Main Report 4677

Site:	Culver Street, Colchester
County:	Essex
Code:	1/81. Sites B,C,D,E,G,H,J,K
Director:	P. Crummy
Type of site:	Urban
Period:	Roman-Medieval
Type of material:	Faecal concretions, molluscá, plant macrofossils

Proposed contents of final report

1. Sampling and recovery methods.*
2. Soil studies (a) Buried soil by Dr R. MacPhail
   (b) Concretions and coprolites.*
3. Faunal remains (a) Land and freshwater mollusca*
   (b) Marine invertebrates*
   (c) Mineralised arthropods (?by Dr H. Kenward)
   (d) Fish-bones (by Alison Locker)
   (e) Avian eggshell.*
4. Plant macrofossils.*
5. Summary and discussion.* (provisional)

N.B. It seems more appropriate to pass on the other small bone (small mammal, amphibian etc.) to Rosemary Luff for inclusion in her programme of work.

* - report included here. The other contributions can be inserted subsequently.

1. Sampling and recovery methods

During the 1981 season sampling at sites B, C and E was on a limited scale, and was confined largely to the Boudiccan destruction levels and to a small number of other contexts, mainly Roman cess pits and rubbish pits. The samples, up to 20 kg. in weight, were processed in the laboratory. Carbonised plant remains were extracted by manual water flotation, collecting the flot in a 0.5 mm. mesh. The non-floating residues, containing bone, shell, mineralised seeds and arthropods, were wet-sieved in a 0.5 mm. mesh. The dried flots and residues were sorted under a binocular microscope at low power.

The results obtained indicated that more extensive sampling, and the collection of larger samples, would be profitable. In the 1985 season, therefore, bulk samples were collected from Roman and medieval contexts. Sample size was recorded in terms of numbers of buckets of approximately 12 litre capacity: usually 1-4 buckets per context were collected, though smaller samples were taken from deposits of limited depth or extent. The stratigraphic complexity of the sites made probabilistic sampling impractical, but an attempt was made to obtain samples from as wide a range of contexts and site periods as possible. These samples were processed on site using a bulk sieving/flotation tank (Kenward et al 1980) with 0.5 mm. meshes to collect the flot and 1 mm. meshes to retain the residue. To complete the extraction of carbonised plant remains it proved necessary to re-float the residues in the laboratory.

The dried flots were sorted under a binocular microscope, extracting carbonised plant remains and any other macrofossils which had floated off (mainly mollusca and small bones with some mineralised seeds and arthropods). The residues from bulk-sieving were usually sorted without magnification, separating artefacts, concretions, bone, shell and other macrofossils. Residues from several deposits, however, proved to contain concentrations of mineralised seeds and small fishbones, and these were sorted under the microscope. Methods used for examining soils and concretions are outlined below.

All categories of plant and animal remains recovered, with the exception of mammal bone fragments and bones of amphibians, reptiles, birds and small mammals, are listed and discussed in this report. The remains of terrestrial vertebrates are more appropriately considered with the hand-collected bone and will form part of a forthcoming monograph by Dr Rosemary Luff on the bone from sites in Colchester.

2(a). Buried soil by Dr R. MacPhail

2(b). Concretions and coprolites

The non-floating residues from several contexts included concretions: F508 and L519 at Site B, F138 at Site C, F900 at Site E and F163, (F185), F232, (F478), F557, F626, L783, L1745, L2520 and F3064 at Site G. These are very variable in form and colour. Those from F900, pale buff in colour with an open porous structure including fragments of plant material, seem mostly to have formed as flat irregular sheets within the pit fill. Concretions from L2520 are greenish-grey and slag-like, fairly flat with holes and irregular ramifying projections, again with an open porous structure including plant tissue (Plate). Other features produced brown to pale buff concretions, porous and usually including some plant tissue. Concretions of this type are quite common in urban deposits, and seem generally to have formed by mineralisation of faeces. Occasionally concreted stools or coprolites are encountered (Jones 1984, 225). A few mineralised droppings or stools retaining their original form were recovered at Culver Street, including small flattened ovoid coprolites from the military cess pit F900 at Site E and some striated ficiform coprolites, possibly goat droppings, from the medieval pits F163 and F557 at Site G.* (Plate .) F557 also included an ovoid coprolite 4.0 x 1.8 cm. including many chips of bone - possibly a canine coprolite.

The concretions from F626, L1745, L2520 and F3064 at Site G were associated with carbonised plant material interpreted as burnt animal fodder (see below) and it seemed possible that these concretions represented animal dung cleaned out from byres or stables and burnt together with spilt fodder and litter. To investigate this possibility concretions from these contexts were examined in more detail, by comparison with concretions from the cess pit F900, which were probably derived from human faeces. The concretions were disaggregated by treatment with dilute HCl, which produced brown solutions with dark sediments and some suspended material. After agitation aliquots of these suspensions were mounted on microscope slides and examined by transmitted light at high power.

The acid-insoluble fraction from F900 consisted mainly of scraps of unidentified tissue, with some fragments of cereal periderm (bran), occasional phytoliths, angular sand grains and a few ova of a parasitic nematode Trichuris sp. (Plate). Bran and trichurid ova are common and characteristic components of human faecal material from archaeological deposits (Jones, ibid), whilst the freshly-fractured sand grains might have been produced when foodstuffs were

*Footnote. Kindly identified by Marijke van der Veen.

ground in mortaria.

The samples from the remaining contexts were quite different. They included abundant grass and/or cereal phytoliths, some of which remained aggregated as 'silica skeletons' of tissue from grass leaves or stems (Plate), with angular and rounded sand grains, some small charcoal fragments and a few diatom frustules. The phytoliths are mostly elongate forms from long cells, comparable to cereal-type phytoliths, but there are also a few 'dumb-bell' phytoliths characteristic of the panicoid grasses Molinia caerulea and Sieglingia decumbens (MacPhail 1981, 324). Charred caryopses of S. decumbens were associated with concretions in several deposits. The siliceous microfossils, derived presumably from grass or hay and drinking water, establish that some type of animal dung is represented, and the absence of large tissue fragments suggests that this dung was from ruminants, possibly cattle, rather than horses.

3(a). Land and freshwater molluscs

Shells of land and freshwater molluscs were not common in the deposits at Culver Street, but some small assemblages were recovered from Sites B, D and G. Retrieval at Sites D and G was by bulk sieving, and hence a proportion of the smallest shells was not recovered from deposits at these sites. However, the concentration of shells in the deposits was too low for the recovery of useful assemblages by the conventional extraction methods. Shells identified are listed in Table . Tentative or incomplete identifications refer in general to shells with abraded surfaces, or to shells obscured by encrustations.

Interpetation of urban snail assemblages presents some difficulties, for they commonly include both shells from the local molluscan fauna as well as shells imported to the site with various raw materials. Two of the assemblages from Site G (Sample 15 from F626 and Sample 58 from F3064) include a high proportion of shells in this latter category. Both samples were from Roman pits, and the shells, which are mostly greyish or black in colour due to the effects of heat, were associated with carbonised grass culm fragments, seeds of grassland plants and grains of barley, thought to represent burnt waste animal fodder, including hay (see below). Most of the molluscs identified in these two samples, including Lymnaea truncatula, Anisus leucostoma, Carychium minimum, Vertigo antivertigo, V. pygmaea and V. angustior occur in grassland, marsh and 'freshwater slum' habitats. It seems that most of these shells arrived at the site with hay cut in wet meadows. The shells of the aquatic snail Valvata cristata from F626 are probably related to river flooding of this wet grassland.

It is possible that specimens of Lymnaea truncatula from other contexts also reached the site with hay, but there may also have been a resident population of this species. Shells of this snail, which can tolerate poorly-oxygenated wet habitats subject to drying-out (Evans 1972, 199-200) came from a drain at Site B (F421) and from Roman 'occupation layers' at Site G (L235, L894, L1507). The presence of L. truncatula in these layers and the occurence of thin layers and lenses of greyish gleyed fine-textured deposits in some parts of Site G point to locally impeded drainage.

The remaining sparse assemblages consist of a mixture of ecotypes and are not readily interpretable.

3(b). Marine invertebrates

Counts of marine mollusc shells and remains of other invertebrates are given in Tables - and the results are summarised in Table . The specimens counted were retrieved from bulk soil samples by wet-sieving over a 1 mm. mesh in the flotation/bulk sieving tank.

Bulk sieving at urban sites commonly produces assemblages of shell representing human food waste (cf. Ayers and Murphy 1983, 34), but the assemblages from the Culver Street sites seem to include material from more than one source. There is no doubt that most of the large shells of whelk (Buccinum undatum), mussel (Mytilus edulis) and oyster (Ostrea edulis) are food wastes, but some remains of other marine invertebrates which would not have been consumed are also present. These are as follows:

i) Shells of molluscs which are too small to form a component of the human diet (Hydrobia ulvae, Nucula sp, Macoma balthica and immature specimens of Cerastoderma spp, Mytilus edulis and Ostrea edulis).

ii) Mature shells of Ostrea, Cerastoderma and indeterminate fragments of bivalve shells which have an encrustation of bryozoans on their interior surfaces. These shells were empty, and had been so for some time, when originally collected.

iii) Valves of Venerupis decussata and V. rhomboides. These are quite large molluscs, but there do not seem to be any records of their ever having been used for human food.

iv) A cheliped fragment most closely matching the shore crab, Carcinus maenas. The edible crab, Cancer pagurus, is not represented in these samples.

v) Numerous shell plates of barnacle species. Barnacles frequently attach to mollusc shells, but shells from these sites do not in general show scars where barnacles had been cemented to them. The cockle valves from F2218 (Site G) are a rare exception to this generalisation. The barnacles from most samples seem to have reached the site on some other substrate.

Had this been a waterfront site these remains of inedible invertebrates could have been interpreted as rubbish discarded when catches were sorted before sale, but Culver Street is on the highest part of Colchester, well away from the river. Some other explanation must be sought. The simplest possibility is that these specimens were brought to the site with seaweed or strand-line detritus for use as organic manure and lime. Many of the species here present are found attached to, or associated with, seaweeds or are commonly seen strewn along strand-lines (Bell 1981, 120). At several archaeological sites the presence of

such species has been interpreted as indicating seaweed collection (Bell, ibid, 121). The cultivated soil at Site G has already been described (see above, p.) and at an urban site this most probably represents horticultural production for which intensive manuring would have been required. Seaweed was known to the Roman agricultural writers as a soil improver, and indeed Pliny mentions it as a root-feed for cabbages (White 1970, 144). Bell (ibid, 117-119) cites ethnographic and historical evidence for the use of seaweed as a horticultural manure. On these grounds the remains of foraminifera, crustaceans and small, abraded and bryozoan-encrusted mollusc shells can plausibly be interpreted as surviving residues from a manure of this type.

The abundant valves and fragments of Venerupis spp, some of which are completely unabraded and occur as paired articulating valves, do not fit so neatly into this category. They appear to have been freshly dug from the gravelly-mud substrates in which they usually occur.

