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309

West Stow, Suffolk: Cereals and crop weeds

Introduction

The excavations at West Stow were carried out at a time when the recovery of botanical remains from archaeological sites was far from being a routine procedure. Nevertheless, during the 1972 season material was collected by flotation for analysis by Dr A.J. Legge. In the event Dr Legge had insufficient time to complete this work, and the plant remains have now been identified by the writer. Further small samples collected during excavation have also been examined. It also seems appropriate to include in this report cereal samples from a few Anglo-Saxon features at the nearby predominantly Iron Age settlement WSW 030. Details of all samples containing charred plant remains are given in Table . Some of the pottery and fired clay from the main settlement site has been examined for grain impressions.

This report therefore deals with a diverse group of samples collected over a period of some ten years and differing greatly in size (the entire fill of Hut 63 was flotated, whereas at WSW 030 a standard 5 kg sampling unit was used). Though the samples from the main settlement are large, they are few in number and this, of necessity, rules out certain lines of investigation. However, considered in relation to information from other Breckland sites and from palynology the samples provide some valuable information, particularly about early Anglo-Saxon farming, of which so little is known.

Site and laboratory methods

In the 1972 season large bulk soil samples from Pit 472 and Hut 63 were processed on site in a froth flotation tank of the type described by Jarman et.al. (1972), collecting the flot in 1mm and 300 micron mesh sieves. Further small samples of miscellaneous conspicuous charred plant remains were collected by hand from Ditch 78, Post-hole 565 and Hearth WE2/3. Plant remains were extracted from a small soil sample of Pit 59, and also from the samples from WSW 030, by water-flotation in the laboratory, using

Feature	Period	Sample wt/volume	Type of material	Extraction method
Ditch 78	Iron Age	-	Nut-shells	Hand-collection
Pit 472 Layers 1-3	Roman	1. 24 buckets 2. 15 buckets 3. 16 buckets	Bulk soil Bulk soil Bulk soil	Machine flotation Machine flotation Machine flotation
Hut 63 (1)	Anglo-Saxon Mid 5th c.	362 buckets	Bulk soil	Machine flotation
Pit 59 (3)	Anglo-Saxon	500 g.	Bulk soil	Flotation in lab.
Post-hole 565	Anglo-Saxon 5th-6th c.	-	Inflorescences	Hand collection
Hearth WE2/3	Anglo-Saxon?	-	Cereals	Hand collection
WSW 030 026 (Pit): 20-40cm; 40-50cm;50-60cm	Anglo-Saxon C14: 1280 ± 70 bp or 670ad(HAR-3382)	3 x 5 kg	Bulk soil	Flotation in lab.
WSW 030 101 (Hut)	Anglo-Saxon	5kg	Bulk soil	Flotation in lab.
WSW 030 143 (Hut)	Anglo-Saxon	5kg	Bulk soil	Flotation in lab.

Table : Details of the samples

In the 1972 season the soil volume processed was recorded as numbers of buckets (approx. 2.5 gallon or 11.35 litre) of excavated soil.

a 250 micron mesh sieve. The difference in fine mesh size is unlikely to have affected the recovery of anything larger than *Juncus* seeds.

The dried flot was sorted under low power of a binocular microscope. There was some contamination by modern plant remains, mainly fine roots, but contaminant weed seeds were rare. Most samples were completely sorted, but the largest were sub-divided (472 (2) and (3)). Charred plant remains identified are listed in Table

Pottery and fired clay fragments from seven huts (3, 12, 15, 16, 21, 44 and 47) were inspected in detail for cereal impressions. Conspicuous impressions on Anglo-Saxon pottery from layer 2, noted during sorting, have also been identified. In addition Iron Age pottery from securely-phased contexts was examined, along with large lumps of fired clay from the Roman Kiln V. Identifications were made from latex casts of these impressions. The impressions are listed and described in Table

The charred cereals

Brief descriptions of the cereal remains are given here to supplement the illustrations of typical specimens in Fig. In general the material is too poorly preserved for measurement.

Wheats (*Triticum* spp.)

Glume bases, spikelet forks, rachis internodes and caryopses are present in the samples. In both pit 472 and hut 63 the wheat chaff is of a brittle-rachis form; no nodes of tough rachis wheat were seen. The glume bases, where well preserved are robust and broad ($\geqslant$ c 1mm), generally having one prominent vein with subsidiary strong venation though not infrequently showing less well-defined veins. Overall, these features are typical of spelt (*T. spelta*). Spikelet forks are rare, and lack internodes, but the specimens present have spelt-type glume bases attached. Spikelet bases, lacking internodes and with only the extreme basal part of glumes still attached are more common. The loose internodes are variable in size and thickness, but all have fairly clean basal and apical fractures.

The caryopses from pit 472 are almost all deformed as a result of germination before carbonisation, but nearly all are elongate forms, probably spelt. There are a few shorter grains with maximum widths just above the embryo, but these show some signs of distortion. By contrast the grains from hut 63, though again including a high proportion of distorted specimens, are mainly short and broad with steeply-placed embryos; these are identified as bread or club wheat (T. aestivum sensu lato). There are a few poorly-preserved elongate grains in addition, though the separation of these from poorly-preserved rye presents some difficulties. WSW 030 ~~036~~ 026 and 143 produced a small number of short grains apparently of a free-threshing wheat.

Rye (Secale cereale)

Rye is represented by grains and short sections of rachis. The grains are variable in size and form, but all are elongate, sharply keeled dorsally and pointed in the region of the embryo.

	Length(mm)	Breadth(mm)	Thickness(mm)	L/Bx100	T/Bx100
minimum	3.5	1.2	1.4	200	75
mean	5.07	2.07	1.94	248	94
maximum	6.5	2.6	2.5	300	117

Table : Measurements and indices of rye grains from WSW 030 026 (N = 30).

Fragments of rye rachis comprising up to three internodes are present. The specimen from pit 59 retains slight traces of marginal pubescence towards the base of the central internode.

Barley (Hordeum spp)

Grains and rachis internode fragments were recovered. The grains from hut 63 are the best preserved. These are clearly hulled specimens: several examples retain fragments of lemma and palea, but lemma bases and rachillas have not survived. There are several twisted lateral grains, which indicate the presence of six-row barley. The poorly-preserved grains from WSW 030 are also hulled. Those from pit 472 are in a poor state including many germinated specimens, though again only hulled grains appear to be present.

The rachis internodes are fragmentary, and ear density cannot, therefore, be determined.

