25	100	100	25	100	100	100	50	100	50	25	100	25	25	100	25

Table 4 : Carbonized plant remains from Roman military contexts (Phase II)

Notes : (a) Includes germinated grains; (b) Charred fruit;
(c) Includes two short grains; (d) Large cotyledon;
(e) Includes glume base from terminal spikelet fork;
(f) Immature spelt

	0065	0113	0124	0127	0133	0136	0139	0145	0273	0281	0290	0304	0328	0581	0582	0666	0679	068
Cereal indet. (ca fr)	-	-	+	+	+	+	+	+	+	-	-	+	-	+	+	+	-	-
Cereal indet. (ca)	-	-	3	1	4	-	2	2	4	-	1	5	-	-	5	2	1	-
Cereal indet. (spr)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cereal indet. (rn)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Triticum spp (ca)	-	-	6	-	1	-	2	1	2	-	1	-	-	-	10	2(b)	-	-
Triticum spp (gb)	-	-	1	-	-	-	2	-	5	1	1	54	-	1	7	2	-	-
Triticum spp (bri)	-	1	-	-	-	-	-	-	2	-	-	14	-	-	6	1	-	-
Triticum spp (rn)	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum spp (spb/spf)	-	-	-	-	-	-	1	-	5	-	-	6	-	-	2	-	-	-
Triticum spp (afr)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum spelta L (gb)	-	-	4	-	1	-	5	-	20	1	3	51(a)	-	1	28	3	3	-
Triticum spelta L (spf)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum dicoccum Schubl (gb)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Triticum dicoccum Schubl spf)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1cf	-	-	-
Hordeum vulgare L. (ca)	-	-	5	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-
Hordeum sp. (ca)	-	1	-	1	1	-	2	1	4	-	-	-	-	-	1	1	-	-
Hordeum sp. (rifr)	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-
Avena sp. (ca)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avena sp. (afr)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Avena sp. (fb)	-	-	-	-	-	-	-	-	1cf	-	-	-	-	-	-	-	-	-
Secale cereale L (ca)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Secale cereale L (rn)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pisum-type	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ficus carica L	-	2m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Juglans regia L	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Pteridium-type (pi)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculus acris/repens/bulbosus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Ranunculus sp	-	-	-	-	-	-	1m	-	-	-	-	-	-	-	-	1	-	-
Papaver cf. rhoeas L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Papaver argemone L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Papaver sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Raphanus raphanistrum L	-	-	-	-	-	-	-	-	-	-	1fr	1fr	-	-	-	-	-	-
Thlaspi arvense L	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-
Cruciferae indet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silene sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Agrostemma githago L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stellaria media-type	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caryophyllaceae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montia fontana L. subsp. chondrosperma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chenopodium album L	-	-	5	-	-	-	-	-	1	-	-	6	-	-	-	-	-	-
Atriplex sp	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
Chenopodiaceae indet.	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	1	1m	-
Malva sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Medicago/Trifolium-type	-	-	1	-	-	-	1	-	fr	-	-	3	-	-	-	92	-	-
Lathyrus nissolia L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vicia/Lathyrus spp	-	-	-	-	-	-	-	-	3s+1co	-	-	2	-	-	-	1s+1co	-	-
Leguminosae indet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prunus spinosa L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prunus sp	-	10m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Apium-type	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Umbelliferae indet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rumex acetosella agg	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-
Rumex sp.	-	-	-	-	-	-	-	1	9	-	-	21	-	-	4	3	-	-
Polygonum aviculare agg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polygonum lapathifolium/persicaria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polygonum convolvulus L.	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
Polygonum sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polygonaceae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corylus avellana L.	+	-	+	+	+	+	-	-	-	+	-	+	-	+	-	cf	cf	-
Calluna vulgaris (L) Hull	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	+
Primulaceae indet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lithospermum arvense L	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Prunella vulgaris L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago lanceolata L	-	-	2	-	-	-	-	-	1	-	-	6	-	-	-	1	-	-
Galium aparine L.	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-
Galium sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthemis cotula L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1cf	-
Tripleurospermum maritimum (L) Koch	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Chrysanthemum segetum L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compositae indet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eleocharis sp(p)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Carex sp(p)	-	-	-	-	-	-	-	-	-	1+1cf	-	14	-	-	-	1cf	-	-
Sieglingia decumbens (L) Bernh	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-	2+1fr	-	-
Bromus mollis/secalinus	-	-	6	-	-	1+1cf	2+fr	3	1	-	1	6	-	2fr	7	8	1fr	-
Arrhenatherum elatius var bulbosum (Willd) Spenn	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gramineae indet.	-	-	-	1	-	1	1	-	2	-	1m	41	-	-	2	66	1m	-
Gramineae/cereal (cn)/(cfr)	fr	-	1+fr	-	-	-	-	-	2+fr	fr	-	1+fr	-	-	1+fr	fr	-	-
Gramineae/cereal (cb)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhizome fragments	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
?Moss fragments	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indet seeds etc (carbonised)	1	-	2	-	-	-	3	-	4	-	-	63	1	-	2	68	-	1
Stem fragments (m)	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Arthropods (m)	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Faecal concretions (m)	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-
Indeterminate seeds etc (m)	-	10	-	-	-	-	1	-	-	-	-	-	-	-	-	2	3	-
% flot sorted	25	25	25	50	100	25	50	50	50	25	50	25	12.5	100	50	50	25	50

