EAST ANGLIAN ARCHAEOLOGY

Frontispiece Aerial view of the Mill Lane excavations in progress; north to the top of the picture
Photo: Derek A. Edwards, 19 June 1995. TL 8682/AQ/HBV 5

Excavations at Mill Lane, Thetford, 1995

by Heather Wallis

with contributions from
Umberto Albarella, Sue Anderson,
Marion Archibald, Alex Bayliss,
Mark Blackburn, David Buckley, John A. Davies,
Roger Doonan, Richenda Goffin, James Greig,
Alison Locker, Alice Lyons, Quita Mould,
Peter Murphy, Ian Riddler, John Shepherd,
David Starley and Susan Youngs

illustrations by
Steven Ashley, David Dobson, Mark Hoyle
and Hoste Spalding

and photographs by
Rob Barrett and Nigel Macbeth

East Anglian Archaeology
Report No.108, 2004

Archaeology and Environment
Norfolk Museums and Archaeology Service

EAST ANGLIAN ARCHAEOLOGY
REPORT NO.108

Published by
Archaeology and Environment Division
Norfolk Museums and Archaeology Service
Union House
Gressenhall
Dereham
Norfolk NR20 4DR

in conjunction with
ALGAO East
www.algao.org.uk/cttees/regions/

Editor: Stanley West
Managing Editor: Jenny Glazebrook

Editorial Committee:
Brian Ayers, County Archaeologist, Norfolk Museums and Archaeology Service
David Buckley, County Archaeologist, Essex Heritage and Conservation
Keith Wade, Archaeological Service Manager, Suffolk County Council
Peter Wade-Martins
Stanley West

Set in Times Roman by Trevor Ashwin using Corel Ventura ™
Printed by Witley Press Ltd., Hunstanton, Norfolk

ISBN 0 905594 41 X

For details of other titles in the *East Anglian Archaeology* series, see last page

This report is published with the aid of funding from English Heritage

Cover illustration
Detail of 10th-century brooch SF161. *Photo: Nigel Macbeth*

Contents

List of Plates

List of Figures

List of Tables

List of Charts

Contributors

Umberto Albarella
formerly Department of Ancient History and Archaeology, University of Birmingham

Sue Anderson
Finds Manager, Suffolk County Council, Archaeological Service

Steven Ashley
former illustrator, Norfolk Archaeological Unit

Alex Bayliss
Scientific Dating Co-ordinator, Centre for Archaeology, English Heritage

Mark Blackburn
Keeper of Coins and Medals, Fitzwilliam Museum, Cambridge

David Buckley
Heritage Conservation Manager, Essex County Council

John A. Davies
Chief Curator, Norfolk Museums and Archaeology Service

David Dobson
Illustrator, Norfolk Archaeological Unit

Roger Doonan
formerly Ancient Monuments Laboratory, English Heritage

Richenda Goffin
Finds Officer, Norfolk Archaeological Unit

James Greig
consultant on pollen

Mark Hoyle
former illustrator, Norfolk Archaeological Unit

Alison Locker
consultant on fish bone

Alice Lyons
Finds Specialist, Norfolk Archaeological Unit

Quita Mould
consultant on metal artefacts

Peter Murphy
Regional Advisor for Archaeological Science, English Heritage

Ian Riddler
consultant on worked bone and antler

John Shepherd
Archaeological Archive Manager, Museum of London

Hoste Spalding
former illustrator, Norfolk Archaeological Unit

David Starley
formerly Ancient Monuments Laboratory, English Heritage

Heather Wallis
Project Manager, Norfolk Archaeological Unit

Susan Youngs
Department of Medieval and Modern Europe, British Museum

Acknowledgements

I am grateful to all who have been involved in this project, and to my colleagues at the Norfolk Archaeological work, for their hard work, support and advice. The project was initially directed by Jayne Bown, supported by an excavation team comprising David 'Ghost' Adams, Rob Barrett (photography), Jessica Cowley, Annabel Durnford (finds), Kevin Forrest, Katie Lister, Steve Manifold, John Percival, Chris Phillips, Melanie Stone, Danny Voisey, Pete Warsop, and Heather Wallis.

A number of local metal-detectorists assisted on site, and volunteers helped with the excavation. Their time and skills were greatly appreciated.

The site illustrations were drawn by Hoste Spalding and Mark Hoyle. The finds were drawn by Steven Ashley. All illustrations were edited and prepared for publication by David Dobson. Site photographs were taken by Rob Barrett and the small finds were photographed by Nigel Macbeth.

Thanks are due to the following specialists for undertaking the assessment of the finds and environmental evidence from the site: Umberto Albarella (animal bone), Sue Anderson (human bone), David Buckley (querns) John Davies (coins, jettons and tokens), James Greig (pollen), Irena Lentowicz (ceramic building material, pottery and unfired clay), Jo Mills (copper alloy finds, fired clay, lead and lead alloy finds and stone objects), Quita Mould (iron finds), Peter Murphy (environmental samples), Ian Riddler (worked bone and antler), Peter Robins (flint), John Shepherd (glass) and David Starley (metalworking debris).

Quita Mould is most grateful to Susan Youngs (Department of Medieval and Modern Europe, British Museum), John Cherry (Department of Medieval and later Antiquities, British Museum) and Marion Archibald (formerly of the Department of Coins and Medals, British Museum) for their help and comments on a number of objects submitted to them. Thanks are also due to John Clark of the Museum of London for his comments on items of lead alloy. Wherever appropriate, their comments have been included in the text in their entirety.

The excavation was funded by Centurion Safety Products, while English Heritage provided a grant for assessment, analysis and publication.

Summary

A large-scale excavation was undertaken in Thetford, to the south of the Little Ouse, during 1995. The site was located in an area which had once been part of the Late Saxon settlement.

Analysis of deposits from the river valley has provided important new insights into local environmental conditions from the Bronze Age through to the Late Saxon period.

The excavation results have added significantly to our understanding of Late Saxon Thetford, and confirmed that there was no earlier settlement in this part of the town. That the success of Thetford as a large and influential town was fairly short-lived was reflected in the relatively brief main span of activity, which was most intense in the 10th–early 12th centuries.

The evidence for occupation consisted of post-hole structures and sunken-featured buildings, rubbish pits and wells. As well as indicating domestic habitation, the artefactual evidence included waste products from the working of silver, copper alloy and iron. A number of hearths appear to have been associated with metalworking.

Occupation continued, on a much smaller scale, into the 13th and 14th centuries, after which the area became open fields. The site remained open until light industrial development took place in the mid-20th century.

Résumé

En 1995, des fouilles à grande échelle ont été entreprises à Thetford au sud de Little Ouse. Le site se trouvait dans une zone qui faisait autrefois partie de l'implantation de la période saxonne tardive.

L'analyse des dépôts provenant de la vallée de la rivière a apporté des éclaircissements importants sur les conditions de l'environnement local depuis l'âge du bronze jusqu'à la période saxonne tardive.

Les fouilles ont également donné des résultats qui ont considérablement augmenté notre compréhension de Thetford pendant la période saxonne tardive, et elles ont permis de confirmer qu'il n'y avait aucune implantation dans cette partie de la ville avant cette périodeLa prospérité de Thetford n'a duré que peu de temps, comme le confirme la brièveté relative des principales activités de la ville qui se sont surtout déroulées du dixième siècle jusqu'au début du douzième siècle.

Des trous de poteaux, des bâtiments au plancher situé en contrebas, des puits ainsi que des fosses contenant des déchets représentent les traces résultant de l'occupation du site. Les artefacts découverts indiquent la présence de maisons d'habitation et comprennent également des débris provenant du travail de l'argent, d'alliage de cuivre et de ferUn certain nombre de foyers semble avoir été associé au travail du métal.

L'occupation a continué à une moins grande échelle jusqu'au treizième et quatorzième siècles, puis les lieux sont devenus des champs ouverts. Le site est resté ouvert jusqu'à l'installation d'une industrie légère au milieu du vingtième siècle.

(Traduction: Didier Don)

Zusammenfassung

1995 wurde eine umfangreiche Ausgrabung in Thetford unternommen, und zwar südlich des Flusses Little Ouse. Die Ausgrabungsstätte lag in einem Gebiet, das einst zu einer spätangelsächsischen Siedlung gehörte.

Die Analyse von Ablagerungen aus dem Flusstal erbrachte wichtige neue Einblicke in die ökologischen Bedingungen von der Bronzezeit bis in die späte angelsächsische Periode.

Die Ausgrabungsergebnisse haben erheblich zu unserem Verständnis von Thetford als spätangelsächsische Siedlung beigetragen und bestätigt, dass es in diesem Teil des Ortes keine frühere Besiedlung gab. Dass Thetfords Erfolg als große, einflussreiche Stadt recht kurzlebig war, zeigte sich an der relativ kurzen Hauptspanne menschlicher Aktivität, die zwischen dem 10. und dem frühen 12. Jahrhundert ihre größte Ausprägung erlebte.

Die Besiedlung wurde durch Pfostenlöcher und eingetiefte Grubenhäuser, Abfallgruben und Brunnen nachgewiesen. Neben Hinweisen auf eine Wohnbesiedlung wurden auch Abfälle aus der Silber und Eisenverarbeitung sowie aus Kupferlegierungsprozessen gefunden. Eine Reihe von Feuerstellen diente offenbar der Metallbearbeitung.

Die Besiedlung setzte sich in stark verringertem Maße bis ins 13. und 14. Jahrhundert fort. Danach verwandelte sich das Gebiet in eine offene Feldlandschaft. Die Stätte blieb ungenutzt, bis in der Mitte des 20. Jahrhunderts Leichtindustrie angesiedelt wurde.

(Übersetzung: Gerlinde Krug)

1. Introduction

by Heather Wallis

I. Background to the project
(Figs 1 and 2)

Excavations at Mill Lane, Thetford took place over a sixteen-week period between April and July 1995, prior to the redevelopment of the site. The area under archaeological investigation is situated on the south bank of the Little Ouse River approximately 0.5km south of the present town centre and within the modern parish of St Mary. The site was divided into two by Mill Lane, with one part (Site 5761, TL 8716 8260) lying between Mill Lane and the Little Ouse River and the other (Site 1022, TL 8694 8260) lying to the south-west of Mill Lane, between it and the Bury Road (Figs 1 and 2).

The development of this site was subject to a Section 52 Agreement (Town and County Planning Act 1971) between Breckland District Council, Thetford Moulded Products (now Centurion Safety Products) and Norfolk County Council. Negotiations regarding the archaeological arrangements began in 1988. There was concern at that time that the development of this site may have been severely hindered by the additional costs of the archaeological project above the other development costs. In order to reduce the cost to the developer, English Heritage agreed in principle to fund post-excavation and publication work. Following this, in 1989, the project was put into 'hibernation' due to the poor economic situation. It was revived in late 1993, with Centurion Safety Products funding the excavation and English Heritage funding assessment and analysis.

II. Archaeological background
(Fig. 2)

This section is necessarily brief, as a great deal has already been published outlining the development of Thetford. The reader is primarily referred to Volumes 22, 62, 72 and 87 of the *East Anglian Archaeology* monograph series (Rogerson and Dallas 1984, Dallas 1993, Andrews 1995, Andrews and Penn 1999).

Much archaeological work has been undertaken in and around Thetford, with finds being recorded since the mid-18th century (Dunmore and Carr 1976, 5) and formal excavations being undertaken from 1948 onward. The results of this fieldwork have continually refined and challenged models of the development of the town.

The importance of the location of Thetford undoubtedly lies in its location on the Little Ouse River.

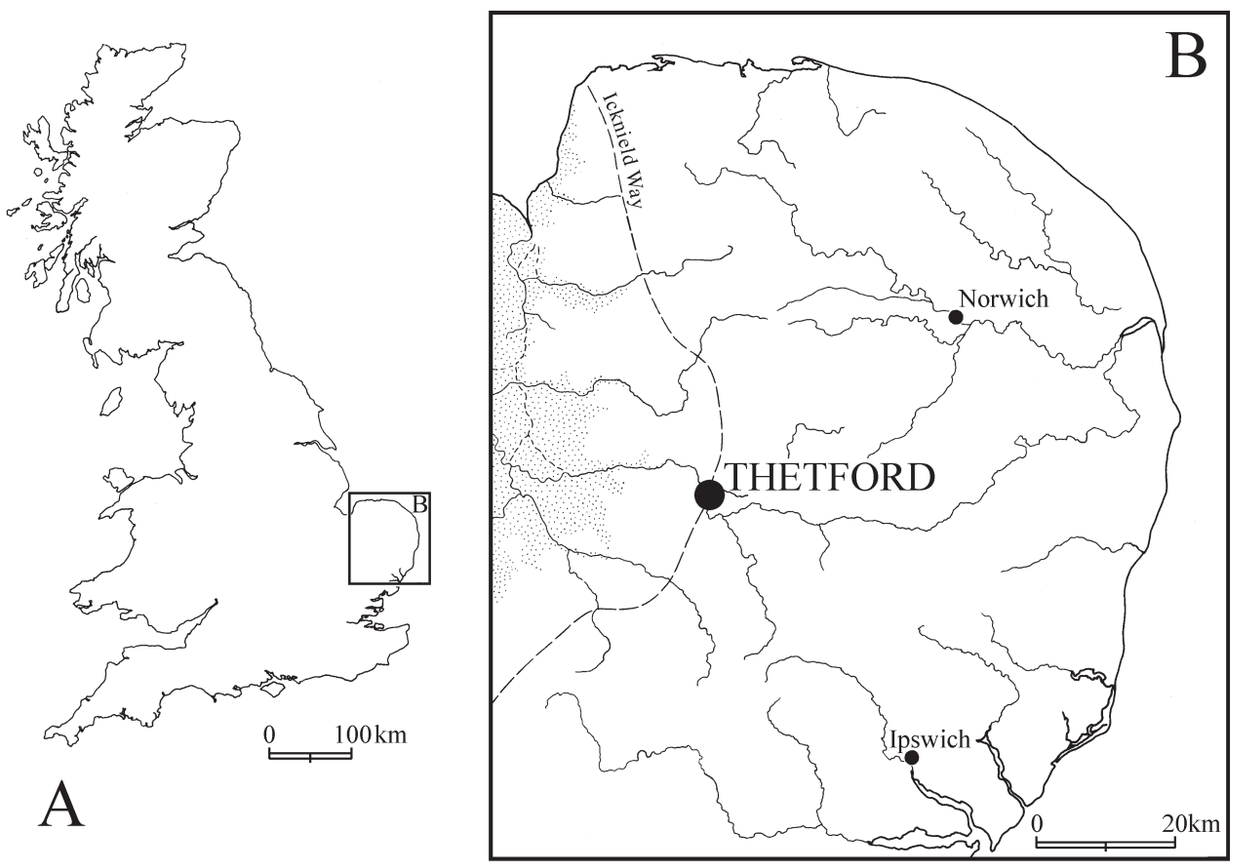


Figure 1 Location maps

The Icknield Way, a significant route in the Iron Age, forded the river at Nuns' Bridges. The earliest evidence for any significant occupation in Thetford dates to the Iron Age, when a fort (at present-day Castle Hill) was built to the north of the river. There has been some discussion on the likely date of construction for this fort, but it is generally thought to have originated in the 5th century BC (Davies and Gregory 1991; Green and Clarke 1963).

Evidence of occupation during the Romano-British period is still scarce, but recent excavations at St Nicholas' Street (Andrews and Penn 1999) and Melford Meadows (Mudd 2002) have both revealed evidence of occupation during this period. The emerging pattern is of a scatter of small farmsteads along the river valley.

An increase in the density of occupation, centred to the west of the modern town, is apparent during the Early and Middle Saxon periods. Early Saxon occupation has been identified at Redcastle Furze (Andrews 1995) and Brandon Road (Dallas 1993, 2–57). Further occupation of this date has also recently uncovered at Melford Meadows, to the east of the present town (Mudd 2002). With regard to the Middle Saxon period, documentary evidence suggests that Thetford was an important settlement in the late 9th century as it is recorded that the Vikings over-wintered here in 870. Excavation, however, has not uncovered significant areas of occupation of this date, except at Redcastle (Knocker 1967).

It was not until the Late Saxon period that settlement at Thetford reached it zenith. During the 10th century the area and density of occupation both increased greatly, with occupation being located on both the north and south banks of the river. During this period earthwork defences encircled the town but these do not appear to have been long-lived, and settlement soon spread out over the infilled ditches (Rogerson and Dallas 1984, 63). By the time of Domesday in the late 11th century, the estimated population of Thetford would have made it the sixth largest town in England.

This success did not last, however, and Thetford contracted during the late 11th and early 12th centuries as the town went into decline. The south bank of the river was almost totally abandoned and settlement was concentrated into a small area on the north bank. This became the core of the medieval town from which the present town developed. The southern bank remained largely unsettled until the early 20th century, when much of the area became subject to housing and light industry in a planned redevelopment for London over-spill population. These processes of continued settlement on the north bank and abandonment on the south bank have led to differential survival of archaeological remains, and different excavation opportunities, on the opposite banks of the river. The continued settlement on the north bank has to some extent preserved the early topography of the town, while on the south bank most of the street pattern and even the location of some of the churches can only be defined by excavation.

III. The site

(Figs 2–4)

The site lay within the defended Late Saxon town on the south bank of the river, in an area which had been largely abandoned from the 12th to the early 20th centuries. Thus it was envisaged that well stratified archaeological deposits would have survived at the Mill Lane site. The total area of the development was *c*. 1.8 hectares (Site 1022 = *c*. 1.33 hectares and Site 5671 = *c*. 0.47 hectares), of which *c*. 0.4 hectares (Site 1022 = *c*. 0.36 hectares and Site 5671 = *c*. 0.04 hectares) was excavated.

Most recently both sites had been occupied by the plastics factory of Centurion Safety Products. On Site 1022 these buildings had been demolished prior to excavation, while on Site 5761 excavation took place on rough ground adjacent to the buildings. Both these areas of development lie within designated Scheduled Ancient Monuments (No. 296 to the west of Mill Lane and No. 297 on the east).

IV. Previous excavations

(Figs 2 and 3)

An area of 110m was excavated in 1973 at Site 1022 (Figs 2 and 3), revealing evidence of 11th-century ironworking in the form of slags and hearths. The pottery sequence indicated that activity continued into the 13th century, and putative post-hole structures were recorded. Observations immediately to the south of the site during construction work revealed large pits containing iron slag along with Thetford Ware and other Saxo-Norman pottery (Rogerson and Dallas 1984, 64).

In 1980 a trench was excavated *c.* 50m north of the 1973 site, to the north of the present development area (Fig. 2). Graves were present in the topsoil and were also cut into natural sand. The base of the trench was almost entirely covered with grave cuts, the deepest of which appeared to be at *c*. 1.30m below ground level. These burials were probably from the graveyard of St Etheldreda's Church. There was no evidence for other occupation within the trench prior to the use of the ground for burial (Rogerson and Dallas 1984, 64).

Five trial holes scattered across Site 5671 were excavated by machine in 1978. Each recorded at least a 1m depth of topsoil, with archaeological deposits below ranging in total depth to *c.* 2.5m below the ground surface. There was a notable lack of artefacts and ecofacts, except for some human bone and medieval pottery (Norfolk County Sites and Monuments Record).

V. Geology and topography

The site lies on the east side of Thetford, adjacent to the Little Ouse River and midway between Nuns' Bridges and the Great Bridge, two of the three fordable points of the River at Thetford. The underlying geology is solid chalk, above which mainly flint-based gravels have accumulated. These are probably derived from glacial sands and gravels, and as such are probably part of the Freckenham Series (Corbett 1973, 67–8). Site 5761 lies on the alluvial flood plain of the Little Ouse River at an elevation of *c.* 10.5m OD. This alluvium is underlain by the river sand and gravel. Mill Lane appears to run along the edge of the terrace (at 11.6m OD) with the gravels of the first terrace rising gently behind it, reaching a height of 13.00m OD at the west edge of Site 1022.

VI. Research aims

The original research aims of the project were reviewed on completion of the assessment and included in the updated

Figure 2, FOLDOUT see separate file

Figure 3, FOLDOUT see separate file

project design (Wallis 1997). They can be summarised as follows:

1. to obtain evidence for structures, and to compare this with evidence from previous excavations;
2. to characterise the changing nature of land-use;
3. to examine the variable nature of post 12th-century land usage;
4. to examine the interrelation between settlement and river;
5. to examine the relationship between commercial, industrial and domestic areas prior to the 12th-century relocation of the town;
6. to determine when Mill Lane was established, and how its alignment has affected subsequent development;
7. to determine the nature of the riverside environment and its changes through time;
8. to understand the nature and scale of metalworking across the excavated site;
9. to modify and develop the typology of Thetford Ware and its dating.

VII. Methods

(Figs 3 and 4)

The excavation and recording methodologies were, where possible, kept consistent across both parts of the sites. Variation did occur with regard to topsoil stripping, however, due to limitations within the excavation agreement with the landowners. On Site 5761, to the east of Mill Lane, two trenches and one small box were excavated (Fig. 3). Area 1 was T-shaped, with part of it running parallel to the present street frontage. Area 2 was L-shaped, with the majority of the trench running at right-angles to the road, towards the river. Area 3 was excavated with the express purpose of recovering soil samples for environmental analysis. This area was kept separate from the main trenches in order to reduce the risk of flooding within the excavation area.

To the west of Mill Lane (Site 1022) site clearance strategies were constrained by the requirements of the site agreements. These established that a maximum depth of 0.5m of material could be removed from the site as a whole, with the provision for spot excavations to a depth of a further 0.5m (or until archaeological deposits were encountered). These spot excavations took the form of 5m x 5m boxes within the larger areas of excavation. Initially seven areas (Areas 1–7), each of *c.* 400 sq.m, were cleared on this site. Additional trenching was undertaken at the northern (Area 8) and southern (Area 3A) extents of the development, primarily to check for the presence or absence of human remains since early churches are known to have existed just beyond the northern and southern boundaries of the site. As excavation progressed an additional area of *c.* 500 sq.m (Area 9) linking Areas 2, 4 and 5 was also stripped. The intention was to increase the retrieval of information, primarily in plan form, to assist in the identification and interpretation of spatial differentiation across the site.

The depth of overburden was greatest in Areas 3 and 7 and part of Areas 1 and 2, which meant that spot excavation took place after 0.5m of material had been removed. These 5m x 5m boxes were excavated to a greater depth, and archaeological remains investigated within them only. This effectively transformed these interventions from area excavations to a series of box trenches, a strategy which affected the quality and quantity of the data recovered and prevented the recording of some stratigraphic relationships.

Topsoil was stripped in spits of *c*. 0.2m thickness. Metal-detectors were used to recover finds from this material and the resultant finds recorded according to allocated area numbers. The pre-excavation plan (Figs 3 and 4) illustrates the density of archaeological features revealed. The majority of pits/post-holes were half-sectioned in order to ascertain profile, depth and date. Linear features were sectioned as appropriate in order to record their profile, and sections targeted to record the relationships between intercutting features. Where detailed structural information or significant artefact assemblages could be obtained, full excavation was undertaken.

The location of finds was recorded either by context, for stratified finds, or (where possible) by area number for unstratified material. In total, 850 Small Finds were recorded. Samples for the recovery of environmental data were taken in consultation with Peter Murphy (English Heritage Environmental Co-ordinator). Sampling targeted deposits that appeared to be securely dated and would help address the specific project aims outlined above. In all, nineteen bulk samples were taken. Additional monolith samples were taken in Area 3 adjacent to the river.

Assessment of the data recovered from the excavation followed the guidelines laid down in MAP2 (English Heritage 1991). The structural analysis was undertaken by the staff of the Norfolk Archaeological Unit, while artefacts were divided according to material type and sent to appropriate specialists. Following this a full assessment report and updated project design was compiled using the data provided by specialists, and was submitted to English Heritage for approval prior to analysis taking place (Wallis 1997).

The criteria for including information on individual features in this publication were that some form of interpretation other than simply ‘pit’ or ‘post-hole’ was possible for them, or that their fills had produced significant finds. In total 160 pits were excavated, and over 500 post-holes/stake-holes recorded. Many of the features described have been grouped together due to similarities in form or function. A complete list of excavated features may be consulted in the site archive, which is lodged with the Norfolk Museums and Archaeology Service.

VIII. Phasing

Interpretation has been limited by later truncation of parts of this site. This was restricted to the top of the natural ridge crossing the site and affected some of the areas where the majority of structures were located (Areas 4, 9 and 5), including that with the greatest density of archaeological deposits (Area 4). This truncation was not the result of late and post- medieval building activity, as is normally expected in an urban situation, as the site was used as pasture during these periods. More probably it results from natural erosion, augmented by landscaping during the site’s recent history and by the construction of the factory.

The site was not highly stratified, so much of the phasing was based on the pottery assemblage. The shape, form and location of features have also been considered,

however. Many of the smaller features, particularly post-holes, could not be phased confidently due to the paucity of datable material within them. However, it is assumed that many of them would have belonged to the period of most prolific activity on the site.

The period divisions employed in this report are as follows:

Period 1	prehistoric
Period 2	Roman/Early Saxon
Period 3	Late Saxon (10th–11th centuries)
Period 3a	Late Saxon (11th century)
Period 4	early medieval (late 11th–12th centuries)
Period 5	medieval (12th–14th centuries)
Period 6	late/post-medieval (15th–17th centuries)
Period 7	modern (18th–20th centuries).

Period 3a is a subdivision of Period 3, and includes features that were dated to the 11th century by the ceramic assemblage and those at the top of a stratigraphic sequence dating to the 10th–11th centuries. This subdivision has proved useful in the analysis of the pottery and metalworking debris.

The nature of the pottery assemblage on which the phasing is based, like that from many other sites in Thetford, make a separation of material into distinct date-ranges very difficult, and precise phasing almost impossible. This has resulted in the main phases — 3, 3a and 4 — all overlapping in the 11th century, the period which probably saw the most intensive occupation. It must be stressed that the evidence suggests continuing occupation from the 10th to the 12th centuries, probably peaking in the 11th century. While the general layout and nature of activity in this part of Thetford has been established, the contemporaneity or otherwise of individual features cannot be established with any confidence.

Figure 4, FOLDOUT see separate file

Figures 5, 6, 7 and 9, FOLDOUT see separate file

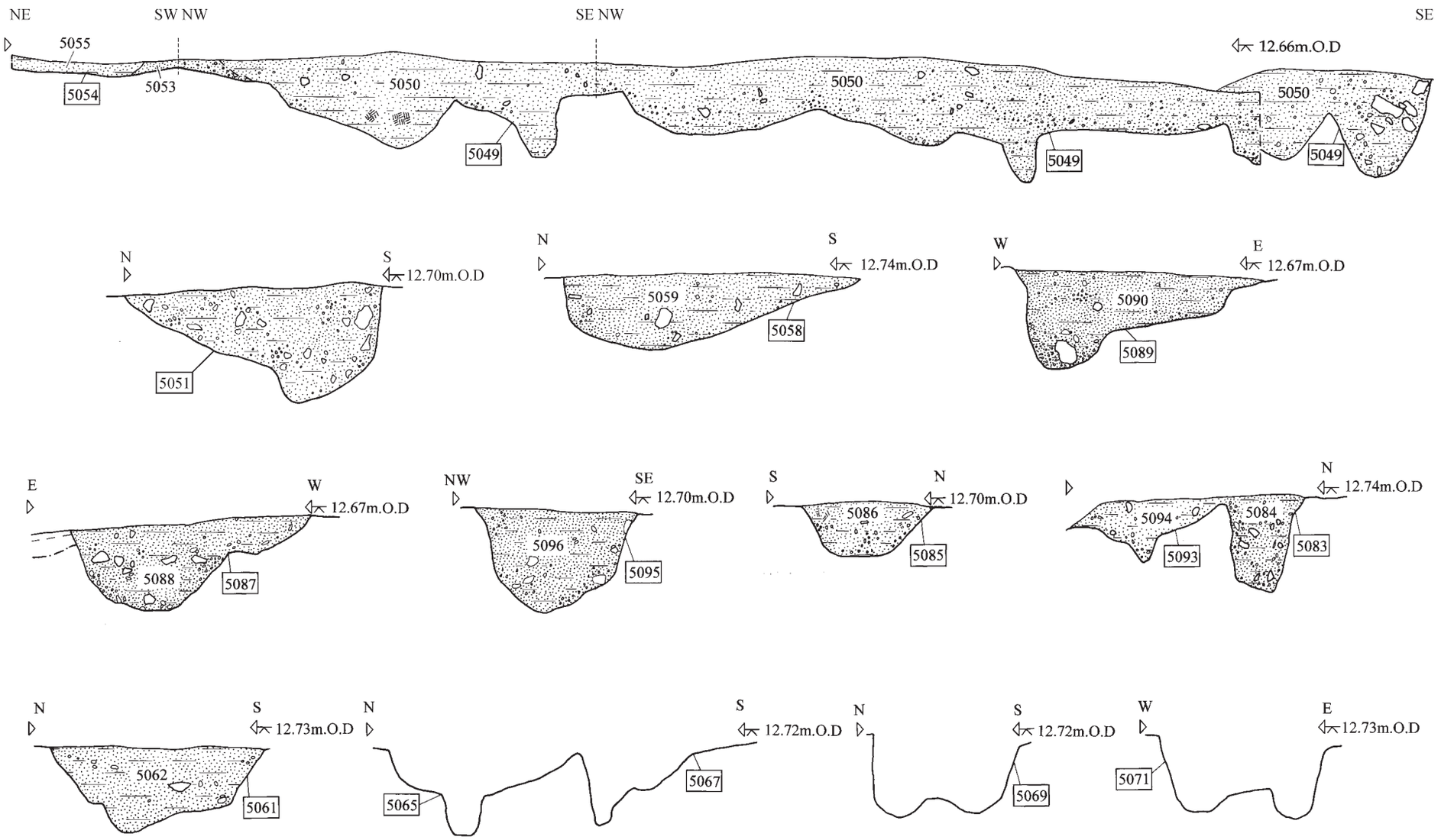


Figure 8 Building B: sections. Scale 1:20.

2. The Archaeological Sequence

by Heather Wallis

I. Periods 1 and 2: Pre-, Early and Middle Saxon

No features pre-dating the Late Saxon period were identified. Only one sherd of Iron Age flint-tempered pottery was recovered, and only two undiagnostic struck flints. Five Roman coins were found: three of them were topsoil finds while the others were found residually in Late Saxon features. Two sherds of Oxford Red Colour Coat and one of Central Gaulish samian were recovered; of these, only the samian sherd was non-residual. No pottery of the Early or Middle Saxon periods was retrieved, although two items of decorated metalwork were dated stylistically to the Middle Saxon period.

II. Period 3: Late Saxon (10th–11th centuries)

(Plates I–III; Figs 4–25)

Late Saxon activity commenced on previously unoccupied ground. Activity in this period was widespread across the site, and in some areas was particularly intense. Of the excavated features, 33 linear features, 101 pits and 228 post-holes belong to this period of occupation. The evidence indicates that the site housed a number of buildings (two sunken-featured examples and five post-hole structures) along with many refuse pits and wells. Industrial activity was also represented by hearths and by a significant quantity of metalworking debris. Linear boundaries crossed the site dividing the land into different enclosures and open areas (Fig. 5).

The layout of the site was determined by the position of two trackways, located on a natural ridge. One route (Track A) crossed the site on a north-east to south-west course and joined the second (Track B), which turned towards the south-east. The two may have represented a single route, or may have formed a T-junction (any western continuation of Track A lying outside the excavated area). The ridge of high ground on which the tracks ran was more susceptible to later truncation than the remainder of the site.

Three 'enclosures' (Enclosures A–C) lay adjacent to the trackways, while the remainder of the site is described within five broad areas (Open Areas A–E). Pits within these areas that have been selected for detailed description in this report are located on Fig. 6. The Late Saxon occupation of the site spans two centuries, during which developments and alterations to the settlement pattern occurred: these changes are indicated throughout the following text.

Enclosure A

(Figs 5–8)

Located in the southern part of the site, this was defined to the west by Track B and to the north by a ditch 0.5m wide. This ditch was only 0.10m deep at its west end but was 0.57 deep at its east end, a variation due to differential truncation across the site. Within this enclosure lay two buildings and thirteen pits.

Building A

(Fig. 5)

This rectangular structure measuring *c.* 14m x 4.5m was formed by a large number of post-holes, of which 54 were excavated. The building was orientated east to west, with the short west end fronting onto the projected line of Track B. The exact plan of this building was difficult to define as most of the post-holes only survived to a few centimetres in depth, and many remained unexcavated. There may have been two phases of construction, as a number of double post-holes suggested at least some rebuilding. A slot and three post-holes indicate that this structure could have been divided into two rooms, with the western part being 6.4m long. The small amount of pottery recovered hints at a date in the earlier 10th century.

Building B

(Figs 7 and 8)

A number of post-holes and linear construction cuts were located to the north of Building A. These appeared to form part of a building, which probably extended beyond the eastern edge of excavation. The main part of this structure was rectangular (5m north-to-south and 6m east-to-west), with two additional bays 1.5m and 2m wide to the north.

Along the west, the south, and part of the east side, the post-holes were set within linear trenches. On the east side the construction trench was shallower than the post-holes, which were mostly between 0.35 and 0.4m in depth and fairly vertically sided. The south and west construction slots had post-holes along their edges, which were slightly shallower than the slots themselves. A post-hole (*5099*) lay at the junction of the two slots. There may have been two posts held within some individual post-holes: some were unusually shaped, being oval with a flat central base and with deeper areas at each end (*5061*, *5065*, *5067*, *5069*, *5071*).

The fills of these features were generally mid grey/brown sandy silt, with occasional small and medium flints and chalk flecks. Finds were few, although some sherds of pottery suggested a 10th- or possibly 11th-century date for this structure, *i.e.* perhaps slightly later than Structure A.

Other features

Two distinct groups were noted amongst the thirteen pits within this enclosure. One lay in the north-west corner of the area, to the north of Building A and west of Building B; the other lay to the south of Building B, cutting some of the post-holes which formed Building A. A 10th-century lead rectangular plate brooch (SF437, Fig. 35) was found in the latter group.

Enclosure B

(Figs 5, 6 and 9)

Lying adjacent and to the north of Enclosure A, and sharing a common ditched boundary with it, was another enclosure. Its north and west sides were represented by lines of post-holes. The main corner post (*9073*) was much more substantial than the rest, being 0.8m deep, compared to the others which averaged *c.* 0.25m in depth. A small square structure measuring 5.5 x 5.5m (Structure A) was built into the corner of the enclosure (Fig. 9). Its east side was formed by beam slot and three post-holes, while two smaller post-holes indicate the line of the south side. The pottery from these features is very abraded and suggests an 11th-century backfill date.

Three pits lay centrally within this enclosure, one of which contained an unusual glass find of probable Roman date (p.58 below: SF558, Fig. 39). The pit itself (*9030*) was rectangular, measuring 1.62 x 1.27m, and was 1.08 m deep with a concave base. It contained a single fill (*9029*), a dark–mid grey sandy silty organic deposit with small flints and charcoal flecks. Other finds included

metalworking debris (1142g), shell (1218g), animal bone (1654g), fired clay (100g), and pottery (1534g) dating to the 10th–early 11th centuries.

A second group of three pits was located in the eastern part of this enclosure and close to its southern boundary. One, a large oval pit (*6002*) measured 2.4 x 2.7 x 1.12m and contained loamy sand fills, some with high ash content. Finds included metalworking debris (5976g), animal bone (1812g), 10th–early 11th century pottery (384g), lava (152g), fired clay (24g) and three small finds — a glass linen smoother (SF276), a hone stone (SF9) and a piece of copper alloy sheet (SF564).

Most other features within this area were post-holes, mainly located near the edge of the enclosure, although many of these were not excavated. The paucity of features within this enclosure suggesting that this was a fenced open space, possibly utilised for animal husbandry, with Structure A forming a smaller enclosure or stable-type building.

Enclosure C

(Plates I and II; Figs 5, 6 and 10–16)

This enclosure was defined by ditches on its north-west, south-west and south-east sides, with an 'entrance' in the south-west corner.

A single L-shaped section of ditch (*4284*) defined the two western sides of the enclosure; this feature also defined part of the south-eastern edge of Track A. In general the ditch was 2.10m wide with even sides, a flat base and a depth of 1.15m. The fills varied along its length. In some areas the initial fill was a loamy silt overlain with sandy silt deposits while elsewhere the fills were considerably more gravelly. The excavation of the ditch terminal suggests that it had been recut, but this was not evident in all the excavated sections. Finds from the backfill include animal bone (3750g), metalworking debris (1854g), lava (292g) and pottery (1669g), the majority of which was Thetford Ware of late 10th–early 11th century date. This quantity of material suggests that the ditch was used for the dumping of general refuse.

Two adjacent ditches (*4244* and *4268*) formed the southern edge of this enclosure, extending over 11m and continuing beyond the eastern edge of excavation. The sandy and silty nature of the fills suggest that they had probably been left open and allowed to silt up naturally rather than being purposefully backfilled. These ditches were slight in comparison to those marking the western edges of this enclosure, being only *c*. 0.5m wide and 0.15m deep. The slightly uneven nature of the base and edge indicated that a fence may have been built along its northern, internal edge. No finds were recovered from these features. The less substantial nature of this boundary suggests that it was in use for a relatively limited period of time. Stratigraphically this is clear, as a pit (*4230*: *Open Area A*, below) also dating to this period cut the backfilled ditch.

This enclosure contained three substantial buildings, their locations indicating that they were not contemporary, but sequential. The earliest was probably sunken-featured Building C. This was replaced by sunken-featured Building D, which was replaced in turn by Building E, a post-hole and post-in-slot structure. Spatially the earliest sunken-featured structure, Building C, was the most likely to be contemporary with the southern boundary of this enclosure, as it was positioned more centrally within it. The location of Building E close to this ditch suggested that the ditch was no longer a feature of the landscape by the time of its erection.

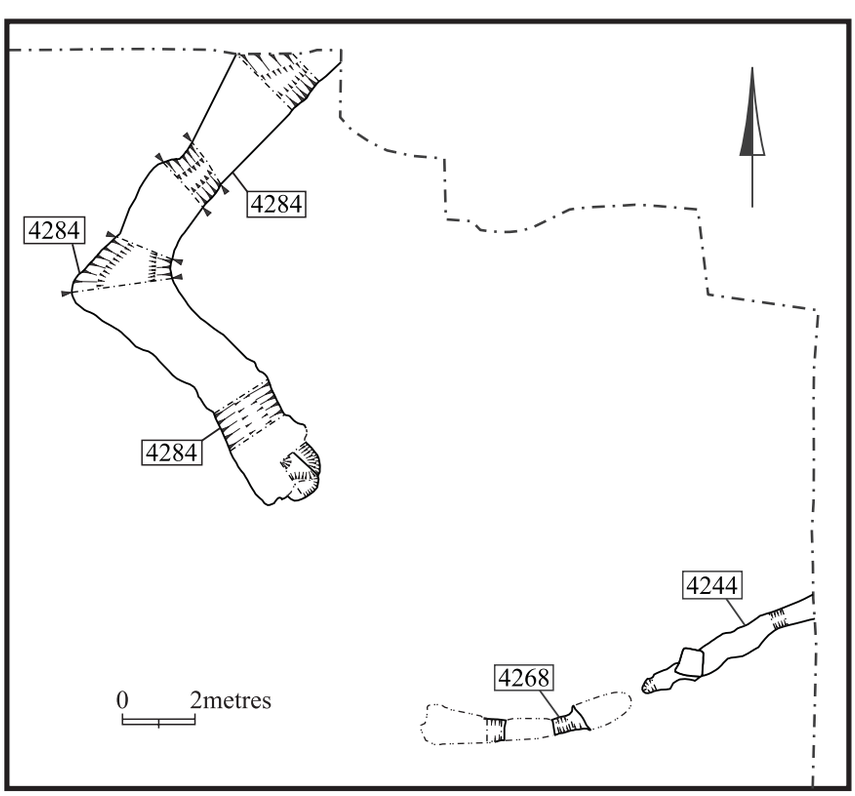


Figure 10 Boundary to Enclosure C: Plan. Scale 1:200.

Building C

(Plate I; Figs 5, 11, 12 and 13)

A sunken-featured building was located fairly centrally within this enclosure. This was made up of two main components: a large rectangular cut (*4045*) with associated post-holes, and a smaller rectangular cut (*4122*) perpendicular to the first, with a sloping and stepped base. The large rectangular cut measured 3.9 x 2.3m in plan, with its long axis running north-to-south, and was 1.5m deep. It was very regular in shape, with steep vertical sides and a flat base. It had been partially truncated on its east and south edges by later pits. Fourteen post-holes were cut into the base of the feature; all trace of one additional post-hole had probably been removed by later truncation. Of these probable fifteen features, six would have been arrayed along each of the long (north-to-south) axes, with three additional ones along the south end. At the north end there were no post-holes, but nine stake-holes were recorded.

The four corner post-holes (*4129*, *4133*, *4137*, *4140*) ranged in size from 0.18 x 0.16m to 0.33 x 0.30m. They were significantly deeper than the others (0.30–0.40m), indicating that they were the primary structural elements of the building. It is probable that these posts were removed after this building's disuse, as no post-pipes were evident. The three additional post-holes along the south edge (*4130*, *4131*, *4132*) were shallower (0.15–0.27m deep) and more 'dished' in shape than the four main corner supports. The post-holes down both long sides (*4134*, *4135*, *4136*, *4181* on the west side; *4141*, *4142*, *4143* on the east side) were sub-oval with fairly flat bases. This oval shape may have been created during the removal of the timbers that they had contained, or alternatively could be the result of the timbers rotting *in situ*. They ranged in size from 0.54 x 0.36 x 0.26 m to 0.23 x 0.19 x 0.08m.

The nine stake-holes at the north end of the building were typically *c*. 30–40mm in diameter and 40–50mm deep. It is possible that similar stake-holes had been located all round the edge of the sunken-featured building, but that only those at the north end were visible as they were cut into fine light yellow natural sand. Immediately to the south of these features the natural subsoil changed to a coarse gravel, in which it would not have been possible to identify features as small as these stake-holes.

A clay deposit (*4060*) survived around the edges of the cellared area. This was 0.04m thick, extended for 0.30m up the sides of the feature, and had apparently once formed a lining. Impressions on the back of the clay indicate that it had been pushed onto a wattle framework, probably erected to prevent the collapse of the natural sand and gravel edges of the cellar. The clay had been smoothed on its inner surface and painted with a chalk-based whiting. Along the west edge of the sunken-featured building the clay lining appeared to have been packed round the back of a structural post (post-hole *4134*), as the clay still retained its impression.

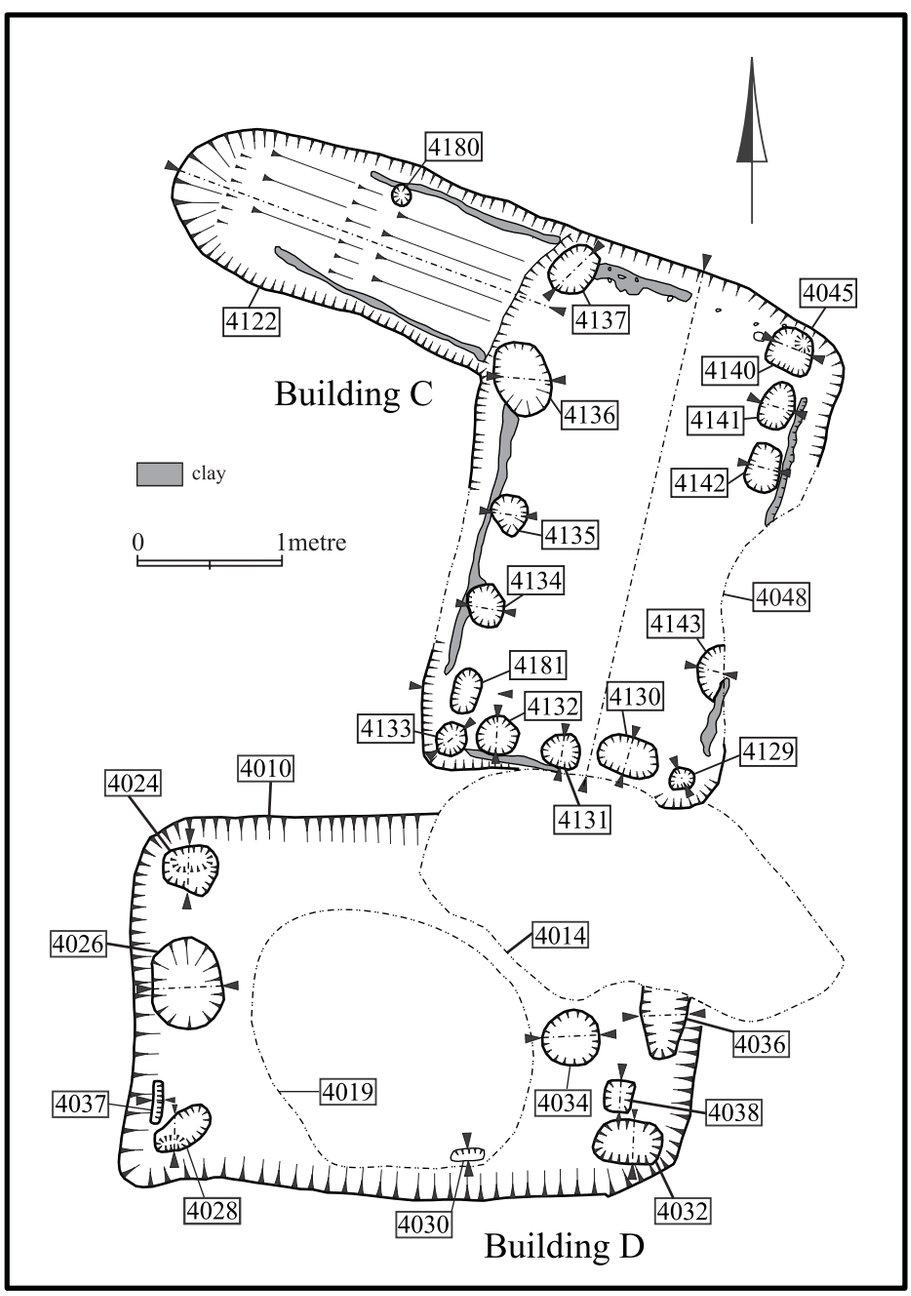


Figure 11 Buildings C and D: plan. Scale 1:50.

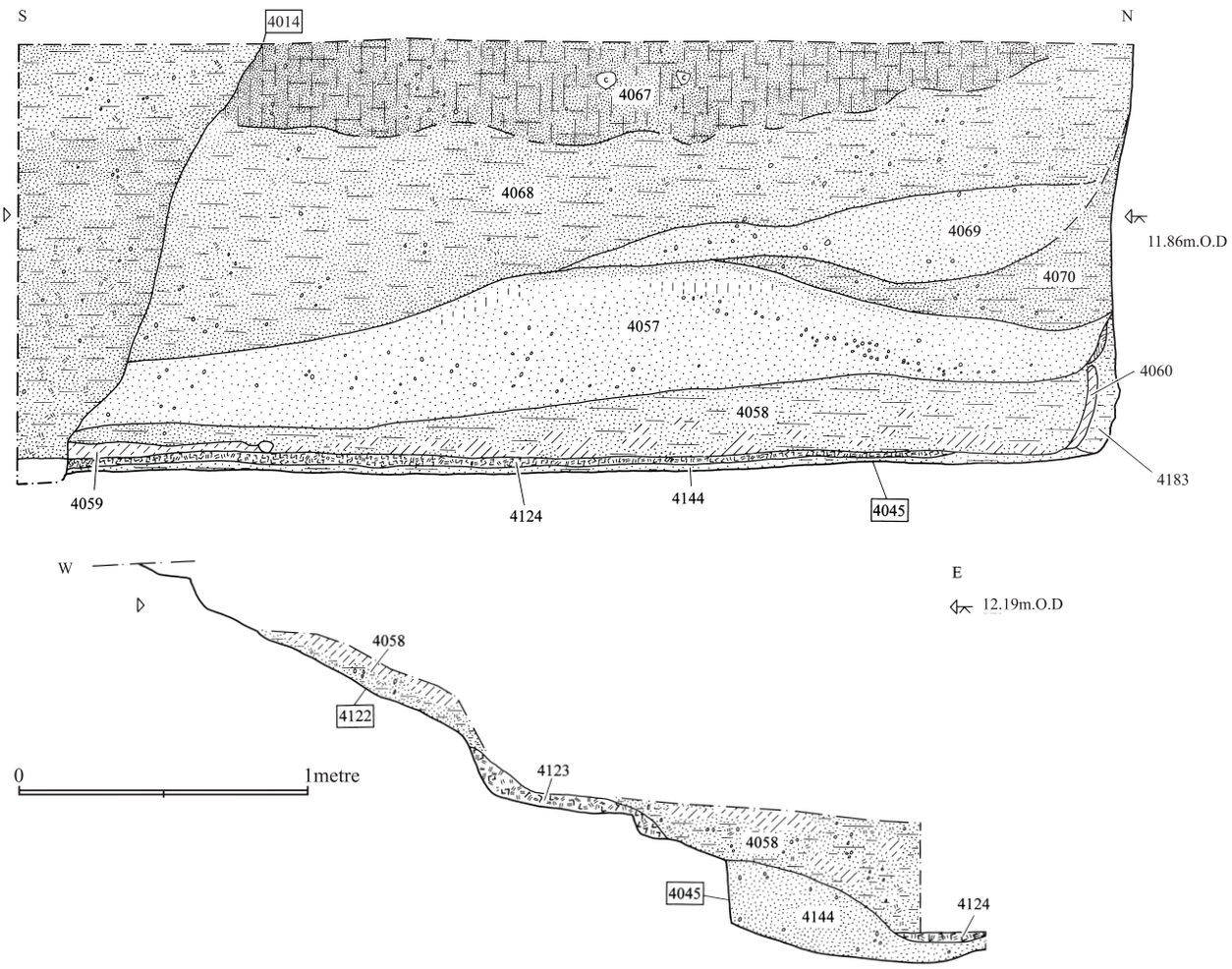


Figure 12 Building C: sections. Scale 1:25.

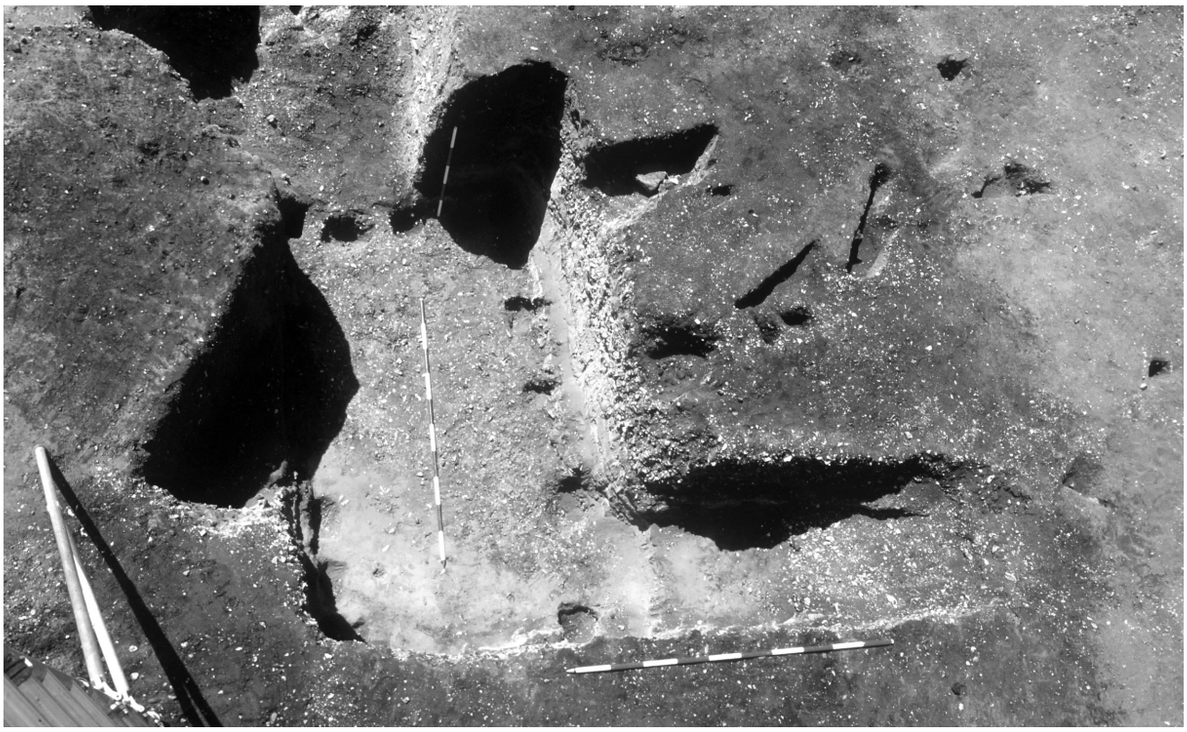


Plate I Building C. Fully excavated. Looking south.

