Ancient Monuments Laboratory Report 00/00

Charred plant remains from the Late Iron Age and Roman Settlement at Elms Farm, Heybridge, Essex.

Angela Monckton

Summary

Samples of first to fourth century date were analysed representing the phases and zones of the extensive village settlement. The most abundant cereal was spelt with a trace of emmer and a few bread wheat type grains, and hulled barley including six-row barley, as a second cereal. Samples interpreted as fine sieved cereal cleaning waste were found throughout the periods of occupation and included some samples with abundant wheat glumes and arable weeds. Some evidence of larger scale cereal cleaning was found from the late 1st-early 2nd century onwards including waste from malting spelt from rubbish deposits. Cereal waste was widely spread on the site until the Later Roman phases when remains were more abundant at the periphery. Other crops included flax/linseed and indeterminate legume, while hazel nut, sloe, wild/sour cherry, blackberry, hawthorn and elder were possibly gathered for consumption. Weeds increased in variety in the later phases to include, for example white bryony and henbane, possibly as weeds of the settlement. The results were compared with other sites in the region and nearby sites in the Lower Blackwater valley.

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Introduction

The Elms Farm site is located on a gravel terrace near the River Blackwater and consists of an extensive Late Iron Age to Roman settlement of 30 hectares which was excavated by Essex County Council Field Archaeology Unit in 1993-5. The site was divided into five main zones (see plan 1): a northern outer zone (Areas D, E, F and G) of plots by Road 1, the central zone (Areas H, I and J) consisting of a temple site J near a possible market place H and an open area I, a southern outer zone (Areas K, L, M, N, P and Q) which was possibly residential plots with extensive pitting, the settlement periphery (Area R) near the watercourse, and outside the settlement (Area W) a hinterland of fields with boundary ditches (Atkinson and Preston 1998).

The phases of the site relevant to this report are phase II the Late Pre-Roman Iron Age and transition period (mid 1st BC to mid 1st century AD), phase III Early Roman period (Later 1st to mid 2nd century AD) and the later Roman phases grouped together for this analysis phase IV to VI (later 2nd to late 4th century AD).

A large number of samples were taken for the recovery of charred plant remains which include seeds, cereal grains and chaff, these can give evidence of the crops cultivated and food consumed as well as provide evidence of activities on the site. It was intended to investigate whether continuity or change was shown in the evidence from the plant remains over the period of occupation of the site. During the 1993 excavation of Area W a total of 286 samples were assessed (Murphy 1994) but were generally unproductive and were not selected for analysis. During the 1994-5 excavation 790 samples were taken and samples selected from these form the basis of this report.

Methods

Samples were chosen at the discretion of the archaeologists and the features sampled included pits, ditches, postholes, hearths, layers, wells and other features from all periods of the site. From the samples taken 665 dated samples were processed by wet sieving with flotation using a 0.5mm mesh and collecting the flotation fraction (flot) on a 0.5mm sieve. The residue was then dried and separated using 2mm and 5mm sieves. All the material larger than 2mm (the coarse fraction) was sorted by eye by environmental assistants and the material smaller than 2mm (the fine fraction) was saved but not sorted.

During the assessment flots from 334 of the processed samples were examined using a x10 stereo microscope and only 42 were found with over 20 items of charred plant remains present. However, examination of a few fine fraction residues indicated that some material had not floated so it was necessary that the residues should be included in the analysis of the selected samples. In order to provide more samples for analysis additional material was processed, where available, from samples with any evidence of charred plant remains in the assessment. Additional samples were then selected to cover under represented phases and areas. During analysis of the selected samples the fine fraction of the residue was refloated and the material dried and sorted from the 'reflot' using a stereo microscope and this together

with the remains from the flot and coarse fraction were identified and counted. Around a hundred samples from each period had been assessed and after completely sorting the selected samples, the 20 most productive from each period were tabulated (tables 1-3). Identification was carried out by comparison with modern reference material in the Department of Archaeology, University of Leicester, the plant names and order follow Stace (1991) and the cereals Zohary and Hopf (1993), remains are seeds in the broad sense unless described otherwise (tables 1-3). The occurrence of remains by phase was then summarised in table 4.

