# The Environment and Agrarian Economy of Saxon and Medieval Ipswich

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a-g charred h-j mineralised
5mm scale

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## Introduction

A programme of urban rescue excavations under the direction of Keith Wade for the Suffolk Archaeological Unit since 1974 has established the overall development of the town (Wade 1988, in press). It was founded in the early 7th century on terrace gravels flanking the head of the Orwell estuary on an unoccupied site, and covered some 6ha on the north bank of the river. Structures, pits, wells, probable field boundaries and a cemetery have been recorded. In the early 9th century the town grew to cover about 50ha with timber buildings, a street system and industrial activity, notably the production of Ipswich ware. Waterfront structures have been excavated. By the late 9th-10th centuries house-types changed, with the introduction of cellared buildings positioned further from street frontages and from one another. A defensive circuit was constructed in the early 10th century, but subsequently occupation spread beyond the defences. Middle Saxon Ipswich is considered by the excavator to have been the earliest post-Roman industrial and international trading centre in East Anglia (Fig 1.1).

From an early stage in the excavation programme, sampling for the retrieval of biological remains was seen as an integral part of the investigation of the town's development. This work, begun in 1974 by Andrew Jones, has continued up to the present. As a result, a large body of data has been amassed both from small sample excavation areas, up to about 200m$^2$ and from more extensive excavations, as at Foundation Street (IAS 4601) and the Buttermarket (IAS 3104).

**Table 1.1 : Excavations in Ipswich**

1. Cox Lane, 1958 (IAS 3503)
2. Shire Hall Yard, 1959 (IAS 6901)
3. Old Foundry Road, 1974 (IAS 1501)
4. Elm Street, 1975 (IAS 3902)
5. Great Whip Street, 1975 (IAS 7501)
6. St Helen’s Street, 1975 (IAS 3601)
7. Vernon Street, 1975 (IAS 7402)
8. Lower Brook Street, 1975 (IAS 5502)
9. Turret Lane, 1978 (IAS 4302)
10. School Street, 1979 (IAS 4801)
11. Foundation Street/Star Lane, 1979 (IAS 5801)
12. Arcade Street, 1979 (IAS 1804)
13. Tower Ramparts, 1979/81 (IAS 0802)
14. Little Whip Street, 1980/81 (IAS 7404)
15. Tacket Street, 1980/81 (IAS 3410)
16. Bridge Street, 1980/81 (IAS 6202)
17. St Peter’s Street/Greyfriars Road, 1982 (IAS 5202)
18. Key Street, 1981/82 (IAS 5901)
19. Shire Hall Yard, 1982 (IAS 6904)
20. Fore Street, 1982 (IAS 5902)
21. St Stephen’s Church, 1982 (IAS 3203)
22. St Nicholas Street, 1983 (IAS 4201)
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24. St Helen’s Street, 1983 (IAS 8804)
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26. Smart Street/Foundation Street, 1984 (IAS 5701)
27. Wingfield Street/Foundation Street, 1985 (IAS 4601)
28. Greyfriars Road, 1986 (IAS 5203)
29. St Stephen’s Lane, 1987/88 (IAS 3104)
30. Buttermarket, 1987/88 (IAS 3201)
31. Neptune Quay, 1989 (IAS 6601)
32. Greyfriars Road, 1989 (IAS 5204)
33. Franciscan Way, 1990 (IAS 5003)
34. 85-87 Fore Street, 1990 (IAS 6106)

The locations of sites excavated are shown in Fig 1.2

Full publication of these sites has been deferred so as to permit a considered account and interpretation of the available information, rather than producing a disjointed succession of site reports. As a result the present report is in a somewhat unconventional format. So as to make it more accessible to the general reader, whilst at the same time providing sufficient detailed information for specialists, the report is in two parts. The printed text includes summaries of the data in diagrammatic form where possible, including technical data and full species tables only where necessary to support or advance arguments. The report is largely concerned with plant macrofossils, though results from analyses of infra-red spectroscopy (F MacLaren) , soils (H C M Keeley, R MacPhail), molluscs, foraminifera (B Funnell), insects (H Kenward, M Robinson) and mosses (R Stevenson), are summarised and discussed where necessary. Detailed supporting data may be found in Murphy (199 )

The printed text begins with an intentionally brief outline of the modern ecology and palaeoecology of the area. There follows a longer section on plant and other macrofossils firmly linked to their archaeological contexts: essential pits, cellared buildings and waterfront deposits. This section includes discussions of crop production, processing, storage and use and of the evidence for natural and semi-natural habitats in the area. The use of wood for construction and fuel is considered separately. Finally, the results are related to the economic development of the town.

## 2. Environment and Palaeoecology

### 2.1 Geology, Soils and Vegetation

The principal geological deposits outcropping at the surface in the Ipswich area are as follows (Allender and Hollyer 1981; Ranson 1982).

Alluvium : clays/silts with peat
Brickearth : sandy clay, slightly stony
River terrace deposits : flint/quartzite gravel with sand
Boulder Clay : stiff blue-grey clay
Glacial sand and gravel : sands with flint/quartzite gravel
Red Crag : sand, shelly in places
London Clay : blue-grey clay with nodules
Lower London Tertiaries (Reading and Thanet Beds) : clay/silt/sand

Terrace gravels form a band of virtually flat ground, flanking the flood-plain alluvium and estuarine sediments, elevated a few metres above the flood-plain surface. Early areas of settlement north of the Orwell and at Stoke were located on these terrace deposits. Along valley slopes above the terraces the Tertiary and Lower Pleistocene deposits outcrop, but over large areas to the north and east there are glacial sands and gravels and further north and west boulder clay overlies these sands and gravels.

Soils developed on these varied parent materials, partly masked by head an aeolian deposits, are correspondingly complex (Hodge *et al* 1984). The urban area of Ipswich was obviously not surveyed by the Soil Survey, but interpolating from adjacent areas it is probable that soils in the vicinity of the Saxon town would have been of the Newport 2 and 4 Associations, predominantly deep well-drained sandy, often stony, soils including brown sands and humo-ferric podzols and the Ludford Association. This is a complex association of soils formed over a variety of parent materials but predominantly consists of non-calcarous argillic brown earths to brown sands commonly with a component of aeolian silt. To the north of Ipswich there are loamy over clayey soils formed on thin till at the Boulder Clay plateau margins (Melford Association) and heavier clay soils formed on chalky till (Hanslope Association). An extensive area of sandy, often acid Newport Association soils extend to the east beyond Martlesham Heath, to Sutton Hoo across the Deben estuary and beyond as far as Lowestoft.

The light sandy and gravelly soils of East Suffolk still support large areas of heathland – the Suffolk Sandlings – which formerly stretched almost without a break from Ipswich northwards towards the Lowestoft area (Simpson 1982). Traditionally, grazing and controlled burning maintained the heathland; but, as in many areas, a cessation of grazing and a reduction in the rabbit population has resulted in the spread of scrub. Other heathland areas have been lost to agriculture. Outside the urban area to the north extensive areas of Boulder Clay soils are similarly under arable production.

The Suffolk estuaries, including the Orwell, are characterised by mud flats, creeks and salt-marshes. At the site of Ipswich reclamation and channel diversion have obliterated the original vegetation, though further downstream extensive areas survive, albeit threatened by the spread of *Spartina* and severe erosion from the wash of large vessels.

## 2.2 Palaeoecology : The Pre-Urban and Early Urban Environment

### 2.2.1 The Site of Ipswich

Information about the palaeoecology of the Ipswich area prior to the establishment of the Middle Saxon town is sparse. At several sites, however, pre-urban soil profiles sealed by later deposits were recorded (e.g. at IAS 4201, IAS 4302). The profile at the latter site was investigated in detail (Plate 2.1).

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**A Soil at IAS 4302** – by Helen C M Keeley and R MacPhail

The buried soil was examined and sampled by H Keeley. Ignition and particle size analysis were carried out by R MacPhail.

The soil was developed on sand and gravels and was well-drained (mottles were absent). The profile was as follows:

| | |
|---|---|
| 0-1cm | Remains of overlying occupation deposit. |
| 1-6cm | Brown (10YR 5/3) moderately friable medium sand with weak medium subangular blocky structure, containing common charcoal and burnt clay fragments. Roots were absent but there were traces of earthworm activity. Stones common, gravel to small rounded and angular flint pebbles. |
| 6-20cm | Dark yellowish-brown (10YR 3/4) structureless, friable medium sand containing abundant stones, gravel to medium. Roots were absent. |
| Below 20cms | Yellowish brown (10YR 5/6) friable, structureless medium sand and gravel containing more clay than over-lying horizons. Stones were abundant, gravel to medium. |

Samples were ignited and loss on ignition found to be fairly constant (range 1.4% - 1.6%, mean 1.525%). Ignition colours indicated that sample 1 was less iron-rich (containing bout 0.13 to 0.15% Fe) than samples II, III or IV (which contained approximately 0.25 to 0.18% Fe).

These figures are the result of comparing the Ipswich samples with ignited soil samples of known Fe content:

Results of particle size analysis were as follows (Table 2.1)

| ***Sample Number*** | ***%Clay*** | ***%Silt*** | ***%Sand*** |
|---|---|---|---|
| I | 2 | 8 | 90 |
| II | 5 | 10 | 85 |
| III | 2 | 7 | 91 |
| IV | 10 | 3 | 87 |

**Table 2.1 IAS 4302 – Buried Soil, Particle Size Analysis**

The soil texture is therefore fine to medium sand; the silt fraction is mainly dominated by coarse silt. The lowest horizon (sample IV) contained noticeably more clay than those above.

On initial examination the soil section appeared to represent a truncated profile of a soil showing evidence of podzolisation. The ignition colours tend to confirm this – the upper horizon shows signs of eluviation. The A horizon may have been incorporated into the overlying occupation deposits and the upper layer of the truncated profile also shows disturbance.

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These results point to the development of a podzolised profile on terrace gravels, which would originally have supported heath vegetation. It is probable that similar podzolised profiles were widespread on these gravels. The two sites in Ipswich which have produced evidence for field systems, Fore Street and Elm Street (Wade 1988, 94) were located on terrace gravel areas and may represent reclamation of heathland for agriculture.

No evidence about the earlier history of the pre-urban soils at Ipswich is currently available. However it may have been analogous to that at Sutton Hoo in the Deben valley. Recent micromorphological studies there on buried soils formed on glacial sands and gravels (C French, in prep) indicate:

1. Development of an argillic brown earth under woodland (Earlier Flandrian).

2. Deforestation and soil acidification (? pre-Bronze Age).

3. Concomitant development of a humo-ferric podzol.

Micromorphology has resulted in some revision of Dimbleby's (1975) interpretation of pre-mound soils at Sutton Hoo as acidic brown earths: they are now considered to be podzols. Truncation of profiles under mounds 2 and 5 had removed any evidence for disturbed plough horizons as seen by Dimbleby under mound 1. There, increases in *Rumex* and cereal pollen in the topmost part of the profile were interpreted by Dimbleby (1975) as indicating Anglo-Saxon arable farming on sand soils as at Ipswich.

In summary, it is possible, by analogy with Sutton Hoo, that terrace and outwash gravel soils became podzols in prehistory following deforestation. It is certain that the Middle Saxon town was established in an area of heathland on podzolised soils which were subsequently buried beneath occupation deposits or, at at least two sites, reclaimed for agriculture.

### 2.2.2 The Estuary and the Waterfront

The River Gipping flows into the broad, tidal estuary of the Orwell at Ipswich, which meets the North Sea at its confluence with the Stour between Felixstowe and Harwich. Brew (1990) undertook studies of stratigraphy (by coring and seismic methods), and of palaeoecology, (principally by foraminiferal analyses) in the main Suffolk estuaries including the Orwell. His results are of limited value for coastline reconstruction post-6500yrs BP, mainly due to a lack of relevant dated information: the Holocene sequence in the Orwell, beginning c. 8000yrs BP, comprises largely clastic sediments (silts/clay) with no dated intercalated peats. This may have been due, in part, to a high subsidence rate in this area. It is, however, clear that unlike the Blyth to the north the mouth of the Orwell was not protected by barriers or spits at any stage in the Holocene. There is no reason to think that the overall morphology of the Orwell estuary differed significantly in the Saxon period from that of today.

On a more detailed level at Ipswich there are significant differences, as a result of reclamation, wharf and dock construction. As shown in Fig 1.1 a now-infilled channel of the River Gipping extended to the south-west of the Middle Saxon settlement area. This palaeochannel and its floodplain are indicated by a broad belt of alluvial sediments, now largely built over (Allender and Hollyer 1981). On the north bank of the Orwell, at Bridge Street, IAS 6202, progressive expansion southwards of the waterfront form the Middle Saxon period occurred (Fig 3.17). The morphology of the estuary at Ipswich took up its present-day form with the construction of the New Cut and docks in the 19th century.

## 3. Context, Taphonomy and Activities

### 3.1 Pits and Other Cut Features

Much of the plant material retrieved during excavations at Ipswich came from pits, shallow wells and a few ditches cut into the terrace gravels of the River Orwell (Plate 3.1). Retrieval was by machine flotation, normally of central columns 35 x 35cm, subdivided at 10cm vertical intervals. In this section material from Middle Saxon and earlier features of this type at 13 sites (IAS 0802, 4601, 4801, 5202, 5203, 5502, 5701, 5801, 5901, 5902, 6904, 7402 and 7404) and from Late Saxon to early medieval features at IAS/3201, 4601 and 4801 will be considered, together with some features including waterlogged fills at other sites (Table 3.1).

Due to the freely-drained character of the gravel-based fills of these features, waterlogged deposits with structured organic material were rare, and were confined to the bases of deep features. Samples of these organic deposits, processed by the methods of Kenward *et al* (1980) are discussed separately below.

### 3.1.1 Preservation and Distribution

Macrofossils in most features were preserved either by chardring (carbonisation) or by phosphatic mineralisation (Figs 3.1, 3.2). The charred material relates largely to the processing and use of cereals and other crops. The mineralised macrofossils comprised a rather restricted range of identifiable material: occasional whole cereal grains; pulse testa fragments including hilums of *Pisum sativum*, pea; rare fruits of *Cannabis sativa*, hemp (at IAS 5202); *Humulus Lupulus*, hop, (IAS 0802, 5801); nutshell of *Corylus avellana*, hazel; achenes of *Figus carica idaeus* (raspberry); internal casts of *Prunus* endocarps (?sloe); seeds of *Malus* sylvestris (apple); and some mineralised weed seeds including a high proportion of unidentified specimens. Mineralised arthropod remains, fishbones and phosphatic concretions were often associated with these plant remains. Phosphatic mineralisation is commonly associated with garderobes and latrine pits, resulting probably from reaction of biogenic phosphate in faeces with lime used as a sterilising agent (Green 1979). The mineralised macrofossils from these Ipswich features are thought to represent durable food residues which had passed through the human gut.

It was notable that mineralised macrofossils were not present in all features and were apparently absent at some sites (IAS 0802, 7404, 7402). These were peripheral sites where occupation may not have been so intense and consequently sewage disposal was a less pressing problem. However at most sites they were present. It was quite clear that in many features the distribution of charred and mineralised material was complementary: charred material being more common towards the top of features, mineralised macrofossils towards the base. Three examples of features showing this pattern are illustrated in Fig 3.3 a-c. The diagrams show absolute counts of the more common macrofossil types: charred cereal grains, mineralised fruitstones of *Prunus* and *Rubus*. and *Malus* seeds. It seems reasonable to interpret this commonly observed pattern as indicating initial use of the features as latrine pits (probably with some other types of organic refuse deposition) followed by backfilling and sealing with less organic deposits incorporating charred material.

This was the common pattern observed, though in the Late Saxon pit 0306 at IAS 4801 mineralised material was present throughout the fills (Fig 3.3 d), presumably indicating continued deposition of faeces and organic refuse. This exceptional feature is useful in demonstrating that the distribution of mineralised material is not a function of post-depositional processes: that, for example, mineralisation could only occur in basal fills close to groundwater levels.

In summary, then, variations in the type of preservation suggest similar usage of the majority of pits as latrine pits, later backfilled and sealed, throughout the period of occupation from Middle Saxon to early medieval.

Middle Saxon (dry feature fills)

IAS 0802 0007, 0052, 0109, 0182, 0190, 0203
IAS 4601 0192, 0648
IAS 4801 1668
IAS 5202 0007
IAS 5203 0046, 0596
IAS 5502 0113, 0229, 0369, 0374, 0434, 0537
IAS 5701 0017
IAS 5801 0019, 0028, 0035, 0038, 0059
IAS 5901 0238, 0288, 0293, 0320
IAS 5902 0064, (6th – 7th century ditch) 0134, 0141
IAS 6904 0018, 0026 0051
IAS 7402 0090, 0237, 0281
IAS 7404 0005, 0020

Middle Saxon (waterlogged fills)

IAS 4302 0039*
IAS 5502 0455*

Late Saxon/Early Medieval (dry feature fills)

IAS 3201 0104*
IAS 4601 0002, 0415, 0668, 0902
IAS 4801 0270, 0306, 0309, 0366, 0808

Late Saxon/Early Medieval (waterlogged fills)

IAS 4201 0069*, 0070*
IAS 4302 0035*, 0047*
IAS 4801 0376*
IAS 5003 0985*, 0802*
IAS 5204* 0041*, 0055*, 0068*, 0108*, 0136*, 0273*
IAS 5502 0280*
IAS 5701 0033*, 0085*, 0088*

Medieval to Post-Medieval (waterlogged fills)

IAS 3201 0148*
IAS 5801 0065*

**Table 3.1 : Sites and Contexts Referred to in Section 3.1**

*Contexts not included in the compilation of Fig 3.5

### 3.1.2 Charred Plant Remains

Crops and Other Utilised Plants

Counts and frequencies of grains, seeds and fruits of crop plants from the 39 Middle Saxon and 9 Late Saxon to early medieval contexts considered are given in Fig 3.4

In addition fragments of hazel nutshell (*Corylus avellana*) occurred in most contexts and there were rare, often fragmentary, charred fruitstones and seeds of *Rubus* spp (blackberry/raspberry), *Prunus spinosa* (sloe), *Prunus avium* (cherry), *P. domestica* subsp *insititia* (bullace), *Crataegus monogyna* (hawthorn), *Malus* sp (apple) and *Sambucus nigra* (elderberry). There were numerous indeterminate cereal grains and a generally very low proportion of cereal chaff.

Evidently the figures summarised in Fig 3.4 are unlikely to have been related in any simple way to the relative importance of crops in terms of production but rather to processing and utilisation, discussed further below. However it is remarkable how similar the relative proportions of crops are between the two main chronological groups, implying similar types of activity.

The Weed Flora

With the exception of two contexts (IAS 4601 0192, 5203 0046) the charred crop remains were associated with a rather restricted range of wild plant remains, predominantly segetals represented by carbonised fruits, seeds and tubers.

The weed flora identified from carbonised seeds includes several species commonly found on light sandy soils: *Fumaria officinalis, Raphanus raphanistrum, Spergula arvensis*, *Scleranthus annuus* and *Hyoscyamus niger*. Seeds of *Vicia* and *Lathyrus* (including *V.* cf *sativa*, *V.* cf *tetrasperma* and *L.* cf *nissolia)* are common. Other frequently-occurring weed species are *Agrostemma githago, Chenopodium album, Medicago lupulina*-type, *Polygonum persicaria, P. lapathifolium , P. convolvulus, Rumex* sp, *Plantago lanceolata, Galium aparine* and *Bromus mollis/secalinus.* Weeds occurring at lower frequencies comprise *Polygonum aviculare,* cf *Urtica urens,* cf *Convolvulus arvensis, Lithospermum arvense, Slanum nigrum, Mentha arvensis/aquatica, Valerianella* cf *dentata, Lapsana communis, Anthemis cotula, Centaurea* sp, *Lolium temulentum*-type and *Arrhenatherum elatius* var. *bulbosum* tubers. There are also some fruits of species characteristic of damp and wet habitats: *Eleocharis* (cf *palustris*), *Schoenoplectus* sp and *Carex* sp. Capsules of heather, *Calluna vulgaris* were identified, and there were occasional charred bracken pinnules (*Pteridium aquilinum*).