Oats (*Avena* spp.)

Small numbers of oat grains were identified, but floret bases are apparently absent. The large grain from WSW 030 143 (length 6.7 mm) may be from a cultivated oat.

The impressions

The Iron Age pottery had impressions of hulled barley caryopses (*Hordeum* sp.), of a glume possibly of spelt (*Triticum* c.f. *spelta*) and of probable brome grass caryopses (*Bromus* sp.). No impressions on the Roman Kiln debris were identified.

Almost all the cereal impressions on the Anglo-Saxon pottery are of hulled barley caryopses. Typical specimens are illstrated in Plate The dorsal views clearly show the lemma nerves, though sharp impressions of lemma bases were not obtained. Indistinct impressions of rachillas are visible in a few cases. There are several grains from lateral spikelets of six-row barley, though the majority of the specimens are symmetrical. The three impressions of barley rachis internodes are relatively short and broad (Plate), and are thought to be from a dense-eared variety. Two lateral impressions of caryopses are tentatively identified as wheat and there is a single poor impression probably of an oat floret. In addition many sherds show impressions of finely-divided fragments of grass culm, leaves and spikelets - the so-called 'chaff-tempering'. These impressions were not identified; they show no clear diagnostic features.

Composition and formation of the assemblages

The composition of the cereal assemblages is examined here with a view to understanding the ways in which they were formed. This is of intrinsic interest since it may give information about crop processing techniques and crop purity. It also helps to ensure that invalid comparisons between samples of quite different origin are avoided (Dennell 1974).

The composition of the larger charred samples from West Stow is summarised in Table   The samples are listed in descending order of 'purity'.

	Indeterminate cereal grains	Triticum (wheat) grains	Hordeum (barley) grains	Secale (rye) grains	Avena (oat) grains	Spikelet fragments	Weed seeds
WSW 030 026 (40-50 cm)	*	-	5	385	2	-	3
Pit 59	11	-	-	290	-	4	191
Hut 63	144	25	21	24	5	62	1807
Pit 472 (1)	69	47	17	1	1	211	1618
Pit 472 (2)	53	23	6	-	-	440	2485
Pit 472 (3)	10	8	1	1	-	297	2389

Table   : Numerical composition of the larger samples
* - indeterminate grain fragments not counted; 1.2 cc in volume.

The interpretation of the large 7th century deposit from WSW 030 026 is straightforward. Consisting almost entirely of rye grains, with very few impurities, it is clearly a fully-processed crop ready for consumption or sowing. Carbonisation presumably occurred either during drying prior to storage, or in a catastrophic granary fire. The sample from Pit 59, an unphased Anglo-Saxon feature, also consists largely of rye grains, but includes a significant number of corn-cockle seeds (Agrostemma githago) and small grass caryopses. Since seeds of corn-cockle are nearly as large as the rye grains themselves it would have been almost impossible to remove them by winnowing or sieving. These seeds have several unpleasant properties: they taint flour, and contain haemolytic toxins known as saponins (Forsyth 1968, 47). The charred moth larva from this sample apparently indicates insect infestation in addition. It therefore seems plausible that this contaminated batch of rye was deliberately burnt as refuse, possibly in the adjacent hearth F50, and that the charred residue was dumped into pit 59.

The three samples from the Roman pit 472 are similar in composition to one another, although the proportion of cereal grains decreases towards the base of the pit. They are thought to derive largely from a common source though in this refuse deposit some mixing may have occurred. All three samples contain large numbers of weed seeds, moderate amounts of spikelet fragments, and relatively few cereal grains. They are thus comparable to Dennell's Type 3 deposits (1974, 280), which are interpreted as crop cleaning waste. Opportunities for carbonisation would have occurred when such waste was burnt, either as refuse or fuel, the ash and charred remains subsequently being disposed of in this refuse pit.

The sample from the mid-5th century Hut 63 is more heterogeneous in composition. Compared with the samples from Pit 472 it has a rather higher cereal grain: weed seed ratio (0.12: 1 compared with 0.08: 1, 0.03: 1 and 0.008: 1 in 472). Moreover no one cereal is numerically predominant: wheat, barley and rye are almost equally abundant in 63. The proportion of spikelet fragments in 63 is also lower than in 472. A further feature worth noting is that the wheat grains from 63 are mainly of bread/club wheat type whereas the chaff is of spelt. Thus the sample from 63 appears to include cereal remains from several sources, though it contains a major component of crop-cleaning waste. The fill of this hut pit was not seen in situ by the writer, but from the separate bags of 'flot' it would appear that plant remains were not clustered in the fill, but fairly evenly distributed. This may be taken to indicate a slow accumulation of plant remains from a variety of sources rather than delberate dumping.

The impressions of cereals on the Anglo-Saxon pottery are almost entirely of hulled barley grains. This contrasts with the samples of charred cereal remains examined, in which barley, though consistently present, is not the most abundant cereal.

A predominance of hulled barley seems, on the present evidence, to be characteristic of grain impressions on Anglo-Saxon pottery from the Midlands and East Anglia (Table). Jessen and Helbaek (1944), working with pottery from a number of Saxon sites mainly in Oxfordshire, Suffolk and Cambridgeshire, reported 80 impressions of hulled barley, 3 of naked barley and 14 of cultivated oats, besides a few impressions of wild oat, flax and woad. Impressions on cremation urns from the Saxon cemetery of Spong Hill, Norfolk were again mainly of hulled barley, though bread wheat grains and rachis internodes, cultivated oats and rye were also represented (Murphy, forthcoming). Thus there does seem to be a fairly clear and consistent pattern to these groups of impressions. However, this pattern is not likely to be related in any simple way to crop production.

	Triticum sp. (wheat)	*Hordeum* spp. (barley)	*Avena* spp. (oats)	*Secale cereale* (rye)
West Stow	c.f. 2	33(32)	c.f. 1	-
Spong Hill	7 (5)	52(31)	6 (4)	3(2)
Midlands + East Anglia	-	83	15	-

Table : Three groups of Anglo-Saxon grain impressions
'Corrected' totals, discounting multiple impressions, in brackets.