Recovery by flotation was often poor, only 17% of the remains in phase III were found in the flots the rest being mainly in the fine residue. Refloating these residues proved efficient in recovering material from the selected samples and refloating more residues may have produced more samples with higher numbers of remains. Unfortunately this was not possible so a selection of residues has been retained in the archive, these should be refloated if required for long term storage. The material sorted by eye from the coarse fractions of some samples was relatively rich in grains, hence it may be more efficient in future on such sites to refloat the residue below 5mm (rather than 2mm) in order to save time and give more consistent recovery of remains.

In order to compare the samples with each other and with those from other sites the proportions of chaff (the glumes and spikelet forks which consist of two glumes), cereal grains and seeds were calculated (from tables 1-3). This was done because the composition of the remains can indicate stages of cereal processing (Hillman 1984). The proportions were shown on a barchart (figure 1) which also shows the density of remains expressed as items per litre of soil. The barchart of phase IV-VI includes the charred plant remains from two samples from the palaeochannel of phase IV (Murphy forthcoming, table 5) instead of two less productive samples from Areas J and H. The ratios of glumes to wheat grains, barley rachis to barley grains and weed seeds to total cereal grains were also calculated (tables 1-3) to assist with interpretation of the plant remains (van der Veen 1992). All the tabulated samples were included on the barcharts to show the range and character of the samples, however, those with less than about fifty items cannot be interpreted.

Results, the plant remains.

Cereals: Wheat chaff fragments were numerous in some of the samples (tables 1-3) and the majority of identifiable glumes were of spelt (*Triticum spelta*) with prominent minor veins, one prominent wide angled keel and wide bases. A few glumes were identified as emmer (*Triticum dicoccum*) because of their lack of prominent minor veins, the acute angles of the two keels and their small size. Glumes which were too short to distinguish these features or were of intermediate type were identified only as the glume wheats either emmer or spelt (*Triticum dicoccum/spelta*). Small rachis segments were also identified only as glume wheat, but most were probably of spelt.

Cereal grains were not numerous on the site and it was thought that they may have been broken down by abrasion in the sand and gravel, however when the residues were examined few cereal grain fragments were found. The identifiable cereal grains were mainly of wheat (*Triticum* sp), a few of these had the characteristic shape of emmer, a few were short rounded grains classed as free-threshing wheat, possibly bread wheat (*Triticum aestivum* s.l.). Wheat grains consistent with the form of spelt wheat were more numerous although the majority could only be identified as either emmer or spelt. It is difficult to identify

charred wheat grains with certainty because of wide intra- and inter-specific variation in grain characters today (Hillman et al 1995), and because distortion can occur on charring (Jacomet 1989). Hence only the most characteristic grains were identified to type. Evidence of germination was found as detached cereal sprouts which were numerous in one of the samples. Barley (*Hordeum vulgare*) of a hulled form was found with the occurrence of twisted grains indicating the presence of six-row barley, a few germinated grains were found and a few chaff fragments (rachis segments). Oats (*Avena* sp) were present probably as a weed or contaminant of the cereals.

Other cultivated plants: Seeds of flax or linseed (*Linum usitatissimum*) represent a further crop and a fragment of a larger legume (*Vicia/Pisum/Lathyrus*) may represent food or fodder.

Gathered food: This was represented by hazel (*Corylus avellana*) nut shell fragments, sloe (*Prunus spinosa*) and wild or sour cherry (*Prunus avium/cerasus*) as an additional fruit to those found in the waterlogged deposits. Blackberry (*Rubus fruiticosus*), hawthorn (*Crataegus* sp) and elder (*Sambucus nigra*) berries may also have been consumed, all these plants may represent scrub or possibly hedgerows in the area. Thorns of blackthorn or hawthorn and a thorn, possibly of bramble, were also found.

Wild plants: Most of the plants found were those of arable or disturbed ground probably present as weeds of the crops. They include those those typical of autumn sown cereals such as corncockle (*Agrostemma githago*) and cleavers (*Galium aparine*). Spelt is usually considered to be an autumn sown crop. The large grasses including brome grass (*Bromus* sp) were the most numerous in the samples and this was a common weed of cereals in the past. Weeds of disturbed land, such as is found in settlements as well as in cultivated fields, included such plants as goosefoots (*Chenopodium* sp) and stitchworts (*Stellaria* sp). Plants of sandy soils were represented by wild carrot (*Daucus carota*). A group of grassland plants is also present including eyebright or bartsia (*Euphrasia/Odontites*), selfheal (*Prunella vulgaris*), ribwort plantain (*Plantago lanceolata*) and the grasses (*Phleum* sp. and *Cynosurus cristatus*). Plants of damp ground such as sedges (*Carex* sp) and spike-rush (*Eleocharis* sp) were also present. Some of these plants may have been brought to the site for such uses as fodder or flooring, however all the above mentioned could have grown in the cultivated fields which were much less uniform in the past. Plants used for thatching may have included bulrush or club-rush (*Schoenoplectus* sp) as well as straw.