Soils in the Ipswich area are predominantly light and sandy and unreclaimed areas of heathland still survive. Keeley and MacPhail have described a palaeosol from IAS 4302 buried beneath Middle Saxon and later occupation deposits (above 2.2.1). This was truncated, but showed evidence of podzolisation. On this evidence it seems probable that much of the land available for agriculture around the Middle Saxon town would have been acid and poor in plant nutrients. The presence of weed species characteristic of acid sandy soils, and the frequent occurrence of vetch seeds in the samples is clearly consistent with this, and the bracken and heather remains indicate development of heath vegetation in the area. However, *Anthemis cotula* is a weed largely confined to Boulder Clay soils in East Anglia (Kay 1971) and its presence is likely to indicate that some cereals grown on clay soils to the north reached Ipswich.

Crop Processing

Interpreting the samples in terms of crop-processing activities depends upon sample composition. Ethnographic studies of crop products and by-products in a modern Greek peasant community on the island of Amorgos provide a basis for interpreting archaeological charred assemblages (Jones 1984). Using a simplified scheme Jones distinguished four main products and by-products related to different types of activities. A winnowing by-product was found to consist of light chaff and straw; a coarse-sieve by-product was composed of large straw fragments, weed heads, unthreshed ears etc; a fine-sieve by-product of small weed seeds; and the fine sieve product was the cleaned grain, including some grain-sized contaminants.

The results from the archaeological deposits considered in this section are summarised as triangular scatter diagrams in Fig 3.5. The assemblages are considered to have three components: grain, chaff and wed seeds, omiting straw fragments, which are not readily quantifiable. In calculating the percentages on which these diagrams are based only charred plant remains were included. Charred nutshells, fruitstones, pulses, flax and hemp were omitted. The counts used for charred chaff were of rachis nodes. All fruits/seeeds of wild herbaceious plants were included in the ‘weed seed’ category for, as Hillman (1981) has demonstrated, species nowadays considered as grassland or wetland plants may in the past have formed a component of the segetal flora, due to inefficient drainage and ploughing.

It is quite clear that the majority of assemblages from both Middle and Late Saxon/Early medieval features are composed of more than 70% cereal grains. These are thought to represent ‘fine sieve products’: largely cleaned grain, still including some contaminants. The small assemblage from IAS 5902 0064 was also of this type. Although this ditch may originally have formed part of a field system it was evidently back-filled with refuse akin to the at deposited in pits. ‘Purity’ is variable. One large assemblage (5801 0028) was composed of 94% grain (mostly barley and oats) with very few contaminants; by contrast 0802 0109 included only 63% grain with numerous weed seeds, principally *Vicia/Lathyrus* spp, though with some smaller-seeded species including *Spergula arvensis* and *Rumex* sp(p).

Discounting small assemblages, which may be unreliable, there are two samples from Middle Saxon contexts with relatively large quantities of weed seeds and some chaff: from 5203 0046 and 4601 0192. Straightforward numerical comparison with data from Jones (1984) would suggest that these fall, at least in part, into the fine-sieve by-product category, though since both contexts included unusual charred assemblages, a more detailed consideration of their composition is necessary. Their contents, together with that of another rather unusual assemblage from 5203 0596, are listed in Tables 3.2, 3.3 and 3.4.

Site IAS 5203 : 0046 and 0596

The assemblages are clearly very diverse, including remains of crops and wild plants form several distinct communities. The cereal remains consist predominantly of grains with very few rachis or awn fragments. Wild plant communities represented include:

1. Heathland. *Pteridium aquilinum* (bracken), *Calluna vulgaris* (heather).

2. Grassland. *Ranunculus* spp (buttercups), *Vicia/Lathyrus* spp (vetches/tares), *Medicago*-type (medicks etc), *Agrimonia eupatoria* (agrimony), *Plantago lanceolata* (ribworth plantain) and Gramineae (grasses – represented by fruits and culms). *Beta vulgaris* (beet) commonly occurs in tall maritime grassland, on sea-walls etc. Taxa found in wet grassland and marsh include *Ranunculus flammula* (lesser spearwort), *Eleocharis* spp (spike-rush) and *Carex* spp (sedges).

3. Scrub and woodland. *Rubus fruticosus* (bramble), *Prunus* spp (bullace, probably sloe), *Corylus avellana* (hazel), *Sambucus nigra* (elder). The presence of abundant charcoal, charred young twigs, thorns (possibly of *P. spinosa*) and charred epidermal and mesocarp tissue implies that this material might represent hedge trimmings rather than food waste. *Humulus lupulus* (hop) is a common liane of wet woodlands, and the fruits from 0046 might merely be derived from wild plants or could have been utilised.

4. Weed communities. Typical segetal plants (e.g. *Agrostemma githago* – corn cockle; *Anthemis cotula* – stinking mayweed) and ruderals (e.g. *Malva sylvestris* – mallow; *Urtica urens* nettle) are both present, the former probably representing contaminants of grain, the latter the local weed flora.

It appears from this that simple numerical comparison of assemblage composition is misleading in this case. The assemblage is clearly composed of a mixture of materials, (probably grain processing waste, food debris, waste or fouled hay, hedge trimmings, bracken and heather, perhaps used as flooring or litter). In short the assemblage could well have been produced on a bonfire following a general tidying of the site, and is not simply relatable to crop processing.

Sites IAS 4601 : 0192

Carbonised and mineralised plant macrofossils from pit 0192 are listed in Table 3.3. The fills of this feature also produced an unusually wide range of animal macrofossils. Full quantitative analysis and complete identification of all these macrofossils has not been undertaken but some of them are relevant to the interpretation of the plant material. The distribution of animal macrofossils, with identifications where appropriate, is therefore summarised below.

| Context | 0046 | 0046 | 0046 | 0596 |
|---|---|---|---|---|
| Depth (cm) | 30-40 | 40-50 | 80-90 | 40-50 |
| *Pteridium aquilinum* (L) Kuhn pi | - | - | 1 | - |
| *Ranunculus acris/repens/bulbosus* | 2 | - | - | - |
| *Ranunculus flammula* L | - | 1 | - | - |
| *Ranunculus op* | - | - | 1 | - |
| *Agrostemma githago* L | 6 | 3 | 1 | - |
| *Chenopodium album* L | 3 | - | 1 | - |
| *Beta Vulgaris* L (a) | - | - | - | 20 |
| Chenopodiaceae indet | 5+fr | 2 | - | 4+fr |
| *Malva sylvestris* L | - | - | - | 6 |
| *Malva sp* | 1 | - | 1 | - |
| *Vicia/Lathyrus sp (p)* | 3 | - | 1 | - |
| *Medicago*-type | 2 | 2 | - | 2 |
| Leguminosae indet (b) | - | 1+1co | - | - |
| *Rubus fruticosus agg* | 1 | - | - | 2 |
| *Agrimonia eupatoria* L | - | 1 | - | - |
| *Prunus domestica* spp *insititia* | 1 | - | - | - |
| *Prunus* sp fs fr | + | - | - | - |
| *Malus sylvestris/domestica* s | 3+fr | - | - | - |
| end | + | - | - | - |
| *Polgonum persicaria/lapathifolium* | 1 | 1 | 4 | - |
| *Fallopia convolvulus* (1) | - | 2 | 2 | 1 |
| *Rumex* sp (p) | - | 3 | - | 15 |
| Polygonaceae indet | 11 | 2 | - | - |
| *Urtica urens* L | 1 | - | - | - |
| *Humulus lupulus* L | 3 | - | - | - |
| *Corylus avellana* L ns fr | - | - | - | + |
| *Calluna vulgaris* (1) Hull st fr | - | + | - | + |
| *Ballota nigra* L | 1 | - | - | - |
| *Plantago lanceolata* L | 1 | 1 | - | 1 |
| *Galium aparine* L | - | 2 | - | - |
| *Galium* sp | 1 | - | - | 1 |
| *Sambucus nigra* L | 24 | 16 | 9 | 7 |
| *Athemis cotula* L | 1 | - | - | - |
| Compositae indet | - | - | - | 1 |
| *Eleocharis palustris/uniglumis* | 1 | - | - | 1 |
| *Carex* sp (p) | 3 | 1 | - | 3 |
| *Bromus mollis/secalinus* | 4 | 9 | 8 | - |
| Gramineae indet ca | 10 | 3 | 1 | 4 |
| Gramineae indet cn | 9+fr | fr | 13(d)` | 8+fr |
| Cereal indet ca | 9 | 21 | 9 | 26 |
| *Triticum aestivum* sl ca | 8 | 22 | 2 | 18 |
| *Hordeum vulgare* L amend Lam ca | 2 | 55(c) | 7(c) | 15 |
| *Hordeum* sp ri fr | - | - | - | 1 |
| *Secale cereale* L ca | 1 | 22 | 5 | 6 |
| *Secale cereale L* rn | 2+fr | 1 | 3 | - |
| *Avena* sp (p) ca | 3 | 23(c) | 2 | 6 |
| *Avena* sp a fr | - | + | - | - |
| Indeterminate fruits/seeds etc | 23 | 14 | 2 | 15 |
| Stems | + | + | + | + |
| Thorns | 13 | 5 | 2 | + |
| Epidermal and mesocarp tissue (e) | + | + | + | - |
| String (charred) | + | - | - | - |
| Insects | - | + | + | - |
| Molluscs etc (f) | + | + | - | - |
| % flot sorted | 50 | 25 | 25 | 100 |

**Table 3.2 IAS 5203. Charred Plant Remains from Middle Saxon Pits**

Taxa are represented by fruits or seeds unless otherwise indicated. Abbreviations: a - awn; ca - caryopsis; cn - culm node; co -cotyledon; end - endocarp tissue; fr- fragments; fs - fruitstone; ns - nutshell; pi -pinnule; ri - rachis node; s - seed; st - stem.

Notes: (a) fruit aggregates (b) large-seeded (c) includes germinated grains (d) large cf *Phragmites*. Also leaves (e) from large succulent fruits; (f) includes partly burnt shells of *Clausilia* sp, *Hydrobia ulvae, Littorina* sp, *Rissoa* sp and forams.

## Animal Macrofossils

### Bone

Entire and fragmentary bones of fish, birds and mammals were present throughout the fills of the feature. Both burnt and unburnt bone was present. Burnt bone was generally rare towards the base of the pit, except at 150-160cms. Most of the burnt bone is white or grey in colour though black bone charcoal was fairly common at 30-50cm indicating burning in oxygen-deficient conditions.

### Avian Eggshell

Small fragments were discovered from 140-150 and 160-170cm.

### Marine Mollusc Shell

Shells and fragments, mostly of *Ostrea edulis* and *Mytilus edulis*, with rare *Cerastoderma* sp, *Hydrobia ulvae*, *Littorina* spp and *Nucella lapillus* were retrieved from all levels of the pit. Shells discoloured by burning were frequent in the top 60cm of the feature and at 150-160cm. The small marine gastropods, together with barnacles and large foraminifers, which were also noted in the samples, may have reached the site incidentally with edible shellfish.

### Land Molluscs

Rare shells including *Cecilioides acicula*, *Vallonia* spp and *Trichia* spp were noted. Some of these are grey in colour due to partial burning.

### Charred Insects

The following taxa were identified by Dr Mark Robinson (Table 3.4)

| | | | |
|---|---|---|---|
| 30-40cm | *Onthophilus striatus* (For.) | 1 individual | |
| | cf Histeriade indet | 1 | " |
| | *Aphodius* sp | 1 | " |
| | Ceuthorhynchinae indet | 1 | " |
| 40-50cm | *Aphodius* cf *foetidus* (Hbst) | 2 | " |
| | cf *Aphodius* sp | 1 | " |
| 60-70cm | *Kissiter minimus* (Aub) | 1 | " |

**Table 3.4 : IAS 4601, pit 0192; Charred Insects**

Dr Robinson notes: "Species of *Aphodius* live in dung, especially of large herbivores. They do not occur in manure heaps; they are species which live in individual animal droppings in the field. *O. striatus* (a member of the Histeridae) lives in a variety of decaying plant and animal remains including herbivore droppings. *Kissiter minimus* occurs at the roots of grassland plants, while Ceuthorhynchinae are phytophagous on a wide range of herbs.

Mineralised Insects

Mineralised insects, mostly fly puparia, were frequent in association with mineralised plant material in most samples below 110cm.

Coprolites, Concretions, etc

Mineralised coprolites occurred in samples between 10 and 120cm. An intact stool from 50-60cm is 65 x 27 x 26mm. Like the other fragmentary examples it is pale buff in colour with an open porous structure. Bone fragments in the fragmentary specimens are up to 20mm in length, suggesting that they are canine droppings.

In samples below 140cm amorphous phosphatic concretions including plant tissue occurred.

Samples from 30-50 and 150-160cm produced masses of charred porous material containing charred plant tissue including grass or cereal culm. This might be charred herbivore dung.

Charred Leather

Small fragments of charred leather came from samples at 30-50cm and a possible fragment was noted in that from 140-150cm.

Charred Textile

The sample from 30-40cm contained many small fragments of coarse charred textile and a few charred threads came from that at 40-50cm.

The distribution of plant macrofossils in the column sample from this feature is similar to that in many other Middle Saxon pits from Ipswich in that mineralised plant macrofossils are fairly frequent in most of the lower fills whereas carbonised plant material predominates in the upper fill (see Fig 3.2). As in other comparable features this is thought to indicate initiail use of the pit as a latrine pit and subsequent back-filling with other types of refuse. Mineralised plant remains from the lower fills include fruitstones of *Malus sylvestris/domestica* (apple) and *Sambucus nigra* (elder). These mineralised macrofossils are both sparse and poorly preserved, but their association with mineralised phosphatic concretions and fly puparia is consistent with interpretation of these lower fills as being partly composed of human sewage.

In pit 192 the carbonised macrofossils comprise mainly fruits and seeds of weeds and grassland plants with abundant charred grass/cereal culm, some cereal remains including both grains and rachis, and remains of scrub plants. Two episodes of disposal of charred material are indicated by concentrations of carbonised plant remains at 150-160cm and 0-70cm.

The carbonised cereal remains are mainly of rye (*Secale cereale*) and barley (*Hordeum vulgare*) with some bread/club wheat (*Triticum aestivum/compactum*) and possibly cultivated oats *(Avena* sp). A single bean seed (*Vicia faba* var. *minor*) came from the sample at 40-50cm. Rachis fragments are unusually frequent, in some samples more so than grains. The generally high rachis node : cereal grain ratio certainly implies that the assemblages include a component of cereal processing waste. The numerous seeds and fruits of weeds from these samples probably came form the same source: taxa identified include *Raphanus raphanistrum, Thlaspi arvense, Agrostemma githago, Stellaria media*-type, *Chenopodium album, C. hybridum, Atriplex patula/hastata, Malva sylvestrius, Polygonum aviculare, P. persicaria/lapathifolium, P. convolvulus, Rumex* spp, *Galeopsis* sp, *Galium aparine, Anthemis cotula, Cirsium/Carduss* sp, *Lapsana communis, Bromus mollis/secalinus* and *Avena fatua*-type. The wide range of carbonised fruits and seeds of grassland and wetland plants in the samples from pit 192 is, however, unusual. These include *Caltha palustris, Ranunculus acris/repens/bulbosus, R* cf *flammula, Lynchnis flos-cuculi, Medicago/Lotus/Trifolium*-type, *Vicia/Lathyrus* spp, *Rhinanthus minor, Prunella vulgaris, Plantago lanceolata, Centaurea* cf *nigra, Juncus* sp, *Sparganium* sp, *Eleocharis palustris/uniglumis, Carex* spp, *Sieglingia decumbens* and other Gramineae. This list of taxa includes plants characteristic of damp hay-meadows (cf Greig 1984) and it strongly suggests, together with the abundance of charred grass culm in the samples, that burnt hay was discarded in the pit. Very similar assemblages of charred seeds from grassland/wetland plants occurred in Roman deposits at Culver Street, Colchester (Murphy 1992) and were likewise interpreted as charred hay.

Charred remains of scrub plants also occurred in the samples. Fruitstones of *Rubus fruticosus* (bramble) and sloe (*Prunus spinosa)* and fairly abundant seeds of elder (*Sambucus nigra*) were associated with twigs and rosaceous thorns, implying that they may have been carbonised whilst brushwood was being burnt, rather than representing human food refuse. The carbonised nutshell fragments of hazel (*Corylus avellana*) and seed of apple (*Malus sylvestris/domestica*) may have come from either source.

Finally, a few remains of two coastal plants were identified: ‘fruit lids’ of *Beta vulgaris* (beet) and nutlets of *Scirpus maritimus* (sea club rush). The former is a characteristic plant of sea-banks, the latter occurs in shallow water at the margins of tidal rivers.

In summary then, it is clear that the carbonised plant material from pit 192 came from a variety of sources: it includes cereal crop processing waste, hay and brushwood. The charred or partly burnt animal macrofossils associated with this carbonised plant material include bone, marine and land mollusc shells, insects including phytophages and dung beetles and probable charred herbivore dung, besides charred leather and textile. Organic refuse from the site and it surroundings was evidently collected and burnt, apparently on two occasions. Pit 192 was a convenient place in which to dump the charred residue. The plant remains can very tentatively be interpreted as indicating that this tidying-up took place in autumn, i.e. at a time when ripe fruits of bramble, sloe and elder were on the bushes. From the point of view of the economy of Middle Saxon Ipswich, however, the most significant reliable result from this feature is the presence of charred hay and dung beetles showing quite clearly that stock were kept in the vicinity.

Crop Utilisation

The charred crop remains from pits and similar features were all in secondary contexts and occurred in heterogeneous allochthonous assemblages of largely unknown origin.

Interpreting the activities involving the use of crops which resulted in deposition of these assemblages is, therefore, difficult.

It is, however, possible to distinguish one form of crop use: malting and brewing. Charred sprouted cereal grains occurred frequently. They were of all four of the principal cereals but it was notable that germinated barley grains were most frequent, followed by oats, with a few sprouted grains of wheat and rye. Samples from the Middle Saxon pit, IAS 5801 0028, contained a high proportion of spouted grains and these were mostly of barley (see Fig 3.1).

Germination has caused deformation of most grains, but a few specimens from lateral spikelets can be distinguished and it therefore appears that six-row hulled barley is the main crop represented. There is considerable variation in the lengths of sprouts: they extend for up to about three quarters of the grain length but many grains show only the beginnings of sprouting. A lack of uniformity in sprouting does, however, seem to have been characteristic of early medieval malt. At Alms Lane, Norwich, good structural evidence for the existence of a brewery site has been obtained, in the form of a steeping pit, malting floor, drying ovens and a millstone, probably used for crushing the dried malt. Deposits of carbonised malt were present in the ovens but these included a high proportion of grains showing only incipient sprouting (Murphy 1985). Krzywinski *et al* (1983, 156) report wide variations in sprout lengths in carbonised malt from Bryggen, Bergen, Norway. It would be surprising if early medieval malting barley showed the degree of uniformity in germination of modern varieties: it is only to be expected that there would have been wide physiological variability.

Another pit fill, of Late Saxon date, IAS 3201 0104, produced a charred assemblage interpretable in terms of activities relating to brewing and to the storage of fruits.

<u>Site IAS 3201 0104 Middle Late Saxon Pit</u>

A 1.8kg sample of charred material from the western half of the feature (0326) was flotated. Large charcoal fragments and other charred plant remains were abundant, the mineral soil content being low. Materials identified are listed in Table 3.5.

The charcoal appears to include the remains of structural wood, and closely resembles material from the burnt 11th century cellared buildings at IAS 3104 (see below). The hazel roundwood fragments, some of which show oblique transverse cuts could represent the remains of wattling. Fragments apparently of larger structural wood, mainly oak but including some hazel, ash and ?hawthorn were also common. The sample also produced fragments of thin oak boards or staves with maximum cross-section dimensions of 45 x 6mm; these seem too small to be structural and may have come from a barrel or similar stave-constructed container (cf context 2111 at IAS 3104).

One of the hazel roundwood stems had some charred coarse textile fused to its surface and similar textile fragments were common in the finer fractions of the flot. This material seems to represent charred fragments of a sack.

Crab apples (*Malus sylvestris*) are represented by large fragments of charred fruits, some fractured transversely to reveal the loculi of the carpel and seeds within. Loose fragments of seeds and endocarp tissue occurred in the flot. Two specimens, though fragmented, are measurable.  One is 26mm wide, a second *c*. 37mm.  Some allowance for shrinkage during carbonisation must be made but these fruits do not fall within the size range of cultivated apples and are apparently large crabs.  Their surfaces are quite smooth and do not show the wrinkling characteristic of dried apples:  these fruits were evidently stored in a fresh state.

