WINCHESTER
A CITY IN THE MAKING

Archaeological excavations between 2002 – 2007
on the sites of Northgate House, Staple Gardens and the former Winchester Library, Jewry St

Section 15

Charred and mineralised plant remains
by Wendy Carruthers

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Contents

Introduction

Although excavations have taken place through the 1970s and 1980s on many sites in Winchester, the recently published synopsis of these investigations (Serjeantson & Rees 2008) has shown that the environmental evidence recovered from these assorted sites is patchy and difficult to interpret. As Serjeantson points out, urban bone and plant assemblages are notoriously difficult to interpret, with problems such as contamination and complex stratigraphy requiring detailed analysis. In urban situations where plant remains are often abundant, it can be particularly difficult to gauge whether or not charred plant assemblages are representative of a period, as opposed to representing sporadic atypical accidents, and to what extent residuality is a problem. In his discussion of the charred and mineralised plant remains in Serjeantson & Rees (*ibid.*), Frank Green noted that;

> "The lateral variation and lack of deposits of particular periods on many of these suburban sites in Winchester makes it difficult to interpret economic and social change over time in the city."

He suggested that "this highlights the need to undertake further detailed research… for the recovery of data sets of mineralised and charred plant remains from city centre sites." The examination of a large number of pits for charred cereals in order to study changes through time was one aspect that he recommended. This opportunity was presented when excavations were undertaken at the Northgate House and Discovery Centre sites. Pits producing frequent charred and mineralised plant macrofossils were abundant on these sites, and as widespread a sampling regime as possible was adopted so as to overcome the problems of 'patchy data' that Green had highlighted.

Table 1 illustrates the coverage of samples examined for this report, both spatially across the different plots, and by phase. The samples were selected following assessments of 357 flots undertaken by the author and Ruth Pelling. One hundred and forty flots were selected for full analysis. Where mineralised material was observed in the flots, residues were scanned in order to assess the potential for the recovery of faecal waste. Nineteen samples were selected to be sorted for mineralised remains. These are marked as * in Table 1 and as 'R' in the sample lists given below under the phase and plot headings.

	Pre-Roman			Roman			Post-Roman Dark Earth	Late Saxon			Anglo-Norman AD1050-1225	Medieval 1225-1550	
Plot/ phase	**1 & 1.1**	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**4**	**4.1**	**4.2**	**5**	**6**	**Total per plot**
BE1								3**					**3****
BE2										2	1*		**3***
BE3								1					**1**
BE4										7*****	2**	2*	**11********
BE5											3	1	**4**
BW1										2			**2**
BW2									10	5	2		**17**
BW3										2	9*	3	**14***
BW4									4	6*	2		**12***
BW5								1	1*	4*	1		**7****
BW6								1					**1**
SE1									1	4**	7*		**12*****
SE2										3		1	**4**
SE3								4			4		**8**
No plot	16	7	3	3	1	11	6*						**47***
Total no. samples per phase	**16**	**7**	**3**	**3**	**1**	**11**	**6***	**10****	**16***	**35***********	**31*******	**7***	**146 (19*)**

Table 1: Numbers of samples analysed for plant remains, by phase and plot. Each * represents a sample residue sorted for mineralised remains (total sorted residues = 19 samples)

The main aims of this report

Taking into account the gaps in data outlined by Frank Green (2008) and the strengths and weaknesses of the assemblages, the main aims of this report are to discuss;

- Uses of the principal economic plants (primarily cereals and pulses) using the evidence recovered from 140 flots and 20 residues. This includes considering
  - the state in which grain was being brought onto the site (processed/unprocessed),
  - whether the cereals and pulses were being grown locally, and other crop husbandry information gathered from the arable weed assemblage
  - how much of the grain and pulses might represent fodder
  - how the importance of different crops changed over time

- Additional information about diet, providing some indication of status. This information has mainly been recovered from the 19 samples of faecal waste (almost all from cess pits) from phases 2.4 to 6. The evidence includes large quantities of native hedgerow fruits and nuts, orchard fruits, and a few flavourings, with only rare imported fruits and herbs.

- The plant evidence for craft working, such as textile manufacture and dyeing.
- As well as looking at changes through time, comparisons between the different plots will be made in order to see how varied the diet of occupants of Winchester was in the Late Saxon to Medieval periods.
- Comparisons will be made to contemporary sites in the region, such as Winnall Down, Easton Lane, Oxford and Hamwic

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Methods

Samples were processed using standard methods of floatation in a Siraf-type tank. Meshes of 500 microns were used to retain the residues and flots. Residue fractions greater than 4mm were sorted for charred and mineralised plant remains. The 4-2mm and 2-0.5mm fractions were made available for microscopic sorting by the author, where this was recommended.

Flots were fully sorted by the author using an Olympus SZX7 stereoscopic microscope. Selected residues were generally sorted as follows: 50% of 4-2mm residue (usually around 1 litre of residue) plus 200ml of 2-0.5mm residue. Where residues were small (< 800ml), 100% of the 4-2mm fraction was sorted.

Quantification

Mineralised cess pit residues usually produce large quantities of faecal concretions containing abundant bran fragments (Plates 1-2). It would be impossible to count these concretions or convert them into any meaningful record (e.g. quantity of bread consumed) particularly since rate of formation is an unknown and probably variable factor. Therefore, a rough visual estimate of the percentage of residue taken up by faecal concretions was made (ie % of Petri dish covered by concretions). This provides some indication of how concentrated the cess was, and a means to compare several samples. Many fills had been 'diluted' by dumps of chalky material, presumably to dampen smells and perhaps absorb moisture. Rough estimates have been used where remains were difficult to quantify; + = occasional; ++ = several; +++ = frequent; ++++ = abundant.

Fragments of pea (*Pisum sativum*) and field bean (probably Celtic bean *Vicia faba* var. *minor* but whole seeds are needed to identify to this level) seed coat or 'testa' are also recognisable, and can be identified to species level where pulse hila are preserved (Plates 3-4). These thick seed coats tend to be present in larger, often curled fragments, perhaps because they were not always ground into flour and were sometimes eaten whole in stews and soups. These fragments were more easily quantified for comparative purposes (e.g. between plots and phases). However, it is still impossible to convert the figures in Table 2 into numbers of peas and field beans, except to use the number of hila = minimum number of individuals, but this would be a gross under-estimate. It is inevitable that many fragments will have been missed if the distinctive circular cells were not visible, or the fragments were very small or were enclosed in faeces. The figures, therefore, are useful for broad comparisons only.

Similarly, impressions of corn cockle (*Agrostemma githago*) seed coat are distinctive and quantifiable (Plate 5), but counts are useful for comparative purposes only. Once ground into flour as contaminants of the grain, the spiky seed coat from a single seed could produce several impressions in faecal material before rotting away. It is useful, however, to be able to compare the numbers of whole charred and mineralised seeds that were probably picked out of the crop before food preparation with the occurrence of impressions, to investigate the level of quality control on grain being brought into town (see discussion below).

Notes on preservation

Charred plant remains were variable in their state of preservation, with soil layers such as the phase 1.3 'subsoil' and phase 2.4 Dark Earth producing a higher percentage of unidentified grain, as might be expected for a ploughsoil. In general, surface erosion and high temperature 'vacuolation' (puffing up) was not common, so most of the charring had taken place in fairly controlled fires and ovens, and most of the charred material was probably being cleaned out of these types of features straight into the pits, rather than being swept from floors and yards. This may help to explain some of the differences in cereal distribution between different types of context, as described below.

Mineralised material (calcium phosphate replaced, see Green, 1979 and Carruthers, 2000) was found as follows (Table 2, and see Table 1 above for distribution of concentrated cess across plots).

	Total Number of samples	Trace of mineralisation	Concentrated cess
Phase 1: Pre-Roman	26	3	
Phase 2 : Roman	15	3	
Phase 2.4: Dark Earth	6	3	1
Phase 4 : Late Saxon	61	22	12
Phase 5: Saxo-Norman	31	9	5
Phase 6: Medieval	7	2	1

Table 2: Occurrence of mineralised material

Concentrated cess was obvious in many of the Late Saxon features, since amber-coloured seeds, arthropod remains and fine bran fragments were visible in the flots. In addition, residues were large, and large clinker-like concretions, some with matted straw, could be seen in the best preserved deposits. Apart from the 19 samples examined for mineralised remains, a few other features (e.g. CC2177, NH2619, NH2134, NH2237) contained reasonable quantities of material but these were not analysed in datail.

Traces of mineralisation were widespread in phase 4 and, to a lesser degree phase 5. This usually consisted of occasional brassica seeds (*Brassica/Sinapis* sp.), worm cocoons, millipede fragments or ‘nodules’ (see Carruthers 1989). In some of the sample residues that were assessed but not considered to contain concentrated cess, bran-rich concretions were scarce or the concretions contained mineral soil but no visible bran. In these cases either the preservation conditions were not suitable for mineralisation to take place and the organic matter had decayed away, or low concentrations of redeposited cess were present. Midden material or faecal waste containing mineralised remains had also been trampled around the site, since occupation layers frequently contained traces of mineralisation.

Contamination – residual and intrusive plant remains

Urban multi-period sites present huge problems for environmental archaeologists due to re-working of the same soils and the formation of numerous thin interleaved occupation layers. Unless abundant radiocarbon dating is carried out it is impossible to determine the extent to which contamination has occurred, particularly with charred cereal grains. One indication of possible contamination might be the occurrence of unexpected taxa, although dating would have to be carried out in case genuine early introductions, or the continued cultivation of old crops, were present (and to avoid the dangers of a circular argument). Where distinct changes can be seen through time it is less likely that serious contamination and mixing has taken place. The distribution of marker crops and introduced weeds such as hulled wheat, oats and corn cockle can be examined, although exact dates for their introduction and abandonment are not known and sites will vary to some extent depending on local conditions. Bearing these caveats in mind, the assemblage from the Winchester sites is thought to be reasonably secure for the following reasons;

- Hulled wheats decrease steadily by phase through the pre-Roman and Roman periods and very little is found after the Late Saxon period. This follows the general trend in southern England (but see Discussion below for the possibility of some continued cultivation of hulled wheat).
- Crops that appear later (mostly Roman and later) in most parts of the British Isles, such peas, oats and rye, follow the expected trends
- weeds such as corn cockle, stinking chamomile and corn marigold that are found in Roman and later periods are not present in unexpectedly early samples
- comparing the Saxon and later samples located near to Phases 1 and 2 occupation (SE1-3, BE1-2) with the areas where no early occupation was found, no obvious differences in the numbers of possible residual remains (e.g. hulled wheat grains and chaff fragments) were observed (i.e. reworking of old material appears to be minimal in these areas;).

However, the occurrence of free-threshing wheat grains in the phase 1 and 2 samples was unusually high, (particularly in sample 119, posthole NH1619, but see discussion below) and radiocarbon dates on two free-threshing wheat grains obtained from a pre-Roman feature NH6177 provided Late Saxon dates as follows: AD783-985 and AD780-982 (see *Digital Section 19*). This area of the site was heavily pitted by post-Roman features (Steve Teague, pers. comm.), so contamination is understandable. These results indicate that intrusive material may be present in some areas of the site, and that the Roman and pre-Roman assemblages should be viewed in this knowledge.

Some notes on cereal identification

Wheat – Cereal grains are notoriously variable in morphology (Jacomet, 1987), so identification is mainly based on chaff fragments such as glume bases (hulled wheats) and rachis fragments (free-threshing wheats). A few reasonably well preserved glume bases showed that both emmer (*Triticum dicoccum*) and spelt (*T. spelta*) wheat were being grown in the prehistoric period. Wheat grain shape was very variable in the later phases, suggesting that some hump-backed rivet-type (*T. turgidum*) free-threshing wheat may have been grown in addition to flatter-backed, more rounded, squarer-shaped bread-type wheat (*T. aestivum*-type, may include compact wheats). Unfortunately no well-preserved rachis fragments were recovered to confirm this, so only bread-type wheat can be said to have definitely been grown. Rivet-type wheat is increasingly being found in Medieval and some Late Saxon sites, e.g. West Cotton (Campbell, 1994). It was often grown alongside bread wheat because it has different culinary properties (more a 'biscuit' than bread wheat), a different growth form (tall and strongly awned, providing better protection from birds, but later to mature) and provided long, strong straw for thatching.

Barley- Where the grains were well preserved hulled barley could be identified due to the angular shape and presence of chaff adhering to the grain. Many of the grains were large and straight, but some twisted lateral grains were observed indicating that hulled six-row barley was present (*Hordeum vulgare*). Because crop processing alters the straight to twisted grain ratio in six-row barley, removing a lot of the small twisted grains, it was not possible to determine whether 2-row barley (straight grains only) was present or not. It was not considered useful to calculate straight to twisted grain ratios for this reason. Unfortunately well-enough preserved 2-row barley rachis fragments are seldom found, so confirmation of this species is rare.

Rye and oats – Rye (*Secale cereale*) was confirmed when characteristic bullet-shaped grains were observed and by the presence of rachis fragments. Some grains were intermediate between rye and wheat, being less blunt-ended and plumper than rye, and these were left at 'rye/wheat'. No oats with well-preserved floret bases were recovered, so it was not possible to confirm that cultivated oat, as opposed to weed oat, was present. However, the very large, plump grains in many of the samples were characteristic of cultivated oat, and in some samples oats were present in large quantities confirming the fact that cultivated oats were present.

