Assessment of charred and mineral-replaced macroscopic plant remains from excavation at Lyminge, Kent, 2008-10

Gill Campbell
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Introduction

Nearly every context was sampled for the recovery of charred plant remains as part of the three seasons of excavation at Lyminge with additional samples taken for other purposes such as micromorphology and for radiocarbon dating. Samples ranged in size from 2.5 litres to 40 litres. Each bag, roughly equivalent to 5 litres, was processed separately as bag 1 of 1 and 2 of 2 etc. meaning that it was possible to investigate intra-context variation as part of this assessment. 66 samples were available for assessment from the 2008 excavations, 48 from trench 1 and 18 from trench 2. 144 samples were available from the 2009 excavations and 129 from the 2010 excavations of which 70 came from the 4 sunken-featured buildings (SFBs) and 59 from other features including the post –built timber hall. Samples were floated using a modified Siraf tank with a 250 micron mesh employed for flot (the material that floats) and a 1mm mesh for the residue (the material that does not float).

The principal aims of this assessment were establish the potential of the macroscopic plant assemblages to answer the following research questions:

- What types of cereals were being utilised at the site and how does this vary over time?
- What types of crop processing activities may have taken place within the areas of intervention?
- Is there any evidence for: a.) crops other than cereals, b.) useful plants?
- Is there any evidence for long-distance trade such as the presence of imported fruit and spices?
- What is the nature of the charcoal assemblages and what information might they provide on fuel use and use of timber in construction?
- Is there variation between assemblages from the same context (intra-context variation and between different contexts types and features (inter context variation)?
- How do the macroscopic plant remains from Lyminge compare to other assemblages of the same period, especially Bishopstone, East Sussex?

Methods

At least one flot from each of the samples was assessed as to its contents by scanning under a binocular-dissecting microscope at magnifications up to x 50. The preservation and the nature of any plant remains present was recorded. Notes were made on the range of other material encountered in the flots. The amount of charcoal, cereal grain, weed seeds, and cereal chaff present in each flot was recorded using the following five point scale: 1=

present, 2=frequent, 3=common, 4=abundant, 5=superabundant. Preliminary identifications were also made and possible interpretations of the larger assemblages put forward

In addition, the residues (the material that does not flot) were examined from the 2009 samples as in many cases they contained mineral-replaced remains which are generally too dense to float. Material from residues was recorded in a similar manner to that from flots except that in this case a series of '+'s were used to indicate abundance. (e.g. +++ =common).

Identification of plant remains took place with reference to the modern comparative collection held at Fort Cumberland (English Heritage). Nomenclature follows Stace (1997) for wild plants and Zohary and Hopf (2000, table 3, table 5) for the cereals. As florets of cultivated common oat (*Avena sativa*) were found in 2 samples, indeterminate oat grain has been considered along with the other cereals. Although, it remains a possibility that only wild oats, a mixture of wild and cultivated oats are present most of the samples. It was not possible spend much time undertaking the detailed examination of the morophology of the wheat grain in each sample as part of this assessment, rather the presence of typical naked and hulled wheat type grains was noted where observed though no attempt was made to estimate the relative numbers of the different types in each sample. Where mineral-replaced mystery objects are recorded this refers to the typical items found in mineral-replaced deposits which are described by Carruthers (1988) but still remain unidentified.

Results

The results of the assessment of the flots and residues from the two principal phase of occupation are present in Appendix 1. This table combines the results obtained from the different sub-samples for the sake of brevity. However, it was clear that there was considerable variation between the different sub-samples, in particular the amount of mineral-replaced material recovered in any one sub-sample and also the range and type of charred plant remains recovered (see for example notes on sample 22 (pit fill 1312).

Middle Bronze Age vessel

Six samples were taken from contexts associated with an *in situ* ceramic vessel provisionally of middle Bronze Age date in the southern half of the trench dug in 2010. Both the contents and the area surrounding the vessel were sampled. Only very tiny fragments of charcoal of a size below which identification is not possible were observed in flots examined from these samples.