Consequently, despite the lack of direct evidence that they ever have been consumed it is at least possible that they represent human food waste.

	Roman (Sites D,G,H)		Medieval (Site G)	
	MNI	No. of samples in which present	MNI	No. of samples in which present
Littorina littorea (L)	1	1	0	0
Littorina sp.	3	3	1	1
Hydrobia ulvae (Pennant)	3	3	0	0
Buccinum undatum L.	29	23	8	4
Indeterminate gastropod	2	2	0	0
Nucula sp.	1	1	0	0
Mytilus edulis L.	264	28	21	9
Ostrea edulis L.	81	35	36	9
cf. Pecten maximus (L)	1	1	0	0
Cerastoderma edule (L)	7	4	0	0
Cerastoderma cf. lamarcki (Reeve)	1	1	0	0
Cerastoderma sp.	19	16	2	2
Venerupis rhomboides (Pennant)	2	2	0	0
Venerupis decussata (L)	23	18	1	1
Macoma balthica (L)	2	2	0	0
Tellinacea indet.	1	1	0	0
Indeterminate bivalve	6	6	0	0
Foraminifera	-	1	0	0
Barnacles	-	25	-	4
Carcinus maenas L.	1	1	0	0

Table : Summary of marine invertebrates from Sites D, G and H.

This table lists minimum numbers of individuals, and the number of samples in which each taxon is present.

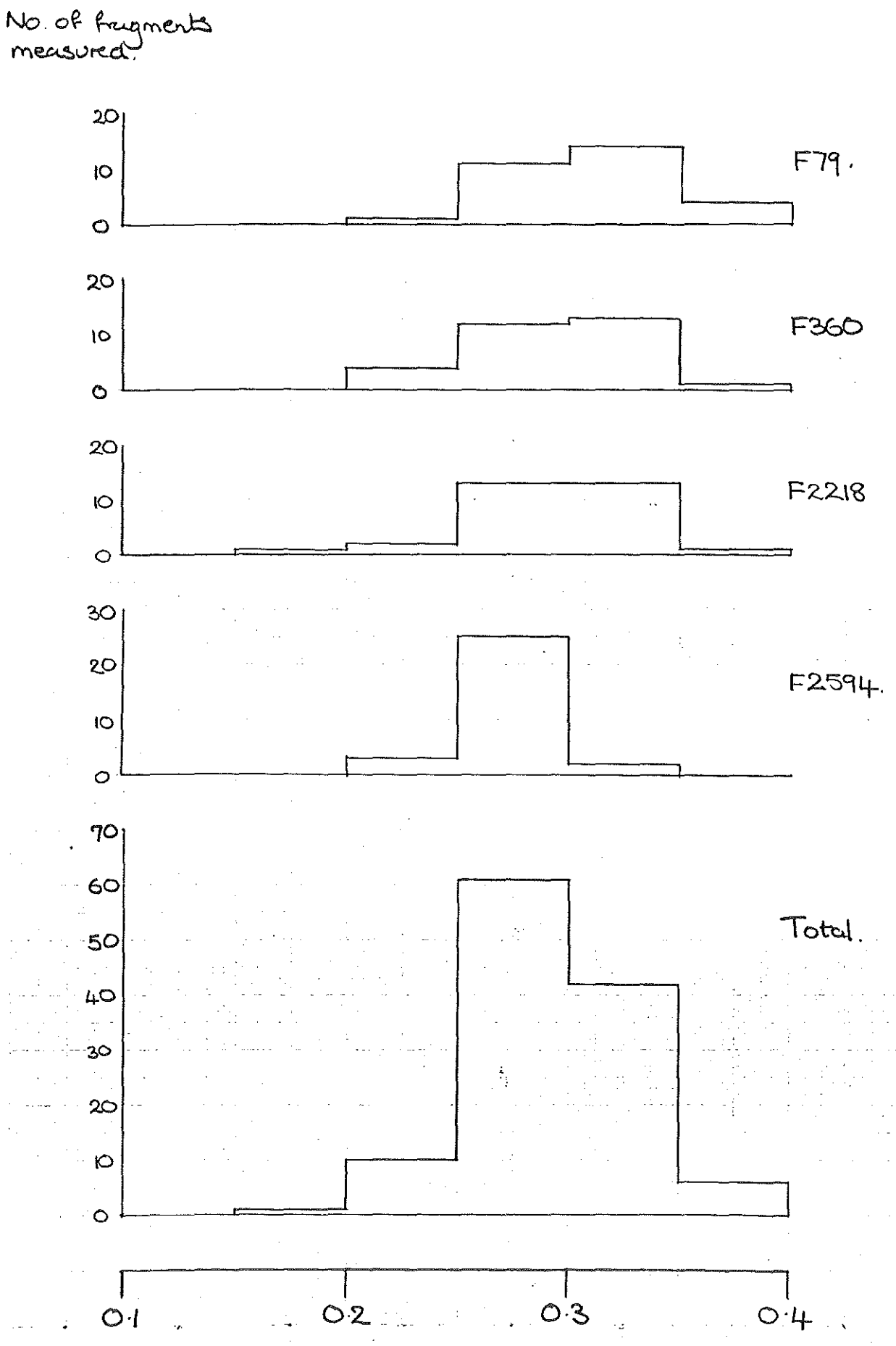
3(c). Mineralised arthropods

3(d). Fish-bones by A. Locker

3(e). Avian eggshell

Fragments of avian eggshell were present in a high proportion of contexts at the Culver Street sites, though never in large quantities. At Site G eggshell fragments were recovered by bulk sieving from twenty samples from Roman contexts, and two from medieval pits. Specific identification of such fragmentary archaeological material is not at present possible, though measurements of shell thickness can be used to distinguish the main size categories of birds (Keepax 1981, 323). Thicknesses of shell fragments from four contexts at Site G have been determined: three early Roman pits (F79, F2218, F2594) and one late Roman hearth (F360). Measurements on thirty fragments from each context were taken using a screw-gauge micrometer. The results are summarised in Fig. . In all four samples a unimodal distribution of measurements was obtained, most fragments being between 0.25-0.35 mm. thick. These dimensions are comparable to those obtained from modern domestic fowl (Keepax, ibid). In these particular samples from Culver Street there are no thicker-shelled fragments comparable to larger birds - goose, swan or guinea-fowl - though thick shell fragments of this type are reported by Keepax from a Roman context at Little Chester, Derby.

Fig : Eggshell thicknesses from four Roman contexts at site G.



4. Plant Macrofossils

Plant remains preserved by carbonisation and phosphatic mineralisation (Green 1979) were recovered from Roman contexts at Sites B,C,D,E,G,J and K and from a group of medieval pits at Site G.

Food plants

The range of food plants identified in samples from Roman and medieval contexts at Culver Street is summarised in Table . Detailed descriptions will not be given here, though some remains of exotic food plants are illustrated in Plate .

In the Roman samples the main cereals are wheats, represented by predominantly elongate grains with occasional glume bases and rachis internodes of spelt, Triticum spelta and a few possible emmer glume bases (Triticum dicoccum), and six-row hulled barley (Hordeum vulgare). There are some grains of oats (Avena sp) and rye (Secale cereale) and one floret base of Avena sativa. In a sample from a late or post-Roman context at Site D (L349) rye (Secale cereale), represented by grains and rachis nodes and possible two-row barley (Hordeum cf. distichon), tentatively identified from the predominance of symmetrical grains, were common. Medieval pits at Site G produced small assemblages of cereals including short grains of free-threshing wheats (Triticum sp), grains and rachis nodes of rye (Secale cereale) and grains of Hordeum vulgare and Avena sp. The single glume base possibly of spelt from F14 could indicate continued cultivation of glume wheats in the medieval period, but is perhaps more likely to have been derived from a Roman deposit.

Remains of pulses are not common. Both Roman and medieval contexts contained a few carbonised and mineralised pea-sized seeds and cotyledons but none of these retains its hilum. The corn-dryer F12 at Site K included a single seed of horse-bean (Vicia faba var. minor), and from a medieval pit at Site G (F557) came a mineralised hilum of this species. F14 at this site produced a single carbonised seed of lentil (Lens esculenta). This, again, could have been derived from a Roman context.

Carbonised fragments of hazelnut shells (Corylus avellana) occurred sporadically in Roman contexts and a carbonised fragment of walnut endocarp (Juglans regia) came from L914 at Site G. Roman cess pits at Sites C and E (F900, F138) contained mineralised remains of opium poppy (Papaver somniferum),

			Roman	Medieval
Triticum spelta	(spelt)		+	?
Triticum cf. dicoccum	(emmer)		+	-
Triticum sp. (free-threshing)	(?bread wheat)		+	+
Hordeum vulgare	(6-row barley)		+	+
Hordeum cf. distichon	(2-row barley)	(a)	-	?
Avena sativa	(cultivated oats)		+	-
Avena sp.	(wild/cultivated oats)		+	+
Secale cereale	(rye)		+	+
Vicia faba var. minor	(horse-bean)		+	+(b)
Pisum sativum	(pea)	(c)	?	?
Lens esculenta	(lentil)		-	+
Corylus avellana	(hazelnut)		+	-
Juglans regia	(walnut)		+	-
Malus sylvestris/domestica	(apple)		-	+
Prunus spinosa	(sloe)		+	-
Prunus sp.	(?cherry)	(d)	+	+
Rubus fruticosus	(bramble)		+	+
Rubus idaeus	(raspberry)		+	-
Sambucus nigra	(elderberry)		+	+
Olea europaea	(olive)		+	-
Ficus carica	(fig)		+	-
Morus nigra	(mulberry)		+	-
Vitis vinifera	(grape)		+	-
Papaver somniferum	(opium poppy)		+	-

Table : Food plants from the Culver Street sites (summary).

Notes: (a) The Hordeum cf. distichon from Site D L349 is of late or post-Roman date. (b) Mineralised hilum. (c) Carbonised seeds and cotyledons lacking hilums, or mineralised seeds. (d) Mineralised internal casts of endocarps, P. avium-size.

elderberry (Sambucus nigra), raspberry (Rubus cf. idaeus), grape (Vitis vinifera) and fig (Ficus carica) with mineralised internal casts of Prunus sp, possibly P. avium. Further mineralised remains of Vitis vinifera and Morus nigra (mulberry) came from L349 and L535 at Site D. Carbonised endocarp fragments of sloe (Prunus spinosa) and olive (Olea europaea) were present in samples from Site B (F265) and Site G (L1745). Olive, mulberry and walnut have not hitherto been identified from Roman contexts at Colchester, and there are few records of these crops from other Roman sites in this country. (Willcox 1977, 278-9). The remains of olive, dated to the 2nd-3rd century, represent an imported commodity, whilst mulberry and walnut could have been cultivated locally. At Site G a restricted range of mineralised fruitstones and seeds (Malus sylvestris/domestica, Prunus sp, Rubus fruticosus, Sambucus nigra) was recovered from medieval pits.