Table 5a : Carbonised and mineralised plant remains from early Roman civilian contexts (Phase III)

Contexts 0633, 0978, 4011,. 4050, 4093, 4148 produced no seeds etc

Notes : (a) Including b ases from terminal forks
(b) One short grain
(c) Includes germinates grains
(d) Numerous indet. degraded seeds
(e) 2.5 ml sub-sample examined from c.350 ml. of flot

	0584	0615	0616	0647	0659	0686	0698	0711	0850	0945	0946	0952	0993	4001	4003	4004	4009	4012	4016	4017	4020
Cereal indet. (ce fr)	+	+	+	+	+	+++	+	-	-	+	+	+	+	-	+	+	+	+	+	+	+
Cereal indet. (ce)	3	5	1	7	2	18	3	1	-	1	7	11	1	1	-	1	2	10	-	12	2(c)
Cereal indet. (spr)	-	-	-	-	-	7	7	-	-	5	1	3	1	-	-	1	-	12	-	-	-
Cereal indet. (rn)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum spp (ce)	1	5	1	4(c)	3(c)	33(c)	3(c)	-	-	4	3	19	2	-	-	5(c)	-	9(c)	-	3(b)	3(c)
Triticum spp (gb)	1	2	-	7	5	41	56	1	-	103	7	36	2	-	6	13	1	217	-	1	1
Triticum spp (br)	-	1	-	2	1	7	25	-	-	39	1	7	1	-	-	1	-	71	-	1	-
Triticum spp (rn)	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Triticum spp (spb/spf)	-	1	-	6	3	16	19	-	-	11	2	7	2	-	4	3	-	24	-	-	1
Triticum spp (mfr)	-	-	-	-	-	+++	+++	-	-	++	-	-	-	-	-	-	-	+	-	-	-
Triticum spelta L (gb)	3	11	3	8	10	30	87	-	-	97	10	31	14	-	8	14	-	209(a)	1	4	7
Triticum spelta L (spf)	-	-	-	-	-	-	1	-	-	2	-	-	-	-	-	1	-	1	-	1	-
Triticum dicoccum Schubl (gb)	-	-	-	-	-	-	1	-	-	2cf	1	-	-	-	-	-	-	1cf	-	1	-
Triticum dicoccum Schubl spf)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hordeum vulgare L. (ce)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Hordeum sp. (ce)	-	5	-	-	2	1	1fr	-	-	-	5	-	-	-	1	1	1	2	2	-	-
Hordeum sp. (rifr)	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avena sp. (ce)	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Avena sp. (mfr)	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Avena sp. (fb)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Secale cereale L (ce)	-	-	-	-	-	-	2cf	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Secale cereale L (rn)	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Pisum-type	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ficus carica L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Juglans regia L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pteridium-type (pi)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculus acris/repens/bulbosus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculus sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Papaver cf. rhoeas L	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Papaver argemone L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Papaver sp	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Raphanus raphanistrum L	-	-	-	-	-	-	-	-	-	-	-	1s	1	-	-	-	-	-	-	-	-
Thlaspi arvense L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cruciferae indet	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silene sp	-	-	-	1	-	4	-	-	-	1fr	-	1fr	-	-	-	-	-	-	-	-	-
Agrostemma githago L	-	-	-	-	-	8	1	-	-	-	-	1cf	-	-	-	-	-	-	-	-	-
Stellaria media-type	-	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stellaria cf. graminea L	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caryophyllaceae indet.	1	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montia fontana L. subsp. chondrosperma	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
Chenopodium album L	-	2	-	2	-	22	-	-	-	4	-	5	-	-	-	-	-	1	-	2	-