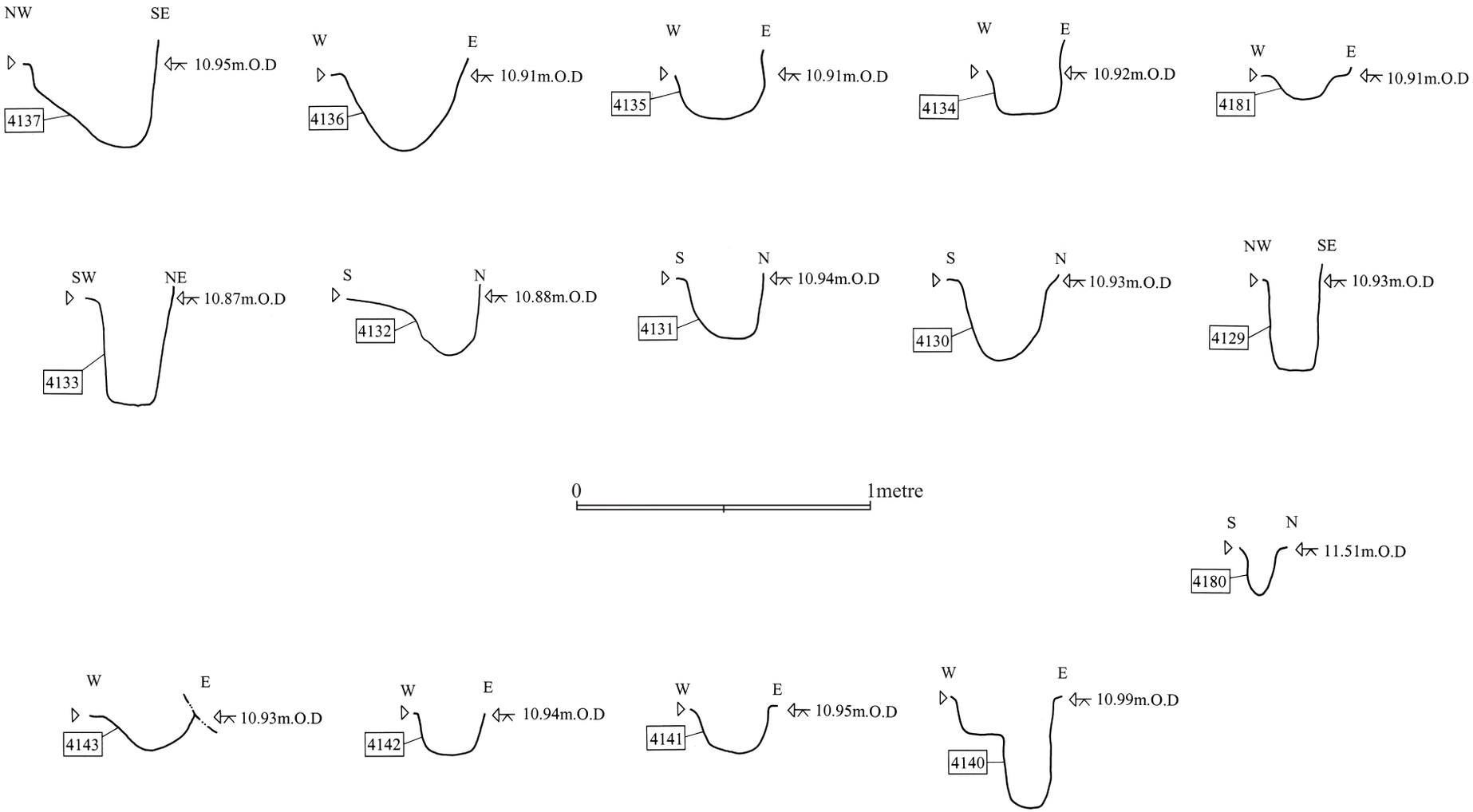


Figure 13 Building C: post-hole sections. Scale 1:20.

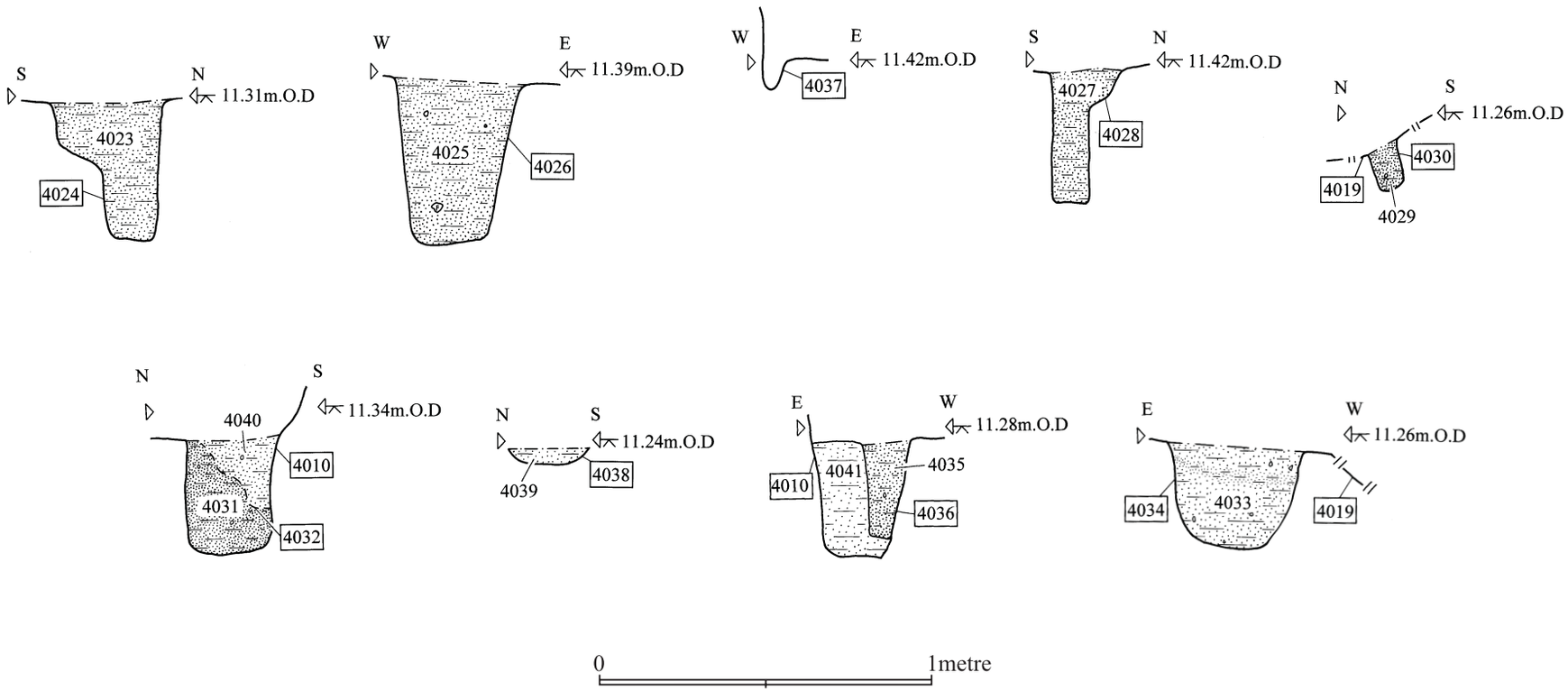


Figure 14 Building D: post-hole sections. Scale 1:20.

Although the evidence for the construction techniques employed survived well, no occupation deposits remained within Building C. This probably indicates that the area was keep clean, or that any flooring that may have been used had been removed during the destruction of the building.

The second element of this building, represented by cut *4122*, sloped down to the base of the cellared area. This measured 2.3m in length and was 1m wide. It was located at the north end of the building and extended out towards the west, apparently forming an entranceway and access down into the cellar. The base of this feature, which had been cut into natural gravel, was partially stepped; like the main part of the building, it was lined along both sides with clay. One circular post-hole (*4180*), with a pointed base and measuring 0.13 x 0.13 x 0.16m, was recorded halfway along its north edge.

All of the post-holes were filled with a mid–light brown sandy gravel with frequent small and medium pebbles (*4144*), which also formed the primary deposit in both the main chamber and the postulated entranceway leading to this cellar. Across the base of the building this was only 0.03m thick, and was probably the result of erosion from the sides. Above this was a 0.04m depth of light grey/black ashy deposit with small charcoal chunks (*4124*, *4123*), which resembled the residue from a bonfire.

Towards the south side of the cellar was a deposit made up of large chunks of clay (*4059*), which had once formed part of a clay lining (*4060*) but had since fallen from the sides of the cellar. This had collapsed in one single event, possibly during demolition, and lay face down on the ashy deposits. On top of this, and across the whole building, lay a mid-brown sandy silt (*4058*) containing many yellow/green clay chunks. This clay was the broken-up remains of the clay lining of the building. Many of these clay chunks retained impressions of the wattle or wooden framework to which the clay had adhered, and many also retained a thin layer of the whiting that had been applied to the face.

Once the demolition of the building was complete, the residual hollow continued to be filled by a 0.45m-thick layer of light orange/brown gravelly sandy silt (*4057*). This deposit incorporated a large quantity of clean natural gravel, perhaps derived from the digging of other features in the area. Two deposits then accumulated towards the north side of the building. The first was a silty rain-washed deposit (*4070*), followed by a fairly clean backfill deposit of natural gravel (*4069*). Sealing these and extending across the whole of the disused building was a deposit of mid grey/brown sandy silt (*4068*), with occasional flecks of charcoal and frequent small and medium pebbles. This deposit was 0.8m thick and constituted the bulk of the fill material. The final phase of backfilling was represented by dark grey sandy silty loam *4067*, with moderate flecks of charcoal and moderate small and medium pebbles.

Dating of this structure's demolition rests only on five sherds of Thetford ware in the ashy material at the base of cut *4124*. These might date to the 10th century, but this suggestion rests on the presence of one rim sherd. Sherds from the same vessel occurred in the demolition layers of both the main structure and the entranceway, again indicating deliberate demolition rather than abandonment. The remaining finds came from backfill deposits. The pottery (1562g) indicates a late 10th–early 11th century date for backfilling. Other finds include metalworking debris (3102g, including a smithing hearth bottom), animal bone (1158g), lava (168g), fired clay (54g), and unfired clay. Three iron artefacts (two nails (SF350 and SF352) and a heckle tooth (SF351)) were found within the upper fill.

Building D

(Plate II; Figs 11 and 14)

Located immediately to the south of Building C, closer to the southern boundary of the enclosure, was a second sunken-featured building (*4010*). This measured 3.8 x 2.5m, with its long axis running east-to-west. It had regular vertical sides and a flat base, and was 1.2m deep. In the base there were a number of cut features which represented structural elements of the building. The building had been heavily truncated in its central, northern and eastern parts by later pits.

In the base at the west end three post-holes and part of a slot were identified. These features were arranged with one in each corner (*4024*, *4028*), and one centrally close to the edge (*4026*). The corner post-holes were both sub-rectangular with flat bases, and measured 0.3 x 0.35 x 0.4m and 0.25 x 0.15 x 0.45m respectively. The central post was sub-oval with a flat base, and measured 0.43 x 0.65 x 0.5m. The profiles of the corner post-holes displayed 'steps', possibly caused by the removal of the timbers during demolition. The bases of most of the timbers may have rotted *in situ* as the post-holes contained deposits of dirty natural material. The central post-hole, however, had sloping sides, which could represent the working-loose of a timber in order to remove it. Small slot *4037* was probably an impression left by a horizontal plank, a series of which could have formed a timber lining to the cellar.

At the east end the arrangement of features was somewhat more difficult to understand. The north-east corner had been totally truncated by a later pit (*4014*). A post-hole in the south-east corner (*4032*) was sub-rectangular with a flat base, and measured 0.45 x 0.30 x 0.38m. While it corresponded to that at the west end, a nearby impression (*4038*) in the natural sand suggested that it may have been supported by a bracing post. Some post-packing was evident in the fill of the post-hole. The central feature (*4036*) was rectangular with a flat base, and measured 0.52 x 0.30 x 0.32m. This may, then, have been used to support other horizontal planks that retained the sides of this sunken area. Another feature (*4030*), measuring 0.25 x 0.09 x 0.15m, was identified in the centre of the south side. This was angled away from the sides, and may have been shaped in this respect by the removal of the timber. A single post-hole (*4034*) was located *c.* 0.80m in from the east side and halfway along its length. It was circular with a flat base, and measured 0.43 x 0.40 x 0.32m. This was probably the central load-bearing post at this end of the building, opposite central feature *4026* at the west end. Finds from the backfill of the post-holes included pottery and animal bone, along with very small amounts of metalworking debris and shell.

The lower fill within this sunken-featured building was a mid–light brown sandy silt with frequent clay lumps and moderate small pebbles, while the upper fill was a mid–light brownish-yellow sandy silty clay with occasional clay lumps, flecks and lumps of charcoal and frequent small and medium pebbles. Fill material seems to have accumulated fairly quickly, with a combination of natural deposits and deliberate backfill represented. Some clay lumps might indicate that clay had been used in the original construction. There was no evidence of the collapse of the sides of the building, supporting the idea that backfilling occurred soon after its demolition.

An 11th-century backfilling date was indicated by the pottery (398g). Other finds included animal bone (1290g), metalworking debris (192g), daub (74g) and an iron cheek piece from a snaffle bit (SF296, Fig. 36). The small size of the pottery assemblage overall suggests that the material was either the result of slow deposition over time, with no deliberate rubbish dumping taking place, or a single infilling episode

Plate II Building D. Fully excavated. Looking east. The central dark area is a later pit.

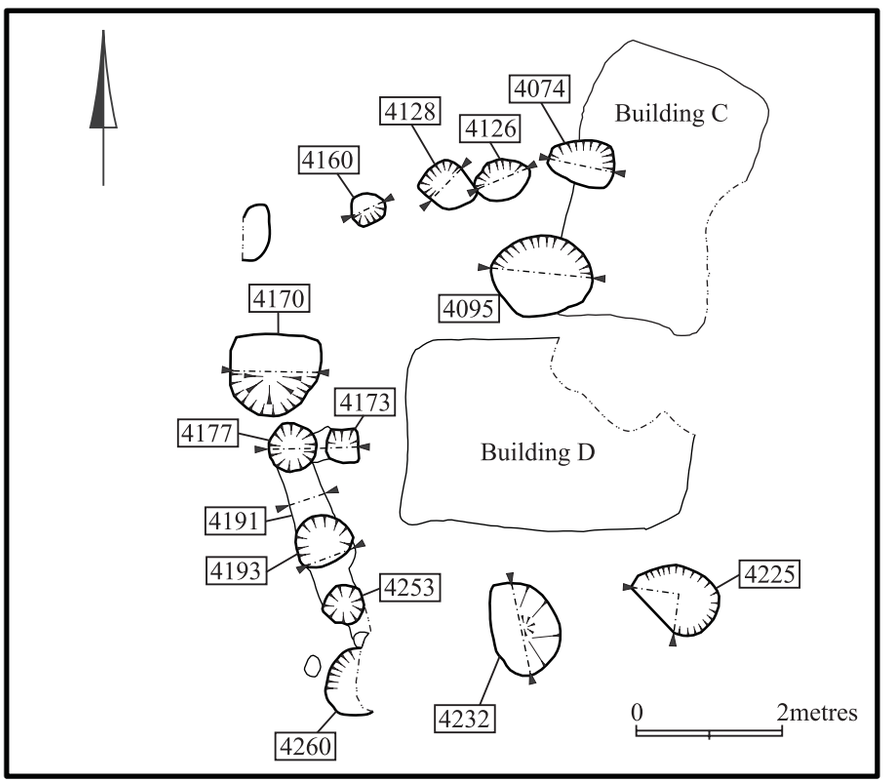


Figure 15 Building E: plan. Scale 1:100.

using surrounding soil. The latter interpretation is favoured, as rubbish pits dating to later in this period had been cut into the backfill.

Building E
(Figs 5, 15 and 16)
Also within Enclosure C was a third building, this time of post-hole construction. This was located close to the south, less substantial enclosure ditch, which suggests that this part of the enclosure boundary may have been backfilled and have fallen out of use by this time. The post-holes also cut into the backfill of Building C, while it covered the area once occupied by Building D.

This rectangular post-hole building was 5.5m x 7m in size, although its east end was not defined. The northern line of posts consisted of four excavated features and one unexcavated feature. The most substantial of this line of posts was that to the north-east (*4074*). Its lower fill (*4093*) contained many lumps of limestone and chalk post-packing material. The upper fill probably represented backfilling of all these features following demolition. All the other three post-holes were more heavily truncated from above, and contained a dark brown sandy silt.

Approximately 1m further to the south, two more substantial post-holes (*4170*, *4095*) were excavated. That to the west was oval, and again the post that it contained appears to have been removed. That to the east was very similar in size and contained large pieces of limestone and chalk, probably the remains of post-packing. Three posts delimited the south end of the building, although these had been damaged by later truncation. The west side of the building was defined by a beam slot and three post-holes. In one of these (*4117*) the post-pipe was clearly evident, with flints and chalk serving as post-packing.

Only seventeen sherds of pottery were recovered from these features, indicating an 11th-century date.

Other features
Six pits dating to this period were recorded within this enclosure, of which two were later than Buildings C and D. A number of small post-holes were also located, though their function is unclear.

Open Area A

(Figs 5, 6 and 17–21)
This area was defined to the north and west by Tracks A and B, although there was no evidence of a ditched or fence boundary between them. It was bounded on its southern side by Enclosure B, while Enclosure C was located to the north-east. The majority of the features in this area were pits, many containing evidence of metalworking, although a number of small post-holes were recorded close to Enclosure C. One hearth and two isolated graves were also excavated.

Rubbish pit
(Figs 6 and 17a)
To the south of the sunken-featured buildings, and cutting an earlier Period 3 ditch, was refuse pit *4230*. This was circular, with a diameter of 1.35m, a depth of 1.3m and a concave base. The lower fills were sandy, some with an organic content that was also present in the upper fills, along with inclusions of lumps of burnt and unburnt clay. Finds included animal bone (1172g) and pottery (1330g). All of the pottery was Thetford ware, and the rim forms suggested a 10th-century date. Small finds included an antler comb (SF415, Fig. 42), bone offcuts (SF589), an iron buckle frame (SF450, Fig 35) and an iron coin die (SF479, Fig. 37). In shape and size, this pit was typical of many of those on the site.

Hearth A
(Fig. 5)
Hearth *4005* was sub-circular, with a concave base, and measured 1.64 x 1.34 x 0.35m. It contained a single fill of dark grey sandy silt, with frequent flecks of charcoal and occasional flecks of chalk and clay. Some large pieces of hearth lining remained *in situ*. Finds included metalworking debris, charcoal, fired clay, 37 sherds (378g) of 10th–11th century pottery, and animal bone (298g), as well as six nails, a heckle tooth (SF175) and iron tongs (SF284, Fig. 37). Smithing hearth bottoms and vitrified hearth lining were also found.

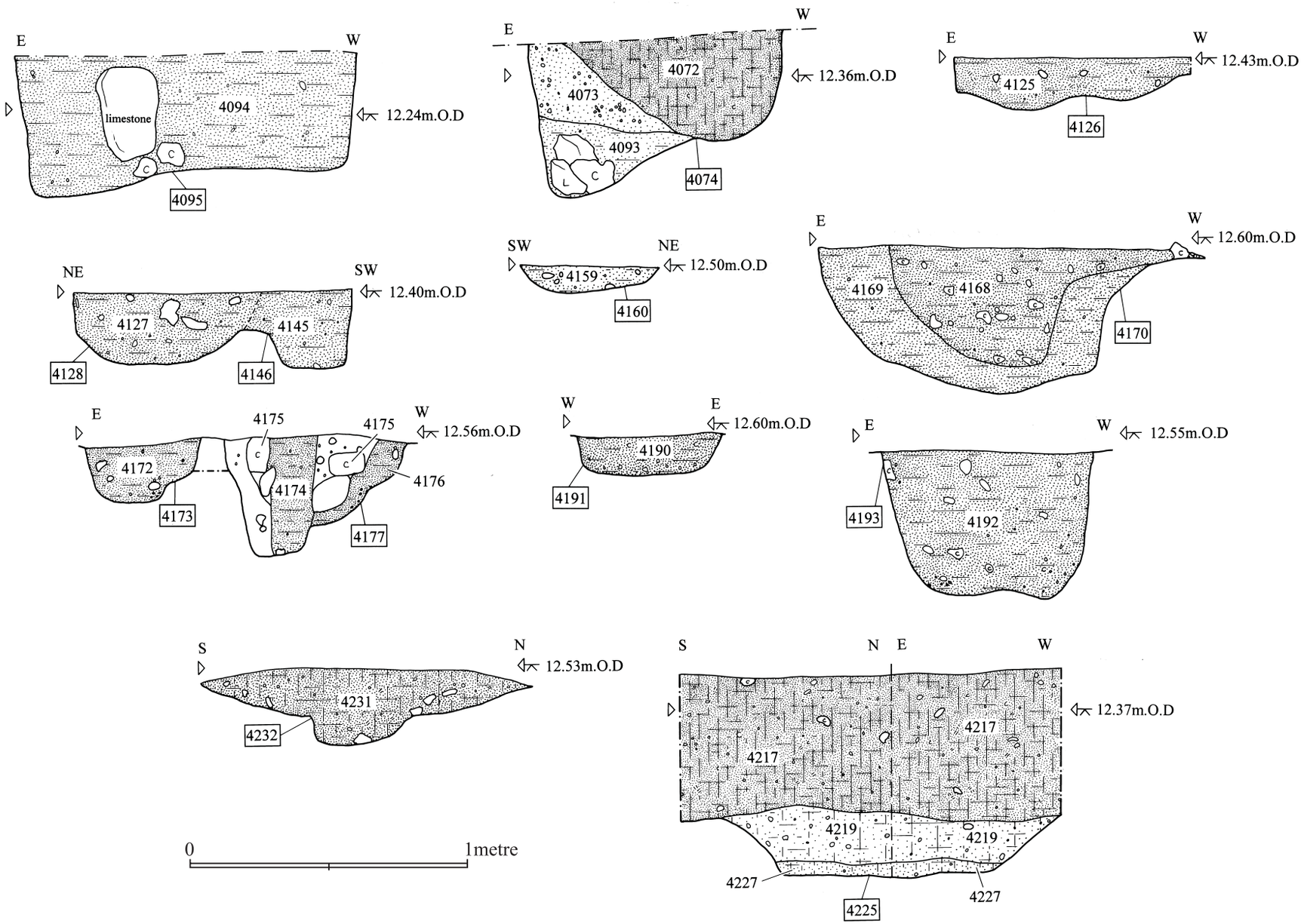


Figure 16 Building E: sections. Scale 1:20.

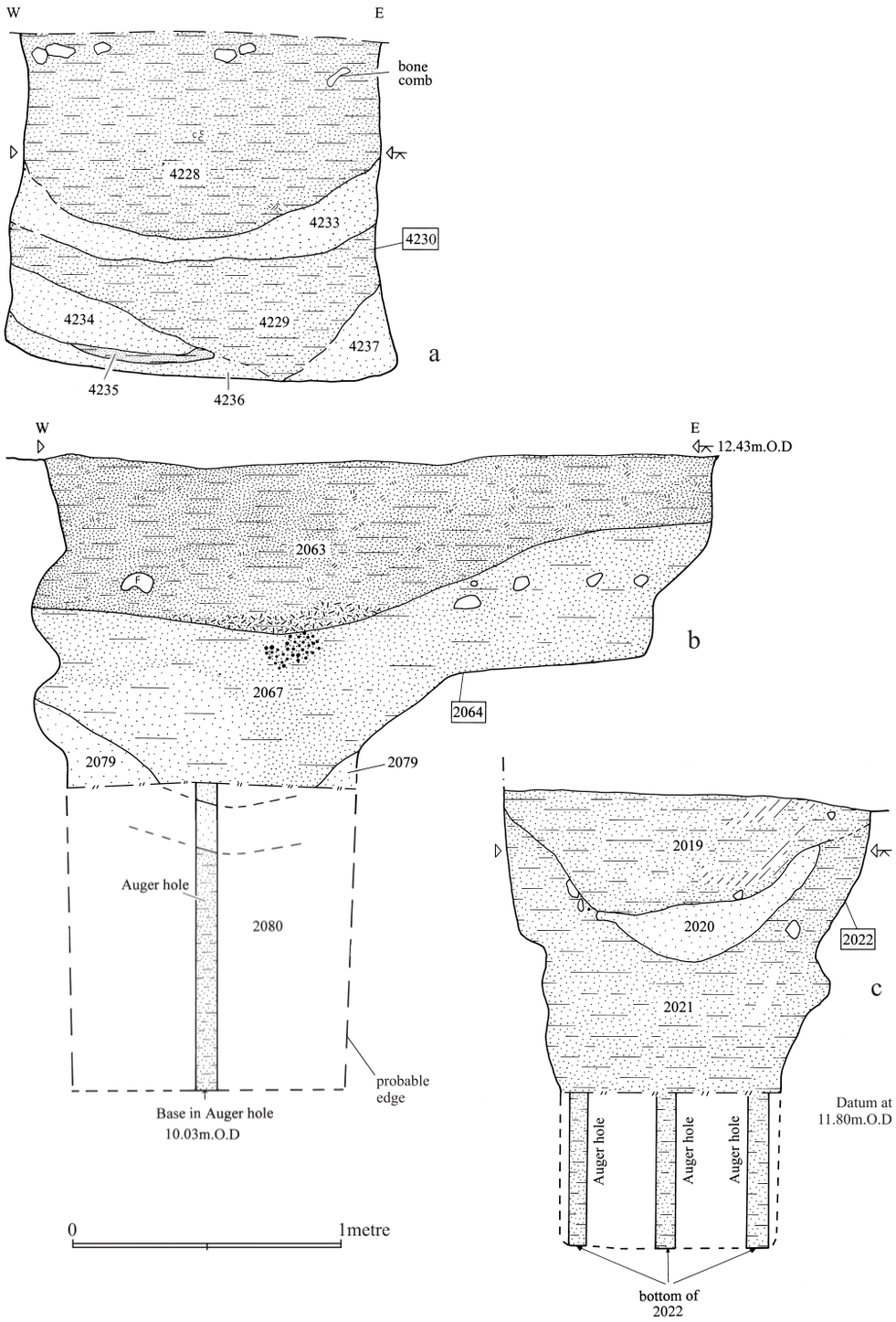


Figure 17 Pit sections: *4230*, *2064*, *2022*. Scale 1:25.

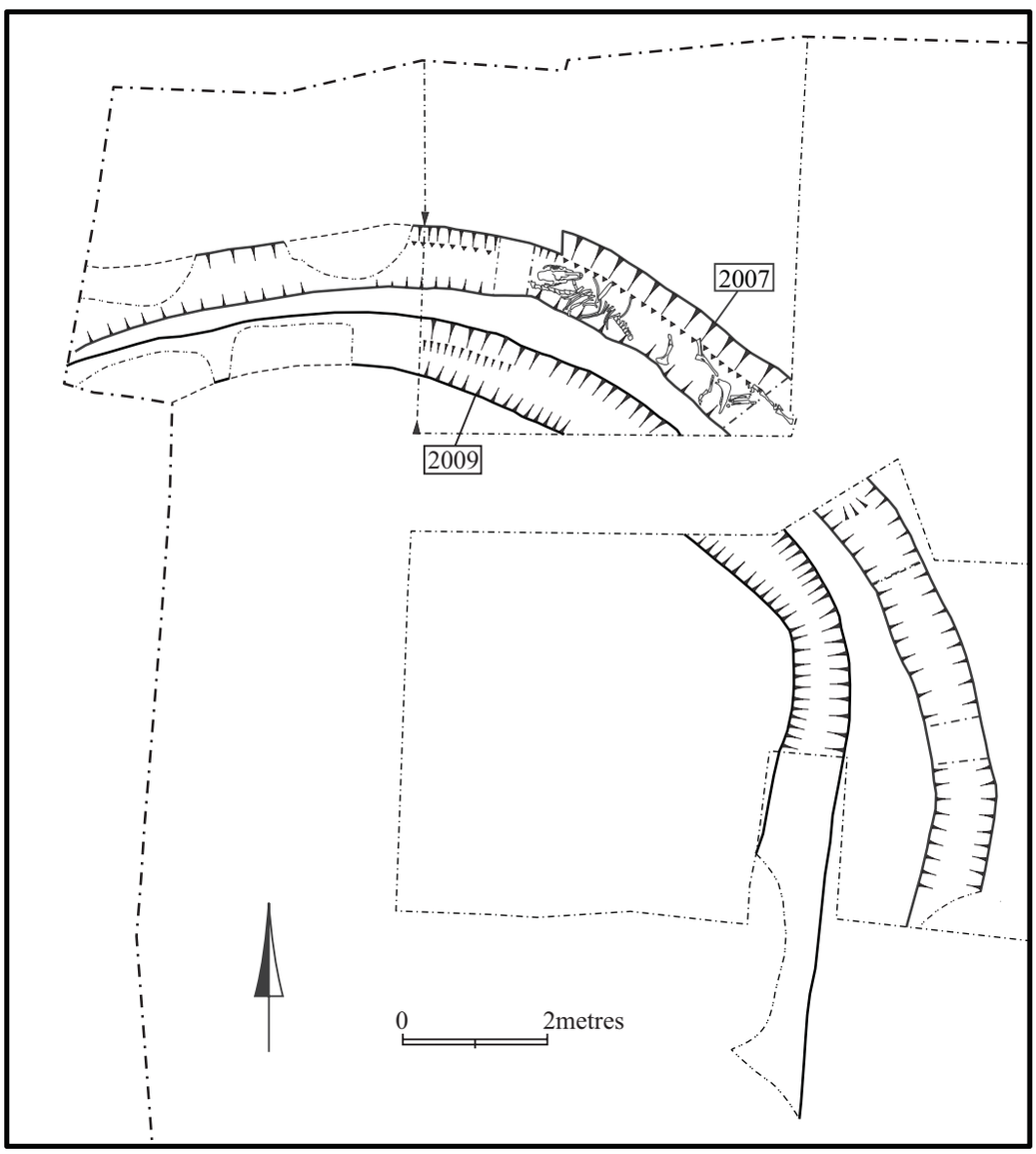


Figure 18 Curvilinear features: plan. Scale 1:100.

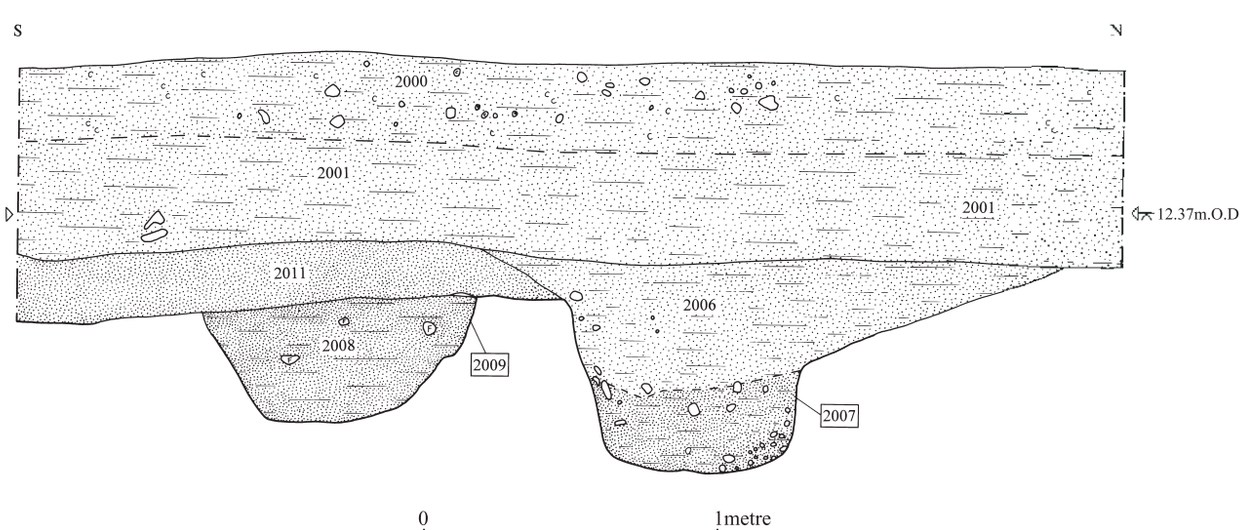


Figure 19 Curvilinear features: section. Scale 1:25.

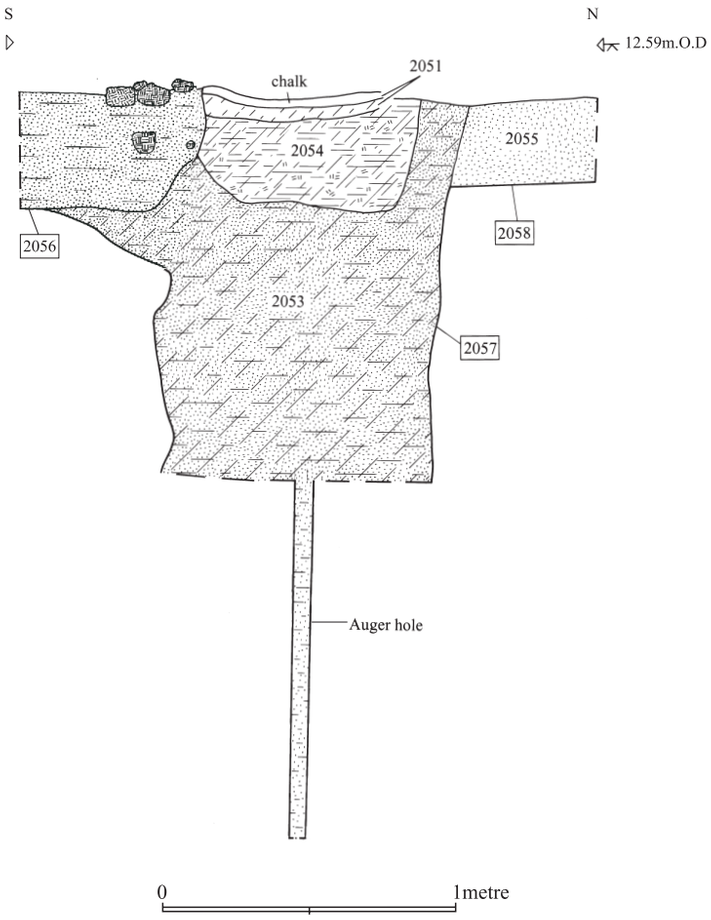


Figure 20 Well A: section. Scale 1:25.

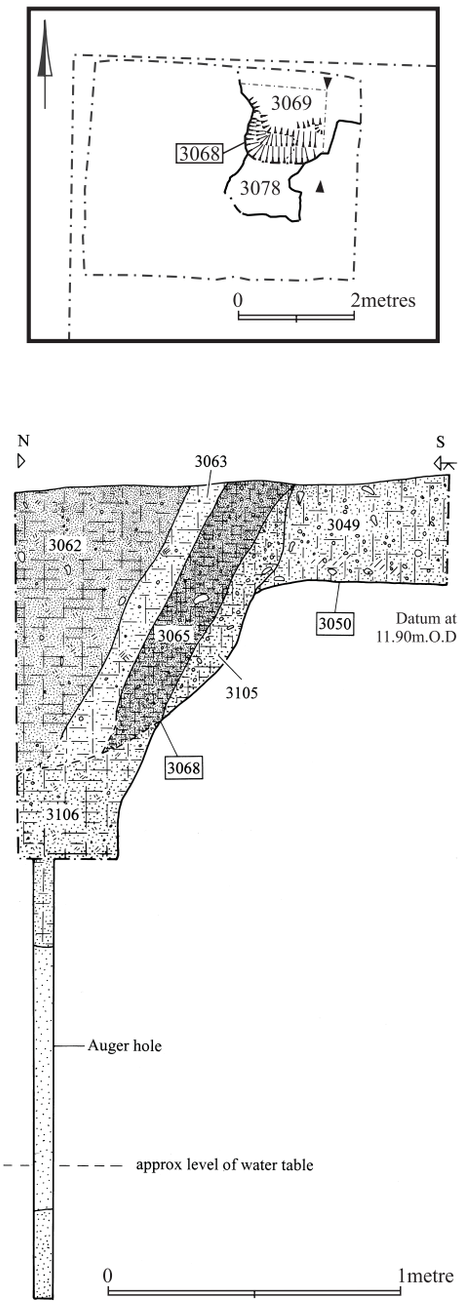


Figure 21 Well B: plan (scale 1:120) and section (scale 1:25).

Graves
(Fig. 6)
Two graves lay on the western side of this enclosure and encroached into the area of Track B. Grave *4050*, orientated broadly east-to-west, was rectangular (1.6 x 0.6m) with a flat base, and contained an inhumation burial. The skeleton (*4052*) was supine, with its head to the west. Animal disturbance had occurred, particularly on the south side, with ribs being misplaced.

Rectangular grave cut *4247* was orientated north-east to south-west. This grave was cut by a pit (*4259*) and only the skull, the lower legs and few other bones survived. Two iron nails (SF478 and SF477) were recovered from the fill, possibly indicating that there was once a wooden coffin.

Open Area B

(Figs 5, 6 and 18–21)

Located to the west of Track B, this area appeared to have been totally unfenced as no evidence for any boundaries was observed. A probable structure, two curvilinear ditches, thirty-two pits, two wells and nine post-holes were excavated within it.

Structure B
(Fig. 5)
In the north-west corner of Area 3 two possible beam slots were excavated, running at right-angles to each other. One extended beyond the west edge of excavation while the other was truncated by a well, also dated to this period. These were of similar dimensions, being *c*. 0.5m wide and 0.2m deep.

Curvilinear features
(Figs 18 and 19)
Two curvilinear ditches lay adjacent to the western edge of the site in Area 2. They extended beyond the edge of excavation, curving in from the west and turning to the south. Although these features ran almost parallel to each other they were not contemporary, stratigraphic contact showing that the inner of the two (*2009*) was earlier than the outer (*2007*) (Fig. 19). The southern terminal of both ditches was obscured by a mass of other features, but they almost certainly terminated within the area of excavation.

The earlier ditch (*2009*) was 0.9m wide and varied in depth between 0.56m and 0.4m. Its fill was a dark brown sandy silt with occasional small and medium flints and charcoal flecks. Finds included animal bone (1860g), lava (456g), metalworking debris (150g), fired clay (54g), a piece of antler waste (SF129) and one iron nail shank (SF358). Sixteen sherds of Thetford ware (426g) were found, although there was only one rim sherd, which suggested a 10th- or 11th-century date. Parts of a human skeleton were also recovered from the top of this ditch. However, it was not possible to distinguish whether a grave had been deliberately dug here or if the body had been deposited during the backfilling of this feature, as a later pit had been cut through this area, disturbing the burial.

The later feature (*2007*) was of slightly greater radius and was flat-bottomed throughout its length, with almost vertical sides. From where it was first identified at the western edge of excavation, over a distance of 6.5m, it was 0.8m in width and 0.53m deep. At this point the ditch became wider, displaying a flaring outer edge. Close to this point of change, a dead horse had been placed at the bottom of the ditch. The skeleton was articulated but had been divided into large disjointed segments. All the leg components were placed together to the south-east of the pelvis. The pelvis was not attached to the sacrum and lumbar vertebrae. The spinal column was complete but the skull was detached from spine, and the lower jaw placed with the legs to the south-east. The ribs had collapsed and splayed at many angles, suggesting that the corpse had at least partially decomposed prior to backfilling. A mid–dark grey sandy silt filled the ditch; finds included pottery (918g), lava (868g), metalworking debris (1600g) and shell (218g). The ceramic assemblage is mainly 10th-century, with a few later 10th–11th century sherds.

The curvilinear nature of these features is unusual, and their function remains elusive. Only three features were identified within the area defined by these ditches, although these do not appear to be related to the ditches in any way.

Well A
(Figs 5 and 20)
Well *2057* lay in the northern part of Open Area B. It had probably been circular, with a diameter of 1.3m, but its shape was obscured by later features also dating to this period. The shaft had vertical sides, although some irregularities indicated slippage of material. The lower fills were augered to a total depth of 2.5m (to *c.* 9.9m OD), but the base of the feature was not reached. The main excavated fill *(2053*) contained large lumps of metalworking debris (2000g) along with animal bone (1542g), pottery (704g) suggesting an 11th-century backfill date, and small quantities of fired clay (48g).

Well B
(Figs 5 and 21)
A second well (*3068*) lay some distance further to the south, and had cut through part of Structure B. The outline of this feature was irregular in plan, although the main shaft of the well was rectangular with rounded corners. Its upper part was less steep, especially to the south-west. The upper sides of the feature were lined with a hard-packed yellow clay (*3069*) with some small flints and flecks of burnt clay and chalk, which also formed a surface (*3078*) lying to the south of the cut. The inclusions in the clay probably acted as a temper, helping it to adhere to the underlying material.

The feature was excavated to depth of 1.2m, and augered for a further 1.5m to *c.* 8.2m OD, but its bottom was not reached due to the hard stony nature of the underlying deposit. The lowest fill augered was a cessy waterlogged sand. Above this lay a 0.9m-thick deposit of sand. The present water table was reached at 8.6m OD.

Of the excavated fills, the lowest (*3106*) was a mix of old topsoil and redeposited natural sand; it contained some animal bone but no datable artefacts. Above this was deposit *3105*, the fill of the beam-slot of Structure B, which had slumped down into the well. The existence of this earlier feature explains the absence of the clay lining deposit here, as it would have collapsed into the well along with loose fill material. A steeply-profiled dump of material (*3065*), consisting of black sandy silty loam with flecks of clay, charcoal and burnt clay, lay above this. Following the same steep profile was a light yellowish-brown sandy silty loam (*3063*), again a mix of redeposited natural sand and ancient topsoil. The uppermost fill of this feature (*3062*) was a dark grey sandy/silty loam with occasional lumps of chalk, flecks of charcoal, burnt clay and clay. Finds recovered from the well included animal bone (2822g, some butchered), fish bone, fired clay (260g), and metalworking debris (134g). Only ten sherds of pottery (167g) were found, and these suggest an 11th-century date for the completion of the backfilling process.

Pits
(Figs 6 and 19)
Four of the pits within this area have been interpreted as cess pits. Only two of them are described here, *2064* (Fig. 17b) and *2078*. These were both very similar in form and size. Both had wide tops, narrowing to near-vertical shafts which were offset to one side. The shaft of *2064* was 1.05m wide and augered to a depth of 2.3m, while *2078* was 1.3m wide with a flat bottom at a depth of 2.45m. The flared tops measured 2.5m and 2.8m (east-to-west) respectively, but the north-to-south extents could not be identified due to the presence of intercutting features.

The lowest fill of pit *2064* was a greenish-grey sandy silt (*2080*). This was investigated by auger only, and was moist and cessy. Above this was a yellow sand deposit 0.18m thick (*2079*), which could have slumped in from the sides, or perhaps was deliberately spread to seal the lower fill. In the top of the shaft, and extending across its wider part, was a mid greenish-grey sandy silt (*2067*), which appeared to represent a second phase of waste disposal.

Similarly the lower fill of pit *2078* was not excavated but augered. Above this deliberate backfilling or slumping seems to have occurred on both the east (*2075*) and west edges (*2077*) of the feature. This was followed by the deposition of a very hard iron-rich flint deposit (*2076*), which had bonded into a large semi-solid mass. Sealing this was a mid greenish-brown sand with occasional sand lenses (*2072*) representing cessy material, above which lay redeposited natural (*2074*, *2073*) and rubbish deposits (*2071*, *2069*, *2068*). The upper fills of both features were very similar.

Finds from these features included the usual assortment of domestic refuse including pottery, generally of 10th-century date, and some metalworking debris. Metal finds included a broken iron needle (SF441), a heckle tooth (SF424), a knife blade (SF371), a broken 9th–10th century strap-end (SF425, Fig. 35) and a coin of Constantine dating from AD 330–5. Pit *1064* contained twelve sherds of Thetford ware, including five jar rims suggesting a 10th-century date. Pit *2078* contained 21 sherds including Thetford Ware, St Neot's ware, one sherd of Grimston Thetford ware and one of Early Medieval ware. Excluding the latter two sherds, which are highly abraded and probably intrusive, the pottery assemblage indicates a broadly contemporary date for pits *2064* and *2078*.

Two rubbish pits, *2022* and *2060* (Fig. 17c) lay further to the west (Fig. 6). They were of similar dimensions (*2022* being 1.4m x 1.9m and 1.7m deep, and *2060* 1.75m in width and 1.8m deep), with almost

vertical sides. The primary fill of *2022* was a very organic mid-brown sand silt including small quantities of domestic rubbish (80g of pottery and 36g of animal bone). This was sealed by a deposit of yellow sand that had collapsed in from the side of the feature. The upper fill was a mid-brown sandy silt backfill, the finds from which included possible hearth debris (patches of burnt and unburnt clay) as well as pottery (344g) and animal bone (952g). The other pit (*2060*) contained a single fill similar to the upper and lower fills of *2022*. The undercut sides indicate some collapse. Finds again included pottery (178g), animal bone (634g) and fired clay (264g). The pottery from both these features indicates a 10th-century date.

Located in the south part of this area were two pits (*3082, 3117*) which had apparently been lined. Both were only partially excavated, as they extended beyond the limits of excavation. Series of stake-holes present in their bases suggest that stakes were used to retain planking, or to support wattle and daub lining the edges of the pits. The fills of these two pits contained daub (867g), pottery (1641g) indicating an 11th-century backfill date, animal bone (8112g) and shell (142g). An iron handle hinge fitting (SF396, Fig. 38) and a decorated binding (SF397, Fig. 38), both for use on boxes, were also found.

Many of the pits in Open Area B — *3116* in particular — contained metalworking debris. Unfortunately only a very small part of the upper fill of *3116* was investigated, as most of it lay outside the excavation area. Its upper fill was a mid grey/brown sandy silty loam with moderate lumps of clay, some of which were burnt, and frequent charcoal flecks. Finds from the upper fill included a large quantity of metalworking debris (1454g), some worked stone and a small amount of animal bone (48g). The inclusions, and the quantity of metalworking debris recovered from an essentially 'unexcavated' feature, all point to this pit being closely associated with metalworking.

One further pit (*3034*) stands out from the others in this area by way of its finds assemblage This circular feature in the southern part of this area measured 1.74 x 1.7 x 1.35m and was very steep-sided, with a single fill. As well as the usual assemblage of pottery (695g), animal bone (1798g), fish bone, shell (150g) and metalworking debris (560g), it also contained a number of objects related to craft activities. These included an iron awl (SF329, Fig. 37) for leather or textile working, an iron knife tang (SF332) and an iron needle or pin (SF331). The pottery suggests a 10th-century date for this material.

Open Area C

(Figs 5, 6, 22 and 23)

Located in the north-eastern part of the site, this area lay to the north of Track A, being separated from it by a ditch recorded during the 1973 evaluation excavation (Rogerson and Dallas 1984, 64). Its north-western boundary was also demarcated by a ditch (*1114*), although this was probably a later addition to the layout (see below). Within this area one structure and five pits were excavated. The pits were mainly located in the northern part of this area; since the boundary to this area was a later feature, they may have been more closely associated with some of the features in Open Area D.

Structure C

(Figs 5, 22 and 23)

This consisted of sixteen post-holes arranged in a broad L-shape, on a north-east to south-west to south-east alignment. All were oval or circular, with flat or slightly concave bases. They varied in size and depth (the deepest being 0.18m), although this variation was probably due in part to greater truncation in the southern area occupied by this group rather than reflecting any functional significance. All of the post-holes were filled with a similar mid grey-brown sandy silt with occasional small flints and flecks of charcoal. Finds recovered included small amounts of animal bone, metalworking debris and eight small sherds of pottery of 10th–12th century date. These were almost certainly intrusive pieces introduced following the decay or removal of the posts.

Open Area D

(Figs 5, 6, 24 and 25)

No structural features were identified within this area, which lay to the north of Track A and Open Area C. Twenty pits, two post-holes and three small linear features were excavated. It is probable that this area, along with Open Area C, formed a single open space during the early

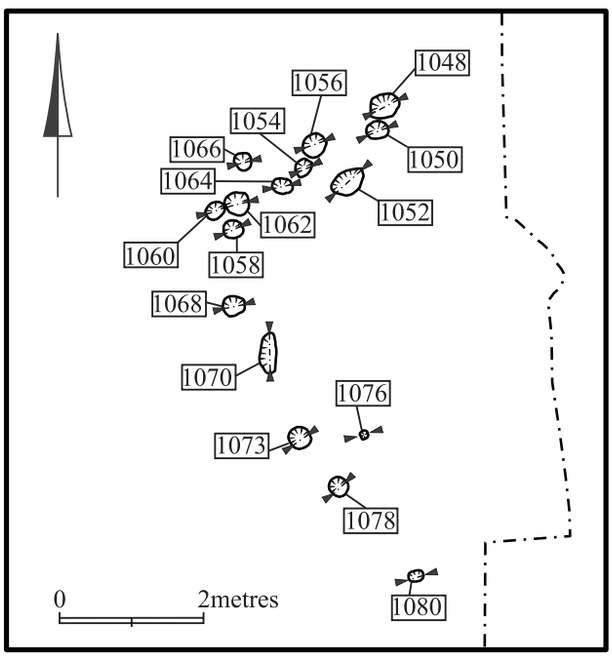


Figure 22 Structure C: plan. Scale 1:100.

part of this period, which was later sub-divided by ditch *1114* (Fig. 24). This ditch was fairly substantial, being 2.8m wide at the top. The north-east edge was stepped and flaring compared with the south-west edge, which was noticeably steeper. The lower fill (*1113*) was deposited by erosion of the sandy sides of the ditch. The upper sandy silt fills contained many finds, including pottery (405g), animal bone (510g) and metalworking debris (4114g). Small finds included three horseshoe nails (SF463, SF462, and SF460), three other nails (SF465, SF386 and SF385), an iron buckle pin (SF464), lead metalworking waste and spillage and a cast silver coin flan (SF164), possibly intended for the manufacture of a counterfeit Roman *denarius* of the 1st–3rd centuries AD. The pottery indicates a backfill date in the late 11th century.

Pits

(Figs 6 and 25)

Twenty pits were excavated in this area, one of which contained an unusual assemblage of finds. This pit (*1149*) appeared circular (*c.* 1.65m diameter), although it extended beyond the edges of excavation and its total depth was not established. The lowest excavated fill was a dark brown silty sand containing many finds, including shell (220g), animal and fish bone (2894g), fired clay (614g), pottery (2370g), lava (130g) and metalworking debris (700g). Iron finds included tweezers (SF360, Fig. 37), a heckle tooth (SF361), a nailed binding of a type used on stave-built wooden buckets (SF363, Fig. 38) and five nail fragments. Three bone objects consisting of a skate (SF387, Fig. 41), a spindle whorl (SF389) and a horn and bone double-sided comb (SF503, Fig. 42), as well as a bone off-cut. Copper alloy artefacts include two matching D-shaped buckles (SF391 and SF392, Fig. 35) of a type most commonly found in 9th–11th century deposits. A harness fitting from a bridle check piece (SF393, Fig. 36) dated to the 10th–12th centuries, and a Carolingian copper alloy brooch (SF390, Fig. 35) of *c.* 800, were also found. Cereal grains were common within the sample taken from *1149*, perhaps suggesting cereal processing. The pottery recovered included a large group of identifiable forms, which is unusual for this site. The size of the sherds and the presence of several joining sherds suggest deliberate dumping of household waste. The pottery indicates a 10th–11th century date for this.

Only one pit (*1123*) displayed any evidence of having once been lined (Fig. 25). This pit was excavated to a depth of 1.15m and augered to

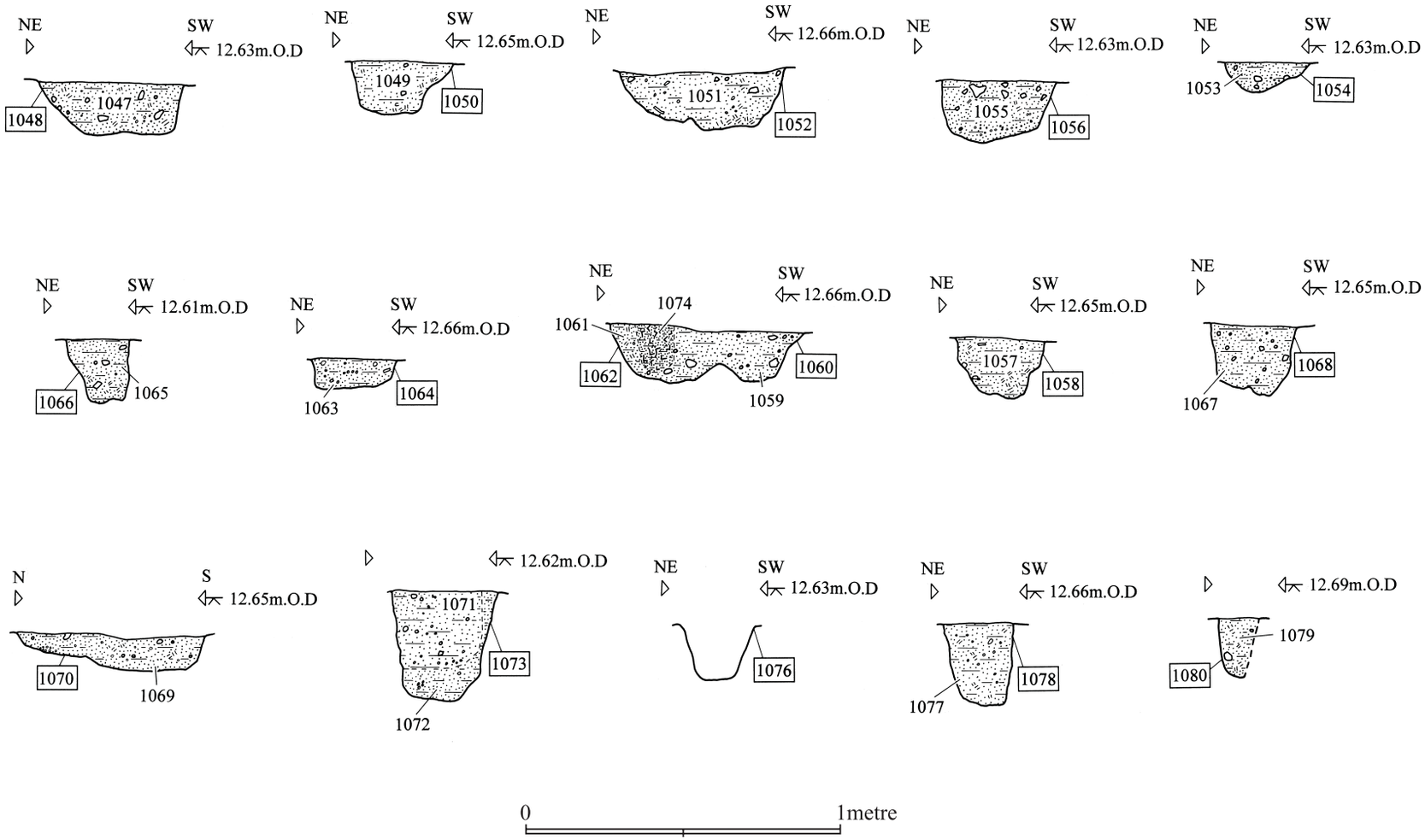


Figure 23 Structure C: sections. Scale 1:20.