A few different weeds appear during the Roman period these include the crop weeds corncockle, scentless mayweed (*Tripleurospermum* sp) and stinking mayweed (*Anthemis cotula*) identified from the charred remains from the palaeochannel (Murphy forthcoming, table 5). Other plants such as the mallow (*Malva sylvestris*), henbane (*Hyoscyamus niger)* and white bryony (*Bryonia dioica*) are possibly weeds of the settlement (table 4). The latter is more often found in waterlogged deposits but charred specimens were recovered from this site. Roman contexts at Leicester (Monckton 1999) have also produced charred seeds of white bryony.

Types of remains in samples: In order to interpret the samples it is necessary to consider what is known about processing cereals from ethnographic studies. Spelt is a glume wheat in which the grains are held firmly in the chaff even after threshing, which only breaks the ears into segments called spikelets. This type of wheat could be stored as spikelets because the chaff protected the grains from weevil and fungal attack (Hillman 1984). Before use, the

chaff could be removed by parching by heating, then pounding, followed by fine-sieving to remove the chaff (glumes) and any small weed seeds, leaving cleaned grain for use (Hillman 1981). The waste chaff can be preserved by charring if it was burnt, either as rubbish, or if it was used as fuel or kindling. Evidence for this fine sieving waste is found where the ratio of glumes to wheat grains is high because in the ear of wheat there is one glume to each grain so an excess of glumes in a sample indicates that this waste is present. Similarly a high ratio of weed seeds to cereal grains also indicates cereal cleaning waste (van der Veen 1992). When samples are found with grain more abundant than chaff (figure 1) they may originate from domestic use of grain or may represent part of the product at various stages of cereal processing. Large seeds such as those of cleavers, large grasses and black bindweed were probably hand sorted from the grain before use as they are not removed by fine sieving.

Discussion of results by phase

Phase II Late Iron Age/Early Roman (mid 1st century BC-mid 1st century AD)

The 20 selected samples were relatively productive giving a total of 2961 items of charred plant remains ranging from 0.7-79 items per litre, average 14.9 items per litre (table 1). Wheat was the main cereal, mostly spelt with occasional remains of emmer. Barley was present only sparsley in five of the samples. Most of the samples were dominated by chaff or weed seeds showing the presence of cereal cleaning waste (fig 1).

Northern zone samples were relatively poor containing a scatter of cereal cleaning waste consisting of wheat chaff, weed seeds and a few grains. This was present in the Area D samples including the storage jar oven D406 giving little indication of the use of the oven. The sample from F1540 was more productive being dominated by weed seeds particularly large grasses, a common contaminant of cereal grain at the time. Sample D306 contained a group of charred elder seeds which may have been food waste gathered from scrub or hedgerow. This scatter possibly suggests domestic activity in this area.
Central zone samples include H2138 as the most productive from the site with abundant wheat chaff and seeds representing fine sieving waste from dehusking wheat. The pit sample H2163 differs from other samples from this period in being dominated by cereal grains which may be waste from food preparation, the sample also contains abundant hazel nutshell and a fragment of a possibly edible legume supports this interpretation. The sample from J1109 thought to be a destruction layer of the temple area, contained only a small amount of cereal cleaning waste probably accumulated from the general scatter of domestic waste on the site.
Southern zone pits produced a larger number of productive samples than the other areas of the site which contained samples dominated by wheat chaff and weed seeds. Areas K, L and N all contained productive samples with Area L most productive. This material probably represents waste from dehusking batches of wheat for consumption with the waste being burnt and the hearth cleanings dumped in the pits. The evidence would suggest that this activity took place in this area. Ditch L791 also contained this waste so was probably also used for rubbish disposal at this time.
Peripheral area sample R2433 from a storage jar oven contained only material similar to the general scatter of cereal cleaning waste as found in the oven in Area D above. This probably represents disuse and most other hearths and ovens examined produce few remains suggesting they were cleaned after use.
Phase III Early Roman period (Later 1st to mid 2nd century AD)

This was the most productive phase with a total of 4724 items from the 20 most productive samples ranging from 1-88 items per litre, average 16.6 items per litre (table 2).