The charred and mineralised plant assemblages

Pre-Roman (Phases 1, 1.1, 1.2, 1.3)

Phase 1	Sample 119	Context NH1620	PH NH1619
Phase 1.1	Sample 83	Context NH1492	PHNH1491
	Sample 86	Context NH1534	PH NH1524
	Sample 103	Context NH1549	Pit NH1547
	Sample 112	Context NH1558	Pit NH1557
	Sample 118	Context NH1578	Post packing NH1579
	Sample 121	Context NH1623	Pit NH1621
	Sample 360	Context NH6166	PH NH6167
	Sample 369	Context NH6179	PH NH6180
	Sample 371	Context NH6200	PH NH6199
	Sample 372	Context NH6201	PH NH6202
	Sample 376	Context NH6198	PH NH6197
	Sample 377	Context NH6208	PH NH6207
	Sample 378	Context NH6209	PH NH6210
	Sample 379	Context NH6211	Pit NH6212
	Sample 385	Context NH6228	PH NH6227
Phase 1.2	sample 122	context NH1629	Pit NH1628
	Sample 124	Context NH1634	Gully NH1633
	Sample 359	Context NH6169	PH NH6168
	Sample 362	Context NH6164	Gully NH6162
	Sample 363	Context NH6165	Gully NH6163
	Sample 367	Context NH6190	Gully NH6189
	Sample 506	Context NH7607	Gully NH7610
Phase 1.3	Sample 79	Context NH1447	Subsoil NH8503
	Sample 114	Context NH1599	Subsoil NH8503
	Sample 115	Context NH1604	Subsoil NH8503

Table 3. Analysed samples from Phase 1

The phase 1 sample from a small posthole, NH1619, stood out as being different (see Figure 1) because an unusually large number of bread-type wheat (*Triticum aestivum*-type) cereal grains were present in addition to several hulled wheat grains (*T. dicoccum/spelta*). No hulled wheat chaff fragments were found and the few general weeds of disturbed/cultivated ground (e.g. dock (*Rumex* sp.)) recorded gave no further indications as to probable date. This feature produced no finds and, although sealed below the phase 1.3 subsoil, the fill was darker in colour to the other features in phase 1. Therefore it is possible that the posthole was cut from higher up, or contamination may have occurred (Steve Teague, pers. comm.). However, since free-threshing wheat has been recovered in small amounts from even Neolithic contexts, a phase 1 date for this assemblage cannot be totally ruled out.

The phase 1.1 (probable early Iron Age) pit and posthole samples from structure NH8508 were notable in that four of the six samples produced more barley than wheat (particularly posthole NH1524). Where identifiable, the barley was mainly hulled (*Hordeum vulgare*), although a single possible naked grain suggested some naked barley may have been present either as a minor crop or sporadic variant (*Hordeum vulgare* var. *nudum*). The moderate number of chaff fragments indicated that emmer (*Triticum dicoccum*) and spelt wheat (*T. spelta*) were cultivated, with spelt being the dominant crop. Within structure NH8508, pit NH1621 produced an assemblage that was dominated by hulled wheat (82% of identifiable grain), with a notable quantity of free-threshing wheat (11%). This feature may have been part of an Early Iron Age roundhouse that burnt down, which may explain the relatively high occurrence of charred cereal remains (c.33 charred fragments per litre). As noted above, the possibility of contamination cannot be ruled out, particularly if an early date is postulated.

Structure NH8502 (also phase 1.1) produced more wheat than barley at a ratio of 3 : 2, with almost all of the wheat being hulled wheat (emmer/spelt wheat). Small amounts of chaff and a possible large pulse fragment were present. Of particular note was the large deposit of cf. black mustard seeds (68 seeds, cf. *Brassica nigra*) found in posthole NH6210. The possible use of this native plant as an oil seed crop is discussed below.

In general, phase 1 and 1.1 samples produced relatively large concentrations of material for the pre-Roman period (average of 11.9 charred fragments per litre (fpl)). Barley was the most frequent cereal although hulled wheat was close behind. More free-threshing wheat was recovered than might be expected from some features, and it is uncertain whether this was due to contamination or a relatively early use of this crop (see discussion below). Hazelnut shell (HNS), an indicator of wild food usage, was present in small quantities in only half of the samples, and it is interesting that this is lower than in the post-Roman period, where almost all the samples contained moderate numbers of fragments.

The phase 1.2 samples from five gulley fills, a pit and a posthole produced very similar assemblages to the 1.1 samples, with mixed domestic waste, most of which consisted of wheat grains but also frequent barley. Low numbers of chaff fragments, weed seeds and HNS fragments were present. Items of note were a possible sloe stone fragment (gully NH6162, cf. *Prunus spinosa*) and a possible Celtic bean fragment (*Vicia faba* var. *minor*). No obvious differences between the two phases were observed because of the variable nature of the cereals, but when Figure 1 is examined, there appears to be an increase in bread-type wheat, and oats (*Avena* sp.) make their first significant appearance. At this low level oats could still be growing as a weed, although many other Iron Age sites produce small quantities of oats so perhaps they are mainly being used for fodder and are not often becoming charred.

The phase 1.3 'orange brown to greyish-brown silty clay' subsoil sealed the pre-Roman features. Soil samples from this deposit produced remarkably high concentrations of cereal grains for a soil layer, some of which was very eroded (NH1599) but others were in a good state of preservation (NH1604). This suggests that working of the soil may only have been taking place for a short time. Bread-type wheat was the dominant cereal in two of the three samples, with hulled barley dominating in NH1599. Hulled wheats were also frequent. No chaff fragments and very few weed seeds were present, perhaps because cultivation of the soil had destroyed these more delicate items, or possibly because the type of burnt waste being used to fertilise the soil was derived from fully processed grain, i.e. household waste in a fairly urban setting. One item of note was the recovery of three corn cockle seeds (*Agrostemma githago*) from two of the samples. This was the earliest record on the site for this poisonous arable weed, and it may relate to the bringing in of seed corn from outside the region. It is thought to be a weed introduced by the Romans (Godwin, 1975), so occurrence in the subsoil suggests that cultivation was taking place in the Roman period.

Romano-British (Phases 2.1, 2.2, 2.3)

Phase 2.1	Sample 164	Context CC1704	Occupation Layer
	Sample 169	Context CC1766	Occupation Layer
	Sample 173	Context CC1762	Trample
Phase 2.2	Sample 373	Context NH6194	Pit NH6193
Phase 2.3	Sample 63	Context NH1307	Backfill PH? NH1308
	Sample 64	Context NH1313	Backfill PH? NH1308
	Sample 67	Context NH1346	Midden
	Sample 77	Context NH1449	PH NH1448
	Sample 78	Context NH1451	Disuse?
	Sample 92	Context NH1539	Spread
	Sample 93	Context NH1561	Spread
	sample 107	Context NH1566	Dump/consolidation
	Sample 108	Context NH1584	Dump
	Sample 113	Context NH1603	Silting deposit
	Sample 117	Context NH1542	Post pipe NH1544

Table 4. Analysed samples from Phase 2.1 - 2.3

Because few samples were examined from phases 2.1 and 2.2, the assemblages have been shown together in Figure 1. This, and the fact that only grain counts have been used for this figure, partially mask the concentration of spelt wheat grain and chaff in sample 169 (layer CC1766), although hulled wheats still show an increase in Figure 1. Large amounts of spelt chaff, frequent sprouted grains (with dorsal grooves), collapsed grains and detached embryos indicated that the deposit probably represented the waste from malting spelt wheat. This was one of the purest deposits examined (i.e. very few other types of cereal) and the only weed seeds present in large numbers were large, mainly grass-family seeds (e.g. rye-grass (*Lolium perenne/rigidum)*, chess (*Bromus* sect. *Bromus*)), i.e. weeds of a similar size to grain that would not have been removed by processing. It is likely, therefore, that rather than representing processing waste that had been used as tinder, this material had originated as cleaned spikelets of spelt that had become too heavily roasted or fallen into the fire during the malting process. During malting, sprouts and chaff often come away from the grain and fall through the malting floor into the flames below. It is interesting to see that, although corn cockle had been growing as an arable weed with this crop (since charred capsule valve fragments were present), the large black seeds must have been carefully hand-picked from the processed crop, since none were present. It appears that quality control was higher at this time than in the Late Saxon and Saxo-Norman times (see below), perhaps because the high saponin content in the seeds of this weed tainted the beer. The appearance of rye-grass as an arable weed for the first time in this period is of interest, since on sites such as Stansted (Carruthers 2008) it first became a significant weed during the Late Iron Age/Early Romano-British period. Whether this relates to changes in cultivation methods (chess and wetland weeds also appear at this time) or an introduction with imported crops deserves further investigation.

The phase 2.1 and 2.3 samples were mainly taken from layers, and as noted with the later samples (see below), this can bias cereal composition towards cereals that were probably being used for fodder. The 'trample' sample (context CC1762) contained primarily hulled barley grain, some of which had signs of insect damage and a few of which had sprouted (too few to indicate malting). This suggests that low quality grain was being used for fodder (or that fodder grain was stored in poorer conditions), along with some chaff and possible hay. The other samples from these phases produced low concentrations of domestic waste consisting primarily of mixed hulled wheat and barley grain, much of which had probably been damaged by trampling (indicated by high indeterminate cereal numbers).

A similar type of mixed domestic waste was being deposited in most of the phase 2 (2.1 to 2.3) samples, as can be seen in Figure 1. The main differences between the two sets of phase 2 columns in this figure are due to the midden sample (sample 67) in phase 2.3 causing the bread-type wheat and rye columns to increase. Midden NH1346 produced a large number of bread-type wheat grains, 47% of which showed signs of insect damage. Small quantities of other cereals, chaff fragments and weed seeds were present but little that indicated the presence of animal fodder or bedding. Perhaps this material was not being burnt, or maybe the midden was only being used for the deposition of household waste, i.e. fully processed grain, including damaged grain that had been burnt to prevent the spread of pests.

Post-Roman Dark Earth (Phase 2.4)

Phase 2.4	Sample 60	Context NH1162	Dark Earth
	Sample62	Context NH1270	Dark Earth
	Sample68	Context NH1280	Dark Earth
	Sample69	Context NH1316	Lower Dark Earth
	Sample356	Context NH6059	Dark Earth
	Sample 554	Context NH4753	Cess pit NH4744 (slump?)

Table 5. Analysed samples from Phase 2.4

The Dark Earth samples produced relatively high concentrations of charred cereals (average = 7 charred fragments per litre (fpl)). Although fragmentation was a problem in some samples (e.g. sample 68), preservation was generally good, without excessive signs of surface abrasion. Figure 1 shows that both the phase 1.3 subsoil sample and Dark Earth sample produced more indeterminate wheat grains than the other phases, and this is mainly due to fragmentation making it difficult to specify whether free-threshing or hulled wheat was present. The frequencies of the different wheats and oats were intermediate between Roman and Late Saxon assemblages (see Figure 1), fitting into the trend of increasing bread-type wheat at the expense of hulled wheats, and slowly increasing cultivation of oats. The overall character of the Dark Earth assemblage was material from burnt waste that was probably mainly domestic in origin, since the fodder crops, barley and oats were not especially frequent. Occasional mineralised seeds were present, including a field bean hilum in sample 356. This suggests some human or animal faecal waste may have become incorporated into the soil.

The small cess pit NH4744 was possibly associated with the Roman structure NH8521. It was the earliest feature to produce reasonable numbers of mineralised plant remains, although concretions with visible cereal bran were very rare. This was probably due to poor preservation conditions, as the absence of cereals from the diet is unlikely. Small numbers of pulse testa fragments (seed coat) and a pea (*Pisum sativum*) hilum demonstrated that pulses were being consumed. The only other foods represented were frequent small sloe or cherry-sized (*Prunus spinosa/avium*) stone kernels. Charred cereals were present in moderate numbers, primarily comprising bread-type wheat.

Late Saxon to later medieval (Phases 4-6) by plot

As Table 1 shows, the coverage of the different plots was not equal, and mineralisation was not present on all plots. This, in itself, is probably an indication that conditions were 'less sanitary' on some plots than others, since organic material needs to build up in damp locations for mineralisation to take place. Sample coverage was extensive at the assessment stage, so the selection of these samples pinpoints the areas where burnt waste and faecal/midden-type waste had been allowed to build up. Of course, factors such as better drainage in some parts of the site or slight variations in the soils may have played a part with regards to preservation by mineralisation. Rapid burial and preservation *in situ* favour preservation by charring.

BE 1

Phase 4	Sample 109 R	Context CC1026	Pit CC1010
	Sample 126	Context CC1348	Pit CC1346
	Sample 145 R	Context CC1429	Pit CC1427

Table 6. Analysed samples from BE1

Three phase 4 pit fills were analysed, two of which contained concentrated faecal material (i.e. > 50% bran-rich concretions). The charred plant remains comprised mostly wheat, with frequent barley and some oats. Two hulled wheat grains could represent residual material, although radiocarbon dating on a number of other sites (e.g. Late Saxon Stansted, Carruthers 2008; AD960-1040±30 (NZA23235)) has demonstrated that small amounts of hulled wheats (most likely spelt) continued to be grown well into the Saxon period. Two samples produced fragments of cultivated flax seeds (Linum usitatissimum). These could have been present as a by-product of a fibre crop, been used for linseed oil or been consumed as a flavouring and laxative.

The mineralised faecal assemblages showed that pea and field bean were important components of the diet on this property. The large fragments and occasional whole peas indicated that at least some pulses were being eaten whole or coarsely mashed, perhaps in pottages. Corn cockle was a major flour contaminant, presumably indicating a poor quality, cheaper flour as the black seed fragments would have affected the colour and taste, and so been obvious at the time of purchase. The range of stone fruits was more varied than on most plots, including frequent plum (Prunus domestica ssp. domestica) and bullace/damson/greengage (P. domestica ssp. insititia) stones, as well as abundant cherry/sloe. However, apple/pear was less frequent than some plots, with just a couple of seed fragments being present (Malus sylvestris/Pyrus communis). Non-edible materials that may have been used as toilet paper, been used to dampen smells or simply been deposited as waste included mostly straw fragments with occasional rushes. Rodent droppings, worm cocoons, woodlouse fragments and millipedes fragments were present but not abundant.