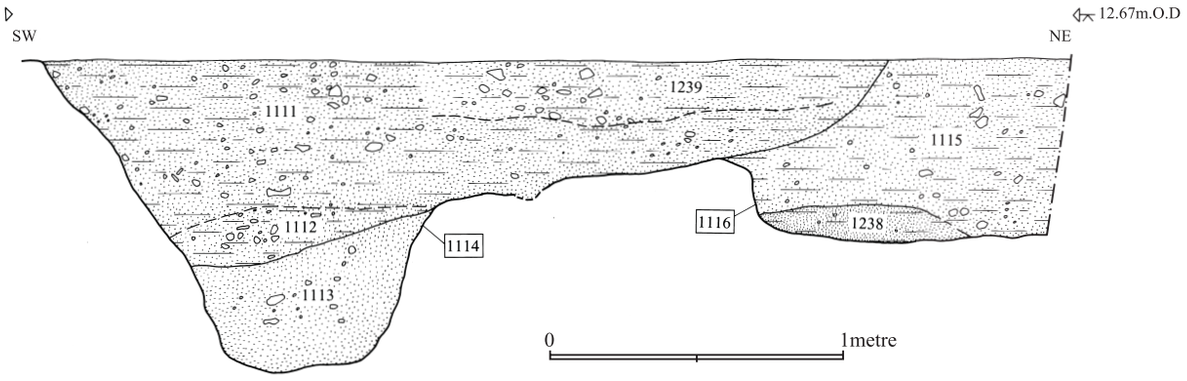


Figure 24 Boundary between Open Areas C and D: section. Scale 1:25.

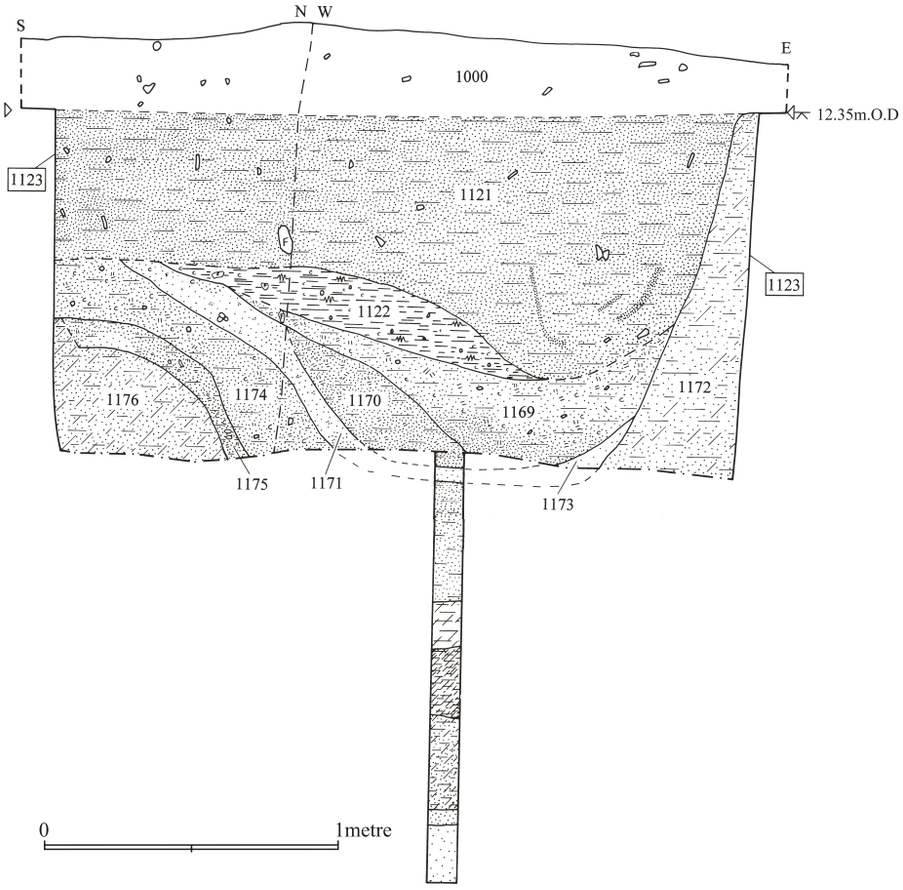


Figure 25 Pit section: *1123*. Scale 1:25.

a depth of 3m. It appeared to be square but extended beyond the edge of the excavation, and was not fully exposed in plan. Deposits *1172* and *1176* at the edges of the cut may represent redeposited or slumped natural that would originally have been held back by shuttering, presumably wooden. Once the shuttering had decayed the sides would then have slumped down into the feature. The lower augered fill was a very dark brown/black deposit with green flecks and inclusions of fired clay and charcoal. Other lower fills were very silty, with a high organic content. Upper fills included slumped or redeposited natural. Finds from this pit included industrial waste (992g: lithage cake, smithing hearth bottom, vitrified hearth lining), a broken scabbard chape (SF376) and a broken plate from a hooked tag (SF373). The pottery assemblage (328g) dates to the mid-11th century.

Hearth B

(Fig. 5)

A hearth (*1147*) had been cut into the top of an earlier feature. It was 1.5m wide, had a concave base and was 0.3m deep. The lowest fill was a reddish-brown clayey silty sand with flecks of chalk; above this was a very dark reddish-brown silty sand with frequent burnt clay flecks. These two deposits appeared to form the base of the hearth, which was later backfilled with dark brown sandy silt containing metalworking debris (396g), animal bone (318g), pottery (750g) of mid 10th–early 11th century date, fired clay (128g) and two iron nails (SF577 and SF583).

Open Area E

(Fig. 5)

This area lies in the eastern part of the site, between the areas of main occupation and the Little Ouse River. Very few features were present in this large area, with only four pits dating to this period being identified. It is possible that this area may have been meadowland.

III. Period 4: early medieval (11th–12th centuries)

(Figs 26–30)

The early medieval period saw a dramatic decline in activity, with only sixty-six features belonging to this period. The finds assemblage included a large quantity of residual material. It is only the identification of diagnostic sherds within feature assemblages that has allowed individual features to be dated to this later period. There was a concentration of features in the western half of the site, and a small group on the river terrace, but the rest of the site seemed devoid of activity. No structures were noted. The stratigraphic evidence was confined to pits and a well, although it is interesting to note that metalworking continued to be an important activity.

Pits

(Figs 26–8)

Forty-eight pits were dated to this period. Two pits in the western part of the site, *2016* (Fig. 27a) and *2039*, displayed similar backfilling processes, although whether they were originally excavated for the same purposes is less certain. Both appeared to have been irregularly circular in plan, although the shape and extent of *2016* was not fully identified due to the presence of a conglomeration of other features and a modern stanchion in the area. Neither was fully excavated but both were augered to ascertain their full depth: *2016* was 1.7m deep, while *2039* was 3m deep. The earliest fill deposits in each — mid-grey sandy silt *2014* in *2016*, and greenish-brown sandy silt *2038* in *2039* — occurred around their edges. These fills contained very few finds, and were deposited in such a way as to leave a 'funnel' in the centre. In both features this was filled with a mid–dark grey/brown sandy silt containing many finds, including large quantities of animal bone (2106g) and pottery (954g), but unusually only a very small amount of metalworking debris (28g). The small finds included a silver penny of William I (1074–77, SF438), an iron penannular brooch with overlapping scrolled terminals (SF458, Fig. 35), a copper alloy suspension mount for a harness pendant (SF407), an iron knife blade (SF495), two iron heckle teeth and an iron horseshoe of 11th–13th century date, as well as other iron nails and fittings.

One further pit (*1024*, Fig. 27b) in the north-western part of the site produced a finds assemblage of note. It was sub-circular, measuring 2.1 x 1.8m and its augered depth was 2.1m. The lower fills were fairly clean; in contrast the upper deposits contained many finds, as well as having a high ash content. Finds included large quantities of metalworking debris (3864g), the largest assemblage of pottery from a single feature of late 11th–early 12th century date (2004g, including a large number of crucible fragments), animal and fish bone (1050g), lava (54g), shell (72g), fired clay (64g), and tile (48g). Small finds included eleven iron nails, a small pair of iron smithing tongs (SF284, Fig. 37), a cheek piece of a horse bit (SF304), an iron knife blade (SF283), a copper alloy suspension/attachment ring (SF488), bone offcuts (SF574) and a chalk ?gaming board (SF341, Fig. 39). Cereal grains were fairly common within the sample taken from *1019*, suggesting cereal processing. Charred germinated oats were also present, as were fragments of lithage cake and vitrified hearth lining.

Two pits (*1030*, *1038*; Fig. 28) that may once have been lined with wood or other organic material were located in the northern part of the site. Both were sub-square in plan, with similar profiles and fills. The larger of the two (*1030*) was 2.4m by at least 0.8m (it extended beyond the edge of the excavation) in plan, while the other (*1038*) was 1.6 x 1.5m. Neither was fully excavated because of their depth, but they were augered to 2.7m and 2.2m respectively. The lowest augered fill of *1030* had a very high charcoal content, while the lowest excavated fill was a thick band of redeposited, clean sand (*1042*). The upper fills (*1029* and *1040*) were a mid-brown sandy silt with small gravel, occasional sand lenses, lumps of chalk and common flecks of charcoal. A possible lining was indicated by the well-defined cut and the slight separation of *1042* from the sides of pit. Finds included animal bone (332g), pottery (178g), lava (128g), metalworking debris (68g) and an iron awl (SF297, Fig. 37).

The upper fills of pit *1038* (*1032*, *1033*, *1034*) contained evidence of the dumping of metalworking debris (1988g), along with pottery (846g) suggesting a late 11th-century date, animal bone (1734g), lava (238g) and a worked bone pinbeater (SF294). Below this were large sandy fills. Again, a possible lining was indicated by a vertical band visible in the south edge of the section, and also by the sharp definition of the cut in this area.

Hearth C

(Figs 26 and 29)

This feature, located in the western part of the site, had been cut into the top of an earlier pit. It was an irregular circle in plan, with a rounded bowl profile measuring 0.7m in depth (Fig. 29). It had been lined with a clay deposit *c.* 0.03m thick (*2105*), which was originally yellow in colour but had been discoloured red by heating. Above this, and following the contours of the lining was a thin deposit of light purple/grey sandy clay with frequent charcoal inclusions (*2104*). A period of disuse is represented by a mixed brown sandy silt deposit which included frequent lenses of burnt sand and charcoal (*2100*). This hearth was renewed and used a further four times (*2093*, *2088*, *2086*, *2084*), yellow clay being used to form a bowl shape on each occasion. The backfill (*2091*) of the second hearth *2093* was very distinctive, being highly vitrified sandy silt with a deep purple hue. Sitting immediately on the clay (*2086*) of the fourth hearth was a sandy silt deposit with a very high charcoal content (*2085*). The sandy silt fill (*2083*) of the fifth and final phase *2084* contained a complete ceramic crucible. This fill was sealed by a deposit made up of laminated pale yellow clay (*2082*), which has been interpreted as the collapsed roof or sides of the final hearth. The remaining small hollow was backfilled with a sandy silt.

The fills of this feature contained 139 sherds of pottery (1598g), including a complete Stamford ware crucible (Fig. 46, No. 42). XRF analysis of the interior of this vessel could not identify the type of metal alloy that it once contained. The primary fill of the pit that this hearth has been cut into contained material of a mid-12th century date, while the assemblage from the upper fills represents large amounts of residual 11th-century pottery. Other finds included animal bone (2978g), fired clay (252g) and metalworking debris (362g).

Hearth D

(Fig. 26)

This was located adjacent to Hearth A (Period 3) and was of similar form. The associated pottery, however, suggests that this feature was of a later date. It was sub-circular and 0.2m deep, with a concave base, and had been cut into the backfill of an earlier feature. It was lined across its base with a dense deposit of metalworking debris, forming a hearth base. Altogether 6798g of metalworking debris was recovered. The nineteen sherds of pottery (133g) recovered from within the backfill suggested a mid–late 11th-century date.

Figure 26, A3 FOLDOUT see separate file

Figures 27, 28, 29, 30, A3 FOLDOUT see separate file

Hearth E
(Fig. 26)
Pentagonal in shape, this hearth (*9049*) measured 1.2 x 1.1m in plan and was 0.23m deep. It was lined across its base and sides with a layer of flints, upon which a very light brown clay (*9048*) had been compacted. The surface of the clay had been scorched orange by heat. The backfill of the hearth contained frequent lumps of charcoal and burnt clay, which may have derived from its use. Pottery (330g) suggests a 12th-century date for the disuse of this feature, and was found alongside animal bone (1480g), metalworking debris (386g) and shell (226g).

Hearth F
(Figs 20, 26 and 30)
This feature (Figs 20 and 30) had been constructed in the top of a previously backfilled pit, a feature characteristic of all of the hearths identified on the site. It was made up of a bed of yellow clay (0.09m) upon which a layer of rammed chalk (0.04m) had been laid. There was no evidence of burning within this remaining structure. To the south of this a large, shallow pit cut this feature, the backfill of which included lumps of clay discoloured red by heat. It is suggested that this represented the disuse and destruction of the adjacent hearth. Finds from this backfill included animal bone (770g), fired clay (32g), pottery (502g) and metalworking debris (190g), as well as an iron heckle tooth (SF349) and an iron flesh fork (SF372).

IV. Period 5: medieval (12th–14th centuries)
(Plate III; Figs 31–4)

Activity continued into the medieval period. The distribution of features changed, however, now focusing on the Mill Lane street frontage and an area in the northern part of the site.

Buildings
(Fig. 32)
The remains of three possible structures were located in the trench nearest to the Mill Lane Street frontage (Area 7). Interpretation of the features in this area is hindered by the fact that excavation was limited to box excavation.

Structure D
(Fig. 32)
A footing (*7044* or *7029*), composed mainly of small flints with some irregularly-shaped chalk pieces set in a yellow sandy clay, formed the northern edge of this structure. This line was extended towards the east by five post-holes (*7062*, *7060*, *7064, 705, 7052*). A second footing (*7036*) ran at right-angles further to the south. This had been constructed of roughly-squared chalk pieces and flints set in a yellow lime mortar. Three associated surfaces were recorded. One, made of clay and chalk (*7102*), lay on the west side of wall *7036* while the other two lay to the east. Floor surface *7029* was made up of a light yellow sandy clay with occasional chalk lumps, the southern edge of which was flanked by pale cream mortar and lime surface (*7043*; not on plan). The pottery associated with this structure suggests a 13th–14th century construction date. The structure supported by these footings was demolished by later levelling of the area (*7050*), which truncated the footings and the surfaces.

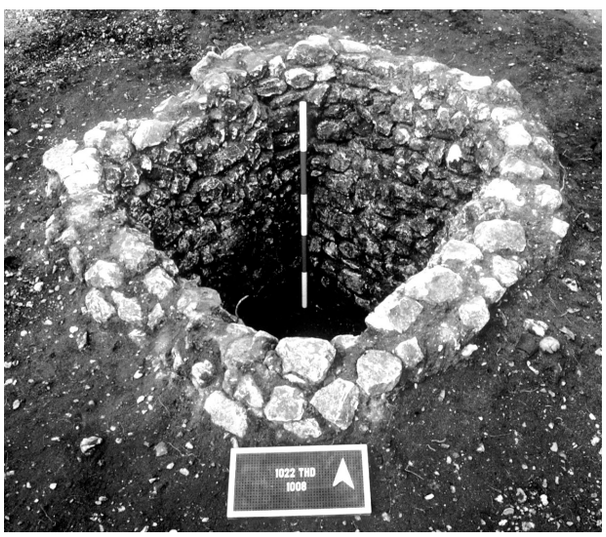


Plate III Chalk-lined pit *1012*, excavated, looking North.

Structure E
(Fig. 32)
Eleven metres to the north of Structure D a similar surface of layered sandy clay (*7068*) was noted. Small chalk blocks and flints had been incorporated along its northern edge, along with a post-pad (*7072*) of chalk and flint set in mortar. Eleven stake-holes had been cut into the surface, but no associated walls were seen.

Structure F
(Fig. 32)
A comparable structure, represented by a platform or surface of chalk and sandy loam with two post-holes along its west edge, was glimpsed ten metres to the north of Structure E.

The similarity in the materials used within these buildings suggest that they were all broadly contemporary. Although footings for walls were only present in Structure D, it is possible that the posts associated with the other floor surfaces supported less robust walling or roofing. Structure D was also physically close to Well C (see below), with which it was probably contemporary.

Wells
(Fig. 32)

Well C
(Fig. 32)
This well (*7003*) was located *c.* 8m back from the present line of Mill Lane, and was associated with the structures just described. It was constructed of irregular-shaped small and medium-sized flints bonded with by a light yellow mortar, while its interior had been finished with a mortar render. The thickness of this construction was 0.36m, while the feature's internal diameter was 0.75m. The well had been built within a sub-circular construction cut (*7011*) which measured 1.9 x 2m in plan, narrowing to the width of the shaft itself at a depth of 0.35m. The material backfilling the construction cut was a loose, light reddish-brown sand. Only a few sherds of pottery (10g), indicating a 13th–14th century date, were recovered from this construction fill.

Only a 0.3m thickness of the shaft fills was excavated by hand, the remainder being investigated by augering. This located the base of the well at 9.05m OD, at which level the deposits were waterlogged. The lowest deposit was a grey/green sandy silt, which progressively became browner until it appeared as a distinctive deposit of black silt with charcoal flecks at a depth of *c.* 0.8m. Deposits above this were again green/brown in colour, the top fill being a brown sandy silt. The nature of these fills suggests that the well was backfilled over a period of time with cess and other refuse.

Well D
(Fig. 32)
This well (*1258*), located in the north part of the site, had been constructed within a large cut (*1264*). Only part of this was excavated as it extended beyond the edge of excavation; pottery within its backfill suggested a late 12th–mid 13th century construction date. The shaft was constructed of medium-sized chalk blocks with occasional flint nodules set within a light yellow/brown sandy mortar with small lime flecks and lumps and occasional gravel. The thickness of the lining was 0.35m and the internal diameter of the shaft was 1.2m at the top, narrowing to 1.00m.

Three auger holes were made within the fill of the well. These showed that the upper fill of loamy clay was 0.75m thick. Below this a layer of highly compacted chalk was encountered, which prevented further augering. This could have formed a capping layer.

Other features
(Plate III; Figs 31, 33 and 34)

Pit *1012*
(Plate III; Figs 31, 33 and 34)
A chalk-lined pit was located in the northern part of the site, close to Well D. The rectangular cut (1.5m x 1.4m) was 1.3m deep with almost

vertical sides, and was lined with chalk blocks and occasional flints set in a coarse sandy mortar. Most of the chalk blocks were *c.* 0.10 x 0.06m, with occasional larger pieces (0.15 x 0.6 x 0.6m). All were roughly squared and appeared randomly coursed, although a neat inner face had been formed. A repair to the chalk lining was noticeable in the upper part of the north side. This had presumably been made after part of the original side had collapsed, although there was no evidence of this collapse within the pit fills.

The centre of the pit extended below the depth of the chalk lining, and was possibly the result of cleaning out the interior of the pit. The lowest fill (*1011*) was a sandy silt, with some mortar and chalk lumps and charcoal flecks. Above this was a deposit of weathered sand and silt (*1010*), which had built up particularly against the west edge, followed by a mid-brown sandy silt (*1009*) up to 0.6m thick. This was sealed by two deposits made up almost wholly of mortar (*1007, 1005*), which were separated by a layer of mid-brown sandy silt (*1006*). The latest excavated fill was a mid–light brown sandy silt. Finds from this feature included pottery (12th-century as well as residual), metalworking debris (including vitrified hearth lining) and animal bone.

Oven *1022*

(Figs 31 and 34)

Just to the south-west of the pit lay an oven (*1022*), built within a rounded-cornered rectangular cut measuring 3.2m x 2.2m x 0.75m deep. This housed a horseshoe-shaped structure of chalk blocks and occasional un-knapped flints, set into a soft mortar which contained area of burnt chalky ash. Another area of chalk blocks set in mortar was recorded in the south-east corner of the pit. This had a noticeably stepped profile and had probably provided access to the base of the pit, where an area of trampled earth was present.

When the oven was no longer in use it was backfilled, initially with a sandy deposit containing many chalk and charcoal inclusions (*1014*) which was probably the residue from the robbing of the chalk blocks from the oven structure. Finally the area was levelled with sandy silt *1013*, pottery from which indicates a 12th–14th century date.

Figure 31, A3 FOLDOUT see separate file

Figures 32, 33, 34, A3 FOLDOUT see separate file

3. The Finds

by Sue Anderson, Marion Archibald, David Buckley, John A. Davies, Roger Doonan, Richenda Goffin, Alice Lyons, Quita Mould, Ian Riddler, John Shepherd, David Starley, Heather Wallis and Susan Youngs

I. Coins, jettons and tokens

by John A. Davies
(Plate IV)

A total of 37 numismatic items was recovered from the Mill Lane excavations. These comprise 28 coins (Table 1), three tokens and six jettons (Table 2). The coins span the years from the Roman occupation to the 20th century (Table 3).

There are five Roman coins. Thetford was not a major Roman settlement but material of that date has regularly been encountered across the town. Coins of 3rd- and 4th-century date have been recovered during excavations by Knocker (Rigold 1984), at Brandon Road (Metcalf 1993) and at Redcastle Furze (Archibald 1995). Four of the examples from Mill Lane are bronzes of the 4th century, all of them worn by heavy circulation. The fifth, and earliest, is an unstruck *denarius* flan, presumably prepared for the striking of a counterfeit coin during the early 3rd century AD.

The earliest English coins are two pennies of Edmund and one of Aethelred II (Plate IV, **8**). Local mints are represented solely by the early coins, with Norwich, Lincoln and Thetford itself all recorded. It is from the reign of Henry I that London makes an appearance. It may be the take-off of trade around the middle of the 11th century (Archibald 1995) that explains the appearance of more distant mint products after this time. The issues of the period from the 10th to the 13th centuries are summarised in Table 4. Most of these are shown to be complete pennies, with a single cut halfpenny from the reign of Henry I and with cut farthings appearing from the late 12th century onwards. This situation contrasts with that recorded among the coins from Redcastle Furze, where there is a higher proportion of early cut fractions (Archibald 1995).

The list continues with steady coin loss through all centuries, as shown on Table 2. The use of tokens from the17th century onwards is represented by Royal farthings of James I and Charles I. The five jettons present include an early English type, two French types and three produced in Nuremberg.

II. Metal artefacts

by Quita Mould
with contributions from Marion Archibald and Susan Youngs
(Plate V; Figs 35–8)

Introduction

There were 392 items of metalwork recovered during the excavations themselves.

The assemblage of Saxo-Norman material is similar to that recovered from excavations in other parts of the town, and many artefacts can be parallelled exactly by finds from previous excavations at Thetford. Several items can also be parallelled by finds from Anglo-Scandinavian York. Outstanding amongst the metalwork recovered was a coin die (p.45: *Metalworking tools*), providing direct evidence for the minting of coinage in the vicinity, and a small but exceptional group of lead alloy and copper alloy brooches. Along with structural ironwork and domestic items were a small number of box fittings, and an assemblage of horse equipment of relatively high status. Tools for metalworking, leatherworking and textile-working were all found. While the metalworking debris indicated production on a relatively large scale, the textile and leatherworking was more likely to have been undertaken at a domestic level. This agrees with findings from earlier excavations, which suggested that most areas of the town were used for a range of small-scale activities. It was noticeable that no shears were recovered from the excavations, although these have been found in some numbers elsewhere in Thetford (Rogerson and Dallas 1984, 87 nos 105–10; Goodall and Ottaway 1993, fig. 120 nos 37–45). Agriculture was poorly represented, as has been the case at earlier excavations at Thetford, supporting the idea that the intensity of land-use left little space for cultivation when the town was at its height (Rogerson and Dallas 1984, 199).

Of particular interest was a small assemblage from Period 3 pit (*1149*) comprising a Carolingian copper alloy brooch (SF390, Fig. 35), a pair of matching copper alloy D-shaped buckles (SF391 and SF392, Fig. 35), iron tweezers (SF360, Fig. 37), an iron heckle tooth (SF361), a broken copper alloy link from a bridle cheek piece (SF393, Fig. 36), and the scrolled bifurcated terminal of a nailed binding (SF363, Fig. 38) of a type used on stave-built wooden buckets. The remains of insect pupae (*ophyra puparia*, identified by Gordon Turner-Walker) of a type often associated with burials were preserved on the plate of one of the buckles (SF392, Fig. 35), suggesting that the context might represent a disturbed grave, previously unrecognised. Analysis of the stratigraphy of the pit, however, makes this interpretation extremely unlikely. The metalwork suggested a wide date range for the group. The openwork brooch with toothed border (SF390, Fig. 35) can be exactly parallelled by another dated to *c.* 800 AD (below): if this date is accepted it suggests either that the Thetford brooch had a very long life before being finally discarded, or that the brooch type had a long span of popularity. The harness cheek piece link (SF393, Fig. 36) belongs to a range of harness fittings of later 10th- and 11th-century date, although its similarity to those on the complete iron snaffle bit from Coppergate (Waterman 1959, 745, fig. 8 no. 1) makes an earlier (9th–10th century) date possible.

Roman coins

Cat No	*SF No*	*Ctxt No*	*Period*		*Type*	*Date*	*Obverse*	*Reverse*	*Mint*
1	164	*1111*	3A	Blank, cast, silver coin flan. Possibly intended for the manufacture of a counterfeit Roman denarius of the 1st–3rd century AD.					
2	254	*5000*	u/s	Constantine I	Follis	AD 307–16	NTINV	MAR[TI CONSERVATORI]	
3	292	*2068*	3	House of Constantine	Follis	AD 330–5	Illegible	[GLORIA EXERCITVS], 2 standards	
4	482	*9000*	u/s	Gratian	AE3	AD 367–75	DN GRATIANVS PF AVG	GLORIA ROMANORVM	Siscia RIC 9: 14c
5	48	*2000*	u/s	Gratian	AE3	AD 367–75	DN GRATI[ANV S] AVGG AVG	GLORIA NOVI SAECVLI	Arles RIC 9: 15

English coins

Cat No	*SF No*	*Ctxt No*	*Period*		*Type*	*Date*	*Obverse*	*Reverse*	*Mint*	*Moneyer*	*Weight*	*Die-axis*		
6	1	*2000*	u/s	Eadmund	Crowned bust type penny	AD 939–46	+EADMV REX; crowned bust left	+BAPBE MO NOR[(legend set in 'mirror image'); small cross pattee	Norwich	Barbe	1.90g	180	As North 698	BM C vi
7	602+603	u/s	u/s	Eadmund	Small cross type penny	AD 939–46	Coin not available for study							
8	160	*1194*	3	Aethelred II	Crux type penny	AD 991–7	+AEDELRAE D REX ANGLOX	+LEMAN M-O LINCO; short voided cross with CRVX in angles	Lincoln	Leofman	1.03g	45	North 770	BM C iiia
9	438	*2013*	4	William I	Two stars type penny	AD 1074–77	+PILLEM REX AN	+ESB——DEOTF	Thetford	Esbearn	1.28g	0	North 845	BM C v
10	614	u/s	u/s	Henry I	Cut half-penny Quadrilateral on cross fleury type.	AD 1134–35	NRICVS R	MVND:ON:L	London?	Estmund ?	0.68g		North 871	BM C xv
11	7	*2000*	u/s	Stephen	Penny Cross moline (Watford) type	*c.* AD 1135–41	Completely illegible				1.04g		North 873	BM C I
12	605	u/s	u/s	Plantagenet king	Penny – short cross	AD 1180–1247	Coin not available for study							
13	606	u/s	u/s	Plantagenet king	Cut farthing – short cross	AD 1180–1247	RE	Illegible						

English coins

Cat No	*SF No*	*Ctxt No*	*Period*		*Type*	*Date*	*Obverse*	*Reverse*
14	607	u/s	u/s	Plantagenet king	Cut farthing – short cross	AD 1180–1247	-R—	—-AN.O——
15	538	u/s	u/s	Henry III	Cut farthing – long cross	AD 1247-50	——VS R——	——VND——
16	46	*3000*	u/s	Edward III	Penny – clipped	AD 1351-61 Pre-Treaty period	EDWARDVS REX —— (double-struck)	CIVITAS LONDON (double-struck); with annulet in each quarter.
17	608	u/s	u/s	Edward III	Penny	AD 1327–77	——DVS REX AN——	Illegible
18	347	u/s	u/s	Edward II	Farthing	AD 1307–27	EDWARDVS REX AN	CIVITAS LONDON
19	604	u/s	u/s	Edward IV	Penny – clipped	AD 1461–70 first reign	EDW——	Illegible
20	613	u/s	u/s	Elizabeth I	Threepence	AD 1558–1603	Illegible	
21	610	u/s	u/s	Charles I	Sixpence – clipped	AD 1625–49	Coin not available for study	
22	609	u/s	u/s	Charles I	Penny – clipped	AD 1625–49	Pierced at border.	
23	554	u/s	u/s	Charles II	Farthing	AD 1660–85		
24	612	u/s	u/s	William III	Sixpence	AD 1694–1702	Bent into a ‘love token’	
25	47	*7000*	u/s	George III	Halfpenny	AD 1799		
26	49	*3000*	u/s	Victoria	Halfpenny	AD 1868	‘Bun head’ issue	
27	553	u/s	u/s	Victoria	Farthing	AD 1890	‘Bun head’ issue	
28	611	u/s	u/s	George V	Threepence	AD 1913		

Table 1 Catalogue of Roman and English coins

Tokens									
Cat No	*SF No*	*Ctxt No*	*Period*	*Type*		*Date*	*Obverse*	*Reverse*	
29	555	u/s	u/s	James I	Royal farthing token – Lennox type	AD 1614–25			
30	556	u/s	u/s	Charles I	Royal farthing token – Richmond round type	AD 1625–34			
31	638	u/s	u/s		Token or counter	18th–19th century	Male bust to left	OP	
Jettons									
Cat No	*SF No*	*Ctxt No*	*Period*	*Type*		*Date*	*Obverse*	*Reverse*	*Wt*
32	45	*7000*	u/s	English Jetton		*c*. 1280–1343	Short cross moline, with pellett in each angle. Border of pellets	As Obverse	0.88g
33	50	*3000*	u/s	French Jetton		14th–15th century	Shield of France modern bearing 3 fleurs de lis	Rampant lion to left, within beaded border	1.94g
34	636	u/s	u/s	French Jetton		15th century	AVE MARIA GRA PL; Shield of France bearing 3 fleurs de lis	Triple-stranded cross fleuretty in 4-arched tressure	5.7g
35	557	u/s	u/s	Nuremburg Jetton (Pierced through centre)	Damianus Krauwinckel Rose/orb type	1543–81	—-VS KRAVWIN —-	Fictitious legend	1.8g
36	628	u/s	u/s	Anonymous issue	Nuremburg Jetton Rose/orb type	*c*. 1500-85	3 crowns alternate with 3 lis. Illegible	Imperial orb. —-ENCRV—-	1.3G
37	629				Nuremburg Jetton	16th century			

Table 2 Catalogue of tokens and jettons

	Coins	*Tokens*	*Jettons*
Roman	5		
10th century	3		
11th century	1		
12th–13th century	6		1 (13th–14th)
14th century	3		1 (14th–15th)
15th century	1		1
16th–17th century	5	2	3
18th century	1		1 (18th–19th)
19th century	2		
20th century	1		

Table 3 Chronological summary of coins, tokens and jettons

Reign	*Type*	*1d*	*½d*	*¼d*	*Total*
Edmund	Small cross	2			2
Aethelred II	CRVX	1			1
William I	Two stars	1			1
Henry I	Quad. on cross fleury		1		1
Stephen	Watford	1			1
Plantagenet	Short cross	1		2	3
Henry III	Long cross			1	1
	Totals	**6**	**1**	**3**	**10**

Table 4 Summary of English coin types of the 10th–13th centuries

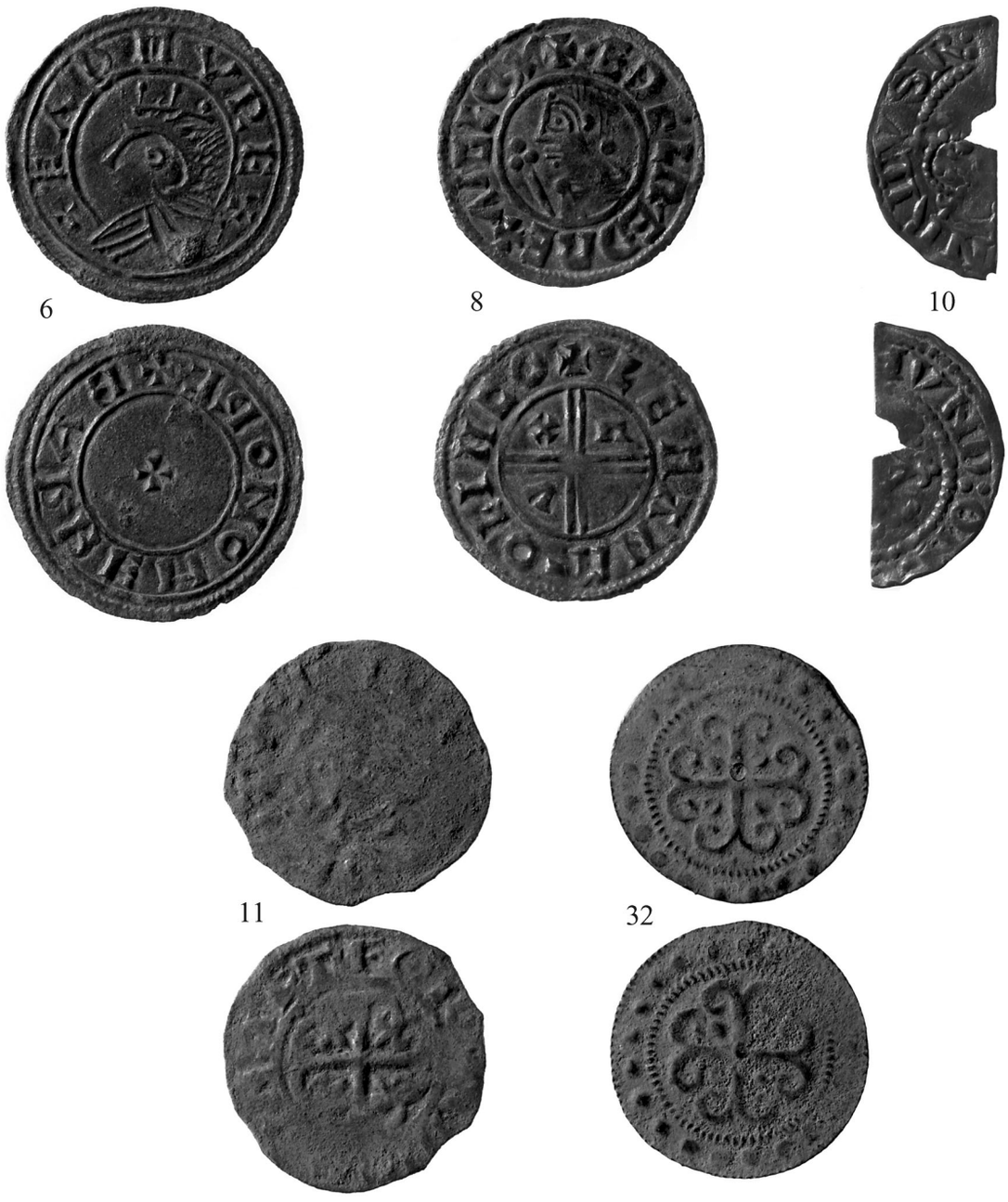


Plate IV Coins: catalogue refs 6, 8, 10, 11 and 32 (see Table 1). Scale 2:1
Photo: Nigel Macbeth

Plate V Lead alloy plate brooches SF161 and SF437. *Photo: Nigel Macbeth*

Dress accessories
(Plate V; Fig. 35)

Brooches

Lead alloy brooches
by Susan Youngs
(Plate V; Fig. 35)
Two lead alloy rectangular plate brooches were found (SF161 and SF437;Plate V). The first was unstratified; the other was from the fill of Period 3 pit *5122* and associated with 11th-century pottery.

The first brooch is made of pewter (SF161) and is a fine and unusually richly-decorated rectangular plate brooch of 10th-century date, the form being an imported one. A richly-decorated mount (not a brooch) of this type was excavated at Winchester, with three animals not in procession (Hinton 1990, 498–9, fig. 125 no. 1058). Such mounts may have been influential because the continental rectangular plate brooches are often bow-sided. A truly rectangular bar brooch published by Frick from Hedeby, Germany, is covered with chip-carved acanthus, and was indeed adapted from a 9th-century Carolingian scabbard mount (Frick 1992/3, 284, fig. 8 no. 37). A pair of 9th-century Carolingian brooches in the British Museum each have a single bird in profile with arrow-like stylised foliage; they also have the slightly concave sides typical of these pieces, and the birds are in a much more wooden style (see Ager 1995, 257–8). However, the detailed portrayal of the Thetford birds suggests they are later and in the Winchester style, as represented by birds similar in both detail and pose on the well-known mid-10th-century strap-end from Winchester (Backhouse *et al*. 1984, 96 no. 83) and also seen, again in open-work, on a bone plaque (Backhouse *et al*. 1984, 126–7 no. 131). The bird motif appears in the 11th century as a brooch form in Scandinavia and England, the type being represented by an example from Stoke Holy Cross in Norfolk (Margeson 1988, 199 fig. 2). These birds show Ringerike details in their decoration. A surprising parallel for the whole Thetford brooch composition is to be found on the wooden doorway of the church at Hylestad, Norway, on the last of the panels depicting the Sigurd legend, where two birds sit in heavy acanthus foliage below the horse Grani. The door is 12th-century, the legend much older (Graham-Campbell *et al*. 1994, 112–3).

The second example (SF437) is made of low-quality tin. The upper part of an iron pin survives, with the possible impression of textile preserved. This piece is in Scandinavian Borre style and the leg type can be seen on a Gokstad strap-end of the middle Viking period (Graham-Campbell 1980, cat. 498). It is datable to the 10th century on stylistic grounds. The central lozenge motif is often used as a separate brooch form, while the division of the rectangular field is seen on the Broa strap mounts (Graham-Campbell 1980, cat. 485).

These two rectangular plate brooches are both exceptional pieces. The rectangular form is known from north Germany and the Rhineland in the 9th and 10th centuries, but examples given by Frick (1992/3, taf. 7–9) and Wamers (1994b, 587) are much less accomplished or ambitious in their ornament. Many of the continental brooches have concave sides and many have decorative projections at the corners, a form Wamers has traced back to the 8th century. The Mill Lane brooch with birds has a truly rectangular form, suggesting the influence of Carolingian harness mounts on the form of this brooch.

SF 161 Unstratified; Plate V; Fig. 35
Pb alloy plate brooch, rectangular with paired lugs and hook to hold the iron hinged pin. Decorated in relief with a procession of two realistic birds in profile facing left, their pinions and tail feathers clearly indicated, the neck textured, and the clawed feet are either grasping a branch or exaggerated. They are seen against thick fleshy branches of foliage articulated with nodes, and have their heads raised as though pecking at fruit. No berries are shown although the bird on the right may have something in its beak, or possibly its beak is misshapen. The casting is not very crisp. The whole bar is bordered by pellets in low relief. The back is plain and cast with twin lugs and a catch plate, with an iron pin *in situ*. XRF AML pewter. Complete. L 45mm, W 18mm, lug Ht 7mm.

SF 437 *5136*, fill of pit *5122*; Period 3; Plate V; Fig. 35
Pb alloy plate brooch, rectangular with pin attachment and curled-over hook to hold an iron pin, half of which remains. It has a beaded border, and pierced loops at the corners which may have held contrasting studs. Back is plain with slight longitudinal ridges and twin lugs and a catch plate. The upper part of an iron pin survives with the possible impression of textile preserved. The plate has a formal design based on two stylised and contorted beasts, the heads and ribbed forelegs forming a knot and a beaded

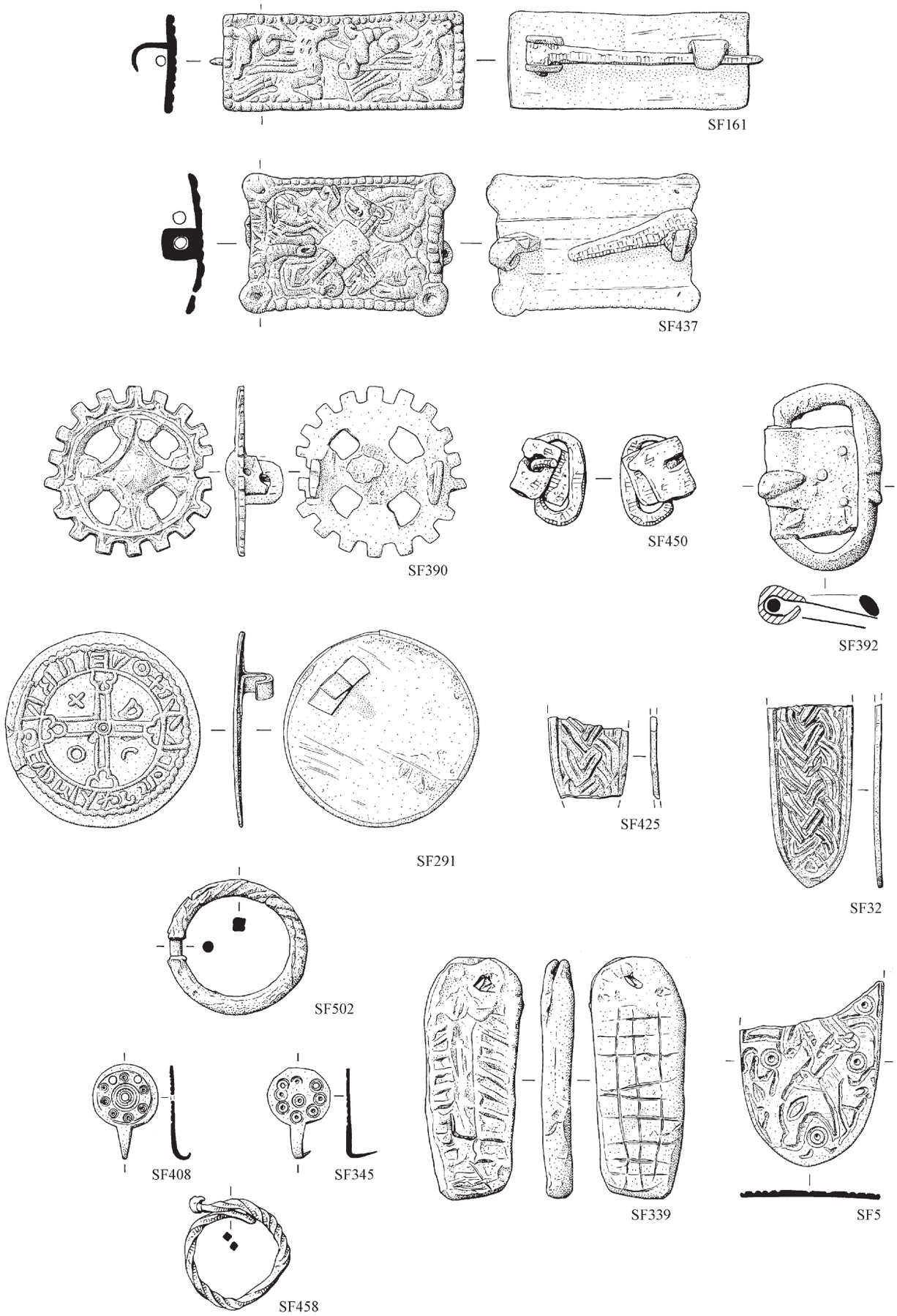


Figure 35 Metal small finds: dress accessories. Scale 1:1, except SF450 (scale 1:2).

section running diagonally through the lozenge-shaped boss in the centre to run into a knot of hindquarters and rear legs. The ribbed and clawed hind legs can be seen lying parallel to each other. XRF AML low quality tin. Complete. L 40mm, W 27mm.

Lead alloy annular brooch
by Quita Mould
(Fig. 35)

An annular brooch (SF502) with a circular frame, which is spirally twisted on one side of the ring only and rebated for the pin, was found associated with the construction of a Period 5 well (*1264*). The same cable pattern occurring on one side of the frame can be seen on a copper brooch from Billingsgate lorry park, London, found associated with pottery dated to *c.* 1230–60 (Egan and Pritchard 1991, 249, fig. 160, no. 1310) and represented by a series of oblique grooves on another from Swan Lane, London (Egan and Pritchard 1991, no. 1312) dated to *c.* 1270–1350.

SF 502 *1263*, fill of construction cut of Well D; Period 5; Fig. 35
Pb alloy annular brooch, round-sectioned annular frame with a rebate to take the pin, now missing. The frame has distinct spiral-twisting on one side only. Possibly a poor casting. D external 26mm, internal 19mm, arm D 3mm.

Copper alloy disc brooch
by Susan Youngs
(Fig. 35)

An openwork disc brooch (SF390) of leaded brass with a toothed border was found in Period 3 pit *1149* along with a small group of other metalwork. This brooch is one of a small group of absolutely standard size (diameter *c.* 30mm, with a border of seventeen or eighteen teeth). A similar example in the Ashmolean is thought to come from Icklingham, Suffolk (Hinton 1974, 21 no. 14), while others have also been recorded from East Anglia (Hattatt 1989, 218, fig. 104 no. 1691; *The Searcher*, Nov. 1995, 13). Recent excavations in Thetford have also recovered a similar example (Masefield and Masefield 1997, appendix 1, illus. no. 6). They are dated by the context of an excavated example from Everswinkel to *c*. 800 (Wamers 1994a, 226 and abb. 57). The recovery of five of the six known examples of this Caroligian brooch from eastern England is interesting, but they are undoubtedly imports.

If the dating of the Everswinkel brooch is unchallenged, this brooch is the earliest item to be found in the vicinity; no Middle Saxon material has been found previously in the central area of Thetford, and the Late Saxon town began to develop in the late 9th century. It is possible that the Everswinkel brooch was deposited when the brooch type was new whilst the Thetford example was kept in use for a long time before being discarded after the brooch type ceased to be popular. As such, it must represent one of the earliest objects to be found in the town to date.

SF 390 *1148*, fill of pit 1149; Period 3; Fig. 35
Cu alloy circular openwork cast brooch with cruciform motif with central boss, each arm terminal being a pair of flat circles. The surrounding border is denticulated. Flat reverse has a cast pin catch and broken pin seating; iron corrosion present from an iron pin and possibly mineral preserved organic. XRF AML leaded brass. Almost complete. D 31mm.

Copper alloy pseudo-coin brooch
by Marion Archibald
(Fig. 35)

A pseudo-coin brooch (SF291) of thin leaded gunmetal was found unstratified. The brooch is 27mm in diameter and has a design on the exposed face only, parts of which are obscured by surface corrosion. The loop for the pin is in place on the reverse, but the pin and catchplate are missing. The brooch was probably struck between two dies: the design engraved on the lower one, and the upper one blank. This is suggested by the slight rim on the reverse, caused by the upper die being a little smaller than the flan and biting into the metal.

The design is a short cross-voided with a pellet-in-annulet at its centre, each limb terminating in three crescents within a line inner circle. In the angles of the cross are the letters O opposite P (facing outwards) and X opposite A (pointing inwards). This is surrounded by the inscription within a beaded outer circle. The inscription is composed of mixed Roman letters (the Ms are cursive and letters with an orientation are retrograde), and runes or pseudo-runes. Two letters are not quite clear because of surface erosion. The inscription apparently commences with a cross as on coin legends but not (as coin legends usually do) at one of the cross-ends. It is also punctuated by a pellet-in-annulet (twice) and a large pellet. Read either straightforwardly or retrograde it does not seem to make sense, and is not recognisably a blundered version of a coin legend.

The basic design is taken from the reverse of a silver penny of Edward the Confessor (1042–1066), Pointed Helmet type (North and North 1980, no. 825, pl. 14, 28–30), struck *c*. 1056–9. The angles of the cross on this type are blank, and the letters on the brooch are probably derived from the first substantive type of the reign, the Pacx type (North and North 1980, no. 814, pl. 14, 12–13) which was struck *c*. 1042–6. The cross on that type is similar but is a long cross extending to the outer circle, and has a single crescent at each cross-end instead of three, as on the Pointed Helmet type and the brooch. The letters on the coins read PACX, using a phonetic spelling of *pax* in order to fill the four quarters. The brooch-maker has either copied the C as an annulet or, as the letter is square rather than curved, he has perhaps chosen to use an annulet stop in the position. He could have been inspired to add this word without a coinage prototype by the contemporary *pax Dei* movement, but in this context it seems likely that in its layout at least it was derived from the coin. Harold II's only type in 1066 also has a PAX motif but, on it, the usual Latin form of the word is placed in a line across the centre of the design, most unusual in the later Anglo-Saxon coinage, without a cross. The earlier PACX type clearly seems the more likely prototype.

The Anglo-Saxon coin types were successive and it was apparently intended that each new type should supersede its predecessor rapidly, leaving just one type, barring a few strays, in circulation. However true this may have been under Aethelred II, several hoards buried on the eve of the Norman Conquest, including those at Chancton and Seddlescombe, show that substantial numbers of previous types dating back to the time of Cnut were still around. After the Conquest Anglo-Saxon coins were quickly replaced, and regular recoinages re-instituted. Thus, while the coin prototypes provide a *terminus ante quem non* of *c*. 1056 for the brooch, coins of the types

involved could have been current until 1066. The fact that two coins of Edward the Confessor provided prototypes increases the likelihood that the brooch was made in his time, rather than having been inspired by later casual finds. The form of the brooch also seems to absolve us from any special pleading on possible reasons for later survivals.

SF 291 Unstratified; Fig. 35
Cu alloy disc brooch, with pin hook on reverse, decorated in relief with a large central equal-armed cross with a border of ?false epigraphy and outer pelleted ring and letter in each space between arms of the cross. Nummular brooch, 10th–11th century. XRF AML leaded gunmetal. Almost complete, pin missing. D 35mm.

Buckles
(Fig. 35)
Buckles with D-shaped frames, the most popular type from the mid-9th to the 11th centuries, were the type most commonly found. Five plain iron buckles were recovered, two from Period 3 deposits and the others occurring residually. One complete example (SF450, Fig. 35) was found in pit *4230.* A broken frame (SF430, not illustrated) is comparable with another from GMK Site 2 at Thetford (Goodall 1984, fig. 137 no. 237). Two of the frames had a scarf joint visible at the pin bar (SF219 and SF524, not illustrated). This feature is common at this period, and another example was found associated with 10th- and 11th-century occupation during earlier excavations at Thetford (Goodall 1984, 43, fig. 137 no. 238). Comparable examples were found at Coppergate, York and also occur frequently in Scandinavia (Ottaway 1992, 683, fig. 294 no. 3733). A pair of copper alloy buckles (SF391, not illustrated and SF392, Fig. 35) with D-shaped frames were found in pit *1149* in association with an openwork circular brooch of copper alloy (SF390) dating to *c*. 800 (above). The oval sectioned frames have an offset pin bar and paired mouldings at the outer edge.

Two residual copper alloy buckles also with D-shaped frames (SF335 and SF457, not illustrated) have decorated frames suggesting a later medieval date. A copper alloy oval buckle frame (SF77, not illustrated), with an ornate outside edge comprising transverse grooves between large terminal knops, was found in the topsoil in Area 1. This is a common buckle type in use from the late 12th to late 14th centuries (see Egan and Pritchard 1991, 76 for English and continental comparanda).

A copper alloy folding strap clasp (SF267, not illustrated) with a rectangular frame and rectangular folded plate held by two rivets, and a copper alloy shield-shaped strap-end with a rectangular bar mount (SF269, not illustrated) likely to have been used with it, were found unstratified, as were a pair of narrow buckle plates (SF273, not illustrated) from another example. Another shield-shaped strap-end (SF224, not illustrated) was found in the topsoil in Area 3. In London these folding strap clasps were in use from the late 13th/early 14th to the early 15th centuries (Egan and Pritchard 1991, 116).

Other unstratified buckles included 18th-century shoe buckles, a stock or hat buckle and large buckles from harness. Five iron buckle pins were recovered, three from Period 3 deposits (SF464, SF560 and SF576, not illustrated). Two separate buckle plates were found unstratified (SF547 and SF548, not illustrated), one of which (SF547) was gilded with a stamped border of opposed triangles, a common medieval decorative motif.

SF 450 *4228*, fill of pit *4230*; Period 3; Fig. 35
Iron buckle and frame, D-shaped frame of round or plano-convex section with straight narrowed pin bar and remains of rectangular buckle plate and buckle pin present. Almost complete, encrusted. Buckle Ht 34mm, W 20mm, plate L 20+mm, W 20mm measured from X-ray.

SF 392 *1148*, fill of pit *1149*; Period 3; Fig. 35
Cu alloy buckle, D-shaped frame with oval section and narrowed, round-sectioned pin bar. Double transverse mouldings at the pin rest, fragment of iron pin. Small buckle plate with three rivet-holes. Mineral preserved organic present with possible textile and random vegetable matter (?straw). Almost complete. Pair with SF391.

SF 457 Unstratified; not illustrated
Cu alloy buckle, cast D-shaped buckle frame; wide plano-convex sectioned outer edge decorated with a series of irregular oval 'coffee bean'-type motifs, round-sectioned narrowed pin bar. Pin missing. *Conservator observed non-mineralised puparia of conicera tibialis. Frame complete. Ht 28mm, Length 20mm

SF 77 Unstratified; Area 1; not illustrated
Cu alloy buckle, oval frame with ornate outside edge comprising a central pin notch flanked by three low collars produced by transverse grooves with a large knop at each end. Offset and narrowed pin bar. Late 12th–late 14th century (Egan and Pritchard 1991, 76). Complete. W 25mm, L 22mm.