Northern zone samples were most productive particularly the area D well sample D396 which in disuse was used for rubbish disposal. The sample contained very abundant spelt chaff and evidence of germinated cereal from numerous cereal sprouts, these were fairly uniform being around 4mm in length suggesting that this was waste from malting. The germinated grain was roasted to halt germination before extracting the malt for brewing. The favoured fuel for this purpose was waste chaff and here this is mixed with detatched sprouts similar to the charred waste found in the phase IV palaeochannel (Murphy forthcoming). Spelt is known to have been used for malting in the Roman period as at Catsgore (Hillman 1982), the use of barley for malt being unknown until the Anglo-Saxon period (G. Campbell pers com). Hence this deposit suggests that brewing was being carried out nearby and also provides evidence of larger scale dehusking of wheat than is seen on the rest of the site. A second sample from a ditch D410 also has a high concentration of dehusking waste.
The sample from the beaten earth floor of Building 54 of area G sample G1223 contains abundant wheat chaff with a few grains and very few seeds mainly of large grasses. This can also be interpreted as fine sieving waste from dehusking wheat. This may be part of the scatter of waste from the site mixed with the flooring material rather than reflect the activity within the building, although the waste chaff may have been burnt in a domestic hearth within the building. It does however show the high concentration of this waste in the Northern zone in this period.
Central zone samples again show fairly high concentrations of remains in Area H although only fine sieving cereal cleaning waste was found. The samples from Area J also compare with those from the previous phase being less productive than others on the site perhaps suggesting a cleaner area.
Southern zone samples are less productive on Area K than in the previous phase all the samples producing few remains. Productive samples were found on Areas L, N, P and Q with N the most productive. Samples on Area N also differ in being richer in grains and having the highest proportion of barley from the site. A few germinated barley grains were found in sample N1674 but this is too little evidence to suggest malting. Some grassland plants such as eyebright, selfheal, crested dog's-tail grass and cat's-tails grass are present in this sample which may suggest the presence of fodder although these could be weeds of the cereals, barley was however sometimes used as animal food. The pit may well contain a mixture of waste from different activities. The general high concentration of cereal waste in this zone shows that mainly domestic activity continued here.

Phase IV-VI Middle to Late Roman

These phases were considered together as the productive samples were fewer, this was despite over 200 samples being processed, 128 being assessed and additional samples having residues refloated and sorted. A number of these samples produced nothing. The 20 most productive samples produced 1345 items averaging 3.5 items per litre of soil (table 3 and 4).
More productive samples were found at the periphery of the site (Murphy forthcoming).

Northern zone samples were unproductive and lacked cereal remains, only charred seeds were found in samples from Area E.

Central zone samples were similar, the hearth H2105 producing only a few charred seeds with a few fragments of hazel nutshell as evidence of food waste. Area J was even less productive despite assessment and sorting of more samples, suggesting a clean area with little accumulation of charred waste.
Southern zone produced more samples with charred plant remains but much less than in the previous phases. A pit from Area K sample K681 was the most productive from this period containing evidence of fine sieving waste from dehusking spelt but other samples from this area showed little potential. Of the other pits K729 contained a cherry stone giving evidence of the availability of this fruit. Area L produced most remains from fills of a kiln and stokehole which contained samples dominated by weed seeds but included cereal grains probably from a scatter of domestic waste. A pit L794 and well samples L752 and L788 contained samples with more grain present which probably represent domestic waste from food preparation. Area M samples were less productive but contained a scatter of cereal waste while area N kiln sample N1657 was dominated by weed seeds as were those from the kiln of area L. These probably include weeds growing on the site as well as domestic waste.
Peripheral zone samples from features were unproductive. Hearth R2434 containing very few remains similar to the general scatter of domestic waste. However, the palaeochannel sampled for waterlogged plant remains contained a high concentration of charred wheat chaff (Murphy forthcoming, table 5). The phase IV samples R2413 and R2416 contain around 200 charred items per litre and over 95% of wheat glumes (fig 1). Hence Murphy concludes that dehusking waste was dumped in the channel. The samples also contain numerous cereal sprouts suggesting that malting was possibly carried out on the site (Murphy forthcoming). Samples assessed from the hinterland Area W included two grain rich samples from phase IV features identified as corn driers (2647) and (3042) (Murphy unpublished). The first contained only wheat grains the latter was dominated by wheat grains with a moderate amount of chaff and very few weed seeds. Both appear to represent the remains of cereal product being parched, probably for dehusking. This evidence shows larger scale cereal processing was being carried out at the periphery of the settlement at this time.