Dennell (1976) has discussed some problems associated with the interpretation of impressions. The first point to be considered is related to quantification: that multiple impressions of a crop species on a single vessel may bias the overall results. In the case of the West Stow impressions, where barley is virtually the only species represented, the 'correction' of totals to allow for multiple impressions on sherds has little effect on the overall picture. A second problem is that of possible transportation of the pottery after manufacture. At present most of the West Stow pottery, (with the exception of some very early forms), is believed to have been produced locally using the Chalky Lowestoft Till (Stanley West, pers comm) as a clay source. This being so it is assumed that the plant material in the pottery was of local origin. Consequently the apparent discrepancy between the evidence from charred plant remains and impressions is not thought to indicate a distinct cropping regime based on barley at some other locality.

A more probable explanation for this discrepancy can be inferred from a consideration of the process by which impressions were made in clay objects. Unlike the finely-divided fragments of grass in the 'chaff-tempered' pottery, (which was presumably mixed with the clay to improve firing qualities), included cereal grains would weaken the pot by creating relatively large voids after firing. For this reason it is generally assumed that such grains were accidental inclusions. Renfrew (1973.15) suggests that hand-made pots may have been made close to the domestic hearth, and that grains on the floor lost during food preparation would have become incorporated into the clay. Consequently, as Dennell notes, 'impressions ... are more likely to represent the diet of the inhabitants than the overall plant economy of the settlement'. A further point worth bearing in mind is the possibility that cereal crops which were utilised as whole grain (eg. in stews and soups, or for brewing) may be preferentially represented, compared with those eaten as flour or meal. This might to some extent, explain the low frequencies of wheat and rye impressions on Saxon pottery. In conclusion, then, it appears that the impressions are an accidental by-product of a relatively small section of the overall cereal economy of the site, providing information primarily on consumption rather than production and processing.

Crop plants

Little need be said here about the Iron Age plant remains. Impressions of two cereals, spelt wheat (Triticum spelta) and hulled barley (Hordeum sp.), were identified, and Ditch 78 produced charred hazelnut shell fragments (Corylus avellana). However, much larger and more informative assemblages were recovered at the nearby Iron Age settlement WSW 030. These provide a fuller picture of Iron Age farming in the area, and will be published elsewhere.

The Roman samples from Pit 472 consist largely of remains of spelt together with some hulled barley and traces of rye (Secale cereale) and oats (Avena sp.) Roman cereal assemblages of this general type, containing spelt and hulled barley sometimes with small quantities of other cereals including emmer, bread/club wheat, rye or oats, are common throughout East Anglia. The West Stow samples are thus quite typical.

Palaeobotanical evidence from East Anglian sites indicates a major shift at some time in the post-Roman period in the range of cereals cultivated, so that by early medieval times, spelt had been replaced by tough-rachis free-threshing hexaploid wheats and rye apparently became a more important crop. The stages in this change are at present poorly understood, but the Anglo-Saxon samples from West Stow provide some useful evidence. Two features are of particular interest: the presence of spelt in Hut 63 and the earliest known large rye deposits from Pit 59 and WSW 030 026.

Hut 63 was selected for sampling since it was isolated, and intersected with no other features. There is therefore no reason to believe that any of the plant remains from this hut could be derived from earlier deposits. Consequently the remains of spelt from the hut can be taken as firm evidence for the continuation of spelt cultivation until at least the mid-5th century at West Stow. The survival of this crop and of necessity the specialised methods required for its processing (Helbaek 1952) would seem to indicate some degree of agricultural continuity, (at least so far as wheat production is concerned), between the Roman and Anglo-Saxon periods. In the later samples from WSW 030, one of which is dated to the late 7th century, there is no trace of spelt; the few poorly-preserved wheat grains in these samples are short forms, probably of bread/club wheat-type. Nor has spelt been identified in Middle Saxon samples from Brandon, Suffolk and Ipswich (Murphy, forthcoming). On the present evidence, then, spelt cultivation seems to have ceased in East Anglia at some point between the mid-5th century and Middle-Saxon times.

The two large rye deposits from Anglo-Saxon contexts are the earliest known in this area at present. Rye occurs in the Roman samples from pit 472 but in such small quantities as to suggest that it was no more than a minor contaminant of a spelt crop. However rye certainly was cultivated as a crop in its own right in Roman Britain: samples containing a large proportion of rye are known from Verulamium (Helbaek 1952) and, less certainly, Caerleon (Helbaek 1964). The extensive root system of this crop, which is thought to enable it to exploit soil water not available to other cereals (Renfrew 1973, 85) makes it a particularly suitable crop for the dry sandy soils of Breckland. One would, therefore, expect that it would have become an important crop during the Roman period in this area; and indeed pollen evidence from Hockham Mere in the Breckland indicates Roman rye cultivation (Sims 1978). Why, then, is it so sparsely represented in Roman features at this site (and also at other Roman Breckland sites - Gallows Hill, Thetford; Weeting, Norfolk; Icklingham, Suffolk. Murphy, forthcoming) yet relatively abundant in Anglo-Saxon features? Perhaps the most likely explanation is that there was a change in crop processing methods between the Roman and Anglo-Saxon periods which resulted in rye having a better chance of becoming carbonised. However it may be that future work at Roman sites will produce better evidence for rye cultivation.

The remaining cereals from the Anglo-Saxon features are the free-threshing bread or club wheats, barley and oats. Free-threshing wheats are represented here only by grains; no chaff was seen. Charred remains of barley are reasonably common only in Hut 63, though barley accounts for almost all the impressions. As is noted above, however, the impressions probably relate to consumption rather than providing any evidence about the overall importance of barley as a crop. Oats are very sparsely represented; these samples provide no evidence for the cultivation of oats as a separate crop. Indeed, since oats are best adapted to damp climates, and the oat plant requires more water than other temperate cereals (Renfrew 1973, 98) its cultivation on any large scale would seem improbable in this area.

Of crops other than cereals there is very little information. Hut 63 produced a single pea-sized leguminous seed; however the features which would permit identification have not survived.

Weeds and other wild plants

The seeds of wild plants associated with the cereals provide information about soil conditions in the arable fields. Hence it is possible to draw some inferences about the location of the arable area, and to some extent about cultivation methods. This depends upon the assumption that the weed seeds in these samples are truly representative of the weed flora in the arable fields as a whole. This is probably the case since crop processing waste is likely to include a 'randomised' sample of weed seeds, derived probably from a relatively large area. The majority of the seeds are of common arable weeds having no particular soil requirements in terms of pH or drainage, but some of the weeds are more characteristic of specific edaphic conditions. In addition there are some seeds of plants more common in non-arable habitats. These must be derived from residual plants surviving from the vegetation of the area before cultivation, at the field margins and sporadically in the crop. The similarity of the weed seed assemblages from Roman and Anglo-Saxon features at West Stow is remarkable. There are a few minor differences some of which will be referred to below, but overall the assemblages are so similar that separate consideration is unnecessary.