SF 224 Unstratified; Area 3; not illustrated
Cu alloy strap-end, small shield-shaped sheet plate with two decorative notches and a central peak, held by a dome-headed rivet to a lozenge-shaped rove on the underside. Late 13th/early14th–early 15th century (Egan and Pritchard 1991, 157, no. 734). Incomplete. L 15+mm, W 15mm.

Strap-ends
by Quita Mould with Susan Youngs
(Fig. 35)
The plate of a strap-end of leaded brass (SF32) decorated with three strand ribbon interlace was found unstratified, and a fragment from another (SF425) was recovered from the fill of Period 3 well *2078*. These strap-end fragments date to the late 9th–10th centuries; a similar ornamental field occurs on a bone strap-end from York (Hall 1984, 81 fig. 85) and on a bronze example from Bawsey, Norfolk (private collection).

The rounded terminal of a tongue-shaped strap-end (SF5) of leaded brass dating to the 10th century was found in the topsoil of Area 2. It is crudely decorated with a series of animals with gaping jaws interspersed with ring-and-dot motifs.

A crude strap-end of lead (SF339) from the topsoil of Area 4 is most unusual. It is decorated on one side with a linear design resembling a gaming board, and with a feather-like design with double central rib on the other. No other examples of strap-ends made of lead alloy readily spring to mind. It is thought to date to the 9th–10th centuries.

A single sheet from a copper alloy strap-end (SF42, not illustrated) of double sheet construction with a small terminal knop was found in the topsoil of Area 3. In London such strap-ends occur from the early 14th to the early 15th century, and are considered a 14th-century form (Egan and Pritchard 1991, 145). A complete example was found at Redcastle Furze, Thetford (Andrews 1995, fig. 66, 7). A tongue-shaped fragment (SF376, not illustrated) of highly corroded copper alloy, possibly from a strap-end or scabbard chape, was found in Period 3 pit *1177*.

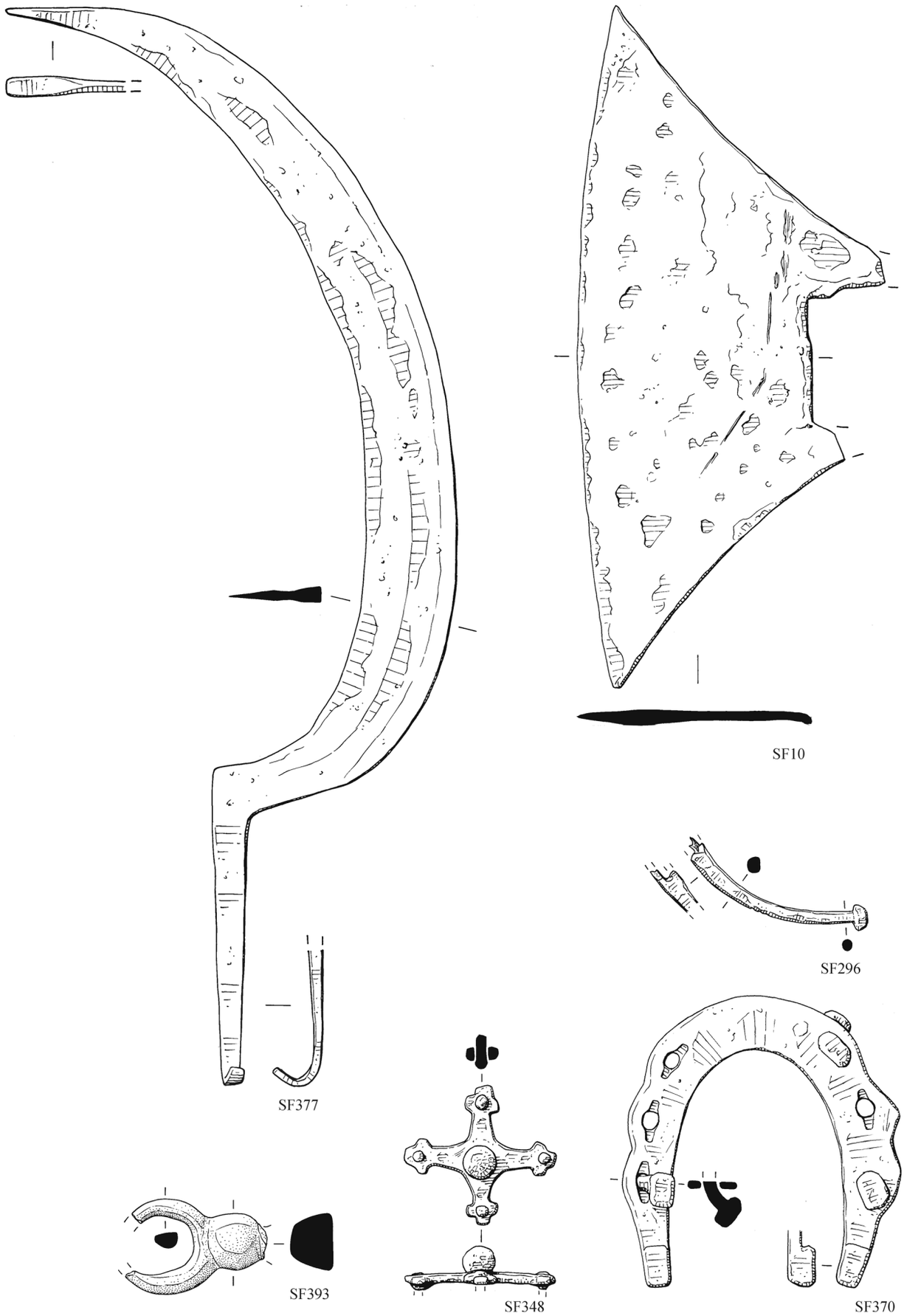


Figure 36 Metal small finds: horse equipment, weapons and armour and agricultural tools. Scale 1:2, except SF393 (scale 1:1).

The spacer from a wide rectangular strap-end (SF81, not illustrated) of copper alloy with an iron rivet present was found in topsoil of Area 1. Examples from London have been found exclusively in 14th-century deposits (Egan and Pritchard 1991, 146–8, fig. 96 no. 699).

SF 5 Unstratified; Area 2; Fig. 35
Cu alloy strap-end, rounded terminal of flat-sectioned plate with possible stub of rivet for attachment on the reverse. Decorated with an incised design of a winged beast with gaping jaws and lentoid eye in the Jellinge style. XRF AML leaded brass. Incomplete. L 25+mm, W 26mm.

SF 32 Unstratified; Area 3; Fig. 35
Cu alloy tongue-shaped strap-end fragment of flat section with deeply incised double interlaced ribbon motif. 10th century, similar to SF425. XRF AML leaded brass. Incomplete, soil. L 34+mm, W 16mm.

SF 339 Unstratified; Area 4; Fig. 35
Pb strap-end, rectangular-shaped, rectangular-sectioned, strap roughly straight cut at one end and rounded at the other which is split and centrally-pierced. Decorated with crudely incised linear checkerboard design on one side, and with crude stamped feather design with central double rib and obliquely sloping ribs running from it on the other. Complete. L 44mm, W max. 18mm, min. 12mm Th 5mm, Wt 40g.

SF 425 *2068*, fill of well *2078*; Period 3; Fig. 35
Cu alloy plate of strap-end decorated with three-strand ribbon interlace dating to late 9th–10th century. Incomplete. L 15+mm, W 15mm.

Hooked tags
(Fig. 35)
Four hooked tags of copper alloy were recovered from the excavations (SF345 and SF408, Fig. 35; SF373 and SF491, not illustrated). The fragmentary remains of two hooked tags with plain circular plates (SF373 and SF491, not illustrated) can be parallelled by others from Thetford (Goodall 1984, fig. 111, 34), Norwich (Margeson 1993, fig. 8 no. 70) and Winchester (Hinton 1990, fig. 149, 1426–7). Two complete round-plated hooked tags with ring-and-dot ornament (SF345 and SF408, Fig. 35) were found in Late Saxon pits (*3074*, and *4197*). One (SF345) was decorated with a series of nine ring-and-dot motifs before the pair of fastening holes had been punched; the other (SF408), with three fastening holes, has a series of seven motifs with a larger double motif in the centre. Other hooked tags with ring-and-dot decoration have been found at Thetford (Goodall 1984, fig. 111 nos 32–3) and Norwich (Margeson 1993, fig. 8 nos 68–9), the latter providing the closest parallel. Hooked tags are a Middle to Late Anglo-Saxon type occurring from the 7th into the 11th centuries and are thought to have served as fasteners for clothing and cross-gartering, and possibly as purse fasteners (Hinton 1990, 548–9).

SF 345 *3070*; fill of pit *3074*; Period 3; Fig. 35
Cu alloy hooked tag, small flat circular plate with two small fastening holes and a hooked terminal. Plate decorated by series of nine ring-and-dot motifs, two pierced by the holes. Late Anglo-Saxon type, 7th to 11th century (Hinton 1990, 548–9). Complete. Total L 17mm, D 12mm.

SF 408 *4171*, fill of pit *4197*; Period 3; Fig. 35
Cu alloy hooked tag, small flat circular plate with three fastening holes and small hooked terminal. Plate decorated by seven ring-and-dot motifs with a large double ring-and-dot in the middle. Late Anglo-Saxon. Complete. Total L 18mm, D 12mm.

SF491 *2013*, fill of pit *2016*; Period 4; not illustrated
Cu alloy hooked tag, oval-shaped sheet with a round rivet-hole at each side and a central hole at point of fracture. Incomplete, fractured. L *c*. 16mm, W 11mm.

Other dress accessories
(Fig. 35)
Two penannular rings with slightly overlapping arms were found in Period 4 deposits. One was a spirally twisted penannular ring (SF458, Fig. 35) of iron with scrolled terminals, while the other was a plain penannular ring of copper alloy (SF395, not illustrated). The use of these rings is uncertain; having an adjustable fastening they may have been used as suspension rings similar to a modern key rings. A comparable iron ring, with a twisted fastening similar to the Thetford spirally twisted example, was found at the hip of an early Anglian burial at Bainesse Farm, Catterick (Wilson *et al*. 1996, burial 4172, fig. 22 no. 4); no objects were found attached to this latter object, however.

A range of dress accessories was found unstratified. These included ten buttons of copper alloy or white metal dating to the 18th–19th centuries, a copper alloy lace tag with a knop finial (SF272, not illustrated) and a large spherical copper alloy rumbler bell (SF 543, not illustrated). The use of rumbler bells in medieval dress is discussed by Pritchard (Egan and Pritchard 1991, 336–7); in the post-medieval period larger examples were used on horse harness. A small annular ring of copper alloy (SF126, not illustrated) with a diameter of 10mm has a small area of possible textile preserved, which may suggest a use as a simple dress fastening.

SF 458 *2013*; fill of pit *2016*; Period 4; Fig. 35
Fe brooch, spirally-twisted single-strand penannular brooch with overlapping scrolled terminals. Complete. D 38mm, strand W 4mm.

SF 395 *1158*; fill of pit *1139*; Period 4; not illustrated
Cu alloy pennanular ring with slightly overlapping arms, slightly narrowed in width. No obvious areas of wear. Complete, slightly encrusted. D 40mm, max. arm D 4mm

Horse equipment
(Fig. 36)

Harness fittings
by Quita Mould, with Susan Youngs
(Fig. 36)
A collection of Saxo-Norman harness fittings was found. A curving arm from a Y-shaped cheek piece of an iron snaffle bit (SF296, Fig. 36) is decorated with transverse moulding and traces of a non-ferrous metal plating, probably tinning, remain. A complete example of such a snaffle bit has been found at Coppergate, York (Waterman 1959, 74–5, fig. 8 no. 1). Identical horse bits have been found in southern Norway, associated with finds of 9th–10th century date. A piece from a similar snaffle bit has been found previously from Thetford (Goodall 1984, 100, fig. 138 no. 249), along with components from snaffle bits of contemporary styles (Goodall 1984, 100, fig. 138 nos 250–2).

A broken copper alloy link from a bridle cheek piece (SF393, Fig. 36) was found in Period 3 pit *1148* along with a small group of other metalwork. The rounded terminal is typical of a range of strap unions and bit fittings, some with Ringerike style ornament, of Anglo-Scandinavian manufacture of the later 10th and 11th century (Pedersen 1996/7, 137, 155–61). Complete examples show differentiated loops, one quite plain as here, the other with projecting knobs (Williams 1999, 179, fig. 5 no. 42). The proliferation of harness and stirrup fittings in this period suggests the increasing use of horses (*c.f.* general survey

of 11th-century horse equipment in Graham-Campbell 1992, 77–89).

An iron bridle side link (SF844, not illustrated) and another of cast copper alloy (SF533, not illustrated) were found unstratified. A fragment from an iron bit with an integral D-shaped loop (SF304, not illustrated) was found in Period 4 pit *1024*.

One small iron cruciform bridle boss (SF348, Fig. 36) was found in 10th–11th century pit *1141*. The fitting, which appears originally to have been plated with non-ferrous metal (probably tin), has a central boss and four arms each with a trefoil-shaped terminal. It is comparable with an example with pointed arms found in Thetford (Goodall 1984, fig. 139 no. 264). Similarly, an iron four-armed strap distributor (SF19), found occurring residually in topsoil in Area 4 (*4000*), can be parallelled by two others found together at Thetford (Goodall 1984, fig. 139 nos 262–3), on a site where no occupation extended beyond the end of the 11th century (Goodall 1984, 47).

A broken mount (SF407, not illustrated) of gilded copper alloy for the suspension of a harness pendant was found in an 11th–12th century pit fill. Copper alloy pendants were used to decorate horse harness from the 12th century onward (Griffiths 1995, 62).

SF 296 *4022*, fill of Building C; Period 3; Fig. 36
Fe cheek piece from snaffle bit, broken curving plano-convex sectioned arm with a knobbed terminal; the other end is broken across an angular hole, where it takes an angular section. Incomplete, encrusted, flaking, partially cleaned. L 71+mm, arm D 6mm, terminal D 10mm.

SF 304 *1017*, fill of pit *1024*; Period 4; not illustrated
Fe cheek piece of horse bit, square-sectioned shank with integral D-shaped loop, broken at each end. Two radio-opaque specks present in the corrosion. Incomplete, encrusted. L 50mm, loop W 24mm.

SF 348 *1140*, fill of pit *1141*; Period 3; Fig. 36
Fe bridle boss, cruciform fitting with central domed boss and four arms of rectangular section, each with a trefoil terminal with a central rivet. Possible suggestion of non-ferrous metal plating remaining in one small area. Complete, encrusted. L 44mm, W 42mm, Ht *c*. 12mm.

SF 393 *1148*, fill of pit *1149*; Period 3; Fig. 36
Cu alloy cast link from a bridle cheek piece. Raised boss with broken ring af plano-convex section at one end. Incomplete. L 26+mm, W max. 18mm.

SF 407 *2037*, fill of pit *2039*; Period 4; not illustrated
Cu alloy suspension mount for harness pendant; round, domed stud head with central shank and projecting bifurcated arm from which the pendant was suspended. Gilding preserved on the upper surface. Almost complete. D 11mm, L 18mm.

Horseshoes and nails
(Fig. 36)
A complete iron horseshoe (SF370, Fig. 36) with narrow branches ending in rolled, rectangular calkins was found in the top of an unexcavated pit (*2117*). Three round nail-holes within rectangular countersinkings were present in each branch, producing a wavy outer edge. Three fiddlekey nails remained within the holes. A fragment of a second example (SF499, not illustrated) was found in pit *2016*, associated with 11th-century pottery and coin of William I. These 'Norman' horseshoes are of Clark type 2A (1995, 86) in common use from the mid-11th through to the early 13th century (Clark (ed.) 1995, 96). A fragment of horseshoe branch (SF328, not illustrated) with similar nail-holes but no distinctly wavy edge was found in topsoil in Area 4; this may come from a pre-Conquest type (Clark type 1, Clark (ed.) 1995, 85). Horseshoes of similar type have been found previously at Thetford (Goodall 1984, figs 142–3 nos 277–95; Andrews 1995, fig. 73 nos 51–5). Three other fragments of broken horseshoe were found unstratified (SF69, SF519 and SF520, not illustrated). A small quantity (27) of iron horseshoe nails were found separately; both fiddlekey and T-headed nails were found, the latter type probably representing heavily worn examples of the former.

SF 370 *2117*, unexcavated pit Area 2; Fig. 36
Fe horseshoe, narrow branched horseshoe with rolled rectangular calkins, wavy outer edge with three round nail-holes within rectangular countersinkings in each branch. Three fiddlekey nails *in situ*. Complete, slightly encrusted Ht 110mm, W 90mm, max branch W 20mm.

Spur
The broken goad from an iron prick spur (SF300, not illustrated) was found in topsoil in Area 4. Probably of Late Saxon date, it is similar to an example with decorative mouldings present further down the stem recovered from the Kilnyard excavations at Thetford (Goodall and Ottaway 1993, fig. 127 no. 149).

SF 300 Unstratified, Area 2; not illustrated
Fe spur prick, round-sectioned stem tapering to a short point from a slight shoulder. Incomplete, encrusted. L 40mm, D max 9mm

Weaponry and armour
(Fig. 36)
The broken blade of an iron axe (SF10, Fig. 36) was found unstratified. The axe has a long convex edge and concave curving sides. While it could have been used for woodcutting, axes of similar shape are shown being used as weapons in battle by the English forces in the Bayeux tapestry.

A small riveted annular ring of iron from ring mail (SF354, not illustrated) was found in 10th–11th century pit *1084*. A fragment of a second (SF434, not illustrated) was found in an 11th–12th century deposit.

SF 10 Unstratified; Fig. 36
Fe axe blade. Long, slightly convex axe blade with concave curving sides broken before the eye. The edge is not bevelled. Incomplete, encrusted flaking. L 110+mm, blade edge L 250mm.

SF354 *1083*, fill of pit *1084*; Period 3; not illustrated
Fe ring mail link. Small annular ring of round-sectioned wire with a rivet visible in radiograph. Complete. D 16mm, from x-ray. D external 13mm, internal 10mm.

SF434 *4217*, fill of pit *4224*; Period 4; not illustrated
Fe ring mail link. Small broken round-sectioned ring. Almost complete, encrusted. D 16mm, from x-ray. D external 12mm, internal 9mm.

Agricultural tools
(Fig. 36)
An iron balanced sickle (SF377, Fig. 36), with a curving upright blade not extending much beyond the line of the tang, was found in 10th–11th century pit *1156*. An iron tine from a rake (SF243, not illustrated) was found in topsoil in Area 4. A small collar ferrule (SF311, not illustrated) of iron from a tool haft was found in a post-medieval drain cut (*7030*), while an open socket (SF31, not illustrated) broken from an iron implement was found in topsoil.

SF 377 *1155*, fill of pit *1156*; Period 3; Fig. 36
Fe sickle. Straight rectangular-sectioned strip tang with clenched end and curving upright blade; pointed tip not extending beyond the line of the tang. Balanced sickle. Complete, slightly encrusted, flaking. Total L 345mm, blade L c 305mm, W 38mm, back Th 7mm, tang L 115mm.

SF243 Unstratified, Area 4; not illustrated
Fe rake tine. Rectangular-sectioned tine gently curved in profile tapering to a pointed tip, flattening and turned over at right-angle at the head. Complete, slightly encrusted. L 101mm, W 6mm.

Craft tools
(Fig. 37)

Metalworking tools

An iron coin die
by Mark Blackburn and John Davies
A heavily corroded iron object found within the fill of 10th–11th century pit *4230* has been identified as an upper die (or 'trussel') for striking coins. It would have been held vertically and struck with a hammer on its wider head to impress on to a silver blank the reverse design that was originally engraved in incuse on the narrower base of the die. No traces of a coin design can now be seen and the identification of the object relies on similarities in its form with nine other known coin dies of the early medieval period: four Anglo-Saxon, four Norman and one Carolingian. Two 10th-century dies have been found in excavations at Coppergate, York (Pirie 1986, 33–7; Ottaway 1992, 525–7), one late 10th-century die came from excavations at Flaxengate, Lincoln (Blackburn and Mann 1995), two 11th- and two 12th-century dies were found in soil removed from the Thames Exchange site, London (Archibald, Mann and Milne 1995), and one 12th-century die of Stephen was found in Little Bell Alley, London (Archibald 1984, no. 467). The only surviving Carolingian die is of the 9th century and from Melle (Blunt in Pirie 1986, 44–5). All these are upper dies, except for the two York finds and the die of Stephen from Little Bell Alley.

The present find is very similar in its form and dimensions to the other known reverse dies, save in one respect. The top or head of the die is slightly concave and it lacks the usual 'beard' or 'mushroom' profile caused by constant hammering. This difference led us to question our initial identification of the object as a coin die; however, after consultation with conservators we concluded that the 'beard' may well have been corroded away. The whole surface is deeply pitted where corrosion has eaten into the iron, causing metal to flake or ping off. The constant hammering on the head would have changed the metal structure and introduced cracks or fissures, letting moisture enter and encouraging corrosion. The head may also have been partially trimmed, as has been done to some among the group of later medieval dies in the British Museum which were evidently in the process of refurbishment (Barrie Cook, *pers. comm*.). Alternatively, it has been suggested by David Greenhalgh (*pers. comm*.), from his experience with replica dies, that by using a hammer with a smaller head one could avoid creating a beard, and indeed that seems to have been the case with the Carolingian die from Melle.

The base of the die is likewise deeply pitted and the original surface carrying the coin design has gone, but whether this has simply laminated away or a section of the die has been knocked off or deliberately cut off has not been determined. The Thames Exchange and York dies have been shown to be made up of two elements: a wrought iron shank welded to a harder carbonised steel die-cap that carried the engraved design. Such a die-cap was not evident on the Lincoln die, though further scientific investigation might have revealed one. Similarly, visual inspection and X-ray photographs of this Thetford find have not revealed a convincing weld line or difference in the metal, so it is possible that the whole steel die-cap (probably 10–15mm thick) has been lost. This is the shortest of the extant dies, but only marginally so at 33mm compared to 41mm for the Lincoln die and 45mm for that of William I from the Thames Exchange. If it has lost its die-cap it would have been of comparable length to these when last used. Clearly the Thetford die had been heavily used, and must have been near to the end of its practical life. Indeed, it is quite likely that it had been taken out of service and was intended for recycling since its high-quality iron was a valuable commodity.

The shank of the die was clearly faceted to some extent, although corrosion and accretions have contributed to a rounding effect. Late Saxon and Norman dies produced in southern England generally have a die face and shank that are essentially square in cross-section with corners rounded or cut diagonally (producing a semi-octagonal profile). The Thetford die appears originally to have been of this latter form. The thickening of the shank towards the head is typical of upper dies and is caused by regular hammering expanding the diameter of the shank.

The die is very difficult to date. Its form is consistent with that of dies of the late 10th to mid-12th centuries, but we have no reason to think that earlier dies, dating back to the later 8th century, would have been any different. The find context is consistent with a late Anglo-Saxon or early Norman date, with the majority of occupation on the site dating from the 10th to 11th centuries The pit in which the die was found also contained two sherds of Thetford ware dated to the 10th–11th centuries and an antler comb (SF415), which stylistically indicates an 11th-century date.

Thetford is first recorded as a mint towards the end of the reign of Edgar (959–75) when mint-names regularly occur on the coinage (Carson 1949; Jonsson 1987, 167–8; Blunt, Stewart and Lyon 1989, 196), but it is possible that coins from earlier in the 10th century without mint-signatures could have been struck there. From the 970s it rapidly rose to become the most productive mint in East Anglia and, although later overtaken by Norwich and Ipswich, it remained a significant mint until its closure on the eve of the 1180 recoinage. Some four to six moneyers were normally operating there during the late Anglo-Saxon and Norman periods, rising exceptionally to 15–20 at the end of Æthelred II's reign and the beginning of Cnut's around *c.* 1010–25. While the dies were usually supplied to Thetford moneyers from other regional or national centres of die production, it has been argued that there may have been a local die-cutter working in Thetford during Cnut's Quatrefoil issue, *c.* 1018–24 (Blackburn and Lyon 1986, 241–2). It is possible that this die was used by a coin forger, rather than an official moneyer, but its short length suggests that it had seen considerable use, and it might have been refurbished and re-engraved several times; this would have been more consistent with the output of a regular mint.

The substantial evidence for metalworking on this site, both ferrous and non-ferrous and especially in silver, raises the possibility that this was a moneyer's workshop where coins were struck. During the Anglo-Saxon period moneyers probably operated not from a central mint building, but from their own separate premises or ones shared with one or two others. Such an arrangement is documented for Winchester

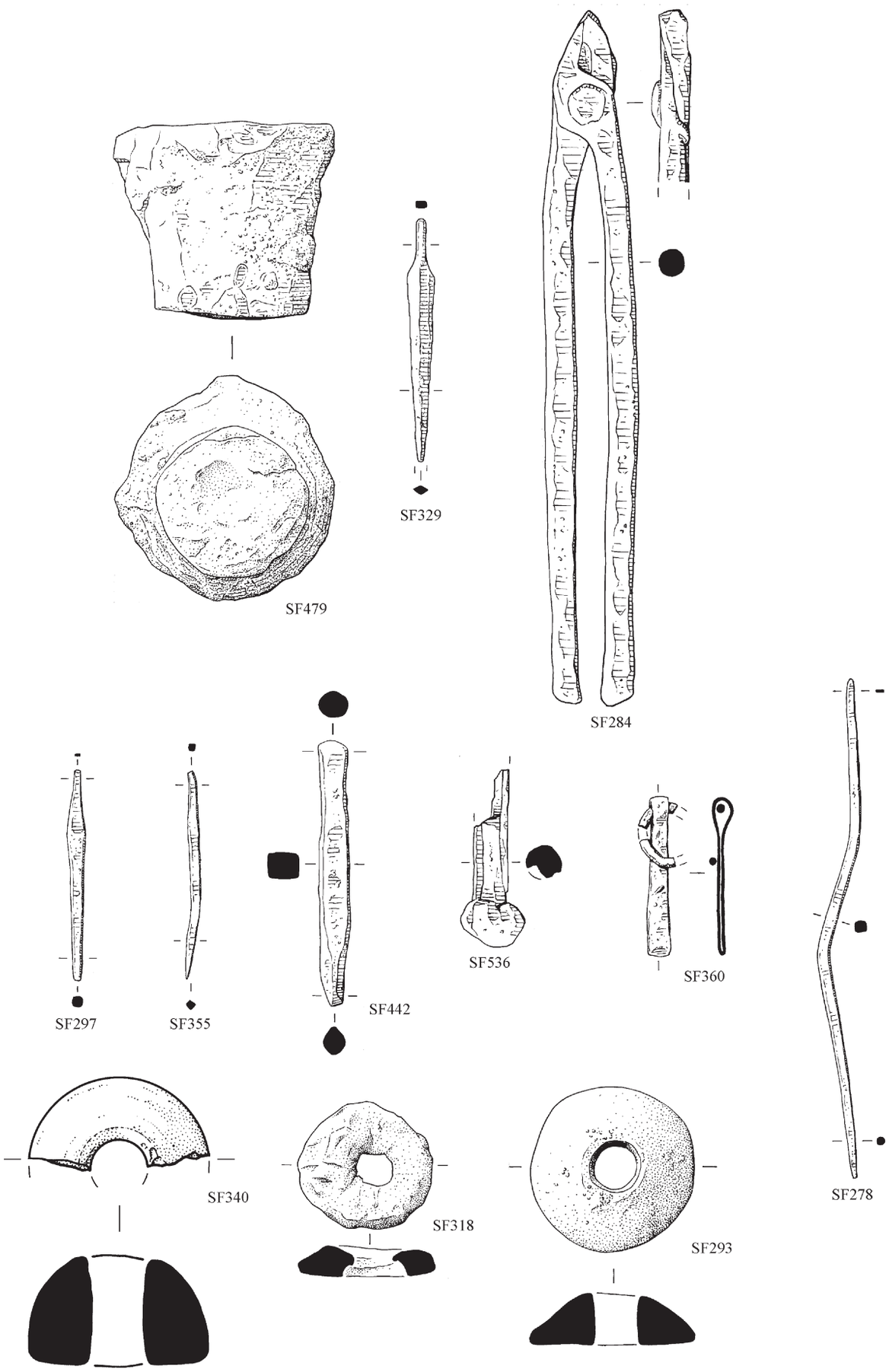


Figure 37 Metal small finds: craft tools. SF479, SF329, SF340, SF318 and SF293 scale 1:1; SF284, SF297, SF355, SF442, SF536, SF360 and SF278 scale 1:2.

in the later 11th and 12th centuries, and was probably widespread at an earlier date (Biddle 1976, 397–400). There is no reason why moneyers should not have been engaged in a variety of activities, and it may be significant that the dies from York and Lincoln were also from contexts rich in evidence for mixed metalworking. In York, Coppergate tenements C and D, where the dies were found, yielded litharge cakes, cupels, parting vessels, crucibles, ingot moulds, smithing slag and scrap metals, showing that metal refining and metalworking in gold, silver, copper alloy and iron were carried on there, silver and iron smithing being the dominant activities (Bayley 1992, 794–814; Ottaway 1992, 471–506). Likewise at Flaxengate in Lincoln, there was evidence of metalworking, predominantly in copper alloy, though with some signs of silver and iron smithing (Blackburn and Mann 1995, 201–2). The London (Thames Exchange) site where four dies were found has plausibly been associated with the production of dies, and this possibility cannot be ruled out in these other cases — there would have been far fewer die-cutters than moneyers, however, so probability would favour the latter. As a third alternative, the occupier of the Mill Lane site may have been simply a general metalworker who had acquired a decommissioned die as scrap iron. In no particular case can we be certain, without finding its by-products, that minting had been taking place on a site, yet the cumulative evidence of four early medieval coin dies discovered in rather similar stratified contexts in York, Lincoln and Thetford is now forming an exciting and suggestive pattern.

SF 479 *4229*, fill of pit *4230*; Period 3; Fig. 37
Fe coin die. Upper, reverse die for an Anglo-Saxon or Norman penny, mid 10th–12th century. Undetermined coin type, mint and moneyer. Shape: faceted (semi-octagonal) shaft expanding from its narrow base to the head. Metal: iron, heavily corroded, with original surfaces lost. State: extensively used, hence reduced length; engraved face lost, perhaps deliberately; splayed head probably reduced through corrosion or trimmed. L 32mm; shank diameter 37mm (at head), narrowing to 26mm (at base), Wt 145g.

Other metalworking tools

A pair of small iron tongs with round-sectioned arms with straight ends (SF284, Fig. 37) was found in a medieval pit. The jaws are broken so their original shape is uncertain, but their small size suggests that they had been used for handling small pieces of hot metal. Two broken iron handles with knobbed finials (SF535 and SF536, not illustrated) were found in the fill of pit *9090*, dating to the Late Saxon period. These may come from the handles of blacksmith's tongs of larger size, though at this date tongs and metal shears with plain and scrolled terminals are also known (Ottaway 1992, fig. 201 no. 2249; Arwidsson and Berg 1983, pl. 22 no. 445).

A round-sectioned iron punch (SF442, Fig. 37) was found in a Late Saxon pit fill. An iron tanged punch (SF182, not illustrated) of square section, of similar form to the leatherworking awls (below) but larger, was found unstratified. This is comparable with another from Thetford (Goodall and Ottaway 1993, fig. 129 no. 155), also found unstratified. Ottaway (Goodall and Ottaway 1993, 114) suggests it may have been used in metalworking, possibly to decorate non-ferrous metal.

SF 182 Unstratified; not illustrated
Fe tanged punch, square-sectioned shank tapering from a central shoulder to a pointed tip at each end. Almost complete, slightly encrusted, flaking. L 78mm, W max. 10mm.

SF 284 *1017*, fill of pit *1024*; Period 4; Fig. 37
Fe tongs; surviving pivoting jaws are short but are flaked and broken so original form is uncertain. The pair of long parallel round-sectioned handles have straight ends. Almost complete, encrusted cleaned. L 245mm, W max 28mm, W jaws 21mm, arm D 10mm.

SF 442 *4250*, fill of pit *4251*; Period 3; Fig. 37
Fe punch, square-sectioned shoulder tapering to a round-sectioned stem at each end; one ends in a blunt tip, the other is broken. Almost complete, slightly encrusted. L 92+mm, D max. 10mm.

SF 536 *9088*, fill of pit *9090*; Period 3; Fig. 37
Fe tongs handle, as SF535 above. Incomplete, enc. L 64+mm, D 13mm, finial D 24mm.

Woodworking tools

In addition to the axe blade (SF10) described above, a bevelled iron strip fragment — possibly a broken narrow chisel blade edge (SF140, not illustrated) — was found in the ditch forming the southern boundary to Enclosure C dating to the 10th–11th centuries.

SF140 *4347*, fill of ditch *4348*; Period 3; not illustrated
Fe blade fragment. Rectangular-sectioned strip tapering in thickness and width to a gently rounded terminal, possibly a blunted chisel blade edge. Incomplete, unencrusted L 19+mm, W max. 14mm, min. 11mm, Th max. 5mm, min. 3mm.

Leatherworking tools

(Fig. 37)

Three leatherworking awls were recovered from the excavations, two occurring in Area 3. An iron awl with characteristic lozenge section and a rectangular tang (SF329, Fig. 37) was found in 10th–11th century pit fill *3034* in Open Area B. Two iron awls were found in 11th–12th century contexts. One, of square section (SF355, Fig. 37), was associated with late 11th–early 12th century pottery, while a slender awl (SF297, Fig. 37) with a round-sectioned point and a short tang was found in pit fill *1030* in Open Area C.

SF 329 *3033*, fill of pit *3034*; Period 3; Fig. 37
Fe awl. Slender awl with rectangular-sectioned tang and fine lozenge-sectioned point, separated by a slight shoulder. Almost complete, tang tip missing. L 69+mm, W max. 5mm.

SF 355 *3035*, fill of pit *3039*; Period 4; Fig. 37
Fe awl. Square-sectioned awl with slight shoulder, tapering to a pointed tip at one end and a short point with the tip probably missing at the other. Almost complete, L 74mm W max. 4mm

SF 297 *1029*, fill of pit *1030*; Period 4; Fig. 37
Fe awl. Slender awl with round-sectioned blunt point and short rectangular-sectioned tang separated by a shoulder. Complete L 73mm, D max. 5mm.

Textile-working tools

(Fig. 37)

A pair of simple straight-ended iron tweezers with suspension ring (SF360, Fig. 37) was found in Late Saxon pit fill *1149*. While their small size suggests they were toilet implements, they could have been used to pick out debris from cloth during the finishing process. Other tweezers of similar date from Coppergate, York, have pointed arms (Ottaway 1992, 550–1 fig. 221).

SF 360 *1148*, fill of pit *1149*; Period 3; Fig. 37
Fe tweezers, of flat-sectioned strip with straight-ended inward curving arms. Complete, encrusted. L 59mm, arm W 9mm.

Four lead spindle whorls were found. The two of Walton Rogers form A (SF293, form A1, Period 3; SF73, form A2, Area 1 topsoil) are of a type popular in the

9th–10th centuries (Walton Rogers 1997, 1736). One (SF293, Fig. 37) is comparable with an example from Brandon Road, Thetford (Goodall 1993, 95, fig. 115 no. 10). A crudely-made whorl (SF318, Fig. 37) of Walton Rogers form B was found in a layer (*8014*) in Area 8 dated to Period 5. At Coppergate, York, this type of disc-shaped whorl was in use from the late 10th–early 12th centuries (Walton Rogers 1997, 1736), so this example dates to the beginning of the period. A spindle whorl (SF 541) of form C, a medieval type (Walton Rogers 1997, 1737–41), was unstratified.

SF 293 *2023*, fill of pit *2025*; Period 3; Fig. 37
Pb spindle whorl, conical with one flat face and large central perforation. Complete. D 28mm, Ht 9mm, hole D 9mm, Wt 39g.

SF 318 *8014*, layer, Period 5; Fig. 37
Pb spindle whorl, crude disc type with smooth flat face and a rough irregular face and large central hole with an inner ring of waste metal within. Complete. D 23mm, Ht 5mm, hole D max. 13mm, min. 7mm, Wt 16g.

SF 541 Unstratified; not illustrated
Pb spindle whorl, spherical with large central hole. Form C. Complete. Diameter 18mm, Ht 12mm, hole D 8mm, Weight 21g.

Twenty-two fibre-processing spikes of iron were found in stratified deposits, while another six were found unstratified. Over half (thirteen) were found in 10th–11th century contexts and six in 11th–12th century contexts, the remainder occurring residually. They were located principally in the main area of occupation, with 44% of the stratified examples being found within Open Area A and Enclosure C.

The difficulties involved in distinguishing the teeth of a wool comb from those of a flax heckle are discussed by Walton Rogers (1997, 1727–31). Applying her criteria, a single wool comb tooth of round section from a 10th–11th century pit fill could be recognised with certainty (SF175, not illustrated). The others had a square or rectangular section. The complete examples (sixteen) ranged in length from 79mm to 115mm, with both heckle teeth and wool comb teeth apparently represented. In addition, a similar but double-pointed spike was noted (SF278, Fig. 37). The square-sectioned spike, 179mm long, was pointed at each end and appears to have functioned as a double spike discarded before being separated into two individual spikes by the blacksmith.

Fibre-processing spikes from both wool combs and flax heckles have been found in quantity on previous excavations at Thetford (Goodall and Ottaway 1993, 99, 114; Goodall 1984, 79, fig. 119, nos 22–30; Andrews 1995, 90). The iron bindings from the wooden block heads in which they were originally mounted have also been recovered (Goodall 1984, 79, fig. 119 nos 20–1).

SF175 *4004*, fill of pit *4005*; Period 3; not illustrated
Iron heckle tooth, round-sectioned slightly tapering stem, tip broken. Almost complete, slightly encrusted. L 95mm, D 6mm.

SF 278 *4011*, unstratified, Area 4; Fig. 37
Fe heckle tooth, length of slender square-sectioned stem with gently sinuous profile and pointed terminals. Complete, L 179mm, W max. 5mm.

Five round-sectioned iron ?needle stems were found, three of them coming from 10th–12th century deposits. One (SF446) was broken across the eye and clearly came from a needle; another three (SF183, SF420 and SF441) of similar diameter (2mm) were also likely to be broken needles. Another stem (SF331) is of larger diameter (5mm) and could have come from a larger needle or a wool comb tooth (see above). Iron needles have previously been found in small quantities at other sites in Thetford (Brandon Road, Goodall and Ottaway 1993, fig. 119 nos 33–6; Goodall 1984, 79, fig. 119 nos 32–3), and vary considerably in size.

SF331 *3033*, fill of pit *3034*; Period 3; not illustrated
Fe needle/pin, length of round-sectioned stem. Incomplete, slightly encrusted. L 36+mm, D 5mm.

SF446 *4217*, fill of pit *4224*; Period 4; not illustrated
Fe needle, round-sectioned stem broken at each end, with the suggestion of an eye visible in radiograph. L 36mm, D 2mm.

Metalworking debris

(not illustrated)

In addition to the metalworking slags, lithage and crucible fragments recovered (p.52–6, below), a small amount of other metalworking debris was noted. A little bar iron was found in 11th–12th century pit fill in Area 4, and in the topsoil from Areas 1 and 3.

Two small ingots of copper alloy (SF52 and SF80), weighing 80g and 20g respectively, were found in topsoil. Both are composed of diverse alloys and are bars of recycled metal. Small droplets and spillages of copper alloy were found in Late Saxon pit *1177* (SF374) and in the topsoil (SF82, SF153 and SF186). Small pieces of offcut sheet and scrap copper alloy destined for recycling were found in topsoil (SF41, SF121, SF189 and SF314). A length of copper alloy wire (SF289) was found in a pit fill (*1028*) dating to the early medieval period.

A casting sprue of pure lead (SF539) was found unstratified and a stem of pure lead (SF130), also likely to be waste from the casting process, was found in topsoil in Area 4. An offcut of lead sheet (SF404) with cut-marks was found in 10th–11th century ditch fill.

Knives

(Fig. 38)

Eighteen knives, all with whittle tangs, were recovered; thirteen of them were sufficiently complete to be classifiable. All could be parallelled by similar knives from earlier excavations at Thetford.

The pivoting double-bladed knife (SF326, Fig. 38) is comparable to others found previously at Thetford (Goodall 1984, fig. 122 nos 48–9; Andrews 1995, fig. 70 no. 15; Goodall and Ottaway 1993, fig. 127 no. 146) and elsewhere (Coppergate, York: Ottaway 1992, fig. 244, nos 2975–8, and fig. 243 for a reconstruction of the knife in use). The majority of pivoting knives date to the 8th–11th centuries (Ottaway 1992, 588). They are likely to have been used for a particular craft function. Biddle (1990, 738–41) has suggested that they were used by scribes; Ottaway (1992, 587) has noted that boneworking and woodworking might also have required a small double-bladed knife.

Two knives with angled backs (Ottaway's back form A: Ottaway 1992, 561–5), a type common in the 9th to 11th centuries, were also found. One (SF421, Fig. 38) has the back rising slightly before the angle (Ottaway form A2), while the other (SF431, Fig. 38) has a straight back (Ottaway's form A1). Another knife (SF105, Fig. 38) has a stepped back (Ottaway's form A3). This feature is less common: stepped-backed knives have been found previously at Thetford (Goodall 1984, fig. 125 no. 103; Goodall and Ottaway 1993, fig. 123 no. 56), Coppergate,

York (Ottaway 1992, fig. 228 no. 2800) and Flaxengate, Lincoln (Ottaway 1992, 565).

Seven knives had narrow straight-backed blades — the knife type most commonly found at Thetford (Goodall and Ottaway 1993, fig. 123 nos 57–64) — with their edges worn away by frequent sharpening. These knives were found in features of all periods. One (SF509, not illustrated) could be seen in the x-radiograph to have the softer metal of the back of the knife joined to the harder edge with a serrated weld line. This feature has also been seen on an angled-backed knife of pre-Conquest type from Brandon Road, Thetford (Goodall and Ottaway 1993, fig. 123 no. 53). Two larger knives (SF371 and SF298, not illustrated) with wider blades, straight backs and edges meeting at central pointed tips were found in topsoil deposits, as was a further knife (SF117, not illustrated) with the edge rising to meet the straight back at a long pointed tip.

A further four broken blades were found (not illustrated). One (SF206) occurred in Period 3 pit *4305*; the others came from topsoil in Areas 1 (SF83) and 3 (SF90), or were unstratified (SF522). Three iron tangs broken from knives were also recovered (SF286, SF301 and SF332).

SF 105 Unstratified, Area 1; Fig. 38
Fe knife. Narrow arrow knife with centrally-placed, rectangular-sectioned tang, sloping shoulder, straight back and edge. The back is stepped before meeting the edge at a long pointed tip. Mineral-preserved organic on tang from organic handle. Complete. Total L 120mm, blade L 85mm, W 14mm.

SF117 Unstratified, Area 1, not illustrated
Fe knife. Short rectangular centrally-placed tang, sloping shoulder and choil, straight back and edge tapering to a meet at a pointed tip, now missing. Possibly some mineral-preserved organic on the tang. Almost complete. L 113+mm, blade L 94mm, W 15mm, back Th 4mm.

SF 326 Unstratified, Area 4; Fig. 38
Fe pivoting knife with straight back, longer blade with edge rising to meet the back at a pointed tip; shorter blade has an angled back dropping to meet the edge; the tip is missing. Two blades separated by a pivot with a notch to either side; the pivot pin and rivet are preserved. Almost complete, slightly encrusted, Total L 94+mm, W 15mm, complete blade L 55mm.

SF371 Unstratified, Area 2; not illustrated
Fe knife, narrow blade with centrally-placed rectangular-sectioned tang, small sloping shoulder and choil, straight back dropping at an angle to meet the straight edge at a central pointed tip. Complete, fractured, slightly encrusted, flaking. Total L 125mm, blade L 80mm, W 16mm, back Th 3mm.

SF 421 Unstratified, Area 2; Fig. 38
Fe knife. Small knife with short rectangular-sectioned tang, straight shoulder, no choil; straight back dropping at an angle to join the edge at a pointed tip; tip missing. Weld line visible in radiograph. Almost complete. Total L 87mm, blade L 74+mm, W 20mm.

SF 431 Unstratified; Fig. 38
Fe knife. Small knife with short centrally-placed tang, sloping shoulder and choil, narrow blade with straight back dropping at an angle to the straight edge at a central tip. Complete, encrusted. Total L 86mm, blade L 65mm, W 14mm, back Th 4mm.

SF509 Unstratified; not illustrated
Fe knife. Small knife with centrally-placed rectangular-sectioned tang, sloping shoulder and narrow straight-backed blade, heavily sharpened so that edge of blade is now missing. In radiograph a saw-tooth edge is visible between the back and the missing edge. Fragment of mineral preserved organic on tang. Complete, slightly encrusted. Total L 86mm, blade 54mm, surviving W 6mm, back Th 3mm.

Locks and keys

(Fig. 38)

A small iron lock bolt (SF277, not illustrated) of common type (*cf.* Goodall 1983, fig. 131 nos 175–7) was found in a 10th–11th century pit fill. A pierced strip (SF497, not illustrated), likely to have been part of an internal locking mechanism, was found associated with 11th-century pottery. The handle of a padlock key (SF9, not illustrated) of common post-Conquest type (*e.g.* Goodall 1984, fig. 132 nos 180–1) occurred in 10th–11th century pit fill. The bows and stems of two rotary keys (SF12 and SF17, not illustrated) were found in topsoil. One bow (SF12), from Area 4, came from a key of particularly large size comparable to another found below topsoil at Site 2N, Thetford (Goodall 1984, fig. 132 no. 191). Another handle (SF372, not illustrated), found with 11th-century pottery, has a thick stem, suggesting it came from another large key or possibly from a flesh fork or other domestic implement. Of particular interest was a fragment broken from a cast copper alloy openwork roundel (SF40, Fig. 38), found in topsoil in Area 5. It can be parallelled by the openwork decorative bow on a bronze key from Great Ellingham, Norfolk, dated to the 10th–11th century and perhaps an import from the Netherlands (Norwich Castle Museum L1975.20).

SF 9 *6001*, fill of pit *6002*; Period 3; not illustrated
Fe key handle. Flat-sectioned strip handle with looped ring terminal, gently sloping shoulder tapering slightly toward the bit, now missing. Almost compete, slightly encrusted. L 105mm, W max. 13mm.

SF 12 Unstratified; Area 4; not illustrated
Fe key, long round-sectioned hollow stem and large rectangular-sectioned circular ring bow. Incomplete, slightly encrusted, flaking, random mineral-preserved organic material. Total L 167+mm, D 12mm, bow D 58mm.

SF 40 Unstratified; Area 5; Fig. 38
Cu alloy roundel. Cast circular openwork roundel fragment. Incomplete, slightly encrusted random mineral preserved organic present (straw *etc.*). D 60mm.

SF277 *4012*, fill of pit *4014*; Period 3; not illustrated
Fe lock bolt, rectangular-sectioned strip with pair of rounded teeth projecting from one side and a single tooth from the other. Complete, slightly encrusted. L 65mm, W max. 6mm, tooth Ht 4mm.

SF372 *2052*, fill of pit *2056*; Period 4; not illustrated
Fe handle, round-sectioned stem with broken bifurcated terminal. Appears to be a broken flesh fork rather than a key with a broken bow. Incomplete, encrusted, flaking, much random mineral-preserved organic material. L 77mm, W max. 20mm, stem D max. 13mm.

SF497 *2013*, fill of pit *2016*; Period 4; not illustrated
Fe strip, slightly tapering, with remains of a small pierced ring terminal at one end and a nail at the other. Incomplete, slightly encrusted, flaking. L 81mm, W max. 19mm, min. 12mm.

Box fittings

(Fig. 38)

Two decorated fittings for a box (SF396 and SF397) were recovered from pit *3117*, while a third (SF382) was found in pit *1098*. All were associated with 10th-century pottery.

The handle hinge fitting (SF396, Fig. 38) with non-ferrous metal plating, likely to be tinning, was probably used to hold a drop handle on a box or casket, and can be parallelled by another from 16–22 Coppergate, York (Ottaway 1992, 640, fig. 268 no. 3485). The flat strip with decorative non-ferrous metal sexfoil mounts around the rivet-holes from the same context (SF 397, Fig. 38) is also likely to be a decorative fitting for a box or casket. The decorative U-eyed hinge (SF382, Fig. 38) is comparable

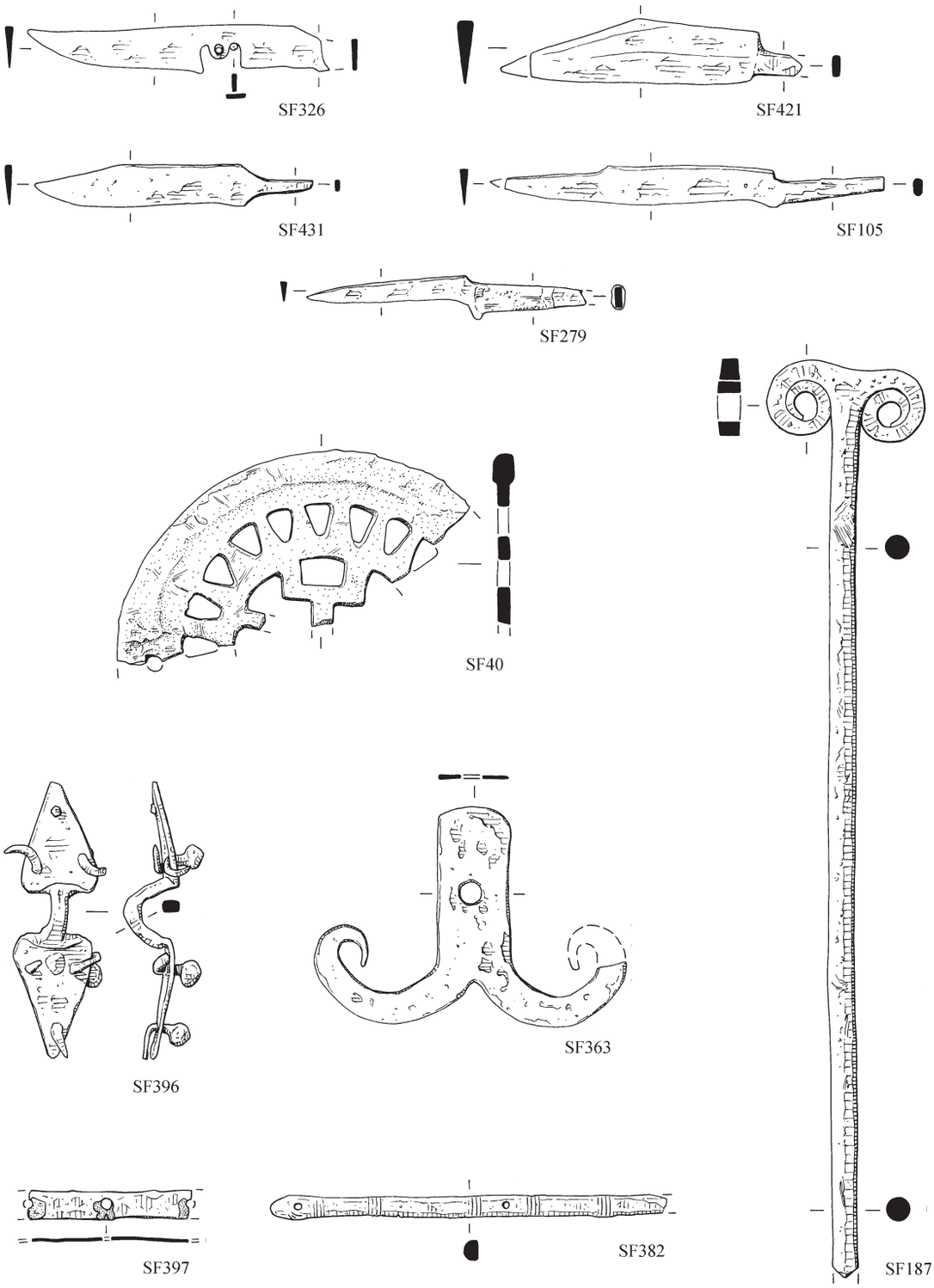


Figure 38 Metal small finds: knives, box fittings and domestic implements. Scale 1:2, except SF40 (scale 1:1).

with another box fitting from Thetford (Goodall 1984, fig. 130 no. 161, from 10th–11th century occupation) and others from Anglo-Scandinavian Coppergate (Ottaway 1992, 624, fig. 259 no. 3303, fig. 260 nos 3322–4, fig. 268 nos 3475 and 3478). The Coppergate examples have more distinctly lobed terminals representing simplified animal heads. The Mill Lane example (SF382), decorated with groups of transverse mouldings and a pair of chevrons at the simple rounded terminal, was covered in a non-ferrous metal coating, probably tinning, as were the York fittings.

SF 396 *3110*, fill of pit *3117*; Period 3; Fig. 38
Fe handle hinge fitting. U-shaped round-sectioned loop with a triangular flat-sectioned plate at each end held by three globular-headed rivets on the opposite side of the loop, one now missing. Non-ferrous metal plating visible in radiograph. Complete, encrusted, cleaned. L 85mm, plate L 37mm, W 28mm.

SF 397 *3110*, fill of pit *3117*; Period 3; Fig. 38
Fe decorated binding. Length of flat-sectioned strip pierced by a central rivet-hole and by one at each of the broken ends. Each rivet-hole has a non-ferrous metal surround, the central one (a sexfoil petal-shaped mount) the best preserved. Incomplete, slightly encrusted. L 51+mm, W 10mm.

SF 382 *1103*, fill of pit *1098*; Period 3; Fig. 38
Fe binding strip. Narrow strip of plano-convex section pierced by two small rivet-holes, one at the centre, the other close to the rounded terminal. Decorated with five groups, each comprising four transverse mouldings and a pair of chevrons at the terminal. Non-ferrous metal visible in radiograph likely to be tinning. Almost complete, partially cleaned. L 124+mm, W max. 6mm, Th 5mm.