The sample also contained fragments of charred material up to about 50mm in size. Some of these are 'cokey' in appearance, others are solidified tarry masses.  The structure of the plant material included within the matrices of these aggregates has often been obliterated.  Some of them show a distinctly porous structure.  On first inspection these 'pores' were thought to be solidified gas bubbles but closer examination showed that the voids represent the interiors of fruits or seeds.  the clue to the identification of these was provided by the whole and fragmentary fruits of hops, *Humulus lupulus*, present in the flot.  Within some of these the distinctive curved embryo was visible, and similar embryos were noted in some of the interior cavities in the tarry aggregates. Some, or perhaps all, of these aggregates are therefore thought to represent fused masses of hop fruits.

Other crop plant remains for the sample included rye grains and rachis fragments, barley grains and flax seeds in association with some arable weed seeds.

Obviously this pit fill represents re-deposited material, but it would appear that this was derived from fire destruction deposits of broadly similar type to those in the fills of 11th century cellars at IAS 3104, consisting of charred structural wood with remains of stored crops.  In this particular case apples and hops seem to be the main stored products, rather than cereals.

The abundance of hops in this  10th century deposit is of particular interest.  At Haithabu the frequency of hop finds increases markedly in the 9th-10th century, and at the same excavation remains of malt were recovered (Behre 1984).  The cargo of hops from the Graveney boat (Wilson 1975) is similarly dated to the 10th century.  Given the clear continental documentary evidence for hopped beer at this time, and the extensive trading contracts  around the North Sea coasts it seems highly probable that the charred hops from this site wre intended for use in brewing.

Sample composed of *c*. 1/3 roundwood stems, 5-26mm diameter, *c* 2/3 larger wood

| | | |
|---|---|---|
| ***Roundwood* (50 fragments identified)** | | |
| *Corylus* sp (hazel) | 47 (5-26mm) | Some oblique transverse cuts. One stem had coarse textile (sacking) adhering to it. |
| *Ulex/Cytisus* sp (gorse/broom) | 1 (6mm) | |
| Indet diffuse porous | 2 (5mm) | |
| *Larger wood* (50 fragments identified) | | |
| *Quercus* sp (oak) | 32 | Large frags including radial board fragments, 70+mm wide x 20+mm thick |
| *Quercus* sp (oak) | 4 | Fragments of thin boards/staves, tangential, max 45 x 6mm |
| *Fraxinus* sp (ash) | 4 | Fragments of mature wood and large roundwood, *c* 60mm |
| *Corylus*/cf *Corylus* sp (hazel) | 7 | Fragments of mature wood, some badly distorted |
| Pomoideae (hawthorn group) | 1 | Fragment of mature wood |
| Indeterminate | 2 | Badly distorted |

(a) Charcoals

| | | |
|---|---|---|
| *Humulus lumpulus* L | (fruits)<br>(fused masses of fruits) | 31 + frags<br>++++ |
| *Malus sylvestris* Miller | (fruit fragments)<br>equivalent to | 4 fruits |
| *Malus* sp | (seed fragments) | 2 |
| | (endocarp fragments) | + |
| *Linum usitatissimum* L | (seeds) | 5 |
| Cereal indet | (caryopses) | 4 |
| *Hordeum* sp | (caryopsis) | 1 |
| *Secale cereale* L | (caryopsis)<br>(rachis nodes) | 1<br>2 |
| *Agrostemma githago* L | | 2+1cf |
| *Chenopodium album* L | | 1 |
| *Rumex* sp (p) | | 3 |
| *Fallopia convolvulus* (L) | | 2 |
| Labiatae indet | | 1 |
| *Trifolium*-type | | 1 |
| cf *Sambucus nigra* L | | 1 |
| Indeterminate seeds etc | | 3 |
| Charred textile | | + |
| Charred vesicular porous material | | +++ |

(b) Other charred macrofossils

Table 3.5 :  IAS 3201 Pit  0104

| | Middle Saxon | Late Saxon/Early Medieval | Medieval | Post Medieval |
|---|---|---|---|---|
| **Cereal Foodstuff Residues** | | | | |
| Cereal periderm (bran) | - | +++ | + | - |
| Weed seed testa frags (*Agrostemma, Fallopia* etc) | + | +++ | - | + |
| **Pulses** | | | | |
| *Vicia faba (horsebean) testa frags* | - | - | + | - |
| **Fruits** | | | | |
| *Rubus fruticosus* (blackberry) | +++ | +++ | + | - |
| *Rubus idaeus* (raspberry) | + | + | - | - |
| *Fragaria vesca* (strawberry) | ++ | ++ | - | - |
| *Prunus spinosa* (sloe) | ++ | ++ | + | - |
| *Prunus domestica* subsp *insititia* (bullace) | + | ++ | - | - |
| *Crataegus monogyna* (hawthorn) | + | - | - | - |
| *Malus sylvestris* (apple) | + | ++ | - | + |
| *Sambucus nigra* (elder) | + | ++ | - | + |
| *Ficus carica* (fig) | - | + | +++ | +++ |
| *Morus nigra* (mulberry) | - | - | + | - |
| *Vitis vinifera* (grape) | - | - | ++ | + |
| **Nuts** | | | | |
| *Corylus avellana* (hazel) | - | ++ | - | - |
| **Flavourings/herbs** | | | | |
| *Papaver somniferum (opium poppy)* | - | +++ | - | - |
| *Apium graveolens* (celery) | + | +++ | - | - |
| *Anethum graveolens* (dill) | + | - | - | - |
| *Coriandrum sativum* (coriander) | - | + | - | - |
| *Humulus lupulus* (hop) | - | + | - | - |

**Table 3.6 : Food Plant Residues from Latrine Pits**

## Waterlogged Deposits

Waterlogged organic deposits were uncommon at sites on the terrace gravels, and were confined to the bases of deep features. There was a gradation from wet basal fills with mineralised plant remains (discussed above) to anaerobic structured organic deposits. Samples from Middle Saxon to post-medieval contexts will be considered here (see Table 3.6). The assemblages fall into three groups:

1. Those composed largely or predominantly of faecal residues.

2. Those consisting mainly of seeds from weed and wetland vegetation.

3. Cereal processing waste.

## Faecal Residues

Non-carbonised remains of edible plants form latrine pit-type assemblages are summarised in Table 3.6. The contexts were a Middle Saxon pit (IAS 5502 0455), Late Saxon/Early medieval pits (IAS 4201 0069, 0070; IAS 4302 0035, 0047; IAS 5003 0985; IAS 5204 0041, 0055, 0068, 0108, 0136, 0273; IAS 5502 0260; IAS 5701 0085), a later medieval pit (IAS 5801 0065) and a 15th/16th century wood-lined pit (IAS 3201 0148). In order to present the results synoptically no quantitative data are given. Indeed, in view of the fragmented nature of most macrofossils meaningful counts were impossible to obtain for many taxa: typically the organic fraction was composed of cereal periderm fragments with testa fragments of large weed seeds (*A. githago, F. convolvulus*) and fruitstones but few other seeds.

The range of taxa present is closely comparable to that form other Saxon-medieval contexts of this type in East Anglia (e.g. Murphy 1987, 120-2) or elsewhere in the country (e.g. Greig 1981). So far as can be judged from the limited information available, the importance of wild fruits diminished through time, whilst exotic fruits (notably figs) became an increasingly important component of assemblages.

## Weed/Wetland Assemblages

Several pits and wells of Middle Saxon date (IAS 4302 0039) and Late Saxon to Early medieval date, (IAS 5003 0802, IAS 5701 0033, 0088) included restricted assemblages dominated by weed taxa such as Chenopodiaceae, *Rumex* spp, *Urtica urens* and *U. dioica* with grassland and wetland taxa in a minority (e.g. *Juncus* spp, *Carex* spp, *Eleocharis palustris/uniglumis*. Apart from indicating the lack of any significant refuse disposal in the bases of these features, these assemblages merely indicate damp weedy grassland in the vicinity.

## Cereal Processing Waste

The Late Saxon pit fill 0376 at IAS 4801 contained abundant uncharred cereal remains, comprising culm fragments with fragments of rye rachis and whole and fragmentary cereal periderm. Seeds of arable weeds were frequent. Small grass caryopses and calyces of *Trifolium* sp(p) were also fairly common, together with mosses, fragments of bracken frond, and rare remains of elder and bramble. The presence of all elements of cereal plants seems to suggest that material from unprocessed cereal crops became incorporated into this pit fill, where it was mixed with macrofossils derived from grass or hay and with bracken. Clearly this assemblage is in marked contrast to the contemporary carbonised assemblages: it implies that some cereals were reaching the site on the ear, though the carbonised material in isolation would indicate that cereals arrived mainly or entirely as cleaned prime grain.

### 3.1.4 Conclusions

Pits, wells and similar cut features included a variety of plant wastes related to different types of activities. The presence of dietary residues preserved by phosphatic mineralisation towards the bases of many features is thought to indicate initial use as latrine pits, followed by backfilling and sealing with largely inorganic deposits. At a few sites the water table was sufficiently high for a wider range of food residues to survive in waterlogged basal organic deposits. However not all features were so used: some wells and pits received only an incidental seed input from local vegetation and were kept ‘clean’ until backfilling. There is no clear evidence for changes in pit usage through time although the range of ‘exotic’ foodstuffs increased marginally in post-Saxon deposits.

Most plant material was preserved by charring and comprises remains of cereals, pulses, fibre crops, nuts, fruits and weed seeds. The latter indicate some cultivation on acidic sandy soils, probably in the environs of Ipswich. However there is very little evidence for crop-processing on site, in either Middle or Late Saxon/early medieval Ipswich. The assemblages are largely of prime grain (‘fine sieve products’) such as would be expected to predominate at net cereal consumer sites (Hillman 1981, 142), whose occupants were not primarily engaged in agriculture. Only form one Middle Saxon pit at IAS 4601 were assemblages of charred crop cleaning waste associated with evidence for proximity of livestock, pointing to a more agricultural aspect to this site. However, uncharred cereal waste was found in a Late Saxon pit fill at IAS 4801

Evidence for utilisation of crops is slight, though a large deposit of sprouted barley from a Middle Saxon pit at IAS 5801 and fused masses of hop fruits from a Late Saxon pit at IAS 3201 are thought to be related to malting and brewing. Further evidence for these activities comes from Early medieval cellared buildings discussed further below.

## 3.2 Early Medieval Cellars – Stored Cereal Products

### 3.2.1 Introduction

Cellared buildings of early medieval date (11th century0 have been recorded at several sites in Ipswich. Since the cellars were dug into relatively well-drained terrace gravels, conditions were not suitable for the preservation of most uncharred organic remains, with the exception of durable propagules such as seeds of *Sambucus nigra*. Where cellars were simply backfilled with refuse on abandonment (see IAS 4801, Building 2486 below) the material surviving is closely comparable to that from Saxon pits in the town. In some cases, however, the buildings had been destroyed by fire, with the result that charred structural timbers, fittings and wooden artefacts survived, together with batches of crop products stored within them. The survival of charred ‘granary’ deposits at British urban sites is most uncommon, the only close parallels being with the material from Boudican destruction layers (1st century AD) at London (Straker

1984) and Colchester (Murphy 1984, 1992). Deposits of this type provide an opportunity to examine in detail the efficiency of crop processing, storage conditions and utilisation of crops.

In this section charred crop plant remains from cellared buildings at four sites (IAS 3104, 4601, 4801, 5203) will be described and discussed. Charred wood from the same structures will be discussed separately below.

### 3.2.2 <u>IAS 3104: Building 2022 (Plate 3.2)</u>

This two-phase rectangular cellared building, 6.7 x 4.7m in its second phase, was abandoned following fire damage. Unlike other similar burnt structures from Ipswich charred material (timber, grain, etc) was localised within the cellar probably because the fire was extinguished before spreading to the whole building. However within the northern half of the cellar there were extensive spreads of carbonised grain, timber and various other charred wooden objects, and some charred loaves.

<u>Contexts and Samples</u>

A general plan of the charred grain deposits and associated items is given in Fig 3.6. Samples were taken from a number of locations within each context. 250ml sub-samples from each of these were taken for manual water flotation using 0.5mm collecting meshes, principally in order to remove fine mineral and charcoal dust from the carbonised plant remains. The flots obtained were initially scanned at low power to assess their contents. No significant variation between samples from the same context were noted so one or two samples per context, usually from its basal layers which might be comparatively unmixed with material form other contexts were analysed. Flot sub-samples of 25 or 12.5ml were examined.

The contexts sampled were as follows:

2112. Carbonised grain contained within wooden barrel 2111 with oak staves (see below). Samples, collectively numbered 134 were taken, and of these samples from the top 2cm and bottom 2cm of the fill were analysed (Table 3.7). A sample from the middle of the fill was scanned but seemed similar in composition.

2355. Carbonised grain apparently spilling out of the barrel 2111. This was sampled in four quadrants, and the sample from the SW quadrant (66) was analysed, the others being scanned.

2356. Carbonised grain below 2355. This was also sampled in quadrants. Sample 392 was analysed and samples 67, 68 and 69 scanned.

| Context No | 2112 | 2112 | 2356 | 2355 | 2126 | 2476 |
|---|---|---|---|---|---|---|
| **Sample No** | **134** | **134** | **392** | **66** | **133** | **393(v)** |
| *Hordeum* sp(p) intact grains | 3 | 31 | 44 | 7 | 1 | - |
| embryos | 4 | 9 | 26 | 8 | - | - |
| grain apices | 118 | 214 | 261 | 182 | 10 | - |
| *Avena* sp(p) intact grains | 19 | 47 | 61 | 26 | 148 | 67 |
| embryos | 12 | 28 | 38 | 27 | 162 | 122 |
| grain apices | 39 | 73 | 64 | 43 | 525 | 506 |
| florets with grain | - | - | - | - | 8 | 4 |
| florets with grain bases | - | - | - | - | 14 | - |
| empty florets/bases | 1 | fr | fr | fr | 62 | 20 |
| sterile florets | - | - | - | - | 1 | - |
| awn fragments | - | - | - | - | + | - |
| *Triticum aestivum* sl intact grains | - | - | 1 | - | - | - |
| *Secale cereal* L intact grains | 1 | - | - | - | - | - |
| Cereal indet intact grains | - | 6 | 8 | - | - | - |
| embryos/'sprouts' | 79 | 143 | 133 | 175 | 54 | 66 |
| apices | 1 | 15 | - | - | - | - |
| *Linum usitatissimum* L seeds | - | - | 1 | - | 1 | - |
| *Corylus avellana* L nutshell frags | - | - | + | - | - | - |
| *Raphanus raphanistrum* L siliqua frags | - | - | 1 | - | - | - |
| *Agrostemma githago* L | fr | 1 | 4 | 2 | 1 | - |
| *Chenopodium album* L | 2 | 1 | 10 | 17 | 1 | 3 |
| Chenopodiaceae indet | 6 | 5 | 15 | 13 | 5 | 10 |
| *Vicia/Lathyrus* sp (p) cotyledons | 2 | 1 | - | - | - | 2 |
| *Polygonum aviculare* agg | - | - | - | - | - | 1 |
| *Polygonum persicaria /lapathifolium* | - | - | - | 1 | 1 | - |
| *Fallopia convolvulus* (L) | 2 | 2 | 6 | 7 | 1 | - |
| *Rumex acetosella* agg | - | - | - | - | 1 | - |
| Polygonaceae indet | - | - | 1 | 2 | 2 | 5 |
| Primulaceae indet | - | - | 1 | - | - | - |
| *Galium aparine* L | 2 | 8 | 2 | 2 | 1 | 1fr |
| *Anthemis cotula* L | - | - | - | - | - | 5 |
| *Centaurea* cf *cyanus* L | 1fr | - | 4 | 4 | 2 | 2 |
| *Lapsana communis* L | - | - | 1 | - | 1 | 3 |
| *Bromus mollis/secalinus* | 1fr | - | - | 1fr | 9 | 9 |
| *Lolium temulentum*-type | - | 8 | - | 3 | - | - |
| *Avena fatua*-type floret base | 1 | - | - | - | - | - |
| Gramineae indet | 2 | 2 | 15 | - | 1 | 1 |
| Indeterminate | 1 | - | 1 | 1 | - | 7 |
| Flot volume sorted (ml) | 12.5 | 25 | 25 | 12.5 | 12.5 | 12.5 |

**Table 3.7 : IAS 3104, Building 2022 Charred Cereals etc**

*All samples include numerous small fragments and the counts given here are minimum numbers of specimens.*

*Fragments (abbreviated to fr) are noted only when intact specimens are absent. Taxa are represented by fruits or seeds except where indicated.*

2126. Carbonised grain above and partly under an area of charred basketry. 2252 made from split hazel roundwood with interwoven whole unpeeled willow/osier stems (see below). Mixed with this deposit were eighteen charred loaves with abundant wheat/rye-type periderm fragments (see below). 2126 was sampled in quadrants at several levels. Sample 133 came from under the basketry and was analysed in detail since it was likely to be comparatively unmixed. Other sample flots (52, 63, 390 i-iii) were scanned.

2476. A thin spread of carbonised grain east of 2126. This was again sampled in quadrants and spits. Sample 393(v) from the bottom spit, NE quadrant was analysed and samples 393 i-ix scanned.

<u>Quantification</u>

A very high proportion of the charred plant macrofossils in the flot consisted of fragments. The significance of this is discussed further below, but it obviously created problems in obtaining counts. So far as grains are concerned whole grains were initially counted, together with fragments including grains apices, fragments showing the embryo area and loose cereal 'sprouts' from germinated grains. From these a count of minimum numbers of grains could be obtained though undoubtedly, as with all categories of material in these samples, some specimens were too fragmented to be counted at all. Identical counting methods were, however, used for each sample, and the results should therefore be comparable.

<u>The Crop Plants</u>

i) Barley (*Hordeum* sp (p))

Barley was represented in these deposits exclusively by grains: no rachis fragments were seen. Virtually all of the grains had germinated prior to carbonisation. Because of the deformation which this caused and also because intact grains were uncommon it was difficult to ascertain whether a two- or six-row form was represented, though the sample from the base of 2112 included some probable lateral grains. The grains were certainly hulled and some well-preserved lemmas and paleas were present. Most specimens, however, were grain fragments. In some cases this was due to fragmentation during processing but the majority of fracture surfaces were distinctly convex and rounded indicating that breakage occurred <u>before</u> the grains were carbonised.

ii) <u>Oats (*Avena* sp (p))</u>

Oat grains formed the predominant component of samples from 2126 and 2476 and were fairly common in other contexts. As with the barley the majority of grains were fragmented. There seemed to be a higher proportion of recently broken grains showing sharp fracture surfaces but grains broken before charring were also noted. The intact grains, mostly germinated before charring, frequently showed well preserved hairs on the pericarp. They were generally small compared to apparently similar charred oat deposits from contemporary contexts (e.g. the cellared building 0676 at Foundation Street, IAS 4601, see below).

| **Site** | **IAS 4601** | | **IAS 3104** | |
|---|---|---|---|---|
| Building | 0676 | | 2022 | |
| Context | 760 | | 2126 | |
| | length (mm) | breadth (mm) | length (mm) | breadth (mm) |
| min | 3.7 | 1.3 | 3.2 | 1.0 |
| mean | 6.05 | 2.18 | 4.53 | 1.52 |
| max | 8.0 | 2.8 | 6.5 | 2.0 |
| n | 100 | | 50 | |

**Table 3.8: Dimensions of *Avena* grains from two Early Medieval Sites in Ipswich**

The grains from 2126 were quite typical in size for these deposits. Such very marked size differences could be related to the presence of more than one species of *Avena*, to a 'poor' crop or to size selection during processing.

The oats from IAS 4601 were all of *A. sativa*. Those from IAS 3104, though including a single sucker-mouth floret base of *A.Fatua*-type, were predominantly of cultivated species. Only 2126 contained a relatively large number of well-preserved *Avena* florets and floret bases. Most of these showed quite broad basal fracture surfaces and were from upper and lower florets of *A.sativa* but there was a proportion of florets with very narrow basal fractures tending towards a stalked base, which were tentatively referred to the *A. strigosa*-group. The grain: floret ratio in the samples was variable. In 2126 it was 8.1:1, in 2476 24.0:1,m whilst florets were very rare in other contexts. This may be in part a preservational factor, since the florets would have been more likely to burn off the grains in thin peripheral grain spreads like 2476 than in piles of grain such as 2126. Even in 2126, however, the ratio suggests intentional de-hulling prior to storage.

iii) Other Crops

Occasional grains of wheat (*Triticum aestivum*) and rye (*Secale cereale*_ and seeds of flax (*Linum usitatissimum*) were noted, presumably representing contaminants of barley and oats. 2356 produced a few hazel nutshell fragments (*Corylus avellana*).