Sample composition and taphonomy

The assemblages of carbonised and mineralised plant macrofossils from Roman contexts fall into five groups.

1) Prime grain. (Table .)

These assemblages consist mainly of cereal grains with small numbers of cereal rachis and spikelet fragments and weed seeds. The sample from L435, part of the Boudiccan destruction layer at Site B, is closely comparable in composition to the cereal assemblages from Balkerne Lane, which were interpreted as burnt granary deposits (Murphy 1984). This sample from Culver Street consists almost entirely of wheat grains (93% of the total 'seed' count) predominantly elongate forms of spelt-type (Triticum spelta) with two glume bases, rare grains of barley (Hordeum sp) and oats (Avena sp) and some arable weed seeds (Agrostemma githago, Rumex sp. and Bromus mollis/secalinus). It represents a fully-processed batch of wheat, carbonised whilst in store during the Boudiccan fire.

At Site G similar assemblages were recovered from two early Roman hearths (F1555 and F2326). Again these consist of fully-processed batches of prime wheat grains with a few spelt spikelet fragments, occasional grains of barley, oats and rye (Secale cereale), some hazel nutshell fragments (Corylus avellana) and rare seeds of grassland plants and arable weeds (Ranunculus sp, Agrostemma githago, Chenopodiaceae, Vicia/Lathyrus sp, Eleocharis sp, Carex sp, Bromus mollis/secalinus and Sieglingia decumbens-type). Carbonisation was perhaps a consequence of poor temperature control whilst wheat was being dried for storage.

At Site K a well-constructed 'corn dryer' (F12) was excavated during the final stages of the excavation, and small soil samples were collected from the stokepit, northern flue and the interior of this feature. These samples produced small assemblages of carbonised plant remains, consisting mainly of grains of free-threshing wheat (Triticum aestivum/compactum), barley (including Hordeum vulgare), rye (Secale cereale) and oats (Avena sp) with a seed of horsebean (Vicia faba var. minor) and a few weed seeds. The feature was evidently used, at least in its final phase, for drying cleaned batches of free-threshing cereals. This is unusual: late Roman corn-dryers appear, in general, to have been used either to dry spelt grain or to parch malted spelt, using spelt chaff as part of the fuel (Hillman 1982; Jones 1979; Murphy 1982). The absence of spelt in F12 and the presence of free-threshing cereals could well be a consequence of the very late date of the fill of this feature, which contained some Saxon pottery.

At Site D a soil accumulation in the hollow left by robbing of a Roman cellar (L349) produced another assemblage of prime grain. The cereals present are barley (Hordeum sp), rye (Secale cereale) and oats (Avena sp). Most of the barley grains are symmetrical and it seems probable that a two-row form (H. distichon) is represented. The only rachis fragments are two rye nodes. Weed seeds include Agrostemma githago, Spergula arvensis, Chenopodium album, Vicia/Lathyrus sp, Rumex acetosella, Centaurea sp, Anthemis cotula, Eleocharis sp. and Bromus mollis/secalinus. The association in this deposit of cereals which are unlikely to have been grown as a mixed crop, and the mixture of weed ecotypes, suggests that cereals from more than one source became incorporated in this deposit, which presumably accumulated slowly, during the late or post-Roman period.

2. Malt. (Table .)

At Site J a small pile of carbonised cereals was found in the corner of a room, up against two burnt wall stubs in the burnt debris from the Boudiccan fire (L222). The sample from this deposit consisted mainly of carbonised wheat grains with some barley (Hordeum vulgare), a few badly preserved wheat glume bases (Triticum spelta and Triticum cf. dicoccum) and a single seed of Agrostemma githago. Almost all the cereal grains had germinated before being carbonised, with 'sprouts' extending for about a half to two-thirds of the grain length. Most grains in this sample are badly deformed as a result of sprouting and cannot be specifically identified, though elongate grains of spelt or emmer predominate.

Sprouting can occur either accidentally, due to damp storage conditions or intentionally during the production of malt for brewing. There are several reasons for thinking that this deposit was malt, stored ready for brewing, which was carbonised during the sack of the town. Firstly, sprout-length is reasonably uniform: in the case of accidental sprouting one might expect to observe much more variation in sprout lengths, depending upon the length of time for which different parts of the grain deposit were exposed to damp conditions whereas malting involves carefully controlled germination. Secondly, grain storage conditions in the early Roman city seem to have been generally good: stored batches of wheat from Site B at Culver Street, from the Cups Hotel and from Balkerne Lane (Murphy 1984) included very few sprouted grains. Thirdly, this sample from Site J differs from other samples of stored grain from Boudiccan deposits at Colchester in that it includes a relatively high proportion of barley. Other Boudiccan-period cereal samples so far examined consist almost entirely of wheat, usually with a few grains of barley, representing chance contamination (Murphy, ibid), but in this deposit from Site J the wheat:barley ratio is close to 10:1. This seems to suggest that grain was mixed to produce a favoured blend for malting. Evidence for the use of spelt in malting has come from other Romano-British sites at Catsgore, Somerset (Hillman 1982) and Caerleon (Helbaek 1964).

3. Fodder crops. (Table .)

Five contexts at Site G (F626, L1745, L2520, F2594 and 3064) and one at Site B (L440) produced assemblages of carbonised plant remains representing animal fodder. They are characterised by high frequencies of seeds from grassland and wetland plants, usually with abundant small grass caryopses, and, in some deposits, grains of six-row hulled barley (Hordeum vulgare), associated with carbonised grass culm fragments. The plant remains can be divided into several categories:

a) Cereal remains. Grains of six-row hulled barley are present in most of these assemblages, and in F626 and F2520 comprise up to almost 15% of the total 'seed count'. A few grains, spikelet forks and floret bases of spelt (Triticum spelta), oats (Avena sativa) and rye (Secale cereale) also occur. In most samples there is a proportion of poorly-preserved indeterminate cereal grains.

b) Arable weeds. Fruits and seeds of Raphanus raphanistrum, Agrostemma githago, Stellaria media, Spergula arvensis, Chenopodiaceae, Malva sp, Polygonum aviculare, P. convolvulus, Galium aparine, Anthemis cotula and Cirsium sp. are present but in most samples these make up no more than 2%

of total seeds. The sample from Site B L440 is the exception to this, with 14% arable weed seeds.

c) Rumex spp. Nutlets of Rumex acetosella and larger but indeterminate Rumex nutlets occur consistently, and in L1745 account for 58% of total seeds. Species in this genus occur in grassland, but Rumex spp. are also common weeds.

d) Grassland and wetland herbs. These include Caltha palustris, Ranunculus acris/repens/bulbosus, R. cf. parviflorus, Dianthus sp, Stellaria palustris/graminea, Montia fontana, Medicago/Lotus/Trifolium spp, Vicia and Lathyrus spp, including L. nissolia, Potentilla sp, Polygonum persicaria, P. lapathifolium, Rhinanthus minor, Euphrasia/Odontites sp, Prunella vulgaris, Plantago lanceolata, Chrysanthemum leucanthemum, Juncus spp, Eleocharis sp. and Carex spp. Together these taxa make up 10-29% of total seed counts from these assemblages.

e) Grasses. Besides grass culm fragments, caryopses of various Gramineae are common, particularly in L2520 and L2594. There is a very wide range of forms but only the more conspicuous taxa (Bromus and Sieglingia decumbens) have been identified.

In several of these deposits from Site G the carbonised plant remains were associated with burnt shells of wet grassland and marsh snails (see above) and with faecal concretions including many grass and cereal phytoliths which have been interpreted as burnt dung, probably from ruminants, most likely cattle (see above). The deposits producing these assemblages are interpreted as sweepings from byres, including dung and spilt fodder (hay and barley), which had been burnt. The carbonised residues from these fires were in some cases placed in pits (F626, F2594, F3064), but in others left as 'spreads' (L1745, L2520). Since such deposits occurred in contexts dating from the 1st-4th centuries it appears that animals, most likely cattle, were kept on or very close to the site throughout the Roman period.

Besides indicating the presence of animals on site, these assemblages provide some useful information on sources of animal fodder in Roman Essex. The evidence for the use of barley as fodder is consistent with known Roman practice: Roman agricultural writers record that six-row hulled barley in particular was grown mainly for stock and was rarely used as a human foodstuff (White 1970, 214-5). The range of grassland and wetland ecotypes represented shows that hay cut in more than one type of grassland was brought to the site. Seeds of several grassland plants which would not have grown in the same habitat are associated in these deposits, for example species characteristic

of valley-floor wet meadows such as Caltha palustris and Rhinanthus minor, and dry grassland plants such as Dianthus sp. and Rumex acetosella. However most of the grassland herbs here identified can occur in valley hay meadows managed by traditional techniques (Greig 1984). The abundance of Sieglingia decumbens amongst the grasses (9.6% of total grass caryopses in F626) is of interest, for this species, the Heath Grass, is not common in Essex today. Jermyn (1974, 206) gives a scatter of records from "dry heathy and sandy places", with only three localities in the Colchester area. Clapham, Tutin and Warburg (1968, 523) note that the plant occurs "locally on damp base-rich substrata", and, given the associated herb flora in these samples, this type of habitat seems the most likely source for the remains of Sieglingia. Its apparent absence from such habitats in Essex today may be due to changes in grassland management.

Relatively pure animal fodder deposits of this type are not common, the closest parallel with the Colchester material being the deposits of charred hay from a Roman site at Dormagen, West Germany (Knörzer 1979). Though differing in detailed species composition the Dormagen samples resemble those from Colchester in containing barley grains, with other cereals, including oats, rare arable weed seeds and abundant seeds of grassland plants.

Finally, it is worth considering whether the Colchester deposits represent waste material burnt as refuse or manure. The cultivated soil from Site G (see above) indicates that there was agriculture, or more likely horticulture, on the site, and manure would clearly have been required. Pliny records that in Northern Italy ash was preferred to dung as a manure, and that stable waste was therefore burnt before spreading on the land (White 1970, 141-2). At an urban site such as Colchester burning dung, litter and waste fodder before application on cultivated plots could well have been more convenient since the ash produced would have been less noisesome and more easily stored in pits such as F626, F2594 and F3064.

4. Cess pit assemblages. (Table .)

Samples from cess pits F138 (Site C) and F900 (Site E) produced mixed assemblages of fruits, seeds and wood fragments preserved by phosphatic mineralisation with carbonised cereal remains. The mineralised material includes fruits and seeds of Papaver somniferum (opium poppy), Prunus sp. (?cherry), Rubus cf. idaeus (raspberry), Vitis vinifera (grape) and Ficus carica (fig). Faecal concretions from F900, disaggregated with dilute acid,

produced fragments of cereal periderm (bran), indeterminate plant tissue and ova of the parasitic intestinal nematode Trichuris sp. (see above). Contexts of this type, which include both table refuse and plant residues which have passed through the human gut, are common at urban sites.