BE2

Phase 4.2	Sample 127	Context CC1376	Pit CC1392
	Sample 142	Context CC1434	Pit CC1397
Phase 5	Sample 155 R	Context CC1550	Pit CC1548

Table 7. Analysed samples from BE2

Two phase 4.2 and a phase 5 pit fill were examined from this plot. Residues from two of the pits were assessed, but only pit CC1548 was found to contain concentrated faecal material (50% bran-rich concretions). Barley was the dominant charred cereal, but wheat and oats were fairly frequent. The cess pit produced evidence for the consumption of cereals (as bran from flour based foods such as bread) and field beans. Although charred hazelnut shell was frequent, no mineralised fruits were recovered from this plot. Both charred (unconfirmed identification) and mineralised flax (Linum usitatissimum) was present, perhaps indicating textile working. Although the seeds themselves may represent use for oil or medicinal use, they could have been a by-product of flax grown for fibre. Some mineralised fragments of twine were recovered from pit CC1548. Other possible useful plant remains include a few seeds that have been used for flavourings in the past, including carrot (*Daucus carota*), brassica seeds (*Brassica/Sinapis* sp.) and poppy (*Papaver* sp.). Straw was frequent in the pit, as were earthworm cocoons and pupa. A possible charred wheat nematode gall (*Anguina tritici*) was present in sample 127. When present in large numbers, this pest is an indicator of poor crop husbandry practices, as it can be eliminated by crop rotation. A weed of acid soils, corn spurrey (*Spergula arvensis*), may reflect the cultivation of poorer sandy soils to the south of Winchester, most likely for oats or rye, since these crops can cope with acidic soils better than bread wheat and barley. As the local soils are primarily calcareous, this suggests that cereals were being brought in to Winchester from some distance. Weeds of calcareous soils such as thorow-wax (*Bupleurum rotundifolium*) were generally more common in the Saxon to Medieval samples than weeds of acidic soils.

BE3

Phase 4	Sample 158	Context CC1612	Pit CC1616

Table 8. Analysed samples from BE3

Only one phase 4 pit fill was examined from this plot, and although a few mineralised remains were present in the flot, concentrated cess was not thought to be present. The charred cereal assemblage was dominated by bread-type wheat, with barley amounting to half as many grains as wheat, and oats and rye being infrequent. Typical arable weeds such as corn cockle and stinking chamomile (*Anthemis cotula*) were present in small numbers, as were hazelnut shell fragments. Stinking chamomile is a weed of heavy, damp clay soils and for this reason it is usually a weed of wheat crops.

BE4

Phase 4.2	Sample 215	Context CC2163	Pit CC2002
	Sample 220	Context CC2177	Pit CC2164
	Sample 221 R	Context CC2178	Pit CC2164
	Sample 234 R	Context CC2259	Pit CC2258
	Sample 272 R	Context CC2448	Pit CC2225
	Sample 273 R	Context CC2449	Pit CC2225
	Sample 274 R	Context CC2458	Pit CC2225
Phase 5	Sample 246 R	Context CC2311	Pit CC2305
	Sample 257 R	Context CC2342	Slumped occ layer in pit CC2330
Phase 6	Sample 213 R	Context CC2144	Pit CC2120
	Sample 239	Context CC2275	Pit CC2269

Table 9. Analysed samples from BE4

This plot produced the largest number of well-preserved mineralised samples (three from the same pit, CC2225), indicating that conditions had been highly organic and damp in the four pits and in occupation layer CC2330. Rodent droppings were also abundant in samples from this plot, but were only occasional in a few samples from other plots. Since textile working was taking place on this plot, perhaps organic waste had accumulated, attracting vermin. Flax retting (processing) waste and dyeing waste are notorious for creating smells and polluting water bodies.

Bran-rich concretions and pulses (both pea and field bean) were abundant in all three of the phase 4.2 pits, and opium poppy (*Papaver somniferum*) was present in three samples from pit CC2225. Plum and cherry/sloe were present in one pit and apple (or apple/pear) was recorded in three pits (phases 4.2 and 5) and occupation layer CC2330.

The excellent mineralisation in pit CC2225 presented an opportunity to examine a sequence of samples, in order to see how much the diet on a single property changed through time. It is impossible to determine how much time the three contexts represent, but the samples are recorded as having been positioned with sample 274 as the primary fill, followed by 273 and 272. The best preserved sample was 273 in the middle, perhaps because the precise conditions of wetness but not waterlogging existed in the centre of the deposit.

In broad terms, 272 and 273 produced similar concentrations of both charred and mineralised plant remains but differences in foods consumed were as follows;

- High concentrations of bran, field beans and peas in all three deposits with highest concentrations in 273. Sample 272 produced most of the large fragments of cereal grain.
- Opium poppy in all three samples but the main concentration in 272, with only traces in the other two samples
- Widest variety of fruits in 273, including one blackberry/raspberry seed (*Rubus* sp.), elderberry (*Sambucus nigra*), several plum (*Prunus domestica* ssp. *domestica*) and cherry/sloe stone kernels (*Prunus avium/spinosa*) (all 273 only).
- Apple/pear in all three samples but mainly in 272.

Although all of these food plants can be preserved for use throughout the year by drying (grain, poppy seeds and pulses, also apples and small fruits such as sloes), it is likely that the widest range of foods would be available when they were in season, primarily in late summer and autumn. Presumably, prices would increase as winter progressed, as the range of foods in the markets became more limited. Differences between samples 272 and 273, therefore, could indicate a change in season from the late summer/early autumn to winter, when grain, dried/stored apples and pulses may still have been in good supply, and the monotonous diet was ‘spiced up’ by the addition of flavourings such as opium poppy seeds.

Although dye plants were not present in obvious quantities, the following plant remains can be used for dying; plums and sloes, blackberry/raspberry (*Rubus* sp.), elderberries (*Sambucus nigra*) and bracken (*Pteridium aquilinum*). It may not be coincidence, therefore, that they were present in these deposits (almost exclusively for some taxa), albeit in small numbers. Unfortunately waterlogged deposits were not available, as these would be more likely to preserve recognisable concentrations of, for example, madder roots. Madder stained pot sherds were present on many of the plots, including BE4. Other possible dye plant remains were found on plots BW2 and BW3. Madder stained potsherds were found on these and five other plots.

Slumped floor occupation layer CC2342 produced so much charcoal that only 1/8th was sorted for charred remains. Hazelnut shell and a few arable remains (barley, corn cockle) were present. The residue, however, produced 40% mineralised faecal concretions with abundant bran. Mineralised corn cockle seeds and impressions were common. Only a few indeterminate pea/bean fragments were present. Orchard fruits, however, were quite varied, including plum, bird cherry (*Prunus padus*), cherry/sloe and apple (including apple/pear but pear not confirmed). Like sloes, the small dark fruits of the bird cherry are rich in tannins and so are very astringent to taste. Also like sloes (blue/black), bird cherry fruits can be used for dyeing (blue/grey). When sloes are dried and then rehydrated they become quite edible (Wiltshire, 1995), so presumably the same is true for bird cherry. Another possible economic plant was carrot (*Daucus carota*) which can be used as a flavouring and for medicinal purposes (see below). Fly puparia were especially numerous in this sample, suggesting that, not only were the cess pits fly-ridden habitats, but accumulations of organic waste within occupation layers probably also attracted large numbers of flies. Perhaps that was why thick layers of charcoal were deposited, in order to dampen smells, absorb moisture and discourage flies.

The two phase 6 samples produced small amounts of mixed charred cereals (bread-type wheat, barley and oats in similar quantities, and a little rye). Pit CC2120 produced evidence of cess, with both plum and cherry/sloe being frequent. However, pulses and apples were not recorded. It is hard to tell whether this is typical of the phase or not, since this was the only phase 6 sample across the whole site to produce mineralised remains.

BE5

Phase 5	Sample 300	Context CC3017	Pit CC3010
	Sample 301	Context CC3034	Slumped floor in pit CC3010
	Sample 306	context CC3083	Slumped occ layer in pit CC3010
Phase 6	Sample 249	Context CC2207	Slumped occ layer in pit CC2111

Table 10. Analysed samples from BE5

Samples associated with slumped floors in pit CC3010 produced three well-preserved charred assemblages that were distinctive in consisting primarily of barley and oats in fairly equal quantities. Bread-type wheat was also common (14% of identified grain), but each of the three samples was dominated by barley and oats, suggesting that a maslin or mixed crop called 'dredge' had been grown. Rye was present in greater amounts than in other plots, but it still only amounted to less than 2% of the identified cereals. Traces of large pulses, possibly including pea, were present. Other factors of note were; positive identification of cultivated vetch, *Vicia sativa* ssp. *sativa* (the only other identification was from a Plot BE4 phase 4 pit, sample 246, in smaller numbers); greater abundance of charred 'weed' seeds, including several indicative of grassland habitats, some from wet soils, and several indicative of poor soils (e.g. small weedy pulses such as medick), or acid soils (e.g. sheep's sorrel, wild radish). Since cultivated vetch and dredge were often used for fodder, it is suggested that many of the grassland and wetland remains were probably burnt amongst hay or dung. Acid and poor soil indicators may have grown as arable weeds amongst the oats and rye, which were commonly grown on the poorest soils. The assemblages, therefore, probably represent waste fodder, animal bedding and/or dung that had been burnt either on the slumped floor, or used to level the ground. Dredge was commonly grown as a crop in the Saxo-

Norman and Medieval periods, being a useful way of 'hedging ones bets' on poor soils and when climatic conditions are uncertain. This is because barley can grow well in a wide range of soils, particularly on well-drained calcareous soils, whilst oats can cope with much poorer, more acidic and wetter soils. It is notable that stinking chamomile (*Anthemis cotula*) and corn marigold (*Chrysanthemum segetum*) were relatively frequent in these samples, and these weeds are indicative of damp, heavy clay (*A. cotula*) and sandy, acidic soils (*C. segetum*).

The phase 6 sample produced frequent bread-type wheat, mixed with reasonable numbers of barley, oat and rye grains. Hazelnut shell was also common, indicating that wild food sources were still important in the Medieval period. As with most of the burnt domestic waste, no chaff fragments were found and weed seeds were fairly scarce. It is clear, then, that cereals were fully processed before they were brought to market, and cereal processing waste was not brought into town for fodder but was most likely consumed by livestock at the point of production, on farmsteads. In order to feed livestock that may have been kept in back yards, such as pigs, hay, dredge, oats, peas and beans and cultivated vetch would have had to be purchased at market.

BW1

Phase 4.2	Sample 278	Context NH4278	Pit NH4278
	Sample 258	Context NH4340	Pit NH4289

Table 11. Analysed samples from BW1

The two phase 4.2 samples produced small quantities of charred cereals (bread-type wheat, barley, oats) and a few common arable weeds seeds such as cleavers (*Galium aparine*) and chess. Hazelnut shell fragments were frequent in sample 278. These pit samples represent low level burnt domestic waste.

BW2

Phase 4.1	Sample 279	Context NH4464	Floor debris NH4464
	Sample 280	Context NH4481	Occupation layer NH4481
	Sample 284	Context NH4232	Pit NH4235
	Sample 290	Context NH4556	Burnt layer NH4556
	Sample 292	Context NH4592	Occupation layer NH4592
	Sample 294	Context NH4523	Hearth NH4523
	Sample 296	Context NH4671	Occupation layer NH4671
	Sample 551	Context NH4711	Pit NH4713
	Sample 552	Context NH4712	Pit NH4713

	Sample 553	Context NH4714	PH NH4715
Phase 4.2	Sample 250	Context NH4718	Floor debris NH4718
	Sample 251	Context NH4318	Floor? NH2318
	Sample 268	Context NH4209	Floor NH4209
	Sample 274	Context NH4217	Occupation layer NH4217
	Sample 277	Context NH4226	Occupation layer NH4226
Phase 5	Sample 260	Context NH4189	Floor debris NH4189
	Sample 263	Context NH4192	Floor debris NH4192

Table 12. Analysed samples from BW2

Samples from this plot differ from most of the other plots (along with BW3 and BW4) in that most were from floor layers and other types of occupation deposit, and none were mineralised. Occasional mineralised seeds were present in the flot, such as poppy, corn gromwell (*Lithospermum arvense*) and brassica seeds, but these may have been introduced in trample or been preserved in very small pockets of organic material. No doubt because twelve of the seventeen samples were from floor layers, the composition of the assemblage was very different from that of the 'pit-rich' plots.

Firstly, hazelnut shell (HNS) fragments were abundant (> 1000 fragments in total) in most of the samples from layers, but not the samples from pits and postholes. (Similarly high concentrations of HNS were found in samples from layers in plot BW3). Secondly, cereal grains were common but not abundant but, as might be expected, by far the greatest number was too poorly preserved to identify further than 'indeterminate cereal'. Trampling and weathering had caused erosion and fragmentation of both HNS fragments and cereal grains in many cases. Thirdly, oats were the most frequent cereal overall, although bread-type wheat was not far behind. The most notable instances on other plots where oats were more frequent than wheat were all phase 5 samples from floor/occupation layers, e.g. plot BE5 (samples 301 and 306); plot BW3, sample 236; BW4, sample 220. This demonstrates that the use and deposition of oats differs from that of wheat, and it is important to bear this in mind when examining the frequencies of each crop. Oats were probably mainly being used for fodder, and because of this they were widely distributed around the backyards of houses, and were burnt amongst waste animal bedding and dung. It is unlikely that oat grains were present due to use of the straw for flooring or thatching, since oat straw is less suitable for these purposes than wheat straw (thatching) or barley straw (flooring). Ash from burnt 'stable waste' appears to have become strewn around the site and trampled onto floors and occupation layers. The abundance of HNS could be due to some sort of roasting of hazelnuts being carried out on the property. Roasting makes the nuts last longer in storage, it makes them more digestable, and enables them to be ground into flour. Alternatively, the shell fragments and animal waste may have been collected together to be used as fuel for smithing and metalworking. In contrast, burnt waste being deposited in the pits seems to have had a different origin, since it was almost invariably contained human food waste, i.e. it was dominated by wheat-type grains. This subject is discussed further below.

Although clear evidence for hay was not present in the layer samples (burnt grass stems are very fragile), grassland and wetland weeds were relatively common, so hay was probably a component of the assemblage. Peas and field beans were also relatively common, indicating that they may have been used for fodder as well as for human consumption (confirmed by the mineralised remains). Documentary sources suggest (Dyer 1994) that peas were commonly used to feed pigs, and there is evidence to suggest that pigs were being kept on some of the plots (see discussion below). Alternatively, the remains may have come from pea/bean straw or household waste being used for fodder.