Domestic implements

(Fig. 38)

Two iron spits were recovered in Late Saxon pit *2005*. One (SF187, Fig. 38), measuring 285mm in length, has a double spiralled head; the other (SF253, not illustrated), slightly shorter at 222mm, has a looped ring terminal. Spits were used in the dressing and cooking of meat. They are shown skewering chicken and different joints of meat on the Bayeux Tapestry in a depiction of the preparation of a feast for William to celebrate the successful landing of the Norman army. The spiral-headed example (SF187) can be parallelled by others of Roman date. One from Richborough was found unstratified (Bushe-Fox 1949, 130 no. 129 and pl. XXXVII), but Henderson (1949) was able to cite others found on the Roman *Limes*. An iron flesh hook with a forked head and small tang similar to three other examples from GMK Site 2 at Thetford (Goodall 1984, fig. 133 nos 193–5) was found in topsoil in Area 2.

SF 187 *2004*, fill of pit *2005*; Period 3; Fig. 38
Fe spit, round-sectioned stem with double spirally-twisted terminal and straight end, possibly broken. ?Complete, encrusted, flaking, much random (straw-like) mineral-preserved organic material on the stem. L 285mm, Head 49x23mm, D 10mm.

SF253 *2004*, fill of pit *2005*; Period 3; not illustrated
Fe spit, long round-sectioned stem with a looped ring terminal and a straight end. Complete, encrusted, flaking, random mineral-preserved organic. L 222mm, D 10mm, head W 20mm.

Vessels

(Fig. 38)

A nailed iron binding (SF363, Fig. 38) with a scrolled terminal, probably from a wooden stave-built bucket, was part of a small assemblage of metalwork found in pit *1149*. A bucket handle mount (SF16, not illustrated) was found in topsoil in Area 4. A decorative roundel of copper alloy (SF315, not illustrated), with a central boss surrounded by six trefoil arcaded motifs and possibly a central boss from a wooden bowl, was found in topsoil in Area 8 and may be post-medieval. Three copper alloy cast vessel feet were found unstratified (SF531, SF532 and SF545, not illustrated). One (SF545) had a small rectangular foot and a splayed leg; another (SF532), from a larger vessel, took the shape of a lion's paw.

SF363 *1148*, fill of pit *1149*; Period 3
Fe nailed binding, strap with round central nail-hole and decorative outward scrolled bifurcated terminal. Incomplete, slightly encrusted. L 70mm, W 28mm, terminal W 100mm.

Miscellaneous domestic items

(not illustrated)

A rectangular gilded copper alloy book plate (SF268) with engraved rocker arm decoration was found unstratified.

A range of small domestic iron items — including a spirally-twisted implement handle (SF213), a strip handle (SF123), a bell clapper (SF208) and a decorative nail (SF419), probably from upholstery — were found in disturbed layers and topsoil. A lead pottery clamp (SF540) was found unstratified.

Seven annular rings of copper alloy and iron were found in topsoil. These could have served various functions in a domestic setting, as simple handles, suspension rings, horse harness *etc*. The iron rings ranged in external diameter from 20–22mm; those of copper alloy from 26–50mm.

Weights and measures

(not illustrated)

Three small lead weights for use with a balance were found, all unstratified: a cuboid weight of 12g (SF148), and two disc-shaped weights of 27g (SF65) and 20g (SF191).

Structural fittings

(not illustrated)

A small range of structural ironwork was recovered. A drop-hinge (SF359) was found in 10th–11th century pit fill and two hinge pivots (SF157 and SF379) were found; the larger of these (SF379) had a double-clenched shank, indicating it had passed through a timber thickness of *c.* 120mm (*c.* 4¾ ins). A large rectangular staple (SF378) came from the same context (*1155*). Smaller U-shaped staples (SF139, SF498, SF159, SF214 and SF230) were also found in 10th–11th century contexts and machined layers. Broken cleats (SF384, SF409 and SF537) were found in Late Saxon pit fills; the broken shank from a wallhook (SF398) was unstratified. All can be parallelled by finds from other Thetford excavations (*e.g.* Goodall 1984, figs 127–9).

A ring-headed pin (SF87) and fragments of nailed binding (SF89 and SF132) were found in topsoil. A small quantity (eleven pieces) of iron strap (width >25mm) and strip (width <25mm) were also recovered.

SF139 *4347*, fill of ditch *4348*; Period 3; not illustrated
Fe U-shaped staple, almost complete, encrusted. Arm Ht 29mm, W 18mm.

SF359 *1140*; fill of pit *1141*; Period 3; not illustrated
Fe drop hinge, straight-ended nailed binding with rectangular-sectioned, U-shaped shank ending in a short round nailed terminal. Two flat-headed nails *in situ*. Complete. Total L 68mm, strap W 20mm, total W 28mm, nail head 12mm, L 20mm.

SF378 *1155*; fill of pit *1156*; Period 3; not illustrated
Fe staple, large, rectangular-sectioned, with two long upstanding arms with straight terminals. Radio-opaque specks present in the corrosion products. Complete, slightly encrusted. W 123mm, arm Ht 115mm.

SF409 *1179*; fill of pit *1120*; Period 3; not illustrated
Fe shank, thick, square-sectioned, tapering to a blunt tip at one end and flattening and turning at a right-angle at the other. Arm from a heavy cleat, or possibly a handling rod. Incomplete, slightly encrusted. L 55mm, W max 21mm.

Timber nails

(not illustrated)

A relatively small quantity of timber nails was recovered from the excavations. While this is probably due to the use of jointing to secure structural timbers and carpentry, and of roofing thatch rather than nailed shingles *etc*., perhaps some nails were salvaged for re-use of the iron. Fifty-nine nails were classifiable, while a further 56 were represented by broken nail shanks only. The majority of the classifiable nails were found to be general-purpose types of medium size with flat heads of square or rectangular shape. A distinct nail type with a small oval head was noted in the early medieval contexts (11th–12th centuries). Two timber nails were found in grave *4247*, occurring residually in fill *4293*. A single Roman type II nail (Manning 1985, 135, fig. 32, no. 2) and modern nails were found in contexts of later Periods.

III. Metalworking debris

by David Starley and Roger Doonan

Ironworking

A total of 150kg of slag and associated debris was visually examined, classified and quantified. The results are available in the site archive and summarised in Table 5. Visual examination of metalworking debris allowed the material to be categorised using criteria of morphology, density, colour and vesicularity. It should be stressed that many 'classes' of ironworking slag form parts of a compositional and morphological continuum. Only certain classes of material are strictly diagnostic, and can be assigned unambiguously to a single metalworking process. Others may derive from a restricted range of processes but might, when found in association with the diagnostic types, provide support for the identification of these activities. Some forms of debris may originate from a very wide range of high temperature processes, and are of no assistance in identifying crafts or industries.

Classification of ironworking debris

Examination of the debris revealed an atypical assemblage, which did not always match well with the classification criteria used at the Ancient Monuments Laboratory. No analysis of the slag was undertaken, but use of a porcelain streak plate indicated a typical, predominantly fayalitic (2FeO.SiO) composition for much of the debris. Slag of this composition would have a relatively low free running temperature.

Of the slag that is diagnostic of a particular process, that which derives from iron smelting (*i.e*. primary extraction of iron from the ore) formed the greatest part of the assemblage. However, there was considerable variation in type within the smelting slag. Although there are several ways in which smelting furnaces can be classified, from the point of view of the debris it is easiest to divide them into those from which the slag is tapped, and those in which it is not tapped and either collects within the furnace or in a pit beneath it. In England tapping furnaces have generally been associated with higher productivity during the Roman and medieval periods, although some post-Roman, pre-Norman Conquest examples are known. Slag pit furnaces (which are far more common in continental Europe, and associated with *schlackenkloetz* slag blocks) belong to a more geographically and temporally restricted tradition centred on Saxon East Anglia (McDonnell 1989).

Tap slag is very easily recognised; it shows a characteristic 'ropy' flowed morphology on its upper surface and very low vesicularity at fracture surfaces. It is clearly the most common diagnostic smelting waste product. Likewise **slag blocks**, the product of pit-type furnaces, are normally easy to identify because of their very large size, pudding-like shape and uniformity of fracture surface. Only one piece of debris from Mill Lane — one quadrant of a block, weighing almost 1.1kg — exactly matched these criteria. **Furnace bottoms** result from the

Period	*3*	*3A*	*4*	*4/5*	*5*	*6*	*7*	*U/S*	*Total*
Iron smelting									
tap slag	15365	415	2459	0	15	0	0	6	18260
furnace bottom	1533	2205	1938	0	498	0	0	2169	8343
slag block	1098	0	0	0	0	0	0	0	1098
furnace slag	0	2079	0	0	0	0	0	0	2079
ore?	30	164	0	0	0	0	0	0	194
total smelting	18026	4863	4397	0	513	0	0	2175	29974
Iron smithing									
smithing hearth bottoms	5890	2440	4381	740	1696	0	173	2105	17425
flake hammerscale	nq	nq	nq	nq	nq	0	nq	0	nq
spheroidal hammerscale	nq	0	nq	nq	nq	0	nq	0	nq
total smithing	5890	2440	4381	740	1696	0	173	2105	17425
Undiagnostic slag									
undiagnostic ironworking	16070	4770	32261	4403	2550	0	423	3327	63804
dense slag	2178	2019	4838	704	634	0	332	894	11599
fayalitic runs	4442	2000	3130	284	246	0	740	342	11184
glassy slag	198	0	0	0	0	0	0	0	198
iron-rich slag	1955	78	450	294	102	0	131	72	3082
vitrified hearth lining	3826	431	1815	14	279	0	55	28	6448
cinder	734	320	661	272	15	0	95	0	2097
total undiagnostic	29403	9618	43155	5971	3826	0	1776	4663	98412
Total	**53,319**	**16,921**	**51,923**	**6,711**	**6,035**	**0**	**1,949**	**8,943**	

nq = present but not quantified

Table 5 Slag weight totals by period (g)

solidification of slag at the base of a furnace. They do not necessarily imply a non-tapping tradition, as tapped furnaces may also retain some slag. Their identification is further complicated by the possibility of confusing small furnace bottoms with large smithing hearth bottoms, which may be morphologically and compositionally similar. The term **furnace slag** is given to large, dense pieces of material, often bearing impressions of the sides of the furnace. Further limited evidence of smelting was provided by a single fragment of roasted **ore**, and some iron-rich material classed as **possible ore**. Although no analysis of this was carried out, the roasted ore appeared to be largely haematite (red streak)/magnetite (attracted to bar magnet), and of sufficiently high grade to be a viable source of iron given the furnace technology of the period.

Although their origin is less certain, a further three categories probably derive from smelting. The two largest of these were **dense slag** and an uncommon form, **fayalitic runs**. Both of these forms were similar to the above four categories of smelting slag in displaying very low porosity and homogenous structure at their fracture surfaces. **Dense slag** comprised large shattered, angular fragments of slag, probably the result of the fracturing of the larger masses of slag blocks and furnace bottoms during cooling. **Fayalitic runs** included a range of morphologies from small dribbles to flat, plate-like forms, generally unconstrained but occasionally solidified into circular or ellipsoid-sectioned cylinders. The single fragment of **glassy slag** closely resembled the waste from blast furnaces. Whilst it is possible that such material of post-medieval date entered earlier levels, more probably it derives from a bloomery furnace that became overheated.

Unusually for an urban site, evidence for smithing (*i.e.* hot working of iron) was more limited than for smelting. Normally this is recognised in two main forms: bulk slags and micro-slags. Of the bulk slags produced during smithing, **smithing hearth bottoms** are least likely to be confused with the waste products of smelting and are therefore considered to be diagnostic of smithing. These hearth bottoms normally display several characteristic features: their form is plano-convex, with a rough convex base and a smoother, vitrified upper surface which is flat, or even slightly hollowed, as a result of the downwards pressure of the air blast from bellows directed through the tuyère. Compositionally, smithing hearth bottoms are also predominantly fayalitic and form as a result of high-temperature reactions between the iron, iron-scale and silica, the latter either from the clay furnace lining or from sand used as a flux by the smith.

The dimensional statistics of the Thetford smithing hearth bottoms are given in Table 6 and the mean weights are broken down by period in Table 7. Perhaps the most unusual feature of the data is the very wide range of dimensions generally, and the difference between the Late Saxon and early medieval periods. Both these periods produced hearth bottoms which are of consistently small size, although Period 3 also accounted for almost all of a handful of much bigger hearth bottoms. The most likely cause of this is that in the earlier period iron smithing included not only the manufacture of artefacts but the primary working of blooms from the furnaces as well. As discussed below, this parallels the early date of the smelting debris in the assemblage.

In addition to bulk slags, iron smithing also produces micro-slags of two types. **Flake hammerscale** consists of fish-scale-like fragments of the oxide/silicate skin of the iron dislodged during working. **Spheroidal hammerscale** results from the solidification of small droplets of liquid slag expelled during working, particularly when two components are being fire-welded together or when a slag-rich bloom of iron is first worked into a billet or bar.

	range	*mean*	*std dev*
weight (g)	42–1789	279	303
length (mm)	55–180	90	25
width (mm)	35–140	67	21
depth (mm)	15–170	35	13

Table 6 Smithing hearth bottom dimensions (all Periods n=148)

Period	*3*	*3A*	*4*	*4/5*	*5*	*7*	*unknown*
No.	16	9	19	2	10	1	8
Mean weight	368	321	196	269	263	173	331

Table 7 Smithing hearth bottoms. Mean weights (g) by Period

Two categories of debris that are not normally considered diagnostic are the most common types: **undiagnostic ironworking slag** and **iron-rich slag**. Similar materials may be produced by iron smelting and iron smithing operations. On a site such as this one where both processes have already been identified, their presence provides little further information. However, the way in which the distribution of undiagnostic types parallels that of the diagnostic smithing debris suggests that the majority of this debris derives from smithing.

Material listed as **vitrified hearth/furnace lining** forms during iron smelting, iron smithing or non-ferrous metalworking as a result of a high-temperature reaction between the clay lining of the hearth/furnace and the alkaline fuel ashes or fayalitic slag. An associated material, classed as **cinder,** comprises only the lighter portion of this material. This is a porous, hard, brittle slag formed as a result of high-temperature reactions between the alkali fuel ashes and either fragments of clay which had spalled away from the hearth/furnace lining or another source of silica, such as any sand used as a flux during smithing.

Ferruginous concretion forms as a result of the redeposition of iron hydroxides, similar to the natural phenomenon of iron panning. However, the process is likely to be enhanced by the nature of the surrounding archaeological deposits, particularly iron-rich waste. One small fragment (context *4004*) of this material was found to contain hammerscale. A further group of finds, classified as **iron objects**, may also be working debris, ranging from metal which was not consolidated into the main bloom, to bar ends and other scrap.

Non-ferrous metalworking

The 'crucible' assemblage and a copper alloy dross find
by Roger Doonan

The crucible fragments were derived from vessels with diameters ranging from 40mm to *c*. 150mm: most commonly they were 60–100mm across. The thickness of the fabric ranged from 3mm to 8mm. Many of the crucible fragments had their external surfaces covered in a less refractory coating, often referred to as an extra outer layer. The function of this would have been to increase the thermal capacity of the vessel, and protect against extremes of temperature and failures brought about by stresses induced by thermal shock (Bayley 1992a, 755). The fabrics represented in the assemblage were either Stamford or Thetford wares, with Stamford wares accounting for the majority of crucibles. Both fabrics exhibit excellent refractory properties as there is little evidence of bloating or slagging, typical of ceramics high in quartz temper and with a matrix with high aluminium and low iron and alkali metal contents (Freestone and Tite 1986). Although the refractory properties of Stamford wares have long been acknowledged (Bayley 1992a, 754), handmade Thetford wares are considered less refractory (Bayley 1984, 107). The lack of evidence for vitrification or slagging on the internal surface of the crucible fragments meant that it was sometimes difficult to determine whether or not a sherd had been used as a crucible. However, close inspection frequently revealed a residue on the sherd that subsequent XRF analysis showed to be rich in metals. The absence of slagged interiors is testament to the great skill and judgement exercised by the smiths when controlling the metallurgical hearth. The absence of slag means that melting was carried out efficiently as metal was not lost, nor were the crucibles damaged.

Chemical analysis concentrated on identifying sherds that showed evidence for use as metallurgical crucibles and, for these, what type of metal was melted. For crucibles which displayed no visible evidence for use, a comparison of the XRF spectra of the internal and external surfaces was made to identify any enhanced metal residue on the internal surfaces.

Inferring the composition of an alloy from the composition of the residue on a crucible is not straightforward, especially when the analysis is determined by qualitative XRF analysis. These problems are

Find No.	*Description*	*Cu*	*Sn*	*Pb*	*Zn*	*As*	*Sb*	*Alloy type*
461	whole crucible	nd	nd	nd	++	nd	nd	?
1019	crucible fragments (a)	+	tr	+	+++	nd	nd	brass
1019	crucible fragments (b)	++	tr	++	tr	nd	nd	leaded copper
1019	crucible fragments (c)	+	tr	+	+++	nd	nd	brass
1019	crucible fragments (d)	+	nd	+	+++	nd	nd	brass
1019	crucible fragments (e)	+	+	+	+	nd	nd	gunmetal
1019	crucible fragments (f)	++	tr	++	tr	nd	nd	leaded copper
1019	crucible fragments (g)	++	+	+++	+	tr	nd	leaded gunmetal
1019	crucible fragments (h)	+	tr	+	+++	nd	nd	brass
1019	crucible fragments (I)	++	tr	++	tr	nd	nd	leaded copper
1019	crucible fragments (j)	+	tr	+	+++	nd	nd	brass
1026	crucible fragment	tr	nd	tr	+++	nd	nd	brass
1123	crucible fragment	tr	nd	+	tr	tr	nd	brass
1019 (bag Y)	crucible fragment (a)	++	tr	+	+++	nd	nd	brass
1019 (bag Y)	crucible fragment (b)	++	tr	++	tr	nd	nd	leaded copper
1019 (bag Y)	crucible fragment (c)	+++	nd	+	++	nd	nd	brass
1019 (bag Z)	crucible fragment (a)	tr	nd	++	tr	nd	nd	leaded copper
1019 (bag Z)	crucible fragment (b)	+	nd	+	+++	nd	nd	brass
1019 (bag Z)	crucible fragment (c)	tr	nd	tr	tr	nd	nd	?
1017 (stam d)	crucible fragment (a)	+	tr	tr	+++	tr	nd	brass
1017 (stam d)	crucible fragment (b)	+	nd	+	+	nd	nd	brass
1017 (stam a)	crucible fragment (a)	+	nd	+	++	nd	nd	brass
1017 (stam a)	crucible fragment (b)	+	nd	tr	+++	nd	nd	brass
1218	crucible fragment	+++	nd	+	++	nd	nd	brass
1115	crucible fragment	+	tr	tr	+++	nd	nd	brass
1250	crucible fragment	tr	nd	+	+++	nd	nd	brass
9045 (stam B)	crucible fragment	+++	+	++	+++	nd	nd	leaded gunmetal
1095	crucible fragment	+	nd	+	+++	nd	nd	brass
9074	crucible fragment	++	nd	+	+++	nd	nd	brass
9088 (stam B)	crucible fragment	nd	nd	nd	++	nd	nd	not crucible?
1019 (the 3)	crucible fragment	+++	nd	+	++	nd	nd	brass
1015	crucible fragment	++	tr	++	++	nd	nd	leaded brass
1055	crucible fragment	+	tr	+	+++	nd	nd	brass
1000	crucible fragment	+++	tr	++	++	tr	nd	leaded brass
1032	crucible fragment	+	tr	+	+++	nd	nd	brass
1019 (vc stam)	crucible fragment?	tr	nd	+	+++	nd	nd	brass
2001	crucible fragment	++	nd	+	+++	nd	nd	brass
2000	crucible fragment	++	+	+	+++	nd	nd	gunmetal
1017 (stam a)	crucible fragment (c)	+++	nd	+	++	nd	nd	brass

(+++ – strong, ++ – medium, + – weak, tr – trace, nd – not detected)

Table 8 XRF analyses of crucible fragments

Context	*SF No.*	*Object*	*Elements present*	*Comments*
1121		litharge cake (lower layer)	(P) Ca (Mn) Fe Cu Pb	
1121		litharge cake (dark upper layer)	(P) Ca (Mn) Fe Cu Ag Pb	less rich in Cu with respect to Pb than lower layer
4000	52	bar ingot fragment	Fe Cu Sn Pb	

Table 9 XRF analyses of other non-ferrous debris

	3	*3A*	*4*	*4/5*	*5*	*6*	*7*	*?*	*Total*
litharge cake*	194	347	174	60	0	0	0	0	775
crucible fragments	43	42	199	645	0	0	144	0	1073
lead spillages	43	18	0	0	0	0	382	112	555

*from initial assessment of debris

Table 10 Non-ferrous debris weight totals by Period (g)

considered by Bayley (1992a, 817–8), to which to the reader is directed for a detailed overview.

Qualitative XRF analysis of the crucible fragments was carried out using a LINK XR 200 EDS with a rhodium X-ray tube running at 35kV, with a 4mm collimator and a live time of 50s or 100s. Surfaces were not prepared, so establishing comparability is further hindered by irregular sample geometry. By noting the presence or absence of various elements — specifically copper, zinc, lead, arsenic, tin and antimony — coupled with observing the relative peak heights for these elements, it was possible to say what alloys were melted.

The XRF results are presented in Table 8. The most common alloys melted at Mill Lane were brasses, with varying amounts of lead. Amongst the crucible debris there is only scant evidence for simple tin-bronzes, leaded copper or gunmetals. This range of alloys seems to be in agreement with general trends observed for this period (Blades 1995, 38–42), although the absence of tin-bronze is notable. The occurrence of leaded and unleaded brasses suggests both casting and wrought fabrication.

XRF analysis of a single piece of copper alloy dross found that this derived from a leaded bronze but contained appreciable levels of arsenic and lower levels of antimony. Such compositions are normally encountered in manufacturing debris from late medieval cauldron or mortar casting (Brownsword and Pitt 1981). However, it would be dangerous to suggest such activities took place here on the basis of such fragmentary evidence, and in the absence of evidence for a casting pit and/or mould fragments.

Lead spillage analysis

by Roger Doonan

Approximately 1kg of leadworking debris was recovered from excavations at Mill Lane. XRF analysis of a random sample (~25%) found that the only element present was lead, thus ruling out the possibility of pewter manufacture.

Of the total assemblage, just over half (555g) were lead spillages. These are difficult to interpret as they are of indeterminate form, and may either represent spillages whilst casting molten lead or the accidental melting of lead fittings in a fire. They cannot therefore be taken as evidence for leadworking on the site. The other main class of lead find was lead sheet (349g). Most of the sheet finds were roughly cut, simple flat sheets, possibly offcuts from some activity utilising lead sheet. However, SF57 was interesting, as it appeared to be a large spillage that had subsequently been rolled up with other pieces of lead scrap. The folded bundle was suggestive of a scrap charge intended for a crucible, and might therefore represent evidence for on-site lead metallurgy. (Other scrap is detailed by Mould, p.48 above.)

Other non-ferrous material

Six separate fragments of **litharge cake**, a waste product from the purification of silver, were identified and confirmed by XRF analysis (Table 9). This important find is not without precedent in Thetford: over 20kg was found in a 12th–13th century pit during excavations at the Guildhall (Andrews and Penn 1999). The debris derives from the refining of silver, and may relate to its preparation for coin production. It is possible that this process would have been carried out on the silver prior to another, less specific, use.

Also examined was a small bar ingot which proved to be of leaded bronze, *i.e.* an alloy of copper with low levels of tin and lead. The total weights of non-ferrous debris are summarised in Table 10.

Dating of metalworking activity

Most of the stratified debris from Mill Lane was assigned to the Late Saxon (10th–11th century) or early medieval (11th–12th century) periods. Looking first at evidence for ironworking, it appears that although debris from smithing is evenly distributed between these phases, smelting is much more strongly represented in the earlier phase. The more limited quantities of non-ferrous debris restrict confidence in any conclusions regarding temporal distribution. With some caution, it could be suggested that the presence of litharge cake shows that silver was refined in the earlier of these periods and probably also in the latter, possibly with greatest activity in the later part of the Late Saxon period. In apparent contrast, the contexts of crucibles seem to indicate that the melting of copper alloys occurred during the later Saxon and into the medieval period. However, as many of the sherds are of Stamford ware, which had its peak of use in the 10th and 11th centuries, many of the crucibles may be residual.

The distribution of the lead spills contrasts considerably with those of all other debris, being largely restricted to 18th–20th century contexts. The most likely reason for the skewed distribution is that metal-detectors were used to scan the ploughsoil, and that pieces of lead are very easily found by this method.

Table 11 shows the distribution of the debris from the different metalworking processes by area. Some, such as the litharge cakes, which were found only in Area 1, show very discrete distributions. It may also be relevant that more lead spillages were found here than in any other area, despite the fact that most came from the ploughsoil and may have been disturbed by agricultural activity. Area 1 also produced the majority of the crucible fragments although, as discussed above, the silver-refining debris tended to be dated earlier than the copper alloy melting. This same area also produced more recorded instances of hammerscale than any other, although a greater weight of smithing hearth bottoms was found in the adjacent Area 4, perhaps reflecting a difference between the location of smithing and that of the discard of bulk debris. Smelting debris, whilst centred on Area 4, was also dispersed over

Area	*hammerscale (occurrences)*	*smithing hearth bottoms (g)*	*smelting slag (g)*	*crucibles (g)*	*litharge cake (g)*	*lead spillages (g)*	*Total (g)*
1	22	5218	3239	757	925	134	10,295
2	2	76	5095	148	0	85	5406
3	4	505	694	61	0	68	1332
4	14	7277	12,542	0	0	58	19891
5	3	1137	5767	0	0	78	6985
6	1	0	858	0	0	3	862
7	0	0	0	0	0	0	0
8	1	0	529	0	0	34	564
9	1	0	1055	46	0	0	1102

Table 11 Distribution of debris by areas at Site 1022

the whole site with the exception of Area 7, which was remarkably free of all metalworking debris.

In Area 1 pit *1147*, as well as defining hearth *1145*, contained its lining (*1146*) and two fills (*1189* and *1190*). The lining deposit produced a single smithing hearth bottom and a piece of dense ironworking slag, whilst the upper fill *1189* contained some undiagnostic slag, an 'iron object' and ferruginous concretion. Taken together, this debris at least suggests that iron-smithing was carried out in the immediate vicinity, even if this was not the blacksmithing hearth itself. The fill (*3036*) of a 'possible furnace', *3116*, provided even more positive evidence, with a smithing hearth bottom, hammerscale, undiagnostic ironworking slag and over 700g of vitrified hearth lining found within it.

Context *4004* was the fill of pit *4005*, in which vitrified lining had been found *in situ*. This deposit contained large quantities of many types of metalworking debris including material deriving from smelting (tap slag, fayalitic runs and dense slag) and smithing (hearth bottoms and hammerscale) and even a lead spillage. The presence of spheroidal hammerscale may be important. As mentioned above, spheroidal hammerscale tends to be produced at higher (welding) temperatures, especially when the slag-rich bloom of iron is being consolidated to a billet or the billet worked down to a bar. It would seem likely that both the smelting of iron and the consolidation of the blooms were carried out in the immediate vicinity, and possible that the pit was either the base of a furnace or a large hearth dug into the ground surface for working a bloom of iron.

Conclusions

The analysis of relatively modest amounts of debris provided evidence of a range of metalworking activities including iron smelting, iron smithing, copper alloy casting and silver refining. Although lead spillages were also found these are not thought to provide conclusive evidence for on-site lead working, although the need for lead in the refining of silver may explain one of the higher concentrations of the metal. This range of waste products shows that the site represents another active and important metalworking area in Thetford. Residual slag and hammerscale showed that the site saw the manufacture of basic primary products such as iron billets and bars. Iron artefacts also appear to have been forged on site, although the debris cannot tell us what the objects were or how specialised the craftsmen were. A less common metallurgical process, silver refining, was also carried out. This involved mixing impure silver alloys with lead, and then allowing the lead oxide and impurities to be absorbed into a bone ash hearth lining. Occasional fragments of this waste 'litharge cake' survived on site whilst the valuable silver was removed, probably for coin production. This possible end use is supported by the identification of an upper coin die amongst the iron artefacts.

Some indication of the types of non-ferrous objects being produced can be deduced from the composition of the waste. Evidence for the melting and working of copper alloys was provided by analysis of the fragments of crucibles. This showed that the copper alloys being melted were mainly brasses along with some leaded alloys suitable for casting, although there was no evidence for tin bronze and little for leaded copper. That the most common crucible size was quite small suggests that copper working at Mill Lane was primarily concerned with the casting of small objects, probably small fittings of indeterminate nature.

There appear to have been differences in emphasis in the type of metalworking being carried out at different times. Blacksmithing and silver refining span the main occupation phases, *i.e.* from the 10th to the 12th centuries. By contrast, iron smelting is predominantly associated with the early part of this period and copper alloy casting with the later. The smelting debris shows most of the iron to have been produced in a slag-tapping furnace, but occasional pieces are reminiscent of the slag-pit technology known in East Anglia in the Saxon period. Unfortunately, the low quantities of material and coarse phasing available do not permit temporal differentiation between these types.

For the site as a whole, metalworking appears to have been an important activity, and other crafts may have been practised alongside. The fact that there appear to be contrasts between different metal crafts at different times and in different places implies specialisation of trades. It is unusual for an urban site to produce more smelting than smithing slag, as was the case here. Smelting was more typically carried out in well-wooded areas with ready access to charcoal, rather than having to compete with a town's demand for fuel. The smelters on the site probably produced more iron than they used to work into artefacts, especially in the Late Saxon period, and this surplus could have been used elsewhere within the town. However, it is difficult to believe they could have fulfilled all local demand. As there are no local sources of copper or lead ore, these materials would have needed to be imported. The presence of silver refining debris shows that this industry relied on recycling old silver rather than bringing in pure new metal.

IV. Stone objects

by David Buckley, Alice Lyons and Heather Wallis
(Fig. 39)

Querns

(not illustrated)
by David Buckley

A total of 62 contexts produced lavastone fragments. In almost every instance the stone was extremely fragmented, with both ancient and modern fractures. Despite this, two fragments of flat stones (from contexts *2006* and *9022*, of 10th–11th and 11th-century date respectively) retain part of the hopper collar, indicating them to be of an early medieval type in use until *c.* 1000 (Hörter *et al.* 1951). Like the finds from numerous other Late Saxon/early medieval sites in East Anglia and the country generally, the stone is a grey vesicular lava; there is no reason for this group to be other than of Rhenish origin. The evidence for trading links between Norfolk and mainland Europe across the North Sea is well established (Rogerson and Dallas 1984, 199) and quernstones were an established part of this activity.

Hone stones
(not illustrated)
by Alice Lyons
Two worked Norwegian Ragstone objects, possibly hone stones, were recovered from Period 3 deposits. It is known from previous excavations in Thetford (Moore and Ellis 1984), Norwich, York and London (Mills and Moore in prep.) that Norwegian Ragstone was in widespread use before the Norman Conquest in these areas.

One example (SF342) that was originally a hone stone (faint blade-marks can be seen on the upper and side surfaces) has been reused. This stone has been rubbed smooth by repeated use, probably as a linen smoother. The underside of the second (SF368) has a slightly indented rough stone centre running along the entire surviving length. It is possible this is a hone waster or second, or that secondary working has taken place.

SF342 *4006*, fill of pit *4007*; Period 3; not illustrated
Norwegian Ragstone hone, well rounded, broadly triangular in section; both ends taper, one end on the horizontal plane, the other on the vertical. The end that tapers on the vertical plane also has a section of rough stone remaining.108mm x 30mm x 30mm.

SF368 Unstratified, Area 2; not illustrated
Norwegian Ragstone hone, well rounded and broadly semi-circular in section, incomplete. The surviving end tapers to a rounded point. 87mm (incomplete) x 28mm x 25mm

Miscellaneous objects
by Heather Wallis
(Fig. 39)
A fragment of chalk (SF341) was decorated with incised lines on one surface (?top), which comprise two almost concentric semi-circles and five radiating lines that extend to the outer concentric groove. Of the five inner segments created, one (possibly two) bear faint zig-zag lines. One of these segments also has a small circular depression.

The shape of the complete item is unknown, although the lower edge and part of the side (although worn) may be original.

No parallels have been found for this small piece of worked stone. The decoration is reminiscent of the markings on a gaming board or sundial.

SF341 *1017*, fill of pit *1024*; Period 4; Fig. 39
Chalk object, rectangular and incomplete, incised lines on upper surface. 50mm x 30mm, thickness max. 37mm min. 21mm.

V. Glass
by John Shepherd
(Fig. 39)

Seven items of glass were found, of which two were modern while a third fragment was of indeterminate form and date. One unstratified piece was a fragment from the pushed-in base of a beaker. This was free-blown and of natural green glass with very deep surface decomposition,

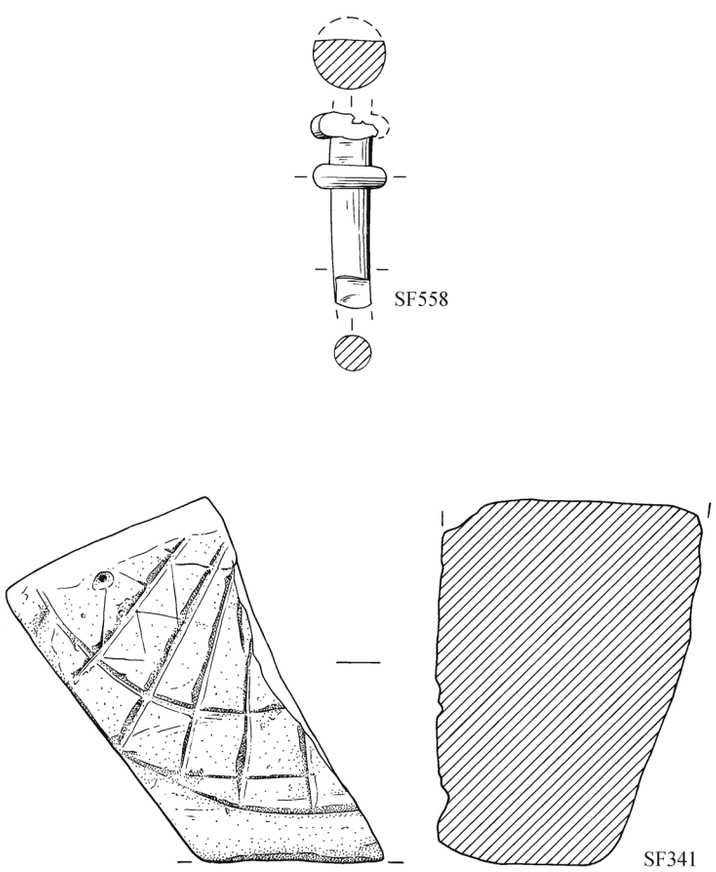


Figure 39 Glass and stone artefacts. SF558 scale 1:2; SF341 scale 1:1.

and dates to the 14th–16th centuries. The three remaining pieces are of more interest.

One is a fragment from a linen-smoother (SF276, not illustrated) of indeterminate colour glass, from a Period 3 pit (*6002*). These were used from the 3rd to the 17th centuries to impart a gloss finishing to cloth (Pritchard 1991, 173). The second is a fragment from a finger-ring (SF506, not illustrated, Period 4 pit *9075*) of yellow/brown glass. This ring probably belongs to a group of Late Saxon objects displaying a high lead content; other examples have been found stratified in 10th-century contexts in Hereford, Gloucester, Lincoln, Oxford, Winchester and York (Bayley 1982). A similar ring from London has been analysed more recently at the Ancient Monuments Laboratory (Vince and Bayley 1983, 93).

The third object, found in a Period 3 pit fill, is very unusual (SF558, pit *9030*) and is reminiscent of the stemmed vessels of the 13th and 14th centuries. This identification is not sound, however, as the colour of the glass does not conform to that expected of these items. The medieval vessels are greenish or yellow/brown with a high lead content. The colour of this item is very similar to Roman metals but is unlike any Roman form. The context of its discovery is securely dated to the 10th–11th centuries. This item therefore cannot be a stemmed vessel as they were not in use at that date. It is most likely to be a type of Roman stirring rod, although these too are relatively rare, even on Roman sites (H. Cool, *pers. comm*.). These items have been found in 10th–11th century contexts at Milk Street, London (MIL72, 4l, 475). This identification is made even more striking by the virtual absence of other Roman residual material from the Mill Lane site.

VI. Bone and antler

by Ian Riddler
(Figs 40–2)

Introduction

A total of 26 objects of bone and antler are considered here, as well as five fragments of antler waste. All are of Late Saxon or Anglo-Norman date. Most belong to categories which have been seen in previous excavations at Thetford, and they have therefore been considered throughout against this background. The terms used to describe and define objects are those adopted for reports on other Anglo-Saxon assemblages, and particularly the bone and antler small finds from Ipswich (Riddler *et al*. forthcoming).

Textile implements

(Fig. 40)

The textile implements include four pinbeaters, a spindle whorl and four needles. The range of bone and antler objects reflects both previous excavations at Thetford and implements gathered from contemporary sites, both in England and on the Continent. Following the publication of significant assemblages from Bergen, Winchester, London and York (Øye 1988; Biddle 1990, 200–42; Pritchard 1991, 203–5; Walton Rogers 1997) it is now possible to place these implements within the context of the development of weaving technology in the early medieval period.

Pinbeaters

(Fig. 40)

The four pinbeaters (SF259 and SF294, not illustrated; SF4 and SF367, Fig. 40) include one complete example, as well as three fragments. All four are of antler and are of single-pointed form, with the two surviving blunt ends rounded, tapered and lightly indented in each case. One example (SF4) has been burnt and is now fragmentary, with both points now missing. It has a tapering, rounded rectangular section, and the broader end shows traces of an attempt at a perforation. Single-pointed pinbeaters are not normally perforated, although examples are of similar date to those from Thetford are known from Beverley and Ipswich (Armstrong *et al*. 1991, fig. 129 no. 1136; Riddler *et al*. forthcoming).

No decoration is present on any of the pinbeaters, but all four are highly polished. This may be a prerequisite of pinbeaters, which need to be smooth in order to pass between threads without catching on them. High polish is, however, also an index of use (Walton Rogers 1997, 1757).

Eighteen examples from Thetford were described and illustrated by Rogerson and Dallas, and nine further examples have been noted by Dallas and Andrews (Rogerson and Dallas 1984, 170, figs 191–3; Dallas 1993, 158, 160, fig. 160 nos 7–8, fig. 163 nos 19–20; Andrews 1995, 116, fig. 87 no. 10). The majority of those identified to material type are made of antler, although bone examples are also known. Not all of the examples of single-pointed pinbeaters from Thetford have yet been identified to material type, however (Dallas 1993, 158).

Single-pointed pinbeaters generally vary in length between 70mm and 160mm, which represents a similar range to that of the earlier, double-pointed variant. They have been plausibly associated with the vertical two-beam loom (Brown 1990, 227; Pritchard 1991, 203–5; Walton Rogers 1997, 1755–7) and they form an index for its introduction (or reintroduction) and currency of use in Late Saxon and Anglo-Norman England. The earliest examples of single-pointed pinbeaters come from 9th-century contexts at Beverley, Ipswich and Winchester (Foreman 1991, 193, fig. 193 no. 1137; Riddler *et al*. forthcoming; Biddle 1990, no. 199). The majority, however, can be placed in the 10th and 11th centuries, as is the case here. Several examples are known from 12th-century contexts but changes in weaving technology, with the adoption of the horizontal loom, had generally caused them to become redundant by this time (Walton Rogers 1997, 1763–6).

SF4 Unstratified, Area 2; Fig. 40
Pinbeater: A fragmentary section of the midshaft of an antler pinbeater, which includes a trace of a perforation at the broader end. The object is highly polished, and has been burnt. L 49mm.

SF259 *3012*, fill of linear feature *3011*; Period 3; not illustrated
Pinbeater: A fragment of an antler single-pointed pinbeater, consisting of part of the shaft and the broad, indented end. The object is of flattened oval section and is highly polished. L 45mm.

SF294 *1034*, fill of pit *1038*; Period 4; not illustrated
Pinbeater: A fragment of an antler single-pointed pinbeater, consisting of the point and a part of the midshaft. It is of flattened oval section, and is highly polished, with a slight trace of burning on the point. L 59mm.

SF367 Unstratified; Fig. 40
Pinbeater: A complete example of an antler single-pointed pinbeater of flattened oval section. The broad end is indented on both faces and the object is highly polished. L 118mm.

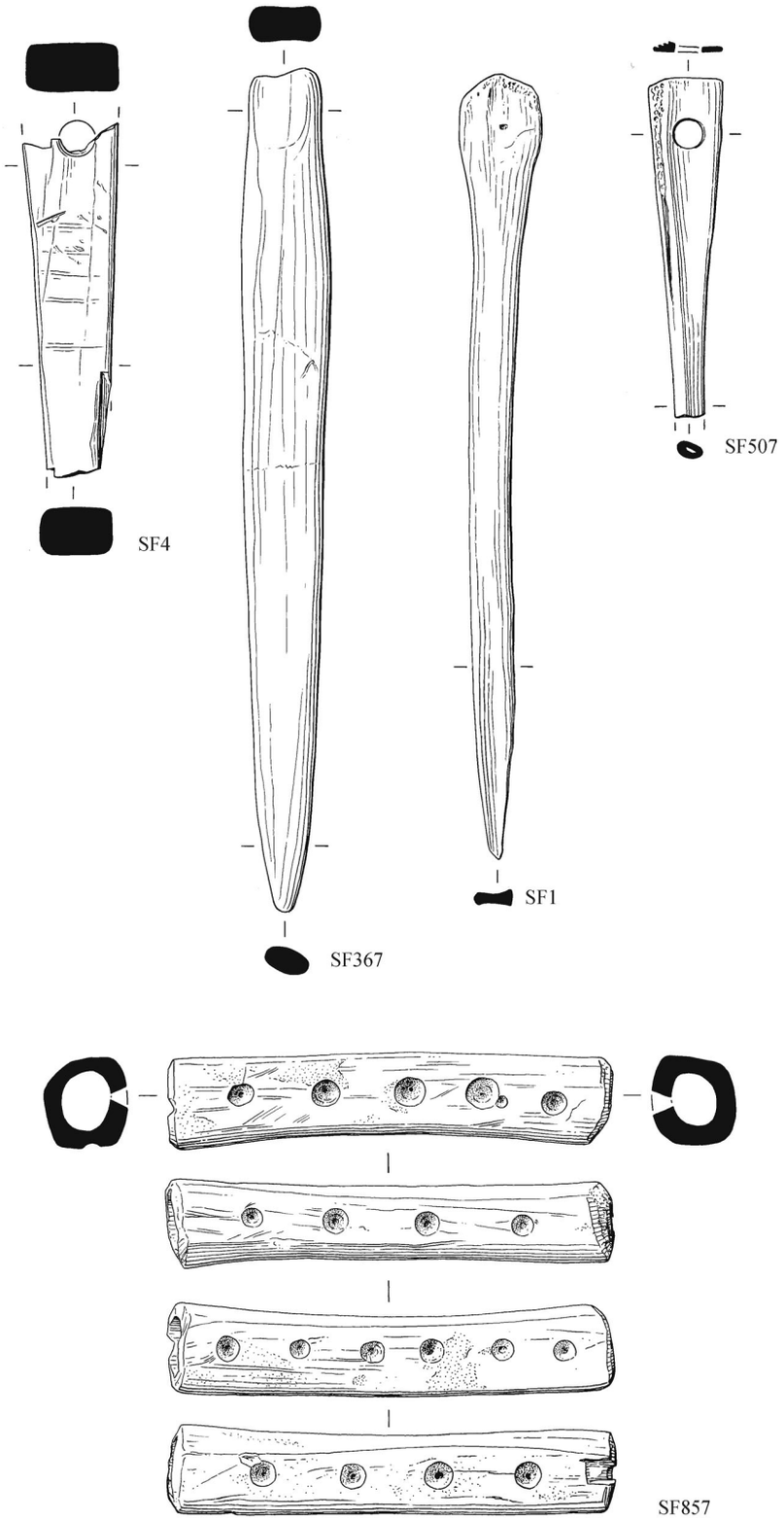


Figure 40 Worked bone: textile implements. Scale 1:1.

Spindle whorls
(not illustrated)
Two bone spindle whorls (SF389 and SF849) have been cut from the proximal ends of cattle femurs and pierced centrally. One example is abraded but both were clearly cut from bones whose epiphyses had fused. In both cases the perforations, which are relatively square at the lower end, splay outwards towards the flattened upper surface of the whorls.

Numerous examples of this type of spindle whorl, which is the most common form in bone or antler, are known from Thetford and from other sites of this period (Rogerson and Dallas 1984, 179; Dallas 1993, 158; Andrews 1995, 116; Riddler *et al*. forthcoming; Woodland 1990, 216–25; Walton Rogers 1997, 1741–3). Femur caput spindle whorls are frequently encountered from the Middle Saxon period onwards, although their *floruit* undoubtedly lies in the Anglo-Norman period (Walton Rogers 1993, 1268). This situation prevails also at Thetford, where antler spindle whorls are unknown, and where all published examples are of bone and have been cut from cattle femora (Rogerson and Dallas 1984, fig. 194 nos 70–7; Dallas 1993, fig. 160 no. 9; Andrews 1995, fig. 87 no. 11).

SF389 Unstratified; not illustrated
Complete bone spindle whorl, made from a cattle femur caput. It has been trimmed around its flat edge, and is perforated by a central hole which is lightly splayed. D 44mm, Ht 20mm, perforation D 13–15mm, Wt 18.5g.

Needles
(Fig. 40)
All four examples of needles (SF231 and SF453, not illustrated; SF1 and SF507, Fig. 40) have been manufactured from pig fibulae. In three cases the head has been shaped from the distal end of the bone and in the other (SF507) it has been cut from the proximal end. Three needles have been perforated and all are now fragmentary, with only their heads and parts of their midshafts remaining. The fourth example (SF1) is complete, with a head that has been shaped and rounded but not perforated.

Pig fibulae modified in this manner are common finds from Anglo-Saxon contexts (Riddler 1993, 114). Just over 30 needles have been listed from previous excavations in Thetford, and most of these were undoubtedly made from pig fibulae (Rogerson and Dallas 1984, 167, fig. 189; Dallas 1993, 158, fig. 160 no. 6). They occur throughout the Anglo-Saxon period and are relatively common until the 12th century.

The needles found at Mill Lane have relatively wide, splayed heads — the most common head form — and appear at first sight to be inherently unsuitable for weaving purposes. In consequence, they have previously been regarded as dress pins and compared with similar objects of Viking period and later date (MacGregor 1982, 91–2; 1985, 120–1; Graham-Campbell 1980, 59). On the Continent, however, this interpretation has been questioned and objects made from pig fibulae have been distinguished from bone pins and needles (Schwarz-Mackensen 1976, 41–2; Ulbricht 1984, 37, 54–5). Other possible functions relate directly to weaving, basketry or netting (MacGregor 1985, 193; Riddler 1993, 114; Walton Rogers 1997, 1783). Although previously distinctions have been made on the basis of the material used in their manufacture (MacGregor 1985, 120–1; Riddler 1993, 114) recent work has indicated that pins, needles and needle-like objects could all be made from pig fibulae (Riddler *et al*. forthcoming). Whilst dress pins changed in form over time, these implements did not, and examples of a similar shape occur throughout the Anglo-Saxon period, and up to the 12th century. The decline in their use corresponds, therefore, with that of the vertical loom.

SF1 Unstratified; Fig. 40
Needle: A complete needle, produced from a pig fibula, with a rounded head cut from the distal end of the bone. The object has not been perforated and may be unfinished. L 109mm.

SF231 Unstratified, Area 2; not illustrated
Needle: A fragmentary needle, produced from a pig fibula, with the head cut with little modification from the distal end of the bone. The head is perforated by a circular hole. L 56mm, perforation D 4mm.

SF453 *1097*, fill of pit *1098*; Period 3; not illustrated
Needle: A fragment of the head and part of the shaft of a needle which has been produced from a pig fibula. The head has been cut from the distal end of the bone and it includes a sub-circular perforation. L 57mm, perforation D 4mm.

SF507 *2108*, fill of pit *219*; Period 4; Fig. 40
Fragmentary needle, cut from a pig fibula, with the head fashioned from the proximal end of the bone. The head is spatulate, with a lightly rounded end, and has been neatly perforated. L 48mm, perforation D 3.5mm.

Needle cases
(Fig. 40)
The mid-shaft of an ovicaprid metatarsal (SF599, not illustrated) has been sawn and rounded at both ends, and skilfully trimmed to provide a square section. All four sides of the object are decorated with single ring-and-dot patterns, groups of dots or latticed designs, some of which are bounded by single vertical lines. A similar object, also produced from an ovicaprid metatarsal (SF857), is decorated on all four sides by deeply indented circular depressions. There are four depressions on two sides, five on a third side, and six on the other. The number of depressions may possibly be of significance, as noted below.

Several modified midshafts of sheep or goat metatarsals are known from Thetford, although only one previously published example is decorated, and that merely by a series of roughly-scratched lines (Rogerson and Dallas 1984, 183, fig. 201). These unusual objects have customarily been regarded as handles, as also has a similar, undecorated example from Schleswig (Ulbricht 1984, 61. taf. 42 no. 5). At the same time, however, objects of a similar size but of circular section and earlier date have been interpreted as needle cases (MacGregor 1985, 193, fig. 101 no. 23).

Another possibility, raised by Frisian finds, is that these narrow cylinders, which are heavily decorated and have four sides of similar dimensions, served as throwing sticks (Roes 1963, 56). It was noted above that the second example from Mill Lane is decorated by the same, simple pattern on each side, and that its indentations occur in groups of four, five and six. There is a passing resemblance to be noted here with earlier Germanic *Stabwurfeln*, or rod dice (Krüger 1982, 144–5; Riddler 1997). These were rolled along their long faces and they often invoked restricted numbering systems which, in some cases, also involved the repetition of certain numbers. *Stabwurfeln* were, however, very much an early Germanic object type, which are extremely rare in this country, and they may not have outlasted the Roman

period (Riddler 1997). It remains possible, however, that the concept of throwing or rolling sticks, tied to the significance of numbers, remained an enjoyable diversion.

Outside Thetford itself, precise parallels for this form of object are difficult to find. Undecorated tubular sections of bird bone midshafts are known from several places, including Thetford, Northampton, Ipswich and York, as well as contemporary European sites like Wolin (Rogerson and Dallas 1984, 179; Riddler *et al*. forthcoming; MacGregor 1985, fig. 160 no 16.3; Cnotliwy 1970, ryc 7h). A closer parallel may be provided by an undecorated ovicaprid metacarpal midshaft from Foundation Street in Ipswich, which is of a similar length but lacks any decoration. It comes from a context of 11th-century date and is therefore contemporary with the Mill Lane object.

Two objects from recent excavations at Townwall Street, Dover, are also related to the Thetford implements. Both are ovicaprid metatarsals and one is undecorated and perforated laterally at one end. The other is heavily decorated in patterns redolent of chess piece designs, but the object is not divided into separate sides, as is the case here (Riddler forthcoming b). Both objects come from 12th-century contexts. Dover's close and often tense relationship with the fishing grounds at Great Yarmouth may conceivably be of significance in this respect, also being echoed in the ceramics and other objects from Dover excavations (Riddler forthcoming b).

The most likely functional interpretation for this group of objects as a whole is that they served as needle cases. The lengths of the two examples from Thetford, and of the series as a whole, corresponds with that of contemporary metal needles — like those from Coppergate in York, for example, most of which are between 50mm and 80mm long (Walton Rogers 1997, 1782, fig. 830). As successors to the finely-crafted needle cases of the Viking period they are essentially cruder objects which, by virtue of using ovicaprid midshafts, have hollow tubes of a requisite size to accommodate and secure small bundles of needles. If those needles were held together in cloth or were secured with cord, as was the case with a group of bone needles from Haithabu (Schwarz-Mackensen 1976, abb. 38), they could be held within a hollow tube that would not necessarily require a plugged end.

SF599 Unstratified; not illustrated
Needle case: A section of an ovicaprid metatarsus which has been skilfully trimmed to provide a cylinder of near-square section. The object is decorated on each side in a different fashion, with a variety of ring-and-dot, linear and latticed designs.

SF857 Unstratified; Fig. 40
Needle case: A lightly-curved section of an ovicaprid metatarsus which has been trimmed by knife at either end. It is decorated on each face by deep indentations, some of which extend through the bone. There are four indents on two faces, five on one and six on the other. L 62mm.

Travel and recreation

(Fig. 41)

Skates

(Fig. 41)

The four skates (SF127 and SF514, not illustrated; SF387 and SF515, Fig. 41) include three that have been produced from cattle metapodia and one modified from a horse metatarsus. All four are complete. One example (SF514) has been cut from a cattle metacarpus and is little modified beyond the smoothing of both ends on the anterior face. Two further skates (SF127 and SF515), produced from cattle metatarsals, show some trimming of the distal condyles, which have been reduced in size to the same thickness as the midshafts. In each case the proximal foramen has been retained and this may have served as a convenient point for the attachment of leather thongs, although no obvious wear marks can be seen on any of the relevant edges. The fourth example (SF387), produced from a horse metatarsus, shows characteristic signs of wear on the anterior face of the bone and is perforated obliquely through the proximal end. The distal end has been trimmed to provide an upturned profile.

The horse metatarsal skate is the longest of the group, although one of the cattle metatarsals is also relatively lengthy and extends to over 200mm. The two other skates are comparatively short, with lengths of 170mm or less, and these may have been used by juveniles rather than adults.

Twenty-four skates from Thetford have been published previously and the object type is relatively common, both in southern England and on the Continent (Rogerson and Dallas 1984, 179, figs 195–7; Dallas 1993, 158, 160; MacGregor 1976; Rulewicz 1958; 1994, 214–8; Cinthio 1976; Ulbricht 1984, 39, 60). The range of bones utilised in this assemblage, which is limited to cattle and horse metapodia and is dominated by metatarsals, reflects that seen elsewhere (*e.g*. at Ipswich: Riddler *et al*. forthcoming).