6th-7th-century occupation

Samples from this phase of the occupation produced far fewer plant remains, including charcoal, than those from 8th-9th century contexts. Cereal grain was only present in small quantities in any one sample and no cereal chaff was

found. In addition, preservation of cereal grain was generally poor to very poor meaning that specimens could only rarely be identified beyond genus level. Never the less both naked wheat type (probably bread wheat) grain and hulled six-row barley were identified a number of contexts within this phase Oat grain was also present in some samples but in the absence of oat chaff it is not possible to ascertain whether cultivated as opposed to wild oats or both were present. The samples also produced very little in the way of weed seeds and only samples from SFB 1 and 2 and sample 75 (fill 2560), and one additional sample, produced reasonable numbers of charcoal fragments.

SFB 1: 29 samples were available for assessment from this building. Both naked bread wheat type grain and hulled twisted barley grains were present as well as oat grain and one grain which might be rye but was too poorly preserved to for certain identification (see Table 1). The occasional fragment of large legume (*Vicia/Pisum* sp.) was also noted, but again too poorly preserved to allow further identification. Occasional weed seeds comprised indeterminate large grasses and fat hen (*Chenopodium* cf. *album*), while one sample contained a fruiting body of the soil fungus *Cenococcum* sp.

Some of the post holes associated with this feature produced reasonable amounts of charcoal including ash, oak and willow/poplar type.

SFB 2: 15 samples were available for assessment from this feature. They were notably rich in charcoal, reflecting the concentrations of charcoal observed in the field. Ash and oak were well represented but other taxa were also present including at least one fragment of conifer wood.

Occasional cereal grains were present in 12 of the samples examined (see Table 1). Barley was more commonly recovered than wheat, while only two samples contained oat grain. Hulled wheat type grain was present in samples 29 and 9. Sample 94 also produced one *Vicia/ Pisum* sp. fragment. Weeds noted in samples from this feature were charred mustard, charlock or cabbage (*Brassica/Sinapis* sp.), mouse-ear (*Cerastium* sp.) and fat hen.

SFB 4: This as the most poorly preserved of the SFBs investigated, with 7 samples for assessment. Only three samples contained any cereal grain. Wheat grain was recorded in sample 16 from this feature and barley grain in sample 68, one of which showed definite signs of germination. No weed seeds were noted in any of the samples.

Other contexts including the post-built timber building: Under a third of the samples assessed from these contexts contained cereal grain, although it should be noted that the majority of the samples were of rather small size, being principally taken for the recovery of material for radiocarbon dating rather than for charred plant remains *per* se. However, contrasting with the samples from the SFBs wheat was more frequent in the samples than barley (see Table 1). Only three samples produced weed seeds. A vetch or tare (*Vicia/Lathyrus* sp.) was present in sample 15 (fill 2105), an indeterminate large grass in sample 57 (fill 2371) and stinking mayweed (*Anthemis cotula*) in sample 75 (fill 2560).

Sample 75 from fill 2560 was the exception within this group of samples as it was the only sample to produce a reasonable number of charred plant remains, including a large number of charcoal fragments, especially ash wood. It also contained some mineral-replaced remains: earthworm eggs and a seed belonging to the mint family (Lamiaceae indet.). Charred cereals recorded were hulled barley grain (six-row hulled barley is indicated from the presence of twisted grains, one of which had sprouted), bread wheat type grain and oat. Sprouted barley was also noted in sample 32 (fill 2357), while sample 19 (fill 2272) contained a wheat grain showing possible evidence of grain weevil damage.

8th-9th century occupation

SFB 3: This sunken-featured building has been tentatively dated to this phase of the occupation and the results from this feature are therefore presented here. 19 samples were available for assessment. Cereal grain was only present in only six with barley more frequently recorded than wheat grain (see Table 1). In comparison with SFB 1 and 2 ash and oak wood were less evident. Sample 77 was the only sample to produce a number of charcoal fragments, including a large fragment of willow/poplar type wood. Vetch or tare remains were noted in samples 49, 76 and 77 and one indeterminate large legume was recovered from sample 66. A single dock seed (*Rumex* sp.) was present in sample 45.