Discussion

The main cereal is spelt wheat throughout the phases examined with a trace of emmer and occasional bread wheat type grains as found at many other Iron Age and Roman sites in England (Greig 1991). Barley is also present as a second cereal but is poorly represented in the samples. Many of the weeds are present throughout all periods such as brome grass, goosefoot, docks, spike-rush, sedges, clover type plants, blinks, black bindweed and cleavers. This may suggest continuity in the basic methods of cultivation, this group of weeds appears to have more similarities with the weeds of extensive cultivation than intensive garden type cultivation as described by van der Veen (1992). However this could only be investigated by detailed statistical analysis which is beyond the scope of this project. Autumn sowing of the wheat is suggested by the presence of cleavers in all periods. In phase II wild radish and wild carrot occur suggesting cultivation of light sandy soils for at least some of the crops, although damp ground plants are also more numerous in this phase. Roots and tubers are only present with the cereals in this early phase perhaps indicating more uprooting of cereals during harvesting, with the practice being discontinued in the later periods. In phase III more chickweed type weeds were found than previously and the additional weeds included corncockle and mayweeds with common mallow and club-rush, and the continued presence of cleavers. The presence of short, as well as tall weeds, indicated that the cereal was probably reaped low on the straw.

In the later Roman periods additional weeds occur including the arable weed corncockle which becomes more abundant in England from Roman times onwards, as does stinking mayweed found in phase IV. The latter is usually associated with clay soils (Greig 1991). However, it is also known to occur on soils of medium texture where drainage is poor (Kay 1971). It occurs only sparsely in the waterlogged deposits (Murphy forthcoming). Plants of damp ground such as sedges and blinks occur throughout the phases of the site probably growing in areas of the cultivated fields which were much more variable in the past. In the later phases lower numbers of arable weeds may be explained by less cereal cleaning waste being found, although the most common weeds are present.

Weed seeds dominate many of the samples from features such as kilns where abundant charcoal provided evidence of wood being used as the fuel. The weeds in the kilns may originate from dried weedy vegetation used as kindling or incidentally included with the fuel, so probably include the weeds of the settlement mixed with a scatter of domestic waste. Additional weeds include henbane, a poisonous weed of organically polluted ground such as that near rubbish pits and latrines, perhaps present here because of the accumulation of organic material in the soil during the lengthy occupation of the site. Henbane together with mallow and bryony are thought to have belonged to the urban flora of Roman towns which has been described as being similar to that of a traditional farmyard environment (Hall 1988). Parts of the site here may have been used as farmyards, although the conditions may not have been very different to those found in parts of the towns at this time particularly in areas around rubbish pits.

Comparisons with other sites

The spelt dominated assemblage compares with that described from other Roman sites in Eastern England where many areas seem to have been agriculturally productive (Murphy 1997). The main cereals of the Iron Age were the glume wheats, emmer and spelt, with a shift towards spelt during the Iron Age (Murphy 1997). Iron Age sites in the region are typified by generally low densities of remains with concentrations in some domestic contexts (e.g. Murphy 1992). In contrast Roman rural sites in the region tend to have more concentrated deposits of dehusking waste in features associated with crop processing, or with the waste as spent fuel dumped or accumulated in features, often at the site margin. Rubbish pits are also a common feature on many Roman sites.