5. Background scatter. (Table .)

As at most sites the majority of samples contained only very low concentrations of plant remains, including a haphazard mixture of material probably derived from a variety of sources. Carbonised grains, rachis and spikelet fragments of cereals, seeds of grassland plants and weeds, nutshells and fruitstones are present. In a few samples (eg. from L235, L1932 and F1995 at Site G) remains of grassland plants are fairly common, and it is possible that these contexts may have included some material dispersed from deposits of burnt animal fodder, but in general this thin 'background scatter' of plant remains is not interpretable.

The assemblages from the medieval pits at Site G are less varied in composition. Several included only small quantities of carbonised cereal remains and weed seeds, of unknown origin, but in F163, F185, F478 and F557 mineralised plant remains, fly puparia and other arthropod remains occurred. Mineralised testa fragments of Agrostemma githago from F185 and F557 and a mineralised hilum of Vicia faba from F557 suggest that these features were cess pits: these macrofossils are characteristic residues from a diet including weed-contaminated whole-meal flour and beans. Mineralised remains of edible fruits from these pits include Rubus fruticosus (bramble) fruitstones, internal casts of fruitstones of Prunus avium or P. spinosa, seeds of apple (Malus sylvestris/domestica) and fragmentary seeds of elder (Sambucus nigra). These probably represent a mixture of table waste and faecal residues.

Plates

Plate 1. Mineralised faecal concretions.

Ficiform droppings, perhaps of goat. Site G. F557 (above top left).
Flattened ovoid coprolite. Site E. F900 (above top right).
Slag-like concretions. Site G. L2520 (below left).
Amorphous plate-like concretion. Site E. F900 (below right).
Scale 10 mm.

Plate 2. Acid-insoluble fraction of concretion from F900. (Site E.)

The photograph shows amorphous tissue, sand grains, a phytolith and trichurid ovum.
Scale 50 microns.

Plate 3. Acid-insoluble fraction of concretion from L2520. (Site G.)

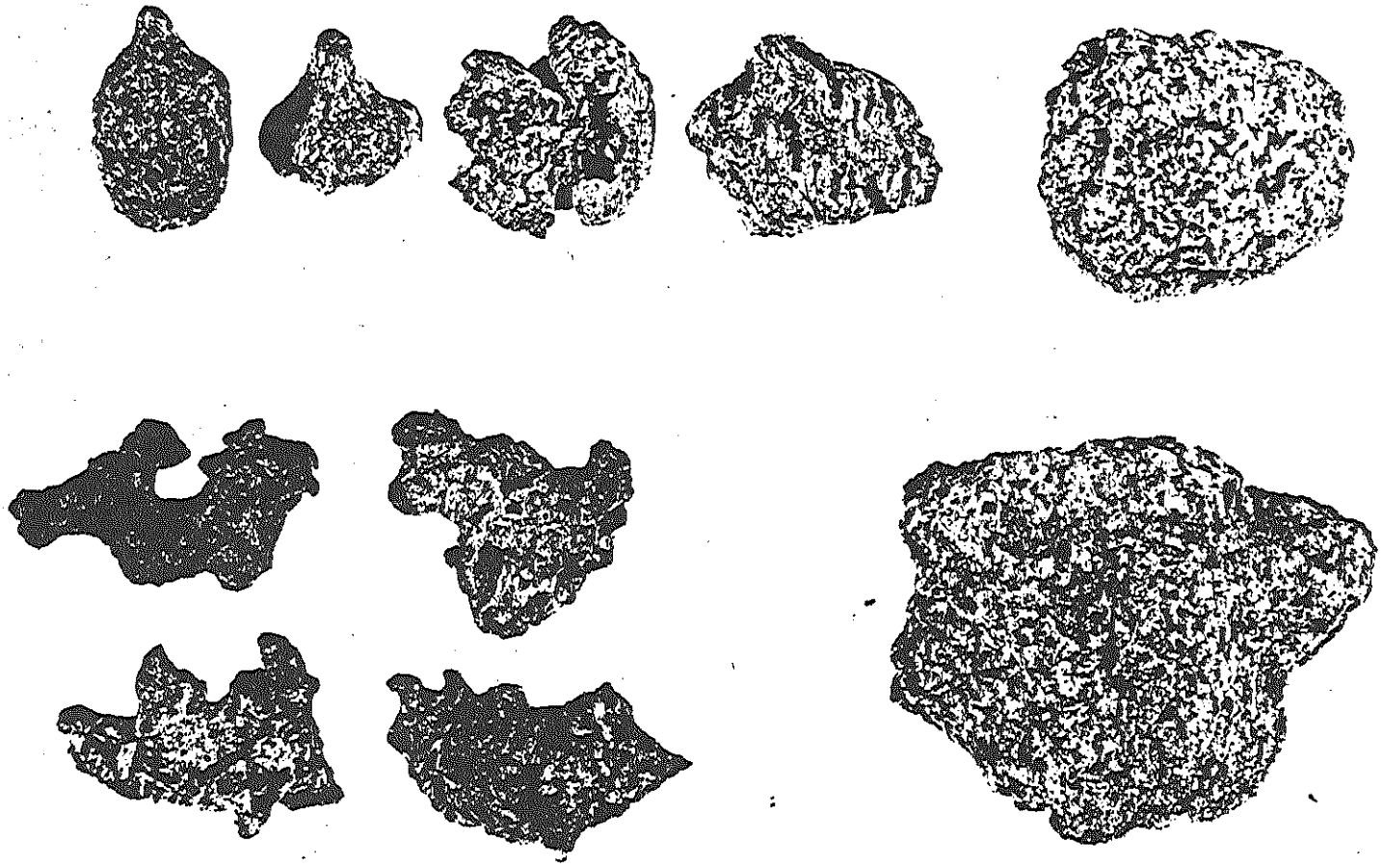
The photograph shows an articulated group of grass/cereal phytoliths, sand grains and charcoal fragments.
Scale 50 microns.

Plate 4. Some shells of Venerupis spp. from Site G, F1545.

Scale 10 mm.

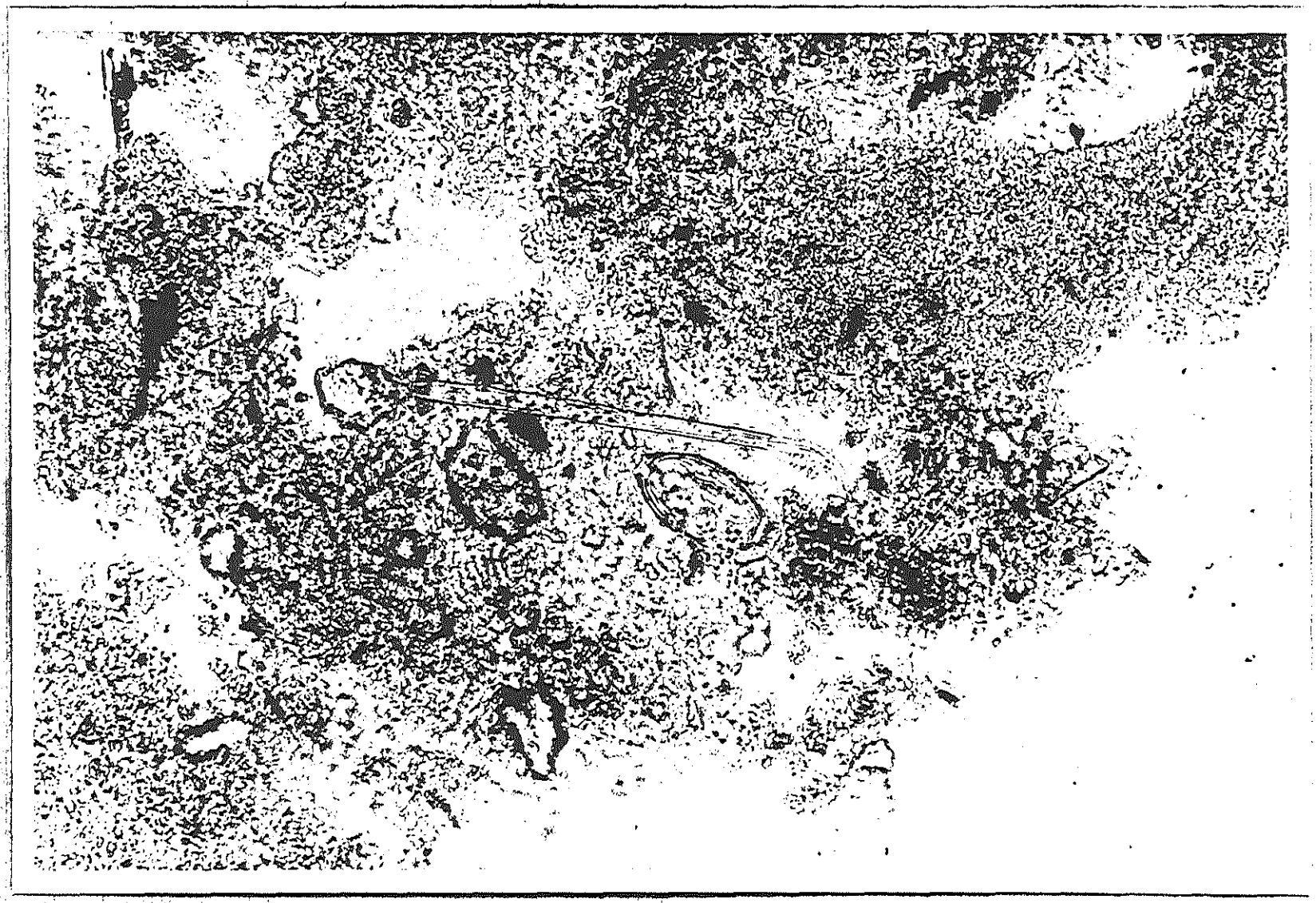
Plate 5. Macrofossils of exotic food plants from Roman contexts.

(a) *Juglans regia* (walnut). Endocarp fragment. Site G, L914.
(b) *Vitis vinifera* (grape). Seed. Site E, F900.
(c) *Olea europaea* (olive). Endocarp fragment. Site G, L1745.
Scale 10 mm.



10mm.

Plate 1.