Atriplex sp	-	-	-	-	-	4	-	-	-	2	-	-	-	-	-	-	-	2	-	1	-
Chenopodiaceae indet.	-	-	-	1	-	23	-	-	-	-	-	1	-	-	1	-	-	2	-	-	-
Malva sp	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Medicago/Trifolium-type	-	-	-	1	-	3	-	-	-	-	1	2	-	-	1	-	-	1	-	-	-
Lathyrus nissolia L	-	-	1cf	-	-	-	-	-	-	-	-	1co	1s	-	-	-	-	-	-	-	-
Vicia/Lathyrus spp	-	1	-	1	-	1s+1co	-	-	-	-	-	2s+9co	-	-	-	-	-	-	-	-	-
Leguminosae indet	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prunus spinosa L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prunus sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Apium-type	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Umbelliferae indet	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rumex acetosella agg	-	-	-	3	1	1cf	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rumex sp.	1	-	-	2	-	2	-	-	-	1	-	3	1	-	-	1	-	1	-	-	-
Polygonum aviculare agg	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Polygonum lapathifolium/persicaria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polygonum convolvulus L.	-	-	-	2	-	2+fr	-	-	-	3	-	6+fr	-	-	2	-	-	-	-	2	-
Polygonum sl	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polygonaceae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corylus avellana L.	-	-	-	+	+	-	-	-	-	-	+	-	+	-	-	-	-	+	-	-	+
Calluna vulgaris (L) Hull	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Primulaceae indet	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Lithospermum arvense L	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prunella vulgaris L	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-
Plantago lanceolata L	-	-	-	2	-	2	-	-	-	-	-	13	-	-	-	-	-	-	-	1	-
Galium aparine L.	-	-	-	1fr	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Galium sp	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	1	-
Anthemis cotula L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tripleurospermum maritimum (L) Koch	-	-	-	-	-	14	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
Chrysanthemum segetum L	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compositae indet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eleocharis sp(p)	-	-	-	1	1	-	-	-	-	-	-	3	-	-	-	1	-	-	-	-	-
Carex sp(p)	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sieglingia decumbens (L) Bernh	-	-	-	-	-	-	-	-	-	-	1cf	1	-	-	-	-	-	1	-	-	-
Bromus mollis/secalinus	1	2	-	6	2	10	5	1	-	11	2fr	33	4	-	2	5	1	26	-	5+1cf	
Arrhenatherum elatius var bulbosum (Willd) Spenn	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gramineae indet.	-	3	-	10	1	10	-	-	-	-	1	8	1	-	2	-	1	9	1	-	-
Gramineae/cereal (cn)/(cfr)	-	fr	-	-	-	6+fr	-	-	fr	-	1	fr	fr	-	fr	fr	fr	-	-	-	-
Gramineae/cereal (cb)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhizome fragments	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Moss fragments	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indet seeds etc (carbonised)	-	3	1	3	2	*(d)	4	-	-	1	1	21	1	-	-	3	-	6	-	1	-
Stem fragments (m)	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Arthropods (m)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Faecal concretions (m)	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeterminate seeds etc (m)	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
% flot sorted	100	100	25	100	50	100	(e)	6.25	25	1.56	100	25	50	12.5	50	50	12.5	6.25	25	50	100