Given their simplicity and ease of manufacture, no typology for bone skates could usefully be created, and there are few indications of dating from the objects themselves. One example is unstratified, and the remainder came from Period 3 contexts. In broad and tentative terms, it is possible to suggest that those produced from cattle metapodia may be earlier than examples made from the metapodia of horses, which are not especially common before the 11th century. The medieval period may also have seen more sophisticated methods of strapping the foot to the bone.

A full account of the nature and development of bone skates has been provided by Arthur MacGregor, who has also looked in detail at their wear patterns (MacGregor 1975; 1976; 1985, 141–4). This sample confirms general trends for most of the characteristics of wear. In each case, it is the anterior face that has been smoothed from contact with the ice, and the bones have been little modified (MacGregor 1976, 58). The horse skate (SF387) extends to 245mm, which exceeds the range of sizes for comparable skates from Lund, and is comparable with the longest skates from London (Cinthio 1976, 385; Riddler 1991). This skate has an unswept toe, a device which does not improve performance on ice but may have been useful in traversing light snow (MacGregor 1976, 59). The roughening of the posterior face of the skate, upon which the foot was placed, is commonly seen on some skates but is absent both here and from examples from Ipswich (MacGregor 1976, 61; 1985, 142; Riddler *et al*. forthcoming).

SF127 Unstratified, Area 4; not illustrated
Skate: An incomplete cattle metatarsus which has been modified and smoothed on the anterior face. The distal end, which is unfused, has been narrowed to a point and the proximal end has been cut down slightly on the posterior face. L 165mm.

SF387 *1148*, fill of pit *1149*; Period 3; Fig. 41
Skate: A complete horse metatarsus which has been smoothed and shows evidence of use on its anterior face. The distal end of the bone has been narrowed and upswept, and the natural perforation at the proximal end enlarged. The proximal end has also been lightly trimmed. L 245mm.

SF514 *9088*, fill of pit *9090*; Period 3; not illustrated
Skate: A complete cattle metacarpus which has been lightly modified on the anterior face at both epiphyses, but otherwise retains the nature shape of the bone. L 174mm.

SF515 *4328*, fill of pit *4324*; Period 3; Fig. 41
Skate: A complete cattle metatarsus, which has been extensively modified by knife on the anterior face in order to provide a flat surface. The distal end has also been narrowed, and the proximal end has been trimmed slightly on the posterior face. L 210mm.

Chess piece
(Fig. 41)
Part of an antler tine (SF343) has been sawn laterally at one end and roughly shaped by knife at the other in order to provide a pointed stub on one side, which is surrounded by two grooves. Most of the central cortile tissue has been removed, although the object is not entirely hollow and appears to be unfinished.

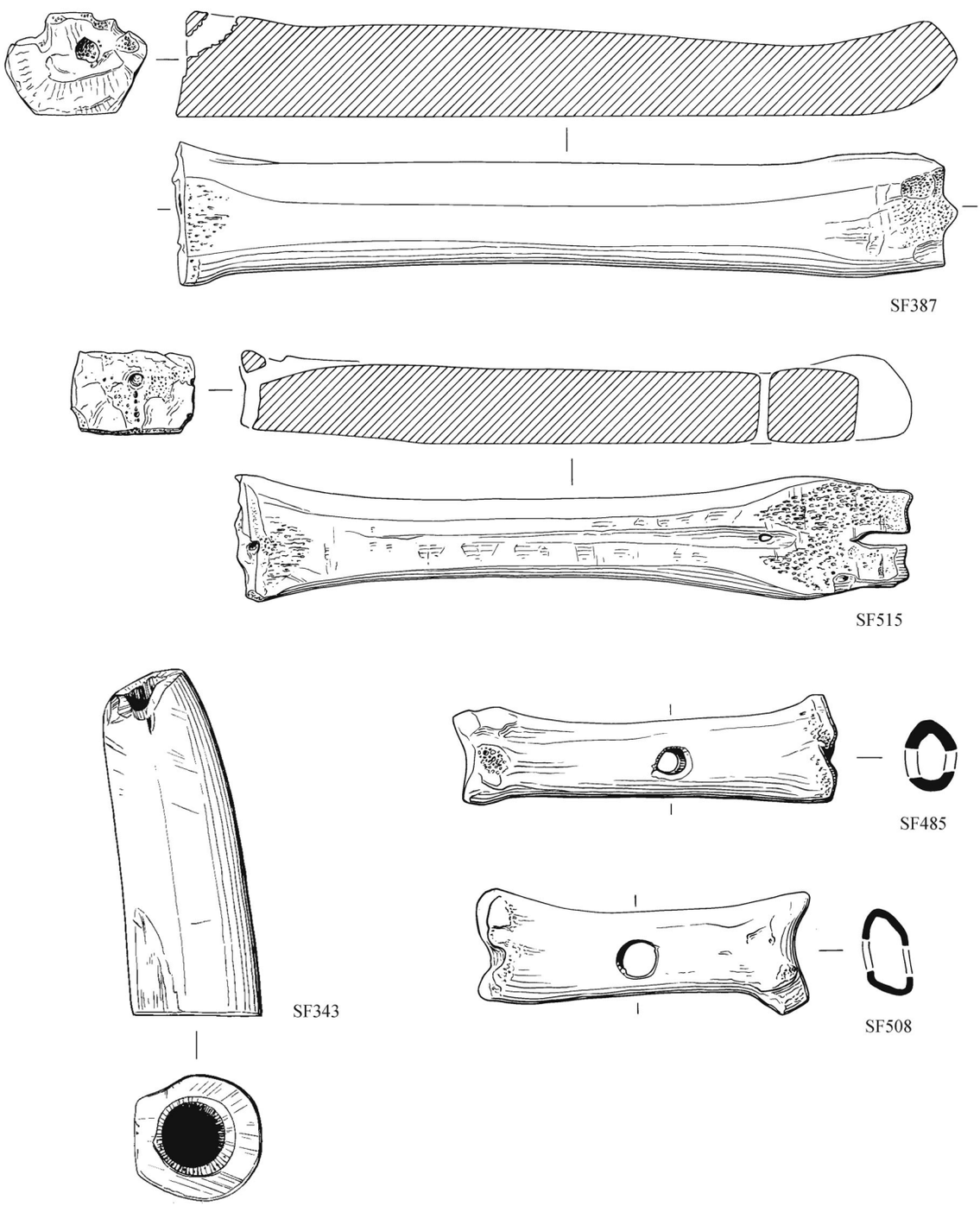


Figure 41 Worked bone: recreational artefacts. SF387 and SF515 scale 1:2; SF343, SF485 and SF508 scale 1:1.

The raised stub at the narrow end resembles those seen on contemporary lucets, which are a form of early medieval textile implement (Blockley *et al*. 1995, fig. 507 no. 1117; Riddler *et al*. forthcoming), but the object is not completely hollow and could not have functioned in that manner in its present form. In addition, it is lightly curved, whereas lucets have straight shafts and are equipped with two or three raised stubs.

The general shape of the object is close to that of a rudimentary antler chess piece in the form of a knight from Habsburg in Switzerland, although the identification of this object as a gaming piece is not absolutely certain, because of its simplicity (Kluge-Pinsker 1991, 114 nø A14). Further chess pieces with abstract designs made in a simple manner are known, however, from Bradwell Bury and Gloucester, amongst other English sites (Mynard 1994, fig. 18 no. 20; Hassall and Rhodes 1974, fig. 28 no. 27). An unfinished antler object from North Elmham, which has not been hollowed, is also of a related form (Wade-Martins 1980, fig. 260 no. 24).

Objects of this type were often hollowed for the provision of plugs of solid material. In some cases the entire object was hollowed, and in others one or more plugs were applied to areas which had been partially cut away, as with the abstract figure of a bishop from Northampton, for example (Murray 1913, 767; Kluge-Pinsker 1991, nø A49). The hollowing of the Thetford piece looks incomplete, and would eventually have involved the removal of all of the cortile tissue.

It is possible, therefore, that this object is a rudimentary chess piece, although this can only be a tentative identification because of the simplicity of the item and its unfinished nature. With this particular example, the deep angled grooves on one face may suggest that the object was intended to be a king or queen, with the lines indicating the mahout. Alternatively, however, it may be an unfinished bishop or knight. Its simple design echoes that of contemporary figures, like the kings found in London excavations, for example, or contemporary pieces from Russia (Kluge-Pinsker 1991, 144 nø A44; Linder 1994, 169–86, figs 202, 213, 219, 220 and 222–3).

Early medieval chess pieces have been found in both Norwich and Ipswich, although no examples, in any material, have previously been identified from Thetford (Ayers 1987, fig. 84 nos 31–4; Riddler 1995, 104, fig. 1d; Riddler *et al*. forthcoming). Given the presence of such objects from a wide range of urban sites of 11th- and 12th-century date, the lack of any recognisable chess pieces from Thetford is perhaps a little surprising. Equally, however, English chess pieces are only rarely found in pre-12th-century contexts (Riddler 1995, 100-7) and they are often associated with churches, castles or manors. The Mill Lane example comes from a Period 4 context and was retrieved from a pit in Area 3.

SF343 *3035*, fill of pit *3039*; Period 4; Fig. 41
Chess piece: A complete but unfinished chess piece, which has been produced from the end of an antler tine. The tine is partially hollowed at either end. It has been smoothed by knife and the narrow end includes two grooves which have been applied in order to delineate a raised stub. L 55mm, D 20mm.

Perforated pig metapodia

(Fig. 41)

Four examples of perforated pig metapodia (SF364 and SF365, not illustrated; SF485 and SF508, Fig. 41) all have single lateral perforations. Three are metatarsals and one is a metacarpus. All four are central metapodials, of either metatarsus III or IV, or metacarpus III. The ten examples of this type of object published previously from Thetford are mostly also metatarsals, although not all have been identified to bone type (Rogerson and Dallas 1984, 182, fig. 199 nos 100–1; Dallas 1993, 159; Andrews 1995, 116, fig. 87 no. 12). All four examples from Mill Lane are unfused and little modified, although the proximal ends of the three metatarsals have been lightly trimmed. The general choice of bone reflects that seen elsewhere at this time (Lemkuhl 1982, 214).

Perforated pig metapodia are now widely regarded as simple musical implements threaded with twine or leather and twisted in the hand so that, when released, a loud buzzing noise could be produced (Hruby 1957, 195; MacGregor 1985, 102–3; Lemkuhl 1982, 218; Brown and Lawson 1990, 589–91). An example from Beverley retains part of a leather thong in its perforation (Armstrong *et al*. 1991, 184). Previous examples of perforated pig metapodia from Thetford have been described as toggles, but this interpretation has now been overturned, and they can be viewed in effect as a rudimentary form of musical instrument used principally by children (Lemkuhl 1982, 218; Margeson 1993, 213–5; Riddler *et al*. forthcoming).

The four examples of perforated pig metapodia from Mill Lane all come from Late Saxon contexts. Perforated pig metapodia are first seen in England in the 10th century and are concentrated in contexts of the 11th and 12th centuries, although they continued in use throughout the medieval period and beyond, until modern times. European examples go back in date to the 9th century, allowing for the possibility that they represent a continental introduction to Late Saxon England (Lemkuhl 1982, 220; Hruby 1957, 217; Riddler *et al*. forthcoming).

SF364 *4057*, fill of Building C; Period 3; not illustrated
Perforated pig metapodial: A near-complete example of a perforated pig metatarsus IV, which lacks a part of the distal diaphysis. The bone is unfused and is perforated laterally at its centre. L 62mm, perforation D 5mm.

SF365 *1103*, fill of pit *1098*; Period 3; not illustrated
Perforated pig metapodial: A complete example of a perforated pig metatarsus IV, which has been lightly modified by knife at its proximal end. It is perforated laterally and slightly obliquely at its centre. L 64mm, perforation D 5.5mm.

SF485 *1198*, fill of pit *1200*; Period 3; Fig. 41
Perforated pig metapodial: A complete example of a perforated pig metatarsus III, which has been slightly modified at its proximal end and perforated laterally off-centre, towards the distal end. L 58mm, perforation D 4mm.

SF508 Context *4341*, fill of pit *4342*; Period 4; Fig. 41
Perforated pig metapodial: A complete example of a pig metacarpus III, which is modified only by a lateral perforation at its centre. L 54mm, perforation D 5mm.

Personal items

(Fig. 42)

Combs

(Fig. 42)

The three combs (SF439, not illustrated; SF415, and SF503, Fig. 42) include two fragments of bone connecting plates from horn and bone double-sided composite combs and an incomplete single-sided composite comb of antler. In addition, sampling revealed two antler comb teeth (SF561 and SF562, not illustrated), which come from

separate contexts and represent further, undiagnostic fragments of combs.

One of the two connecting plates for horn and bone double-sided combs (SF439) has been pierced by an iron rivet which indicates that the horn tooth segments, which no longer survive, were 6mm thick. The connecting plate is made of bone, which is probably animal rib, although it survives in a degraded condition. The second (SF503) is complete and is pierced by three rivet-holes, none of which shows any traces of ferrous metal. Knife-marks remain on the obverse face and it is unlikely that this connecting plate had been used. The connecting plate has also been made from animal rib. It is 125mm in length, which places it amidst the longer group of its type (Riddler *et al*. forthcoming; Biddle 1990, 679, table 81).

No tooth-marks are visible on either of the Mill Lane combs, but both undoubtedly stem from double-sided composites. One of the larger collections of horn and bone double-sided composite combs from England is that from Thetford, where extensive quantities of waste from their manufacture have also been located, although the actual significance of the objects themselves was not fully appreciated at the time (Rogerson and Dallas 1984, 167, 192, pl. XXII, fig. 188). The discovery and re-evaluation of several examples of combs of this type for which the horn still survives led to their proper identification and to the realisation that riveted pairs of connecting plates represent vestiges of combs, and are not implement handles or other forms of artefact (Winter 1907, nos 45 and 83; MacGregor 1985, 95–6; Pritchard 1991, 199–200; Biddle 1990, 678–83). Horn and bone double-sided composite combs have now been established as one of the most common forms of Late Saxon comb, continuing in use until the 12th century, having first been noted in contexts of 9th-century date (MacGregor 1985, 95–6; Margeson 1993, 66; Riddler 1993, 53; Riddler *et al*. forthcoming). Biddle has proposed a typology for connecting plates of this comb type, but this is not broadly applicable and it has not been used here (Biddle 1990, 679–81).

At present, horn and bone double-sided composite combs appear to be an insular phenomenon, which is not matched on the Continent. There is indirect evidence for the working of horn from both Dorestad and Ribe, but no horn comb connecting plates have yet been published from either place (Ambrosiani 1981, 100–1; Clason 1980, 239; MacGregor 1985, 96). Dunlevy has noted, however, that double-sided horn combs have come from medieval contexts at Dublin (Dunlevy 1988, 371).

Twenty examples of horn and bone comb connecting plates have previously been noted from Thetford, twelve of which have been illustrated (Rogerson and Dallas 1984, 167, fig. 186 nos 1 and 7, fig. 187 no. 13, fig. 188; Dallas 1993, 158, fig. 159 no. 5). They include pairs of connecting plates fastened with either two or three rivets. The choice of two or three rivets is likely to reflect the use of one or two sheets of horn, the latter situation occurring with the comb from Milk Street, London (Pritchard 1991, fig. 3 no. 80).

SF439 *2081*, fill of Hearth C; Period 4; not illustrated
Horn and bone composite comb connecting plate: Fragment; probably animal rib, although now in a degraded condition. It tapers towards one end, where it is pierced by an iron rivet which includes traces of horn. These indicate that the sheet of horn was originally 6mm in thickness. L 56mm.

SF503 *1148*, fill of pit *1149*; Period 3; Fig. 42
Horn and bone composite comb connecting plate: Complete, produced from animal rib. It tapers gently to either end and is pierced by three rivet-holes. There are no traces of any rivets and may never have been used. L 125mm.

The third comb, an antler single-sided composite comb (SF415), is incomplete and consists of a substantial part of a single-sided composite with antler tooth segments, end segments and connecting plates, fastened by iron rivets. The central part of the comb is decorated on each side by paired crossing diagonal lines, which are bounded by bands of incised vertical lines. Few of the comb teeth survive, except at the centre, where they show signs of considerable wear.

One important characteristic of the comb should be mentioned here. The surviving teeth are relatively coarse, with four per centimetre, and they extend over one half of the comb. The longest connecting plate fragment includes tooth-marks beyond these teeth and these measure *seven* per centimetre. No teeth of this fineness survive from the comb itself, and it is possible (if somewhat unlikely) that this connecting plate has been re-used from an earlier comb. The other connecting plate is rather shorter, and does not extend beyond the surviving teeth, so that it cannot be used to confirm or deny this suggestion.

The most likely explanation for this situation, however, is that the comb included both fine and coarse teeth, although only the latter now remain. Single-sided composite combs of this type are not unknown, although they are comparatively rare. There is a suspicion that a further comb from Thetford was also arranged in this way, and others are known from Emden, London, Lund and Frisia (Haarnagel 1959, taf. 7.7; Tempel 1969, 102; Rogerson and Dallas 1984, fig. 187 no. 9; MacGregor 1985, fig. 50.h; Blomqvist 1942, 146; Roes 1963, 20, pl. XXIV.4). This small sample appears to encompass combs purely of 11th- or 12th-century date; on typological grounds, the Mill Lane comb can be assigned to the 11th century. It was recovered from a Period 3 deposit. Fine and coarse teeth also occur together on Frisian forms of asymmetric comb, which include examples from Domburg, Huizum and Southampton (Tempel 1969, fig. 24 no. 116; Roes 1963, pl. XXIX.6; Riddler forthcoming a). These are combs of 9th- and 10th-century date and they may have provided some of the inspiration, at least, for this variant in comb design.

SF415 *4228*, fill of pit *4230*; Period 3; Fig. 42
Single-sided composite comb: Incomplete, consisting of an end segment and four tooth segments, fastened to two antler connecting plates by four iron rivets. Traces of two further rivet-holes are also present. Where the material can be identified, the tooth segments are made of antler. Both connecting plates are decorated in a similar manner, with paired crossing diagonal lines confined within four vertical bounding lines, located towards the centre of each plate. The surviving teeth have been cut at five per centimetre and they mostly survive on the end segment. They show considerable traces of wear. There are traces on one connecting plate of the marks of teeth that were cut at seven per centimetre, which suggests that both fine and coarse

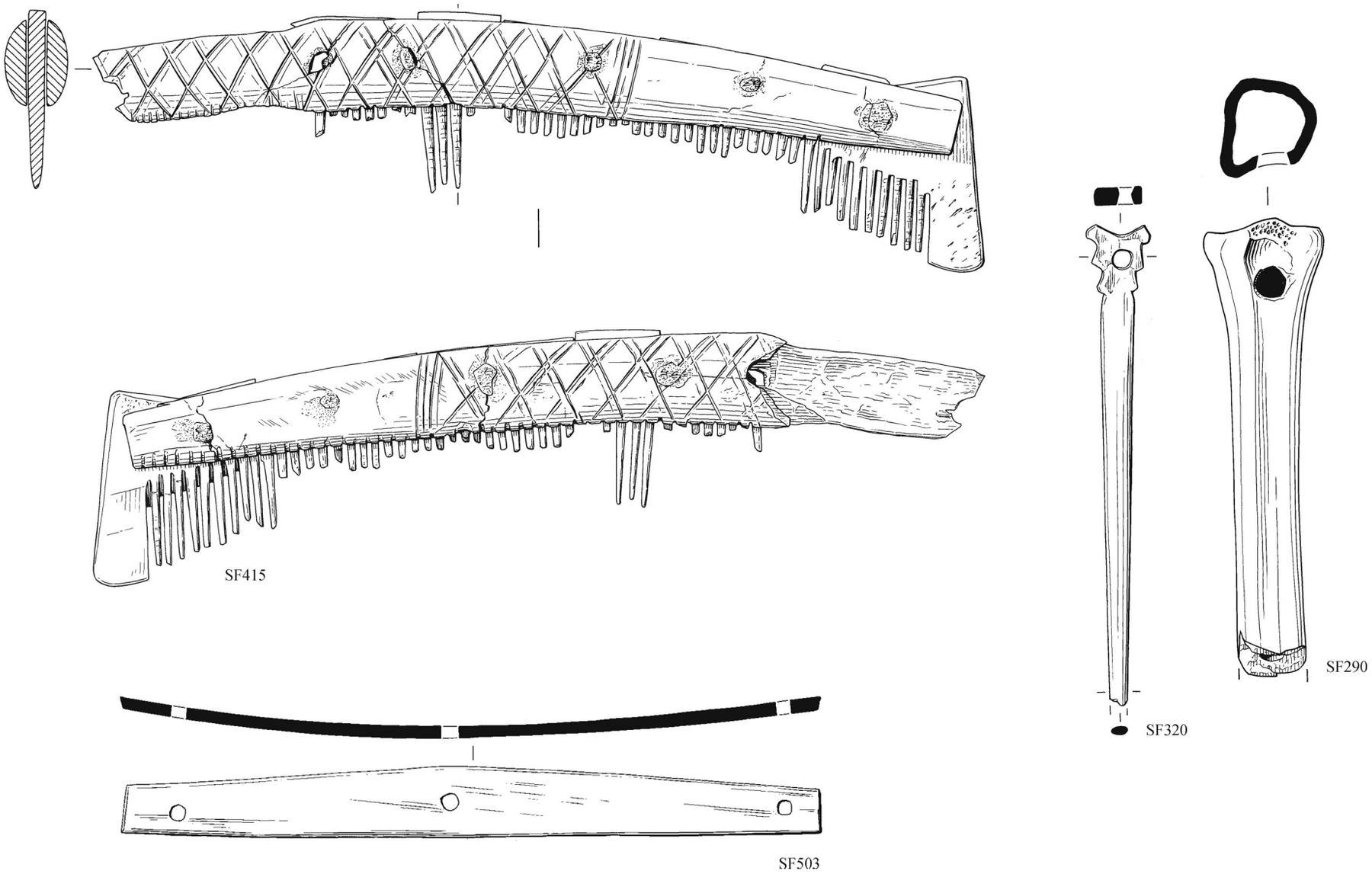


Figure 42 Worked bone: personal items. Scale 1:1.

teeth were both originally present. L 161mm, tooth values 5 and 7 per centimetre.

Comb teeth

SF561 *4301*, fill of post-hole *4032*, Building D; Period 3; not illustrated
Fragmentary antler comb tooth which has been shaped but shows no signs of use. L 19mm.

SF562 *1021*, fill of pit *1025*; Period 3; not illustrated
Bone or antler comb tooth which shows some traces of use. L 26mm.

Pin
(Fig. 42)
An incomplete bone pin (SF320), produced from a pig fibula, can be compared with a similar example recovered from earlier excavations in Thetford (Rogerson and Dallas 1984, fig. 189 no. 33). The head is perforated and is cut in a stepped pattern, with winged ends and a concave top. The careful modelling of the head of this object and the provision of a straight shaft, which involves dextrous shaping of the fibula, both indicate that this is well-produced object which is best regarded as a dress pin. Further pins of this type include less elaborate examples from Ipswich, Lund and York which emulate some, but not all, of the features of this particular head form (Riddler *et al*. forthcoming; Mårtensson 1976, fig. 241 no. 8; Waterman 1959, 85, fig. 14 nos 10 and 12; MacGregor 1982, fig. 48 no. 503). The form of the head corresponds broadly with Schwarz-Mackensen's type 8, which includes several examples from Haithabu, Lund and Sigtuna, all of 10th- or 11th-century date (Jankuhn 1943, 136, abb. 70e; Schwarz-Mackensen 1976, 37-9, abb. 12.6–7).

SF320 *5033*, fill of pit 5028; Period 3; Fig. 42
Near-complete bone dress pin, which has been produced from a pig fibula. The head has been cut from the distal end of the bone and it is shaped to a stepped pattern with a curved apex. It has been perforated centrally by a circular hole. The shaft runs in a straight line to the point, which is missing. L 86mm, perforation D 3mm.

Objects of uncertain function
(Fig. 42)

Perforated metatarsus
(Fig. 42)
An ovicaprid metatarsus (SF290) has been neatly perforated laterally on the posterior face, close to the proximal epiphysis, but is otherwise unmodified. The midshaft is incomplete but shows no signs of being shaped to a point or a rounded end, in the manner of gouges of Iron Age type (Roes 1963, 34–7 and pl. XXXVII; Sellwood in Cunliffe 1984, 382–7). None the less, the possibility that this object did serve as a gouge cannot be ruled out, particularly as some of these objects are perforated laterally at the epiphyses, as is the case here. With this example, however, the lateral perforation only passes through one side of the bone. The object is fragmentary and in its present condition it is difficult to establish its function. It can be compared with a similar object from Jarlshof, which Hamilton suggested was an otter whistle (Hamilton 1956, 123 no.135, fig. 57 no. 6).

SF290 *3004*, fill of pit *3003*; Period 3; Fig. 42
Fragmentary ovicaprid metatarsus, which has been perforated laterally just below the epiphysis on the posterior face. The perforation extends through this face alone. L 80mm.

Waste material
(not illustrated)
The five pieces of antler waste (SF128, SF129, SF484, SF569 and SF592) all came from separate contexts, and are all cut from red deer antler. They include two tine ends and one section of tine or beam, which has been sawn laterally at both ends. An antler burr is naturally shed, with the beam and brow tine removed by sawing. All of these pieces are relatively conventional, both for their type and for the nature of their separation from the antler (Riddler 1996). They represent early stages in object manufacture, when the raw material is cut to size, mostly with the aid of a saw, and unwanted sections of antler are discarded.

The fifth piece is an extensive section of an antler crown, for which four tines survive. This stems from a mature or senescent animal; given that it includes a relatively straight section of beam, it is surprising to note that it was not further dismembered. It is now in relatively poor condition, but appears to have been separated from the remainder of the beam by sawing.

Small quantities of antler waste have come from previous excavations in Thetford and have been described briefly (Rogerson and Dallas 1984, 190 and 191–2; Dallas 1993, 188). The five pieces described here almost double the total known from the settlement as a whole.

SF128 Unstratified; Area 2; not illustrated
A relatively short tine from a red deer antler which has been sawn from the beam and is otherwise unmodified. It has a porous texture, which may indicate that it was cut from an antler which retained its velvet. L 75mm.

SF129 *2008*, fill of curvilinear feature *2009*; Period 3; not illustrated
A section of tine or beam, probably from a tine, which has been sawn laterally at either end. At the broader end the piece was snapped away from the remainder of the tine, close to the junction with the beam. L 44mm.

SF 484 Unstratified, Area 2; not illustrated
A naturally-shed red deer antler burr, from which the beam and brow tine have been removed by sawing. Circumference 193mm.

SF569 *2103*, fill of pit *2107*; Period 3; not illustrated
The end of an antler tine which has been removed by sawing and fracturing. L 63mm.

SF592 *9077*, fill of pit *9087*; Period 3; not illustrated
A section of an antler crown from a mature animal, with four tines still remaining. It is now in a degraded condition but it appears to be unworked, although knife-marks are visible in one area. It was removed from the beam with the aid of a saw. L 268mm.

VII. Pottery

by Sue Anderson
(Figs 43–7; Charts 1–14)

Introduction

Pottery from Sites 1022 and 5761 was submitted for analysis together, and is treated as a single assemblage throughout. The aims of this study are defined by the project aims (Wallis 1997). The major aim of the pottery analysis is to refine the dating of Thetford Ware on the basis of the stratigraphic evidence. Social, economic and industrial aspects of the site are studied, particularly with reference to the large quantity of crucibles recovered from a small area of the site. There is also some analysis of spatial and chronological aspects of ceramic usage, with comparisons of fabrics, forms and overall quantities of material through time.

Methodology

Quantification was carried out using sherd count, weight and Estimated Vessel Equivalent (EVE). A full quantification by fabric, context and feature is available in the archive. Fabric identification was aided by the use of a x20 microscope. Local fabrics were identified using the Norfolk fabric series (supplied by Irena Lentowicz). The form series was not available, so simple form and rim type descriptions are used where appropriate (generally Early Medieval and Medieval coarsewares). Thetford Ware forms follow Dallas (1984); Stamford Ware was identified using Kilmurry (1980) and fabric samples from Stamford Wharf Road and St Paul's Road kilns; Grimston-type Wares were identified from Little (1994); local medieval wares and imports from Jennings (1981). Recording uses a system of letters for fabric codes (similar to that employed in London and Lincoln) together with number codes for ease of sorting in database format. All rims were drawn so that form attributions could be checked following analysis. NAU pottery quantification proformas were used, and the results were input onto Access v.2.0. NAU pottery codes were added to the database file where possible. Aspects of methodology related specifically to Thetford Ware are discussed in the section on this material. Dates were assigned to all features containing pottery, some of which may be wide ranging (*e.g.* 10th–11th century for undiagnostic Thetford Ware) and some of which are tighter (based on specific rim types and/or fabrics occurring together). Dates were finalised following study of Thetford Ware forms in comparison with stratigraphic and associated pottery fabric evidence. These pure 'feature dates' have been used in comparison with the site phase data supplied by the excavator, which were based on pottery and other artefact dates and stratigraphic relationships.

Quantification

A total of 5761 sherds weighing 73.198kg was analysed. The EVE for the whole assemblage, based on 695 measurable rims, was 87.48. The two sites (1022 and 5761) were divided into ten areas, of which Areas 1 and 4 produced the greatest amount of pottery (Table 12).

Table 13 presents the pottery quantification by fabric. From this it can be seen that the Late Saxon group is overwhelmingly the largest from the site, with early medieval coarsewares forming a large proportion of the remainder.

Area	*No.*	*Weight (g)*	*EVE*
U/S	4	359	0.46
1	1826	20,833	20.70
2	797	10,982	16.12
3	516	6030	6.98
4	1220	21,056	26.00
5	556	5488	7.35
6	92	847	2.11
7	40	642	0.57
8	59	574	0.55
9	530	4595	4.30
5761	121	1792	2.34
Total	**5761**	**73,198**	**87.48**

Table 12 Quantification of pottery by area

Pottery by type

Pre-Saxon pottery

A small amount of possible prehistoric and Roman material was found, all heavily abraded. Three sherds of unidentified handmade pottery were collected, one of which could be either an Early Medieval or a Late Roman shelly ware. One sherd of burnt-flint-tempered Iron Age pottery was found in a pit/grave. The Roman pottery consisted of fragments of one bowl and one dish in Oxford Red Colour Coated Ware, the latter decorated with rouletting, and a small sherd of Central Gaulish samian.

Thetford Ware

(Figs 43–7; Charts 1–3)

Around 80% of the pottery from Mill Lane was Thetford Ware. This provided a large group of more than 4500 sherds with which to work. One of the main aims of this study (as defined by Lentowicz, in Wallis 1997) was to use the stratigraphic evidence to refine the dating of Thetford Ware. Although the present author had studied earlier work on Thetford Ware prior to undertaking this analysis, it was felt that a 'blind' study would provide the most reliable data. To avoid any bias, suggestions for dating made by previous analysts were ignored as far as possible during the initial data collection.

Following analysis, a comparison was made between the stratigraphic evidence (based on a Harris matrix) and the recorded forms. At this stage it became clear that only sixteen groups of inter-related features contained rims. Although there were many features containing several discrete layers these were less useful stratigraphically, as the distribution of forms through these layers suggested broad contemporaneity and in many cases only one or two layers contained diagnostic sherds. Residuality and mixing of layers was also a problem, as it was clear that many features contained both 'early' and 'late' Thetford Ware forms. This may be due in part to continued manufacture of some of the more 'popular' forms, but could also be attributed to backfilling with surrounding disturbed earth which might have contained pottery up to a century earlier than the features themselves.

Other artefactual evidence for dating was also considered, but unfortunately only one feature contained a closely datable small find: this was a coin of William I (SF438), which showed little sign of wear, in pit *2016* (Period 4). This corroborated the suggested pottery date for this feature, in the late 11th century. A late 9th–10th century strap-end (SF425) in well *2078* (Period 3) was found in association with two 'early' rim types.

The suggested dating of Thetford Ware form types discussed below (*Forms*) is therefore based on a number of sources. The two small finds mentioned above have produced some confirmation of previous ideas, although clearly this evidence is slim. Stratigraphic evidence has provided a limited amount of data, although again has not been as useful as was envisaged. Stamford Ware has produced some close dating, and the presence of Early Medieval Ware has generally suggested an 11th-century date for non-residual Thetford Ware in the same context.

Fabric Name	*Code*	*Fabric No.*	*No.*	*%(No)*	*Wt/g*	*%(Wt)*	*EVE*
Unidentified Handmade	UNHM	0.00	3		6		-
Iron Age Flint Tempered	IAFT	0.41	1		3		-
Oxford Red Colour Coat	OXRC	1.47	2		26		-
Samian (Central Gaulish)	SACG	1.61	1		5		-
Total pre-Late Saxon			7	0.1	40	0.05	-
Thetford Ware Smooth	THET1	2.51	29		302		0.51
Thetford Ware Fine	THET2	2.52	55		529		0.78
Thetford Ware Medium	THET3	2.53	4501		58,761		70.79
Thetford Ware Coarse	THET4	2.54	6		164		-
Grimston Thetford-type Ware	THETG	2.57	75		2663		0.54
Stamford Ware	STAM	2.60	21		120		-
Stamford Ware Fabric A	STAMA	2.61	129		871		1.10
Stamford Ware Fabric D	STAMD	2.62	13		209		0.34
St Neot's-type Ware	STNE	2.70	380		3609		7.37
Miscellaneous ?Saxo-Norman	SXNO	2.80	5		44		-
Total Group 2 (LSax)			5214	90.5	67,272	91.9	-
Early Medieval Ware	EMW	3.10	237		1363		1.49
Early Medieval Ware Gritty	EMWG	3.11	5		49		-
Early Medieval Ware Chalky	EMWC	3.12	3		41		0.05
Early Medieval Ware Shelly	EMWS	3.14	14		240		0.07
Early Medieval Sandwich Ware	EMSW	3.16	46		665		0.51
Yarmouth-type Ware	YAR	3.17	7		91		0.07
Early Medieval Ware Sparse Shelly	EMWSS	3.19	5		85		0.27
Stamford Ware Fabric B	STAMB	3.71	40		353		0.29
Stamford Ware Fabric G	STAMG	3.72	17		499		0.76
Total Group 3.1 (EMed)			374	6.5	3386	4.6	-
Medieval Coarse Wares	MCW	3.20	5		38		-
Grimston Coarse Ware	GRCW	3.22	13		265		0.20
Local Medieval Unglazed	LMU	3.23	16		209		0.52
Bury Sandy Fine Ware	BSFW	3.31	1		9		-
Bury Coarse Sandy Ware	BCSW	3.32	4		41		-
Bury Medieval Coarse Ware	BMCW	3.33	23		222		-
Bury Medieval Coarse Ware Gritty	BMCWG	3.34	2		22		-
Medieval Shelly Wares	MSHW	3.50	3		7		-
Bury Medieval Shelly Ware	BMSW	3.53	9		75		0.06
Ely Coarse Ware	ELCW	3.61	4		30		-
Total Group 3 (Med)			80	1.4	918	1.3	0.78
Unprovenanced Glazed	UPG	4.00	5		80		0.32
Grimston-type Ware	GRIM	4.10	22		451		0.12
Hedingham Fine Ware	HFW1	4.23	1		3		-
Developed Stamford Ware	STAMC	4.71	4		67		-
Ely Glazed Ware	ELYG	4.81	2		42		-
Total Group 4 (Med glazed)			34	0.6	643	0.9	0.44
Pingsdorf Ware	PING	7.24	29		594		1.00
Rouen-type Ware	ROU	7.34	1		1		-
Andenne Ware	ANDN	7.35	15		109		-
Total Group 7 (Imports)			45	0.8	704	1.0	1.00
Transfer Printed Earthenwares	TPE	8.00	2		14		-
Late Post Medieval Earthenware	LPME	8.01	4		198		0.07
English Stoneware	ESW	8.20	1		23		0.25
Total Group 8 (Modern)			7	0.1	235	0.3	0.32
Total			**5761**		**73,198**		**87.48**

Table 13 Pottery quantification by fabric

Comparison with other Late Saxon wares has also been a source of inspiration, particularly with regard to the dating of Torksey Ware in York (Holdsworth 1978), suggested dates of Norwich Thetford Ware (Jennings 1983), and some Stamford Ware forms (Kilmurry 1980).

Despite all of this, the evidence is still not good enough to provide anything more than suggestions for dating. The use of phases based on the dates of the artefacts recovered to substantiate the dating of rim forms clearly risks involving an element of circularity.

Fabrics

The four basic fabric types — smooth (THET1), fine (THET2), medium (THET3) and coarse (THET4) — originally defined by Dallas (1984, 1993) have been employed in this study. Since no fabric samples from Thetford were available, distinction between the types has necessarily been subjective and may not be directly comparable with Dallas's work. The quantities of each type are shown in Table 13, and it is clear that the medium fabric is by far the most common. This is the case at most Thetford sites.

Forms and dating

The forms defined by Dallas (1984) were used for recording this pottery. However, it became clear that there were problems with the type series, largely resulting from the use of different form numbers for the same rim types within the jar series. For example, the rim type of small jar AA11 corresponds to medium jar AB13 and large non-handled jar AF9 (see Table 14 for the full range of correlations). Some previously 'missing' rim types were identified in this series, and the use of different numbers for each form does not allow these to be added easily. The difficulty of assigning some rims to particular form types complicated this further, and it became clear that there was some degree of inter-observer error when the results of the present author's analysis were compared with the assessment (carried out by Irena Lentowicz). For these reasons, it was felt necessary to modify the original type series to make it easier to use, and therefore more comparable between analysts.

The changes made refer only to the jar type series, as there were too few of the other form types on which to base changes. It is proposed to keep the original letter codes for forms, *i.e.* AA small jars, AB medium jars, AC large jars, AD spouted jars, AE handled jars, AF large non-handled jars, AG large multi-handled jars. However, separate number codes for rims are suggested, which will allow rim types to be recorded even when the form is uncertain. The basic rim types and their suggested date ranges are defined in Table 15 and examples of each are shown in Fig. 43. These can be divided into hollowed and non-hollowed by adding the suffix 'H' for hollowed, or by using the code 'x.0' for non-hollowed and 'x.1' for hollowed (*e.g.* a hollowed square wedge would be 5.1). However, no distinction has been made in this study because the presence or absence of a hollow does not appear to have any relationship with date, and also because some hollows are very indistinct or almost non-existent and are another cause of inter-observer error.

At this point, it may be useful to summarise previous authors' proposals for dating Thetford Ware in Thetford and elsewhere. Dallas (1984) suggests that the smooth and fine fabrics were probably 'late' or 11th-century. The smooth ware in her study occurred in jar forms with upright, plain flared, parallel-sided and tapered rims, and the fine ware had a similar range but also included some triangular and square wedge forms. Later jars are more commonly in smooth and fine fabrics, tend to be smaller, and have no decoration: forms AA1 and 2, and AB1, 2 and 9 occur most often. She suggests that forms AB13, AB7, AB8, AB15 and AB17 are 'present from the beginning' (Dallas 1984, 125), and that most have rouletting at the shoulder. Early bowl types seem to be rare, but BB12 is the most common. At the Redcastle Furze site, where the majority of pottery was dated to the 11th century or later, form BB12 did not occur (Little 1995). However, this site produced a large proportion of jars with 'early' rim types (triangular and square-wedged), suggesting either that the date range given is incorrect, or that these types had a very long life span. Work on a kiln site (Dallas 1993) dated to the mid–late 10th century (from the pottery) suggests that jars with square wedge rims formed the main part of the assemblage, with a few rounded wedge rims also appearing. In this publication, she suggests that smaller vessels are *early*, and that by the second half of the 11th century there was less standardisation of both fabric and form.

The best published information currently available on Thetford Ware in Norwich is the report by Jennings (1983). Two kiln sites were dated, although the date of the later one is open to question. The earlier of the two, Site 424N, was dated to the late 10th–early 11th century and produced mainly square wedge forms, with some rounded wedges and a few parallel rims. The later site, 336N, produced mainly jars with rounded wedge, tapering, and parallel rim forms.

Rural Thetford Ware industries have been studied at Langhale (Wade 1976) and Bircham (Rogerson and Adams 1978). Neither could be closely dated, but circumstantial evidence suggested a 10th- or early 11th-century date for the Bircham kiln, and a more definite 11th-century date for that at Langhale due to the presence of ginger jars. Only small groups of pottery from each were published. At Bircham, the jar rim forms include parallel-sided, plain flared and rounded wedge types, and the bowls have tapered rims. At Langhale there were some square and rounded wedges, some parallel forms and one plain flared type. Rouletting occurred on the Bircham jars, but only incised wavy lines and applied strips decorated the vessels from Langhale.

A limited amount of research has also been carried out, as part of this project, to compare the Thetford jar rim types with those of other Saxo-Norman pottery. St Neot's Ware seems to be produced in a very similar range of forms, which can be tentatively suggested to occur with the same date ranges in Thetford (see below), although the triangular and tapered types do not seem to have been made in this fabric. Torksey-type Ware from York (Holdsworth 1978), when it occurs in 11th-century features, has parallel and rounded wedge rim types; material from 10th-century layers consists largely of jars with square wedge rims. Lincoln Kiln-type Wares also show an increase in round wedge rims (Hollow everted 3) at the expense of square wedge types (Hollow everted 1), but in this case the changes occur between the late 9th and early 11th centuries (Young 1989, fig. 29). Stamford Wares show similar changes, although there is a much wider variety of forms. Kilmurry's forms 2-17, 2-38 and 2-40 (square wedges) are dated to the 10th century, wedges with slight rounding (*e.g.* 2-04, 2-09) are dated to the late 10th century, and fully rounded wedges (*e.g.* 2-33, 2-35, 3-12 and 3-25) are of 11th-century date.

The simplified jar rim forms that have been suggested as a result of the present study (Table 15) appear to fit the pattern suggested by previous work and other pottery types. A sequence can be suggested from this evidence, and this is illustrated schematically in Chart 1. The earliest rim type appears to be Type 5 (square-ended wedge), closely followed by Type 3 (triangular or short wedge). These two probably ran concurrently through most of the 10th century and were joined towards the middle or later part by Type 4 (parallel-sided). There is some suggestion that Type 4 rims with square edges are earlier than those with rounded edges, but this would have to be checked in another assemblage. By the late 10th century, Type 7 (tapered) seems to have evolved from Type 3, and similarly Type 6 (round-ended wedge) may have developed from Type 5. The evidence for the latter is in the form of some rims, classified 5/6, which have a rounded bottom edge but a squared top edge in section, and appear to date to the cross-over period (*cf.* Kilmurry's Stamford Ware forms 2-04 and 2-06, mentioned above). The parallel-sided rims may be replaced in the 11th century by the plain flared Type 1, which also occurs in Early Medieval Ware. Type 2 (upright) is anomalous and uncommon, but may be a crude form of Type 1 made at a single or very few production sites. Although there is some suggestion of developing and changing forms, there is still an element of conservatism in Thetford Ware and it is likely that most of these forms overlap to some extent, possibly by as much as 100 years in some cases. The presence of the various types by date is discussed further in the section on pottery by site period below.

A quantification of jars using the new rim form classification is presented in Table 16. This shows that medium jars (AB) are the most common (77% of jars).

Jar rim sizes were plotted as a bar graph (Chart 2). Distinction between jar types AA, AB and AC is based on rim size, so the patterns shown for these are no surprise. However, from the normal distribution shown by these vessels, it is clear that the division is a purely arbitrary one, and that AA and AC jars are merely outliers that do not form distinct groups in themselves. The mode for the AB group falls at 130mm, and the majority of rims fall within the range 120–40mm. This pattern is the same for all rim types. Plain jars, with no added handles, spouts or applied strips, might be expected to vary between 80mm and 180mm in diameter, although some of these rims could belong to spouted jars AD, which can be as small as 110mm. However, the majority of AD jar rims are between 150mm and 220mm in diameter, and handled jars AE fall within a similar range. Large non-handled jars with applied strips at the neck (AF) tend to cluster around 220–40mm, although there are very large outliers up to 420mm in diameter. In view of the difficulty in distinguishing these jars from bowl form BB7, together with the lack of a depth measurement to determine the form, it is probably more reasonable to classify the very large vessels in this group as bowls. Very few rims of large multi-handled jars (AG) were found, but these appear to have a similar range to AE jars, despite their much greater volume.

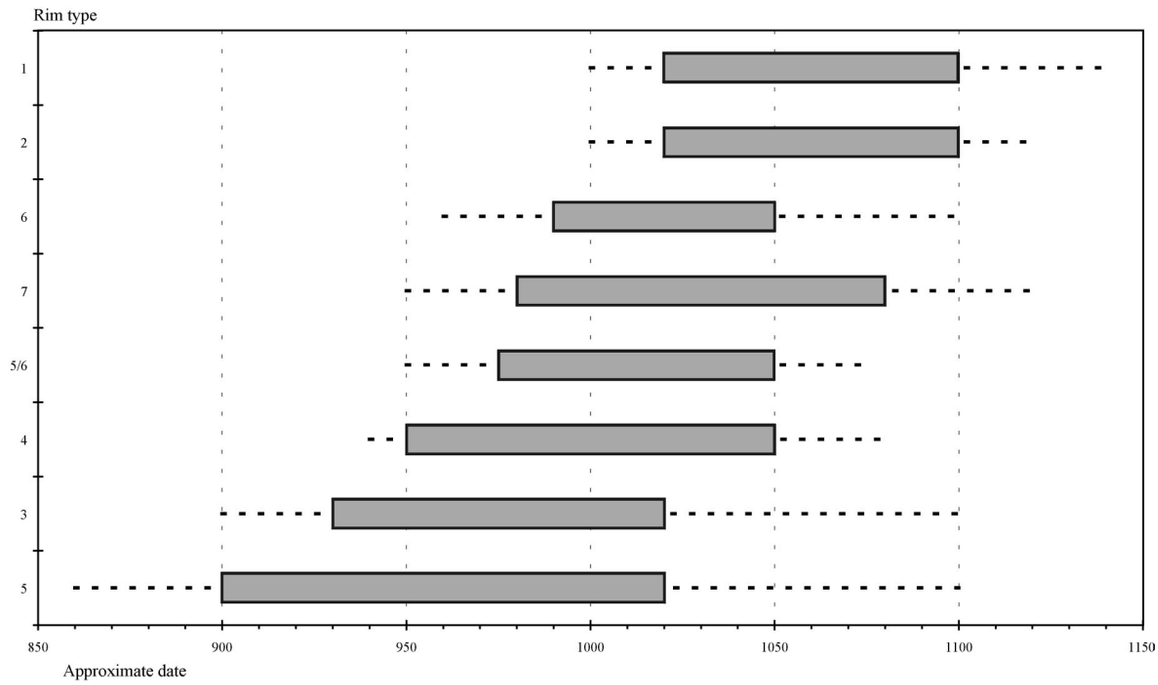


Chart 1 Approximate dates of Thetford Ware rim types

Jars: / *Rim type*	*AA*	*AB*	*AC*	*AD*	*AE*	*AF*	*AG*	*New rim form*
Without hollow								
Rim unknown or unshaped	-	-	-	-	-	-	1	0
Plain flared	1	1	1	1	1	-	2	1
Upright	2	2	2	2	2	-	3	2
Everted, triangular section	-	3	3	-	-	-	-	3
Everted, sides tapering	3	4	4	3	3	1	4	7
Everted, sides tapering, slack shoulders	-	-	-	-	-	2	5	7
Everted, sides parallel or almost parallel	4	5	5	4	4	3	6	4
Everted, sides expanded to wedge	5	6	6	5	5	4	7	5
Everted or rolled, expanded to globular	6	-	-	-	-	-	-	6
With hollow								
Everted, triangular section	7	7	7	6	6	5	-	3
Triangular section with developed pendant	8	8	8	7	7	-	-	3
Upright	-	9	9	8	8	6	8	2
Everted, sides tapering	9	10	10	9	9	7	9	7
Everted, sides parallel or almost parallel	10	11	11	10	10	8	10	4
Everted, sides parallel, exaggerated hollow	-	12	12	-	-	-	-	5
Everted, sides expanded to wedge	11	13	13	11	11	9	11	5
Everted, sides expanded to degenerate wedge	-	14	14	12	12	10	-	5
Everted, expanded with developed pendant	-	15	15	13	-	-	-	5 or 6
Everted, sides expanded with rounded edges	12	16	16	-	-	-	-	6
Everted, external lip expanded to pendant	13	17	17	-	-	-	-	5 or 6
With added clay band at rim	-	-	-	14	-	-	-	-

Table 14 Thetford Ware rim forms (after Dallas 1984) and new equivalents

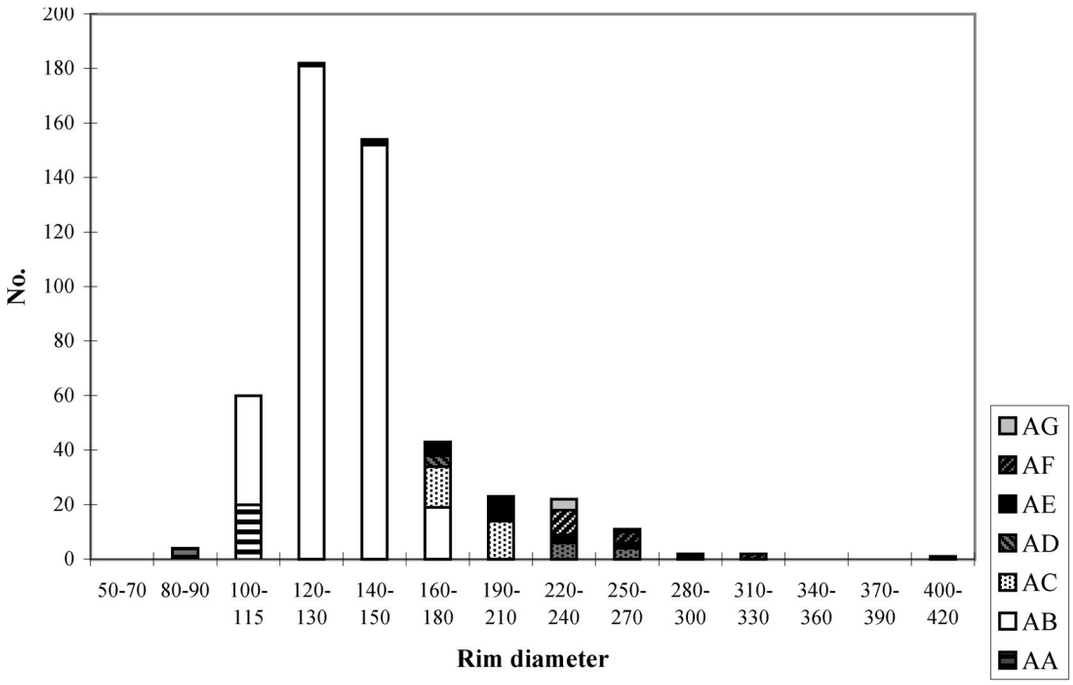


Chart 2 Rim diameters of Thetford Ware jars

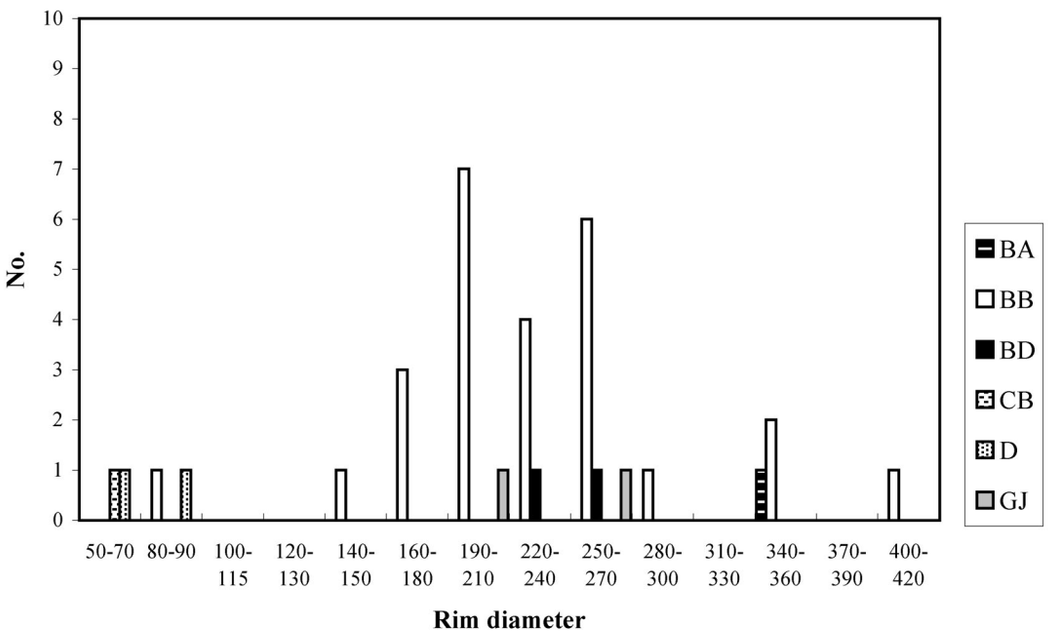


Chart 3 Rim diameters of Thetford Ware non-jars

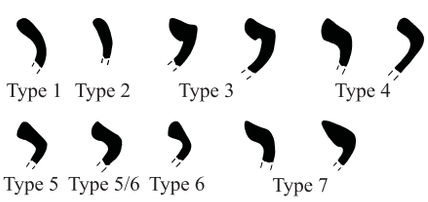


Figure 43 Revised Thetford Ware jar rim typology

Rim	*Description*	*Suggested date*
1	Plain flared	11th C
2	Upright	11th C
3	Triangular (short wedge)	10th C
4	Parallel sided	M.10th–E.11th C
5	Square wedge	10th C
6	Round wedge	L.10th–11th C
7	Tapered	L.10th–11th C

Table 15 New Thetford Ware rim forms

The small numbers of other vessels found do not allow for in-depth analysis. Rim sizes were plotted using the same method as applied to the jars (Table 17, Chart 3). Bowl rims varied from 100mm to 400mm in diameter with no particularly clusters of sizes. The only exception was the BB12 type, examples of which were all between 200mm and 260mm in diameter.