Lyminge 2008 trench 1: Nearly all the samples were retrieved from pits (42 samples) or post-holes (23 samples) reflecting the nature of the archaeology in this trench. A fair proportion of the samples were rich in cereal grain, but very little cereal chaff or weed seeds were found. The presence of bread wheat (*Triticum aestivum*) is confirmed by the presence of hexaploid, free-threshing wheat rachis in sample 24 (pit fill 270). A spelt wheat (*T*. *spelta*) glume base was also recovered from this sample with a second specimen noted in sample 30 (pit fill 223), indicated the hulled grain noted in samples across the trench is likely to derive from spelt wheat. Hulled six-row barley (from the presence of twisted grains) was found most samples with one possible naked barley grain recovered from sample 36 (254). Rye was noted in five of the samples, and appeared to form the majority of the cereal grain within sample 30. The presence of common cultivated oat (*Avena* sativa) is attested from grain which still retained its florets found in samples 24 and 37 (t fill 223), although there is a possibility that some of the material in sample 24 could derive from bristle oat (*A. strigosa*).

Sprouted grains of oat were recorded in a number of samples, in particular samples 18 (pit fill 207), 24 and 30. Sample 30 also produced some sprouted barley and a single example was noted in sample 31 (pit fill 274). There was considerable variation within the assemblages producing large numbers of cereal grain. In addition to sample 30, where rye grain was numerous, samples 2, 5, 24, and 42 appeared to be dominated by wheat grain while in samples 3 and 53 barley grains outnumbered the other cereals.

Other crop plants found as charred remains in samples from this trench were celtic bean (*Vicia faba*) in sample 5 from pit fill 164, pea (*Pisum sativum*) in sample 53 from pit fill 296, with other possible examples in samples 40 (pit fill 247) and sample 54 (post hole fill 303), and flax (*Linum usitatissimum*) in sample 24. In addition, several of the samples contained charred hazel nutshell fragments. Edible species recorded as mineral- replaced remains were apple or pear pips (*Malus/ Pyrus* sp.), mustard, charlock, or cabbage seeds (*Brassica/ Sinapis* sp.), and possible plum and /or sloe fruit stones (*Prunus* spp.).

The most frequent weeds recorded were brome grass (*Bromus* sp.), vetch or tares, docks, and cleavers (*Galium* cf. *aparine*). The larger charred plant assemblages also produced some weeds typical of medieval fields: corn cockle: (*Agrostemma githago*), shepherd's needle (*Scandix pecten-veneris*), and stinking mayweed..

Some samples also produced abundant charcoal fragments. The assemblages from pits appeared to contain a greater variety of wood types, with those from post pipes possibly containing only one taxon and in at least one case (sample 1, post hole fill 53) evidence of insect damage prior to burning.

Lyminge 2008, trench 2: All the samples available for assessment were retrieved from pit fills. While cereal grain was noted in nearly all the samples, the numbers of grains in any one sample were generally small with only sample 518 (pit fill 700) producing a reasonably large assemblage. However even in this sample preservation was poor. Hulled barley grain, naked and glume wheat type grain, and oat grain were recorded as occasional finds. A possible celtic bean was noted in sample 501 (pit fill 525).

Some of the assemblages produced numerous fragments of charcoal. Samples from two pits: sample 503 (fill 527) and sample 523 (fill 624) contained principally oak charcoal while the other charcoal assemblages from pits showed greater diversity in terms of the woods present.

Mineral replaced remains were evident in some of the samples from pit fills, notably in sample 507 (pit fill 644) which contained some cereal bran within the fragmented coprolites, the usual seeds or of *Brassica/ Sinapis* sp, as well as some particularly well preserved brasscicas which were tentatively identified as black mustard (*Brassica nigra*). Sample 515 from pit fill 684 was also rich in mineral-replaced material. A possible plum stone was identified from this feature along with elder (*Sambucus* nigra) and the usual *Brassica/ Sinapis* sp seeds.

Lyminge 2009: 83 of the samples examined as part of this assessment were recovered from pit fills, 16 samples came from post-hole fills and another 16 from ditch fills. Cereal grains (hulled six-row barley, naked wheat type, glume wheat type, oat and rye) were the most abundant charred plant remains other than charcoal in the assemblages, with cereal chaff and weed seeds present at similar levels to that seen in samples from Lyminge 2008 trench 1. Once

again, in some samples barley was the most commonly occurring cereal [e.g. sample 25 (post-ghost fill 1378), sample 64 (pit fill 1473), sample 122 (post-ghost fill 1643), sample 134 (pit fill 1653)], while in others wheat grain was predominant [e.g. sample 31, (ditch fill 1439), sample 69 (pit fill 1508), sample 123 (ditch fill 1615), sample 128 (pit fill 1142)]. In sample 134 some of the barley grain had distinct sprouts while sprouted grains of both oat and barley were recovered from sample 71 (post-ghost fill 1548). Occasional sprouted cereal grains were noted in a number of other samples.