Table 5b . Carbonised and mineralised plant remains from early Roman civilian contexts (Phase III) continued

Contexts 0633, 0978, 4011,. 4050, 4093, 4148 produced no seeds etc.

Notes : (a) Including bases from terminal forks
(b) One short grain
(c) Includes germinates grains
(d) Numerous indet. degraded seeds
(e) 2.5 ml sub-sample examined from c.350 ml. of flot

	4024	4027	4032	4034	4035	4039	4040	4049	4051	4056	4061	4063	4066	4069	4073	4083	4086
Cereal indet. (ca fr)	+	+	+	+	+	+	-	+	+	+	+	+++	++	+	+	-	+
Cereal indet. (ca)	3	7	2	-	2	-	1	2	1	1	-	7	9	12	1	-	1
Cereal indet. (spr)	2	2	-	-	1	-	-	1	-	-	1	-	-	-	-	-	-
Cereal indet. (rn)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum spp (ca)	5(c)	4	1	1	1	-	-	6(c)	2	1	2(c)	10	8	6	1	1	-
Triticum spp (gb)	22(a)	3	-	12(a)	5	-	3	17	10	8	37	1	4	-	2	2	-
Triticum spp (br)	10	7	-	1	1	-	-	14	3	1	9	-	-	-	-	1	-
Triticum spp (rn)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum spp (spb/spf)	9	2	-	1	-	-	-	2	1	2	7	-	2	3	1	-	-
Triticum spp (afr)	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum spelta L (gb)	51	38	6	21	13	-	2	39	21	15	39	2	3	-	2	13	1
Triticum spelta L (spf)	-	-	-	-	-	-	-	2(a)	1	-	-	-	-	-	-	1cf	-
Triticum dicoccum Schubl (gb)	-	-	-	-	2cf	-	-	-	-	-	-	3	-	-	-	-	-
Triticum dicoccum Schubl spf)	-	-	-	-	-	-	-	1	-	-	2cf	1	-	-	-	-	-
Hordeum vulgare L. (ca)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hordeum sp. (ca)	-	1	-	-	-	-	-	1	-	-	1	1	3	3	2	-	1
Hordeum sp. (rifr)	-	-	-	-	-	-	-	-	-	-	3	1	-	-	-	-	-
Avena sp. (ca)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Avena sp. (afr)	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Avena sp. (fb)	-	-	-	-	-	-	-	-	-	-	-	1cf	-	-	-	-	-
Secale cereale L (ca)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Secale cereale L (rn)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pisum-type	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ficus carica L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Juglans regia L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pteridium-type (pi)	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculus acris/repens/bulbosus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculus sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Papaver cf. rhoeas L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Papaver argemone L	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Papaver sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Raphanus raphanistrum L	-	1	-	-	-	-	-	-	-	-	-	fr	-	1	-	-	-
Thlaspi arvense L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cruciferae indet	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Silene sp	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Agrostemma githago L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stellaria media-type	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Caryophyllaceae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montia fontana L. subsp. chondrosperma	-	-	-	-	-	-	-	1	-	-	-	3	-	-	-	-	-
Chenopodium album L	-	-	-	-	-	-	-	-	-	-	2	4	-	2	1	-	-
Atriplex sp	-	-	-	-	-	-	-	-	-	-	-	1fr	-	-	-	-	-
Chenopodiaceae indet.	-	1	-	1	1	-	-	2	-	-	-	-	2+fr	-	-	-	1c+1f
Malva sp	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Medicago/trifolium-type	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lathyrus nissolia L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vicia/lathyrus sp	-	-	-	-	-	-	-	-	-	-	1s+2co	1co	1s	2s	-	-	-
Leguminosae indet	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Prunus spinosa L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prunus sp	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-
Apium-type	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Umbelliferae indet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rumex acetosella agg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1cf	-
Rumex sp.	-	-	-	2	-	-	-	1	-	-	1	3	2	1	-	-	-
Polygonum aviculare agg	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Polygonum lapathifolium/persicaria	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Polygonum convolvulus L	-	-	-	-	1	-	-	-	-	-	1	1	-	2	-	-	-
Polygonum sp	-	fr	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-

Polygonaceae indet.	-	-	-	-	-	-	-	-	-	-	-	4cf	-	-	-	-	-
Corylus avellana L.	-	-	-	+	+	-	-	+	-	-	-	+	-	+	+	-	-
Calluna vulgaris (L) Hull	-	-	-	-	-	-	-	-	-	-	-	-	1(fic)	-	-	-	-
Primulaceae indet	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Lithospermum arvense L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prunella vulgaris L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantago lanceolata L	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-
Galium aparine L.	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-
Galium sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthemis cotula L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tripleurospermum maritimum (L) Koch	1	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Chrysanthemum segetum L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compositae indet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eleocharis sp(p)	-	1	-	1	3	-	-	-	1	-	-	1	1	2	-	-	-
Carex sp(p)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sieglingia decumbens (L) Bernh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromus mollis/secalinus	14	8	1	2+fr	1	-	1	6	2+1cf	2+fr	10	9+3cf	8	4+2cf	1	1	-
Arrhenatherum elatius var bulbosum (Willd) Spenn	-	-	-	-	-	-	-	-	-	-	-	1tu	-	-	-	-	-
Gramineae indet.	-	-	1	-	-	-	-	5	-	-	-	9	-	-	-	-	-
Gramineae/cereal (cn/cfr)	-	-	-	-	-	-	-	-	-	-	1+fr	fr	1	1+fr	-	-	-
Gramineae/cereal (cb)	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Rhizome fragments	-	-	-	-	-	-	-	-	-	-	-	-	3cf	-	-	-	-
Moss fragments	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-
Indet seeds etc (carbonised)	-	2	1	1	4	-	2	1	-	-	-	23	7	8	1	-	-
Stem fragments (m)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arthropods (m)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Faecal concretions (m)	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Indeterminate seeds etc (m)	-	-	-	2	-	-	1	-	-	-	1	-	-	-	-	-	1
% flot sorted	25	50	50	50	25	100	25	12.5	25	50	25	50	25	50	100	25	50