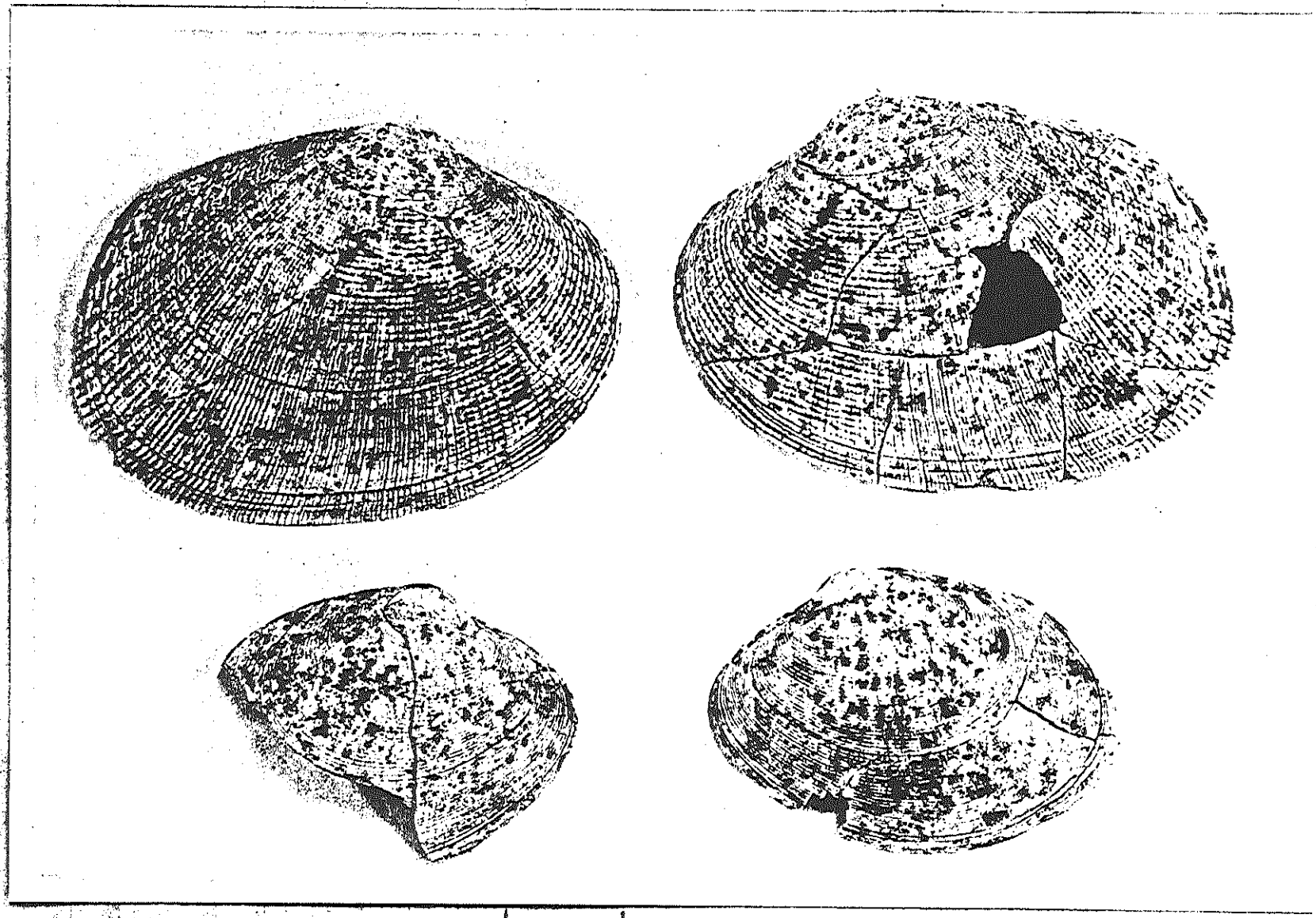


50μm.

Plate 2.

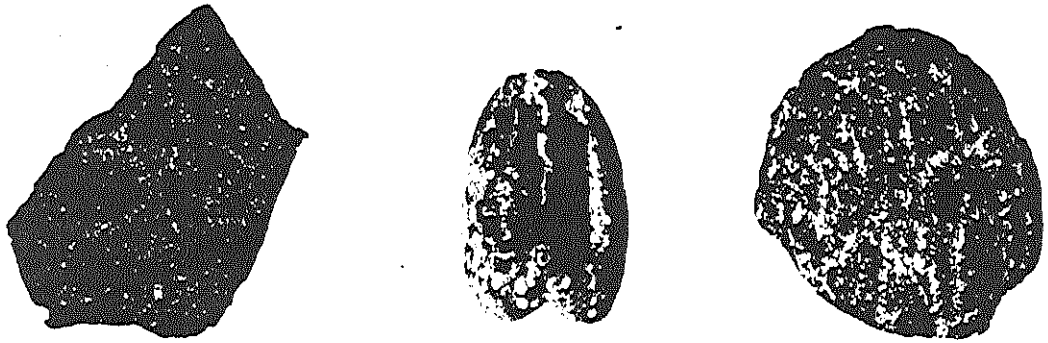
50μm.

Plate 3.



10mm.

Plate 4.



10mm.

Plate 5.

5. General discussion provisional

Studies of soils and biological remains at Culver Street have indicated a range of activities undertaken at the site and have yielded information on the food supplies of the Roman and medieval cities.

One very marked feature of the results is the 'agricultural' aspect of the site. Mixed assemblages of carbonised barley and hay with partly burnt shells of wet grassland snails and burnt faecal concretions, thought to be from ruminants, were recovered from several Roman contexts at Site G. These are interpreted as burnt sweepings from byres or stables, and indicate that livestock were housed at, or in the vicinity of, the site. The widespread occurrence of avian eggshell fragments could suggest that fowl were also kept.

At Site G a buried soil profile showing clear evidence for cultivation has been described. In an urban setting this is most likely to represent horticultural production, for which heavy manuring would have been required. Fresh manure would have been available but the presence of burnt byre or stable sweepings suggests that some manure was deliberately converted to ash for convenient storage in pits until needed (cf. White 1970, 141-2). Remains of inedible marine invertebrates, including foraminiferans, crustaceans and molluscs, are thought to have reached the site with seaweed or strand-line debris, well known as a useful horticultural manure in coastal areas throughout Western Europe (Bell 1981, 117-119).

The evidence for cultivation and livestock-keeping at Culver Street is thus clear, but its economic significance is not easily assessed. Given limitations of space it is perhaps most probable that these activities simply met the domestic requirements of a large household for eggs, poultry, milk and horticultural produce. However, the *fundus suburbanus*, the suburban farm, producing perishable commodities of this type, was a common feature of Roman cities (White 1970, 393-4). At Colchester the cultivated ridged plots at Balkerne Lane (Crummy 1984, 138-141) are likely to have been used for horticultural crops but it is also possible that *horti* closer to the city centre, supplied produce for market. No macroscopic remains of specifically horticultural crops were recovered from Roman deposits at Culver Street, though some of the nuts and fruits present (hazel, walnut, apple, ?cherry, raspberry, fig, mulberry, grape) and also the opium poppy could have been grown locally.

Most of the crop plant remains identified, however, are from staple food

crops. At Site B a cleaned prime grain deposit consisting mainly of spelt came from the Boudiccan destruction layers, indicating some storage of cereals on site during the 1st century. Similar carbonised deposits from Roman hearths at Site G seem to be related to accidents during grain-drying prior to storage as do the assemblages of barley, rye and bread wheat grains from the 'corn-dryer', F12, at Site K. Other cereals present include emmer, cultivated oats, rye and six-row hulled barley, though it seems that the latter was largely used as animal feed. At Site J a small pile of grain consisting of sprouted wheat and barley grains was found in the corner of a room burnt down in the Boudiccan fire. This is thought to be malt, carbonised whilst in store for brewing. No deposits of crop-cleaning waste were recovered and it thus appears that cereals were brought into the city in a fully-cleaned form. Of the exotic food plants only a fragment of olive endocarp need necessarily indicate foodstuffs imported from overseas. The food plants from medieval contexts include free-threshing wheat, barley, oats, rye, horsebean, ?pea, lentil (possibly residual from Roman deposits), apple, ?cherry, bramble and elderberry.

Marine foodstuffs are well represented. Large shells of mussel, oyster and whelk were abundant in both Roman and medieval deposits. Cockles were much less common, and winkles rare. These may have been eaten, but could also be related to the importation of seaweed to the site. The Culver Street excavation was the first site in Colchester at which large-scale bulk-sieving for the retrieval of fish bones has been undertaken. The results provide useful information on the early development of East Coast fisheries.....

Acknowledgements

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Trichia sp.	-	+	-	+	0	2		0	0		2	1		
Trichia cf. striolata (Pfeiffer)	-	-	-	2	-	-	-	-	-	-	-	-	-	
Helix aspersa Müller	-	-	-	2	-	-	-	-	-	1	-	-	-	-
Ostracods	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Indeterminate (mineralised)	-	-	-	-	-	-	-	-	-	-	-	-	1	-

Table : Land and freshwater molluscs

Notes (a) Apices. (b) Intact shells with apertures obscured by concretions.
Shells of Cecilioides acicula are present in several samples, but have not been counted.

Site	B	D	D	D	D	G	G	G	G	G	G	G	G	G
Sample No.	-	26	27	36	41	13	15	22	23	33	37	38	42	58
Context No.	F421	F854	F858	L535	L535	L235	F626	L894	F360	L1507	L914	L914	L1745	F3064
Bag No.	1477	856	860	1391	1697	350	683	956	426	2128	1092	1110	2199	3156
Valvata cristata Müller	-	-	-	-	-	-	2	-	-	-	-	-	-	-
Lymnaea truncatula (Müller)	1	-	-	-	-	3	2	1	-	3	-	-	-	12
Anisus leucostoma (Millet)	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Carychium minimum Müller	-	-	-	-	-	-	2	-	-	-	-	-	-	-
Carychium sp.	-	-	-	-	-	3	5	-	-	-	-	-	-	-
Succineidae indet.	-	-	-	-	-	-	4	-	-	-	-	-	-	-
Cochlicopa sp.	-	-	-	1	3	-	-	-	1	-	-	-	-	-
Vertigo antivertigo (Draparnaud)	-	-	-	-	-	-	1+cf2(b)	-	-	-	-	-	-	-
Vertigo pygmaea (Draparnaud)	-	-	-	-	-	1	13+10cf(b)	-	-	-	-	-	-	1
Vertigo angustior Jeffreys	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Vertigo sp. (a)	-	-	-	-	-	3	26	-	-	-	-	-	-	4
Vertigo sp. (b)	-	-	-	-	-	-	8	-	-	-	-	-	-	-
Pupilla muscorum (Linne)	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Vallonia costata (Müller)	-	-	1	-	-	1	-	1	-	-	-	-	-	-
Vallonia excentrica Sterki	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Vallonia sp.	-	-	-	-	-	-	2	-	-	-	3	-	-	-
Punctum pygmaeum (Draparnaud)	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Discus rotundatus (Müller)	-	1cf.	-	1	-	-	-	-	-	-	-	-	-	-
Vitrina pellucida (Müller)	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Vitrea sp.	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Zonitidae indet.	-	1	-	-	2	1	-	2	1	-	-	-	-	-
Clausilia bidentata (Ström)	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Clausiliidae indet.	-	-	-	1	1	-	-	-	-	-	-	-	-	-
Helicella sp.	-	-	-	-	-	-	1	-	-	-	-	-	-	-

Sample No.	25	26	27	36	41	-	-
Context No.	D:L349	D:F854	D:F858	D:L535	D:L535	H:L497	H:L522
Bag No.	418	856 (a)	860 (a)	1391	1697	517	524 (a)(c)
Littorina littorea (L)	-	-	-	1	-	-	-
Littorina sp.	+	-	-	-	-	-	-
Hydrobia ulvae (Pennant)	-	-	1	-	1	-	-
Buccinum undatum L.	-	+	+	1	+	+	1
Indeterminate gastropod	-	-	-	-	-	+	-
Nucula sp.	-	-	-	-	-	-	-
Mytilus edulis L.	4	8	12	11	18	83	46
Ostrea edulis L.	28	2(b)	4	13	8	4+2(b)	3
cf. Pecten maximus (L)	-	-	-	-	-	+	-
Cerastoderma edule (L)	-	-	-	-	-	-	-
Cerastoderma cf. lamarcki (Reeve)	-	-	-	-	-	-	-
Cerastoderma sp.	-	2	+	-	1	+	-
Venerupis rhomboides (Pennant)	-	-	-	-	-	-	-
Venerupis decussata (L)	-	1	+	+	2	-	4
Macoma balthica (L)	-	-	-	-	-	-	-
Tellinacea indet.	-	-	-	-	-	-	-
Indeterminate bivalve	-	-	-	-	1	+	-
Foraminifera	-	-	-	-	-	-	-
Barnacles	+	+	+	+	+	+	+
Carcinus maenas L.	-	-	-	-	-	-	-

Table : Marine invertebrates from Sites D and H

Notes (a) Some grey in colour (burnt). (b) Small immature shells. (c) This sample also included chalk fragments. Counts refer to umbones of bivalves and apices of gastropods. Other fragments are indicated by a cross.