The Weed Seeds

These are listed in Table 3.7. The seed assemblages are clearly very restricted numerically and in species diversity and consist almost entirely of large propagules, as would be expected in fully-processed stored crop products.

Discussion

The deposits from 2022 represent cleaned grain products with some impurities. Numerically weed seeds comprise up to 17% of the total count (in 2355) but, of course, much less than this in terms of weight or volume. Sample composition is summarised in Fig 3.7 from which oat florets are omitted since variations in their frequency are probably related in part to localised condition of temperature and oxygenation.

Clearly the samples fall into two groups. In 2112 (top), 2112 (base), 2356 and 2355, the barley: oat grain ratios are 2.08:1, 2.04:1, 2.44:1 and 2.73:1 respectively. In 2126 and 2476 oats vastly predominate, with barley as a trace or entirely absent. It seems reasonable to suppose that these two clear sample groups were derived from two separate batches of cleaned crops, though there was probably some mixing of material during the destruction of the building. Spatially the barley/oat samples came from within the barrel 2111 and from material spilling out of it whereas the oat-dominated samples came from the two spreads of grain to the north-east of the barrel. The consistency of results confirms that the sub-samples analysed, though representing only a minute fraction of the total deposit, are representative.

The fact that almost all grains from these samples had germinated before charring and a high proportion of them had then been broken, again before charring, leaves no doubt that the deposits represent malt. The traditional malting process involved steeping, controlled germination on a malting floor, dryign to kill and harden the grain and then grinding prior to mashing (production of the wort for brewing). Whole-grain malt has been reported from medieval hearths and associated contexts at Alms Lane, Norwich (Murphy 1985) and Red Castle Furze, Thetford (Murphy, in prep) as well as from Saxon pits in Ipswich (e.g. IAS 5801, 0028, see above) but these deposits fromIAS 3104 represent the subsequent stage in the process – the grist produced after the malt had been ground. This process is necessary in order to reduce the endosperm to small fragments with a larger surface area and thereby to facilitate water absorption, enzyme activity and the extraction of sugars and othe compounds during mashing. The fineness of grinding depends nowadays on the type of wort-recovering mthod used but modern adjustable roller mills can produce coarse grits, at around 0.3 – 0.6mm, down to flour less than 0.15mm (Hough 1985, 54-7). Very fine flour, though providing a large surface area poses problems of wort extraction. Corron (1975, 164) quotes Ree's *Cyclopaedia* (1819-20) thus: "… the flour when immersed in the water and wetted, forms a sort of paste which at first absorbs a considerable portion of water but will not afterwards quit it, so that very little extract is obtained." This can be dealt with by modern mash filters, but for traditional mash tun methods a coarse grist is used (Hough, ibid 63).

There are grounds for thinking that the mills used to produce the grist represented at IAS 3104 were coarsely set by modern standards. Evidently the millstones were close enough together to fracture most of the barley grains: the low proportion of whole grains could just represent accidental over-spills which evaded milling. However there are relatively large numbers of intact or recently-broken oat grains in the deposits, implying that the millstones were not close enough to crush all of the more slender oat grains. The unusually small size of intact oat grains from the deposits has been noted above, and it is possible that coarse milling acted as a selective process, crushing the larger oat grains but leaving the smaller ones entire.

Corran (175, 60) notes that in the late 16th century barley malt was coarsely ground and about 10% of unmalted wheat or oats added before mashing. The oast from IAS 3104, however, were clearly matled and the deposits seem to represent two distinct types of malt: one composed of barley and oats as a roughly 2.5:1 mixture and another consiting almost entirely of oats. Oaten malt was produced in eighteenth-century England (Findlay 1956, 21).

The Loaves

The charred loaves, 2388, comprised 18 whole and fragmentary specimens. Intact examples were conserved for display purposes (Plate 3.3) but seven fragmentary loaves were examined to determine their composition. Following initial inspection by light microscopy, scanning electron microscopic studies were undertakent o examine plant tissue fragments; subsequently material was submitted to Ms Frances McLaren for chemical analyses using infra-red spectroscopy.

Microscopic Studies

Methods

The seven samples were initially examined at low power under a binocular microscope. the specimens were repeatedly fractured and notes were made on their structure and any macrofossils which they contained. Subsequently typical fragments were examined unde the scanning electron microscope in order to study mor closely scraps of epidermal and other plant tissue.

Results

The fragments typically show an open porous structure of irregular empty vesicles with walls of amorphous charred material. Scraps of plant tissue are visible embedded within this amorphous material. The plant tissue includes the following components:

1. Tissue fragments composed of long transverse cells (Plate 3.4). Cell patterning of this type is very characteristic of grain pericarp of both *Triticum* (wheat) and *Secale* (rye): (Körber-Grohne 1964, 46). Distinguishing between small pericarp fragments of these gwo generan presents some difficultuies (Holden 1990). However, the fragment shown in Plate 3.4 shows no obvious sign of pitting in the cell walls and there are some short rows of transverse cells apparently with thickened end walls – features said to be characteristic of rye pericarp. Tissue of this type was more frequently observed on fractured surfaces than any of the following types.

2. Tissue fragments (? testa) with hexagonal isodiametric cells up to about 35 microns across.

3. Fragments of stem tissue with annular thickening in the vessels, up to about 1.5mm in diameter.

4. An oval hilum, *c*. 1mm long, from a legume seed, possibly *Pisum*.

5. An intact grain of rye, Secale cereale.

Other components showing less well-defined cell structure or gross morphology are present.

Conclusions

Full characterisation of the plant tissue in these loaves would involve preparation of a great deal of reference material. Insufficient time is available for such work at present, though all the material will be retained for possible future study.

On the basis of this preliminary examination it appears that cereal pericarp (bran) forms a major component of the loaves and that this includes rye pericarp. Other plant tissues are, however, present. Quantification is difficult, so it is hard to say whether this other tissue merely represents material contaminating coarsely-ground wholemeal flour or an intentional addition to the loaves.

Infra-Red Spectroscopy (Frances McLaren)

IR is one of a range of analytical techniques that has been genrally available since the 1960s for use by chemotaxonomists and phytochemists (Harborne, 1984 and Chapman, 1965). Anlaysis of small sample extracts is routinely investigated (Dönges and Stai 1962). The early IR spectrophotometers were not capable of the sophisticated electronic manipulation such as accumulating spectra which is now a standard functional refinement of more recent models.

IR is a chemical technique that can assign a compound to its chemical class. It does not necessarily provide the exact identity of a substance. IR analysis proved successful in theidentification of charred seeds recovered from a wide range of prehistoric excavations (McLaren *et al* in the press). It was decided, therefore, to investigate the Saxon loaves by the application of the same technique. The IR analysis of the loaves discussed below proved more difficult than the identification of the charred grains because their composite origins produce more complex spectra which are less easy to interpret.

Differential spectroscopy is a method of analysis where, if exactly the same amounts of two compounds are placed in the separate light paths of the double-beam spectrometer, owing to the small frequency difference, differentiation occurs as an absorption band is transversed and the resulting spectrum reflects the differences in the compounds. If the compounds are absolutely identical then a straight line appears. Small differential bands need only reflect the difference in the amounts of the extracts. In using this method of IR analysis it is unlikely that a completely straight line could be expected when comparing the extract from a Saxon loaf with another plant source. However, if no major differentiated bands occur then it could be suggested that the appropriate plant source was used.

IR is non-destructive and the extracts can be retained for further examination by other analytical techniques. Fortunately the samples are sufficiently large for TLC to be used. Although TLC is less sensitive than IR it is more versatile. TLC can speedily separate out the chemical components of the loaves. The compounds can be separately collected and then presented for IR analysis.

## Potential Questions

The problems these Anglo-Saxon loaves posed were: firstly, what was their cereal or plant content and, secondly, could the original receipt be replicated?

It was to be expected that there would be some difference in the chemical content of the actual processed loaf compared to whole grains of a cereal but it was uncertain as to how much effect any change would have. As McCance *et al* (1945) point out, in their review of the chemical compositon of wheat and rye flours, milling results in a general increase in the carbohydrate content but a decrease in the other chemical constituents.

If seeds or flour are badly stored for a long time the action of lipase, bacterial, fungi or microfauna may result in significant changes between the spectra of a raw grain and the processed loaf. The lipids of bacterial, fungi and microfauna are separable using other chemical techniques such as GLC because they have distinct lipid patterns not found in plants such as cereals (Harwood & Russell 1984). The study o Farag *et al* (1986) on the effects of four fungi on wheat suggested that there should be no significant problem with fungi for this method.

Finally, if any changes occurred as a result of storage or processing would these significantly reduce the possibility of matchng the standard spectra produced from the extracts of an entire seed?

## Method and Materials

Before the examination of the Saxon loaves began a simple investigation was carried out on a home produced bread of known composition made with a modern strong flour to see if any significant differences as a result of cooking could be detected in the IR spectra.

A series of seven samples from the Saxon loaves were extracted using three increasingly polar solvents; hexane, chloroform and propanol. The examination of the extracts by IR spectroscopy showed spectra of a cereal type. The procedure employed was an extension of the method applied to the ancient charred seeds (McLaren *et al* in press). They were analysed by blind sampling.

Initially the spectra were run against a variety of plant spectra to see if any prominent matches could be observed or ruled out. The spectra of the hexane extracts were compared to spectra made from individual standards of modern plant species primarily based on Gordon Hillman's plant collection mde in Turkey in the 1970s, supplemented by further material collected over a number of years in Europe. A large variety of spectra of plants, were initially examined including tetraploid and hexaploid wheats, ryes, barley, oat, pea, lentil and acorn. Comparison of these spectra indicated that the spectra of the cereals: wheat and rye were probably the most signficant, however, the following species are discussed below:-

## Species

*Triticum turgidum* (L) subsp *diococcum* (Shrank) Thell (Emmer)
*Triticum turgidum* (L) conv *durum* (Desf) Mackey (Durum Wheat)

*Triticum aestivum* (L) subsp *spelta* (L) Thell (Spelt Wheat)
*Triticum aestivum* (L) subsp *vulgare* (vill) Mackey (Bread Wheat) also referred to as *T aestivum* L.
*Secale cereale* L subsp *cereale (Rye)*
*Secale montanum* Guss.
*Pisum sativum* L (pea)

Preliminary examination of the hexane extracts suggested that the bread of composite origin although the dominant cereal appeared to be wheat. The presence of two strong peaks at 1500cm$^{-1}$ to 1400cm$^{-1}$ (Fig 3.9) in these spectra suggested that there was the strong possibility that rye was also present. AT this point it was decided to extract a series of standards from modern, commercially produced wheat and rye mixture breads. These were used because the rigorous standards demanded in production would ensure that it would be possible to reproduce the Saxon loaves.

The following breads were used for the analysis:-

1. Home made wheat bread.
2. Sour dough bread; purchased from Selfridges.
3. Dark rye bread; purchased from Marks and Spencers.
4. Pumpernickel bread; purchased from the Co-Op.

P Murphy had examined the loaves by optical and scanning electron microscopy prior to presenting them for chemical analysis (see above) and had detected the presence of cereal periderm (including rye) as well as minor inclusions such as legume testa fragments. It was therefore decided to apply differential spectroscopy in order to test the validity of the presence of some possible inclusions in the bread (Chapman 1965 and Evans & Biek 1976).

Differential spectroscopy was carried out using the propanol extract of Saxon loaf (sample number 58) and the propanol extract of the sour dough bread, peas and two ancient charred grains, recovered from archaeological excavation; *S montanum Guss* from the early Neolithic site of Tell Abu Hureyra, Syria, TAH 324/6 which was extremely unlikely to have been exploited by the Saxons (McClaren *et al*, in press) from Neolithic Blackwater, Essex (BL28c Ct274). These ancient grains had previously been subjected to IR analysis to independently confirm their identity. The identity was confirmed in the case of the rye. However, the wheat while it has a spectrum compatible to the species *T aestivum* L had not been compared with the complete range of sub-species of wheat which could have been exploited at this time.

Differential spectroscopy was only carried out on the propanol extract (discussed below) because this extract seemed to suggest, on the basis of straight comparison of the spectrum with the standards, that the bread was not of composite origin but almost totally wheat. It was decided to deliberately run this spectrum against the sour dough spectrum, a pea spectrum and a primitive Near Eastern Rye spectrum. It was extremely unlikely that the rye should show any correlation with the loaf and it would, therefore, be interesting to ascertain how much of a miss-match showed between the extracts. Once this was established the differential spectra between the loaf spectrum and the sour dough spectrum and also the pea spectrum could be evaluated. Finally, the propanol spectrum was compared to that of a charred seed from Neolithic Essex by differential spectroscopy because straight comparison showed remarkable similarity.

Time did not permit differential spectroscopy to be applied to the hexane or chloroform loaf extracts which suggest closer compatibility to rye bread. However, it is anticipated that these extracts will be examined in the near future.

## Results and Discussions

### Modern Bread

The spectra obtained from the extracts of the modern flour and home made bread were amazing in their clarity of match (see Fig 3.8). The hexane spectra showed only a significant difference at around $1700cm^{-1}$ to $1400cm^{-1}$, the raw flour spectra having water peaks that did not survive the cooking process. The chloroform spectra of the bread extract showed that some degradation occurred as a result of cooking because there is a general flattening of peaks in the spectra from $1200cm^{-1}$ to $700cm^{-1}$. This was even more emphasised in the propanol extract in the same area (not illustrated).

A possible reason for the general flattening may be that it is a result of the rearranged molecules caused by processing and subsequent cooking of the food. Unfortunately IR spectroscopy alone would not be able to resolve the problem of the precise composition of the extract without resorting to further chemical analyses which have yet to be carried out.

The extracts from the modern flour and bread however showed such good correlation that indicated it would be profitable to pursue the problem of the composition of the Saxon loaves.

### Saxon Loaves

The extracts of each solvent made from the loaves showed the same general patterns but there were minor differences in the peaks (Fig 3.12). No obvious trace of the use of animal fat was noticed in the IR spectra, so far examined in detail.

The hexane extracts appeared to indicate that the bread was of composite origin. The hexane spectrum of white bread wheat (*T aestivum* L) appeared to have some close affinity to the spectra of the loaves but the hexane spectrum of the sour dough bread appeared to confirm that the Saxon loaves were of a composite origin of wheat and rye.

The chloroform extracts appeared to confirm the composite nature of the loaves although the dark rye bread from Marks and Spencers appeared to have the closest composition (Fig 3.10). The chloroform extracts were also compared to some spectra of various wheats to ascertain the closest match (Fig 3.11). This appeared to be the bread wheat *T aestivum* L although it is possible that a closer match may be found with one of the sub-species of wheat discussed below that have yet to be examined by this technique.

Indeed it is entirely possible that more than one wheat source may have been exploited. Rivet wheat is a soft wheat more suitable for baking biscuits than the baking loaves but it could have been used to supplement the preferred bread wheat *T aestivum* L.

In contrast the spectra from the propanol extracts appear to indicate an almost total bread wheat origin. The comparative spectra from the modern rye breads showed no close comparison. One possible reason for this is that the hexane and chloroform extracts may be extracting the lipids which indicate the composite nature of the loaves but the more polar solvent may be extracting more complex mixtures which may be dominated by the wheat content. The complex mixtures may include not only the phospholipids but also some proteins and carbohydrates, although the data of Zeven *et al* (1975) would suggest that protein should not be present.

To investigate the composite nature of the loaves differential spectroscopy was used on one of the propanol extracts of the loaves with a sour dough bread and two charred seeds (Fig 3.13). The strongest negative spectra was between modern sour dough bread and the loaf, which was most surprising. It would therefore appear that the bread may not have been thoroughly mixed or the added rye may have been almost an accidental filler.

Differential spectroscopy was carried out where a complete miss-match was to be expected. There was almost no possibility that the charred grain of the primitive rye, *S montanum* Guss should show a match with the Saxon loaf because it is a primitive Near Eastern rye which does not tolerate cultivation. A strong negative peak could be observed.

The differential spectroscopy of the loaf with a pea also showed a strong negative peak in relation to the loaf in a similar manner to the rye. This suggested that the presence is no more likely than the occurrence of a primitive rye in this extract. It is therefore probable that the pea was possibly intrusive in one of the loaves and not present in this sample.

A further charred grain, the Neolithic Essex, was also subjected to differential spectroscopy. This showed the closest match to the loaf. This closeness confirmed the straight comparison of the individual spectra (Fig 3.14). This showed a strong similarity although there are some minor differences observable.

This would appear to suggest that the loaf was produced mainly from a bread wheat. At this point it should be mentioned that the full range of possible sub-species of bread wheats have not yet been established as modern reference standards. For example, neither an extreme form of bread wheat, *Triticum aestivum/compactum* Schiem, nor *Triticum turgidum* L (rivet wheat) which were probably cultivated about this time have been examined. The latter has been tentatively identified from Saxon sites on the basis of rachis fragments because identification cannot be made on the grains alone (L Moffet, unpublished data, pers comm).

The Saxon loaves present an intriguing problem that has yet to be fully resolved. Comparative IR spectra of the complete range of wheat that was possibly available to the Saxon baker will soon be completed. In the meantime it can be suggested that a species of wheat, probably *T aestivum* L was the prime plant source used for the flour with a small element of rye almost certainly present. The exact recipe will probably not be resolved until some supportive analytical analyses such as TLC or GLC are examined. While IR has yet to prove as satisfactory with the analysis of the Saxon bread as it has been in the identification of charred seeds it can be stated that IR analysis has gone a long way in establishing the loaves composite origin.

Conclusions

Microscopic studies established that most of the identifiable plant tissue present was wheat/rye pericarp (bran) with some other, very minor, components. Separation of wheat and rye bran was difficult but some rye-type cell structure was noted. Spectroscopic techniques suggested that in fact bread wheat was the main component in the flour used, but that a small element of rye was detectable. The loaves were therefore certainly made from a mixed flour of wheat and rye though further refinements of technique would be necessary to establish flour composition precisely.

3.2.3 IAS 4601: Building 0676 (Plate 3.5)

This cellar was more extensively burnt than 2022 and charred structural timbers were preserved on all wall faces. Strewn across the floor were dense and extensive spreads of charred cereals (Figs 3.15, 3.16).

Methods of Sampling and Retrieval

Samples of varying size were collected from discrete areas of charcoal and charred cereals within the cellar fill. The samples consisted largely or entirely of charred plant material with little mineral soil and sub-sampling was clearly necessary. It was not practicable, or indeed useful, to identify all the charcoal fragments present, but an attempt was made to isolate for identification all fragments which could be interpreted with greater or lesser certainty as the remains of structural wood, fittings or wooden artefacts. Fragments larger than 25mm, apparently from major structural components, were first separated by dry sieving and the finer fraction of each sample was then sorted through, picking out fragments of young stems and any cut or worked pieces of charred wood. Only these fragments were identified, but other smaller charcoal fragments from the samples have been retained for possible future study.

Having removed charcoal for identification, a 250ml sub-sample of matrix was taken from each sample, apart from the smaller samples which consisted of charcoal with little or no soil matrix. Manual water flotation and wet-sieving with 0.5mm meshes was then used to separate carbonised cereals and seeds from the mineral fraction of these sub-samples. The dried flots and residues were sorted under a binocular microscope at low power, though the richest samples were further sub-divided and only partly sorted: for example, 25% of the 250ml sub-samples from 0754 produced over 800 cereal grains besides chaff and weed seeds.

The Crop Plants

Apart from carbonised cereals, the only crop represented is *Linum* cf *usitatissimum.* A few somewhat deformed seeds were present and sample 0677, from the general fill of the cellar, contained a seed fused during charring to its capsule segment. Occasional grains of *Hordeum* sp, *Triticum aestivum sl* and grains and rachis nodes of *Secale cereale* were also recovered. However remains of these crops all occur at very low frequencies and are clearly no more than contaminants of oats (*Avena* sp) which are abundant in almost all samples.