The more ecologically exacting species may be divided into five main groups, as follows: (Clapham, Tutin and Warburg 1962; Hind 1889; Petch and Swann 1968):

1. Weed plants, particularly characteristic of light, well-drained soils:
   Papaver argemone Long prickly-headed poppy
   Raphanus raphanistrum Wild radish
   Arenaria serpyllifolia Thyme-leaved sandwort
   Spergula arvensis Corn-spurrey
   Scleranthus c.f. annuus Knawel
   Aphanes arvensis/microcarpa Parsley-piert
   Rumex acetosella Sheeps sorrel

2. Weed plants, particularly characteristic of heavy clay soils:
   Anthemis cotula Stinking mayweed

3. Grassland plants of widespread distribution:
   Ranunculus acris/repens/bulbosus Buttercup
   Prunella vulgaris Self-heal
   Plantago lanceolata Ribwort plantain

4. Dry grassland and heath plants:
   Stellaria graminea Lesser stitchwort
   Calluna vulgaris Heather

5. Damp grassland and marsh plants:
   Ranunculus c.f. flammula Lesser spearwort
   Montia fontana subsp. chondrosperma Blinks
   Polygonum c.f. persicaria Redshank
   Ajuga c.f. reptans Bugle
   Juncus spp. Rushes
   Eleocharis sp. Spike-rush
   Carex spp. Sedges

Within a kilometer radius of the site a wide variety of soils occur. (Corbett 1973). The settlement itself is located on a gravel terrace of the River Lark, partly overlain by blown sand deposits. The soils of the terrace are well-drained brown earths (Freckenham Series) and humus podsols.

The main modern natural vegetation is grass-heath and Calluna-heath with Carex arenaria on the blown sand.

On the gentle slopes above the terrace, soils are mapped as the Methwold-Worlington complex and show marked small-scale lateral variations in pH. This is reflected in natural vegetation patterns, where Calluna develops on the Worlington series, and Agrostis-Festuca heath including some calcicoles is found on the Methwold Series. In the valley floor below the site poorly-drained gley podzols, ground-water grey soils and organic soils formed on peat occur.

The well-drained soils in the vicinity of the settlement would clearly have provided suitable conditions for weeds of light soils, and for dry grassland and heath plants (Groups 1 and 4 above). Seeds of plants in these two groups are relatively abundant in all the larger samples; Arenaria serpyllifolia, Scleranthus c.f. annuus and Rumex acetosella are particularly common. This suggests that the terrace soils were of primary importance for arable farming.

Seeds from plants of damp habitats (Group 5) are much less common and by no means all of them indicate permanently wet conditions. Montia fontana subsp. chondrosperma (blinks) requires a high water-table in the spring, preferably on light acid soils (Walters 1953). Some species of Eleocharis are likewise adapted to seasonally damp conditions. Not all the Carex (sedge) nutlets need necessarily be derived from species of damp habitats; it is probable that some specimens are of C.arenaria (sand-sedge), though poor preservation makes certainty impossible. Overall the seeds of these plants are thought to indicate that the arable area extended onto the more poorly drained soils at the edge of the terrace, where damp-ground plants were able to colonise the fields; but these damper areas apparently formed only a very minor part of the arable land.

There are no obligate calcicoles amongst the wild plants identified, and there is thus no evidence that cultivation extended onto the more calcareous slope soils.

In the present context the achenes of Anthemis cotula (stinking mayweed) are quite anomalous. They occur in Hut 63, but the species has not been identified in any other cereal assemblages from the Breckland. Stinking mayweed is much more characteristic of heavy Boulder Clay soils in Norfolk and Suffolk (Petch and Swann 1968, 210). Its presence here may indicate the importation of seed-corn from Boulder Clay areas to the south. Whether it would persist for long as an arable weed on the light soils of the West Stow area is questionable.

The remaining common arable weeds provide little useful information. The small-seeded Leguminosae (probably Medicago and Trifolium, but not closely identified due to deformation during carbonisation) are, however, of interest by virtue of their abundance. They account for 19.8% of the weed seeds in Pit 472 (3), and 13.2% in Hut 63. These relatively high frequencies probably indicate nitrogen deficiences at least in parts of the arable fields (cf. Warington 1924, 119).

From the samples examined it is difficult to discern any significant change in the wild flora through time. There are differences between the Roman and Anglo-Saxon samples but these involve species occurring at very low frequencies. Comparison with the modern flora (Darrah, Musgrove and Radley 1980) shows some changes, but these are attributable almost entirely to the absence, until recently, of suitable arable areas open for colonisation. by weeds.

Local factors

For a number of reasons early farming in the West Stow area is unlikely to have been typical of East Anglia as a whole, but rather was adapted to particular and rather unusual local conditions. These are outlined here, and responses to these conditions for which there is evidence or which may be inferred are briefly discussed.

The Breckland has historically been marginal land so far as arable farming is concerned. The main factors limiting productivity are as follows (Corbett 1973):

1. Climate. Annual rainfall in the southern Breckland is very low, between 23-25 in (584-635 mm).

2. Soil moisture deficits. Partly as a consequence of low rainfall, but also because the soils are coarse-textured. SMD's occur between June and October. This results in reduced transpiration and reduced crop yields (Sturdy and Eldridge 1976).

3. Soil instability. Wind-blowing of dry soil occurs in most springs sometimes making re-drilling necessary.

4. Soil nutrient deficiencies. These may further reduce yields within the constraints imposed by the moisture supply.

The conservation of soil moisture is thus of considerable importance. It seems probable that modern experimental 'minimum cultivation' was in practice, if not in intent, anticipated by early farmers in the Breckland since plough-types were less efficient than those of today. Manuring would have been of critical importance, however; the addition of organic material to the soil would increase its water capacity, thus helping to reduce soil moisture deficits and stabilising the soil surface, whilst adding nutrients to replace those lost by cropping and leaching. Indirect evidence possibly indicating liming or marling is provided by the occurrence of chalk lumps in the archaeological features. These must have been imported to the site from the chalk-sand drift of the slopes since surface chalk outcrops do not occur in the immediate vicinity.