Another point of interest is that a charred cultivated flax (*Linum usitatissimum*) seed was recovered from occupation layer NH4226 (sample 277). This was one of seven possible and confirmed charred and mineralised flax seeds recovered from the site as a whole. The oily seeds of flax do not preserve well by charring; they often crumble or are too distorted to identify with certainty. Flax was widely grown for fibre in the Saxon period, particularly in moist soils. The seeds are also a useful source of oil, and useful for medicinal purposes.

BW3

Phase 4.2	Sample 238	Context NH3679	Yard
	Sample 244	Context NH3782	Hearth NH3806
Phase 5	Sample 200	Context NH3098	Consolidation
	Sample 203	Context NH3099	Occupation layer
	Sample 218	Context NH3281	PH NH3280
	Sample 219 R	Context NH3415	Pit NH3438
	Sample 236	Context NH3617	Occupation layer
	Sample 243	Context NH3794	Burnt layer
	Sample 275	Context NH4453	Oven NH4458 rakeout
	Sample 282	Context NH4494	Floor debris
	Sample 288	Context NH4511	Oven rakeout?
Phase 6	Sample 209	Context NH3178	PH NH3179
	Sample 210	Context NH3181	Burnt layer
	Sample 214	Context NH3241	Burnt deposit 3240

Table 13. Analysed samples from BW3

As noted above, the samples from Plot BW3 were similar to those from BW4 in that several were from occupation layers and floor surfaces (five samples). Burnt layers and hearth and oven rakeouts also contributed five samples. Similarities with the occupation layers from BW4 were that hazelnut shell fragments were abundant and oats were more frequent than wheat in some of the samples (including the hearth). Wheat was frequent only in pit NH3438, and this was the only feature selected to be studied for mineralised plant remains.

Charred cereals were not abundant in most of the burnt and ashy samples, and grains were often eroded and fragmented. However, hearth NH3806 was more productive. Oats and barley were more frequent than wheat in this feature, and field beans and possible peas were recorded. Charred remains from other edible taxa included abundant hazelnut shell fragments (777 fragments); charred bullace/damson/greengage, sloe, cherry/sloe and apple remains. A variety of weeds of arable and disturbed ground were present, but no chaff fragments were found. This feature has the character of a domestic hearth where food waste was thrown by people eating and perhaps processing (i.e. roasting and drying) nuts, fruits, pulses etc. Grain being brought to the hearth for cooking was already fully processed, but weed seeds such as corn cockle may have been picked out by hand prior to adding the grain to the pot. Waste animal bedding or dried dung may have been used for tinder and fuel, hence the frequency of oats. One taxon of note in this feature and in pit NH3438 was possible dyers greenweed (cf. *Genista* sp.). Four charred seeds were recovered from the hearth and pit, and this may signify waste from the dyeing process. All parts of the plant are used to make a yellow/green dye.

The residues from pit NH3438 were sorted for mineralised plant remains because a large number of whole mineralised corn cockle seeds were present in the flot. A total of 82 corn cockle seeds were recovered from the sample as a whole, although very few bran-rich faecal concretions were observed in the residues, so preservation conditions had not been ideal, or the waste was very dilute. Whether this deposit represents a much more careful screening of cereals for contaminants than on other plots is difficult to say, but this was by far the highest concentration of corn cockle seeds in all of the samples. No mineralised edible taxa were recorded, apart from the rare bran-rich concretions. Perhaps this deposit represents a different type of organic waste (perhaps unrecognisable dyeing waste?) into which hand-picked weed seeds were thrown.

The only other samples of note were two reasonably productive layers that probably contained burnt hay, turf and/or animal fodder. The phase 5 occupation layer NH3617 contained the highest concentration of cereal grains in this plot, dominated by oats. Arable weeds and weeds of disturbed (often nutrient-enriched) waste places were frequent and varied, as were wet grassland/marsh plants. The phase 6 burnt deposit NH3240 was the only sample from the whole post-Roman assemblage to produce reasonable amounts of chaff. Poorly preserved free-threshing wheat, barley and rye rachis fragments were present. The frequent small-seeded weeds such as corn marigold, sheep's sorrel and stinking chamomile could represent other components of a small quantity of cereal processing waste. The first two of these weeds prefer acidic soils, and the latter prefers heavy, damp clays. These weeds indicate the range of soils cultivated, with the sandy soils probably being used for rye and the more fertile clays being more suitable for bread wheat. Most of these small weed seeds were scarce in the other samples in this report, because they would have been sieved and winnowed out with the chaff during crop processing. With only one sample producing this type of waste it is impossible to know whether this indicates a temporal change or simply the chance preservation of material brought into town to feed livestock.

BW4

Phase 4.1	Sample 186	Context NH2614	Pit, secondary fill NH2594
	Sample 198	Context NH2712	Occupation layer
	Sample 241	Context NH3720	Occupation layer
	Sample 242	Context NH3724	Occupation layer
Phase 4.2	Sample 151 R	Context NH2114	Pit NH2133
	Sample 207	Context NH3174	Occupation layer
	Sample 208	Context NH3175	Occupation layer
	Sample 212	Context NH3186	Occupation layer
	Sample 213	Context NH3199	Occupation layer
	Sample 215	Context NH3328	Floor surface
Phase 5	Sample 220	Context NH3434	Occupation layer
	Sample 223	Context NH3466	Levelling

Table 14. Analysed samples from BW4

As with plots BW2 and BW3, the main productive samples from BW4 were occupation layers rather than pit fills. Although pit NH2133 produced a large quantity of bread-type wheat, occupation layer NH3434 (phase 5) produced primarily oats. Hazelnut shell was frequent in this sample, and present in small quantities in all of the others. Cereal grains were not particularly frequent in most of the samples. The presence of small numbers of mineralised seeds in flots from five of the occupation layers suggests faecal or midden material had been spread or trampled around the plot. Small numbers of common arable and wasteground weeds were present as charred seeds but no chaff was found. The charred waste probably represents background burnt domestic waste being trampled and spilt around the site.

Reasonably concentrated faecal waste was present in pit NH2133, in addition to abundant charred bread-type wheat. The following foods were being consumed; moderate amounts of field beans and peas; sloes or cherries, apples. Opium poppy seeds and possibly mustard were being used as flavourings. Straw, sedges and bracken may have been used as flooring, toilet paper or to dampen smells. Corn cockle contamination of the flour was high (i.e. seed impressions were frequent).

BW5

Phase 4	Sample 505	Context NH7589	Burnt layer
Phase 4.1	Sample 181 R	Context NH2515	Pit NH2451
Phase 4.2	Sample 173	Context NH2399	Pit NH2237
	Sample 175	Context NH2411	“
	Sample 176	Context NH2426	“
	Sample 180 R	Context NH2377	Pit NH2373
Phase 5	Sample 152	Context NH2314	Pit NH2237

Table 15. Analysed samples from BW5

Of the four samples from pit NH2237, only the uppermost, (sample 152) produced useful quantities of both charred and mineralised plant remains. Bread-type wheat was dominant in all samples from this plot, although charred cereals were not abundant in the other two pits. Hazelnut shell was present in five of the seven samples but never abundant. A few charred field beans and peas were present in two pits.

The mineralised evidence from a phase 4.1 and phase 4.2 pit confirmed that pulses were being consumed by humans. Fruit remains were present in moderate numbers, including sloe/cherry, apple and a possible fig (*Ficus carica*) seed. Unfortunately the possible fig seed was distorted, making identification difficult, but if present, fig suggests a higher status diet since the large size of the seeds shows that it was almost certainly imported. Both rushes (pit NH2373) and straw (mainly pit NH2451) were being used either as toilet paper or to dampen smells. The main arthropods present were woodlouse fragments, but fly puparia were also present. A charred fragment of possible cultivated flax was present in pit NH2451. Corn cockle contamination of the flour was frequent (i.e. seed impressions were frequent).

BW6

Phase 4	Sample 502	Context NH7581	PH NH7581

Table 16. Analysed samples from BW6

This posthole produced several charred cereal grains, including some hulled wheat, HNS and a possible pea. A few weed seeds, including corn cockle, were recovered. The character of the assemblage was one of typical burnt domestic waste.

SE 1

Phase 4.1	Sample 301	Context NH5090	Pit NH5089
Phase 4.2	Sample 351	Context NH6121	Garden soil
	Sample 354 R	Context NH6137	Pit NH6138
	Sample 384	Context NH6161	Pit NH6158
	Sample 388 R	Context NH6243	Pit NH6231
Phase 5	Sample 304	Context NH5165	PH NH5167
	Sample 305	Context NH5168	Pit NH5169
	Sample 306 R	Context NH5177	Pit NH5175
	Sample 307	Context NH5183	Pit NH5184
	Sample 308	Context NH5193	Pit NH5192
	Sample 315	Context NH5224	Pit NH5192
	Sample 389	Context NH6236	Pit NH6237

Table 17. Analysed samples from SE1

There is some evidence to suggest that the occupants of this plot had a slightly more varied (possible higher status) diet than most of the other plots. As with all of the cess samples, mineralised concretions from the two pit residues contained primarily cereal bran, with reasonable quantities of pea and field bean fragments (confirmed by the presence of hila, with indeterminate pulse seed coat fragments). Opium poppy seeds were abundant in sample 354 and present in sample 388. Apple pips were numerous and sloe/cherry was common. A possible fragment of peach stone (cf. *Prunus persica)* and a possible fennel seed (cf. *Foeniculum vulgare*) suggest that the occupants were wealthy enough to purchase imported fruits and herbs. Fennel may have been grown as a pot herb on the property, but the seed would need to be purchased in the first instance as it originates from the Mediterranean region. Another tentative identification was a cf. white bryony seed embryo (cf. *Bryonia dioica*). Uses of the fruits of this poisonous native hedgerow plant, for dyeing and for medicinal purposes, are described below. Fennel also has medicinal properties and chewing fennel seeds is good for the digestion.

The gardensoil, charred remains showed signs of surface erosion & fragmentation, particularly the HNS fragments. The phase 5 samples were more productive, particularly sample 315 which contained a well-preserved assemblage containing a diverse haymeadow flora. This included damp meadow taxa such as ragged robin (*Lychnis flos-cuculi*) and marsh marigold (*Caltha palustris*). Cereal grains were relatively scarce, and oats and barley were as common as bread wheat. Sample 315, therefore, probably represents burnt fodder, or hay used for bedding.

The overall character of the seven phase 5 samples was one of low concentrations of domestic waste, with bread-type wheat being the most frequent cereal present. Oats and barley were present in almost all of the samples but no rye was recorded. Chaff was rare but present in the sort of small amounts that may have been missed during processing. Common arable weeds such as corn cockle, cleavers (*Galium aparine*) and thorow-wax (*Bupleurum rotundifolium*) were present in low numbers in most samples. These larger, heavy-seeded weeds are likely to have passed through the processing along with the grain and remained in the cleaned crop as contaminants. Hazelnut shell fragments were quite frequent in some of the samples.

Pits NH5169 and NH5175 both contained mineralised remains indicative of faecal waste, i.e. concretions containing bran, but only the latter pit was studied in detail because of time constraints. Pulses were not frequent in sample 306, with only field bean being identified. As with most of the faecal samples, corn cockle seed impressions were frequent, indicating that contamination of flour was rife and that quality control was fairly low in phases 4.2 and 5 (see discussion below). Several cherry/sloe stone embryos and a couple of apple seeds were recovered, and the only grape pip (*Vitis vinifera*) to be recovered from the site was present in NH5175. Although a fairly limited amount of information was recovered from this sample, it is possible that the lower dependence on pulses and presence of a probably imported fruit, grape, indicates higher status occupants on this plot. Unfortunately no phase 6 samples were suitable for analysis, since higher status buildings were constructed in this area during the 13th century.

SE2

Phase 4.2	Sample 56	Context NH1154	Soil layer
	Sample 65	Context NH1274	Hearth NH1277
	Sample 110	Context NH1589	Pit NH1586
Phase 6	Sample 60	Context NH1007	Pit NH1005

Table 18. Analysed samples from SE2

The samples from this plot produced fairly small amounts of charred cereals and HNS fragments. The character of the assemblage was general background levels of domestic waste, although the frequent holes in the dorsal sides of the bread -type wheat in sample 110 suggests that this slightly larger quantity of grain had been deliberately burnt because of pest infestation. The predominant cereal was bread-type wheat, with smaller amounts of hulled barley and some oats. A trace of rye was present in a phase 4 sample (sample 56). The few weed seeds recovered were common weeds of arable and wasteground, such as stinking chamomile and dock. No mineralised remains were found. The results from this plot were very similar to plot SE3.

SE3

Phase 4	Sample 58	Context NH1248	Disuse?
	Sample 71	Context NH1356	Disuse?
	Sample 84	Context NH1513	Backfill NH1512
	Sample 126	Context NH1643	Pit NH1598
Phase 5	Sample 57	Context NH1190	Pit NH1190
	Sample 70	Context NH1362	Pit NH1598
	Sample 74	Context NH1391	Pit NH1598
	Sample 111	Context NH1597	Burnt deposit NH1258

Table 19. Analysed samples from SE3

All of the samples from this plot produced small charred assemblages indicative of burnt domestic waste, and none contained concentrated faecal waste. A few mineralised items occurred in samples 57 and 84 (including a brassica seed, some corn cockle impressions and a few arthropod fragments), indicating that small amounts of faecal waste or midden material were being spread or trampled around the plot. Bread-type wheat and HNS fragments were the main components of all of the samples from this plot. The small quantities of hulled barley and oats had probably originated from fodder. Corn cockle and chess were the main arable weeds, and these large seeds would have been difficult to process out of the crops, being a similar size and density to cereal grains. The assemblages are characteristic of fully processed grain.

Pit NH1598 produced three small charred assemblages of domestic waste, consisting primarily of bread-type wheat and HNS fragments. Hulled barley and oats were found in very low numbers, and fragments of large pulses suggested peas or field beans may have been present. Chess was the only weed contaminant.

Discussion and period summaries

The sites examined for this report were typical of many sites in Winchester in producing plant remains that were preserved both by charring and mineralisation. Whilst plant material becomes charred as a result of every day cooking accidents, domestic waste disposal and craft activities, mineralisation occurs only where sufficient concentrations of organic material accumulate, providing mineral-rich, moist conditions which lead to the replacement of plant tissues by calcium phosphate (Green, 1979; Carruthers, 2000; McCobb *et al,* 2003). These conditions usually only occur in specific types of features, primarily cess pits, drains and middens, and factors such as soil type and degree of waterlogging can be critical. The presence of mineralised remains, therefore, provides information about the conditions in specific features, as well as providing direct evidence of foods being consumed, many of which are rarely preserved by charring (e.g. fruits and herbs).