None of the well-preserved *Avena* floret bases shows the *A fatua*-type 'sucker-mouth' basal articulation, though there are a very few fragmentary or damaged specimens which could tentatively be identified as wild-type. Most of the floret bases show either broad basal fracture surfaces and are from *A sativa* lower florets, or are rather more slender and match upper florets of these species. The grains, though including a fairly large proportion of specimens deformed during charring, mostly have convex sides. They are usually relatively broad and have a large mean length (Table 3.9).

Samples 0879 and 0880, however, include a higher proportion of 'tail grains' from secondary and tertiary florets.

| | Length (mm) | Breadth (mm) | 100 x L/B |
|---|---|---|---|
| Min | 3.7 | 1.3 | 158 |
| Mean | 6.05 | 2.18 | 277 |
| Max | 8.0 | 2.8 | 356 |

**Table 3.9: IAS 4601, Building 0676 (0760)**
**Dimensions and L:B Index for 100 Avena Grains**

Thickness measurements were not made because many grains are slightly ' puffed' along the ventral furrow.

From these characteristics *Avena sativa* L is the only species whose presence can definitely be established. If other *Avena* spp are present they can only represent minor contaminants.

The Weed Seeds

Most of the large cereal samples from 0676 are from batches of crops which had been fully cleaned before storage. These produced few weed seeds, though in samples from the south-west corner of the cellar (0879, 0880, 0897) there was a slightly wider range of taxa. By far the most abundant weed species overall is *Anthema cotula*, a plant particularly characteristic of heavy clay soils. Occasional fruits of *Ranunculus flammula*, *Carex* sp and *Eleocharis* sp were also identified, and these could indicate damp soil conditions. The samples also contained fruits and seeds of weed plants prevalent on dry sandy soils, including *Raphanus raphanistrum*, *Spergula arvensis* and *Rumex acetosella*. The remaining weed taxa are widely distributed on a variety of soil types: these comprise *Brassica* sp, *Agrostemma githago*, *Stellaria media*-type, *Chencopodium album, Atriplex patula/hastata, Vicia* and *Lathyrus* spp, *Polgonum* spp, *Rumex* sp, *Hyoscyamus niger, Plantago lanceolata, Tripleurospermum maritimum, Centaurea* sp, *Lapsana communis* and *Bromus mollis/secalinus*. This mixture of weed ecotypes suggests that cereals grown at more than one locality are represented in these samples. Occasional seeds and nutshell fragments of elder (*Sambucus nigra*) and hazel *(Corylus avellan)* occurred in the cereal samples, suggesting that fruits and nuts may also have been stored in the cellar.

Composition and Spatial Distribution of Cereal Assemblages

The distribution of cereal samples and the density of cereal grains (nos of grains/250ml of soil matrix) are summarised in Fig 3.16. The samples with the highest density of cereal grains (predominantly oats, *Avena* spp) came from conspicuous spreads of charred cereals across the cellar floor (0730, 0731, 0741, 0753, 0754, 0755, 0760, 0782) and in its north-east corner (0869, 0901). These samples contained between 420 and 3488 grains per 250ml of soil. They are remarkably uniform in composition, consisting largely of oat grains and florets with occasional grains of other cereals, flax seeds and weed seeds. The floret base: grain ratio is quite high, but variable. This ratio has probably been influenced by differential preservation during charring. The commonest weed is *Anthemis cotula*, fruits of which are frequently aggregated in more-or-less complete capitula. Seeds of *Brassica* sp also occur, together with siliqua fragments. Other weed seeds and oat awns are rare. It thus appears that the oat grains were mostly still in their husks when stored, but the crop had been efficiently cleaned, leaving few fine impurities but some intact seed heads and pods of weeds which subsequently fragmented.

Most of the remaining samples from all parts of the cellar produced assemblages of similar composition but with lower grain densities. Virtually all samples examined contained some cereal remains, representing presumably chance spillages from cleaned batches of oats.

Three samples, however, are conspicuously different in composition: 0879, 0880 and 0897 from close to the southern edge of the cellar's west wall. 0879 and 0880 contain a higher proportion of weed seeds and awn fragments. The oat grains present are small and some had sprouted prior to carbonisation. Many of the florets are sterile. 0897 produced only sterile florets with no grains, but a few weed seeds. These three samples clearly include sievings from grain cleaning – tail-grains, husks, awns and weed seeds. This could perhaps indicate that some grain-cleaning took place in the cellar, or possibly that crop waste was intentionally brought in. The sprouted grains from 0879 and 0880 suggest locally damp conditions in this part of the cellar.

The cellar fill also produced a horse-shoe and a spur (K Wade, pers comm), suggesting that the oats from this feature were intended for use as horse fodder. Nor charred dung or litter was noted in the samples examined, and there is no evidence that the cellar was actually a stable; it is more likely to have served as storage space for fodder and tack. Some indication of the value of horses at this time is given by the fact that the oats had been carefully cleaned, removing virtually all contaminants. Buurman (1983) has reported similar very clean deposits of oats, (again associated with horseshoes) from a 14th century context at the Priory of Postel, ‘s-Hertogenbosch, Netherlands.

In summary, the dense spreads of cereals across the cellar floor and in its north-east corner consist largely of oats: fully-cleaned prime grain still mostly husked but including a few contaminants. These comprise grains and rachis fragments of barley, bread wheat and rye, seeds and capsules of flax and weed seeds. The mixture of weed ecotypes suggests that batches of oats from different sources were mixed during processing prior to storage. Three samples of crop cleaning waste are present, but the significance of these is uncertain. The presence of horseshoes and a spur in the cellar fill suggest that the oats represent stored horse fodder.

### 3.2.4 IAS 4801: Buildings 2376 and 2486

Samples were collected for laboratory analysis and machine flotation from the cellared buildings 2376 and 2486. 2376 had been destroyed by fire and its fills included abundant charcoal; 2486 was unburnt but a sample was taken from an apparent ‘occupation layer’ within it. Sampling at these two building was much less extensive than at the similar cellared building 0676 at site IAS 4601. The bulk samples were processed by the standard method in the flotation tank. Plant material was extracted from the laboratory samples by repeated flotation and washover, with a 0.5mm collecting mesh and the non-floating residues were wet-sieved in a 1mm mesh.

#### Building 2376

All samples from this building contained small quantities of carbonised cereals (*Triticum aestivum/compactum*, *Secale cereale*, *Hordeum* sp and *Avena* sp) associated with a range of common arable weeds. Carbonised fruitstones of bramble (*Rubus fruticosus*) and carbonised seeds of elder (*Sambucus nigra*) were also identified together with a capsule of heather (*Calluna vulgaris*). The density of cereals in these deposits is very much lower than in the fills of 0676 at IAS 4601, and it is therefore unclear whether the use of this cellar for cereal storage is indicated, or whether the assemblages simply represent small-scale spillages of cereals from domestic activities. The sample from 2304 comprised the fill of an intact storage pot within the scraps of *Ostrea* and *Mytilus* shell, mineralised woodlice, fragments of large mammal bone, small mammal bones and abundant amphibian bones. It would appear that after the fire the cellar acted as a trap for small mammals and amphibians, and the storage jar, in which rain water no doubt accumulated, was a suitable damp refuge for the amphibians. At the same time burnt debris from the vicinity fell or was washed into the jar. There is no reason to suppose that its fill was at all related to its original function. Amphibian and small mammal bones also occurred in 2401.

#### Building 2486

The sample from 2543 contained abundant uncarbonised seeds of elder (*Sambucus nigra*) with some mineralised weed seeds and a thin scatter of carbonised cereals and weed seeds. It also produced mineralised fly puparia, shells and fragments of the edible marine molluscs *Littorina littorea*, *Mytilus edulis* and *Ostrea edulis*, fishbones, small mammal bones and large fragments of large mammal bone. From these characteristics the layer is probably best interpreted as an accumulation of refuse, thrown into the disused cellar, upon which elder bushes and weeds grew, rather than being an occupation layer related to the use of the building.

### 3.2.5 IAS 5203: Building 0064

Four 5kg samples were collected from layer 0356 in this feature. The layer consisted of heterogeneous loamy and sandy deposits including burnt timbers (some only semi-charred) and other carbonised and part-charred plant material. Unlike comparable burnt deposits in cellars of similar date at sites 3104 and 4601, 0356 did not directly overlie the cellar floor: beneath it were unburnt loamy and sandy layers indicating that the cellar and perhaps the building over it were disused for some time prior to deposition of 0356. The plant remains from this layer are therefore not definitely interpretable as derived from *in situ* fire destruction deposits.

Plant remains extracted are listed in Table 3.10. Cereal grains predominate and barley is the main species. The barley grains are all hulled and asymmetrical grains are present indicating the presence of six-row barley, although most grains are symmetrical. However precise ratios of median: lateral grains cannot be determined due to deformation caused by germination prior to carbonisation. In 0356C 71 of 95 barley grains have definitely sprouted, the remainder either showing no clear signs of sprouting or being very poorly preserved. Some of the oat, wheat and rye grains are also sprouted. Other possible food plants present include bramble, sloe, hazel and elder. Seeds of wild taxa consist of grassland, ruderal and segetal species. Ruderals, especially *Urtica dioica* are much more common than in cereal deposits from other contemporary cellars at Ipswich. The density of carbonised plant remains in 0356 is very much lower than in these other deposits.

Deposits of charred sprouted barley immediately suggest the possibility of malting at the site, or at least storage of malt and its charring when the building was destroyed by fire. However, there is evidence for disuse of the cellar prior to burning, and the relative abundance of ruderal taxa may imply development of a weed flora around or even within the cellar. It is also noticeable that all cereal taxa, not just barley include a proportion of sprouted grains. It is therefore possible that the cereals present are derived from batches of cleaned prime grain which had been stored in rather damp conditions, perhaps in the dilapidated superstructure above 0064.

### 3.2.6 Conclusions

The remarkable and, for this period, unparalleled deposits of charred cereal products from these cellars provide useful information on the uses of crops. From the charred malt deposits at IAS 3104 it appears that two types of beer were being produced: one using a barley/oats mix and one almost entirely of oats. At IAS 4601 stored batches of oats seem to have been intended for use as horse fodder. The charred loaves from IAS 3104 were made using wheat and rye flour. Crop cleaning methods were efficient: weed seeds and other contaminants were few.

| Context | 0356A | 0356B | 0356C | 0356D |
|---|---|---|---|---|
| Cereal indet ca fr | + | + | + | |
| ca | 6 | 1 | 19 | 67 |
| cn | - | - | - | 1 |
| *Hordeum* sp(p) ca | 14 | 1 | 95 | 315 |
| *Triticum aestivum* sl ca | 4 | - | 11 | 53 |
| *Avena* sp(p) ca | 3 | - | 12 | 34 |
| fb | - | - | 1 | - |
| *Secale cereale* L ca | - | - | 1 | 6 |
| *Ranunculus acris/repens/bulbosus* | - | 1 | 5 | - |
| *Raphanus raphanistrum* L sil fr | - | - | - | 2 |
| *Thlaspi arvense* L | - | - | - | 1 |
| *Reseda* sp | - | 1 | 3 | 2 |
| *Stellaria media*-type | - | 2 | - | - |
| *Stellaria graminea/palustris* | - | - | 1 | - |
| *Agrostemma githago* L | - | 1 | 2 | 3 |
| *Chenopodium album* L | - | fr | 54+fr | 4 |
| Chenopodiaceae indet | 1 | fr | fr | 2 |
| *Malva* sp | - | - | - | 1 |
| *Vicia/Lathyrus* sp(p) | - | - | 2 | 2+1co |
| *Trifolium*-type | - | - | 1 | - |
| *Rubus fruticosus* agg | 1 | - | - | - |
| *Prunus spinosa* L | - | - | 1 | - |
| Umbelliferae indet | - | - | - | 1 |
| *Polygonum aviculare* agg | - | - | 2 | - |
| *Polygonum perscicaria/lapathifolium* | - | 2 | 1 | 1 |
| *Fallopia convolvulus* (L) | - | - | 1 | 1 |
| *Rumex acetosella* agg | - | - | 1 | 1 |
| *Rumex* sp(p) | 1 | 1 | 1 | - |
| Polygonaceae indet | - | - | 1 | - |
| *Urtica dioica* L | - | 6 | 26 | 1 |
| *Corylus avellana* L ns fr | + | + | + | + |
| *Hyoscyamus niger* L | - | - | 1 | - |
| *Galeopsis tetrahit/speciosa* | - | - | 1 | - |
| *Galium aparine* L | 1 | - | - | - |
| *Sambucus nigra* L | - | 2 | 1 | - |
| *Anthemis cotula* L | - | - | 1cf | 2 |
| *Centaurea* cf *cyanus* L | - | - | - | 1 |
| *Eleocharis* sp | 1 | - | 1 | 1 |
| *Carex* sp | - | 1 | 3 | 1 |
| *Bromus mollis/secalinus* | - | - | - | 1 |
| Indet seeds etc | - | - | 18 | 3 |
| % flot sorted | 100 | 50 | 100 | 25 |

**Table 3.10 IAS 5203: Charred Cereals etc, from Building 0064, Layer 0356**

All samples 5kg. Taxa are represented by fruits or seeds except where indicated.
Abbreviations: ca-caryopses; cn-culm node; fb-floret base; fr-fragments; ns-nutshell; sil-siliqua.

## 3.3 The Waterfront at Bridge Street (IAS 6202) (Plate 3.6)

### 3.3.1 Introduction

The trench evacuated at this site provided the main opportunity during the current excavation programme to examine waterfront structures and associated waterlogged fluvial deposits and dumped layers associated with reclamation. The investigations outlined in this section were seen as a pilot study designed to assess the potential of the Orwell waterfront excavations in East Anglia. The deposits included a wide range of taxa including foraminefera, molluscs, crustaceans, insects, echinoids, bones of fish, other small vertebrates and mammals, avian eggshell, mosses, fruit/seeds. stems, leaves and wood. In this section the main results from studies of plant macrofossils and invertebrates will be presented and discussed.

Comparable Late Saxon to early medieval waterfront deposits were collected at Neptune Quay (IAS 6601). Assessment of these indicated that the plant macrofossil assemblages were very mixed, including halophytes, grassland, wetland, weed and scrub plants with some residues probably derived from sewage. In view of the complex taphonomy of these assemblages, detailed analysis was not thought to be profitable.

## 3.2 Methods

With the exception of wood and large bones (which were collected by hand) biological remains were extracted from soil samples. Column samples were taken from the waterfront deposits at several locations in the trench (samples 214, 225, 262, 406, 490), and individual samples from some other deposits of potential interest were collected The locations of the column samples are shown in Fig 3.17. The columns consisted of two parallel series of samples: large samples for bulk-sieving on site and smaller samples for laboratory analysis.

The extraction methods used were those of Kenward *et al* (1980). Plant macrofossils, foraminifers, small molluscs and other aquatic invertebrates were recovered from 1-2kg samples in the laboratory. After disaggregation the organic fraction of these samples was separated by wash-over, graded in a sieve bank with a minimum mesh size of 0.25mm, and sorted wet under a binocular microscope at low power. The mineral fractions were wet-sieved in a 0.5mm mesh, and dried before sorting. The bulk samples, each normally consisting of a 10cm vertical sub-sample from a 20 x 20cm column, were processed in a bulk sieving/flotation tank on site. They produced bones of fish, mammals and other vertebrates, avian eggshell, mollusc shells and larger plant macrofossils. 1mm meshes were used for processing these bulk samples.

Plant remains were extracted from the disaggregated organic fractions of 1-2kg soil samples in the laboratory using a rack of sieves as described in Kenward *et al* (1980). The fine fraction (<500 microns) was not totally sorted, but only scanned under the microscope. It commonly contained abundant *Juncus* seeds and rare seeds of *Papaver, Typha, Arenaria, Hypericum* and small-seeded (often under-developed) *Chenopodium*. These, and possibly some other small-seeded taxa, are therefore under-estimated (consistently) throughout. It was considered that to sort completely this fine fraction would have added greatly to the time spent without adding significant information.

The flots and residues from bulk-sieving were dried prior to sorting. No attempt was made to extract plant remains smaller than 2mm: the flots and residues were graded in a 2mm mesh sieve prior to sorting and only the coarse fraction was examined. The fine fraction has, however, been retained for possible future study.

Plant macrofossils recovered are listed in Table 3.11. Nomenclature follows Clapham, Tutin and Warburg (1962) and all identifications were confirmed by comparison with modern reference material.

### 3.3.1 Fruits, Seeds, Leaves, Stems, etc

The taxa identified, grouped into cultivated plants and ecological groups of wild taxa, are listed in Table 2.11.

## Cultivated and Utilised Wild Plants

The cultivated plants identified have all been reported from comparable contexts at waterfront sites at Norwich (Ayers and Murphy 1983; Murphy, in Ayers 1988) with the exception of *Triticum turgidum/durum*. At Bridge Street short charred rachis sections of this crop came from bulk samples of 13th century contexts (174, 176: Fig 3.18). It was not recorded from earlier contexts at this site or elsewhere in Ipswich. Similarly, at IAS 6202, grape, medlar and walnut were absent in pre-13th century samples. Apart from this, the cultivated and edible wild species identified occurred in contexts dating from the Middle Saxon period onwards.

Interpreting the assemblages in terms of activities on site presents considerable problems, for the taphonomy of the deposits is thought to have been complex, involving intentional refuse dumping, deposition of fluvial sediments and re-working of deposits. Concentrations of charred cereal remains in bulk samples from 13th century deposits, of fruitstones and seeds in 11th/12th century deposits and of *Cannabis* fruits in 12th/13th century deposits, are clear (Fig 3.19). These may have resulted from variation in the types of refuse dumping along the waterfronts, but cannot be related to any specific activities with the possible exception of the 13th century deposits. Higher concentrations of charred cereals and a deposit of rye chaff and straw with weeds (162: discussed below) may point to cereal processing in the area at this time. Other types of macrofossils from utilised or probably utilised plants (charred cereal rachis fragments, culm fragments, pulse seeds, seeds of *Linum* and *Humulus* fruits) showed no marked variations in abundance through time.

## Wild Plants

-

Fruits and seeds of wild plants from these samples may be divided into six main categories: aquatics, wetland and grassland plants (reedswamp, marsh, wet-dry grassland and carr species), halophytes, heath plants, segetals (crop weeds), ruderals (disturbed ground species) and scrub or woodland plants. The ruderals and segetals are numerically the most important component of the assemblages, but the remaining species provide some information on the vegetation of the surrounding area. No attempt has been made to reconstruct in detail the types of plant association represented (cf Van Zeist 1974), since the assemblages are clearly very mixed and contain a substantial allochthonous element – seeds derived from a variety of sources by both natural and anthropogenic processes.

Remains of aquatic plants are rare in samples from this site: only four taxa have been identified (*Ranunculus* subgenus *Batrachium, Alisma plantago-aquatia, Ruppia* sp and *Zannichellia palustris*). *Ruppia* and *Zannichelia* are particularly characteristic of brackish water where there is little current, and commonly occur in drainage ditches on reclaimed land (Van Zeist 1974, 339; Petch and Swann 1968, 225). *Alisma*, however, is typically a freshwater aquatic (Petch and Swann 1968, 221).

Wetland and grassland plants, indicating the proximity of a range of habitats from shallow water littoral conditions and reedswamp to marsh, fen and grasslands are better represented. The most abundant and consistently present wetland taxa are *Eleocharis* sp and *Carex* sp, but a wide range of herbs has also been identified. Fruits of *Typha* and *Phragmites* cum nodes are relatively rare, and reedswamp may not have been present locally. Fruits of alder *(Alnus* sp) were present in Mid-Late Saxon contexts. The common liane of alder carr, the hop (*Humulus lupulus*), occurred only at low frequencies throughout the sequence.

<u>Cultivated Plants/Edible Wild Species</u> (c – carbonised)

*Triticum aestivum* (c: bread wheat), *Triticum turgidum/durum* (c: rivet/durum wheat), *Hordeum* sp (c: barley), *Secale cereale* (c: rye), *Avena sativa* (c: oats), *Vicia faba* var *minor* (c: horsebean), *Pisum sativum* (c: pea), *Corylus avellana* (hazel), *Juglans regia* (walnut), *Prunus domestica s l* (plum/bullace etc), *Prunus spinosa* (sloe), *Prunus avium*-type (cherry), *Crataegus monogyna* (haw), *Fragaria vesca* (strawberry), *Rubus fruticosus* (blackberry), *Rubus idaeus* (raspberry), *Malus sylvestris* (apple), *Mespilus germanica* (medlar), *Sambucus nigra* (elderberry), *Vitis vinifera* (grape), *Apium graveolens* (wild celery), *Daucus carota* (wild carrot), *Anethum graveolens* (dill), *Humulus lupulus* (hop), *Papaver somniferum* (opium poppy), *Cannabis sativa* (hemp), *Linum usitatissimum* (flax).