Wheat chaff was found in 5 different samples. Spelt wheat glume bases were recorded in samples 32 (pit fill 1408), 69 (pit fill 1580), and 110 (pit fill 1508). Sample 69 also produced a hexaploid free-threshing wheat (bread wheat) rachis. Tetraploid free-threshing rachis (rivet wheat) rachis was recorded in sample 67 (pit fill 1514) and sample 71 (post ghost 1548) with a further possible example in sample 110. The types of weed seeds recorded in this trench were broadly similar to those found in samples from the 2008 excavations, a single seed of knapweed/ cornflower (*Centaurea* sp.) eyebright or red bartsia *(Euphrasia/ Odontites* sp.) and stinging nettle(*Urtica dioica)* expanded the number of different taxa recorded. A tentative identification of pea was made from sample 52 (ditch fill 1455) but otherwise the fragments of large legume found were to poorly preserved to identify to genus level.

Mineral replaced remains were frequent in many of the pit fills and were also recovered in a few samples from ditch fills. Cereal bran fragments were noted in some of the coprolite material but these were infrequent in comparison to that from West Cotton garderobe for example (Campbell 2010, 479-81). Other edible species recorded as mineral-replaced remains were: apple pips, apple or pear pips, blackberry seeds, elder seeds, probable flax seed, sloe, cherry and possible damson fruit stones, and seeds of *Brassica/ Sinapis* sp. Millipede fragments, whole woodlice, fly puparia and insect eggs were also found as mineral-replaced remains within many of the samples.

Most of the weeds seeds recorded as mineral-replaced were remains were also found as charred macro-fossils. The exceptions were a seed of hemlock (*Conium maculatum*) recorded in sample 80 (pit fill 1521), poppy in sample 51 (pit fill 1311), Lamiaceae indet in sample 130 (pit fill 1618), and Apiaceae indet in sample 137 (pit fill 1711). It may be possible to identify the latter two finds further as part of the analysis phase. In addition, while preservation in of mineral-replaced remains in sample 68 (pit fill 1552) was very variable, this was only sample where grape may be present. However the remains were very poorly preserved so this remains a very tentative identification. No definitive remains of fig were found, despite seeds of these species often being common in such deposits (e.g. Ballantyne 2011, Pelling 2003, 440, Robinson 2011, 289). Sample 57 (pit fill 1148) appeared to contain material preserved as a result of anoxic conditions that had become dried out.

Charred hazel nutshell fragments were noted in 11 samples. A possible fruit stone of hawthorn was found in sample 78 (pit fill 1095) and a possible fruit of *Sorbus* sp. (rowan, whitebeam etc.) was noted in sample 58 (pit fill 1319).

Both these samples also produced large assemblages of charcoal so it is likely that these remains represent incidental incorporations from the use of these woods as fuel. A gorse seed found in sample 92 (pit fill1374) may also derive from the use of gorse as fuel.

In general the charcoal assemblages obtained from the pits in this trench appeared to consist of a variety of woods, the exceptions were sample 106 (pit fill 1507) and 140 (pit fill 1764) which contained mainly oak wood charcoal. Several of the post-hole fills also appeared to contained only oak charcoal suggesting that oak may have formed the original posts: sample 37 (1268), 83 (1582),and sample 84 (1417).

Discussion

6-7th century assemblages

The results from the assessment show that wheat, principally naked wheat, hulled six-row hulled barley and potentially oats were used by the inhabitants of Lyminge in the 6th 7th centuries, although there is no evidence from the plant remains for crop processing having taken place in the area excavated as no chaff and very few weed seeds were found. In fact the few weed seeds recovered from the best preserved SFBs dated to this phase, such as fat hen and mouse-ear, are more typical of plants that would be found growing within the settlement and likely to be found within the soil seed bank (Campbell and Kenward forthcoming).