In order to compare diet between different properties and through the periods, as wide a range as possible of mineralised samples were studied. However, mineralised samples are costly to analyse, as sorting the remains from the residues under a microscope is very time-consuming. An even coverage of the periods was not possible, as mineralised deposits were not evenly spread, but were mainly concentrated in the Phase 4 and 5 pits, with 18 of the 19 samples studied coming from plots BE1, BE2, BE4, BW3, BW4, BW5 and SE1. The remaining sample came from a Phase 2.4 pit (NH 4744) (see Tables 1 and 2). The phase 4 and 5 samples were scattered across the site, with no obvious concentration to indicate that preservation conditions had been more favourable in one particular area. Plot BE4 to the north-east of the site produced 8 mineralised samples (three from one very productive pit), and SE1 to the south-west produced three mineralised samples.

Pre-Roman (Phases 1, 1.1,1.2, 1.3)

Charred plant remains were frequent (average density = 7.8 fragments per litre of soil processed (fpl) for phases 1.1 and 1.2) and reasonably well preserved. The general character of the whole period 1 assemblage was one of burnt domestic waste, most of which probably derived from the piecemeal processing of hulled wheats (primarily spelt but with some emmer) and hulled barley over domestic hearths. Barley may have been more important in phase 1.1, or the differences seen between roundhouses NH8508 and NH8502 could indicate different uses, e.g. stock rearing versus human habitation. Bread-type wheat, oats, Celtic beans and black mustard may have been more important than their charred record suggests (although it is possible that some of the bread-type wheat at least was intrusive, as noted above). This is because they do not need to come into contact with heat during their initial processing, although drying prior to grinding, storage or oil extraction would involve contact with fire.

Wild foods were being gathered from woodland margins and hedgerows, including hazelnuts and sloes. The range of weed seeds were typical of an Iron Age charred cereal assemblage, including indicators of winter sowing such as cleavers (*Galium aparine*), some indicators of nutrient-rich soils (e.g. henbane (*Hyoscyamus niger*)) and others of nutrient-poor soils (e.g. small-seeded weed vetches (*Vicia/Lathyrus* sp.)). The fairly high rate of recovery of charred material from this phase could in part be due to contamination, although hulled wheat remains were also relatively frequent for the period. This suggests that the level of arable activity on the site was fairly high, but was probably not taking place on such a scale to produce accumulations of cereal processing waste. No storage pits were encountered in this area of the enclosure, probably because the gravel/clay soils would not have been very suitable. The only storage pits to be excavated within the Iron Age Orams Arbour enclosure were located higher up the slopes on the chalk, towards its western side in 2001-02 (Steve Teague, pers. comm.).

Earlier excavations within the Orams Arbour enclosure (Biddle & Green 2005) produced sparse charred plant assemblages dating from the Beaker period. The Middle Iron Age defensive ditch and a few MIA features from Sussex Street produced small numbers of spelt wheat, hulled barley and oat remains. Apart from the absence of bread-type wheat grains, these findings fit in with the site's results. They lend some support to the suggestion that the bread-type wheat at Northgate House may be intrusive.

Although other well-sampled Iron Age sites such as Winnall Down (Monk 1985), Micheldever Wood (Monk & Fasham 1980), Easton Lane (Carruthers 1989) and Brighton Hill South (Carruthers 1995) occur within about 30 km of Winchester, it is debatable whether these sites are comparable from an archaeobotanical viewpoint. This is because the majority of samples from these sites came from storage pits, either cylindrical or beehive-shaped, and the charred assemblages from Iron Age storage features are quite specific in character. They often produce either the remains of crops stored in spikelet form (i.e. high grain and chaff with some weeds), or what may have been burnt pit linings (lower grain but very high weed seed numbers and sometimes abundant chaff). Pits of this kind were not found on the site, and most of the samples came from postholes and gullies. The character of the assemblage at Northgate House was different in being biased towards grain, with low chaff and weed seed numbers (average grain (G) to chaff (Ch) ratio = 13:1; average grain to weed seed (W) ratio = 20:1). At Winnall Down, for example, the average G:Ch ratio = 2:3 and G:W = 1:7. However, the types of crops grown and suite of weed seeds were very similar, with spelt wheat being dominant in most cases but barley dominating some areas of the site (Winnall Down and the site). Small amounts of oats and probable traces of large pulses such as peas and Celtic bean were present on most sites. Weeds such as cleavers, lambs lettuce (*Valerianella dentata*) and chess were present on all sites, suggesting that soils and crop husbandry practices were similar.

The main differences at the site were the high occurrence of bread-type wheat in some of the samples (posthole NH1619, pit NH1621, gully NH6162, gully NH1633 and all three phase 1.3 samples), the low frequency of chaff and, in particular, the small number of weed seeds. Small, low-growing weeds such as were found in the Winnall Down samples were particularly scarce, but this may not imply that cereals were cut high on the stalk, since processing may have removed small seeds and chaff fragments prior to charring. As noted above, the bread-type wheat could be intrusive, since Saxon and later activity on the site was extensive. A few Late Iron Age sites have produced reasonable quantities of bread-type wheat (e.g. Barton Court Farm, Jones 1984), but in the author's experience in most cases where bread wheat is frequent, the grains turn out to be Saxon when radiocarbon dated. The difference in the grain to chaff to weed seeds ratio is explained by the different nature of the features sampled on the site, where general domestic waste dominated the assemblages. The presence of a concentration of black mustard seeds in posthole NH6210 is of particular interest, as several Late Bronze

Age and Iron Age sites have now produced evidence for oil-seed crops such as brassicas. Campbell & Straker (2003) list a number of Bronze Age and Iron Age sites that have produced large assemblages of brassica seeds, including a large deposit recovered from an Iron Age pot sherd at Old Down Farm (Murphy 1977).

As noted above, the phase 1.3 subsoil sealing these features showed signs of being manured with burnt household waste (frequent abraded cereal grains), with the appearance of corn cockle suggesting that cultivation had taken place in the Roman period. If animal waste was also used, it may not have contained much burnt material as there was little evidence of fodder. The soil micromorphology results (MacPhail, *Digital Section 17*) also produced evidence for cultivation, and the presence of Roman artefacts indicated that this probably continued into the Roman period (Steve Teague, pers.comm.).

Roman and Dark Earth (Phases 2.1, 2.2, 2.3, 2.4)

Bread-type wheat and hulled wheat (predominantly spelt) were the main cereals being consumed, and there is evidence that spelt was being used for malting in phase 2.1. Barley was still an important crop, but the recovery of a predominantly barley sample from a layer of trample CC1762 suggests that, as in later phases, it may have been primarily used for fodder. Oats and rye were minor crops, or perhaps their use for fodder meant that they rarely became charred. Hazelnut shell was present in some samples indicating a low but common use of wild food resources. The arable weed assemblage was similar to phase 1, but corn cockle and rye grass started to become more common, being present in low numbers in six of the fifteen samples. Chess was the most frequent weed, as in phase 1, but it was about twice as frequent as in the earlier phase. Perhaps large grasses such as chess and rye grass were tolerated as weeds, since they were edible and could only be eradicated by hand weeding the crop in the field. This can do more damage than good to a crop sown by broadcasting the seed.

Apart from the malting deposit, the general character of the charred assemblages was one of domestic waste, probably originating from hearths over which piecemeal crop processing of hulled cereals and hand cleaning had been carried out. The large deposit of bread-type wheat in midden NH1346 (presuming contamination was not a major factor) probably represented stored grain that had been burnt to eliminate storage pests, since almost half of the grains showed signs of pest damage. The few large deposits of bread-type wheat that have been found in the Roman period in Britain have primarily been from storage contexts, such as South Shields granary, (van der Veen 1994).

Charred cereal remains were frequent in the samples (average density = 14.1 fpl) suggesting that the arable economy was well-established. Although negative data should be viewed with caution (as crop processing could have removed some weed seeds), the low occurrence of leguminous weed seeds and absence of weeds of acidic or clay soils, such as sheep’s sorrel and stinking chamomile, suggest that cultivation was taking place on the local, fertile calcareous soils and that the intensity was not excessive, unlike sites such as Stansted (Carruthers 2008) which showed signs of stress due to intensive cropping of spelt wheat.

Additional evidence of diet was recovered from cess pit NH4744, a small phase 2.4 pit possibly associated with Roman structure NH8521. Unfortunately preservation conditions were not as good as in the later phases, but mineralised remains indicated that in addition to foods made from flour such as bread, peas and sloes or cherries were being consumed. This is very similar to the simple diet revealed in the Late Saxon to Medieval cess pits, being rural rather than urban in character with no evidence of imported foods (although the information was limited).

The five Dark Earth samples produced relatively high numbers of charred cereal grains with some signs of erosion and fragmentation possibly due to plough damage, but perhaps not as much as might be expected if the soil had been worked for a long period. The ‘lower Dark Earth’ sample showed no obvious difference to the others in this respect. The charred remains appear to represent burnt domestic waste that had been used to fertilise the soil. The occurrences of the different cereals were intermediate between the Roman and Late Saxon periods, with bread-type wheat being dominant and hulled wheat dropping off sharply. Although barley was not particularly frequent to indicate the use of animal waste, oats and rye were a little more frequent. Of course, most of the dung and stable waste used for manuring would probably not be burnt or contain burnt material, so it would leave few traces. The presence of a mineralised field bean hilum and a brassica seed could indicate the use of some material cleaned out of cess pits.

Late Saxon to medieval (Phase 4 to 6)

Cereals

By this period bread-type wheat was the main crop being consumed by the occupants, although barley, oats and rye were also present in varying quantities. The almost complete absence of cereal chaff fragments and very low incidence of weed seeds in the phase 4 to 6 samples demonstrated that cereals being brought to these plots had already been fully processed. Unprocessed oats and barley may have been brought in to be used for fodder, and this would be less likely to become charred. However, charred assemblages containing this type of waste, including hay, oats dredge (a barley and oats mixed crop) and cultivated vetch were recovered from many of the occupation layers, and these also produced very little chaff and weed seeds. The only sample to produce more than one or two rachis fragments was sample 214, from layer NH3240, Plot BW3 (46 wheat, barley and rye rachis fragments), and the hay meadow taxa in this sample suggested burnt fodder or dung was probably represented. It is likely that crop processing waste was viewed as a useful commodity by farmsteads, and that most crops would have been fully processed at the site of production so that processing waste could be used to feed livestock, and transport costs were reduced. Therefore, grain being brought into town to be sold is most likely to have been fully processed, as the charred evidence suggests.

Free-threshing bread-type wheat was the principal cereal grown for human consumption by this time, and this falls from the ear when ripe so must be processed on the farm. Rye is also a free-threshing cereal, but there was only a small increase in this cereal in the Winchester samples from the Roman period onwards (Figure 1), and Green (2008) noted how rare it was in samples from Winchester. It may have been purchased more often as mixed wheat/rye flour to make bread, leaving little trace in the fossil record, or it may have been eaten green in the field by livestock. Rye may have been avoided to some extent because it is very susceptible to ergot infection, and possible outbreaks of ergotism or ‘St Anthony’s Fire’ (which can lead to abortions, convulsions and gangrene) are chronicled in the sixth and eighth centuries (Hagen 1992, 116). Barley and oats require additional stages of processing to remove the husks, which may be one reason why they were considered best suited for fodder. It is uncertain whether small amounts of hulled wheat (probably spelt) continued to be grown into the Saxon period, as has been found on some sites in southern Britain (e.g. Late Saxon Stansted, Carruthers 2008). The fact that thirty-nine definite and possible hulled wheat grains were found in the phase 4 samples but only three cf. hulled wheat grains were found in the phase 5 samples suggests that this did not represent residual material, but a crop that was being 'phased out'. Spelt is a hardy crop that produces good yields and stores well in the husk, so it may have continued to be grown for fodder by some farmsteads. If so, its presence in grain brought into town could be as occasional contaminants, or it may have been purchased to feed livestock being kept in back yards.

Whilst most cereals may have been purchased as flour and so leave traces in the mineralised cess but not charred assemblages, small amounts of cereals may have been used whole in broths and cereal pottages, or used to make groats and frumenty (Hagen 1992). Hagen (*ibid.,* 59) mentions a range of Anglo-Saxon recipies that could well have produced the type of food remains found in many of the cess pits, such as bean soup (beonbrod), pea soup (pysena broþ) and cereal pottages containing oil seeds such as flax (linseed). The remains from other foods such as carrots and mallow leaf broth are unlikely to be identifiable, although a few seeds of each taxon were found (perhaps having been used as flavourings, see below).

As suggested by the dominance of cereal bran in faecal concretions in the cess pit fills, bread was the staple food of the Late Saxon and Saxo-Norman periods (Hagen 1992, 19). Hagen (*ibid.,* 20) states that wheaten bread was considered to be far superior to other breads such as barley bread. She also notes that on special occasions such as feast days loaves were sprinkled with seeds such as poppy and fennel, both of which were recovered from cess pits in plots BE2, BE4, BW2, BW4 and SE1. Pit NH6138 produced abundant mineralised poppy seeds and a fennel seed. Mustard seeds (*Brassica/Sinapis* sp.) which were common in many features may also have been used in this way or for seasoning dishes.