<u>Aquatics</u>

*R* subg *Batrachium, Alisma, plantago-aquatica, Rorippa* sp. *Zannichellia palustris.*

<u>Wetland and Grassland Plants</u> (reedswamp, marsh carr, wet-dry grassland)

*Ranunculus acris/ repens/bulbosus, R flammula, R sceleratus, Thalictrum flavum, Hypericum* sp, *Lychnis flos-cuculi, Stellaria graminea, Linum catharticum*, *Filipendula ulmaria, Agrimonia* cf *eupatoria, Epilobium hirsutum*-type, *Oenanthe fistulosa, Polygonum hydropiper, Pedicularis palustris, Lycocpus europacus, Prunella vulgaris, Plantago major, P lanceolata, Eupatorium cannabinum, Leontodon* sp, *Juncus* spp, *Typha* sp, *Eleocharis* sp, *Scirpus/Schoenoplectus* sp, *Isolepis setaceus, Carex* sp, *Phragmites australis.*

<u>Halophytes/Coastal Plants</u>

*Spergularia* sp, *Suaeda maritima, Apium graveolens, Daucus carota, Rumex maritimus, Triglochin maritima.*

<u>Heathland Plants</u>

*Pteridium aquilinum, Calluna vulgaris.*

<u>Weeds</u> (segetals and ruderals)

*Papaver rhoeas, P argemone, Brassica* sp, *Raphanus raphanistrum, Thlaspi arvense, Reseda luteola, Silene alba, Agrostemma githago, Stellaria media*-type, *Arenaria serpyllifolia, Spergula arvensis, Scleranthus* cf *annuus, Montia fontana* ssp *chondrosperma, Chenopodium album, C rubrum/glaucum, C ficifolium, C* cf *murale, C hybridum, Atriplex patula/hastata, Malva sylvestris-*

type, *Potentilla* cf *reptans, Aphanes arvensis/microcarpa, Conium maculatum, Aethusa cynapium, Euphorbia helioscopia, Polygonum aviculare, P* cf *lapathifolium, P convolvulus, Rumex acetosella, Rumex* sp, *Urtica urens, Urtica dioica, Anagallis arvensis*-type, *Hyoscyamus niger, Solanum nigrum, Ballota nigra, Galeopsis tetrahit/speciosa, Anthemis cotula, Chrysanthemum segetum, Arctium* sp, *Onopordum acanthium, Centaurea cyanus, Lapsana communis, Sonchus arvensis, S oleraceus, S asper.*

<u>Shrubs and Trees</u>

*Ilex aquifolium, Rubus idaeus, R fruticosus, Prunus spinosa, P domestica s l, P* cf *avium, Malus sylvestris, Humulus lupulus, Alnus glutinosa, Corylus avellana, Sambucus nigra.*

<u>Undetermined/Unassigned</u>

Cruciferae indet, *Silene* cf *maritima*, Caryophyllaceae indet, Chenopodiaceae indet, Leguminosae indet, *Potentilla* sp, *Torilis* sp, cf *Oenanthe* sp, Umbelliferae indet, *Polygonum* sp, Polygonaceae indet, *Euphrasia/Odontites* sp, *Mentha arvensis/*aquatica, *Stachys* sp, *Lamium* cf *amplexicaule*, *Teucrium* sp, Labiatae indet, cf *Valerianella* sp, *Cirsium* sp, *Carduus* sp, *Centaurea* sp, Compositae indet, Cyperaceae indet, Gramineae indet.

**Table 3.11: Cultivated/Utilised Plants and Ecological Groups of Wild Taxa from Middle Saxon to 13th Century Deposits at IAS 6202**

Seeds of a number of halophytes were identified. *Apium graveolens* is the commonest. In East Anglia today wild celery occurs in marshes near the sea and in ditches in reclaimed land (Petch and Swann 1968, 161). Also present, at lower frequencies, were fruits and seeds of *Suaeda maritima* (herbaceous seablite), *Daucus carota* (wild carrot) and *Triglochin maritima* (sea arrow-grass). *Triglochin* and *Suaeda* are both salt-marsh species and *Daucus* commonly occurs in turf on sea-banks. *Suaeda* is common only in one 11th/early 12th century sample (250); apart from this it is represented, as are *Triglochin* and *Daucus*, by only small numbers of seeds.

Its seems probable that most of the scanty remains of heathland plants represent material brought to the site for use as thatch or litter. Remains of heath (*Calluna vulgaris*) were not observed in pre-13th century samples in 162 and 226 capsules, seeds and shoots with imbricate leaves were present. Pinnules of bracken (*Pteridium aquilinum)* were more widely distributed, but in no samples were they at all abundant. A further species probably derived from dry acid grassland or heath is *Arenaria sepyllifolia.*

Some of the segetals identified have affinities for dry sandy soils, (e.g. *Spergula arvensis, Scleranthus* cf *annuus*), but the majority show no particular soil requirements other than their adaption to disturbed conditions. Indeed, many weed species identified at Bridge Street could have grown equally well as segetals in local arable fields or as ruderals in the immediate vicinity of the site. A 13th century deposit (162) consisted largely of crop cleaning waste: straw fragments of cereal rachis and seeds of segetals apparently with litte admixture of plant remains from other sources. The uncharred rachis nodes from this deposit appear to be all of rye (*Secale cereale*). Seeds of weeds associated with this rye crop were identified as follows:

| | **Nos** | **% of weeds** |
|---|---|---|
| *Papaver rhoeas* (poppy) | 1 | 0.50 |
| *Papaver argemone* (prickly-headed poppy) | 2 | 1.0 |
| *Raphanus raphanistrum* (wild radish) | 1 | 0.5 |
| *Brassica* sp (cabbage-type) | 4 | 2.1 |
| *Agrostemma githago* (corn-cockle) | 1 | 0.5 |
| *Spergula arvensis* (corn-spurrey) | 4 | 2.1 |
| *Chenopodium album* (fat-hen) | 21 | 11.0 |
| *Chenopodium rubrum/glaucum* (goosefoot) | 1 | 0.5 |
| *Atriplex* sp (orache) | 5 | 2.6 |
| Chenopodiaceae indet | 7 | 3.7 |
| *Polygonum convolvulus* (black bindweed) | 1 | 0.5 |
| *Polygonum* cf *lapathifolium* (pale persicaria) | 4 | 2.1 |
| *Polygonum aviculare* (knotgrass) | 1 | 0.5 |
| *Rumex* sp (dock) | 12 | 6.3 |
| *Urtica urens* (small nettle) | 23 | 12.0 |
| *Solanum nigrum* (black nightshade) | 6 | 3.1 |
| *Galeopsis tetrahit/speciosa* (hemp-nettle) | 1 | 0.5 |
| *Anthemis cotula* (stinking mayweed) | 85 | 44.5 |
| *Chrysanthemum segetum* (corn marigold) | 7 | 3.7 |
| *Centaurea cyanus* (cornflower) | 3 | 1.6 |
| *Sonchus arvensis* (field milk thistle) | 1 | 0.5 |
| | **191** | |

***Table 3.12 - 162 Weeds Associated with Waterlogged Remains of Rye***

The range of species present is quite characteristic of medieval cereal crops, but the abundance of *Anthemis cotula* is particularly notable. *A cotula* is common in several other samples from the site and indeed was absent from only two of the fourteen samples examined in the laboratory. Nowadays, it is more frequent on heavy clay soils in East Anglia (Petch and Swann 1968, 210). Its association here with segetals more characteristic of sandy acid soils (e.g. *Chrysanthemum segetum, Spergula arvensis*) might suggest that it was formerly a prevalent weed on the sandy soils of the Ipswich area, though importation of cereals from an area of clay soils could well have occurred (see above, 3.1.2).

The predominant element in most seed assemblages from the site is of seeds from ruderal herbs, *characteric* of nutrient-rich disturbed conditions. Most abundant are the Chenopodiaceae (*Chenopodium album, C rubrum/glaucum, C ficifolium, C murale, C hybridum, Atriplex patula/hastata), Urtica dioica, Urtica urens, Solanum nigrum* and *Rumex* spp (excluding *maritimus* and *acetosella*). Seeds of such species are normally abundant in urban archaeological deposits.

The final group of plants distinguished here consists of shrubs and trees. Species identified from macrofossils other than wood are *Ilex aquifolium* (holly), *Rubus idaeus* (raspberry), *Rubus fruticosus* (bramble), *Prunus spinosa* (sloe), *Malus sylvestris* (apple), *Alnus glutinosa* (alder) and *Corylus avellana* (hazel). Some of these may not have been present locally: the fruitstones, nuts and seeds from these deposits may merely represent food-refuse or specimens brought to the site by natural processes. In some cases, however, macrofossils other than fruitstones are also present (e.g. holly leaves) and it seems probable that here trees and bushes were present at the site itself.

## Assemblage Composition

Fourteen 1-2kg samples were anlaysed, dating from the Middle Saxon period to the 13th century. In terms of gross composition the assemblages were all very similar. The composition of three typical assemblages is shown in Fig 3.20. Weeds (ruderals and segetals) were always predominant, relating to locally disturbed and nutrient rich soils or (in the case of 162) to deposition of crop-processing waste. Wetland and grassland plants typically occurred at moderate frequencies but other ecological groups were generally sparsely represented. It is quite clear from this that the samples provide information on the immediate area of the waterfront, but are of no value for the reconstruction of any wider habitat changes.

3.3.3 Mosses

Mosses from the samples were examined by Dr Robin Stevenson. The list of taxa identified is given in Table 3.13.

| | |
|---|---|
| *Amblystegium serpens* | *Hypnum cupressiforme* |
| *Amblystegium varium?* | *Neckera complanata* |
| *Antitrichia curtipendula* | *Plagiomnium sp* |
| *Brachythecium rutabulum* | *Pleurozium schreberi* |
| *Brachythecium velutinum* | *Polytrichum sp* |
| *Calliergon cuspidatum* | *Polytrichum juniperinum or* |
| *Campylopus pyriformis* | *Polytrichum piliferum* |
| *Dicranum scoparium* | *Pseudoscleropodium purum* |
| *Drepanoclados aduncus* | *Rhizomnium punctatum* |
| *Eurhynchium praelongum* | *Rhynchostegiella tenella?* |
| *Eurhynchium striatum?* | *Rhytidiadelphus squarrosus* |
| *Eurhynchium swartzii* | *Thamnobryum alopecurum* |
| *Homalothecium sericeum* | *Thuidium tamariscinum* |
| *Hylocomium splendens* | *Ulota sp* |

**TABLE 3.13: IAS 6202 MOSSES**

Stevenson (1986) divided the assemblages into three groups:

a. Assemblages consistent with wooded habitat.

b. Assemblages consistent with more open grass or heathland habitats.

c. Assemblages not assigned to any definite habitat.

He found that ‘woodland’ assemblages predominated in Middle and Late Saxon deposits, but in later contexts ‘heathland’ assemblages were more abundant, and interpreted this in terms of progressive deforestation. However, in view of the complex taphonomy of the deposits other interpretations are equally possible. The change in the bryoflora matches the shift from the use of roundwood with bark in the waterfront structures to a predominance of timber structures (see below 4.2). Clearly importation of roundwood could have resulted in accidental importation of woodland mosses, particularly epiphytes. Assemblage composition could therefore be more closely related to local human activity than to any wider habitat change.

3.3.4 Insects by Dr H Kenward

Introduction

Three samples from Bridge Street, Ipswich (IAS 6202) wre submitted for examination. Two of these gave modest assemblages of insects, but sample 3 contained only small numbers of fossils.

A list of the insect species recorded is given in Table 3.14

Methods

Insects were extracted using standard methods (Kenward *et al* 1980). The data from the insect assemblages have been computer-recorded and processed using a system (written in PASCAL by HK) which produces ordered lists and statistics of value in interpretation. These are stored in hard copy in archive at the Environmental Archaeolgy Unit, University of York (EAU) , at the Ancient Monuments Laboratory of the Historic Buildings and Monuments Commission, and a copy has also been submitted to the excavators. Original lists are retained in computer hard disk store and can be reprocessed at any time. Species lists and main statistics are also stored in the EAU database system. The insect material is currently stored at the EAU.

<u>Sample 1</u> (Context 162)

This sample, from a thirteenth century organic refuse deposit, included uncharred fragments of rye. It did not, however, yield any insects associated especially with stored cereals.

The 1 kg sample for which insects were counted in detail gave a minimum number of individuals of Coleoptera and Hemiptera of 123; 55 species were recorded. Many remains were highly fragmented – hence the large number of identifications to taxa above species level. Species associated with with decaying matter made up a substantial part (67%) of the fauna. Much the most abundant species was *Cercyon littoralis* (29 individuals, 24% of the assemblage). This species is found in decaying seaweed along the strandline but doubtless it would invade rubbish deposited by human beings in the same situation. The second most abundant species, *Ptenidium punctatum* occurs in similar habitats. The low diversity of the decomposer component implies a breeding community and these two species probably bred in the layer as it formed. The remaining species were mainly among those which are of frequent occurrence in insect assemblage from 9th-13th century occupation sites (for example Durham (Kenward 1979a), York (Kenward 1984-5 and Hall *et al* 1983) , and Oslo (Kenward 1979b and forthcoming). Their numbers, singly or as a group, were too small to any firm conclusions as to their origins, but they may have been a mixture of colonisers of the rotting matter exploited by the most abundant species (many of the species are recorded from wrack by Backlund (1945) and "background" fauna of mixed origin. Three records are of note: *Apion fuscirostre* develops in the pods of broom (*Sarothamnus* (= *Cytisus*) *scoparius*), while *Bradycellus ruficollis* and *Ulopa ?reticulata* are both associated with heathland, especially with heat (*Calluna vulgaris*). The sample also included a considerable number (over 20) of scale insects (Coccoidea). Many of those which were in reasonably good condition appeared to be adult females of *?Lepidosaphes pomorum* by reference to figures in Newstead (1900). According to the same source this scale has a variety of hosts, incidentally including *Calluna* and *Sarothamnus.*

<u>Sample 2</u> (Context 399)

This material was collected from a layer identified by the excavators as a Late Saxon refuse deposit, dumped on the bank of the River Orwell. A 0.4kg subsample has been examined in detail.

A minimum of 79 individuals including 52 species were recorded. Many taxa were represented only by single sclerites, or small fragments of sclerite, and so could not be closely identified. No insects were particularly numerous; there were six individuals of *Anotylus nitidulus*, the species at Rank 1. *Phloeophthorus rhododactylus*, at Rank 2 (4 individuals), bores under the bark of broom (*Sarothamnus*) and its relatives.

Corixidae sp ("water boatmen"), also at Rank 2, are aquatic Aquatics were rather abundant in this assemblage, making up 10% of species and individuals. Apart from this and the strong representation of taxa from other "natural" habitats, the assemblage had no strong character and may have been mostly background fauna, or deposited by floodwater. A second subsample of this material was processed and sorted, but not recorded in detail. It gave an assemblage of very similar character to the present one, with a few additional species, including *Daphnia* (water fleas) ephippia.

Sample 3 (Context 447)

This Middle Saxon deposit from a former foreshore on the River Orwell consisted primarily of river gravel, but included an organic component. A total of 1.95kg of material was processed, but rather few insects were recovered. Twenty four beetle and bug taxa were noted, none certainly represented by more than one individual. Species from freshwater and other semi-natural habitats formed a substantial part of the assemblage. One species *Oulimnius tuberculatus* lives in clear flowing water, but of course the single specimen may have been carried over some distance.

Acknowledgements

I am grateful to Lesley Morgan for preparing the material, and to Enid Allison for assistance in producing this report.

**Table 3.14 IAS 6202: List of Insects**

Nomenclature follows: Kloet and Hincks (1964 and 1977)
Hemiptera:
*Scolopostethus* sp
Lygaeidae spp
*?Salda littoralis* (Linnaeus)
*Saldula* sp
*Corixidae* sp
*Ulopa ?reticulata* (Fabricius)
*?Lepidosaphes pomorum* (Bouche)

Coleoptera:
*?Pterostichus* sp
*Agonum* sp
*Bradycellus ruficollis* (Stephens)
Carabidae spp
*Helophorus* sp
*Cercyon analis* (Paykull)
*Cercyon haemorrhoidalis* (Fabricius)
*Cercyon littoralis* (*Gyllenhal*)
*Cercyon lugubris* (Olivier)
*Cercyon* sp
*Megasternum obscurum* (Marsham)
*Cryptopleurum minutum* (Fabricius)
Hydrophilinae sp

*Acritus nigricornis* (Hoffman)
Histerinae sp
*Ochthebius* sp
*Hydraena* sp
*Ptenidium punctatum* (Gyllenhal)
*Ptenidium* sp
*Acrotrichis* sp
*Micropeplus fulvus* Erichson
*Dropephylla* sp
*Omalium* sp
*Xylodromus ?concinnus* (Marsham)
Omaliinae sp
*Carpelimus ?bilineatus* Stephens
*Carpelimus* sp
*Platystethus ?nitens* (Sahlberg)
*Platystethus arenarius* (Fourcroy)
*Platystethus cornutus* group
*Platystethus nitens* (Sahlberg)
*Anotylus complanatus* (Erichson)
*Anotylus nitidulus* (Gravenhorst)
*Anotylus sculpturatus* group
*Oxytelus sculptus* Gravenhorst
*Stenus* spp
*Gryohypnus fracticornis* (Müller)
*?Philonthus* sp
Staphylininae sp
*Cordalia obscura* (Gravenhorst)
*Falagria caesa* Erichson or *sulcatula* (Gravenhorst)
*Falagria* sp
Aleocharinae spp
*Trox scaber*
*Aphodius granarius* (Linnaeus)
*Aphodius* spp
*Oxyomus sylvestris* (Scopoli)
Melolonthinae sp
*?Phyllopertha horticola* (Linnaeus)
*Clambus* sp
*Oulimnius tuberculatus* (Müller)
Elateridae sp
*Anobium punctatum* (Degeer)
*Ptilinus pectinicornis* (Linnaeus)
*Ptinus* sp
*Omosita colon* (Linnaeus)
*Cryptophagus ?scutellatus* Newman
*Cryptophagus* sp
*Atomaria ?nigripennis* (Kugelann)
*Atomaria* sp
*Mycetaea hirta* (Marsham)
*Lathridius minutus* group
*Corticaria* spp
*Corticarina* or *Cortinicara* sp
*Anthicus* sp

*?Gracilia minuta* (Fabricius)
Cerambycidae sp
Bruchinae sp
*Phyllotreta* sp
*?Longitarsus* sp
*Chaetocnema* sp
Halticinae spp
*Cassida* sp
*Apion fuscirostre* (Fabricius)
*Apion* sp
*Ceutorhynchus* sp
Ceuthorhynchinae sp
Curculionidae sp
*Phloeophthorus rhodadactylus* (Marsham)

### 3.3.5 Mollusca and other Invertebrates

Sampling and retrieval methods employed at Bridge Street have been described above. Remains of invertebrates, including foraminifers, molluscs, ostracods, cladocerans, barnacles, crabs and echinoderms were retrieved and identified.

a) Foraminifera

Occasional foraminifers were noted whilst samples taken primarily for analysis of plant macrofossils and small molluscs were being sorted. It was clear that specimens occurred only at low concentrations and systematic extraction was therefore not attempted. However a representative selection of specimens larger than 0.25mm was retained. Identifications by Professor Brian Funnell are given in Table 3.15.

b) Mollusca

Small shells and fragments, together with a few large shells, were extracted from the mineral fractions of the laboratory samples after wet-sieving in a 0.5mm mesh (Table 3.13). A few shells were also present in the organic fractions. Larger shells and fragments were recovered by bulk-sieving but only material larger than 2mm has been examined. Mollusca were identified with reference to Kerney and Cameron (1979), Macan (1969), McMillan (1968) and Tebble (1966), and identifications were confirmed by comparison with modern reference specimens.