The only other useful plants recorded from this phase were seeds of mustard, cabbage or charlock, all of which can be used as a spice, and few fragments of pulses, where the preservation was such that was it not possible to say which species were used.

There were some differences between the assemblages obtained from the SFBs and those from the post-built timber-building and associated contexts. In the latter wheat was the most commonly occurring cereal whereas in the latter barley was more frequently recorded than wheat (Table 1). This association of SFBs with barley has been noted at other sites, e.g. Abbots Worthy, Hampshire (Carruthers 1992). It may owe as much to the way in which the cereal was consumed as to the relative importance of the difference crops. For example rubbish containing burnt stable waste is more likely of contain whole burnt grains of cereals use as fodder, i.e. barley and oats. In addition these same cereals are more likely t have been used whole in pottages and to brew ale, than wheat which is likely to be principally ground into flour for bread making.

The charcoal assemblages from the SFBs, in particular post-holes associated with these features, comprised a limited range of woods and thus it may be possible to learn how different woods were used in the construction of the building. Sample 75 (fill 560) would from a useful contrast to the results from the SFBS, potentially giving information on fuel use.

8-9th century assemblages

In addition to hulled-six-row barley and wheat, the presence of substantial numbers of rye and oat, with some of the oat clearly identified as common cultivated oat from surviving florets, indicates that all four cereals were grown, or at the very least used, by the inhabitants of the site at this time. There is also evidence for three different types of wheat and or considerable variation within the wheat crop grown. Bread wheat (hexaploid free-threshing rachis) chaff, spelt wheat glume bases and rivet wheat (tetraploid free-threshing rachis) were all identified from more than one context from this phase. The spelt glume bases seem to be associated with hexaploid free-threshing rachis and with both naked and hulled type wheat grain. This may result from the cultivation of a bread wheat with speltoid tendencies, i.e. a crop where some plants produce ears which are fully hulled as result of mutation (c.f. Miller 1992). This is suggested in particular by the morphology of the wheat grains in sample 24, which contained a mixture of typical grains and some which were very square, short, and steep sided. Alternatively in may be that both types of wheat were grown. Further investigation of the morphology of the wheat grain from the site, including detailed measurement, would be needed to establish which is the case and this should be undertaken as part of full analysis.

The records for rivet wheat chaff are less uncertain in terms of suggesting the use of rivet wheat, since only a few rachises were recorded and tetraploid type wheat grain was only observed in one context. This suggests that rivet wheat was present as a contaminant of other cereals. However, this is the first pre-Norman find of rivet wheat from southeast England known to the author and thus of particular interest. Other early records of rivet wheat come from the Midlands and in particular the Nene valley. Rachis fragments from the middle Saxon estate excavated at Higham Ferrers were dated to between 770-1000AD (Moffett 2007).

As cereal grain greatly outnumbered remains of chaff and weed seeds in those samples producing more than a few plant remains other than charcoal, it is clear that these assemblages represent the remains burnt product as opposed to the by-products of crop processing (Hillman 1981, 1984, van der Veen 2007). This suggests grain was either burnt accidentally such as during drying prior to grinding into flour, or deliberately burnt to dispose of it, such as when the grain had spoilt in storage. These aspects will require further analysis on a sample by sample basis to establish the likeliest scenario in each case taking into the account the nature of the deposits from which the assemblages were obtained. However the fact that wheat was found to dominate in some samples, barley in others, and rye in at least one assemblage, does mean that there is the potential to investigate how the different crops were used and prepared for consumption.

The presence of sprouted oat and barley in some samples may reflect the presence of spoilt grain. Oat in particular is prone to spoilage when stored in the ear (Monk, 1987, 61-62). However, the occurrence in one of two samples of sprouted oat and barley where the sprouts were well developed and where

a reasonable proportion of the grain showed definite signs of germination may indicate the presence of malted grain, and thereby provide evidence of brewing. While barley is often regarded as the preferred cereal for the brewing of ale and beer, the archaeobtanical evidence from sites of early medieval date suggests that oat beer and beer made from dredge (a mixture of oats and barley) was often brewed (Campbell 2010, Murphy forthcoming, Pelling 2006). Documentary evidence also suggests oat beer was an important product, the Domesday book recording that the monks of St Paul's cathedral brewed 67,814 gallons ale from 175 quarts of barley and wheat and 708 quarts of oats (Corran, 1975, 30).