Sample No.	13	15	19	22	23	28	29	31	32	33
Context No.	L235	F626	L783	L894	F360	L1932	L1959	F1545	F1545	L1507
Bag No.	350	683 (a)	796	956	426	2021	2022	2048	2103	2128
Littorina littorea (L)	-	-	-	-	-	-	-	-	-	-
Littorina sp.	-	-	-	-	-	1	-	-	-	-
Hydrobia ulvae (Pennant)	-	-	-	1	-	-	-	-	-	-
Buccinum undatum L.	+	2	-	1	1+1cf.	+	+	-	+	+
Indeterminate gastropod	-	-	-	-	-	-	-	-	-	-
Nucula sp.	-	-	-	-	1	-	-	-	-	-
Mytilus edulis L.	23	4	-	51	8	2	+	6	2	15+?2(c)
Ostrea edulis L.	2	3	+	5	2+2(b)	6	+	+	1	9
cf. Pecten maximus (L)	-	-	-	-	-	-	-	-	-	-
Cerastoderma edule (L)	-	-	-	-	-	-	-	2	1	-
Cerastoderma cf. lamarcki (Reeve)	-	-	-	-	-	-	-	-	-	-
Cerastoderma sp.	1	-	+	+	3	-	-	3	1	1+1(b)
Venerupis rhomboides (Pennant)	-	-	-	-	-	-	-	2	1	-
Venerupis decussata (L)	-	1	-	+	+	+	-	1	6	2
Macoma balthica (L)	-	-	-	-	1	-	-	-	-	-
Tellinacea indet.	-	-	-	-	-	-	-	-	-	1(e)
Indeterminate bivalve	-	-	-	-	-	-	-	-	-	+
Foraminifera	-	-	-	-	-	-	-	-	-	-
Barnacles	+	-	-	+++	+	+	-	+	+	+
Carcinus maenas L.	-	-	-	-	-	-	-	-	-	+(d)

Table : Marine invertebrates from Roman contexts at Site G. (Sheet 1)

(a) Some grey in colour (burnt). (b) Immature. (c) Paired valves just under 2 mm. in length. (d) Cheliped fragment: matches C. maenas and is certainly not Cancer pagurus. (e) Abraded. Counts refer to umbones of bivalves and apices of gastropods. Other fragments are indicated with a cross.

Sample No.	34	35	37	38	39	40	42	43	44	45
Context No.	L1507	F1555	L914	L914	L914	L1959	L1745	F1995	F2218	F79
Bag No.	2129	1621	1092	1110	1111	2158	2199	2206	2340	2359
Littorina littorea (L)	-	-	-	-	-	-	-	-	-	-
Littorina sp.	-	-	-	-	-	-	-	-	-	-
Hydrobia ulvae (Pennant)	-	-	-	-	-	-	-	-	-	-
Buccinum undatum L.	+	1	-	+	+	-	-	-	-	4
Indeterminate gastropod	-	-	-	-	-	-	-	-	1	-
Nucula sp.	-	-	-	-	-	-	-	-	-	-
Mytilus edulis L.	11	14	12	+	1	+	-	1	103(c)	43
Ostrea edulis L.	2(a)	3	+(b)	+	+	+	1	1	3(b)	3
cf. Pecten maximus (L)	-	-	-	-	-	-	-	-	-	-
Cerastoderma edule (L)	-	-	-	-	-	-	-	-	7(d)	1
Cerastoderma cf. lamarcki (Reeve)	-	-	-	-	-	-	-	-	2(d)	-
Cerastoderma sp.	-	1	+(b)	+	-	1	-	-	2(b)	-
Venerupis rhomboides (Pennant)	-	-	-	-	-	-	-	-	-	-
Venerupis decussata (L)	3	3	+	+	-	-	-	-	-	-
Macoma balthica (L)	-	-	-	-	-	-	-	-	-	1
Tellinacea indet.	-	-	-	-	-	-	-	-	-	-
Indeterminate bivalve	-	+	+(b)	-	-	-	-	-	+(b)	-
Foraminifera	-	-	-	-	-	-	-	-	-	-
Barnacles	+	+	+	+	-	-	+	+	+	+
Carcinus maenas L.	-	-	-	-	-	-	-	-	-	-

Table : Marine invertebrates from Roman contexts at Site G. (Sheet 2)

(a) Immature. (b) These bivalves are encrusted with bryozoans externally and internally. (c) External bryozoan encrustation only. (d) External bryozoan encrustation with barnacles; 3 show internal bryozoans.

Sample No.	51	53	54	55	57	58	-	
Context No.	F2362	L2520	F2594	F2363	F2695	F3064	L3239	L3297
Bag No.	2407	2565	2634	2636	3162	3156	3365	3323
Littorina littorea (L)	-	-	-	-	-	-	-	-
Littorina sp.	+	-	-	-	-	-	-	-
Hydrobia ulvae (Pennant)	-	-	-	-	-	-	-	-
Buccinum undatum L.	?1(b)	-	-	-	-	?1(b)	2	1(a)
Indeterminate gastropod	-	-	-	-	-	-	-	-
Nucula sp.	-	-	-	-	-	-	-	-
Mytilus edulis L.	3(a)	-	-	-	-	-	21	8(a)
Ostrea edulis L.	2	+(a)	2	+	18	3(a)	+	1(a)
cf. Pecten maximus (L)	-	-	-	-	-	-	-	-
Cerastoderma edule (L)	-	-	-	-	-	-	-	-
Cerastoderma cf. lamarcki (Reeve)	-	-	-	-	-	-	-	-
Cerastoderma sp.	-	-	-	-	-	1(a)	-	-
Venerupis rhomboides (Pennant)	-	-	-	-	-	-	-	-
Venerupis decussata (L)	-	-	-	-	-	-	+	+
Macoma balthica (L)	-	-	-	-	-	-	-	-
Tellinacea indet.	-	-	-	-	-	-	-	-
Indeterminate bivalve	-	-	-	-	-	-	-	-
Foraminifera	-	-	-	-	-	+	-	-
Barnacles	+	-	-	-	-	+	-	+
Carcinus maenas L.	-	-	-	-	-	-	-	-

Table : Marine invertebrates from Roman contexts at Site G. (Sheet 3)

(a) Grey in colour (burnt). (b) Columella.

Sample No.	25	26	27	36	41
Context No.	L349	F854	F858	L535	L535
Bag No.	418	856	860	1391	1697
Cereal indet.	99	3	5	4	-
Triticum sp.	1cf.	1	3	3	1
Hordeum sp.	111	3	5	3	2
Avena sp.	48	-	-	1	1cf.
Secale cereale L.	76	-	-	1	-
Secale cereale L. (rn)	2	-	-	-	-
Agrostemma githago L.	2+3cf.	-	-	-	-
Spergula arvensis L.	1	-	-	-	-
Chenopodium album L.	1	-	-	-	-
Vicia/Lathyrus sp.	1	-	-	1+1co.	-
Rumex sp.	-	-	1	-	-
Rumex acetosella agg.	1	-	-	-	-
Centaurea sp.	1	-	-	-	-
Anthemis cotula L.	1cf.	-	-	-	-
Eleocharis sp.	1	-	-	-	-
Bromus mollis/secalinus	2	-	-	-	1
Gramineae indet.	5	-	2	-	1
Indeterminate seeds etc.	4	2	-	-	2
Morus nigra L. (min)	-	-	-	1	-
Vitis vinifera L. (min)	1	-	-	-	-
Indeterminate (min. seeds)	4	-	-	-	-
Sample size (no. of buckets, approx. 12 l. capacity)	4	3	2	2	4

Table : Site D, carbonised and mineralised plant remains

Taxa are represented by fruits or seeds except where indicated.
Abbreviations: co - cotyledon; min - mineralised; rn - rachis node.

Sample No.	35	52
Context No.	F1555	F2326
Bag No.	1621	2338
Cereal indet.	43	-
Triticum sp.	1040	566
Triticum sp. (gb)	1	2
Triticum sp. (spb)	1	-
Triticum spelta L. (spf)	-	1
Hordeum sp.	4	3
Avena sp.	cf.2	-
Secale cereale L.	5	-
Ranunculus sp.	1	-
Agrostemma githago L.	4	4
Chenopodiaceae indet.	1	-
Vicia/Lathyrus sp. (co)	2	-
Corylus avellana L. (fr)	+	-
Eleocharis sp.	6	-
Carex sp.	3	-
Bromus mollis/secalinus	7	38
Sieglingia decumbens (L) Bernh.	1cf.	-
Gramineae indet.	2	3
Indeterminate seeds etc.	9	-
Sample size (number of buckets, approx. 12 l. capacity)	4	0.5 approx.
% flot sorted	100	25

Table : Site G, Prime grain assemblages. (Roman)

Taxa are represented by fruits or seeds except where indicated.
Abbreviations: co - cotyledon; fr - fragment; gb - glume base;
spb - spikelet base; spf - spikelet fork.