Table 5c : Carbonised and mineralised plant remains from early Roman civilian contexts (Phase III) continued

	4095	4106	4118	4119	4137	4135	4134	4132	4171	4200
Cereal indet. (ca fr)	+	-	-	+	+	-	+	+	+	+
Cereal indet. (ca)	3	-	-	2	-	1	1	2	3	12
Cereal indet. (spf)	-	-	-	-	-	1	-	-	-	+
Cereal indet. (in)	-	-	-	-	-	-	-	-	-	-
Triticum spp (ca)	-	-	-	1	-	-	-	1	-	11
Triticum sp; (gb)	-	-	-	-	3	-	2	-	7	8
Triticum spp (br),	-	-	-	-	-	-	-	-	1	2
Triticum spp (rn)	-	-	-	-	-	-	-	-	-	-
Triticum spp (spb/spf)	-	-	-	-	1	-	-	-	-	5
Triticum spp (afr)	-	-	-	-	-	-	-	-	-	-
Triticum spelta L (gb)	-	-	-	-	5	-	5	-	3	12
Triticum spelta L (spf)	-	-	-	-	-	-	-	-	-	3
Triticum dicoccum Schubl (gb)	-	-	-	-	-	-	-	-	-	-
Triticum dicoccum Schubl spf)	-	-	-	-	-	-	-	-	-	-
Hordeum vulgare L. (ca)	-	-	-	-	-	-	-	-	-	-
Hordeum sp. (ca)	1	-	-	-	1	-	1	-	-	-
Hordeum sp. (rifr)	-	-	-	-	-	-	-	-	-	1cf
Avena sp. (ca)	-	-	-	-	-	-	-	-	-	-
Avena sp. (afr)	-	-	-	-	-	-	-	-	-	-
Avena sp. (fb)	-	-	-	-	-	-	-	-	-	-
Secale cereale L (ca)	-	-	-	-	-	-	-	-	-	-
Secale cereale L (rn)	-	-	-	-	-	-	-	-	-	-
Pisum-type	-	2co	-	-	-	-	-	-	-	-
Ficus carica L	-	-	-	-	-	-	-	-	-	-
Juglans regia L	-	-	-	-	-	-	-	-	-	-
Pteridium-type (pi)	-	-	-	-	-	-	-	-	-	-
Ranunculus acris/repens/bulbosus	-	-	-	-	-	-	-	-	-	-
Ranunculus sp	-	-	-	-	1	-	-	-	-	-
Papaver cf. rhoeas L	-	-	-	-	-	-	-	-	-	-
Papaver argemone L	-	-	-	-	-	-	-	-	-	-
Papaver sp	-	-	-	-	-	-	-	-	-	-
Raphanus raphanistrum L	-	-	-	-	-	-	-	-	-	-
Thlaspi arvense L	-	-	-	-	-	-	-	-	-	-
Cruciferae indet	-	-	-	-	-	-	-	-	-	-
Silene sp	-	-	-	-	-	-	-	-	-	-
Agrostemma githago L	-	-	-	-	-	-	-	-	-	-
Stellaria media-type	-	-	-	-	-	-	-	-	-	-
Caryophyllaceae indet.	-	-	-	-	-	-	-	-	-	-
Montia fontana L. subsp. chondrosperma	-	-	-	-	-	-	-	-	-	-
Chenopodium album L	-	-	-	-	-	-	1	-	-	2
Atriplex sp	-	-	-	-	-	-	-	-	-	1
Chenopodiaceae indet.	-	-	-	-	-	-	-	-	1	1