Throughout the Roman phases at Elms Farm pits were the most productive type of feature, and the least productive were postholes. The Late Iron Age/Early Roman remains in phase II are more abundant than those from many Late Iron Age sites in the Midlands although very productive extensive Iron Age sites are known from the Thames Valley, often with abundant cereal grain (Jones 1985). Some sites in the Eastern region are also productive with a sample from Caistor St Edmund having a density of around 73 items per litre (Murphy 1992). A phase II sample has a comparable density of 79 items per litre and the average of 14.9 items per litre for the selected samples is quite high, with the samples mostly dominated by chaff and seeds. The distribution, type and the amount of cereal cleaning waste found in phase II is more similar to that from Roman sites, and the spread of material compares with that found at the Romano-British village at Tiddington, Warwickshire (Moffett 1986). In phase III the remains are generally similar but with the additional evidence of larger scale processing in one area, probably including waste from malting spelt wheat as found at a number of Roman sites (Hillman 1982, Murphy 1999). The main change found in the samples occurs in the later Roman phases which have little material on

the settlement site but a high density of charred remains at the periphery with c.200 items per litre from the palaeochannel. This deposit also produced evidence of malting spelt (Murphy forthcoming) with remains similar in character to those from corn driers associated with malting at Stebbing Green, Essex (Murphy 1999).

It is difficult to distinguish between consumer and producer sites from the type of cereal remains alone (Smith forthcoming). It has been pointed out that there are a range of possibilities between types of economy and most types of occupation site consume cereals (van der Veen 1996). Concentrations of grain may therfore be found on any site where cereals are consumed. First threshing waste is rarely found charred because straw is a useful material itself. Furthermore spelt is a glume wheat which can be transported and stored in the chaff and processed in batches before consumption, hence the waste can be found on consumer and producer sites (Hillman 1984). Chaff is also a useful by-product, as well as being used for fuel it can be used for other purposes such as for fodder (van der Veen 1999) when it is unlikely to be preserved. Chaff may even be traded for use (Smith forthcoming), although perhaps this was less likely where grassland and woodland resources were available. However, deposits of abundant cleaned cereal grain found in Colchester (e.g. Murphy 1984) have lead to the conclusion that cereals were processed at some rural sites to supply towns (Murphy 1990). At Duck End Farm, Stansted, samples interpreted as cereal cleaning waste included a sample containing 580 glumes per litre, and that site was identified as a producer and large scale processor of grain for supply to other settlements (Murphy 1990). The waste chaff was very much more abundant there than found at Elms Farm.

The samples here have more abundant remains, particularly chaff, than found at Stonea, Cambridgeshire, which was thought to be a small scale consumer or subsistence producer (van der Veen 1996). The Roman site at Pakenham, Suffolk, produced chaff and seed dominated samples of a similar density to those from Elms Farm, and Pakenham was thought to be a producer and processor of cereals, possibly for distribution (Murphy and Wiltshire 1989). There, pollen and waterlogged plant remains gave evidence for pasture and meadow, as well as cereal production suggesting a mixed economy,

Sites in the Blackwater Valley studied by Wiltshire and Murphy (1998) have produced waterlogged evidence for an increasingly open landscape from the Bronze Age onwards with large areas of grassland, leading to the conclusion that pastoral farming was always important in the area. Charred cereal remains present from the Neolithic period onwards increased markedly in density in the Late Iron Age and Early Roman period (7.08 and 287.3 maximum number of glumes per litre respectively, from less than one per litre in the earlier periods). This corresponds with an increase in cereal pollen as evidence of arable expansion, together with the date of the ditched field system, drainage being necessary to increase cereal production on the local soils (Murphy 1998). A mixed economy was suggested for the area, although the importance of arable may have varied between the sites, there was evidence for cereal and flax production or processing at both sites studied (Wiltshire and Murphy 1998). The maximum densities of charred cereals from Elms Farm fall into the same range (33.4 glumes per litre in phase II and 203 in phase IV) following the pattern of arable expansion. Grassland and possibly hay meadow are also indicated in the vicinity of Elms Farm from the plant macrofossils in the waterlogged wells (Murphy forthcoming). This suggest that a mixed economy of arable and pastoral farming was probably also carried out here. Animals would have been necessary for traction and manure for cultivation.

The charred plant remains found here compare with those from Pakenham mentioned above, which suggests that this site could also have been a producer and processor of cereals. Wheat was probably grown on lighter well drained soils such as those on the gravels on the higher terraces to the north of the site (Atkinson and Preston 1998). However, when the size of the settlement at Elms Farm is taken into account considerable resources would have been required for self sufficiency. It is possible that the cereals were used to support the settlement in order to manufacture other products to trade, or to support pastoral farming, although export of grain is also possible, particularly in the later phases.