The shells recovered are very variable in their state of preservation. Some are extremely abraded and fragmentary but some valves of *Nucula*, *Musculus* and *Mytilus* retain their periostraca, and articulated valves of *Musculus* came from context 446. Abraded and polished iron-stained shell fragments, probably derived from Pleistocene Crag deposits were present in 447, 257 and 250.

| Mollusca | Foraminifera |
|---|---|
| *Littorina littoriea* (L) | *Ammonia beccarii* (Linnaeus) |
| *Littorina saxatilis* (Olivi) | *Elphidium macellum* (Fitchtel and Moll) |
| *Littorina littorialis* (L) | *Jadammina macrescens* (Brady) |
| *Littorina* sp | *Massilina secans* (d'Orbigny) |
| *Hydrobia ventrosa* (Montagu) | *Protelphidium germanicum* (Ehrenburg) |
| *Hydrobia ulvae* (Pennant) | |
| cf *Pseudamnicola confusa* (Frauenfeld) | *Quinqueloculina dimidiata* Terquem? |
| *Bithynia tentaculata* (L) | *Quinqueloculina lata* Terquem |
| *Bithynia* sp | *Quinqueloculina seminulum* (Linnaeus) |
| *Bithynia* sp (opercula) | *Quinqueloculina* sp |
| *Rissoa* sp | *Trochammina inflata* (Montagu) |
| *Buccinum undatum* L | |
| *Nassarius reticulatus* (L) var *nitida* | Others |
| *Retusa* sp | Bryozoa (On *Ostrea* frags) |
| *Phytia myosotis* (Draparnaud) | Cladocera (ephippia) |
| *Lymnaea truncatula* (Müller) | Ostracoda (carapaces) |
| *Lymnaea* sp | Cirripedia (*Balanus* frags) |
| *Bathyomphalus contortus* (L) | Decapoda (carapace frags) |
| *Anisus leucostoma* Millet | (chela frags) |
| *Vertigo antivertigo* (Draparnaud) | Frags of caddis-fly larval cases |
| *Discus rotundatus* (Müller) | Echinoid radiole (?derived fossil) |
| *Trichia hispida* (L) | *Echinocyamus pusillus* (test) |
| *Helix aspersa* (Müller) | |
| Helicid (aperture fragment) | |
| Indet gastropod whorl frags (cf Calliostoma) | |
| Indet gastropod | |
| *Nucula* sp | |
| Mytilus edulis L | |
| Mollusca | |
| *Ostrea edulis* L | |
| *Chlamys* sp | |
| *Cerastoderma* sp | |
| *Pisidium* sp | |
| Indeterminate bivalve | |
| Abraded frags of Crag mollusca | |

**Table 3.15: IAS 6202 Systematic List of Molluscs and other Invertebrates from Samples Examined in the Laboratory**

The Local Molluscan Fauna

The deposits at the site include a mixture of species from aquatic habitats of varying salinity and from marsh and terrestrial habitats. The large shells of edible species were clearly imported to the site for consumption and consequently provide no information on local habitats. Discounting these edible molluscs, intertidal species predominate in the majority of samples. At least three species of *Littorina* are present, representing habitats from the splash zone to the low intertidal zone of fucoid seaweeds (Yonge 1949, 122-125). *Hydrobia* spp are also common, particularly in the later deposits. Other intertidal and shallow sublittoral gastropods include *Rissoa* sp, *Nassarius reticulatus*, *Retusa* sp and *Phytia myosotis*. Small marine bivalves include both infaunal species (*Nucula*, *Cerastoderma*) and epifaunal molluscs (*Musculus*). Valves and fragments of *Musculus* and *Nucula* were recovered only form the basal, largely inorganic, sandy and silty deposits in columns 406 and 262 (447, 446, 257). From their lithology and biological remains these appear to be shore deposits incorporating some dumped refuse.

Freshwater molluscs (*Bithynia* spp *Lymnaea* sp, *Bathyomphalus contortus*, *Anisus leucostoma* and *Pisidium* sp) are generally rare. Only in 447 are freshwater taxa at all common, and only a few dense elements of a freshwater fauna (calcified opercula) of *Bithynia* and *Pisidium* valves) have become incorporated into this deposit. Marsh species (*Lymnaea truncatula*, *Vertigo antivertigo*) occur sporadically; these presumably colonised damp ground and impersistent pools and puddles along the shore above the splash zone. Exclusively terrestrial snails are also present and include the synanthropic species *Helix aspersa* with a few specimens of *Discus rotundatus* and *Trichia hispida*,

The molluscs from these smaller samples thus gives some indication of the range of habitats present in the vicinity, but detailed reconstruction of habitat change is precluded both by the small size of the assemblages and by the fact that a substantial allochthonous element is undoubtedly present.

Shellfish Consumption

The two principle bivalve shellfish are oysters (*Ostrea edulis*) and mussels *(Mytilus edulis*). There are some fluctuations in the relative abundance of these species, but it is not clear whether these are of any significance. Whelks (*Buccinum undatum*) are rare in pre-11th century deposits, but common thereafter. This may reflect increasing exploitation of offshore shellfish grounds; the whelk is a sublittoral species and is nowadays caught using baited pots shot from small vessels offshore. Shells of the two remaining intertidal species, the cockle *(Cerastoderma edule*) and the edible winkle (*Littorina littorea*) were rare in deposits of all site phases and do not appear to have been of great economic importance at any period.

Large shells of some other mollusca were also recovered by bulk sieving and it is possible that some of these (e.g. *Chlamys* sp, *Nucella lapillus*) may have been consumed. If so, such species were of only minor importance.

c) Crustacea and Echinoderms

Besides the aquatic inveterate groups discussed above, samples examined in the laboratory produced remains of some other invertebrates, principally crustaceans. Most have not been specifically identified, but taxa present are listed in Table 3.15. In column 406 the distribution of microscopic crustacea appears to be related to conditions of deposition. Ostracod carapaces, frequently articulated, were particularly common in the lower deposits, which include a high proportion of fluvial sands and silts. Ephippia of Cladocera, however, were not observed in these deposits, but were abundant in the upper deposits of the column, formed apparently in conditions where periodic drying occurred. Fragments of *Balanus* plates were present in most samples, and these presumably reached the site attached to mollusc shells, sea-weeds, drift-wood etc.

Exoskeleton fragments from decapod crustaceans were recovered from samples of three contexts examined in the laboratory (250, 257, 402) and further fragments were extracted from other contexts by bulk-sieving. No exoskeleton fragments were observed in pre-Late Saxon deposits. Most of the fragments are of chelvae from chelipeds but carapace and other limb fragments are also present. From their size and surface patterning almost all of the fragments are thought to be from small specimens of the shore crab *Carcinus maenas*. Cast exoskeletons of this crab are a familiar constituent of strand-lines. A large robust fragment of a dactylus from a cheliped, extracted from the 17th century well-fill, 164, is probably of the edible crab *Cancer pagurus* and is the only specimen suggesting a crab fishery.

Echinoids are represented by a single spine from 257 and by an intact test of *Echinocyamus pusillus* recovered by bulk-sieving from 176, a thirteenth century context. The former is iron-stained, and may perhaps be derived Crag fossil, but the latter shows no staining and is quite unabraded. *E pusillus* is common on British coasts on coarse sandy or gravelly bottoms in shallow depths (Mortensen 1977, 316).

### 3.3.6 General Conclusions

The deposits at this site produced extremely diverse assemblages of plant remains and invertebrates but this very diversity, a result of complicated taphonomic processes, has made interpretation difficult. All of the deposits sampled included components from local vegetation, dumped food wastes and strand-line detritus incorporating macrofossils derived from a variety of terrestrial, freshwater and estuarine habitats. It seems doubtful whether further extensive sampling of such deposits can be justified, though the present study serves as a useful 'base-line' for the future investigation of autochthonous waterfront deposits relating more directly to specific activities.

## 4. **Wood Utilisation: Structural Wood and Fuel**

### 4.1 Introduction

The development of the Middle Saxon town, which grew to cover about 50ha, would have resulted in an enormous demand for structural wood and fuel, a demand which continued and increased in later periods. Besides domestic needs, the Ipswich ware pottery industry had its own, substantial, energy requirements. Wood was also required for the production of containers (barrels, basketry etc) and other portable artefacts. Initially, it is assumed, wood requirements would have been met from local sources and an infrastructure supplying wood, timber and charcoal must have developed. There are grounds for thinking though, that some wood was imported over considerable distances.

Direct information about wood supplies has come from several sites. Waterfront structures preserved in the wet sediments at Bridge Street (IAS 6202) dated from the Middle Saxon period to the 14th/15th century. Timber-lined Saxon wells produced well-preserved wood. Structural timber was preserved by charring in the 11th century cellars at sites IAS 3104 and 4601, and these features also included some smaller charred wooden objects. Charcoals were identified from one Ipswich ware kiln at site IAS 3104.

### 4.2 Waterfront Structures at IAS 6202

### 4.2.1 Introduction

The earliest structures on the Middle Saxon waterfront were of simple post and wattle construction. They were comparatively insubstantial and seem to have been intended just to protect the bank from erosion and to provide a hard-standing for the off-loading of boats. Later, more substantial structures of timber were built.
Large quantities of wood and timber were recovered during excavation, both *in situ* as components of revetments and other structures, and also as isolated pieces from dismantled or collapsed revetments. Sections were cut from the principal pieces of wood and these were retained for examination. The wood was initially sorted into oak and non-oak, the oak wood suitable for dendrochronology was separated. Of the

remaining material only wood from well-defined structures has been identified. The structures will be discussed in turn, before considering some aspects of the overall significance of the wood from the site.

### 4.2.2 The Structures

1) Mid-Late Saxon Structures (404, 386, 448, 405/429) (Plate 4.1)

Characteristics of the wood from these structures are summarised in Table 4.1. The most obvious feature is the absence of large timber and the extensive use of untrimmed roundwood stakes, posts and horizontals. In order of abundance this untrimmed wood comprises hazel, oak, holly, ash, birch, alder, sloe(?) and elm. Centrally split posts of hazel and sloe(?) were also used. The only squared pieces are of oak (0386, 0420) and birch (0404, 0434), and these are not cut from large timber.

2) Late Saxon Structures (258/275. 384. 500, 553, 557, 602, 603, 604, 605)

Compared to the Mid-Late Saxon revetments, the Late Saxon structures show a markedly increased use of squared beams, planks and posts, mainly of oak and ash (Table 4.2). Some of these are cut from more substantial stems, up to about 30cm in diameter. Untrimmed wood cut from stems less than 10cm in diameter continued to form a substantial component of the revetments and this consists, in order of abundance, of hazel, ash, oak, hawthorn-group, alder, birch, holly, willow and sloe(?).

3) 254 – 11th/early12th Century Revetment

This revetment consisted of mainly large thick vertically-set planks. The three samples examined were of oak, made of radial sections from large timber (256, 268, 269). In addition several vertical and slanting posts were sampled. 348 was a segment of oak, 343 a trimmed post of oak and 346 an untrimmed post of birch (*Betula* sp).

4) 0566 - ?12th Century Waterfront Structure

This partly collapsed structure was entirely constructed of oak (*Quercus* sp). Most of the wood consisted of squared oak beams and possible posts cut from large wood, but there are also a few untrimmed posts which were found vertically *in situ* (0569, 0570).

5) 204 – 12th/13th Century Waterfront Structure

204 comprised a horizontal beam of oak (*Quercus* sp), centrally split from a timber of about 18cm diameter, associated with three untrimmed ash (*Fraxinus* sp) stakes about 6cm in diameter (206, 207, 209), and a further split beam of oak (208) from a timber of about 15cm diameter.

**Table 4.1: IAS 6202 Wood Identified from Mid-Late Saxon Structures**

Fragmentary samples whose dimensions could not be determined are omitted. Sizes refer to the original stem from which the wood recovered on site had been cut. Taxa are listed in order of abundance.

| | Round (or part-trimmed) stakes | | | Squared & split beams, posts, etc | |
|---|---|---|---|---|---|
| | >10cm | <10cm | | >10cm | <10cm |
| *Corylus* sp (hazel) | 1 | 10 | | - | 1 |
| *Quercus* sp (oak) | 4 | 6 | | 1 | 0 |
| *Ilex* sp (holly) | - | 5 | | - | - |
| *Fraximus* sp (ash) | 1 | 3 | | - | - |
| *Betula* sp (birch) | - | 3 | | - | - |
| *Alnus* sp (alder) | - | 1 | | - | - |
| *Prunus* sp (sloe etc) | - | 1 | | 1 | - |
| *Ulmus* sp (elm) | - | 1 | | - | - |
| Other diffuse porous | - | 2 | | - | - |

**Table 4.2: IAS 6202 Wood Identified from Late Saxon Structures**

This table includes a total of 107 samples (some were deleted since they were very fragmentary or consisted only of bark). Sizes refer to the diameter of the original stem from which the wood recovered on site had been cut. Taxa are listed in order of abundance.

| | Round (or part-trimmed) stakes | | Squared & split beams, posts, etc | |
|---|---|---|---|---|
| | >10cm | <10cm | >10cm | <10cm |
| *Quercus* sp (oak) | 2 | 11 | 12 | 3 |
| *Fraximus* sp (ash) | 2 | 12 | 3 | - |
| *Corylus* sp (hazel) | - | 13 | 1 | 1 |
| *Alnus* sp (alder) | - | 5 | 1 | 2 |
| *Crataegus*-group (hawthorn group) | - | 7 | - | - |
| *Betula* sp (birch) | 1 | 4 | - | - |
| *Ilex* sp (holly) | - | 4 | - | - |
| *Salix* sp (willow/sallow) | 1 | 2 | - | - |
| *Prunus* sp (sloe etc) | 1 | 1 | - | - |
| *Popular* sp (popular) | - | - | 1 | - |
| Indet diffuse porous | 1 | 16 | - | 1 |

6) <u>499 – 12th/13th Century Waterfront Structure</u>

The timbers sampled from this structure comprised an untrimmed oak (*Quercus* sp) post, about 21cm in diameter (341); an untrimmed post of ash (*Fraxinus* sp), 9.5cm in diameter (342); and two roughly-squared posts of oak, 201 and 340. 201 was crudely trimmed to a point.

7) <u>175 – Collapsed 13th Century Quay</u> (dendrochronological date 1197-1232 AD; Hillam (1985))

This structure (Plate 4.2) consisted mainly of slanting remnants of planks. Samples of nos 178-189, 193, 194, 196, 229-239 and 242-245 were taken. These are all of oak (*Quercus* sp) and had all been converted radially from large timbers. They vary in size from about 4.5 x 1cm to 21 x 3cm. A few show a wedge-shaped cross-sections but the majority have been trimmed to a more rectangular shape. These planks had been pegged to a horizontal pole (197), and plank 179 includes a 2cm diameter peg-hole. 197 was of alder (*Alnus* sp). It had been split centrally from a stem of about 10cm diameter and very roughly trimmed to an approximately rectangular cross-section. Planks 0236 and 237 had masses of fibrous material adhering to their surfaces. This has the appearance of caulking and could perhaps indicate re-use of boat stakes in this waterfront structure.

8) <u>498 – 14th/15th Century Waterfront Structure</u>

The wood from this structure was rather poorly preserved with signs of rotting, cracking and deformation. The majority of the samples are of oak (*Quercus* sp), from horizontal beams and vertical posts, either untrimmed, halved or quartered. Even allowing for deformation, these do no seem to be carefully worked. In addition there is a horizontal untrimmed beam possibly of the Crataegus-group, 134; a vertical post of holly (*Ilex* sp), 215; and a horizontal plank of pine (*Pinus* sp), 142. This is the only conifer wood identified from a structure at the site and has been made from a tangential section of the trunk.

9) <u>170 – 14th/15th Century Timber Revetment for Wall 169</u>
(dendrochronological date post 1303 AD; Hillam 1985)

The samples are from a horizontal beam, squared from a small timber of alder (*Alnus* sp), about 23cm in diameter (223); and four thick radially-split or sawn oak planks (218-221).

4.2.3 Discussion

10) 373/379 – 16th/17th Century Well

This well was constructed with conspicuously large timbers. The horizontal planks, lining the shaft were of willow (*Salix* sp) (468, 471, 472, 474, 476, 483, 485). These are up to 28 x 5cm in cross-sectional dimensions, and have been plain-sawn. The pieces of well-collar (463, 465, 470) are also of willow. Small squared upright posts of oak (480, 484) were also present, together with large untrimmed stakes of ash (*Fraxinus* sp) and the *Crataegus*-group (377, 378).

4.2.3 Discussion

Fig 4.1 summarises the overall composition of the wood samples from Bridge Street. This diagram illustrates one marked difference between wood from pre- and post-11th century structures: in the earlier period a relatively wide range of woods were used, whereas subsequently oak was by far the most important wood employed. This is largely a consequence of a change in the type of wood in use: the earlier structures included a high proportion of untrimmed roundwood poles and stakes under about 10cm in diameter and probably produced by coppicing, but in the later medieval period plank-built revetments with squared posts and braces often cut form larger timber predominated.

It is worth considering whether Mid-Late and Late Saxon wood can give any indication of local woodland structure and composition. It is certainly possible to distinguish a minimum range of trees which were allowed to develop stems greater than 10cm in diameter. Amongst this larger wood oak predominates with ash in second place. There are also a few large stems of hazel, birch, poplar and *Prunus* sp. From this is appears that the main standard trees were oak and ash, though trees of other species also grew to some size, a pattern which conforms with the later medieval emphasis on oak and ash for timber production known from documentary sources (Rackham 1980, 145). All other wood from these pre-11th century phases consists of straight lengths of young growth, which could hardly have been produced in quantity other than by coppicing, pollarding or from suckers. Detailed ageing by ring-counting has not been attempted, although the poles and stakes of ash (a ring-porous wood whose age is quickly determinable) form Late Saxon structures are for the most part between 5 and 7cm in diameter and show about 10-18 years growth. There are also, however, some very young ash stems about four years old and some extremely slow-grown wood.

The Mid-Late and Late Saxon poles and stakes cut from stems less than 10cm in diameter consist of hazel, oak, ash, hawthorn-group (i.e. hawthorn/rowan/whitebeam/pear/apple), birch, holly, alder, willow, *Prunus* sp, willow/poplar and elm. These identifications may give some crude impression of the species composition of the underwood, although it seems very likely that wood from more than one type of woodland is present, perhaps including fen alder-woods with some sallows or willows and woodland on dry soils with birch and holly.

The increased use of oak timber in the form of squared posts, beams and planks in the later structures has already been noted, and indeed the 13th century collapsed revetment 0175 consisted almost entirely of oak planks, in all cases radially cut or split. Some woods other than oak continued in use, however: 254 included an untrimmed 10cm diameter post of birch and untrimmed ash stakes and posts were used in 204 and 499. The planks in 175 were pegged to a horizontal beam of alder. Samples from the 14th/15th century structures were also mainly of oak.

The only coniferous softwood from a structural context at the site is a deal plank (*Pinus* sp) form a 14th/15th century revetment (0498, 0142), although a second plant of pine came from layer 127. Both samples have dentate ray tracheids and large single window-like crossfield pits in the ray parenchyma. They are thus of the red deal type, which includes *P sylvestris* (Scots Pine) as well as Austrian and Corsican pines (Jane 1956, 305). (142 shows a relatively sharp transition from early to late wood, giving a superficial resemblance to larch). Scots pine is, of course, by far the most likely species to be represented here.

It seems quite probable that these pine samples represent imported timber. Rackham (1980, 151) considers that coniferous softwoods did not grow in England during the earlier middle ages, and notes the 13th century trade in softwood boards from the Baltic, known as *Estrychbord* and *bord de Rygold*, and from Hamburg and Norway. Examples from a 13th century door at Lakenheath, Suffolk are ¾ inch (about 2cm) thick, as is the plank 0142 form Bridge Street. These softwood samples raise the whole question of imported timber, for oak boards were also imported from the Baltic in the Middle Ages. Hillam (1985) found that the ring sequence for oak from revetment 170 (post AD 1303) gave good matches with sequences from North Germany, indicating that this wood at least came from the Baltic area.

The latest structure sampled at the site was a 16th/17th century well, This was constructed mainly of *Salix* sp (willow) and is the only example of the use of willow as timber at the site. Oak is a relatively minor component of this well comprising only two small squared upright posts.