Successful cereal farming on these soils would have had to be closely linked with stock-rearing in order to ensure adequate supplies of manure. The site itself is located in a position to exploit both dry grassland areas on the slopes and terraces and also permanent pastures in the valley floor. The agricultural system must have involved folding on the arable areas and also probably the collection of manure from stalled animals, though the relatively high frequency of leguminous weeds in the samples does point to nitrogen deficiences in some areas.

Local conditions must have had effects on the types of crops grown. Winter crops in general would probably have been favoured since the young plants would be relatively well developed before summer droughts (Limbrey 1978, 25). The effects of sand-blowing in the spring would likewise be avoided by autumn sowing; clearly the loss of a newly-sown spring crop could be disastrous to a peasant community. The cultivation of rye, the evidence for which is discussed above, apparently attained some importance in this area at an early date. As has been noted, rye is a particularly suitable crop on dry sandy soils. Spelt, of which most varieties are autumn-sown, is also common in the samples.

In conclusion, then, the cereal remains from West Stow must be seen as the product of an agricultural system adapted to a specific set of quite extreme environmental conditions. It follows that the results should not be extrapolated to apply to other areas. Although the samples provide useful new information, about early Anglo-Saxon agriculture in particular, studies of sites on a wide variety of soil types will be necessary before any overall picture is gained of the earliest English farming.

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Table : Fruits, seeds etc. identified in the flotated samples

Abbreviations:

br	bract	gb	glumebase
bri	brittle-rachis internode	p	plume + primary root fragments
bu	bulbil	ri	rachis internode
ca	caryopsis	spb	spikelet base
cn	culmnode	spf	spikelet fork
fr	fragment		

Notes:

— (a) Sliqua joints

(b) Sepals normally missing. Some slender, slightly incurved sepal midribs survive. S.perennis cannot be excluded.

(c) Nutlet coats missing

(d) These are all small seeds, generally badly distorted with radicles often missing. Distortion makes definite identification difficult but c.f. Medicago and Trifolium.

(e) All surface detail lost, but general shape matches Potentilla.

(f) Separation on size criteria impossible due to possible shrinkage in carbonisation.

(g) No perianths.

(h) Lacking testas or nutlet-coats; or immature specimens.

(i) Surface detail closely matches these taxa, but overall shape less slender than reference material. Possibly distorted in carbonisation.

(j) All one species.

(k) Capsules counted; shoot tips with imbricate leaves also present.

(l) Distortion makes identification using key of Nilsson and Hjelmqvist (1967) impossible: though some C. cf. arenaria are present.

a (m) These are mostly small Pod-sized caryopses. Many are well-preserved, but insufficient time available for complete idenfjtication.

Kenward (n) Dr H. Kenwood comments 'The insect is undoubtedly a moth larva of some kind, and in all probability one of the species found in modern grain. However, it is much too distorted and damaged by charring to be firmly identified'.

(o) Spherical, ovate and elongate charred objects are common. These have not been counted, since it is not known whether all of these are the remnants of fruits or seeds.

Additional hand-collected material was identified as follows:

D78 (Iron Age ditch) : *Corylus avellana* charred nutshell fragments.

WE 2/3 (Anglo-Saxon? hearth):

Hordeum sp. (hulled)	4 caryopses
Triticum sp.	1 caryopses
Indet. cereal	7 caryopses

PH 565 (Anglo-Saxon 5th-6th c. post-hole) 2 charred inflorescences with woody bracts.

Context		Pit 472(1)	Pit 472(2)	Pit 472(3)	Hut 63	Pit 59(3)	Pit 026 20-40cm	Pit 026 40-50cm	Pit 026 50-60cm	Hut 101	Hut 143
			Roman		Anglo-Saxon			Anglo-Saxon (WSW 030)			
Cereal indet.	ca	69	53	10	144	11	6	1.2cc	6cc	8	6
	cn	3	8	3	fr.	-	-	-	-	-	1
	p	+	+	+	+	-	-	-	-	-	-
<u>Triticum</u> sp.	ca	47	23	8	25	-	-	-	3	-	1
	bri	13	31	24	2+cf2	-	-	-	-	-	-
	gb	71	87	75	24	-	-	-	-	-	-
	spb	12	43	24	3	-	-	-	-	-	-
<u>Triticum spelta</u> L.	gb	111	270	170	29	-	-	-	-	-	-
	spf	-	2	-	1	-	-	-	-	-	-
<u>Hordeum</u> sp.	ca	17	6	1	21	-	2	5	25	3	3
	ri	1	6	1	-	-	-	-	1	-	-
<u>Hordeum vulgare</u> L.	ri	-	1	-	-	-	-	-	-	-	-
<u>Secale cereale</u> L.	ca	cf.1	-	1	24	290	4	385	78	-	-
	ri	3	-	3fr	cf.1	4	-	-	1	-	-
<u>Avena</u> sp.	ca	fr	-	-	5	-	-	2	4	-	1
<u>Ranunculus acris/repens/bulbosus</u>		20	25	30	5	-	-	-	-	-	-
<u>Ranunculus</u> c.f. <u>flammula</u> L.		-	3	-	-	-	-	-	-	-	-
<u>Ranunculus</u> sp.		3	-	-	1	-	-	-	-	-	-
<u>Papaver argemone</u> L.		-	2	-	-	4	-	-	-	-	-
<u>Raphanus raphanistrum</u> L.	(a)	13+fr	6	2	1+fr	-	-	-	-	-	-
<u>Silene alba</u> (Miller) Krause		8	16	14	8	-	-	-	-	-	-
<u>Agrostemma githago</u> L.		-	-	-	3	96	-	-	-	-	-
<u>Stellaria media</u>-type		7	30	26	9	-	-	-	-	-	-
<u>Stellaria graminea</u> L.		-	-	1	2	-	-	-	-	-	-
<u>Stellaria/Cerastium</u>		-	4	-	5	-	-	1	-	-	-