Sample No.	15	42	53	54	58
Context No.	F626	L1745	L2520	F2594	F3064
Bag No.	683	2199	2565	2634	3156
Hordeum vulgare L. emend. Lam.	300	1	174	1	28
Triticum sp.	2	5	2	-	3
Triticum sp. (gb)	1	2	3+3fr.	-	-
Triticum spelta L. (gb)	-	-	4	-	-
Avena sp.	4	1+cf2	1+cf2	-	-
Avena sativa L. (fb)	-	1	-	-	-
cf. *Secale cereale* L.	-	-	1	-	-
Cereal indet.	174	6	53	-	19
Olea europaea	-	1fr.	-	-	-
Caltha palustris L.	-	-	-	-	2
Ranunculus acris/repens/bulbosus	51	4	1	-	9+cf8
Ranunculus parviflorus L.	-	-	-	-	4cf.
Ranunculus sp.	1	-	-	-	-
Raphanus raphanistrum L.	4	-	-	-	-
Cruciferae indet.	-	-	-	1	-
Agrostemma githago L.	-	-	1	-	-
Dianthus sp.	5	-	-	-	-
Stellaria media-type	-	-	-	-	4
Stellaria palustris/graminea	1	11	8	7	6
Spergula arvensis L.	1cf.	-	-	-	-
Caryophyllaceae indet.	-	-	1	-	4
Montia fontana L. subsp. *chondrosperma*	-	-	-	-	1
Chenopodium album L.	-	-	12	-	-
Chenopodiaceae indet.	6	1	-	-	1
Malva sp.	-	1	-	-	-
Medicago/Lotus/Trifolium spp. (a)	65	39	20	2	89
Vicia/Lathyrus sp. (s)	4	8	10	-	9
Vicia/Lathyrus sp. (co)	3	6	14	-	4
Vicia sp. (s)	1	-	-	-	-
Lathyrus nissolia L. (s)	7	2	2	-	-
Lathyrus nissolia L. (co)	-	3	2	-	-
Leguminosae (p.fr)	+	-	-	-	-
Potentilla sp.	4	1	-	-	-
Umbelliferae indet.	1	-	-	-	-
Polygonum aviculare agg.	2	-	-	-	-
Polygonum persicaria L.	-	-	cf2	-	-
Polygonum persicaria/lapathifolium	2	1	-	-	-
Polygonum convolvulus L.	4	-	2+cf5	-	-

Rumex acetosella agg.	5	1	3	4	38
Rumex spp.	152	492	26	1	43
Primulaceae indet.	-	-	-	-	1
Rhinanthus minor s.l.	37	1	41	1	4
Euphrasia/Odontites sp.	12	-	-	-	2
Prunella vulgaris L.	2	2	2	1	1
Plantago lanceolata L.	47	3	8	1	16
Galium aparine L.	-	2	-	1	-
Anthemis cotula L.	1	-	-	-	-
Chrysanthemum leucanthemum L.	47	-	-	-	-
Cirsium sp.	1	-	-	-	-
Compositae indet.	-	-	1	-	-
Juncus sp. (b)	+	-	-	-	-
Eleocharis sp.	10	18	5	-	7
Carex spp.	128	4	6+cf6	1cf.	5
Sieglingia decumbens (L) Bernh.	70	3	21	3	3
Bromus mollis/secalinus	22	12	4	-	14
Gramineae spec. div. (c)	638	83	572	83	224
Gramineae (cfr)	+	+	+	-	+
Indeterminate (seeds etc)(d)	320	138	177	19	158
" stem fragments	+	+	+	-	+
" buds	1	-	-	-	-
" capsules	-	1	-	1	-
Charred insects	-	+	-	-	-
Sample size (no. of buckets, approx. 12 litre capacity)	4	1	1	2	2
% flot sorted	25	100	12.5	100	100

Table : Site G: Fodder crop assemblages. (Roman)

Taxa are represented by fruits or seeds except where indicated.

Abbreviations: c - culm; co - cotyledon; fb - floret base; fr - fragment; gb - glume base; p - pod; s - seed.

Notes (a) A range of small leguminous seeds similar to seeds of Medicago, Lotus and Trifolium spp. is present, but identification has not been attempted in the absence of pod fragments since the seeds have probably been more or less deformed during carbonisation.

(b) Aggregates of seeds, representing the remains of seed-filled capsules. The capsule themselves have been burnt away.

(c) A wide range of grasses is represented, from small Poa-type caryopses to large caryopses of Bromus. Only the distinctive caryopses of Avena, Bromus and Sieglingia have been identified, though others are potentially identifiable.

(d) These are merely minimum figures for unidentified seeds: there were in addition many seed fragments which were not readily quantifiable.

Sample No.	11	12	14	16	17	18	20	21	24
Context No.	F185	F185	F14	F293	F557	F661	F376	F478	F163
Bag No.	346	345	423	501	587	751	837	971	995
Cereal (frags)	-	+	+	+	+	+	+	+	+
Cereal indet.	2	3	1	1	9	3	2	2	3
Cereal indet (m)	-	1	-	-	-	-	-	-	-
Triticum sp. (ca)	1	-	-	4	13	5	1	2	-
Triticum sp. (gb)	-	-	1	-	-	-	-	-	-
Secale cereale L. (ca)	-	-	-	2cf.	7	2	1	-	1
Secale cereale L. (rn)	-	-	-	-	-	1	-	-	-
Hordeum vulgare L. emend Lam.	-	-	-	-	16	-	-	-	-
Hordeum sp.	-	-	-	-	-	2	2	-	1
Avena sp.	-	-	-	-	1	2+cf4	2	1cf.	-
Cereal indet. (cn)	-	-	-	1	-	1	-	-	-
Pteridium-type (pi:m)	-	+	-	-	+	-	-	-	-
Papaver sp. (m)	-	1	-	-	-	-	-	-	-
Stellaria sp.	-	-	-	-	-	1	-	-	-
Agrostemma githago L.	-	-	-	-	1+1cf.	2	-	-	-
Agrostemma githago L. (fr:m)	-	+	-	-	+	-	-	-	-
Chenopodium album L.	-	-	-	-	-	3	-	-	1
Chenopodium sp. (m)	-	-	-	-	1	-	-	-	-
Chenopodiaceae indet.	-	-	-	2	1	-	-	-	2(m)
Malva sp. (m)	-	2	-	-	-	-	-	-	-
Trifolium-type	-	-	-	1	-	-	-	-	-
Medicago lupulina-type	-	-	-	-	-	-	-	1	-
Vicia/Lathyrus spp. (s)	-	-	-	-	6	9	1	2	-
Vicia/Lathyrus spp. (co)	3	-	-	-	1	-	-	-	-
Vicia faba L. (h:m)	-	-	-	-	1	-	-	-	-
Lens esculenta L.	-	-	1	-	1s(c)+	-	-	-	-
Pisum-type (m)	-	-	-	-	2s+1co.	-	-	-	-
Rubus fruticosus agg. (m)	-	4	-	-	-	-	-	5+fr.	1
Prunus sp. (m)	-	147	1	-	283	-	-	21+fr.	fr.
Malus sylvestris/domestica (m)	-	1	-	-	4	1fr.	-	-	-
cf. Conium-type (m)	-	1	5	-	-	-	-	-	-
Polygonum aviculare agg.	-	-	-	1cf.	-	-	-	-	1
Polygonum lapathifolium L.	-	-	-	-	1	-	-	-	-
Rumex sp.	-	-	-	2	-	1	-	1	1
Rumex sp. (m)	-	-	-	-	3cf.	-	-	-	-
Polygonaceae indet.	-	-	-	-	-	1	-	-	-
Urtica dioica L. (m)	-	-	-	-	1	-	-	3	-
Corylus avellana L.	-	-	-	-	-	-	+	-	-

Atropa bella-donna L. (m)	-	-	-	-	-	-	-	-	2
Solanum nigrum L.	-	-	-	-	1	-	-	-	-
Prunella vulgaris L.	-	-	-	1	-	-	-	-	-
Labiatae indet. (m)	-	1	-	-	-	-	-	3	16
Plantago lanceolata L.	-	1	-	-	1	1	-	-	-
Galium aparine L.	1	-	-	-	1	2	-	-	-
Sambucus nigra L. (m)	-	+	-	1(c)	+	-	-	+	+
Anthemis cotula L.	-	1	-	-	-	12	-	-	-
Lapsana communis L. (m)	-	-	-	-	1	-	-	-	-
Centaurea sp.	-	-	-	-	-	3	-	1	-
Compositae indet.	-	2(m)	-	-	-	-	1(c)	-	1(c)
Carex sp. (m)	-	-	-	-	1	-	1	-	-
Anisantha sterilis (L) Nevski	-	-	-	-	-	1	-	-	-
Bromus sp.	-	-	-	-	5	5+cf1	6	3	2
Gramineae indet.	1	-	-	14	1	1	-	-	-
Gramineae indet. (m)	-	1	-	-	-	-	-	-	-
Indeterminate seeds etc.	-	-	1	7	7	4	-	6	3
Indeterminate seeds etc. (m)	-	27	2	-	74	-	6	8	1
Stem fragments (m)	-	+	-	-	+	-	-	+	-
Samples size (no. of buckets, approx. 12 litre capacity)	4	4	4	?	4	4	4	4	4

Table : Site G. Mineralised and carbonised plant remains from medieval pits

Taxa are represented by fruits or seeds except where indicated.

Abbreviations: c - carbonised; ca - caryopsis; co - cotyledon; cn - culm node; fr - fragments; gb - glume base; h - hilum; m - mineralised; pi - pinnule; s - seed.

Sample No.	13	19	22	23	28	29	30	31	32	33
Context No.	L235	L783	L894	F360	L1932	L1959	F1983	F1545	F1545	L1507
Bag No.	350	796	956	426	2021	2022	2042	2048	2103	2128
Triticum sp.	5	-	2	-	2	1	2	-	1	2
Triticum sp. (gb)	-	-	-	-	-	-	-	1	-	-
Triticum spelta L. (gb)	-	-	-	-	2	-	-	1	-	-
Triticum cf. *spelta* L. (ri)	-	-	-	-	1	-	-	-	-	-
Hordeum vulgare L. emend Lam.	-	-	-	-	-	-	-	-	-	-
Hordeum sp.	-	-	-	-	1	-	-	1	1	2
Avena sp.	-	-	1cf.	-	-	-	-	-	-	-
Cereal indet.	4	-	1	1	3	1	3	1	+	+
Ranunculus acris/repens/bulbosus	1	-	-	-	4+2cf.	-	1	-	-	-
Ranunculus sp.	-	-	-	-	-	-	-	-	1	-
Stellaria graminea/palustris	1	-	-	-	-	-	-	-	-	-
Chenopodium album L.	-	-	-	-	-	-	-	-	-	-
Chenopodium sp.	-	-	-	-	-	1	-	-	-	-
Medicago lupulina-type	1	-	-	-	2	-	-	-	-	-
Medicago/Trifolium-type	-	-	-	-	6	1	-	-	-	-
Vicia/Lathyrus sp.	1+1co.	-	-	-	1+2co.	-	1	-	-	-
Lathyrus nissolia L.	-	-	-	-	-	-	-	-	-	-
Pisum-type	1+1co.	-	-	-	-	-	-	-	-	-
Leguminosae indet.	-	-	1	1	-	-	-	-	-	-
Prunus sp. (fragments)	+	-	-	-	-	-	-	-	-	-
Umbelliferae indet.	-	-	-	-	-	-	-	-	-	-
Polygonum aviculare agg.	-	-	-	1	-	-	-	-	-	-
Polygonum cf. *persicaria* L.	-	-	-	-	-	-	-	-	-	1
Rumex sp.	2	-	-	-	6	-	-	-	1	1
Rumex acetosella agg.	-	-	-	-	2+cf1	1	-	-	-	-