Approximately 61% of bases in Thetford wares were sagging, the remainder being flat. The spread of the two types through the site phases is very similar, and does not indicate any increase of one type at the expense of the other. Other sites in the town have also produced a majority of sagging bases.

Decoration

A total of 599 sherds were decorated, of which 50 were rim sherds. Twelve of these rims were decorated on both the body and the rim, and the remainder on the rim only. The types of decoration and numbers of sherds involved are shown in Table 18. Note that some sherds occur more than once.

Some types of decoration commonly occurred in connection with other types. For example, all the stamps were on vessels with applied thumbed strips (Fig 44, Nos 21–3), and incised wavy lines were found in association with cordons (one example) and diamond rouletting (four sherds, Fig. 44 No. 20). Rouletting was also found on three sherds with applied thumbed strips.

Although it has been implied that rouletting may be an early form of decoration (Dallas 1984), there was no evidence for this in the Mill Lane assemblage. Girth grooving might also be expected to appear early in the sequence as it is associated particularly with Ipswich Thetford Ware. However, on this site it occurs largely in late 10th- and 11th-century contexts. There appears to be some correlation between incised wavy line decoration and 10th–early 11th century features, but examples do occur later, and in view of the common use of this method of decoration on 11th-century rural Thetford Ware (Wade 1976) and local medieval coarsewares it seems unlikely that it is an entirely 10th-century phenomenon in Thetford.

Discussion

Despite the suggested sequence for the revised Thetford Ware jar rim forms discussed above, there is still no evidence for absolute dates; the periods of use proposed for each type are still relative and based on possible developments of rim types. The sequence is based on three general rim types (wedge, parallel, triangular) which seem to evolve slightly during the period from the beginning of the 10th century to the end of the 11th, but which are likely to overlap at any given point in time between these dates. In practice, this means that the dating of Thetford Ware will only become reasonably precise when there is a large group of rims from a single feature, and that dating based on a single rim form should still be limited to a broad date range.

Recent work at Castle Mall, Norwich (Site 777N) has suggested that Thetford-type Ware and Early Medieval Ware in the city may be earlier than has previously been thought (Liz Shepherd Popescu, *pers. comm*.). No detailed information on this is available at the time of writing, but clearly any changes will have implications for the study of the two Wares generally. However, even if different date ranges are accepted in the future, the *sequence* of rim types suggested here would still stand for the Mill Lane site.

Grimston Thetford Ware
(Figs 44, 45 and 47)

Fabric

Grimston Thetford Ware (THETG) has been described by Little (1994). It varies in colour from pinkish-buff to brown, often with a grey core, and contains abundant colourless and white quartz, sparse ferrous particles, sparse angular red/brown flint and occasional grog. The larger vessels, particularly bowls, are difficult to distinguish from Grimston coarseware (GRCW: below). Seventy-five sherds were identified as Grimston Thetford Ware, forming 1.3% of the total assemblage by count and 3.6% by weight. This difference is due to the size of sherds, which are generally from thick-walled vessels broken into relatively large pieces. It forms only a small proportion of the Thetford Ware from this site.

Form:	*AA*		*AB*		*AC*		*AD*		*AE*		*AF*		*AG*		*Total*	
Rim	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
1	1	4.5	12	3.0	3	8.3	-	-	1	6.2	1	5.6	-	-	18	3.5
2	1	4.5	1	0.2	-	-	-	-	-	-	-	-	-	-	2	0.4
3	-	-	118	29.2	6	16.7	1	5.9	1	6.2	1	5.6	-	-	127	24.5
04	8	36.4	85	21.0	5	13.9	3	17.6	4	25.0	5	27.8	3	42.9	113	21.8
5	8	36.4	97	24.0	11	30.5	6	35.3	2	12.5	2	11.1	3	42.9	129	24.9
6	1	4.5	70	17.3	5	13.9	4	23.5	3	18.8	-	-	-	-	83	16.0
7	3	13.6	21	5.2	6	16.7	3	17.6	5	31.3	9	50.0	1	14.3	47	9.1
Total	**22**		**404**		**36**		**17**		**16**		**18**		**7**		**519**	

Table 16 Quantification of Thetford Ware jars by form and rim type (maximum no. of vessels)

Dishes		*Bowls*		*Spouted bowls*		*Bottles*		*Lamps*		*Lid*		*Ginger jars*	
Form	*No.*	*Form*	*No.*	*Form*	*No.*	*Form*	*No.*	*Form*	*No.*	*Form*	*No.*	*Form*	*No.*
BA2	1	BB2	1	BD	1	CB	1	D	1	E	1	GJ	1
		BB3	1	BD2	1			DA	1				
		BB4	3	BD4	1			DB	3				
		BB5	3					DC	1				
		BB7	4										
		BB10	2										
		BB11	2										
		BB12	11										
Total	**1**		**27**		**3**		**1**		**6**		**1**		**1**

Table 17 Quantification of Thetford Ware forms other than jars (maximum number of vessels)

Forms
Common forms in this fabric are large storage jars and bowls. At this site, there were at least six large storage vessels (Dallas type AG), one handled jar (Little type HJA), one medium jar (Dallas type AB11) and one bowl (Dallas type BB2, Fig. 47 No. 56). A new jar type in either Grimston Thetford or coarseware was found (Fig. 47 No. 62). All bases were sagging, and two wide strap handles were also found.

Decoration
Thirty-five sherds of Grimston Thetford Ware were decorated. By comparison with Thetford Ware, the range of decoration is limited. One sherd showed signs of possible burnishing, one was stamped (Fig. 44 No. 2), one had applied rouletted strips, seven had thumbed rims, and twenty-six had applied thumbed strips. Nineteen sherds with applied thumbed strips probably belonged to only two vessels, both with unusually thick strips and deep impressions (Fig. 45 No. 39).

Stamford Ware
(Fig. 46)

Fabrics
Kilmurry's fabrics A and D (Late Saxon), B and G (early medieval/medieval) and C (medieval) were identified in the 79 sherds of Stamford Ware from this site (Kilmurry 1980). Fabrics A and D, of mid 10th–late 11th century date, represent 16.5% and 13.9% respectively of the total number of Stamford sherds. Fabrics B and G, most common after the mid-11th century, form the bulk of this group. By weight, Fabric G represents 41.0% of the total and Fabric B 15.4%, but by count these proportions are reversed (B 43.0%, G 21.5%). Developed Stamford Ware (in Fabrics B and C) was not common at this site, forming only 5% of the total Stamford Ware group. Stamford Ware crucibles are not included in these quantifications (*Crucibles*, below).

Forms
Very few forms were identifiable. Four jars or cooking pots, two each in Fabrics D and G, were found (Fig. 46 No. 43). Other cooking vessels included a small bowl in Fabric B (Form 12-16?, Fig. 46 No. 50), and a large bowl (1-66, Fig. 46 No. 44) and spouted bowl (13-12) in Fabric G. The rim of a jug or tubular-spouted pitcher (Form 6-21 or 24-04) and three handles from spouted pitchers or jugs were the only identifiable tableware forms. Presumably the three copper-glazed sherds of Developed Stamford Ware were also from jugs.

Decoration
Eight sherds were decorated. Diamond rouletting was present on the spouted bowl and one cooking pot, incised lines were seen on four sherds, and applied thumbed strips on two. Forty-one sherds were glazed, 22 with Glaze 1, seven with Glaze 2, three with Glaze 3, and nine with Glaze 6.

St Neot's-type Ware
(Fig. 45)

Fabrics
The majority of St Neot's-type Ware was in the typical dense shelly fabric with a 'soapy' feel, usually with oxidised surfaces but occasionally black. A few sherds of the later, sandier material were also identified. St Neot's-type Wares represent 6.5% by count and 4.9% by weight of the total assemblage.

Decoration	*Body*	*Rim*
Applied thumbed strip	188	11
Cordoned	2	-
Combed wavy lines	1	-
Finger tip impressions	2	20
Girth grooving	10	-
Incised horizontal lines	1	2
Incised wavy lines	20	1
Rouletting (indistinguishable)	3	-
Rouletting: diamond	227	17
Rouletting: interlace	1	-
Rouletting: rectangular	18	-
Rouletting: square	22	1
Rouletting: triangular	2	-
Stamped	5	-

Table 18 Thetford Ware, occurrence of decoration

Forms
A maximum of 74 separate rims were identified, of which 72 could be assigned to a form type. In addition, one rim and one body sherd were identified simply as bowls. The form types used are based on previous work in Thetford by Little (1995), in turn based on Hurst (1976). A description of form types, together with quantities identified from this site, are recorded in Table 19. Bowl types SNB2 (straight-sided) and SNB3 (spouted with inturned rim) and jar types SNJ5 (plain flared rim with external groove), and SNJ7-9 (unusual forms identified by Little) were not found.

The expanded wedge rim type can be further divided into squared (fifteen examples) and rounded (29 examples) types, corresponding to Thetford Ware Rims 5 and 6. The plain flared types are similar to Thetford Ware Rims 1 and 4. Tapered and triangular types do not appear to occur. Dallas (1984 and 1993) has suggested that St Neot's Ware occurs mainly in features of late 10th–11th century date in Thetford, and this seems to be the case at Mill Lane.

Crucibles
(Fig. 46)

Fabrics
A total of 152 sherds, weighing 938g, was identified. This represents 2.6% by count and 1.3% by weight of the total assemblage.

All crucible sherds were examined microscopically to determine the fabric type. The majority (144 sherds) was probably Stamford Ware, usually Fabric A, although in some cases the pottery was too vitrified to be certain. Four sherds were probably Thetford Ware (three medium fabric, one coarse fabric). One small piece of St Neot's Ware also had a glassy deposit on the interior and may have been used in this way. Two fabrics were unidentified. One was a fine hard grey/white fabric tempered with very coarse white or grey limestone, and the other was

Forms		*Description*	*No.*	*Fig.*
Bowls	SNB	Unidentified bowl.	2	45.32
	SNB1	Deep bowl, bold inturned rim, sloping sides, sagging base	12	-
	SNB4	Shallow dish with hammerhead rim	1	-
Jars	SNJ1	Plain flared rim with internal hollow	7	-
	SNJ2	Plain flared rim without internal hollow	6	46.40
	SNJ3	Expanded wedge rim with internal hollow	18	46.41
	SNJ4	Expanded wedge rim without internal hollow	26	45.31
	SNJ6	Rounded rim with lid seating	1	-
Jugs	SNJG	Unidentified jug?	1	-

Table 19 St Neot's-type Ware forms

similar to Stamford Ware but with very coarse quartz inclusions. The origins of these two fabrics are uncertain.

The same pattern — with crucibles mainly of Stamford Ware, with a few locally made vessels — has been found previously in Thetford (Bayley 1984) and on other Late Saxon urban sites in, for example, York (Bayley 1992a) and London (Bayley *et al*. 1991).

Forms

Most sherds were probably from typical bag-shaped and hemispherical Stamford Ware vessels. These were classified into seven basic rim types: Type 1, expanded triangle (four sherds); Type 2, thickened (seventeen sherds); Type 3, rounded (eleven sherds); Type 4, with internal bead (one sherd); Type 5, thickened and grooved (two sherds); Type 6, slight upright protrusion and groove (three sherds); and Type 7, parallel sides (one sherd). However, it seems likely that rim forms are variable within a single vessel and these 'Types' may be unreliable as a method of classification. In addition to the fragments, one complete vessel was found (Fig. 46 No. 42), in hearth *2109* (SF461). This was the same as form 16.01 published by Kilmurry (1980).

Two of the Thetford Ware sherds were simple, upright tapered rims from thumb-pot crucibles (Bayley 1992b). Several sherds had the vitrified remains of an outer layer of clay still adhering. Further discussion of crucibles, their contents and uses can be found above (*Non-ferrous metalworking*, pp**00–00**).

Other Saxo-Norman wares

Two sherds in unidentified fabrics were probably Saxo-Norman. One was heavily abraded, in a pale buff fabric with coloured quartz, and could be a regional variant of Thetford Ware. The other was in a hard red fabric with a grey core and contained quartz sand, grog, ferrous particles and chalk. Three other sherds recorded as Saxo-Norman in Table 13 are part of the crucible assemblage and are discussed above.

Early Medieval Wares (EMW)
(Figs 46 and 47)

Fabrics

The total group of Early Medieval Wares represents only 6.5% of the assemblage by count and 4.6% by weight. This is the largest group in the assemblage after the Late Saxon material.

Several types of Early Medieval Ware were identified. The most common was the hard, thin-walled handmade variant of Thetford Ware which occurs frequently in both Norwich and Thetford but less so elsewhere in the region. Other types are generally coarser, with major inclusions consisting of large grains of quartz (EMWG), coarse chalk (EMWC) or coarse shell (EMWS). Shell is also a common inclusion in Yarmouth-type Ware (YAR), although in this it tends to be leached out, and it occurs to a lesser extent in Early Medieval Sparse Shelly Ware (EMWSS). Most of these types were probably locally made. One example of EMWC was extremely coarse and had a wheel-turned rim in a non-local form. The origin of this fabric is uncertain.

One other fabric is included in the early medieval group. Early Medieval Sandwich Ware (EMSW) is a fairly soft sandy type with black surfaces, red margins and a dark grey core (Jennings 1981, 22). It occurs frequently in association with Thetford Ware, and often in the same forms. It is likely to be a regional variant of Thetford Ware, probably of rural manufacture, rather than a true Early Medieval Ware, although it probably belongs to the 11th century.

Early Medieval Stamford Ware fabrics are dealt with in the section on Stamford Ware, above.

Forms

Forty-four separate rims were present. Ten of these were EMSW Thetford types, and consisted of two bowls (Fig. 46 Nos 45–6), two dishes and five jars. Of the remaining 35 vessels, 28 rims were from jars, three from 'ginger jars' and four from bowls. The majority of jar rims were simple everted types characteristic of EMW, and bowl rims were generally plain upright or flat-topped (Fig. 47 No. 63). Only seven bases were found, six of which were sagging and one flat. Most sherds had some degree of sooting on the exterior, suggesting use for cooking or water heating. A few contained lime or burnt food residues.

Decoration

Very few sherds in this group were decorated. Five sherds had applied thumbed strips, four rims were decorated with thumbing, and one EMSW vessel had diamond rouletting on the rim.

Medieval coarsewares (MCW)
(Figs 46 and 47)

Fabrics

Medieval coarsewares as a group represent just under 1.5% of the total assemblage. There does not appear to have been a pottery production site within or near Thetford beyond the 12th century, which could explain the presence in the town of medieval coarsewares from a wide variety of sources. However, two unusual ?Thetford-fabric rims from a Period 4 pit have been recorded as medieval (Fig. 46 Nos 48–9). Identifiable medieval coarsewares include material from Grimston and unknown production centres in or near Norwich, Bury St Edmunds and Ely.

Grimston medieval coarseware (GRCW) is difficult to separate from Grimston Thetford Ware, but at least thirteen sherds of the former were present in this group. Identification was based largely on the form, although even this is not always a reliable discriminant.

Local Medieval Unglazed (LMU) Ware is the typical medieval coarseware in Norwich (Jennings 1981) and other Norfolk towns, but does not appear to have travelled into Suffolk. It is in a hard, grey sandy fabric, which is noticeably finer than other regional medieval coarsewares.

Several fabrics seem to be local to Bury St Edmunds. A fine type, comparable to Norfolk LMU but in a dark reddish-buff fabric with a grey core (BSFW), is common in Bury and occurs rarely in Thetford. A similar coloured but extremely coarse fabric (BCSW) containing sparse chalk, ferrous particles and flint, also appears to have a Bury origin. The general sandy greyware (BMCW and BMCWG) has been found on other sites in Thetford and appears to occur in the medieval areas of the Mill Lane site, although its macroscopic similarity to the coarser varieties of medium Thetford Ware has been noted. A shelly (shell-dusted) ware was also produced in the Bury area (BMSW), but the shell of this fabric is merely a shallow surface treatment on a basic sandy fabric, often occurring on the top half of the vessel only. Similar treatment is found on medieval wares in Lincoln (A. Vince, *pers. comm*.) and occurs in Colchester (Cotter 2000, 70–1) in the 12th century.

A few sherds of Ely coarseware were found in medieval or unstratified contexts. This is a sand and chalk fabric, which has been identified previously in Thetford (Little 1995, 108) and referred to as Cambridgeshire-type Ware.

Forms

Other than six typical large bead-rimmed bowls from Grimston (types BE and BJ), very few forms were identifiable in this group. Four LMU 12th–13th century jars with simple everted rims and one developed 13th–14th century type were found. There was also a small BMSW bowl with a square bead rim. As with the early medieval group, most sherds were sooted and some had deposits of burnt food or lime on the inner surface.

Decoration

One BMCW sherd had a narrow applied thumbed strip, and one Grimston coarseware base was thumbed.

Medieval glazed wares
(Fig. 46)

Fabrics

Very few medieval glazed wares (less than 1% of the total assemblage) were found, although the proportion is relatively high in comparison with the medieval coarsewares, which usually far outnumber any glazed wares of the same date.

Grimston Ware (GRIM) was the most common medieval glazed ware on the site, as is the norm for Thetford. Small quantities of Hedingham Ware (HFW1), Developed Stamford Ware (see above) and Ely Glazed Ware (ELYG) were also found. These fabrics are all adequately described elsewhere (Little 1994, 84; Walker 1995, 104; Kilmurry 1980; Little 1995, 108).

Five sherds of five different unidentified glazed wares were also collected. These are as follows:

UPG1 Coarse sandy pale pinkish-buff, moderate mica, red, white and black rounded quartz up to 0.4mm. Yellow glaze. Possibly from Lincolnshire or Yorkshire? Fig. 46 No. 51.

UPG2 Very gritty orange fabric with pale grey exterior, containing very common sub-angular quartz 0.1–0.5mm in diameter and occasionally up to 5mm across, sparse red ?grog and ferrous oxide. Light green glaze. 12th–13th century?

UPG3 Sandy greyware with pinkish-buff external surface, containing common sub-angular quartz of *c.* 0.5mm

diameter, occasionally up to 2mm, sparse ?limestone and mica. Pale green lead glaze patchy on rim.

UPG4 Thin-walled sherd in pinkish-white sandy fabric containing moderate clear quartz and moderate red grains. Green glaze with metallic brown around edges.

UPG5 Very fine hard greyware with buff outer surface containing moderate clear quartz up to 0.2mm across, sparse small black particles and sparse mica. Only one spot of ?yellow glaze. Possible import?

Forms

The majority of glazed sherds were probably from jugs, but only four rim sherds and two handles were found. One Grimston sherd was from a face jug and one handle was a twisted rod, generally associated with later jug types.

Decoration

Most sherds were green-glazed, although a few bore yellow (UPG1, ELYG) or orange (HFW1) glaze. Several Grimston sherds had brown slip lines, and bases were often thumbed. The neck of the UPG1 vessel was finely rilled below a collared rim.

Imports

Fabrics

Three imported wares were identified: Pingsdorf Ware (PING), Rouen-type Ware (ROU) and Andenne Ware (ANDN). The latter can be difficult to distinguish from Stamford Ware, and some sherds may have been misidentified. However, assuming that all have been correctly attributed, this would seem to be the most common import on the site. Pingsdorf forms the greatest proportion by both count and weight, since all but two sherds were from a single vessel found in one pit (Fig. 47 No. 59).

Forms

The single Pingsdorf vessel was a bellied-type spouted pitcher (Keller 1995) with two short strap handles. No other vessels were identifiable.

Decoration

The Pingsdorf pitcher was decorated with red slip-painted lines and one other Pingsdorf sherd (reduced type) was also slip-decorated (Fig. 44 No. 24). All Andenne sherds were yellow-glazed and two had applied thumbed strips. The Rouen sherd was green-glazed.

Post-medieval wares

Fragments of a redware bowl, a willow pattern plate, a late post-medieval earthenware plate and mug, a Maling Ware marmalade pot and a piece of English stoneware were collected, generally from unstratified contexts.

Pottery by site Period

(Figs 44–7; Charts 4–14)

Table 20 presents the pottery quantification by site period. This information is presented graphically in Chart 4, and shows that approximately half of the total assemblage was collected from Period 3 features, with a smaller group from Period 3a increasing this total for the Late Saxon phases to over 60%. Period 4, which also overlaps with Late Saxon activity, produced almost a quarter of the total from its features. Material from contexts of earlier and later phases is, by contrast, almost insignificant. Table 21 shows the quantities of each fabric by period, and Chart 5 shows the percentages of each pottery group as a bar chart. It is clear that Thetford Ware forms the largest proportion of material in all periods from Period 3 to Period 7. It shows a steady decrease from Period 3 to Period 5, with a corresponding rise in Early Medieval Wares to Period 4, after which medieval wares start to increase. The small amount of pottery from Period 6 contexts is dominated by Thetford Ware, as is the larger group from Period 7.

Discussion of the pottery by period will concentrate on the major periods of activity — Periods 3 and 4 — with occasional mention of Periods 5 and 7. The quantities of fabric groups by period have been noted above, and it is clear from this that Thetford Ware and other Late Saxon fabrics dominate every Period assemblage from 3 onwards.

Distribution of fabric groups by period

Chart 6 shows the percentage of pottery groups in each period. Pre-Saxon material consisted of only seven sherds, most of which were residual and appeared most commonly in Period 4 features. Thetford Wares occurred most frequently in Period 3, with a reduction in Period 3a and a slight increase in Period 4. Other Late Saxon material is most common in Period 4, followed by Periods 3 and 3a, and Early Medieval Wares follow a similar pattern. Medieval coarse and glazed wares are both more common in Period 5 than Period 4 contexts, although glazed wares occur most frequently as residual material in Period 7. Post-medieval wares are most common in Period 7, but one sherd was intrusive (or wrongly numbered) in a Period 3 feature.

Distribution of vessel types by period

Chart 7 show the different vessel types identified from rims in Periods 3 to 5, divided into 'Thetford Ware' and 'other'. This shows a predominance of 'jars' or cooking pots throughout the Periods, as would be expected. However, the proportion of these vessels decreases through the Periods, corresponding with a slight increase in the proportion of bowls and jugs. Low proportions of spouted/handled jars (or pitchers) and bowls, and of large storage vessels, are seen throughout; while this may be partly a result of the difficulty involved in recognising some of

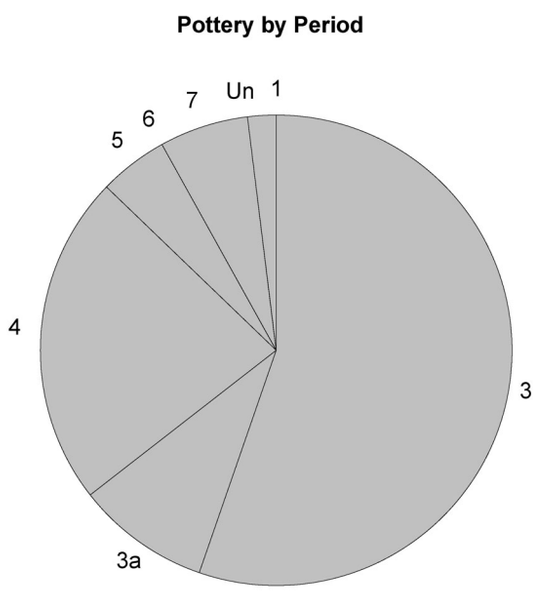


Chart 4 All pottery by Period (number of sherds)

Period	*No.*	*%(No.)*	*Wt/g*	*%(Wt)*	*EVE*
Unphased	109	1.9	1899	2.6	1.79
1	1	0.02	5	0.01	0
3	3183	55.3	35,987	49.1	46.76
3a	521	9.0	7149	9.8	10.03
4	1318	22.9	17,956	24.5	17.57
5	266	4.6	3343	4.6	2.72
6	6	0.1	57	0.08	0.05
7	356	6.2	6802	9.3	8.56

Table 20 Pottery by site Period

Pot period	*Fabric*	*Code*	*Period 1*		*Period 3*		*Period 3a*		*Period 4*		*Period 5*		*Period 6*		*Period 7*		*Unphased*	
			No.	*Wt/g*	*No.*	*Wt/g*	*No.*	*Wt/g*	*No.*	*Wt/g*	*No.*	*Wt/g*	*No.*	*Wt/g*	*No.*	*Wt/g*	*No.*	*Wt/g*
?Prehist	UNHM	0.00	-	-	-	-	1	4	2	2	-	-	-	-	-	-	-	-
	IAFT	0.41	-	-	1	3	-	-	-	-	-	-	-	-	-	-	-	-
Roman	OXRC	1.47	-	-	-	-	-	-	-	-	-	-	-	-	1	16	-	-
	SACG	1.61	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LSax	THET1	2.51	-	-	15	131	1	4	6	65	3	24	-	-	1	46	3	32
	THET2	2.52	-	-	43	401	2	4	5	44	1	16	1	18	2	37	1	9
	THET3	2.53	-	-	2824	32,300	425	6264	764	12,046	118	1416	3	18	284	5448	83	1269
	THET4	2.54	-	-	3	102	-	-	1	12	1	30	-	-	-	-	1	20
	THETG	2.57	-	-	15	400	2	28	37	1495	11	159	-	-	8	344	2	237
	STAM	2.60	-	-	-	-	1	4	20	116	-	-	-	-	-	-	-	-
	STAMA	2.61	-	-	7	52	7	30	111	760	-	-	-	-	4	29	-	-
	STAMD	2.62	-	-	10	170	-	-	2	21	-	-	-	-	1	18	-	-
	STNE	2.70	-	-	181	1662	44	565	134	1082	6	44	-	-	9	116	6	140
	SXNO	2.80	-	-	1	26	-	-	4	18	-	-	-	-	-	-	-	-
	PING	7.24	-	-	1	10	-	-	1	10	27	574	-	-	-	-	-	-
EMed	EMW	3.10	-	-	51	331	22	115	122	636	23	108	1	10	12	95	6	68
	EMWG	3.11	-	-	1	10	1	11	2	18	1	10	-	-	-	-	-	-
	EMWC	3.12	-	-	-	-	2	15	-	-	1	26	-	-	-	-	-	-
	EMWS	3.14	-	-	3	27	-	-	8	191	1	7	-	-	2	15	-	-
	EMSW	3.16	-	-	15	179	5	60	21	347	2	45	-	-	1	8	2	26
	YAR	3.17	-	-	1	18	-	-	6	73	-	-	-	-	-	-	-	-
	EMWSS	3.19	-	-	1	11	-	-	3	28	-	-	-	-	1	46	-	-
	STAMB	3.71	-	-	2	13	3	5	30	273	3	21	-	-	1	23	1	18
	STAMG	3.72	-	-	3	118	-	-	12	349	-	-	-	-	2	32	-	-
Med	MCW	3.20	-	-	-	-	1	6	-	-	4	32	-	-	-	-	-	-
	GRCW	3.22	-	-	-	-	-	-	1	36	8	115	1	11	3	103	-	-
	LMU	3.23	-	-	-	-	-	-	6	107	8	76	-	-	2	26	-	-
	BSFW	3.31	-	-	-	-	-	-	1	9	-	-	-	-	-	-	-	-
	BCSW	3.32	-	-	1	4	-	-	2	28	1	9	-	-	-	-	-	-
	BMCW	3.33	-	-	-	-	-	-	2	10	20	206	-	-	-	-	1	6
	BMCWG	3.34	-	-	-	-	-	-	-	-	2	22	-	-	-	-	-	-
	MSHW	3.50	-	-	-	-	-	-	-	-	3	7	-	-	-	-	-	-
	BMSW	3.53	-	-	1	4	1	7	5	56	1	4	-	-	1	4	-	-
	ELCW	3.61	-	-	-	-	-	-	-	-	4	30	-	-	-	-	-	-
	UPG1	4.01	-	-	-	-	-	-	1	33	-	-	-	-	-	-	-	-
	UPG2	4.02	-	-	-	-	-	-	-	-	-	-	-	-	1	13	-	-
	UPG3	4.03	-	-	-	-	-	-	-	-	1	13	-	-	-	-	-	-
	UPG4	4.04	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-
	UPG5	4.05	-	-	-	-	-	-	-	-	-	-	-	-	1	19	-	-
	GRIM	4.10	-	-	-	-	-	-	-	-	12	302	-	-	8	89	2	60
	HFW1	4.23	-	-	-	-	-	-	-	-	1	3	-	-	-	-	-	-
	STAMC	4.71	-	-	-	-	-	-	2	36	-	-	-	-	1	17	1	14
	ELYG	4.81	-	-	-	-	-	-	-	-	2	42	-	-	-	-	-	-
	ROU	7.34	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-
	ANDN	7.35	-	-	2	13	3	27	7	35	-	-	-	-	3	24	-	-
PMed	TPE	8.00	-	-	-	-	-	-	-	-	-	-	-	-	2	14	-	-
	LPME	8.01	-	-	1	2	-	-	-	-	-	-	-	-	3	196	-	-
	ESW	8.20	-	-	-	-	-	-	-	-	-	-	-	-	1	23	-	-
	Totals		**1**	**5**	**3183**	**35,987**	**521**	**7149**	**1318**	**17,936**	**266**	**3343**	**6**	**57**	**356**	**6802**	**109**	**1899**

Table 21 Pottery fabric by Period

	Period 3				Period 3a				Period 4				Period 5			
Form	*Thetford Ware*		*Other*		*Thetford Ware*		*Other*		*Thetford Ware*		*Other*		*Thetford Ware*		*Other*	
	No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
Jar	274	85.6	29	78.4	63	87.5	17	70.8	79	79.0	16	25.8	9	69.2	3	33.3
Handled or spouted jar	17	5.3	-	-	3	4.2	-	-	6	6.0	-	-	1	7.7	1	11.1
Large storage vessel	12	3.8	-	-	3	4.2	-	-	11	11.0	-	-	1	7.7	-	-
Ginger jar	-	-	1	2.7	-	-	-	-	-	-	2	3.2	1	7.7	-	-
Dish	1	0.3	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Bowl	11	3.4	4	10.8	2	2.8	5	20.8	2	2.0	9	14.5	1	7.7	1	11.1
Socketed bowl	2	0.6	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Lamp	2	0.6	-	-	1	1.4	-	-	-	-	-	-	-	-	-	-
Lid	1	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crucible	-	-	2	5.4	-	-	2	8.3	2	2.0	33	53.2	-	-	-	-
Jug	-	-	-	-	-	-	-	-	-	-	2	3.2	-	-	2	22.2
Total	**320**		**37**		**72**		**24**		**100**		**62**		**13**		**9**	

Table 22 Types of vessel by Period (based on maximum number of rims)

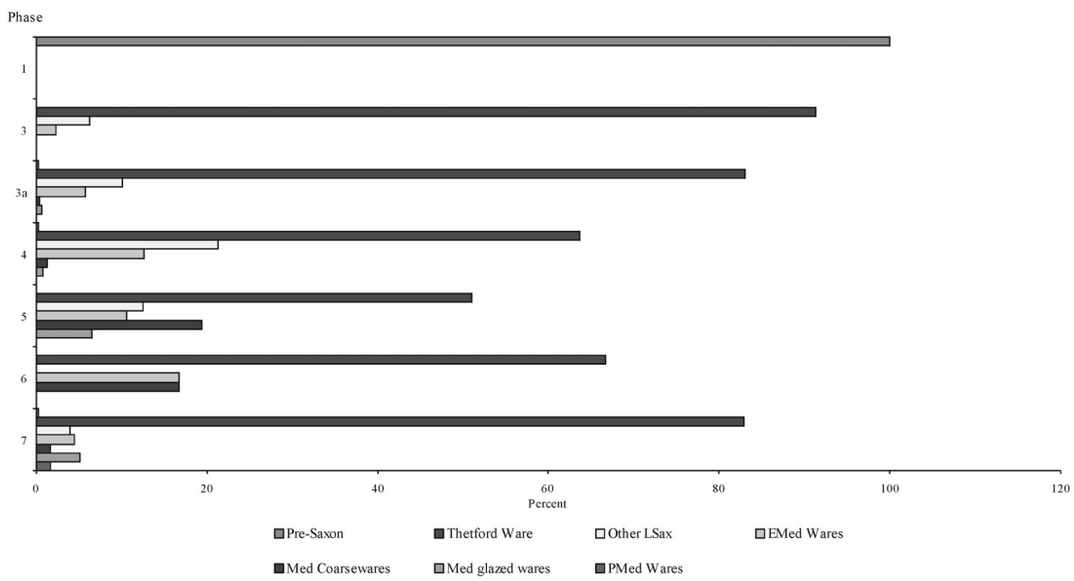


Chart 5 Percentages of pottery types by Period (percentage of total for period)

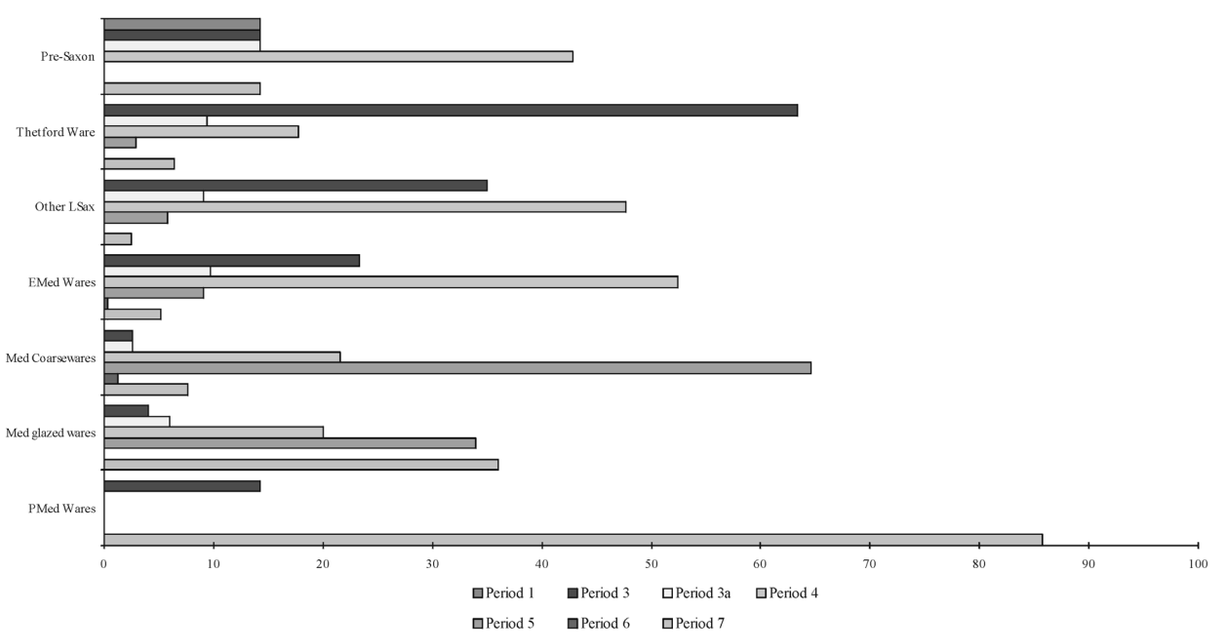


Chart 6 Percentages of pottery types by Period (percentage of total pottery type)

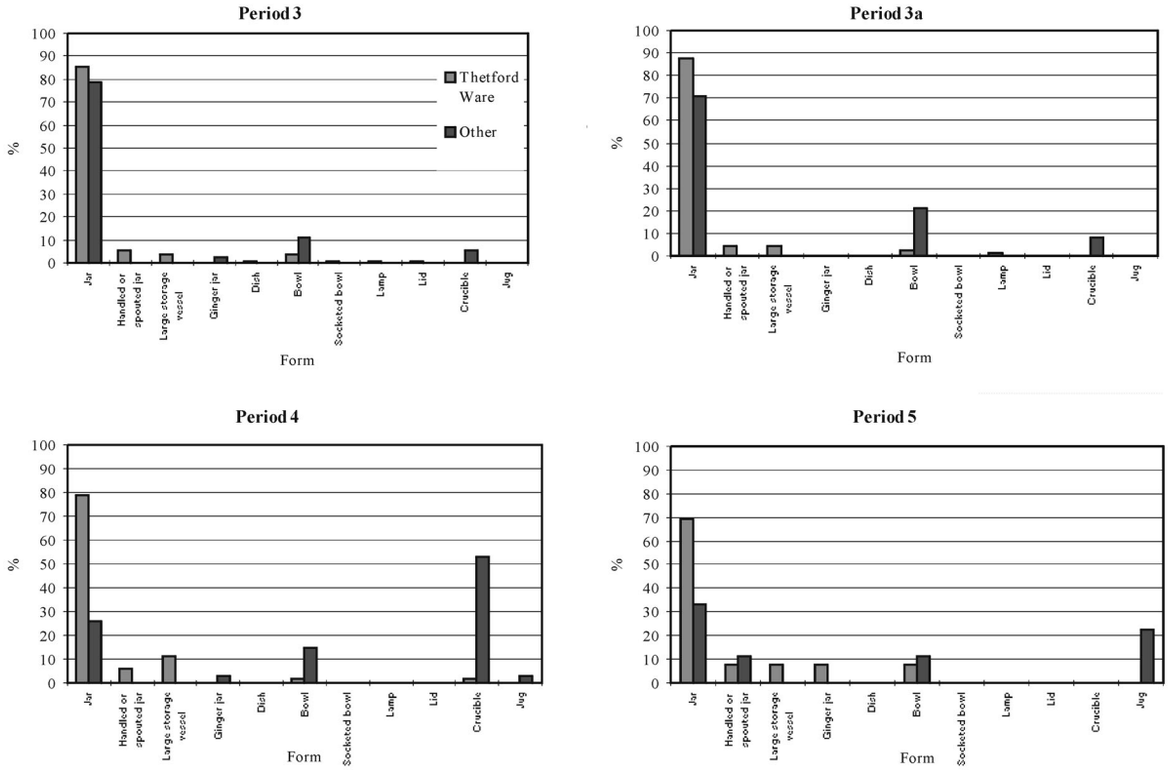


Chart 7 Types of vessel by Period (based on maximum number of rims)

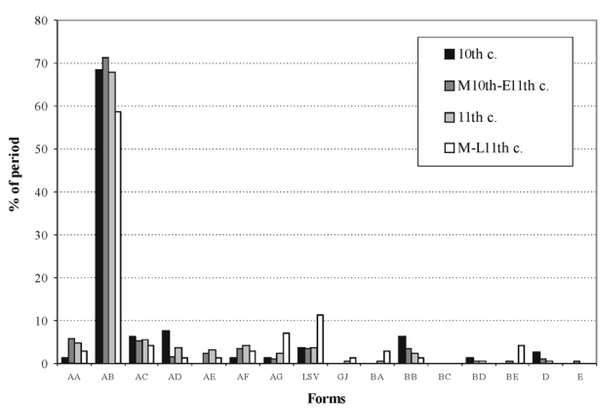


Chart 8 Percentages of Thetford Ware forms by feature spot date

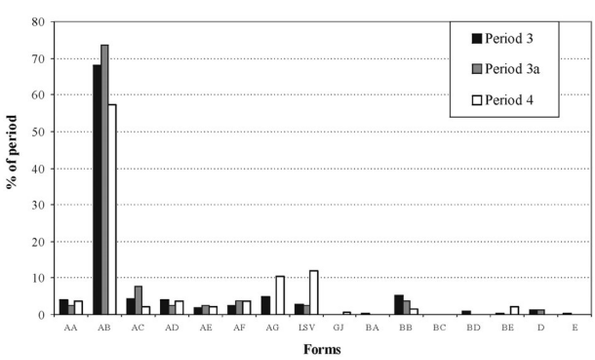


Chart 9 Percentages of Thetford Ware forms by Period

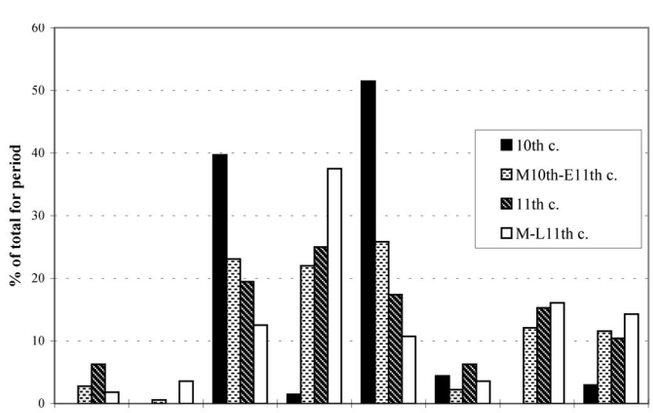


Chart 10 Thetford Ware rim types by feature date

these forms if the diagnostic area is missing, the figures may also reflect a smaller demand for vessels of these types. Ginger jars, lamps, lids and dishes are all uncommon, although in the case of lamps this may be due to the poor survival of rim fragments as the robust stems and bases appear more frequently in the assemblage, and three other lamps are identifiable from non-rim sherds. Of the total of six lamps, five are from Period 3 and one from Period 3a. One possible costrel or bottle, not included in the table or figures, was found in a Period 3 context. Crucibles increase in frequency from Period 3 to 4 and do not occur later (below). The increase in jugs during the later Periods reflects a general shift towards these vessel types during the medieval period, when they replaced spouted pitchers as the main liquid carriers and were also used for water heating, as evidenced by the presence of sooted and limed jug base and body sherds.

Thetford Ware can be further divided into the vessel types suggested by Dallas. Percentages were plotted for both feature date (*i.e.* the pottery spot date for a feature) and site period (*i.e.* the stratigraphic phase), producing broadly similar results (Charts 8 and 9). AB jars are the most common, increasing in proportion from Period 3 to 3a, and then decreasing to Period 4. AC jars follow a roughly similar pattern, and AA and AD jars are relatively stable throughout. AE and AF jars show a small increase from the 10th to 11th centuries, and AG jars (and LSV — large storage vessels) a rather larger increase. Although there may have been an increase in their use during Period 4, it seems more likely that they were used to a lesser extent than everyday jars and were more durable. They may not have entered archaeological deposits until activity at the site was in decline, when they may have been disposed of if this was preferable to their removal. Alternatively, the large size of the sherds may have ensured their survival as residual material. BB bowls were the most common bowl form and show a decrease from Period 3 to Period 4, which appears to coincide with the increase in bowls produced outside Thetford. Other form types were too infrequent to draw conclusions regarding their period distribution.

After Thetford Ware, the most commonly identified vessel forms were in St Neot's Ware, Early Medieval Ware and Stamford Ware. From Period 3a onwards, the increasing number of bowls consists largely of these fabrics and Grimston coarseware. St Neot's and Early Medieval Ware jars are also common throughout.

Thetford Ware rim types by period

Rim types were plotted by feature date and site period and the results are presented in Charts 10–13. Plotted by feature date, rim 1 shows a slight increase in the 11th century, although the period data shows a very slight decline from Period 3 to Period 4. Rim 2 is most common in Period 4 and in features dated to the mid–late 11th century, but the very small numbers of this type make conclusions impractical. Rims 3 and 5 show a decrease from the 10th to the 11th century by feature date, but are relatively stable in Period 3 to 3a with a slight decrease in Period 4. Rim 4 shows a marked increase from the 10th to the 11th century, with a smaller increase from Period 3/3a to 4. Rim 5/6 shows a slight increase in the 11th century, but by period is most common in Period 3. Rims 6 and 7 increase slightly from Period 3 to 4, and show a similar increase by feature date. A simplified graph of the changes by period (not including the small amounts of rim types 2 and 5/6) is shown in Chart 14.

As noted previously, the dating of these rim types and recording their appearance in contexts of Periods whose definition has been based to a large extent on spot dates derived from the pottery is rather circular. However, the rim types do seem to show relative changes over time, as has been suggested above. In summary, rim types 3 and 5 decline as rims 4, 6 and 7 increase, although there is clearly a high degree of overlap which cannot entirely be accounted for by residuality.

Industrial evidence

Table 22 shows the distribution of crucible sherds by period and feature. The majority of features containing fragments are assigned to Period 4, with 80% of the total number of pieces occurring in a single pit (*1024*). The presence of so many crucible fragments in this one pit could suggest that the odd fragments occurring in nearby features were derived from the same source, and that any containing Stamford Ware crucibles were either contemporary with or later than this group. However, several Period 3 features contained Stamford-type crucibles, some in their primary fills where they are unlikely to have been intrusive. This could be explained if industrial activity involving crucibles was being carried out in this part of the site throughout the 11th century, with broken pots being discarded erratically around the workshop area. The concentration in pit *1024* could be due to backfilling of a pit using soil that had accumulated with and over a concentration of broken vessels. Most of the crucible fragments belonged to discrete vessels, suggesting that pieces of broken pots were not deliberately discarded in the feature immediately on breakage.

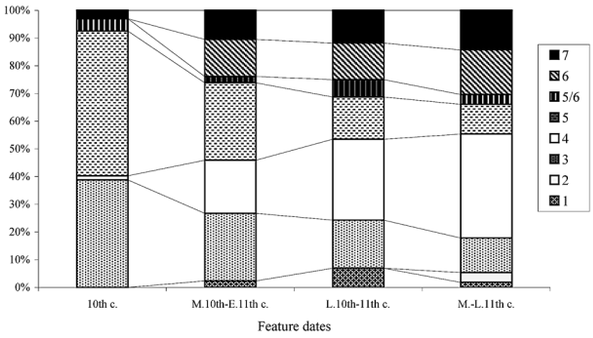


Chart 11 Changes in proportions of Thetford Ware rims by feature date

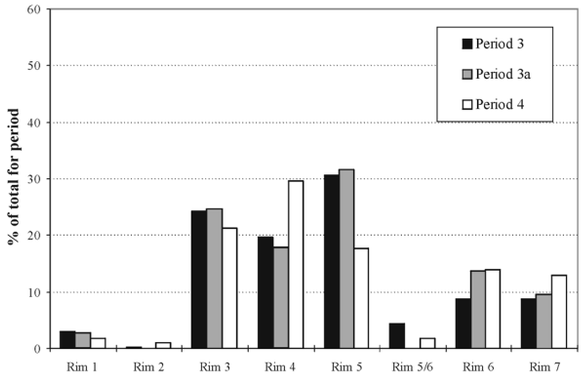


Chart 12 Thetford Ware rim types by Period

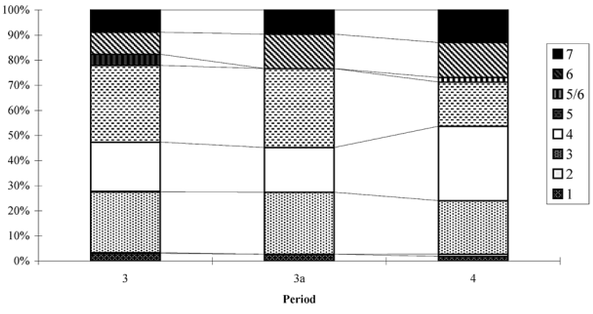


Chart 13 Changes in proportions of Thetford Ware rims by Period

The majority of ceramic industrial waste occurs in Area 1. However, apart from the concentration of crucibles in pit *1024* at the south-west corner of this area, most of the other features containing these vessels produced only one or two sherds. A single complete crucible from the northern edge of Area 2 in hearth *2109* may be evidence for the industrial area continuing across the unexcavated part of the site between Areas 1 and 2. The number and density of pits in Area 1 may indicate rubbish disposal around a workshop during several decades of occupation, and Structure C could be related to this.

Two features at opposite ends of Area 9 contained small quantities of crucible sherds, but the isolated nature of these pits makes it difficult to relate them to the more intensive industrial activity seen in Area 1. They could be the remains of workshops beyond the limits of the excavation to the south and east of Area 9.

Pottery associated with structures

Very little pottery was found in association with the major structures on this site. Even the sunken-featured buildings to the north-east of Area 4 contained only small amounts in their backfills, and there is no evidence that these sherds were from vessels in use at the time of demolition.

However, it is noticeable that these two features contain some of the widest-ranging groups of Thetford Ware forms to be found on the site. Building C, or features cutting its fill, produced sherds of small, medium and large jars, spouted and handled jars, large storage vessels and a spouted bowl. Large pits cutting the fill of Building D contained a similar range of vessels. One other feature that contained a similar variety of forms is the pit group *4003*/*4005*/*4007*/*4009*. Apart from these concentrations, there is a general spread of all Thetford Ware vessel forms across the site with no distinctive groupings of types.

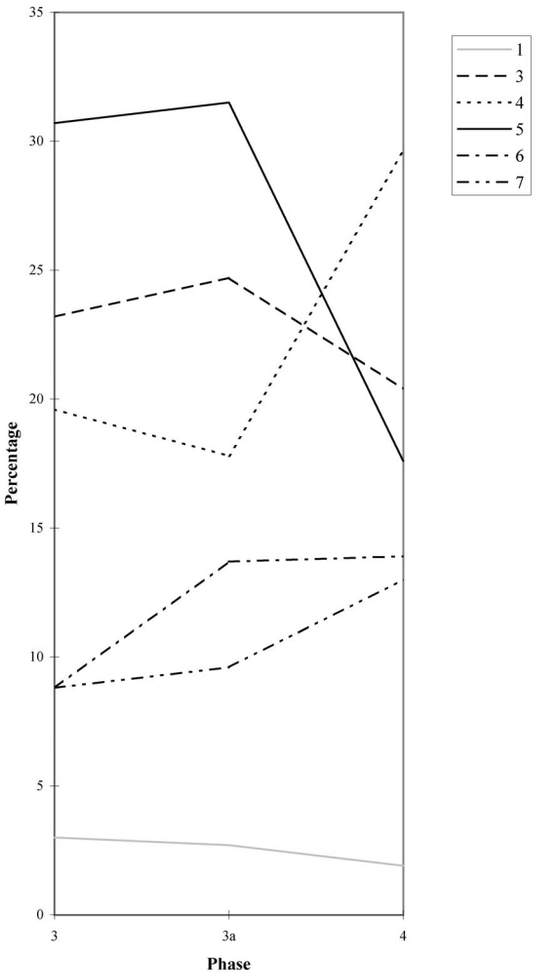


Chart 14 Simplified chart showing percentages of rim types by Period

Unfortunately the post-hole structures in Enclosure A have little directly associated pottery. Pits to the west of the buildings contain several vessel types including small, medium and large jars, a spouted jar, bowls and a lamp. These could be the remains of domestic vessels disposed of during the life of the structures.

Spatial distribution of wares

The large proportion of Thetford Ware from this site makes any attempt at simple spatial analysis based on fabric meaningless. However, other wares were plotted and their distribution patterns studied. St Neot's Ware, the next most common fabric after Thetford Ware, formed no clear groupings and occurred in most large features across the site. Smaller quantities of Early Medieval Ware and Grimston Thetford Ware were similarly widespread, but there was a noticeable grouping of Grimston coarseware to the south-east of Area 1. Stamford Ware was particularly common in Area 1, partly due to the number of crucible sherds found there, and also in Area 4 where it may be associated with rubbish pits relating to the structures.

As there was no clear pattern to the basic ware distribution, weights of sherds by feature were plotted. Clearly this method of spatial analysis is problematic, as smaller features or excavated sections might be expected to produce smaller groups of pottery. If this is allowed for, however, it is possible to see a differential spread of pottery of all types on this site. Concentrations of Thetford Ware occur particularly in the north-east half of Area 4, especially in Building C, the pits cutting Building D, the southern boundary ditch to Enclosure C, and several large pits to the south of the structures (*4221*, *4230*, *4342*, *4359*). In Area 1 several pits contained over 400g of Thetford Ware, including *1024*, *1038*, *1141* and *1184*; *1237* had more than 800g; *1120* had more than 1000g; and *1149* had more than 1500g. Other noticeable concentrations were seen in the north-west part of Area 2, on the west side of Area 5, and in pit *3117* in Area 3. A very similar pattern, but with smaller total weights, was seen for St Neot's Ware, whilst Stamford Ware occurred in the same general areas but often in different features (for example *1139*, *1230*, *4048*). Early Medieval Ware was more widespread than Stamford Ware, but was found in similar concentrations. Presumably this is related to the slightly different dates during which pits were open, and reflects continuity in the nearby structures' use. The heaviest groups of Grimston Thetford Ware were to the south-east of Building D, in pits *4223* and *4359*, but this is partly due to the presence of several sherds from a single AG jar in both. One other large group of this ware, which is not reflected in most of the other fabrics, was found in pit *2039*.

In general, these results suggest concentrated Late Saxon and early medieval activity in the areas surrounding Buildings C, D and E, but there is also a high level of rubbish deposition in Area 1 which continues into the medieval period, and more localised deposits in Area 3 east and Area 2 north-west.

Feature	*Contexts*	*Period*	*Feature type*	*No.*	*Wt/g*	*Feature date*
–	*1000*	Un	unstratified	1	8	–
–	*2000, 2001*	Un	unstratified	2	13	–
1056	*1055*	3	post-hole	1	3	10th–11th C
1096	*1095*	3	pit	1	5	L.10th–M.11th C
1116	*1115*	3	pit	3	23	11th C
9090	*9088*	3	pit	1	11	L.10th–E.11th C
1139	*1250*	3a	pit	2	12	M.11th–E.12th C
1123	*1123*	3a	well	8	27	M.11th C
1023	*1015*	4	pit	1	4	12th–13th C? (or 11th C with intrusive)
1024	*1017, 1019*	4	pit	121	635	11th–12th C
1028	*1026*	4	pit	1	7	12th C
1038	*1032*	4	pit	1	6	M.–L.11th C
1230	*1218*	4	pit	1	12	11th C
2109	*2083*	4	hearth	1	137	M.12th C (primary context; rest 10th–11th C)
9049	*9045*	4	?	5	23	12th C
9075	*9074*	4	pit	2	12	M.11th C+

Table 23 Features containing crucibles

Discussion and conclusions

This site has produced evidence for continuous activity throughout the Late Saxon period. The density of features in some areas shows continuity of occupation and the opening and backfilling of pits for rubbish and cess disposal over at least two centuries. Most intercutting and mixing of deposits therefore occurred in a period during which ceramic production was extremely conservative.