Spergula arvensis L.		1	3	1	3	-	-	-	-	-	-
Scleranthus c.f. annuus L.	(b)	19	19	33	9	-	-	-	-	-	-
Caryophyllaceae indet.		6	9	16	4	-	-	-	-	-	-
Montia fontana subsp. chondrosperma		5	3	3	6	-	-	-	-	-	1
Chenopodium hybridum L.		-	-	-	3	-	-	-	-	-	-
Chenopodium album L.		47	87	75	278	-	-	-	-	-	-
Atriplex patula/hastata		292	502	406	215	-	-	-	2	-	-
Chenopodiacecoe indet.	(h)	123	157	132	269	-	4	-	28	2	2
c.f. Malva sp.	(c)	1	2	3	2	-	-	-	-	1	-
Vicia sp.		-	-	-	2	-	-	-	-	-	-
Vicia/Pisum sp.		-	-	-	1	-	-	-	-	-	-
Leguminosae indet.	(d)	199	415	475	238	3	-	-	-	-	-
c.f. Potentilla sp.	(e)	8	-	42	13	-	-	-	-	-	-
Aphanes arvensis/microcarpa	(f)	-	1	2	3	-	-	-	-	-	-
c.f. Ruphorbia helioscopia L.		-	-	-	-	-	-	-	-	-	1 fr.
Polygonum aviculare agg.		216	258	270	102	-	-	-	-	-	1
Polygonum cf. persicaria L.		4	-	2	7	-	-	-	-	-	-
Polygonum convolvulus L.		196	188	105	66	-	-	-	-	1	3
Rumex sp.	(g)	53	56	60	33	-	-	1	-	-	-
Rumex acetosella agg.		148	356	280	214	-	-	-	-	-	2
Polygonaceae indet.	(h)	75	60	71	44	-	-	-	1	1	2
c.f. Urtica urens L.		-	-	1	-	-	-	-	-	-	-
Urtica dioica L.		-	-	-	-	-	-	-	-	-	1
Corylus avellana L.		-	-	-	-	-	-	-	-	-	-
Calluna vulgaris (1) Hull	(k)	-	2	4	6	-	-	-	-	-	-
Anagallis sp.		-	1	-	-	-	-	-	-	-	-
Myosotis sp.		-	-	-	1	-	-	-	-	-	-
c.f. Verbasam sp.		-	-	-	1	-	-	-	-	-	-
Euphrasia/Odontites	(i)	-	-	-	7	-	-	-	-	-	-
Prunella vulgaris L.		1	8	2	4	-	-	-	-	-	-

c.f. Lamium album		-	-	1	-	-	-	-	-	-	-
Ajuga c.f. reptans L.		-	-	1	-	-	-	-	-	-	-
Labiatae indet.	(j)	45	30	63	49	-	-	-	-	-	-
Plantago lanceolata L.		6	10	4	10	1	-	-	-	-	-
Galium sp.		-	-	-	1	-	-	-	-	-	-
Galium aparine L.		-	1	-	-	-	-	-	-	-	-
Anthemis cotula L.		-	-	-	14 15	-	-	-	-	-	-
Tripteurospermum maritimum (L) Koch		3	3	-	-	-	-	-	-	-	-
Onopordum acanthium L.		-	-	-	-	-	-	-	-	2	-
Composite indet.		2	-	5	1	-	-	-	-	-	-
Juncus sp.		-	-	-	-	+	-	-	-	-	-
Eleocharis sp.		10	16	15	7	-	-	-	-	-	-
Carex spp.	(l)	11	27	13	23	-	-	-	-	-	-
Cyperaceae indet.		-	-	1	-	-	-	-	-	-	-
Bromus mollis/secalinus		15	9	7	9	1	-	-	-	-	-
Gramineae indet	(m)	81	142	139	125	86	-	1	-	1	1
Indet (o)	br	-	-	1	-	-	-	-	-	-	-
	bu	fr	-	-	-	-	-	-	-	-	-
Insect (n)		-	-	-	-	+	-	-	-	-	-
% flot sorted		100	50	12.5	100	100	100	100	100	100	100

Table : Fruits, seeds etc. identified in the flotated samples

Table : Description of the impressions.

Iron Age

Phase/Pit	Taxon	Plant part	View	Notes	Dimensions (mm)		
					Length	Breadth	Thickness
I/244	cf. Hordeum sp.	Caryopsis	Ventral	-	6.0	3.2	-
I/246	Indet cereal	Caryopsis	Oblique ventral	-	-	-	-
I/265	cf. Bromus sp.	Caryopsis	Ventral	small	5.5	1.7	-
	cf. Bromus sp.	"	"	small	-	1.8	-
I/409	Indet cereal	Caryopsis	End view	-	-	-	-
II/414	Indet cereal	Caryopsis	Ventral	-	-	-	-
II/414	Triticum cf. spelta	Glume	-	-	width > 1.5 mm		
III/18	Hordeum sp.	Caryopsis	Ventral	Hulled	7.8	3.0	-
III/233	Hordeum sp.	Caryopsis	Dorsal	Hulled	8.0	3.8	-
III/233	Indet cereal	Caryopsis	Ventral	Distorted	-	-	-

Roman

Large fragments of fired clay from Kiln V were examined. No specifically identifiable impressions of plant material were seen, though the fragments did show some impressions of cereal straw and leaves.

Layer 2. (Saxon).

Bag No.	Taxon	Plant part	View	Notes	Dimensions (mm)		
					Length	Breadth	Thickness
191	Indet cereal	Caryopsis	Oblique ventral	-	-	-	-
191	cf. *Triticum* sp.	Caryopsis	Lateral	-	5.9	-	3.0
217	*Hordeum* sp.	Caryopsis	Dorsal	Hulled	7.0	3.8	-
240	*Hordeum* sp.	Caryopsis	Partial dorsal	Hulled	-	-	-
240	*Hordeum* sp.	Caryopsis	Shallow ventral	Hulled	-	-	-
824	*Hordeum* sp.	Caryopsis	Oblique ventral	Hulled, lateral(?)	6.9	-	-
3173	*Hordeum* sp.	Caryopsis	Lateral	Hulled	8.1	-	3.0
Unstrat.	*Hordeum* sp.	Caryopsis	Dorsal	Hulled	6.5	2.9	-

Hut 12. (Late 5th century).

Bag No.	Taxon	Plant part	View	Notes	Dimensions (mm)		
					Length	Breadth	Thickness
135	*Hordeum* sp.	Caryopsis	Shallow dorsal	Hulled	-	4.0	-
135	*Hordeum* sp.	Caryopsis	Dorsal	Hulled, lateral(?)	7.0	3.2	-
135	Indet cereal	Caryopsis	Indistinct lateral	-	-	-	-
135	cf. *Triticum* sp.	Caryopsis	Lateral	-	6.8	-	3.0
135	cf. *Avena* sp.	Floret	Ventral	Lemma margins and rachilla indistinctly visible	-	-	-

Hut 12 continued

Bag No.	Taxon	Plant part	View	Notes	Dimensions (mm)		
					Length	Breadth	Thickness
655	*Hordeum* sp.	Caryopsis	Oblique ventral	Hulled, trace of rachilla	-	-	-
655	*Hordeum* sp.	Caryopsis	End view	Hulled	-	-	-

Hut 16. (Late 5th century).