Malva sp	-	-	-	-	-	-	-	-	-	-
Medicago/Trifolium-type	-	1	-	-	-	-	-	-	-	-
Lathyrus hirsutus L	-	-	-	-	-	-	-	-	-	-
Vicia/Lathyrus spp	-	-	-	-	-	-	-	-	-	-
Leguminosae indet	-	-	-	-	fr	-	fr	-	-	-
Prunus spinosa L	-	1	-	-	-	-	-	-	-	-
Rubus sp	-	-	-	-	-	-	-	-	-	-
Rubus-type	-	-	-	-	-	-	-	-	-	-
Umbelliferae indet	-	-	-	-	-	-	-	-	-	-
Rumex acetosella agg	-	-	-	-	-	-	-	-	-	-
Rumex sp.	-	-	-	-	-	-	-	-	-	4
Polygonum aviculare agg	-	-	-	-	-	-	-	-	-	-
Polygonum lapathifolium/tomentosum	-	-	-	-	-	-	-	-	-	-
Polygonum convolvulus L	-	-	-	-	-	-	1	-	-	-
Polygonum sp	-	-	-	-	-	-	-	-	-	-
Polygonaceae indet.	-	-	-	-	-	-	-	-	-	-
Corylus Avellana L.	-	-	+	-	-	-	-	-	-	-
Tilia cf. vulgaris (L.) Hill	-	-	-	-	-	-	-	-	-	-
Primulaceae indet	-	-	-	-	-	-	-	-	-	-
Lithospermum arvense L	-	-	-	-	-	-	-	-	-	-
Prunella vulgaris L	-	-	-	-	-	-	-	-	2	-
Plantago lanceolata L	-	-	-	-	-	-	1	1	-	-
Galium aparine L.	-	-	-	-	-	-	-	-	-	-
Galium sp	-	-	-	-	-	-	-	-	-	-
Anthemis cotula L	-	-	-	-	-	-	-	-	-	-
Tripleurospermum maritimum (L.) Koch	-	-	-	-	-	-	-	-	-	-
Chrysanthemum segetum L	-	-	-	-	-	-	-	-	-	-
Compositae indet	-	-	-	-	-	-	-	-	-	-
Bidens sp(p)	-	-	-	-	-	-	-	-	-	-
Carex sp(p)	-	-	-	-	-	-	-	-	2	2
Stellaria decumbens (L.) Bernh	-	-	-	-	-	-	-	-	-	-
Bromus mollis/secalinus	1	-	-	-	1	-	1	-	21+	17
Arrhenatherum elatius var bulbosum (Willd.) Spenn	-	-	-	-	-	-	-	-	-	-
Gramineae indet.	-	-	-	-	1	-	-	-	2	6
Gramineae-cereal (ca/rn/cer)	-	-	-	-	-	-	-	-	2	-
Gramineae/cereal (cb)	-	-	-	-	-	-	-	-	-	-
Rhizome fragments	-	-	-	-	-	-	-	-	-	-
?Moss fragments	-	-	-	-	+	-	-	-	-	-
Indet seeds etc (carbonised)	-	-	-	1	2	-	-	1	-	-
Stem fragments (m)	-	-	-	-	-	-	-	-	-	-
Arthropods (m)	-	-	-	-	-	-	-	-	-	-
Faecal concretions (m)	-	-	+	+	-	-	-	-	-	-
Indeterminate seeds etc (m)	-	-	-	-	-	-	-	-	3	3
% flot sorted	25	25	50	100	100	100	100	100	25	25