Comparisons of the cereal assemblages from Winchester with those from Mid Saxon to Medieval Southampton (Kath Hunter 2005, Wendy Smith, pers.comm.) and Late Saxon to Medieval Oxford (Ruth Pelling 2006 and pers.comm.) show that scarcity of chaff and weed seeds in urban settings is a common phenomenon. Late Saxon cess pits in Oxford (Ruth Pelling pers.comm.), however, produced some samples that contained reasonable quantities of chaff and weed seeds, suggesting semi-processed grain or grain plus processing waste were being brought into the burh at this time. A sample from Mid Saxon Southampton contained charred oats still enclosed in chaff (Hunter 2005, 164), suggesting that oats were being brought into Hamwic for fodder. Green (2008) gives details of two large Late Saxon grain deposits from Winchester including a possible deposit of malted barley from Sussex Street and a large deposit of rye from Trafalgar House. These types of rich samples, however, are unusual and they are often the result of accidents or deliberate burning of contaminated grain. The overall picture from urban sites was that bread-type wheat (and in Oxford, rivet-type wheat) and barley were the dominant cereals being deposited as burnt waste in town, with lesser quantities of oats and rye. This was also the impression gained by Green (2008) in his study of sites in the western and northern suburbs of Winchester, with large deposits of bread-type wheat or barley sometimes being present. Barley appears to have been more frequent in Southampton in the Mid and Late Saxon periods, and rye may also have been a little more common, but as Table 20 shows caution must be taken when making these sorts of comparisons. Comparing the waste from different types of feature between different sites may not be valid. Green (*ibid.*) also points out that cereals being consumed as flour will leave little trace (or at least, traces that can be identified to cereal type). Therefore, a large amount of data, together with documentary sources, must be examined before an overall, reliable picture can be obtained.

Number of samples where charred cereal is dominant	**Phase**	**Wheat**	**Barley**	**Barley/ oats dredge**	**Oats**	**Total no. samples examined for each feature type**	**Occurrence of Charred Peas and field beans (no. of items including uncertain IDs)**
Floor/occupation layers + 'garden soil'	**4**	2			2	**25**	12
	5		3	2	3	**13**	8
	6	2				**3**	
Pits	**4**	13				**31**	15
	5	3	2		1	**13**	2
	6					**3**	
Hearths & rakeout	**4**				2	**3**	5
	5					**2**	
Postholes	**4**	2				**2**	1
	5	1			1	**2**	1
	6	1				**1**	

Table 20. Winchester NH & CC: the distribution of major crops in different types of context (charred remains only). Numbers shown are 'numbers of samples where the crop is dominant' (but occurrence of peas/beans recorded rather than dominance).

As Table 20 shows, if changes through the phases are to be fully understood at Winchester, not only would sufficient charred and mineralised samples from each phase have to be examined, but also context types would have to be taken into consideration. Thus, it would be wrong to compare phase 4 pit fill samples with phase 5 layer samples, because different types of waste appear to have been deposited in each case. Figure 1, therefore, which is an average of all samples for each phase, is, to some extent, misleading. The distribution of cereals shown in this table is discussed further in the 'fodder' section below.

Pulses

In addition to bread, pulses were clearly a very important component of the diet. Peas and beans could be grown on a garden scale or as part of a crop rotation system on farmsteads. In addition to being an easily dried and stored source of protein, they can help to restore fertility to poor soils (due to nitrogen-fixing bacteria in their root nodules). Pulses can be ground into flour and added to bread, they can be added whole to soups and pottages, and they can be fed to livestock. 75% of the charred pulses came from phase 4 samples, and there were far fewer mineralised pulse remains in the phase 5 samples than in phase 4, as shown below;

Mineralised cess sample	Phase 4	Phase 5	Phase 6
Average no. bean hila per sample	10	0.8	0
Average no. pea hila per sample	3	0.3	0
High pulse remains (including testa)	BE1x2; BE4x3		
Medium pulse remains (")	BW4; BW5x2; SE1x2	BE2	
Low pulse remains (")		SE1; BE4	
No pulse remains (")		BW3	BE4
Total Number of cesspit samples	12	4	1

Table 21. distribution of mineralised pulse remains in the cess pits (one sample for each plot code unless shown otherwise, e.g. BE1x2)

The consumption of pulses, therefore, appears to have decreased from phase 4 to phase 5 (the phase 6 data was too limited). It is uncertain what replaced this relatively cheap source of protein, but examples of changes in the diet at Sedgeford, Norfolk, during the Medieval period cited by Dyer (2000) showed a change from a mainly bread and dairy based diet in the 13th century to a heavily meat and fish based diet by the early fifteenth century. Perhaps, at this early date in Winchester, dairy products were increasing in importance and beginning to replace pulses, or maybe a wider variety of cereal based dishes were being consumed, as oats and rye became more readily available.

Comparisons with the Mid Saxon cess pits at Hamwic (Carruthers and Hunter 2005) suggest that pulses were possibly even more important components of the diet earlier in the Saxon period, so perhaps the decline seen in Winchester between phases 4 and 5 was part of a larger trend. Abundant mineralised evidence for pulses was present in the Hamwic cess pits. Fifty-nine charred peas and beans were recovered from 26 samples (including cf. pea/bean fragments) compared to over 5000 cereal grains (Carruthers and Hunter 2005, 183). This demonstrates that pulses are grossly under-represented in the charred plant record. The number of charred peas and beans in phase 4 samples in Winchester was 33 (not counting the indeterminate large legume fragments), although the number of samples examined was much larger (61 flots; see Table 20).

Anglo-Norman and later samples from Southampton's French Quarter did not produce large quantities of mineralised material so it is difficult to make comparisons, but one Anglo-Norman sample contained a large number of charred pulses (Wendy Smith, pers.com.). Comparisons with Late Saxon Oxford were also difficult to make because of differences in preservation, although charred possible peas were present in small numbers in several samples (Ruth Pelling, pers.com.).

Using the mineralised cess pit data from Winchester as the most accurate indication of importance of pulses, therefore, of the seventeen phase 4 to 6 cesspit samples examined only the two poorest samples produced no evidence for eating pulses (BE4-CC2120; BW3- NH3438; both <1% faecal concretions) and these were from phases 5 and 6. The only reasonably well preserved samples to produce low concentrations of pulse remains were SE1-NH5175 and BE4-CC2305, (both phase 5, both 50% faecal concretions; 2 hilums and 3 pulse testa fragments only). Since a grape pip was recovered from a phase 5 pit on plot SE1, this could be another indication that the occupants enjoyed a slightly higher standard of living than the occupants of some of the other properties. Perhaps they had an alternative source of protein to pulses, such as greater quantities of meat or fish. All of the phase 4 cess pit samples produced high or medium concentrations of pulses, suggesting that not only were pulses as much a part of the staple diet as cereal-based foods such as bread, but they were also probably being consumed all year round, even when other foods such as fresh leaf vegetables were available. Pulses were, therefore, being eaten on a daily basis either because they were cheap and 'filling', or possibly for cultural reasons.

Nuts, Fruits, Vegetables and Flavourings

Charred hazelnut shell (HNS) fragments were remarkably frequent and widespread, particularly in samples from layers in all phases. This suggests that, rather than eating hazelnuts piecemeal around the fire and throwing the shells into the household fire (from where it became thrown into cess pits with human food waste), HNS was more closely associated with burnt animal fodder and bedding, and general waste from occupation layers. Whether this suggests that some sort of large scale drying was taking place prior to grinding the nuts into flour or storage requires further investigation. Perhaps the shells were collected over time to be used for kindling for smithing hearths and kilns. Some, but not all, of the hearth and rakeout samples examined for this report produced large numbers of HNS fragments e.g. rakeout NH4226 = 482 fragments; hearth NH3782 = 777 fragments.

A few charred and frequent mineralised *Prunus* sp. (plums, cherries, sloes etc.) stones and kernels were recovered from all phases. Unfortunately because mineralisation mainly preserves soft tissues, most of the remains consisted only of the seed kernel, so identification was based on size and shape. This meant that distinction between the small round stones of cherries and sloes could not be made. Because the fruits of sloes are astringent to taste and they are rarely eaten today, it might be thought that most of the sloe/cherry kernels were from more palatable cherries. However, amongst the charred whole stones, only sloe was identified. When preserved by drying and rehydrated, the astringent taste of sloes is lost (Wiltshire 1995). Cooking can also improve flavour. Because sloes are much more likely to be growing wild in the hedgerows, being a particularly useful thorny shrub for hedging (also called blackthorn), sloes would have been much easier to gather for free, or cheaper to buy from market than cherries (which in the authors experience are heavily predated by birds). Other members of this genus are more likely to have been growing as orchard fruits, such as bullace/damson/greengage and plum. These were less common in the cess pits, but found in all three periods. Where the same fruits were found in successive phases, e.g. plums in Plot BE4, phases 4.2 and 5, it is possible that a fruit tree was growing on the plot (NB. the life of an apple tree is usually about 70-100 years).

The mineralised seeds of apples/pears are, fortunately often preserved with their seed coats and on these occasions they be identified as apple. Where seed coats were not preserved the identification had to be left at apple/pear, although no pear seeds were positively identified. It is impossible to tell from the seeds whether the apples were wild crab apples or a cultivated orchard variety. Apple pips were present in phase 4 and 5 samples.

In view of the frequency of other possible hedgerow fruits and nuts it is surprising that blackberry seeds were so rare. They were common in samples from the Middle Saxon cess pits at Hamwic (Carruthers 2005). No wild strawberry seeds were found, and this is another native hedgerow fruit that is often common in faecal deposits.

It is unlikely that this is because of seasonal availability, since fruits can readily be preserved by boiling them down to a thickened pulp, particularly if honey is added to raise the sugar content (Hagen 1992). Also, because a reasonable number of cess pit samples was examined it is likely that cess from all seasons was represented. The absence may indicate that ungrazed open areas of scrub were not common in the vicinity of the town, or that such resources were jealously guarded by land owners.

Seeds that may have been used to add flavour to food include native plants such as mustard seed (*Brassica/Sinapis* sp.), carrot seed and poppy seed. Non-native flavourings include opium poppy, a plant that has a long history of use, dating back to the Iron Age. These seeds can also be used to provide oil, as can flax (linseed). Fennel, a herb originating in the Mediterranean, was tentatively identified in a phase 4 cess pit fill. All of these taxa were recovered from Mid Saxon Hamwic cess pits, along with several additional taxa that were not present in Winchester, such as coriander, caraway, lovage and dill. Herbs such as these could be grown in back yards as pot herbs, although fennel would probably have been bought as imported seed since it does not set seed well in the British climate.

Imported fruits and flavourings were notably scarce in the Winchester samples, presumably indicating a fairly low status. A single possible fig seed was present in a phase 4.1 pit fill NH2451, Plot BW5. The remaining imported taxa were found in Plot SE1, with the fennel seed coming from a phase 4.2 pit fill and the grape pip coming from a phase 5 pit fill. A small mineralised fragment of a deeply ridged, thick walled stone, probably peach (*Prunus persica*), was recovered from pit NH6231, phase 4.2. If this identification was correct it would be the earliest post-Roman record of peach for the British Isles. Peaches originate from China. They were grown or imported into many regions by the Romans, including Britain since it was recorded from AD 1st/2nd Century New Fresh Warf, London (Willcox 1977). No early Medieval records for this soft fruit exist for Great Britain, to the author's knowledge. Being perishable, they would probably have been very expensive to import. Peaches can be grown in this country, but are more likely to fruit well against a wall or under glass. With increasing climatic warming that began in the 11th century AD, it is possible that peaches were successfully grown outdoors in milder parts of the British Isles such as Winchester.

Imported fruits such as grape and fig were more frequent in the Mid Saxon cess pits in Hamwic (Carruthers 2005) and in the Anglo-Norman samples from Southampton French Quarter (Wendy Smith, pers.comm.). Late Saxon deposits in Oxford, which included several waterlogged and some mineralised samples, produced a similar range of native hedgerow and orchard fruits to the Winchester cess pits, including hazelnuts, blackberries, apples, plums/damsons, sloes and possible cherries (Robinson 2003; Pelling 2002; Pelling, pers.comm.). This suggests that exotic foods were typically scarce in the inland Late Saxon burhs, but that coastal towns such as Hamwic with trade links to Europe and beyond had a wider range of foods available. Although the status of the occupants in the areas of these different settlements where excavations took place may not comparable, presumably exotic goods would be cheaper and easier to get hold of at the point where they are imported.

Many other plants may have been consumed but they do not leave an identifiable trace in mineralised pit fills, such as leafy vegetables, leeks, onions and root vegetables. Some of the plants growing as common weeds of disturbed ground, such as fat hen and mallow, can be used as leaf vegetables. Possible wild turnip (cf. *Brassica rapa*) seeds were common in samples from all phases, and even wild plants of this species can be used as a root or a leaf vegetable (Mabey 1972, 166). Leaves from the common hedgerow herb, garlic mustard (*Alliaria petiolata*), can be used as a flavouring, as the name suggests, and has an alternative name of ‘poor man’s mustard’.

Possible Medicinal Plants

Many of the native plants present in the samples can be used for a variety of medicinal purposes, including poisonous weeds such as henbane and corn cockle. One theory as to why corn cockle was so frequent in Saxon cess pits is that the seeds can help to remove worms (Hagen 1992, 116). However, precise dosing would be important as eating them can prove fatal. Unless large concentrations of seeds occur it would be impossible to differentiate the seeds from native medicinal and vegetable plants from the seeds of ruderal weeds growing close to the features. Amongst the plants listed in old herbals such as Culpepper (1826) and Grieve (1931), the following were present as mineralised fruits/seeds and so may well have been consumed for medicinal purposes;

Opium poppy – seeds are not effective but crushed capsules were used internally and externally for pain relief

Figs – laxative

Corn cockle seed – to cure dropsy and jaundice, and remove worms (poison!)

Hemp agrimony – astringent, tonic, diuretic (roots and leaves), tanning leather.

Carrot seed – carminative, stimulant and useful with flatulence

Fennel seed – carminative, for coughs, dispels fleas

Henbane seeds – antispasmodic, hypnotic, mild diuretic, mainly external use (poison!)

Black nightshade and woody nightshade seeds – externally to relive inflammation and internally as a mouthwash (poison!)

White bryony seed – emetic, tanning leather (poison!)