Bag No.	Taxon	Plant part	View	Notes	Dimensions (mm)		
					Length	Breadth	Thickness
203	*Hordeum* sp.	Caryopsis	Oblique ventral	Distorted	-	-	-
228	Indet cereal	Caryopsis	Lateral	-	-	-	-
223	Indet cereal	Caryopsis	Oblique ventral	-	-	-	-

Hut 21. (Mid 5th century).

Bag No.	Taxon	Plant part	View	Notes	Dimensions (mm)		
					Length	Breadth	Thickness
237	*Hordeum* sp.	Rachis internode	-	Not complete	3.0	1.4	-
270	Gramineae indet	Two florets	Lateral	-	-	-	-
271	Indet cereal	Caryopsis	Lateral	-	-	-	-
326	*Hordeum* sp.	Caryopsis	Shallow dorsal	Hulled	-	-	-
342	cf. *Hordeum* sp.	Caryopsis	End view	-	-	-	-
342	*Hordeum* sp.	Caryopsis	End view	Hulled	-	-	-

Hut 21 continued

Bag No.	Taxon	Plant part	View	Notes	Dimensions (mm)		
					Length	Breadth	Thickness
361	Hordeum sp.	Caryopsis	Lateral	Hulled	-	-	-
361	Indet cereal	Caryopsis	End view	-	-	-	-

Hut 44. (Late 6th century).

Bag No.	Taxon	Plant part	View	Notes	Dimensions (mm)		
					Length	Breadth	Thickness
1360	Hordeum sp.	Caryopsis	Oblique ventral	Hulled	7.1	-	-
1360	Hordeum sp.	Caryopsis	Partial ventral	Hulled	-	-	-
1368	Indet cereal	Caryopsis	Lateral	-	-	-	-
1372	Hordeum sp.	Caryopsis	Dorsal	Hulled	9.0	2.8	-
1403	Hordeum sp.	Caryopsis	Ventral	Hulled	7.1	3.5	-
1403	Hordeum sp.	Rachis internode	-	-	3.2	1.6	-
1472	Hordeum sp.	Caryopsis	Ventral	?Hulled	7.4	3.4	-
1605	Hordeum sp.	Caryopsis	End view	Hulled	-	-	-
1763	Hordeum sp.	Caryopsis	Oblique ventral	Hulled, lateral?	8.0	-	-
1767	Hordeum sp.	Caryopsis	Shallow dorsal	Hulled	-	-	-
2354	Hordeum sp.	Caryopsis	Oblique ventral	Hulled	9.0	-	-

<u>Hut 47</u>. (Late 5th century).

Bag No.	Taxon	Plant part	View	Notes	Dimensions (mm)		
					Length	Breadth	Thickness
1629	*Hordeum* sp.	Caryopsis	Oblique ventral	?Hulled	7.3	3.0	-
1629	*Hordeum* sp.	Caryopsis	Dorsal	Hulled	8.0	3.3	-
1733	*Hordeum* sp.	Rachis internode	-	-	3.8	1.1	-
1733	Indet cereal	Caryopsis	End view	-	-	-	-
1733	Indet cereal	Caryopsis	Shallow ventral	-	-	-	-
1733	*Hordeum* sp.	Caryopsis	Shallow ventral	Hulled	-	-	-
1755	*Hordeum* sp.	Caryopsis	Dorsal	Hulled	6.5	3.0	-
1755	*Hordeum* sp.	Caryopsis	Oblique ventral	Hulled	7.0	-	-
757	*Hordeum* sp.	Caryopsis	Ventral	Hulled	7.5	3.0	-
1781	Indet cereal	Caryopsis	?	-	-	-	-

The pottery from huts 3 and 15 (early 7th century) was also examined but no identifiable impressions were seen. There were overall few organic inclusions in this pottery.

Caption to figure

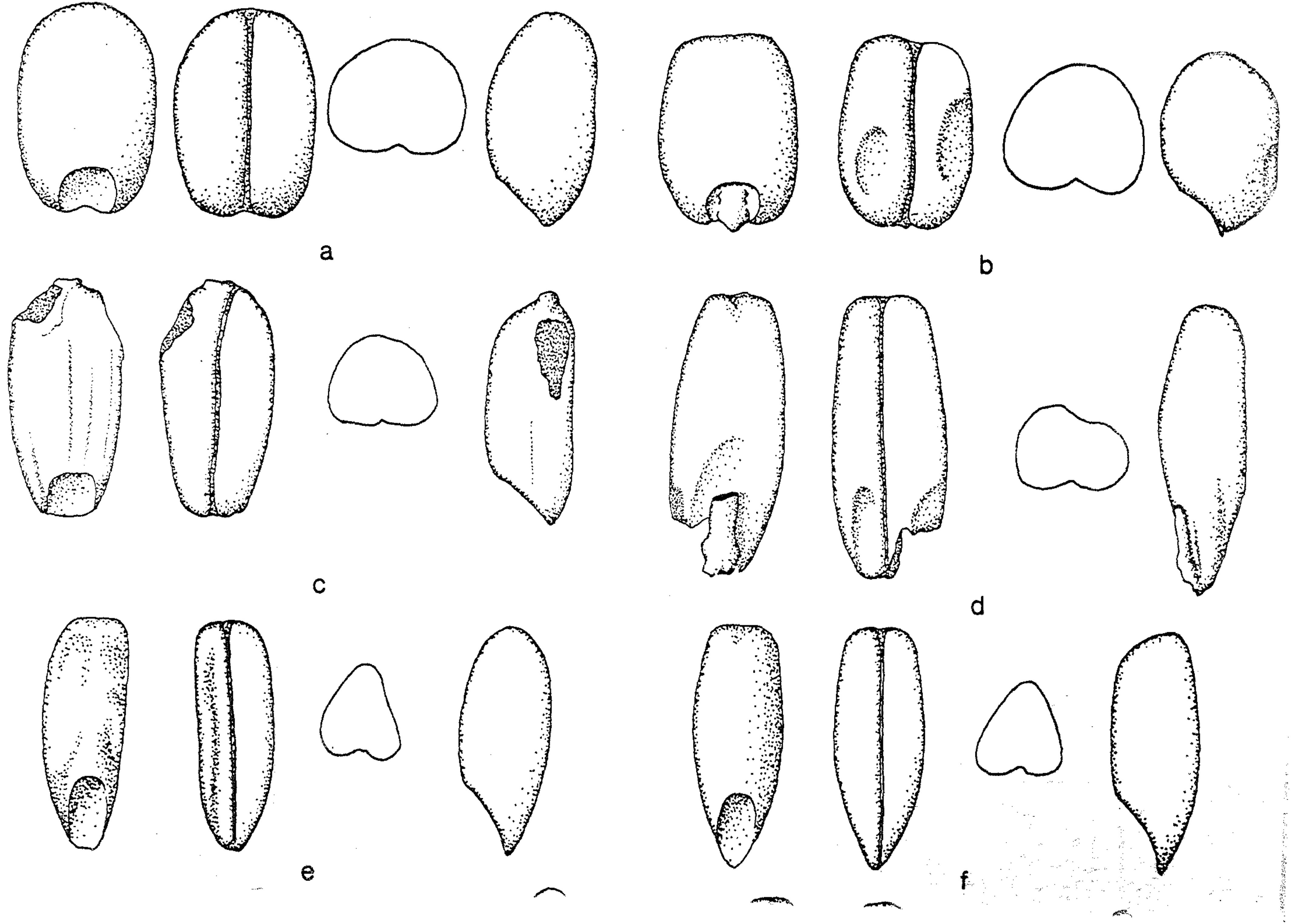
Fig. : Some cereal remains from West Stow