Table 6d : Carbonised and mineralised plant remains from early Roman civilian contexts (Phase III) continued

	0037	0038	0114	0122	0128	0129	0131	0152	0337	0494	0519	0541	0552	0605	0658	0694	0709	0920	0944	0949
Cereal indet. ca fr.	+	-	+	-	-	+	+	+	+	-	+	-	-	+	-	+	-	+	+	+
Cereal indet. ca	3	-	2	1	-	-	-	1	8	-	-	1	2	2	-	4	-	4	1	6
Cereal indet. spr	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	2
Cereal indet. rn	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum spp ca	-	-	-	-	-	-	-	-	6	-	-	-	1	2	-	1	-	2	2	12(a)
Triticum spp gb	1	2	-	1	-	-	-	-	6	-	-	-	-	2	1	4	1	8	-	27
Triticum spp bri	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	1	2	-	6
Triticum spp rn	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum spp spb/spf	-	1	-	1	-	-	-	-	1	-	-	-	-	-	-	-	3	5	-	4
Triticum spp afr	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	cf
Triticum spelta L gb	-	5	1	3	1	-	2	1	3	-	-	-	-	2	-	11	4	19	1	73
Triticum spelta L spf	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1(b)
Triticum dicoccum Schubl gb	-	-	-	-	-	-	-	-	-	1cf	-	-	-	-	-	-	-	-	-	-
Triticum dicoccum Schubl spf	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hordeum vulgare ca	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-	4
Hordeum sp. ca	1	-	-	1fr	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hordeum sp. rifr	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Avena sp. a fr.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Secale cereale L ca	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Secale cereale L rn	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Linum sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pisum-type	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1co	-	-	-	-
cf Vicia faba L. var minor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ficus carica L m	-	-	-	-	1(m)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pteridium-type pi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Brassica sp	-	-	-	-	-	-	-	-	1cf	-	-	-	-	-	-	-	-	-	1	-
Stellaria cf graminea L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Stellaria/Cerastium sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caryophyllaceae indet.	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Chenopodium album L	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Atriplex sp	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Chenopodiaceae indet.	-	-	-	-	-	-	-	-	1+2m	-	-	-	-	-	-	-	-	-	-	-
Medicago/Trifolium-type	3	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	2
Vicia/Lathyrus spp.	-	-	-	-	-	-	-	-	1fr	-	-	-	-	1	-	-	-	1fr	-	1s+12[illegible]
Leguminosae indet	-	-	-	-	-	1co	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rubus fruticosus agg	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Prunus spinosa L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	fr	-	-	-	-
Prunus sp	-	-	-	-	5+(m)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Malus sylvestris/domestica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Umbelliferae indet	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Rumex acetosella agg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Rumex sp.	4	-	-	-	-	-	-	-	18	-	-	-	-	-	-	2	-	-	-	1
Polygonum aviculare agg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polygonum lapathifolium/persicaria	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Polygonum convolvulus L	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1f.
Polygonum sp	-	-	-	-	1(m)	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-
Corylus avellana L.	-	-	+	-	-	-	-	-	+	-	-	-	+	-	-	-	+	-	-	-
Lithospermum arvense L	1	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-
Euphrasia/Odontites sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhinanthus sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1cf
Plantago lanceolata L	-	-	-	-	-	-	-	-	4	-	-	-	-	1	-	-	-	-	-	-
Galium aparine L.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1fr	-	-
Sambucus nigra L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1cf(fr)	-	-	-
Tripleurospermum maritimum (L) koch	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Cirsium/Carduus sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compositae indet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eleocharis sp(p)	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	1
Carex sp(p)	2	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Sieglingia decumbens (L) Bernh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anisantha sterilis (L) Nevski	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromus mollis/secalinus	1	2fr	1+1cf	-	-	-	-	-	16+1cf	-	-	1fr	-	-	-	5	2	2fr	-	3
Gramineae indet.	8	-	-	-	-	-	3	-	4	-	-	-	-	-	-	2	-	-	-	1
Gramineae/cereal (cn)(cfr)	1+fr	-	-	-	-	-	-	-	3+fr	fr	-	-	-	-	-	1	-	-	1	-
Indeterminate seeds etc. (carbonised)	3	-	1	-	-	-	2	-	16	-	-	-	-	1	-	-	1	-	-	-
Stem fragments (m)	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arthropods (m)	-	-	+	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Faecal concretions (m)	+	-	+	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indet seeds etc (m)	1	-	3	-	3	-	-	-	4	-	-	-	-	-	-	-	3	-	-	-
% flot sorted	100	25	25	100	25	100	50	25	50	25	50	25	50	100	6.25	50	50	100	1[illegible]	1[illegible]0

Table 6a : Carbonised and mineralised plant remains from 2nd-3rd century contexts (Phase IV)

Contexts 0008, 0047, 0222, 0272, 0347, 0528 contained no seeds etc.