Fairy flax - purgative

Fibre crops and possible dyeplants

Cultivated flax seeds are commonly found in Saxon charred samples despite the fact that the oily seeds do not preserve well by charring. Both charred and mineralised seeds were recovered in small numbers in seven phase 4 and 5 samples. These may have been a useful by-product of flax plants being grown for fibre, but no flax processing waste was found (although it is more likely to survive in waterlogged deposits). The identification of dyeplants is more problematic, as many of the edible fruits with coloured berries can be used to provide a range of colours. Several seeds were tentatively identified as *Genista* sp., a genus that includes dyers greenweed (*G. tinctoria*). Dyers greenweed is one of the dyeplants recovered from Viking York (Tomlinson 1985). All parts of the plant produce a green/yellow dye. Although many potsherds stained with madder were recovered from the plots, preservation of the root by mineralisation or charring in a recognisable form is unlikely. Unfortunately no waterlogged deposits were found, since Tomlinson recovered most of her dye remains from waterlogged deposits. The following plant remains could have been used for dyeing;

Sloes, plums, elderberries – blue/black

Bird cherry – dark grey to green

Bracken – brown/green

Dyers greenweed – green/yellow

White bryony – red

Blackberry – purple

Black and woody nightshade - red

In addition to fruits and seeds, other parts of plants like the leaves of carrot and bark of apple trees could have been used. The root of white bryony, for example, produces a red dye like madder. The presence of seeds could indicate that plants were being brought onto the plot for dyeing purposes. This is particularly likely for plants like white bryony, which is unlikely to be growing locally as it is a twining plant of woods and hedgerows. It may have served a dual purpose, with the berries being used medicinally and the roots being used for dyeing.

Differences in waste deposition and the occurrence of fodder crops

From Table 20 it can be seen that most of the large deposits of charred bread-type wheat were recovered from the phase 4 pits, mixed in with mineralised faecal waste. These large deposits are likely to mainly represent stored grain that was deliberately burnt in order to destroy pest infestations. They may have been primarily deposited in cess pits because they located close-by, or perhaps to ensure that the pests and diseases were well and truly buried and could not re-infect the stored crop. It is notable that all of the cess pit samples contained reasonable quantities of charred cereal remains, suggesting that this was not just a casual occasional deposition of hearth sweepings, but a more deliberate, regular activity carried out on every property. Similarly, mineralised straw and, sometimes, rush fragments were present in every cess pit. In some cases concretions of matted straw were present. It is likely that these remains represent material swept up from floors, into which charred grain was mixed, having been burnt during preparations for cooking. No charred grain was observed concreted in with the straw, however, so perhaps the deposition of separate hearth sweepings and floor sweepings was more common. Charred material and straw would have been thrown into cess pits in order to reduce smells and soak up liquids. Straw and rushes may also have been used for toilet paper. Occasional moss fragments were mineralised, but not sufficient to suggest it had been regularly used as toilet paper, as has been found in some medieval cess pits (Greig 1981).

The phase 5 cereal assemblages were more varied in composition and fewer large deposits of bread-type wheat were recovered. This could suggest that storage conditions had improved over time, since fewer large deposits of stored grain were being destroyed. Alternatively it could indicate a wider range of cereals were being eaten by humans, or a different type of waste was being thrown into the cess pits. Most of the deposits of oats, barley and dredge present in samples from layers appear to represent fodder and stable waste, since they are mixed with hay grown on damp meadows and cultivated vetch.

Where sufficient comparable contexts have been examined, e.g. phases 4 and 5 pits and layers, changes can be seen as follows. In phase 4 oats were the main fodder crop being spread around the layers as waste, whilst in phase 5 a wider variety of fodder crops were being used, including barley, barley/oat dredge, oats and cultivated vetch. Of the four samples to produce confirmed cultivated vetch seeds, all were from phase 5 (2 pits, 2 layers), so it appears that this fodder crop (which has been eaten by humans in times of famine) was introduced in the Saxo-Norman period. No clear conclusions can be drawn for phase 6 because too few samples were suitable, but there may have been a reduction in keeping livestock in the town, since fewer fodder-type deposits were found. Bread-type wheat was much more dominant, although there was a small increase in rye.

Charred pulses were also commonly present in samples from layers and it is possible that some peas and beans were used to feed livestock being kept in back yards. The animal bone report indicates that pigs may have been reared on the plots (Strid, *Digital Section 11*) and the soil micromorphology found signs of stable waste and trampling (Macphail, *Digital Section 17*).

Arable crop quality over time & corn cockle contamination

The Late Saxon to Saxo-Norman arable fields must have been a riot of colour, with weeds such as corn cockle (large dark pink flowers), stinking chamomile (white, daisy-like flowers) and corn marigold (yellow) growing as major crop contaminants. Corn cockle in particular was rife throughout phases 4 and 5, despite the fact that these large, black seeds could easily be picked out of the flour prior to milling. Clearly, where cereals were purchased already ground into flour, quality control was more difficult, although the fragments of black seed coats of corn cockle can be spotted amongst the flour if contamination is particularly bad.

Corn cockle seeds can have deleterious effects on people and livestock if present in high numbers, because they have a high saponin content. Wilson (1975) mentions a figure of > 0.5% in bread or gruel causing ill effects. Silverside (1977) suggests that crop rotations involving root crops could help to eradicate this harmful weed, because it cannot lie dormant for long periods and its germination is suppressed by root crops. Therefore, changes to the crop rotation system later in the medieval period may be at least part of the reason why later medieval sites usually produce fewer charred seeds than were found in these samples.

It is difficult to compare phases 4 and 5 with phase 6 as only one mineralised sample and seven charred samples were examined from the latest phase. One phase 5 cess pit, NH3438, BW3, contained abundant mineralised whole corn cockle seeds but no evidence of impressions. It is possible that this household was careful to remove contaminants prior to milling, although bran-rich faecal concretions were also rare in this deposit, so the pit may have contained another type of waste rather than cess. Grieve (1931) notes that the seeds have been used to cure dropsy and jaundice in the past, and, as noted above, they can be used for their anti-helminthic effect. The fact remains, however, that 82 corn cockle seeds were recovered from a relatively small amount of residue, so this must indicate hand-cleaning unless medicinal use is suggested. In total, significant numbers of whole seeds that probably indicate deliberate hand-cleaning of corn cockle from grain were found as follows;

Phase 4.2 : Plot BW4, pit NH2133 – 25 charred seeds
Phase 5 : Plot BW5, pit NH2237- 10 charred seeds
Plot BE4, occupation layer 2330 – 20 mineralised seeds
Plot BW3, pit NH3438 – 82 mineralised seeds

Since many more charred and mineralised samples were examined from phase 4 (61 samples, 13 of which were mineralised) than phase 5 (31 samples, 5 mineralised), it appears that hand-cleaning was much more common in the Saxo-Norman phase than the Late Saxon phase. This would improve the quality and taste of the flour and reduce the ill effects of this noxious weed. For each phase, the average frequency of whole corn cockle seeds per sample was:

Phase 4=1.2 ; phase 5=1.5 ; phase 6 = 0.1

Seed impressions in faecal material (although only rough estimates) averaged at;

Phase 4=2.1; phase 5=1.8; phase 6 = 0 (where 1 = +, 2 = ++ etc.)

It appears then that more whole seeds were being picked out in phase 5 resulting in lower rates of contamination of the flour. By phase 6 contamination seems to have been less of a problem (although much fewer samples were examined).

Since corn cockle flowers are bright pink and showy, it is perhaps surprising that it became such a problem in Saxon and Early Medieval times, as this weed in particular would have been easy to remove in the field. Hand-cleaning of seed corn on the farmstead would have been worthwhile in order to help improve the quality of the crop in the field. It would appear that the quality of grain and flour being sold at market in towns such as Winchester was not of a very high quality. On the other hand, impurities such as chaff were very rare in samples from phases 4 to 6 and small-seeded weeds were low in number. Crop processing, in particular winnowing, appears to have been effective enough to have removed all but the larger, heavier weed seeds of a similar size and density to grain. Indications of crop quality from cereal grain size also suggest that the quality was generally good, with most of the wheat grains being large and plump, and the oats and barley grains being well-formed and often notably large. Variations in wheat grain shape, from very square grains to more elongated or pear-shaped grains suggest that a wide variety of land-races were being cultivated, and that grain was being brought into the town from a wide area. This suggestion is also supported by the range of soil preferences represented in the arable weed assemblage (see below).

Weed Ecology

Although it is not always possible to be sure that the weed seeds present in the charred assemblage represent arable weeds (rather than another type of burnt waste) some taxa that were consistently present, and are also often found on other sites, can be useful in providing ecological information. One arable weed indicative of damp clay soils, stinking chamomile, increased significantly in the Phase 5 samples as shown below.

61 Phase 4 samples = 45 seeds (= 0.74 seeds per sample)

31 phase 5 samples = 196 seeds (=6.32 seeds per sample)

7 phase 6 samples = 6 seeds (= 0.85 seeds per sample)

This may indicate that grain was being brought in to town from a different source during this phase, perhaps from further afield to supply the growing population. Corn chamomile is often associated with wheat, because wheat prefers heavier soils.

Corn marigold, a weed of sandy acidic soils was scarce in phase 4 but increased from phase 5 to phase 6. In all cases, the samples where corn marigold seeds were present produced notably high levels of oats or rye. The sample from phase 6 that produced the highest number of seeds (14 seeds; sample 214) was the only sample to produce rye rachis fragments, although no rye grains were recovered. These statistics confirm that oats and rye were being grown on poorer, sandy soils. It also suggests that rye may have been more common in phase 6 than the charred plant record suggests, perhaps being used as an early bite fodder which is cut before it sets seeds.

Charred seeds from plants of wet ground and marsh, such as spike-rush and sedges (*Carex* spp.), greatly increased over time;

Phase 4 = 54 seeds in 61 samples = 0.88 seeds per sample

Phase 5 = 112 seeds in 31 samples = 3.61 seeds per sample

Phase 6 = 121 seeds in 7 samples = 17.28 seeds per sample

Because these wet ground taxa can become charred either amongst hay or as arable weeds growing along field margins next to ditches, these figures are difficult to interpret. Samples that contained burnt hay such as sample 214, Plot BW1, produced large numbers of seeds from wetland taxa. The statistics shown above, therefore, may reflect increased amounts of fodder including hay being burnt on the plots rather than the movement of arable onto wetter soils, or they could suggest that hay meadows were becoming damper.

Conclusions

The charred and mineralised assemblages from Winchester have helped to draw together and clarify previous evidence for agriculture and diet summarised by Green (2008). Unfortunately the Pre-Roman and Roman assemblages were difficult to interpret because of concerns about possible contamination. Apart from the surprisingly frequent bread-type wheat found in both periods, the spelt, emmer and hulled barley frequencies were similar to many sites in southern Britain. There was evidence for malting spelt wheat in phase 2.1.

The Late Saxon and Anglo-Norman samples provided detailed evidence of diet, which was fairly simple in nature, based on cereals and pulses with hedgerow and orchard fruits and nuts. The trace of imported fruits and spices mainly came from plot SE1. Several plots produced evidence to suggest that livestock was being kept in the backyards. Flax and possible dyeplant remains were present on some plots, providing evidence for craft working. Bearing in mind differences in preservation, diet in Late Saxon Winchester was more similar to Late Saxon Oxford than Southampton, although the cereal evidence was similar.

Plot / Economic Plants	Pre-Roman 1	Pre-Roman 2	Roman	BE1	BE2	BE3	BE4	BE5	BW1	BW2	BW3	BW4	BW5	SE1	SE2	SE3
main cereal (charred)	Hulled barley, Spelt wheat	Spelt wheat, hulled barley,	Spelt wheat & bread-type wheat	Bread-type wheat	Hulled barley bread-type wheat	Bread-type wheat	Bread-type wheat, hulled barley	HULLED BARLEY & OATS (DREDGE?), BREAD-TYPE WHEAT	Bread-type wheat, oats	Bread-type wheat	oats	BREAD-TYPE WHEAT, oats	BREAD-TYPE WHEAT	BREAD-TYPE WHEAT	Bread-type wheat	BREAD-TYPE WHEAT
other cereals & fodder crops (charred)	emmer wheat, oats, rye (bread-type wheat?)	Oats, (bread-type wheat?)	Hulled barley, oats, rye	hulled barley, oats, rye	Oats, rye	Barley, oats, rye	Oats, rye, Cultivated vetch	Rye, cultivated vetch, hay?	hulled barley	Hulled barley, oats	Hulled barley, bread-type wheat	Hulled barley, rye	Hulled barley, oats	Hulled barley, oats	Hulled barley, oats, rye	Hulled barley, oats, rye
cereal bran			+	++++	+++		++++					++++	++++	+++		
pulses (pea) (bean)		[cf.B]	P	BP++++	B++		BP+++	[P]		[BP]	[BP]	BP ++	BP++	BP++		
hedgerow fruits & nuts	HNS	HNS, [cf.sloe]	HNS+	HNS++ Elderberry	HNS+++	HNS	HNS++ Blackberry Bird cherry	HNS+++, [blackberry], [hawthorn]	HNS+++	HNS++++, elderberry	HNS++++,	HNS+++	HNS++	HNS++, elderberry+++	HNS++	HNS++
orchard fruits ?			Sloe/ cherry+++	Plum ++ bullace /damson/ greengage ++ sloe/ cherry +++ Apple+			Plum++ Sloe/ cherry+++ Apple+++ Apple/pear+++			bullace/ damson/ greengage	[Bullace/ damson/ greengage], [sloe] ++, [apple]	Sloe/ cherry Apple, apple/pear	Sloe/ cherry, apple	Sloe/ cherry++, Apple +++, apple/pear+++		
flavourings/ oilseeds	Brassica (cf. black mustard)+++				Brassica carrot poppy	brassica	Opium poppy	Brassica+++		Poppy, brassica	brassica	Opium poppy, brassica++		Opium poppy+++ brassica		
fibre and possible dye plants				flax	Flax		bird cherry, blackberry,	Blackberry,		Flax, elderberry, cf. dyers greenweed	cf. dyers greenweed	cf. Flax	flax	Elderberry?, bryony, sloes		
imported foods													cf. fig	Grape, Fennel , cf. peach		
number of samples / mineralised samples examined	16 / 0	7 / 0	15 / 1	3 / 2	3 / 1	1 / 0	11 / 8	4 / 0	2 / 0	17 / 0	14 / 0	12 / 1	7 / 2	12 / 3	4 / 0	8 / 0

Table 22: Main economic plants by phase and plot

KEY : HNS = hazelnut shell fragments; B = field bean; P = pea; occasional = no symbol; several = ++; frequent = +++; abundant = ++++; CAPITALS = some large charred cereal deposits present >100 grains; [ ] = charred pulses & fruits, all cereals charred (NB Tables 23 and 24 in separate document)

References

Biddle, B.(2005) Staple Gardens. In Whinney ,R. (ed.) Oram's *Arbour. The Iron Age Enclosure at Winchester. Winchester*: Winchester Museums Service, pp.75-78.