Conclusions

In Phase II cereal cleaning waste representing processing batches of spelt on a domestic scale was found mainly in pits, it was present in the Northern zone but more concentrated in the Southern zone showing more intense domestic and agricultural activity there in this phase. Evidence of waste possibly from food preparation was found in Area H although few remains were found in Area J samples. In Phase III differences in activity are shown in the Northern Zone where evidence of larger scale dehusking of wheat and malting waste were found. In the central zone disposal of cereal waste continued in Area H but Area J continued as in Phase II, to have fewer remains perhaps as a reflection of the ritual use of this area. Activity on a domestic scale continued in the Southern zone from the evidence of cereal cleaning waste disposed of in pits with less evidence from Area K than previously. Area N differed in having evidence for the use of barley and possibly waste fodder being burnt. The spread of wheat chaff over these areas of the site shows continuity with phase II.

In the Later Roman phases much less cereal cleaning waste was found within the settlement which may be explained by the processing being carried out on the periphery of the site. Abundant waste chaff was found by Murphy in the palaeochannel on Area R, along with evidence of malting, and grain rich samples were noted from corn driers in Area W. This processing was probably on a large scale for the whole settlement, rather than in batches on a domestic scale which seems to have been the case in the earlier phases. Hence the main difference in cereal related activities on the site appears to occur between phases III and IV with the replacement of generally domestic scale processing of cereals with larger scale processing on the periphery of the site.

In all phases the main cereal was spelt wheat with a trace of emmer, and barley as a second cereal, the majority of the weeds were probably present as weeds of the crops. There is insufficient evidence to suggest that cereals were grown or processed for export because spelt can be stored and transported in the chaff, but the wheat is likely to have been grown on the better drained soils in the vicinity to supply the settlement. Other crops were represented by a legume fragment in phase II and flax or linseed in phases II and III. Hazelnuts and sloes were present throughout the phases of the site, with bramble, hawthorn and elder present sporadically on various areas. Wild or sour cherry was found only in the later Roman period. These could all have been consumed and may have been gathered from hedge or scrub nearby. Additional weeds appeared in the later phases including crop weeds, and some plants probably present as weeds of the settlement which are also found in towns of this date. Similar conditions may have occurred here as a result of similar activities such as the disposal of rubbish in pits being carried out over a long period of occupation, probably made necessary because of the large size of the settlement.

Acknowledgements

I would like to thank Lisa Moffett for her contribution to the assessment, Dominique de Moulins for help with the assessment, Peter Murphy for advice and for information from his analysis, Peter Boyer for supervising the processing and sorting on site and Wayne Jarvis for help during the analysis. I am also grateful to Steve Preston for information about the site and to Mark Atkinson for information, discussion and the opportunity to work on the project. I would also like to thank Gill Campbell of English Heritage for reading this report and offering helpful suggestions.
This work was funded by English Heritage and carried out at University of Leicester Archaeological Services, University Road, Leicester LE1 7RH.
October 30th. 2000. ULAS Report 2000/95.

Bibliography

Atkinson M., and Preston S.J. 1998 The Late Iron Age and Roman Settlement at Elms Farm, Heybridge, Essex, Excavations 1993-5: An Interim Report. Britannia XXIX, 85-110.

Greig J., 1991 The British Isles in W. van Zeist, K. Wasylikowa and K. Behre eds. Progress in Old World Palaeoethnobotany. Rotterdam: Balkema. p299-334.

Hall A. R., 1988 Problems of reconstructing past urban floras and vegetation in M. Jones (ed) Archaeology of the flora of the British Isles. Oxford University Committee for Archaeology 1988. pp93-95.

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

Hillman G., 1984 Interpretation of archaeological plant remains: The application of ethnographic models from Turkey. in W. van Zeist and W.A. Casparie (eds) Plants and Ancient Man. A. A. Balkema: Rotterdam. (1984) p1-41.

Hillman G., 1982 Evidence for malting spelt, in R Leech (ed) Excavations at Catsgore 1970-73. A Romano-British Village. Bristol: Western Archaeological Trust Excavation Monograph 2, p137-41.