### 4.3 Saxon Wells (Plate 4.3)

Timber-lined wells were excavated at IAS 4801 (School Street), IAS 5203 (Greyfriars Road) and IAS 5701 (Smart Street). The timber was almost entirely of oak (*Quercus* sp) and samples were submitted directly to the Sheffield Dendrochronological Laboratory for tree-ring analysis (Groves 1987 a, b; Hillam 1989). The timbers from well 1668 at IAS 4801 were mainly knotty or distorted or were radially converted planks with no sapwood. No reliable dates were obtained. At IAS 5203, well 0630 was lined with timbers from a hollowed-out oak tree, dated AD 585-688 whilst well 0697 was lined with re-used barrel-staves, dated AD 539-744. These showed a good correlation with tree-ring chronologies from mid-south Germany. Two further well-linings were sampled at IAS 5701. Wood from well 0053 could not be dated, but timbers from 0026 were felled after AD 712.

## 4.4 Cellared Buildings – Structural Timber and Other Wood

### 4.4.1 IAS 3104

#### Introduction

During excavations at this site several early medieval cellared buildings were found. These structures had burnt down and much of their wood and timber was preserved in a charred state. Not only structural timbers but also pegs, wattling and basketry as well as the remains of a cask/barrel and a turned wooden bowl were found. These charred wooden items are described and discussed in this section.

#### Methods

Samples were collected from the main charred wooden items distinguished during excavation for identification description. An attempt was made to lift the larger pieces of charcoal intact, but this was frequently unsuccessful. During storage and transportation these pieces tended to fragment by splitting along the rays (particularly oak charcoal) or along the annual rings (in the case of ash). Most samples received for examination consisted only of collections of fragments. For this reason, and also because the outer surfaces of many items had partly burnt away, little could be learnt about the original pieces of wood other than their species and (from characteristics of ring curvature) whether they were of timber (from trunks and large branches) or smaller roundwood. However, much of the small roundwood charcoal, some of the larger roundwood and some worked wooden items including boards, staves, pegs and a turned wooden bowl were still at least partly intact. Descriptions of these are given, where possible, below.

Areas of collapsed charred wattle/basketry presented particular difficulties. Detailed recording and sampling in the field, given the exigencies of rescue excavation, proved impractical. Instead two sample areas were collected for laboratory examination: 2252 (Building 2022) and 4093 (Building 4081). After cleaning their upper surfaces, latex solution was poured over these areas and the latex was then reinforced with a plaster backing. The wattling/basketry could then be lifted for laboratory examination. In the laboratory the lower surfaces were cleaned and planned at a 1:1 scale. Charcoal samples were taken from the main longitudinal and transverse elements. The remaining charcoal and soil was then removed from the latex which could then be used as a mould to produce plaster casts which, when suitably painted, made excellent items for museum display.

Full lists of charcoal identifications are given in Murphy (199).

#### Structural Timber and Wood

1) *Quercus* sp (oak)

The majority of charcoal samples collected from these buildings were of oak. In each of the four buildings oak timber was used for the main vertical posts: in building 29, for example, timber 0050 was made from a roughly quartered trunk more than 240mm in diameter. The wall-boards were also of oak, as was the staircase structure in building 2140. The samples from most timbers showed no evidence for jointing, though timber 2432 in the fill of building 2022 had a circular peg-hole with peg in position.

Within the cellar fills many of the wood samples were from oak boards/planks. It seems probable that these represent either collapsed floor-boards or wall-boards. Most of these fragments came from radially-split boards, 16-28mm thick, but usually under 22mm. In building 2140 there were some thicker tangential/near-radial boards, 24-32mm thick (nos 2616 and 2652). There were also some rather thin radial boards in building 4081 (e.g. nos 4084, 4155, 4157, 4161), 9-16mm thick, associated with large ash (*Fraxinus* sp) roundwood.

2) *Fraxinus* sp (ash)

Ash, the second most frequent charcoal, was nevertheless uncommon; it was not identified from building 29 and in buildings 2022 and 2140 only a few samples contained small fragments of ash. Notable samples were some fragments of radial ash boards, 8-10mm thick (2600 : Building 2022) and fragments of a peg or dowel (or possible part of a tool handle) of rounded quadrilateral cross-section, 12 x 15mm made from large wood (2745 : Building 2140).

In building 4081, however ash charcoal was more frequent. The samples from this structure included some ash timber but most pieces were from untrimmed large roundwood stems. Most of these pieces lay horizontally, but two (4288, 4294) were apparently *in situ*, placed vertically against the cellar wall. As noted above, this large ash roundwood was associated with some rather thin oak boards. Interpretation of collapsed structures is inevitably tentative, but it is possible that some sort of fixture or fitting is represented, perhaps shelving.

3) Other Woods

*Corylus* (hazel) was represented exclusively by small roundwood stems, from buildings 2022 (2230) and 2140 (2366, 2453, 2604, 2745). It is probable that these roundwood stems all represent remains of wattling from external walls or internal partitions. The stem fragments from 2604 fall into two distinct size groups: 21-25mm in diameter and 6-19mm, perhaps representing sails and rods respectively. Several items from this sample show oblique transverse cuts, and one had been centrally split.

From building 2140 there were three samples of conifer charcoal (2473, 2474, 2659) probably pine (*Pinus* sp). The sample from 2474 comprised fragments probably of radial boards/planks, only 10-11mm thick.

*Salix/Populus* (willow/poplar) charcoal also came from three contexts: a 21mm diameter peg found *in situ* with a peg-hole drilled in the oak timber 2432, from building 2022; timber fragments from 2939, building 2140; and a second peg, 28 x 24mm, from 4279 in building 4081.

Elm (*Ulnus* sp) was represented by some tangential board or stave fragments 17-19mm thick from 2224, building 2022; and ?*Sorbus*-type (?rowan) by timber fragments from 0376, building 29.

Other Wooden Objects

Beside charcoal thought to represent structural wood and timber, charred remains of a number of other wooden objects were found within the cellar fills.

1) 2111 (Building 2022)

This comprised a group of staves from a barrel or other stave-constructed container. The staves were all of oak (*Quercus* sp) radially split or cut from large timber. They were 9-20mm thick with a maximum surviving width of 55mm. Stave 4 had one edge tapered and rounded, and stave 7 showed an oblique diagonal transverse cut. Stave 3 had a v-shaped groove cut at right angles across its width, presumably for securing the base of the container.

2) 2461 (Building 2022)

This sample contained charred fragments of a turned wooden vessel with a simple rim and a footring. It was of willow (*Salix* sp).

3) 2252 (Building 2022) (Plate 4.4; Fig 4.2)

A block sample of wickerwork/basketry, apparently typical of the charred wickerwork from this area of Building 2022 was collected for detailed recording and identification. Other areas of wickerwork (2249, 2250, 2251, 2545) seemed similar in construction but were not closely examined. A plan of the sample from 2252 is given in Fig 4.2 and identifications of its ‘uprights’ are given in Table 4.3.

Table 4.3: IAS 3104 Charcoals from 2252 (larger stems only)

The numbers refer to locations of samples as shown in Fig 4.2

| | | | |
|---|---|---|---|
| 39 | *Corylus* sp | split roundwood | 8-10mm diameter |
| 40 | *Corylus* sp | split roundwood | *c*. 10mm diameter |
| 41 | *Corylus/Alnus* sp | split roundwood | 7-8mm diameter |
| 42 | *Corylus* sp | s | *c* |

| | | | |
|---|---|---|---|
| | | plit roundwood | . 9mm diameter |
| 43 | *Corylus* sp | split roundwood | *c*. 12mm diameter |
| 44 | *Corylus* sp | split roundwood | c. 12mm diameter |
| 45 | *Corylus* sp | split ro | *c*. 13mm d |

| | | | |
|---|---|---|---|
| | | undwood | iameter |
| 46 | *Corylus* sp | split roundwood | *c.* 10mm diameter |

The transverse rods woven around the ‘uprights’ were all young stems, 2-5mm in diameter, apparently all showing just one year’s growth and with the bark still in position. Specific identification proved difficult: many of these stems were flattened and had largely lost the pith. Most consisted of thin, fragile, hollow cylinders which tended to splinter rather than fracturing cleanly. However they all appeared to be of one species, a diffuse porous wood with fairly uniformly-distributed mainly solitary pores and narrow rays. Two typical stems (though unusually well-preserved ones were selected for s.e.m. examination: 31 and 38. Scanning electron micrographs of transverse, radial longitudinal and tangential longitudinal sections of 31 are shown in Plate 4.5. 38 showed identical features.

As can be seen from this micrographs the rays are uniseriate and heterogeneous and there are large ray-vessel pits, all characteristic features of the genus *Salix*. According to Schweingruber (1982, 154) tree and shrub forms of *Salix* cannot be specifically identified from wood anatomy. Traditionally, however, the main raw material for most basketry consisted of stems of *Salix purpurea*, *S viminalis* and their hybrids grown in osier beds. It is highly likely that the basketry was made from osiers.

In summary, this basketry, 2252, was made from split hazel roundwood stems, *c.* 7-13mm in diameter, with interwoven whole unpeeled willow/osier stems, 2-5mm in diameter. Because the basketry, when found, was in a crushed and collapsed state it is difficult to reconstruct its original form and function with complete confidence. However, the hazel rods and *Salix* stems are interwoven in a roughly rectilinear fashion, implying more or less rectangular form for the original basketry container. Carbonised cereals were directly associated with this basketry, which strongly suggests that some kind of grain container is represented.

4) <u>4093 (Building 4081)</u> Fig 4.3

This appears to consist of a crushed and collapsed basket, a block sample of which was taken for laboratory examination.  A plan of this block sample is given in Fig 4.3 and identifications of charcoal samples, numbered with reference to Fig 2 are listed in Table 4.4.  The basket (if this interpretation is correct) appears to have been flattened during the collapse of the building so that its ‘uprights’ perhaps originally parallel, were found splayed out radially.  Nine ‘uprights’ wre sampled (nos 14-22):  they consisted of split (roughly halved) roundwood rods of hazel (*Corylus* sp) and oak (*Quercus* sp) with one oak ‘slat’, 15 x 6mm in diameter, split from larger wood.  The thirteen transversely-woven rods sampled consisted of whole roundwood stems of hazel in (or in two cases) hazel/alder, 3-7mm in diameter.  No material clearly representing the contents of this ‘basket’ were found:  a few hazelnut shell fragments were associated, but this association may just be fortuitous.

<u>Table 4.4:  IAS 3104 Charcoals from 4093 (Sample 514)</u>

The numbers refer to locations of samples as shown in Fig 4.3

| | | | |
|---|---|---|---|
| 1 | *Corylus* sp | [illegible] | 6-7mm diameter |
| 2 | *Corylus* sp | [illegible] | 7mm diameter |
| 3 | *Corylus* sp | [illegible] | 4mm diameter |
| 4 | *Corylus* sp | [illegible] | 7mm diameter |

| | | | |
|---|---|---|---|
| | | [illegible] | |
| 5 | *Corylus* sp | [illegible] | 7mm diameter |
| 6 | *Corylus* sp | [illegible] | |
| 7 | *Corylus/Alnus* sp | [illegible] | 3mm diameter |
| 8 | *Corylus* sp | [illegible] | 4mm diameter |

| | | | |
|---|---|---|---|
| 9 | *Corylus* sp | [illegible] | 5mm diameter |
| 10 | *Corylus* sp | [illegible] | 4mm diameter |
| 11 | *Corylus/Alnus* sp | [illegible] | 4-5mm diameter |
| 12 | *Corylus* sp | [illegible] | 6-7mm diameter |
| 13 | *Corylus* sp | [illegible] | 4-5mm diameter |
| 14 | *Quercus* sp | [illegible] | 15 x 6mm |

| | | | |
|---|---|---|---|
| | | [illegible] | |
| 15 | *Corylus* sp | [illegible] | 14 x 5mm |
| 16 | *Quercus* sp | [illegible] | 13 x 3mm |
| 17 | *Corylus* sp | [illegible] | 13 x 5mm |

| | | | |
|---|---|---|---|
| | | plit roundwood | |
| 18 | *Corylus* sp | Split roundwood | 17 x 6mm |
| 19 | *Corylus* sp | Split roundwood | 12 x 4mm |
| 20 | *Quercus* sp | Split roundwood fragments | |
| 21 | *Corylus/Alnus* sp | Split roundwood fragments | |
| 22 | *Quercus* sp | Split roundwood fragments | |

The pieces of split roundwood (15-22) typically have lenticular cross-sections and the dimensions given indicate their size. Original stem diameters are difficult to estimate, but were not more than about 30mm. Some pieces are extensively bored by insects.

4.4.2 Site IAS 4601: Building 0676 (Plate 3.5)

Full lists of charcoal identifications are given in Murphy (199-). The fragments identified can be divided into five main categories.

1) Fragments from Large Wood

Fragments of mature wood cut originally from trunks or large branches are almost entirely of oak (*Quercus* sp). This seems to have been the main structural wood used in the building for the stairway, vertical posts and planking. Pieces of oak charcoal up to 110mm in size were present in the samples but most of the fragments have split along the medullary rays and consequently the original size and shape of the timbers from which these fragments came can be reconstructed only from the field descriptions. Fragments of ash branches (*Fraxinus* sp) came from 0914 and an unspecified location (0677). These latter examples were *c*. 100mm in diameter and extensively bored by insects. The sample labelled 0677 also produced some fragments of ?*Alnus* (alder) branches. Context 0877 consisted of apparently non-structural fragments of hazel branches (*Corylus* sp), again badly bored.

2) Thick Boards/Planks

Areas of charcoal thought to represent boards or planks were described during excavation. Fragments, mostly split after sampling, came from several samples. These are all of oak (*Quercus* sp) and are all radial or near-radial.

3) Thin Radial Boards or Staves

Contexts 0872, 0881, 0898, 0904, 0907 and 0913 contained fragments of radial boards or staves of ash (*Fraxinus* sp), 4-7mm thick. One fragment from 0904 gives a complete cross-section across one of them: it is 40 x 6mm. Even allowing for shrinkage during charring these seem too thin to be from structural wood and are more likely to represent staves from small barrels, buckets or some similar type of stave-built wooden container. Slightly thicker but otherwise similar fragments thought to be from radial oak staves (*Quercus* sp) came from 0872, 0907, 0908 and 0910. These are 7-*c*.15mm thick.

Most of these ‘stave’ fragments were found in the north-east corner of the building, though examples also occurred in sample 0872 at its west end.

4) Twigs

Twigs of sloe/bullace (*Prunus* sp), hawthorn group *Crataegus* group), hazel (*Corylus* sp) and conifers were identified. The hazel twigs from 0897 came from stems 10-*c*.30mm in diameter. Some had been centrally split before charring and some fragments show oblique transverse cuts. These twig fragments appear to represent charred remains of wattling. The remaining twigs could be from wattling, but equally could have been brought into the building for other purposes, perhaps as kindling. There are two distinct groups of samples with twig fragments, in the north-east and south-west corners of the building.

5) Various Wooden Artefacts

A charred wooden bung was associated with ash ‘staves’ in the sample from 0898, providing further evidence for thinking that these ‘staves’ represent the remains of barrels. It seems to be of hazel (*Corylus* sp) but cannot be fully identified without fracturing it. Fragments apparently of a dowel, *c*.10mm in diameter, probably of *Prunus* sp came from 0873. Finally, 0908 produced the tip of a wedge of oak *(Quercus* sp), with a conspicuously burred tip.

Conclusions

The main structural timber used in this cellar was oak, though charred branches of ash and ?alder are also present and may have formed part of the superstructure. The building included wattle panels of hazel. Other charred wood from the cellar floor, of hazel, *Prunus*, hawthorn-group and conifer, cannot be related to the structure with certainty. Thin ‘staves’ of ash and oak, and a bung probably or hazel, are thought to represent remains of small barrels, or similar containers.

4.5 Ipswich Ware Kiln: IAS 3104, 2200 (Plate 4.6)

Fifty of the charcoal fragments collected by hand from the kiln floor (S57) were identified. Sixteen of them were of mature oak wood (*Quercus* sp) and thirty four were stems of *Ulex/Cytisus* sp (gorse or broom). These stems, 5-17mm in diameter, show the oblique rows of vessels in TS characteristic of these plants and some, though not all, are distinctly ring porous, a feature generally more characteristic of broom. A 5kg soil sample from the stoke pit (S50) produced charred young twigs with sharply raised angles, closely matching stems of broom, and no charred spines were seen. Broom, therefore, seems to be the only leguminous shrub represented in these samples.

Other charred macrofossils present, but in very small quantities, include a rye grain (*Secale cereale*), nutlets of *Carex* sp and *Scirpus* sp, a grass caryopsis, unidentified seeds and pinnules of bracken *(Pteridium aquilinum*). These may represent plant materials used as kindling. A few scraps of burnt bone and mussel shell were also noted.

The use of broom as part of the fuel is interesting and raises general questions about fuel supply to the Middle Saxon pottery industry. In an area where extensive coastal heaths exist harvesting broom as fuel would obviously make economic sense. There is no obvious way of determining whether the kilns were fuelled with wood or charcoal, but it is perfectly possible that broom charcoal could have been produced in heathland clamps.

4.6 Conclusions

The waterfront structures at IAS 6202 illustrate a long-term trend from the use of predominantly roundwood, of a variety of species, in the Middle Saxon structures to more extensive use of mainly oak timber from the 11th century onwards. This represents, essential, a shift from renewable coppiced wood to non-renewable felling of mature trees. This change is probably related more to the functions of the structures than any change in woodland management. So far as can be determined the Saxon wood appears to have been produced by a coppice-with-standards system (the standards mainly of oak and ash). Direct evidence for importation of wood by sea is provided by deal and oak planks, of 14th century date from Bridge Street and by re-used barrel staves of Middle Saxon date from a well at Greyfriars Road.

The 11th century cellared buildings examined were constructed almost entirely of oak timber. Hazel roundwood from these structures is likely to have represented wattling. Other wooden objects from these structures included barrels or other stave-constructed containers of oak and ash, a turned vessel of willow, various pegs, bungs, dowels and wedges and basketry made of hazel and osier stems. Besides timber trees is it likely that local woodland included coppice and osier bed.

Not all wood, however, was supplied from woodlands. The abundant stems of broom charcoal from a Middle Saxon Ipswich ware kiln hint at the importance of heathland as a fuel source for the pottery industry.

## 5. Summary

Macrofossils, and the activities which they represent, have been discussed in detail a above and it only remains to give a brief summary of the results.

As might be expected at a major trading settlement the evidence for on-site agricultural activities and crop processing is sparse: the majority of samples examined are characteristic of activities relating to storage, consumption and use of plant materials and the disposal of waste. This is most clearly evidence in the assemblages of charred cereal remains, which at all periods are of mainly consumer type, consisting of crop products rather than sieving or winnowing by-products. There are a few exceptions to this, notably at IAS 4601; and some excavated ditches have been interpreted as field systems of late 6th/7th century and Middle Saxon date: but overall the available evidence indicates that from its beginnings Ipswich was receiving crop products from subsidiary farm sites. From the associated weed seeds it seems that part of the arable area supplying the town was reclaimed from heathland, though some poorly-drained land and areas of boulder clay soils were also under cultivation. There is the possibility that some cereals were imported by sea, but there is no direct evidence for this. By the 11th century cereals were being stored in cellared buildings: storage methods before this are unknown. From the Middle Saxon period onwards there is evidence for malting (using mainly barley and oats), whilst coarse-milled loaves of wheat and rye from an 11th century cellar indicate milling and baking on-site. Cereal bran fragments and scraps of arable weed seeds in latrine pits indicate the importance of cereal products in the diet. Other field crops, probably grown locally, include beans, peas, flax/linseed and hemp (Fig 3.4). Waterlogged and mineralised deposits have produced a range of fruits, nuts and herbs (Tables 3.6, 3.10) including wild species no doubt collected in local woodlands with cultivated crops, some of which (e.g. figs, grapes) may have been imported.

Resources from a range of local habitats were exploited. There is evidence for reclamation of heathland for agriculture, but heaths also supplied heather and bracken for litter and perhaps thatching as well as gorse/broom for fuel – particularly for the Ipswich Ware pottery industry. Freshwater wetland areas included hay-meadows, probably osier beds for basketry and perhaps hop-gardens (although hops might represent an imported product). Areas of brackish grassland, salt-marsh and mudflat were present adjacent to the settlement and would have been used as pasture or meadow and for shellfish collection. Dumping organic wastes onto such areas permitted an expansion of the settlement area. The development of the town created an enormous demand for constructional wood and timber (mainly oak). It is impossible to determine how much of this demand was met from local resources but there does seem to have been a shift from extensive use of roundwood in the Middle Saxon period to larger timber in later periods. At least some of this wood (e.g. pine, re-used oak barrel staves) was definitely imported.

Figure 5.1

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