Campbell, Gill & Straker, Vanessa (2003) Prehistoric crop husbandry and plant use in southern England: development and regionality. *In* Kate A. Robson Brown (ed) *Archaeological Sciences 1999. Proceedings of the Archaeological Science Conference, University of Bristol, 1999.* BAR Int Ser. **1111**, 14-30.

Carruthers, Wendy (1989) for 1988 Mystery object no. 2 – animal, mineral or vegetable? Circaea 6 (1), p.20.

Carruthers, W.J. (1989) The carbonised plant remains. *In* P.J.Fasham, D.E.Farwell & R.J.B.Whinney, *The Archaeological Site at Easton Lane, Winchester*. Hants. Field Club Mono. 6, p.131-4.

Carruthers, Wendy. J .(2000a) The mineralised plant remains. *In* A.J. Lawson & C.J. Gingell, *Potterne 1982-5: animal husbandry in later prehistoric Wiltshire*. Wessex Arch. Rep. 17, 72-84, 91-95.

Carruthers, Wendy J. (2005) Mineralised Plant Remains. *In* Vaughan Birbeck, with Roland Smith, Phil Andrews & Nick Stoodley, *The Origins of Mid-Saxon Southampton: Excavations at the Friends Provident St Mary's Stadium 1998-2000.* Wessex Archaeology, pp. 157-173.

Carruthers, Wendy (2008) CD-Rom Chapter 29: Environmental Overview. Chapter 34: Charred, mineralised and waterlogged plant remains. *In* Nicholas Cooke, Fraser Brown & Christopher Phillpotts, *From hunter gatherers to huntsmen*. *A history of the Stansted landscape*. Framework Archaeology Monograph No. **2.**

Culpepper, Nicholas (1826) *Culpepper's Complete Herbal*. Facsimile edition 1979, Gareth Powell Ltd.

Green, F. (1979) Phosphate Mineralisation of Seeds from Archaeological Sites. *Jour. Arch. Sci.* **6**, 279-284.

Green, F. (2005) Sites in the Western Suburbs. In Whinney ,R. (ed.) Oram's *Arbour. The Iron Age Enclosure at Winchester. Winchester*: Winchester Museums Service, pp.75-78.

Green, F.J. (2008) Chapter 2: Late Saxon, Medieval and Post-Medieval Plant Remains. *In* D. Serjeantson & H. Rees, (eds) *Food, Craft and Status in Medieval Winchester*. Winchester Museum Service.

Greig, James, (1981) The Investigation of a Medieval Barrel-latrine from Worcester. *JAS 8*, 265-282.

Grieve, Mrs M. (1931) *A Modern Herbal*. Revised edition 1992. Tiger Books International, London.

Hagen, Ann (1992) *A Handbook of Anglo-Saxon Food Processing and Consumption*. Anglo-Saxon Books.

Jacomet, Stefanie (1987) *Prahistorische Getreidefunde*. Botanisches Institute der Universitet Abteilung Pflanzensystematik und Geobotanik, Basel.

Mabey, Richard (1972) Food for Free. Collins, London.

McCobb, Lucy M.E., Briggs, Derek E.G., Carruthers, Wendy J. & Evershed, Richard P. (2003) Phosphatisation of seeds and roots in a Late Bronze Age deposit at Potterne, Wiltshire, UK. *J.A.S.* **30**, 1269-1281.

Pelling, R. (2002) The charred plant remains. *In* Z. Kamash, D. Wilkinson, B. Ford, J. Hiller. Late Saxon and Medieval Occupation : Evidence from Excavations at Lincoln College, Oxford. 1997-2000. *Oxoniensia,* **LXVII**. pp.199-286.

Pelling, Ruth (2006) The charred and waterlogged plant remains*. In* D. Poore, D. Score & A. Dodd. No 4A Merton St., Merton College, Oxford: the evolution of a Medieval Stone House and Tenement and an Early College Property. *Oxoniensia* Vol.**LXXI,** 211-339.

Pelling, Ruth (in preparation) Oxford Castle: The Charred, Mineralised and Waterlogged Plant Remains.

Robinson, M. (2003) Environmental Reports *in* A.Dodd (ed.) *Oxford Before the University. The Late Saxon and Norman Archaeology of the Thames Crossing, the Defences and the Town.* Oxford Archaeology, Thames Valley Landscapes Monograph No. **17.**

Silverside A.J. (1977) A Phytosociological Study of British Arable Weed & Related Communities. Univ. Durham PhD thesis.

Smith, Wendy (in preparation) The charred, mineralised and waterlogged plant remains from Late Saxon-Early Modern deposits at Southampton French Quarter.

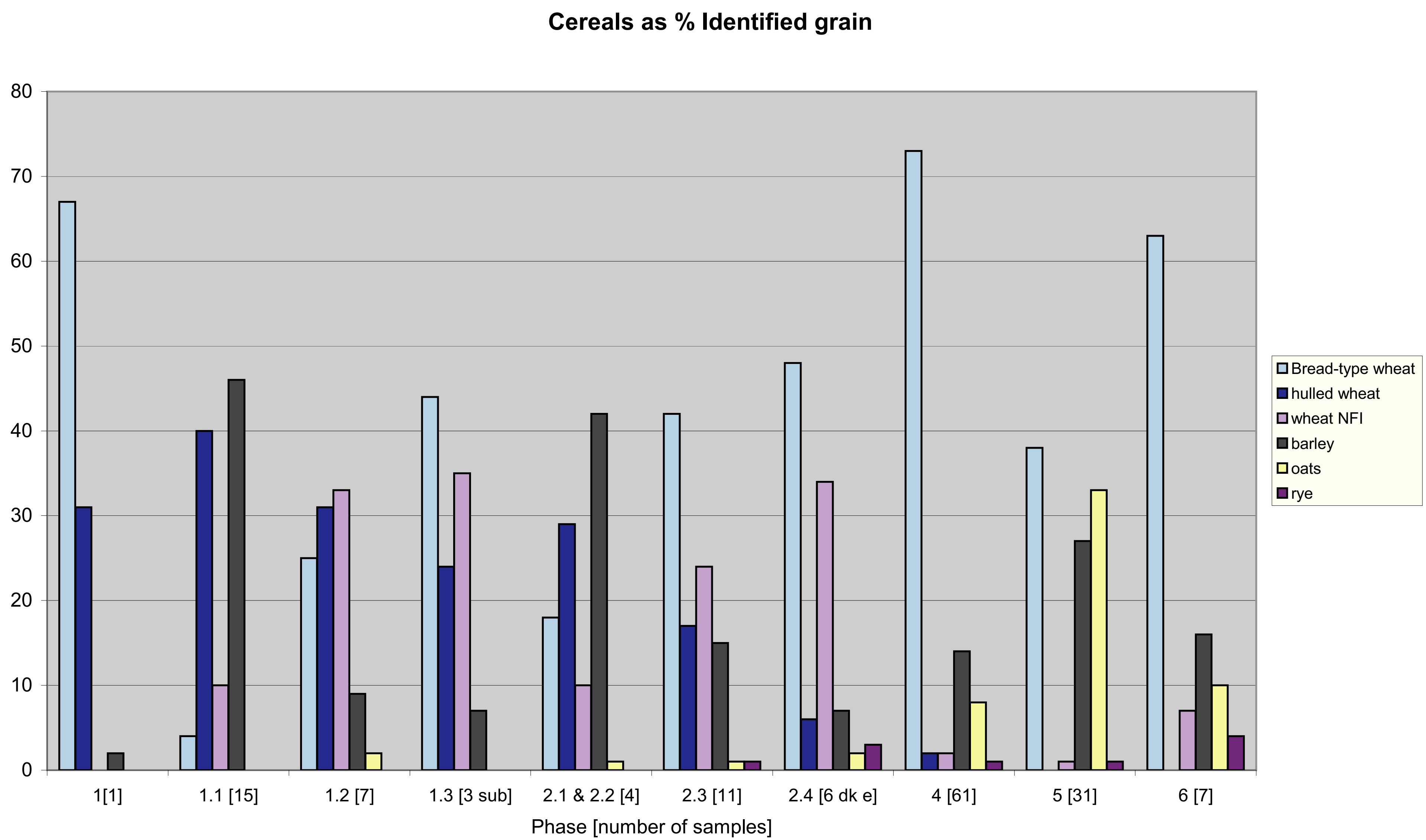
Stace, Clive (1997*) New Flora of the British Isles*. Second Edition. C.U.P.

Tomlinson, Philippa (1985) Use of Vegetative Remains in the Identification of Dyeplants from Waterlogged 9th-10th century AD Deposits at York. *J.A.S.* **12**, 269-283.

Van der Veen, M. (1994) Reports on the biological remains. *In* Paul Bidwell & Stephen Speak, *Excavations at South Shields Roman Fort*. Soc Antiq. Newcastle upon Tyne Mono. Ser**. 4,** 243-264.

Willcox, G.H. (1977) Exotic plants from Roman waterlogged sites in London. *J.A.S. 4,* 269-82.

Wiltshire, Patricia E.J. (1995) The effect of food processing on the palatability of wild fruits with high tannin content. *In* H. Kroll & R.Pasternak (Eds) *Res Archaeobotanicae*. Proc. 9th IWGP Symposium, Kiel, Oetker-Vosges, Kiel, 385-397.



Cereals as % Identified grain
80
70
60
50
40
30
20
10
0
1[1]
1.1 [15]
1.2 [7]
1.3 [3 sub]
2.1 & 2.2 [4]
2.3 [11]
2.4 [6 dk e]
4 [61]
5 [31]
6 [7]
Phase [number of samples]
Bread-type wheat
hulled wheat
wheat NFI
barley
oats
rye

Plate 1

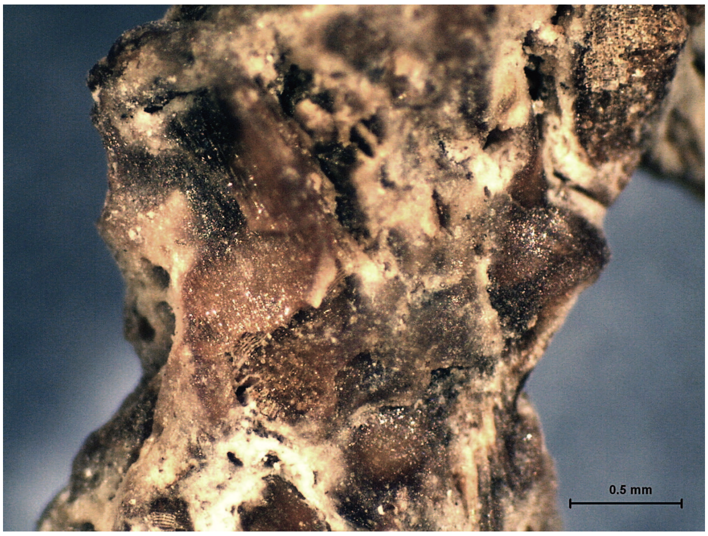


Plate 2

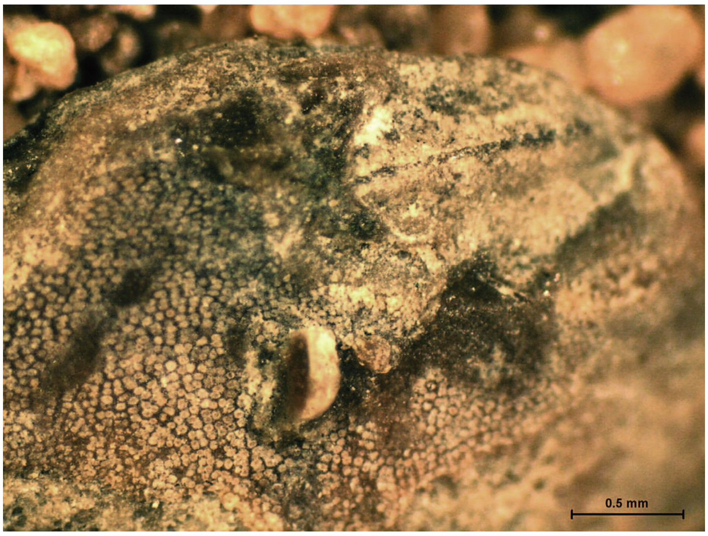


Plate 3

Plate 4

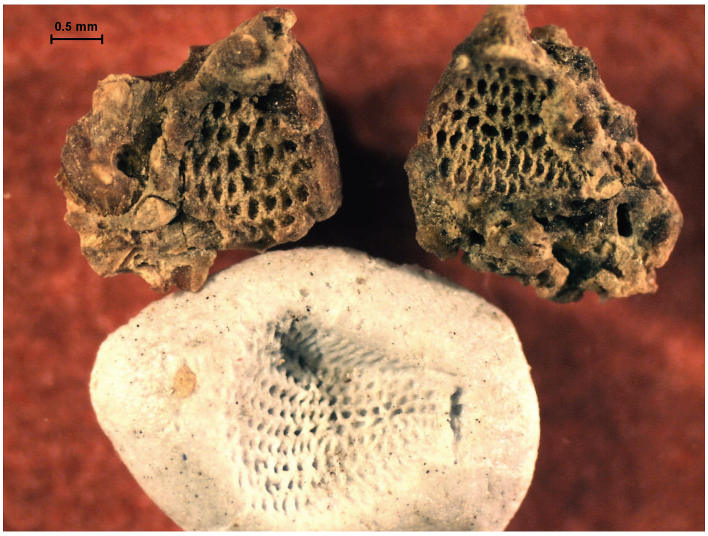


Plate 5

Plates

1. Concreted bran fragments
2. Close up of concreted bran fragments
3. Pea hila & cell pattern
4. Bean hilum and cell pattern
5. Corncockle impressions ancient and modern

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