Polygonaceae indet.	-	-	-	-	-	-	-	-	-	-
Juglans regia L. (frag)	-	-	-	-	-	-	-	-	-	-
Corylus avellana L. (frags)	+	-	-	-	-	-	-	-	+	-
Sambucus nigra L.	-	-	-	1	-	-	-	-	-	-
Plantago lanceolata L.	-	-	-	-	8	-	-	-	-	-
Galium aparine L.	-	-	-	-	-	-	-	-	-	-
Compositae indet.	-	-	-	-	1	-	-	-	-	-
Chrysanthemum leucanthemum L.	-	-	-	-	-	-	-	-	-	-
Eleocharis sp.	-	-	-	-	1	1	-	6(frags)	1	1
Carex sp.	-	-	-	-	1	2	-	3	-	-
Bromus mollis/secalinus	-	-	-	-	-	-	-	-	-	2
Sieglingia decumbens (L) Bernh.	1cf.	-	-	-	-	-	-	-	-	-
Gramineae indet.	4	-	-	-	11	-	-	3	1	-
Gramineae indet. (c.fr.)	-	-	-	-	-	-	-	-	-	-
Indeterminate seeds etc.	2	-	1	2	18	1	1	13	7	3
Indeterminate buds	-	-	-	-	-	1	2	-	-	1
Sample size (no. of buckets, approx. 12 litres capacity)	4	0.5	4	3	3	0.5	1	1	2	4
% flot sorted	100	100	100	100	100	100	100	100	100	100

Table : Site G, Plant remains from other Roman contexts

Taxa are represented by fruits or seeds except where indicated.

Abbreviations: c.fr. - culm fragments; co - cotyledon; fr/frag - fragment; gb - glume base; ri - rachis internode.

-	-	-	-	1	-	-	-	-	-	-
-	-	+	-	-	-	-	-	-	-	-
-	-	-	-	-	+	-	-	+	+	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	1	-	-	1	1	-	-
-	-	-	-	-	-	-	-	1	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	1	-
-	-	-	-	3	7+fr.	1	1	-	-	-
-	-	-	-	4	6	-	-	-	-	-
-	-	-	-	-	-	-	-	6	-	-
-	-	-	-	-	-	-	-	1	-	-
-	-	-	-	10	3	-	-	4	1	-
-	-	-	-	+	-	-	-	+	-	-
-	-	-	-	7	18	-	6	3	3	2
-	-	1	-	-	-	-	-	-	-	-
1	1	1	1	1	0.25	0.3	4	2	2	2
00	100	100	100	100	100	100	100	100	50	50

34	37	38	38	40	43	44	45	51	55	57
507	L914	L914	L914	L1959	F1995	F2218	F79	F2362	F2363	F2695
129	1092	1110	1111	2158	2206	2340	2359	2407	2636	3162
-	-	-	-	1	1	-	-	2	-	5
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	2+1cf.	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	4	-	-
-	-	-	-	-	1	-	-	-	-	-
-	-	-	-	1	-	-	-	2	-	-
-	1	+	-	+	16	-	+	5	-	2
-	-	-	-	1	7	-	-	-	-	-
-	-	-	-	-	2	-	-	-	-	-
-	-	-	-	-	1	-	-	-	-	-
-	-	-	-	1+1cf.	-	-	-	-	-	-
-	-	-	-	-	1	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	3	-	-	-	1	-	-
-	-	1	-	1co.	-	-	-	-	-	-
-	1	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	frags.
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	13	-	-
-	-	-	-	-	1	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	1	-	-	-	6	-	-	11	-	-
-	-	-	-	1cf.	1	-	-	-	-	-

Site No.	J	K	K	K
Context No.	L222	F12	F12	F12
Bag No.	269	46 (Stokepit)	47 (Northflue)	48 (Interior)
Cereal indet.	-	2	6	56
Cereal indet. (m)	-	-	-	1+fr.
Triticum spp.	752(g)	-	-	-
Triticum aestivum/compactum	-	3	-	26
Triticum sp. (gb)	3	-	-	-
Triticum sp. (spb)	1	-	-	-
Triticum spelta L. (gb)	2	-	-	-
Triticum cf. dicoccum (gb)	2	-	-	-
Hordeum sp.	-	-	-	14
Hordeum vulgare L. emend Lam.	75(g)	15	10	-
Secale cereale L.	-	2	1	16+1cf.
Avena sp.	-	-	1cf.	1
Vicia faba L. var. minor	-	-	-	1
Agrostemma githago L.	1	-	-	-
Chenopodiaceae indet.	-	1	-	-
Polygonum convolvulus L.	-	-	1	-
Polygonum sp.	-	-	-	1
Sambucus nigra L. (m)	-	1	-	-
Carex sp.	-	1	-	-
Bromus sp.	-	1fr.	-	4
Indeterminate (seeds etc)	-	-	-	3
Sample weight (kg)	1.6	5.5	3.4	6

Table : Sites J and K, carbonised and mineralised plant remains

These were all small samples, collected in haste towards the close of the excavation. Taxa are represented by fruits or seeds except where indicated.
Abbreviations: g - most grains germinated; gb - glume base; m - mineralised; spb - 'spikelet base'.

Site		B	B	B	B	B	B	B	B	B	B	B	B	B			
Sample No.		1716	1792	1793	1794	1797	1798	1799	1800	1801	1802	1803	1804	1805	1806	1807	
Layer/feature no.		435	435	435	435	438	438	438	438	439	439	439	439	440	440	440	
Description									Period VIII floor levels								
Cereals	Cereal indet	ca	18	1	2	-	-	-	3	-	-	-	-	-	-	frags	-
	Triticum sp	ca	941	-	-	-	1	-	-	-	-	-	-	-	-	-	-
	Triticum sp	ri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Triticum sp	gb	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
	Triticum spelta L	gb	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Triticum spelta L	spf	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Triticum cf dicoccum Schubl	gb	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Hordeum sp	ca	2	-	-	-	-	-	1	-	-	-	1	-	-	-	-
	Hordeum vulgare L	ca	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Avena sp	ca	1	-	-	-	-	-	1	-	-	-	1	-	-	-	-
	Cereal/grass	cn	-	-	-	-	-	-	-	-	-	-	-	-	1	-	
Pulses	cf Pisum sativum L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Leguminosae indet		-	frag	-	1	-	-	-	-	-	2	1	-	-	-	2
Opium poppy Papaver somniferum L			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fruits	Prunus spinosa L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Prunus sp		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Rubus fruticosus agg		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Rubus cf idaeus L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Vitis vinifera L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ficus carica L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sambucus nigra L		1	-	-	-	-	-	-	-	4*	-	1*	-	-	-	-
Nut Corylus avellana L		frags	-	+	+	-	-	-	+	+	-	-	-	+	-	-	-
Ranunculus acris/repens-type			-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Agrostemma githago L			2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stellaria media-type			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

B	B	B	B	B	C	C	C	E	E	E	E
1808	1867	1477	1936	2266	485	486	487	1125	1340	1357	1742
440	459	421	508	265	138	138	138	900	900	900	1362
		Gulley	Drain	Cess Pit		Cess Pit			Cess Pit		
-	-	frags	-	frag	-	4+fr	-	-	frag	-	-
-	-	-	-	-	-	3	2	-	-	-	-
-	-	-	-	-	-	6	-	-	-	-	-
-	-	frag	-	-	-	6	-	-	-	1	-
-	-	-	-	-	3	23	1	-	-	-	-
-	-	-	-	-	-	1	-	-	-	-	-
-	-	-	-	-	-	1	-	-	-	-	-
-	-	-	-	-	-	2	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	1	-
-	-	1	-	-	-	2	-	-	-	-	-
-	-	-	-	-	-	1	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	10*	-	-	-	-
-	-	-	-	1	-	-	-	-	-	-	-
-	-	-	-	-	-	-	1+frags*	-	45+frags*	-	-
-	-	-	-	-	-	-	-	-	-	-	1
-	-	-	-	-	-	-	-	-	10*	2*	-
-	-	-	-	-	-	-	-	-	1*	-	-
-	-	-	-	-	3*	-	2	5*	49*	12*	-
-	-	-	-	-	-	-	frags*	frags*	frags*	-	-
-	+	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-

Spergula arvensis L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
Caryophyllaceae indet		-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
Montia fontana ssp chondrosperma		-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Chenopodium sp		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chenopodium album L		-	-	-	-	-	-	-	-	-	1	-	-	8	1	27
Chenopodiaceae indet		-	-	2	-	-	-	-	-	-	-	-	-	-	1	7
Polygonum aviculare agg		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Polygonum persicaria/lapathifolium		-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Polygonum lapathifolium L		-	-	-	-	-	-	-	-	-	-	-	-	1	-	2
Polygonum cf convolvulus L		-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Rumex sp		1	-	-	-	-	-	-	-	-	-	-	-	9	3	83
Polygonaceae indet		-	2	6	-	-	-	-	-	-	-	-	-	-	-	-
Quercus sp	ch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quercus sp	bu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
[illegible]				[illegible]	-	-	-	-	-	-	-	[illegible]	[illegible]	-	[illegible]	[illegible]
Compositae indet		-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Eleocharis sp		-	-	8	-	-	-	1	-	-	-	-	-	26	14	55
Carex spp		-	-	1	-	-	-	-	-	-	-	-	-	-	-	17
Bromus mollis/secalinus		48	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gramineae indet		-	-	12	-	-	-	-	-	1	-	-	1	-	-	2
Indeterminate seeds		4	5	13	-	-	4	-	1	4	-	2	49	5	84	87 113
Indeterminate bud		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Sample wt (kg)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table : Plant macrofossils from Culver Street (Sites B, C and E)

Most specimens are carbonised; mineralised seeds etc. indicated by asterisks.

Abbreviations bu - bud; ca - caryopsis; ch - charcoal; cn - culm node; frags - fragments; gb - glume bases; ri - rachis internodes; spf - spikelet forks. All other specimens are fruits or seeds.

-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	1*	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	1+1*	-	-	-	-	-
-	-	1*	3*	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	+
-	-	-	-	-	-	-	-	-	-	-	+
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	1	-	-	-	2	-	-	-	-	-
-	-	1	-	1*	-	-	-	-	-	-	-
2	-	-	5*	-	1*	1*	17*	6*	13*	6*	-
-	-	-	-	-	-	-	-	-	-	-	-
1	-	1	10	10	10	6.5	9	10	20	3.5	10