Notes: (a) Includes germinated grains
(b) Single-grained spikelet

	4008	4013	4022	4036	4044	4067	4101	4102	4104	4105	4106	4125	4161	4162	4164	4165	4166	4209
Cereal indet. ca fr.	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+	+
Cereal indet. ca	1	5	-	-	-	-	6	-	6	1	3	2	1	1	-	-	1	4
Cereal indet. spr	-	-	-	-	1	-	-	-	-	1	-	-	2	4	1	-	-	-
Cereal indet. rn	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Triticum spp ca	1	2	-	-	2(b)	-	5	-	-	2	3	1	3(b)	2	-	-	7(b)	1
Triticum spp gb	1	-	1	3(a)	2	1(a)	8	3	10	13	3	19	92	74	4	-	37(a)	122
Triticum spp bri	-	-	-	2	-	1	4	-	1	3	-	3	33	15	3	-	13	6
Triticum spp rn	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triticum spp spb/spf	-	-	-	1	1	-	-	1	-	-	-	2	6	11	-	1	6	-
Triticum spp afr	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-
Triticum spelta L gb	1	5	2(a)	9	5	5	18	6	9	31(a)	5	37	172(a)	97	19	-	61	90
Triticum spelta L spf	-	-	-	-	-	-	-	-	-	1(a)	-	-	3	-	1	-	2(a)	-
Triticum dicoccum Schubl gb	-	1	-	1	-	-	1	-	-	-	-	-	-	2	-	-	1cf	1cf
Triticum dicoccum Schubl spf	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Hordeum vulgare ca	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hordeum sp. ca	1	-	-	-	1(b)	1	-	-	3	-	1	-	-	-	-	-	-	-
Hordeum sp. rifr	-	-	-	-	-	-	-	-	-	-	-	1cf	-	-	-	-	-	-
Avena sp. a fr.	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
Secale cereale L ca	-	-	-	-	-	-	-	-	1cf	-	-	-	-	-	-	-	-	-
Secale cereale L rn	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Linum sp	-	-	-	-	-	-	-	-	-	-	-	-	-	1+1cf	-	-	-	-
Pisum-type	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cf Vicia faba L. var minor	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Ficus carica L s	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pteridium-type pi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brassica sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stellaria cf graminea L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stellaria/Cerastium sp	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Caryophyllaceae indet.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chenopodium album L	-	-	-	-	1	-	2	-	1	-	-	-	-	-	-	-	1	-
Atriplex sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chenopodiaceae indet.	-	-	-	-	-	1m	6m	-	3	-	-	-	-	1	-	-	1	2
Medicago/Trifolium-type	-	-	-	-	-	-	1	-	21	-	-	-	-	-	-	-	-	1
Vicia/Lathyrus spp.	-	-	-	-	-	1co	1a+1fr	-	5co+fr	-	-	-	-	-	-	-	-	-
Leguminosae indet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rubus fruticosus agg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prunus spinosa L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prunus sp	-	-	-	-	-	-	6m	-	-	-	-	1m	-	-	-	-	-	fr
Malus sylvestris/domestica	-	-	-	-	-	1m	1m	-	-	-	-	-	-	-	-	-	-	-
Umbelliferae indet	-	-	-	-	1m	-	-	-	-	-	-	-	1	-	1	-	-	-
Rumex acetosella agg	-	-	-	-	-	-	1	-	17	-	-	-	-	-	-	-	-	-
Rumex sp.	-	-	-	-	-	1m	3	-	5	1	-	2	-	-	-	-	2	-
Polygonum aviculare agg	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	2
Polygonum lapathifolium/persicaria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polygonum convolvulus L	-	1fr	-	-	-	-	-	-	-	2	-	2	(c)	6	-	-	-	-
Polygonum sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corylus avellana L.	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lithospermum arvense L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Euphrasia/Odontites sp	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Rhinanthus sp	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Plantago lanceolata L	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-
Galium aparine L.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sambucus nigra L	-	-	-	-	-	-	1m	-	-	-	-	-	-	-	-	-	-	-
Tripleurospermum maritimum (L) Koch	-	-	-	-	-	-	-	-	2	-	-	-	2	-	-	-	2	-
Cirsium/Carduus sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Compositae indet	-	-	-	-	-	-	5m	-	4	-	-	-	-	-	-	-	-	-
Eleocharis sp(p)	-	-	-	-	1	-	-	-	(c)	-	-	-	-	-	-	-	-	-
Carex sp(p)	-	-	-	-	-	-	1	-	2	-	-	-	-	-	1	-	-	-
Sieglingia decumbens (L) Bernh	-	1cf	-	-	1	-	-	-	(c)	-	-	-	-	-	-	-	-	-
Anisantha sterilis (L) Nevski	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Bromus mollis/secalinus	3	1	-	-	1+1cf	1	6+fr	2fr	12	9	-	4	5	7	1	-	20	3
Gramineae indet.	-	-	-	-	1m	-	2cf	-	52	-	1	-	1	-	-	-	2	-
Gramineae/cereal (cn)(cfr)	-	-	-	-	-	-	1	2	+	-	-	-	-	-	-	-	-	-
Gramineae/cereal (cb)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeterminate seeds etc. (carbonized)	-	-	-	-	-	1	9	1	-	-	1	-	-	2	-	-	2	-
Stem fragments (m)	-	-	-	-	-	-	+	-	-	+	-	+	-	-	-	-	-	-
Arthropods (m)	-	-	-	-	+	+	+	-	-	+	-	+	-	-	-	-	-	-
Faecal concretions (m)	-	-	-	-	-	+	+	-	-	+	-	+	-	-	+	-	+	-
Indet seeds etc (m)	-	-	-	-	4	4	13	-	-	-	-	2	-	-	-	-	14	-
% flot sorted	25	100	25	50	50	25	100	100	3.125	50	25	100	(d)	12.5	25	25	12.5	0.78

Table 6b : Carbonised and mineralised plant remains from 2nd-3rd century contexts (Phase IV) continued

Notes: (a) Including glume bases from terminal spikelet forks;
(b) Including germinated grains;
(c) Noted in other sub-samples scanned over
(d) 2.5ml. Sub-sample examined from c.750ml. of flot