Hillman G., Mason S., de Moulins D. and Nesbitt M., 1995 Identification of archaeological remains of wheat. Circaea 12, 2, 1995. pp195-209

Jacomet S. 1989 Prahistorische Getreiidefunde. Botanisches Institut der Universitat Abteilung Pflanzensystematic und Geobotanik. Basel (1987).

Jones M., 1985 Archaeobotany beyond subsistence reconstruction in G. W. Barker and C. Gamble eds Beyond Domestication. in Prehistoric Europe p107-127. Academic Press Inc. (London) Ltd.

Kay Q. O. N., 1971 *Anthemis cotula.* Journal of Ecology 59, pp623-636.

Moffett L., 1986 Crops and crop processing in a Romano-British village at Tiddington, Warwickshire: The evidence from the charred plant remains. Ancient Monuments Laboratory Report 15/86 English Heritage, London.

Monckton A., 1999 *The plant remains* p346-362 in A. Connor and R. Buckley 'Roman and Medieval Occupation in Causeway Lane, Leicester.' Leicester Archaeology Monograph No.5, University of Leicester 1999.

Murphy P., 1984 Carbonised fruits from Building 5 in P. Crummy, Colchester Archaeological Report 3: Excavations at Lion Walk, Balkerne Lane, and Middleborough, Colchester, Essex. Colchester Archaeological Trust Ltd. 1984.

Murphy P., 1990 Stansted Airport, Essex: Carbonised Plant Remains. Ancient Monuments Laboratory Report No 129/90. English Heritage.

Murphy P., 1992 Norwich Southern By-pass: Plant remains from Beaker, Bronze Age, Iron Age, Romano-British and Late Saxon contexts. Ancient Monuments Laboratory Report 20/92. English Heritage.

Murphy P., 1997 Roman Environment and Economy in J.Glazebrook (ed) Research and Archaeology: a Frame work for the Eastern Counties, 1. resource assessment. East Anglian Archaeology Occasional Paper No. 3, 1997. p42.

Murphy P. 1998 Charred Plant Remains, in S. Wallace and M. Waughman Archaeology and landscape in the Lower Blackwater valley. East Anglian Archaeology 82, 196-204. Essex County Council: Chelmsford.

Murphy P., 1999 Charred plant remains and molluscs from Roman contexts in O. and M. Bedwin (eds) A Roman malt house: excavations at Stebbing Green, Essex 1988. p19-21.

Murphy P., forthcoming Elms Farm, Heybridge, Essex: plant macrofossils from wet and waterlogged contexts. Ancient Monuments Laboratory Report. English Heritage

Murphy P. and Wiltshire P. E. J. 1989 Pakenham, Suffolk: Environmental and Economic Studies. Ancient Monuments Laboratory Report 99/89. English Heritage.

Smith W., forthcoming When method meets theory: the use and misuse of cereal producer/consumer models in archaeology, in U. Albarella (ed) Environmental Archaeology: meaning and purpose. New York: Academic/Plenum Press.

Stace C., 1991 New flora of the British Isles. Cambridge University Press.

Veen, van der M., 1992 Plant Husbandry Regimes. Sheffield Archaeological Monographs 3. J. R. Collis Publications, University of Sheffield.

Veen, M. van der, 1996 Plant Remains in R.P.J. Jackson and T.W. Potter Excavations at Stonea, Cambridgeshire 1980-85. British Museum Press: London. p.613-639

Veen, van der M., 1999 The economic value of chaff and straw in arid and temporate zones. Vegetation History and Archaeobotany (1999) 8: 211-244.

Wiltshire P.E.J., and Murphy P. 1998 An analysis of plant microfossils and macrofossils from waterlogged deposits at Slough House and Chigborough Farms, in S. Wallace and M. Waughman Archaeology and landscape in the Lower Blackwater valley. East Anglian Archaeology 82, 172-196. Essex County Council: Chelmsford.

Zohary D. and Hopf M., 1993. Domestication of plants in the Old World. (2nd ed.) Oxford: Clarendon Press.

Illustrations

Plan 1: Plan of Elms Farm, Heybridge, Essex to show the areas of the site (from Atkinson and Preston 1998).
Figure 1: Barcharts by phase, showing the proportions of glumes, grains and seeds in the samples analysed, with density of remains as items per litre of soil sieved.