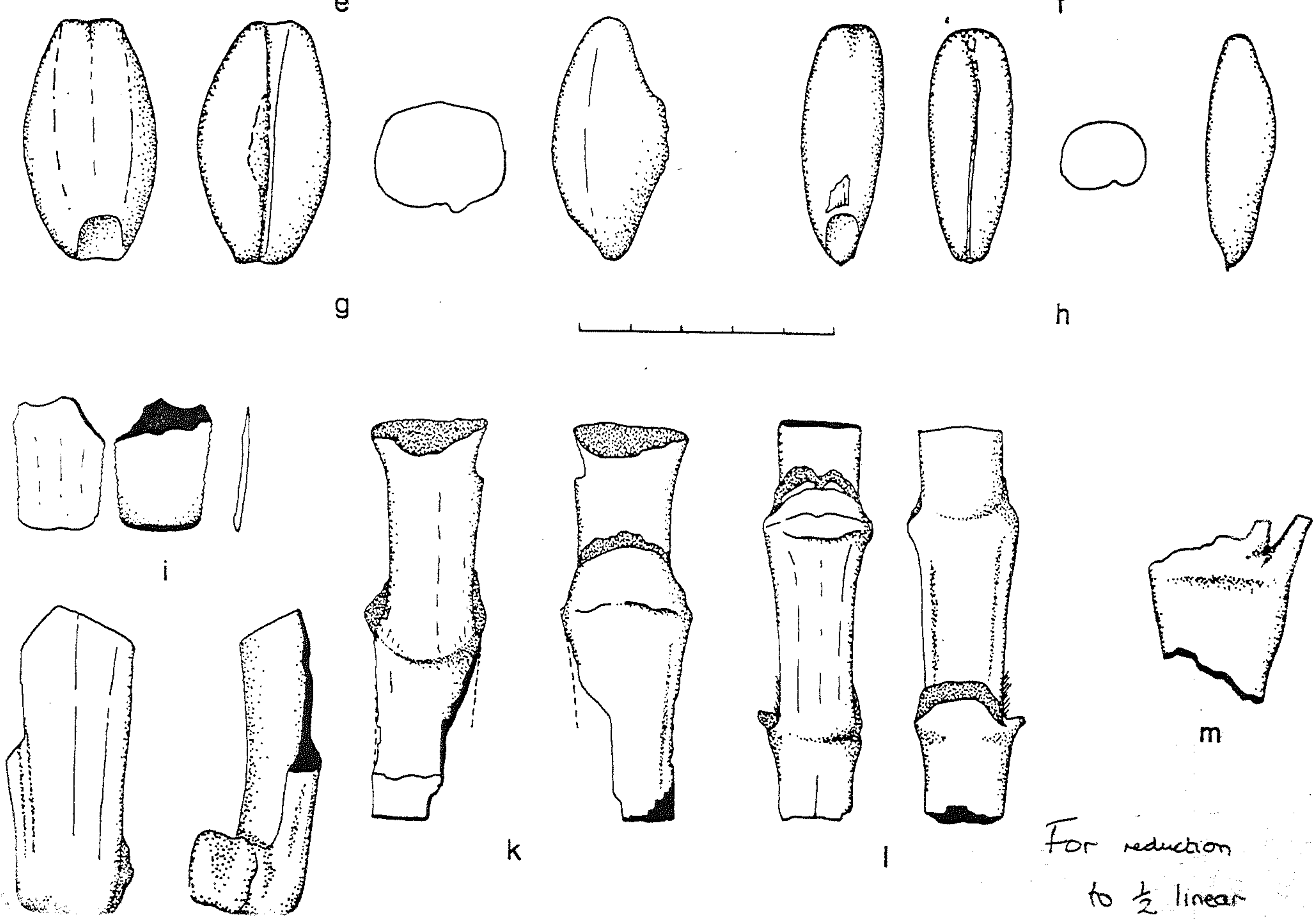
a,b *Triticum aestivum* s.l., caryopses. Hut 63
c. *Triticum* c.f. *spelta*, caryopsis, pit 472 (1)
d. *Triticum* c.f. *spelta*, germinated caryopsis, pit 472 (2)
e,f. *Secale cereale*, caryopses. Hut 63
g. *Hordeum* sp., caryopsis. Hut 63
h. *Avena* sp., caryopsis. Hut 63
i. *Triticum* c.f. *spelta*, rachis internode. Hut 63
j. *Triticum spelta*, glume base. Hut 63
k. *Secale cereale*, rachis fragment. Pit 472 (2)
l. Secale cereale, rachis fragment. Pit 59.
m. *Hordeum* sp., rachis internode fragment Pit 472 (2)
Scales graduated in mm.

Caption to plate

Plate : Barley impressions on Anglo-Saxon pottery from West Stow.

a-c Caryopses in lateral, dorsal and oblique ventral views
d. Rachis internode
Scales graduated in mm.


a
b
c
d
e
f



For reduction to ½ linear