It will be less feasible to obtain information on the types of soils on which the cereals were grown and harvesting techniques used as the weed assemblages are very small with a limited number of taxa recovered (Table 3) most of which are weeds such as brome, corn cockle and cleavers which tend to remain associated with the grain. However, some information on these aspects may be gleaned as a result of full analysis when further weed seeds may be recovered and more detailed comparison can take place between the different assemblages.

The recovery of charcoal assemblages from post –pipes and post hole fills composed entirely, or largely, of wood derived from a single taxon means that these assemblages can be used to gain a greater understanding of the use of wood in construction for this phase of the site which can then be compared with the results obtained from the 6-7th century deposits. Similarly the charcoal assemblages from the pit fills, some of which contained mainly oak charcoal and others where a greater range of taxa were observed can be compared to the assemblage from the 6-7th century pits, potentially allowing changes in fuel use to be traced.

Also attested from the charred plant assemblages from this phase are the use of celtic bean, pea and flax as well as the exploitation of hazelnuts from occasional finds of hazel nutshell. The mineral –replaced assemblages add to the picture, in particular the use of fruit, from records of blackberry, elder, sloe and possibly damsons and plums, as well as apples and or pears. Finds of mineral-replaced mustard, cabbage or charlock seeds nearly always occur within the mineralised deposits examined while one pit produced possible seeds of black mustard. This would seem to indicate widespread use of cole-seed and mustard at this time although the brassicas and their relatives do seem to survive preferentially in such circumstances (Ballantyne 2011).

While the mineral-replaced remains from the 8th-9th century deposits provide some additional information on diet, the range of plant remains recovered is rather small and cereal bran fragments rare so analysis may not be add much in the way of new species or further direct information on diet than that already obtained from assessment.

Comparison with Bishopstone

The macroscopic plant remain assemblages obtained from the 8-9th century phase of occupation are remarkably similar to those from Bishopstone (Ballantyne 2011).The charred plant remains other than charcoal comprise primarily burnt grain with few weed seeds and one type of cereal forms the majority of the grain some deposits. All four major cereals are attested from the 8th -9th century occupation and there is also evidence for the presence of spelt wheat, though not in the quantities recorded at Bishopstone. In contrast to Bishopstone, the 8th-9th century contexts at Lyimnge have produced some evidence for rivet wheat but the quantities noted during this assessment are small.

The mineral-replaced assemblages from the two sites are also very similar. Fig and lentil have not been recovered so far from contexts at Lyminge, whilst the weed taxa recorded are slightly different potentially reflecting different soil types.

Conclusions and Recommendations

The macroscopic plant remains recovered from Lyminge are of national importance. Sites from which large and varied assemblages of charred remains dating to the 8th and 9th centuries are still very rare in England, especially when associated with earlier if somewhat limited evidence of 6th-7th century date and free from contamination by underlying Romano-British occupation. Furthermore, the fact that these remains pertain to an early monastic establishment means that they have the potential to provide information on the agricultural innovation that almost certainly took place as part of this process, as evidenced in the different types of wheat encountered, the possibly use of oat and barley for brewing, and recovery of early coulter. The lack of evidence for imported fruits, such as fig and grape, and the evidence for fruits that could be locally grown within the mineral-replaced remains may also be a reflection of monastic life, the community relying on what could be grown and produced locally rather than imported from aboard. The range of material recovered and the activities taking place on the site during the 8-9th centuries are remarkably similar to those found at Bishopstone which will provide an essential comparandum.

It is recommended that around 40 to 50 samples are fully analysed from contexts dated to 8th-9th centuries. Efforts should concentrate on the samples with larger cereal grain assemblages on the samples that have produced the widest rang of mineral-replaced plant remains. Analysis of larger charcoal assemblages is also recommended, a selection from pits pertaining to the two phases of occupation and also from those features such as the post holes within the SFBs which can provide evidence on how timber was used in construction. This is likely to involve the analysis of around 20 samples.

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