Clearly the degree to which soils and their contents were redeposited is likely to be high in intensively-used areas of the site, as in any urban context. Few complete vessels or matching sherds were found within individual contexts, suggesting that most pottery was not deliberately discarded in features immediately on breakage. The site, however, shows a decline in activity after the 12th century. There is a high degree of residuality in the few features of medieval and post-medieval date, which is not surprising given the long and intensive use of the land in the Late Saxon period compared with the greatly reduced and sporadic activity in later centuries. Most of the rubbish left by Late Saxon inhabitants probably remained undisturbed until the 19th century.

The nature of the pottery assemblage from this site, like many others in Thetford, is such that separation of material into distinct date ranges is very difficult, in turn making discrete phasing almost impossible. One consequence of this is that the main Periods 3, 3a and 4 all overlap in the 11th century, the period which seems to have seen the most intensive occupation of the site.

As noted above, potters in the Late Saxon period produced a narrow and very conservative range of products. The ubiquitous medium jars and cooking pots they manufactured occur in large quantities across the town, making these vessels the most attractive analytical subjects in terms of a study aimed primarily at improving dating of the Ware. It is possible to divide jar rim types into generalised shapes which changed slightly through the period, but which apparently overlapped to a high degree. This fact has always limited the close dating of Thetford Ware, and may well continue to do so even if better-stratified sites than this one are excavated in the future. Results of the Mill Lane study appear to confirm dating suggestions published in previous reports, and it has been possible to suggest a new rim typology which may aid the division of features into 10th- and 11th-century groups as long as there are several rims within each context. The use of jar rims appears to provide the best form of dating evidence, since the absence or presence of certain uncommon vessel types, fabrics or methods of decoration is of little use in all but the largest of assemblages.

The extent to which it is possible to separate 10th- from 11th-century features allows for a few limited conclusions to be reached regarding the growth and decline of various areas within the site. Tenth-century material is particularly common in the curvilinear ditches and several pits in Area 2, and in the pits and post-holes of Area 5. A few features of this date were identified to the north of Area 1 and the centre of Area 4. There is no indication of which area is the earliest in terms of Late Saxon occupation, but the evidence does suggest that the post structures in Area 5 were probably no longer in use by the 11th century, and the curvilinear ditches in Area 2 had probably been filled by the mid-11th century. In contrast, Areas 1 and 4 show intensive activity, with deposition of rubbish throughout the 10th and 11th centuries and residual pottery commonly occurring in Area 1 features. The Area 4 sunken-featured buildings were probably in contemporary use, and the material deposited in the fills and in later intercutting features suggests final demolition and backfilling during the 11th century. Pottery was still being deposited across the southern features of Area 1 in the 12th–13th centuries, and a few pits in Area 4 also contained small numbers of medieval sherds, but the focus of activity appears to have shifted down the slope towards Mill Lane and the river in this period, and most medieval ceramics occurred in Area 7 and Site 5761 features.

Apart from the crucible fragments, this assemblage consists almost entirely of 'domestic' vessels. However, this does not rule out the possibility that some vessels may have been used in workshops both for household and industrial purposes. There is no reason to suppose that a workshop would have had a significantly different range of vessels than a dwelling at this period, particularly if both formed part of the same structure. Very few crafts would require an additional range of ceramic vessels, metalworking being the major exception. No crucible sherds were found in direct association with structural features, and there were no distinctive groupings of domestic vessel types that would allow for greater interpretation or comparison. The whole range of jars, bowls and smaller items such as lamps occurs across the entire site. Those deposited within the fills of the sunken-featured buildings are not necessarily contemporary with their occupation, and may be derived from surrounding soil used to backfill semi-derelict structures. Such material would not necessarily be heavily abraded or heterogeneous, particularly if the source was nearby rubbish pits.

Some changes in vessel types by period have been noted. There appears to be a slight increase in the proportion of bowls found in 11th-century contexts, most of which were made outside the town. This may reflect a change in cooking practices, and emphasis moving away from the smaller jars used in the 10th century towards the large baggy vessels used in the early medieval period. Perhaps bowls represent an intermediate stage in this change. An increase in large storage vessel sherds is also apparent in the later phase of the Late Saxon period. Although these changes may reflect changing food preparation, storage and cooking practices, there is a substantial group of missing evidence in the form of organic vessels and containers, the lack of which makes generalised interpretations of function difficult.

Changes in the proportions of fabrics present in each period were also noted. Thetford Ware apparently decreased slowly from the 10th to the 11th centuries, although it was still the dominant ware throughout this span. Increasing importation of regional Late Saxon wares during the 11th century may reflect changing requirements and preferences, or a declining local industry. Certainly in the 11th century Thetford Ware fabrics became less homogenous, and there may have been flourishing rural production which increasingly supplied the town in competition with the urban producers. St Neot's Ware was the second most common fabric to be found at this site after medium Thetford Ware.

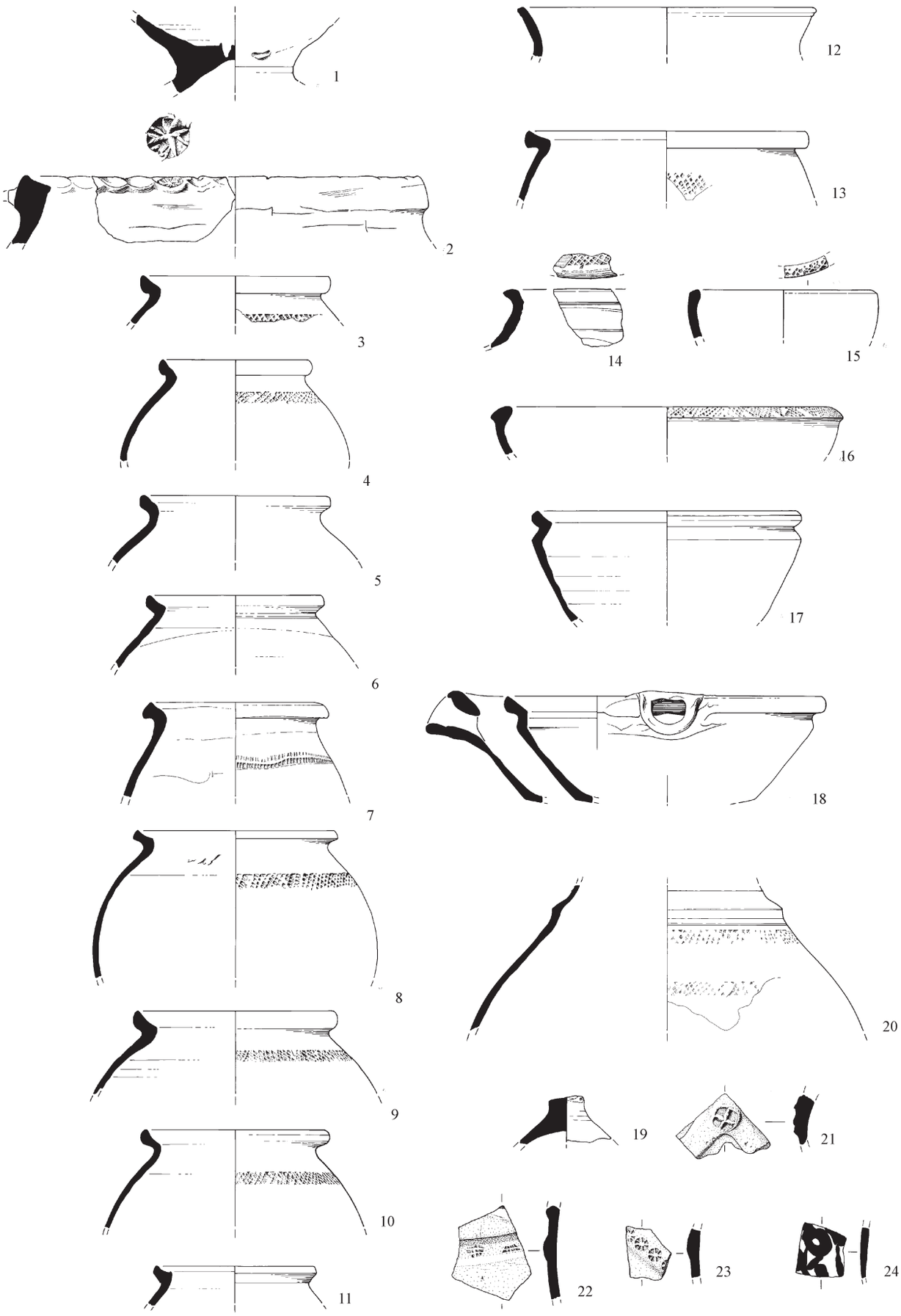


Figure 44 Pottery: unstratified and Period 3. Scale 1:4.

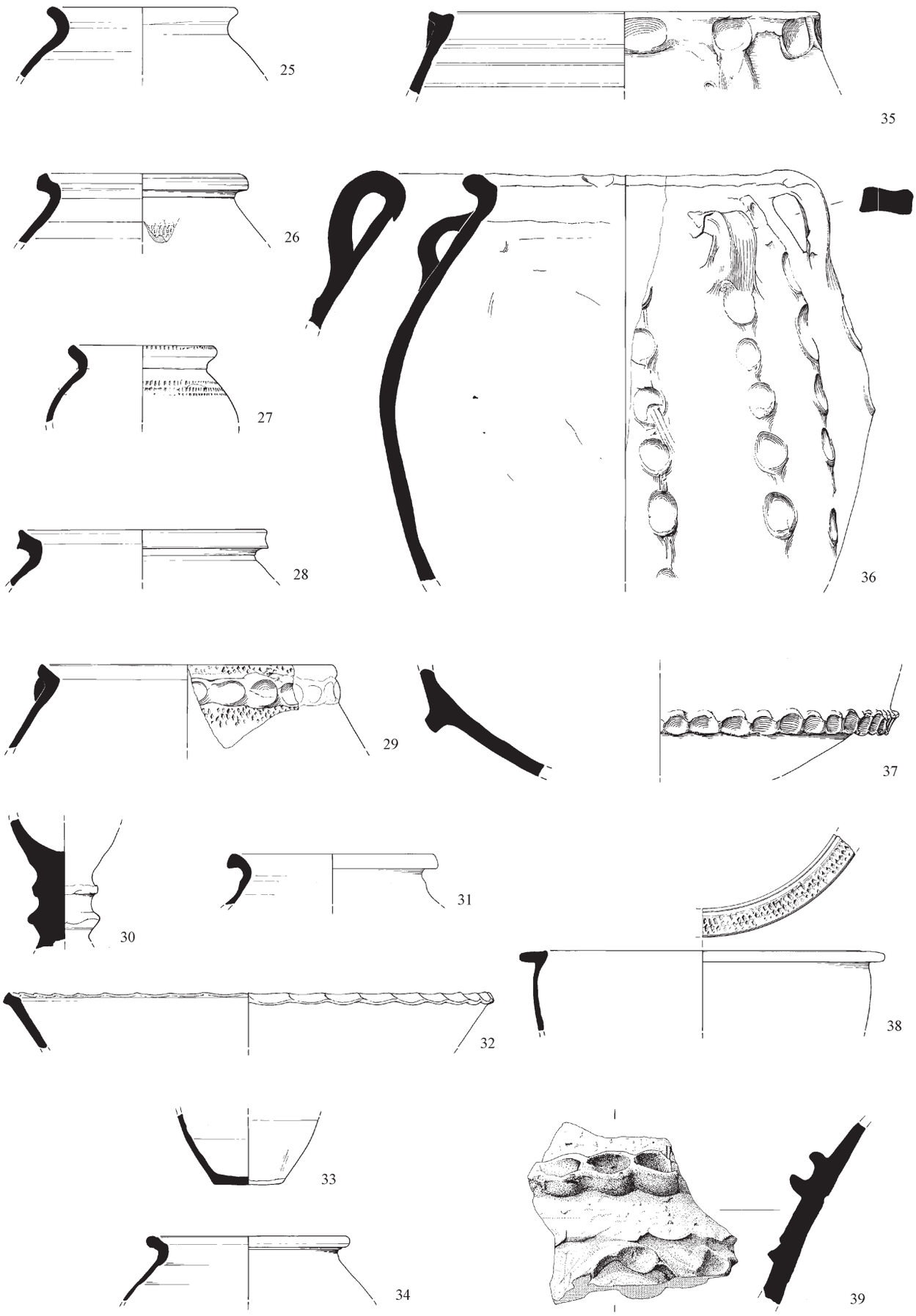


Figure 45 Pottery: Periods 3a and 4. Scale 1:4.

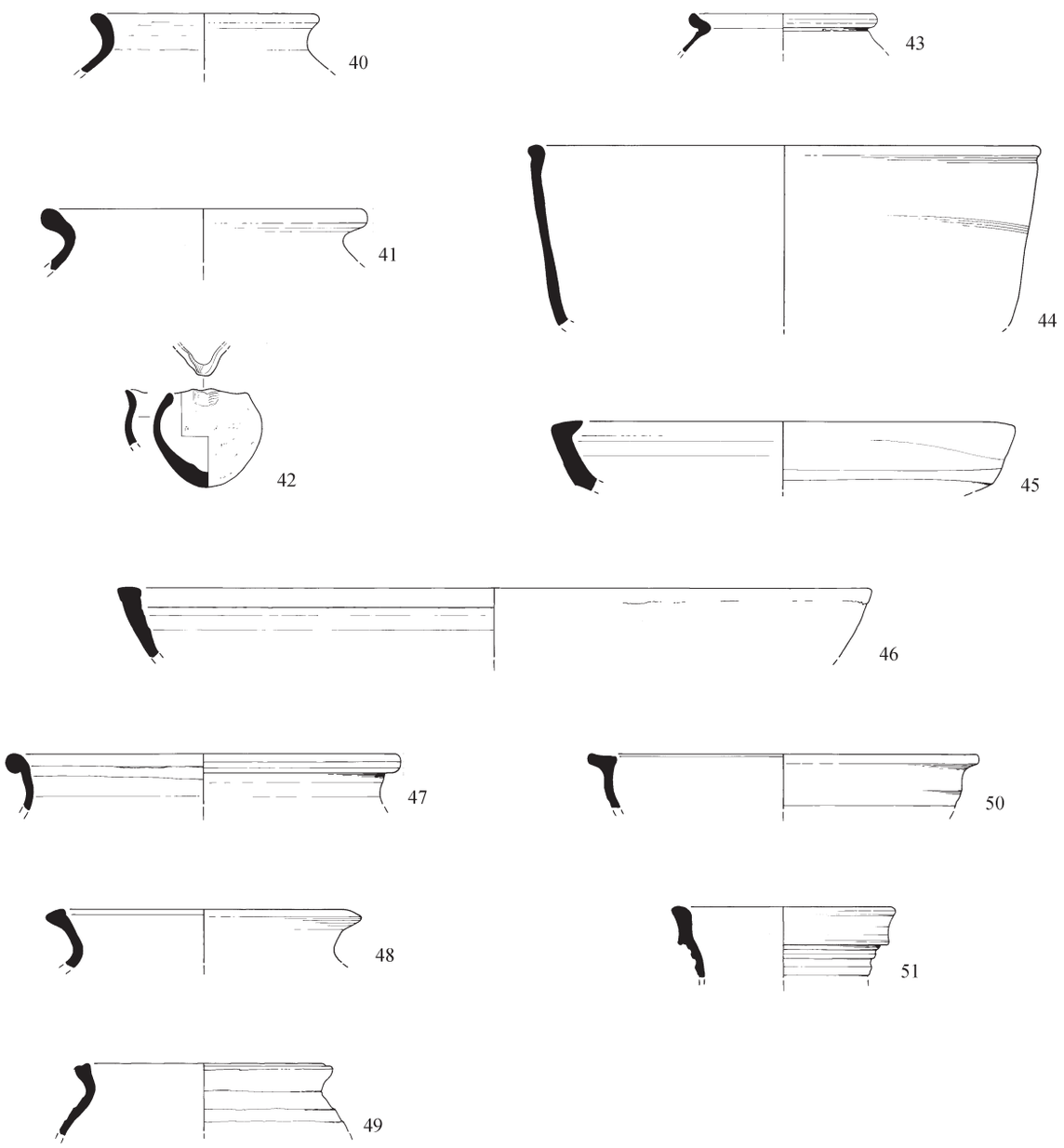


Figure 46 Pottery: Period 4. Scale 1:4.

It has often been stated that this ware was of inferior quality to the local sandy wares and surprise is expressed that it was imported to any great degree. Although soft and easily broken, the presence of large quantities of shell inclusions may have provided this ware with the capability to withstand greater fluctuations in temperature than harder sandy fabrics. One other possibility that is often overlooked is that this type of ware may have been attractive to consumers, and the fact that shell was added as a surface treatment to some local wares in the 11th and 12th centuries may be evidence for this. Stamford Ware may also have been prized for its different colours and textures when compared with the mundane local greyware, but at this site the major group of this fabric is the crucible fragments. The use of these vessels in many Late Saxon towns suggests specialisation in the Stamford industry which was not rivalled locally. The few Thetford Ware crucibles are so crude that they may even be 'home-made' products using local clays, produced when required by the metalworkers themselves.

After the Late Saxon period, most sites in Thetford have small quantities of regional medieval wares and there were apparently few or no potters working in Thetford after the 12th century. The presence of two 'Medieval Thetford Ware' sherds in this group is anomalous, and perhaps indicates a rural pottery producing material with similar clays to those used by the Late Saxon urban industry.

Very few imports were found. Only one type belonged to the Late Saxon period, a Pingsdorf spouted pitcher and two other body sherds. As these vessels were produced from the 10th to the 13th centuries, the presence of the more complete vessel in a Period 5 feature may suggest that it was made during the later years of the industry. Only six sherds of imported wares were found in Periods earlier than Period 4, and of these one was Pingsdorf and five were Andenne Ware. This suggests that there was no

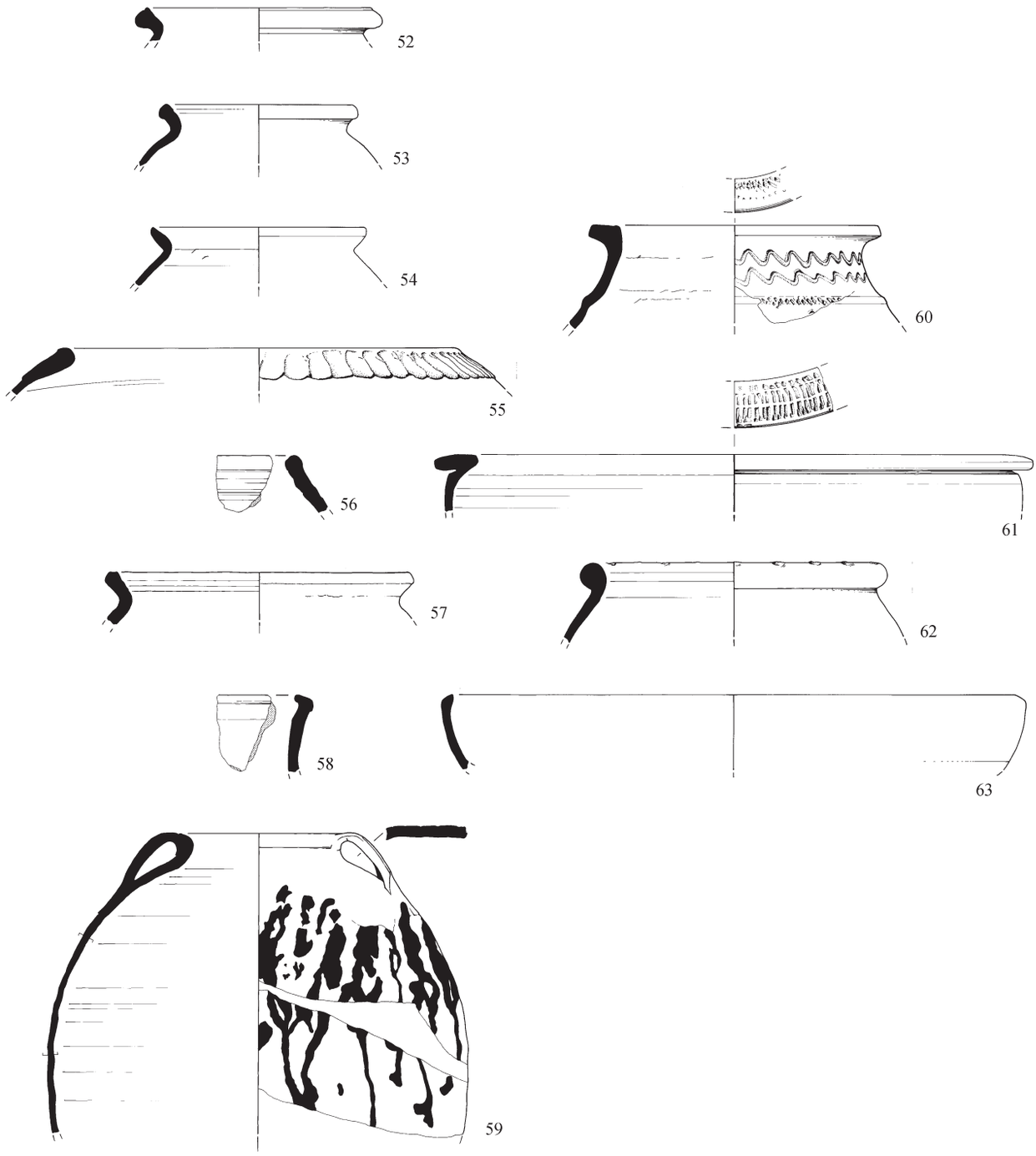


Figure 47 Pottery: Periods 5 and 7. Scale 1:4.

direct continental trade in this part of Thetford either in the Late Saxon period or later, since so little non-English imported material was found.

In summary, the pottery evidence suggests a flourishing suburb within the Late Saxon town. Its inhabitants used the full range of locally-made ceramic wares and had more limited access to pottery from outside the town in the early years, but increased their consumption of local rural and regional wares from the 11th century and had access to regional wares alone from the 12th century onward. Like the Thetford Ware industry that it supported, this area of the town declined rapidly in the earlier medieval period and the focus of settlement shifted towards the river, where it never thrived, and eventually died out by the end of the medieval period.

Catalogue of illustrated pottery
(Figs 44–7)

Unphased
(Fig. 44)

1. THET3, DC lamp base. Large, pierced in centre. Unstratified.

2. THETG, AG jar with rim type 4. Thumbed rim, stamped with wheel-type stamp. Unstratified.

Period 3
(Fig. 44)

3. THET3, AB jar with rim type 3. Diamond rouletting on body. *1119*.

4. THET3, AB jar with rim type 3. Diamond rouletting on body. *1148*.
5. THET3, AB jar with rim type 4. *1020*.
6. THET3, AB jar with rim type 4. Sooted. *1148*.
7. THET3, AB jar with rim type 5 (irregular). Rectangular rouletting on body. *4228*.
8. THET3, AB jar with rim type 5. Diamond rouletting on body. *4364*.
9. THET3, AB jar with rim type 5/6. Diamond rouletting on body. Group 11, *2070*.
10. THET3, AB jar with rim type 6. Diamond rouletting on body. Group 16, *2103*.
11. THET3, AB jar with rim type 7? Unusual type. Group 8, *1195*.
12. THET3 (or THET4), AC jar with rim type 1. *4178*.
13. THET3, AD jar with rim type 5. Diamond rouletting on body. Group 11, *2063*.
14. THET3 (or THETG), BA2 dish. Diamond rouletting on rim. *4364*.
15. THET3, BB3 bowl. Diamond rouletting on rim. Sooted. *1148*.
16. THET3, BB4 bowl. Diamond rouletting on rim. *1148*.
17. THET2 (or STAM?), BB12 bowl with rim type 3. *6001*.
18. THET3, BD4 spouted bowl. *4068*.
19. THET3, probably a lid. Sooted. *1148*.
20. THET3, AD jar. Two rows of diamond rouletting and carination. *1233*.
21. THET3, AG jar. Applied thumbed strip and stamped cross in circle. *3006*.
22. THET3, AG jar? Applied thumbed strip and stamped lattice in circle. *5001*.
23. THET3 (or THETG?), AG jar? Applied thumbed strip and wheel-type stamps. *5033*.
24. PING, decorated sherd, white fabric with grey core. Dark grey slip pattern. *2003*.

Period 3a
(Fig. 45)
25. THET3, AB jar rim type 1. *4011*/*4016*.
26. THET3, AB jar rim type 5. Rectangular rouletting on body. Group 10, *2006*.
27. THET3, AB jar rim type 7. Square rouletting on body and rim. Heavily sooted. *4011*/*4015*.
28. THET3, AC jar rim type 5. Incised horizontal line. Group 10, *2006*/*2002*.
29. THET3, AF jar rim type 4. Applied thumbed strip under rim and diamond rouletting on body. *1140*.
30. THET3, DB lamp. *4013*, SF 258.
31. STNE, SNJ4 jar rim type 5. Sooted. *1121*.
32. STNE, SNB bowl. Sandy type? Thumbed rim. *2028*.

Period 4
(Figs 45 and 46)
33. THET3, AA? jar base, complete. *3038*.
34. THET3, AB jar rim type 6. Group 18, *2052*.
35. THET3, AF jar rim type 7. Applied thumbed strips. *1167*/*1233*.
36. THET3, AG jar rim type 5? Thumbed rim and applied thumbed strips. *4359*.
37. THET3, AG jar base fragment. Thick applied thumbed strip. *1183*.
38. THET3, BB11 bowl. Diamond rouletting on rim. *1167*.
39. THETG, AG jar. Deep applied thumbed strips. *4359*/*4218*.
40. STNE, SNJ2 jar rim type 1. *1085*.
41. STNE, SNJ3 jar rim type 6. *1086*.
42. STAMA, complete crucible Form 16-01. Group 12, *2083*, SF461.
43. STAMG, jar. Pinkish buff surfaces and grey core. *1017*.
44. STAMG, bowl Form 1-66. *1217*.
45. EMSW, BA2 dish. Group 13, *2013*.
46. EMSW, bowl with plain flat-topped rim. *81120*.
47. EMWSS, jar with rolled everted rim. Wheelmade. *4047*.
48. THET3 late type, jar with simple everted rim. *1015*.
49. THET3 late type, jar with beaded rim. Girth grooved. *1015*.
50. STAMB, bowl Form 12-16? *4047*.
51. UPG1, jug with collared rim. Rilled neck, yellow glaze. Internal use wear. *81120*.

Period 5
(Fig. 47)
52. THET3, AB jar with rim type 6. Unusual type, possibly late. *4042*.
53. THET3, AB jar with rim type 6. *81063*.
54. THET3, AB jar with rim type 7. *81063*.
55. THET3, ginger jar. Fairly coarse fabric similar to BMCW. Group 34, *7036*.
56. THETG, BB2 bowl. Group 5, *1263*.
57. EMWC, jar. Very coarse chalk, non-local, wheelmade rim. Group 3, *1013*.
58. GRCW, BA1 or BB6 bowl. Group 5, *1263*.
59. PING, spouted pitcher type 2, double-handled, spout lost. Red slip decoration on white fabric. *81043*.

Period 7
(Fig. 47)
60. THET3, AD jar rim type 7? Incised wavy lines and cordon with diamond rouletting. *3001*.
61. THET1 (or possibly STAMA), BB12 bowl. Pink and white with grey core. Rectangular rouletting on rim. *1002*.
62. THETG or GRCW, jar with bead rim (new type). Small finger impressions on rim. *4000*.
63. EMW, bowl. *1002*.

VIII. Ceramic objects
by Alice Lyons
(Fig. 37)

Part of a hemispherical ceramic spindle whorl (SF 340, Fig. 37) of early Saxon date was found. Similar artefacts have been found on other Norfolk sites (Friedenson and Friedenson 1995, 138). Its burnished exterior is probably the result of repeated use with unwashed greasy wool. After the artefact was broken it had been burnt and sooted.

SF 340 *4046*; fill of Building C; Period 3; Fig. 37
Ceramic spindle whorl; brownish-grey, slightly micaceous hard fabric with a burnished exterior; incomplete.

Two ceramic objects (not illustrated) had been made from re-used Romano-British vessel bases. A spindle whorl, made from a Romano-British Nene Valley colour coat pottery sherd (SF257, pit *4019,* Period 3), has a creamy white fabric with traces of a dark grey slip surviving on both surfaces. It is a base sherd from a beaker; the groove in the base suggests it may have originated from a Hunt Cup or similar form, so dating it to the late 2nd or early 3rd centuries AD. It weighs 20g and has been modified by having a 9mm circular hole drilled through its centre.

A possible gaming piece, also made from a Romano-British Nene Valley colour coat sherd, was found (SF486, pit *4288*, Period 5). The fabric is a creamy white with a dark orange/brown slip surviving on both sides. It was the base of a beaker, possibly a pedestal beaker, which dates to the middle of the 3rd century. It weighs 24g and has been modified by being cut down and smoothed to form a circular ceramic disc.

IX. Ceramic building material
by Richenda Goffin and Sue Anderson

Daub
by Richenda Goffin
(not illustrated)
Almost 12kg of fired clay/daub was recovered. Several fabric types were present. The most common has very few inclusions, although organic impressions and small burnt-out voids are common.

Several of the fragments showed rod impressions, probably from wattling, but the surviving impressions were such that no details of construction could be ascertained. This material was not specifically related to any structural feature, with almost 92% being recovered from the backfilling of pits and wells. Of the remaining material 1% was found in the backfill of the sunken featured buildings and 7% in the backfill of features interpreted as hearths.

In addition to this material, 35 fragments of daub were recovered from Building C. Characteristically these fragments had a clay-like backing, which contained few inclusions, except for the addition of fine organic material and occasional fragments of flint. One fragment showed evidence of small slabs of calcareous material, which may represent the re-use of previous lime-faced walls. The clay-based matrix shows little evidence of sand, which would make a conventional mortar, and the mixture seems more like material from a cob type of wall.

Several fragments show clear indications of structural elements, preserved in the clay backing. For the most part these appear to be standard wattle infill remains, with small rods with diameters in the region of 11–12mm. One fragment shows these impressions set at an angle of approximately 45 degrees to the outer surface, which is coated in limewash. A second fragment provides further constructional detail. This piece has an uneven external surface, and shows the remains of larger structural elements. Immediately set back from the outer limewashed edge of the fragment is a rod impression 18mm in diameter. Parallel to this but set further back is another rod *c*. 16mm in diameter. At approximate right-angles to these elements are two further impressions, the best preserved one 25mm in diameter, and another of *c*. 16mm in diameter. There is no sign of interwoven elements passing in front of and behind each other, although it is possible that this may represent the outer horizontal and vertical elements, and that there could have been a core of wattle panelling passing down the middle of the wall.

The clay-based backing was covered with a white deposit, almost certainly a limewash. This was directly applied to the wall, as no finer intermediate layer had been constructed. The surface of this material is often uneven, and any brushmarks have not survived. The depth of the limewash is very variable, as it was presumably used to even up any lumps and bumps in the outer surface of the wall, as well as protecting the wall from the elements. Several fragments appear to have been concave in shape and may represent joins of walls, or other structural junctions.

Brick and fired clay

by Sue Anderson

(not illustrated)

Fifty-five pieces of fired ceramic building material, weighing 1.919kg, were recovered from the site. The majority (27 fragments) came from Area 1. Most of the material could not be identified due to a high degree of post-depositional abrasion; some may have been fired clay or daub that could belong to any period during the occupation of the site. The only fragments which could be dated came from Area 7, and included a poorly-made white brick comparable to Norwich 'early bricks' which are dated to the late 13th–15th centuries (Drury 1993) and four pieces of medieval roof tile similar to peg tiles found in 13th–14th century contexts at St Saviour's Hospital, Bury St Edmunds (Caruth and Anderson 1997).

4. Zoological, Environmental and Botanical Evidence

by Umberto Albarella, Sue Anderson, Alex Bayliss, James Greig, Alison Locker and Peter Murphy

I. Mammal and bird bones

by Umberto Albarella
(Charts 15–24)

Introduction

In recent times a fair amount of zooarchaeological information concerning Saxon and medieval Norfolk has come to light, particularly from urban sites. It is within this wider context that the animal bone from Mill Lane must be interpreted. Wherever possible comparisons have been made with results from other contemporary, or near-contemporary, sites in the region and in Thetford itself. Other important Late Saxon and medieval animal bone assemblages from Thetford have been studied previously (Jones G. 1984, 1993). These provide an opportunity to find out to what extent the results from Mill Lane can be considered representative of activities in the town as a whole.

The main points that will be discussed here include how the animal bones can contribute to our understanding of:

1. the Late Saxon/early medieval use of the site;
2. the economy and environment of Thetford and its relationship with the surrounding countryside;
3. the Late Saxon/early medieval animal economy at both regional and national levels.

The assemblage from Mill Lane is not very large and the contribution it can make to any reconstruction of Late Saxon and early medieval life is therefore limited. However, a number of hopefully significant and useful considerations will be made in the course of this report. As is so often the case, as many questions as answers will be raised, but these will, at least, be useful in addressing future research.

The finds from medieval and modern contexts were highly contaminated with residual material from earlier periods, and the animal bones from these periods were therefore excluded from the analysis. About 70% of the pottery by weight from Period 4 deposits was also residual from Period 3. Consequently the animal bone from these two periods have been analysed together. The total assemblage considered is one of *c*. 139kg (*c*. 117kg from Period 3 and *c*. 22kg from Period 4) comprising 1796 recorded specimens (1309 from Period 3 and 487 from Period 4).

Methods

Most of the animal bones from Mill Lane were hand-collected. Nineteen samples, usually of 10 litres each, were taken for flotation. The residues from these were collected on a 1mm sieve, producing a very small quantity of mammal and amphibian bone (Table 24). In addition, a substantial part of the (small) fish assemblage is represented by bones collected from the samples. No programme of coarse sieving of larger samples was undertaken.

The sieved samples are far too few and too small to provide quantitative information on the loss of smaller bones due to recovery bias. Since the bones derive almost entirely from hand-collection, an under-representation of smaller species and body parts is to be expected.

The mammal bones were recorded following a modified version of the method described in Davis (1992) and Albarella and Davis (1994). In brief, all teeth (lower and upper) and a restricted suite of parts of the postcranial skeleton was recorded and used in counts. For a complete explanation of the methods adopted, a full list of the ageing and metric data, and further details on this assemblage see Albarella 1999b (archive).

Provenance and preservation

The animal bones were fairly evenly scattered across the nine excavated areas. Area 7 produced no 'countable' bones, however, and very little material was retrieved from Area 8 either. More than anything else the location of the pits, from which about 70% of the animal assemblage derives, seems to have dictated the distribution of bone across the site.

The preservation of the material was generally fairly good, although poor condition of the bone surface was observed in a number of contexts. The majority of contexts produced bones that were homogeneously well (most context) or poorly (a few contexts) preserved. This

Taxon	*Period*		
	10th–11th C	*10th–12th C*	*Total*
Cattle (*Bos taurus*)	2	–	2
Sheep/Goat (*Ovis/Capra*)	4	2	6
(Sheep) (*Ovis aries*)	(–)	(1)	(1)
(Goat) (*Capra hircus)*	(–)	(–)	(–)
Pig (*Sus scrofa*)	4	1	5
Small rodent (*Rodentia*)	–	1	1
Amphibian (*Amphibia)*	4	1	5
(Frog) (*Rana* sp.)	(2)	(–)	(2)
(Toad) (*Bufo bufo*)	(–)	(1)	(1)
Total	**14**	**5**	**19**

'Sheep/Goat' and 'Amphibian' also include the specimens identified to species or genus. Numbers in parentheses are not included in the total of the period.

Table 24 Number of mammal and amphibian bones (NISP) in the sieved assemblage

suggests that, with regard to the Late Saxon period, not much redeposition occurred on this site. Bones in articulation were not uncommon and these suggest that some material comes from primary deposits. However, the abundance of gnawing marks indicates that many bones were not immediately buried after being discarded.

Frequency of species

(Charts 15–24)

Like all European urban sites of any period, the animal bone assemblage from Mill Lane is dominated by the bones of the main domestic animals — cattle, sheep and pig (Table 25). Domestic birds (fowl, goose and duck) are also fairly common, and their number is certainly grossly under-estimated due to the recovery bias already mentioned. Wild animals are rare. This suggests that hunting played a negligible role in food provision at the town.

Taxon	*Period*		
	10th–11th C	*10th–12th C*	*Total*
Cattle (*Bos taurus*)	548	235	783
Sheep/Goat (*Ovis/Capra*)	260	101	361
(Sheep) (*Ovis aries*)	(76)	(30)	106)
(Goat) (*Capra hircus)*	(+)	(1)	(1)
Sheep/Goat/Roe deer (*Ovis/Capra/Capreolus*)	1	-	1
Roe deer (*Capreolus capreolus*)	3	2	5
Red deer (C*ervus elaphus*)	+	-	+
Pig (*Sus scrofa*)	318	85	403
Equid (*Equus* sp.)	*46	10	56
Dog (*Canis familiaris*)	**27	7	34
Cat (*Felis catus*)	***11	+10	21
Hare (*Lepus* sp.)	1	2	3
Domestic fowl (*Gallus gallus*)	++69	20	89
Goose (*Anser/Branta*)	11	10	21
Duck (*Anas* sp.*)*	+++11	14	25
Shelduck (*Tadorna tadorna*)	1	-	1
Sparrowhawk (*Accipiter nisus)*	-	1	1
Thrush/Blackbird (*Turdus* sp.)	1	-	1
Bird (*Aves*)	1	-	1
Total	**1309**	**497**	**1806**

* 23 bones from a partial skeleton
** 12 bones from a partial skeleton
*** 3 bones from a partial skeleton
\+ 7 bones from a partial skeleton
++ 8 bones from a partial skeleton
+++ 9 bones from a partial skeleton

'Sheep/Goat' also includes the specimens identified to species. Numbers in parentheses are not included in the total of the period. '+' means that the taxon is present but no specimens could be 'counted' (see text).

Table 25 Number of hand-collected mammal, bird and amphibian bones (NISP)

Cattle are the most common species in terms of the number of identified specimens (NISP), whereas sheep/goat and pig are almost equally represented. However, it would be wrong to assume, on the basis of their predominance in the NISP count, that cattle were the most common animal utilised on site. NISP numbers are seriously affected by differential preservation and recovery, both probably major factors in the formation of this assemblage. When the minimum number of individuals (MNI) — a system less affected by these biases — is taken into account, cattle become no more frequent than sheep/goat, with pig the third most common species (Table 26). Although by no means a perfect system, MNI probably provides a more accurate estimate of the frequencies of species here. Calculations carried out on other sites (*e.g.* Albarella *et al*. 1997; forthcoming) prove that MNI frequencies are generally closer to NISP frequencies from sieved assemblages than hand-collected ones. This would indicate that the MNI count reduces the misleading effect of a recovery bias.

When the assemblage was divided into the collections from the nine excavated areas, it was possible to observe that no major variation occurred between them in the frequency of the main domestic animals. In terms of NISP cattle were consistently the most common species, and there was no great difference in the frequency of sheep/goat and pig (Table 27). MNI was not used as this system becomes unreliable when applied to very small assemblages. The lack of any great variation between different areas suggests that the total frequency of species can be taken as a reliable average figure for the Mill Lane site as a whole.

The distribution of species in different types of feature is strongly affected by the fact that the overwhelming majority of the bones derive from pit fills (Table 28). This means that all bone groups from other feature types are represented by very small samples. However, it can still be seen that, by and large, the proportional relationship between the main species is fairly constant across different feature types. A possible exception is represented by the grave fills, which are dominated by cattle bones, some of them burnt.

Having seen that the frequency of the main species is probably representative of the whole area currently occupied by Mill Lane, it is time to investigate the possibility that the Mill Lane area might be considered a proxy for the whole town. In Chart 15 frequencies of the main mammals' occurrence at Mill Lane and other sites in Thetford are compared (data from Jones G. 1984, 1993). In all cases cattle are more numerous according to NISP than MNI, due to the severe effect of the recovery bias on NISP. MNI is therefore considered a more suitable system for a comparison; its use also reduces the biases that may

	Period							
	10th–11th C		*10th–12th C*		*Total*		*Total*	
Taxon	*NISP*	*%*	*NISP*	*%*	*NISP*	*%*	*MNI*	*%*
Cattle (*Bos taurus*)	548	49	235	56	783	51	26	36
Sheep/Goat (*Ovis/Capra*)	260	23	101	24	361	23	27	37
Pig (*Sus scrofa*)	318	28	85	20	403	26	20	27
Total	**1126**		**421**		**1547**		**73**	

Table 26 Frequencies of the three most common domestic mammals by number of identified specimens (NISP) and by minimum number of individuals (MNI)

Area		*Taxon*			*Total*
		Cattle (Bos taurus)	*Sheep/Goat (Ovis/Capra)*	*Pig (Sus scrofa)*	
1	NISP	195	102	127	424
	%	**46**	**24**	**30**	
2	NISP	116	42	56	214
	%	**54**	**20**	**26**	
3	NISP	74	36	64	174
	%	**43**	**21**	**37**	
4	NISP	218	111	83	412
	%	**53**	**27**	**20**	
5	NISP	27	23	22	72
6	NISP	25	11	21	57
7	NISP	–	–	–	–
8	NISP	3	–	–	3
9	NISP	125	36	30	191
	%	**65**	**19**	**16**	
Total	**NISP**	**783**	**361**	**403**	**1547**

Table 27 Periods 3 and 4 combined (10th–12th centuries AD), number of identified specimens (NISP) of the main domestic mammals, by area. Percentages calculated only for samples greater than 100.

Type of feature	*Taxon*						*Total*
	Cattle (Bos taurus)	*Sheep/Goat (Ovis/Capra)*	*Pig (Sus scrofa)*	*Equid (Equus sp.)*	*Dog (Canis familiaris)*	*Domestic birds*	
Beam slot	–	–	2	–	–	1	3
Ditch	40	10	22	6	3	4	85
Fill	33	14	10	–	1	3	61
Furnace	1	–	–	–	–	–	1
Grave	55	1	6	–	–	1	63
Gully	1	9	3	–	–	1	14
Hearth	3	3	11	–	–	3	20
Horse skeleton	–	–	–	23	–	–	23
Oven	5	1	1	1	–	–	8
Pit	552	268	300	25	28	90	1263
Post-hole	34	25	13	–	–	6	78
Sunken-featured building	7	4	3	–	–	1	15
Trench	1	–	1	–	–	–	2
Well	35	22	25	–	2	16	100
Uncertain	15	5	6	1	–	–	27
Total	**782**	**362**	**403**	**56**	**34**	**126**	**1763**

Table 28 Periods 3 and 4 combined (10th–12th century AD), number of identified specimens (NISP) of the most common domestic animals, by type of feature

	Chops		*Cuts*		*Total butchery*		*Burning*		*Gnawing*	
Taxon	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Cattle	89	**15**	70	**12**	143	**24**	12	**2**	93	**16**
Sheep/Goat	26	**11**	42	**17**	59	**24**	6	**2**	50	**20**
Pig	25	**11**	31	**13**	48	**21**	–	**0**	38	**17**
Equid	3	**6**	3	**6**	4	**9**	–	**0**	8	**17**
Dog	–	**0**	–	**0**	–	**0**	–	**0**	2	**6**
Cat	–	**0**	–	**0**	–	**0**	–	**0**	–	**0**

Total butchery includes chop- and cut-marks (its value is lower than the total of chopping and cuts because some bones were chopped *and* cut). Gnawing includes one sheep/goat semi–digested bone and bones gnawed by carnivores. No signs of rodent gnawing were found. Percentages are calculated out of the total number of postcranial bones for that taxon.

Table 29 Periods 3 and 4 combined (10th–12th century AD), percentages of butchered, burnt and gnawed postcranial bones

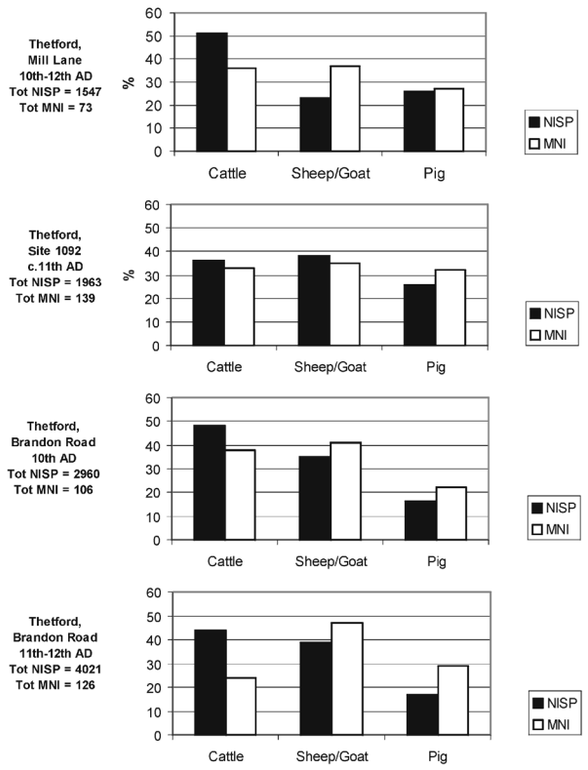


Chart 15 Frequency of the main domestic mammals at Mill Lane and other Late Saxon/early medieval sites in Thetford

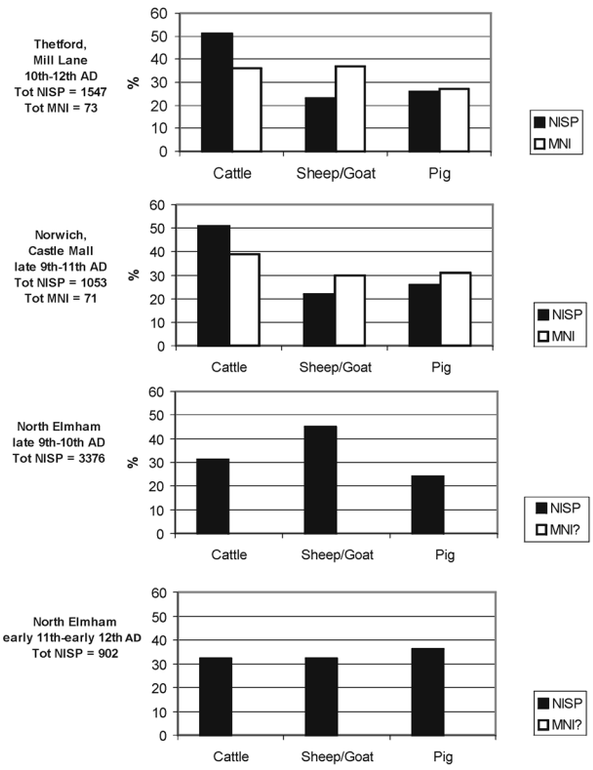


Chart 16 Frequency of the main domestic mammals at Mill Lane and other Late Saxon/early medieval sites in Norfolk

be incorporated by the use of different recording systems. The frequency of different species at Mill Lane and at Site 1092 is remarkably similar, whereas Brandon Road in the 11th–12th centuries seems to display a slightly higher frequency of sheep/goat.

Remarkable similarities are also found when Mill Lane is compared to other sites in the area outside Thetford (Chart 16: data from Albarella *et al.* forthcoming; Noddle 1980). While slight variations occur, the general impression of a roughly equal frequency of the three main taxa is confirmed. North Elmham, however, appears to have produced slightly more sheep/goat, possibly reflecting the rural character of the site. The tendency towards a higher frequency of cattle on urban sites and of sheep/goat on rural sites seems to be a general phenomenon in Saxon and medieval times (Albarella and Davis 1996). Overall, the relative abundance of animals at Mill Lane is consistent with what has been found at other contemporary sites in Norfolk. The assemblage therefore seems to be representative of the wider Late Saxon/early medieval regional economy.

One interesting feature at these sites is the fairly high frequency of pigs. In later medieval periods only castle sites have high pig frequencies (in most cases above 20%), whereas this species is the least common in towns (Grant 1988; Albarella and Davis 1996; Albarella *et al.* 1997 and forthcoming). If the high frequency of pigs in castles is probably due to status, their decline in later medieval times may reflect the reduction of woodland. Although not necessarily associated with woods, pigs would thrive in this kind of environment, where a system of 'pannage' was adopted. The association between woods and pigs was so strong that many medieval documents, including Domesday Book, measure the extent of a woodland area on the basis of the number of pigs that it could support. Preliminary analysis of the pollen spectrum from Mill Lane shows the presence of a fair quantity of tree pollens (mainly oak, but beech is also present: *Pollen*, below); this suggests that some woodland was present around Thetford, and this could have supported a pig population.

Only scanty historical evidence about numbers of livestock is available for the period before the 11th-century Domesday survey. What evidence there is indicates that sheep were abundant and widespread, and that pig-keeping was also very important (Trow-Smith 1957; Finberg 1972). On the Late Saxon farm estate at Egmere in Norfolk there were nineteen cattle, 115 sheep (excluding lambs) and only one pig (Finberg 1972, 498). Pigs may not have been counted because they were kept in woodland areas. Other counts from Late Saxon estates in other counties highlight the fact that sheep were much more numerous than cattle. Counts based on the Domesday survey suggest that there were about 90,000 sheep in Suffolk and Norfolk and only about 5000 cattle ('cows' and 'animals': Darby 1971, 142, 199). Although the cattle count does not include the ever-important oxen, there seems to be little doubt that sheep were by far the most common animals. The problem of the under-representation of sheep in the archaeological record (or their over-representation in the historical record?) is discussed elsewhere (Albarella 1999a) and will not be addressed again here. However, an important

consideration in our interpretation of the Thetford assemblage is that although a market economy was not fully developed at the time, the town was likely to have been at least partly supplied from the surrounding countryside. This would have included the provision of food from villages, as well as estates, but most of the documentary evidence focuses on the latter, whereas the kind of livestock kept in villages is insufficiently known.

One of the Domesday entries for Thetford mentions 163 sheep and nine plough teams of oxen (Darby 1971), which suggests that the town benefited from at least some level of self-sufficiency. Sheep were probably kept on the pasture area on the Norfolk bank, whereas oxen would have been used to plough the arable land present on both sides of the river. Once again, no mention is made of pigs. This suggests that these animals were probably kept in the woodland rather than within the town itself: the rearing of pigs in urban areas seems to be a somewhat later phenomenon (Albarella *et al.* 1997 and forthcoming).

To conclude, it must be emphasised that however useful it is to know the relative frequency of different animals, abundance should not necessarily be equated with importance. In a way, all the main domestic mammals played an essential economic role. Pigs would have been the only animals exclusively reared for meat and fat, but at some point in their lives cattle and sheep would also have been slaughtered for the same purpose. Cattle and sheep, irrespective of their number, would have been important providers of milk, wool, leather, traction power and manure, in addition to meat. Even taking into account the under-representation of the smaller animals due to recovery bias during hand collection, the much larger size of the cattle carcass leaves little doubt that the most commonly eaten meat at Thetford was beef, probably followed by pork and then mutton. To give this statement more weight, however, we must address the above-mentioned clash between the archaeological and historical evidence. The latter appears to suggest that sheep were by far the most common animals, whereas the archaeological evidence points to rather similar frequencies of cattle, sheep and pigs.

Cattle

As suggested above, beef was probably the most common meat eaten in Thetford, and we must therefore consider its source of supply. One way to investigate this is to look at the distribution of body parts in the archaeological assemblage (Chart 17).

The anatomical elements in Chart 17 are arranged according to a sequence of survival suggested by Brain (1976), based on his experimental work carried out on goat skeletons near the Kuiseb river (southern Africa). The elements on the left of the diagram are those that survived better in Brain's experiment. This sequence is used simply to facilitate an easier comparison between the survival of body parts of the three main domesticates. The cattle carcass is much larger than that of the goat and is likely to be subject to different patterns of survival. Moreover, the taphonomic factors that affected the goat assemblage from the Kuiseb river are likely to have been substantially different from those that led to the formation of the Mill Lane assemblage. It is thus not surprising that the sequence of body part survival at Mill Lane hardly conforms with Brain's sequence (Chart 17). What is of interest for our interpretation is that most parts of the cattle skeletons are represented. Elements that bear little or no meat such as teeth and limb extremities are particularly common, but bones that would have been included in the most important meat cuts — such as the scapula, humerus and pelvis — are also well represented, while cattle-size vertebrae and ribs were found throughout the site. This distribution suggests that the cattle assemblage derives from a mixture of primary and secondary butchery, and that complete cattle carcasses were probably processed on site. These were either imported to the site on the hoof, or bred locally. It is possible that selected cuts of meat were occasionally imported, but this practice was probably not sufficiently common to affect the distribution of body parts in the archaeological assemblage. This same pattern has been observed at other contemporary urban sites in Thetford, Norwich, York and Southampton (Jones, G., 1984, 1993 and 1994; Albarella *et al.* 1997 and forthcoming; O'Connor 1994; Bourdillon 1994).

Whether or not some of the cattle were bred inside the town is difficult to say. O'Connor and Bourdillon have both argued — on the basis of the absence of neonatal animals in their assemblages from York and Southampton — that the livestock was imported from outside. Neonatal bones are generally rare in archaeological assemblages, both because they do not preserve well and because (being small) they are often overlooked during excavations. Only one neonatal cattle bone was found at Mill Lane, a radius whose diaphysial length was 112mm. One bone probably does not amount to sufficient evidence to argue for cattle breeding on-site, but the likely presence of open land within the town makes this possible. Neonatal cattle bones were also found in the Saxo-Norman levels at Castle Mall, Norwich. They were no longer present in the later periods, however, when the town was more densely urbanized (Albarella *et al.* 1997 and forthcoming).

Apart from the occasional juvenile specimen, most cattle remains belong to fully-grown animals. As in Norwich, most of the mandibles belong to the wear stages defined as 'adult' or 'elderly' by O'Connor (1988) (Chart 18), with a small number of 'sub-adult' and virtually no 'immature' animals. Analysis of eruption and wear stages displayed by individual teeth also shows that a relatively small number of milk teeth are present, and thus that only a few animals were slaughtered when young. Most third molars — a tooth that erupts in the third year (Grigson 1982) — are substantially worn (Albarella 1999b, table 9).

The fusion of epiphyses (Chart 19) provides evidence consistent with that of the tooth eruption and wear. Almost all early-fusing bones are fused, and even most epiphyses that fuse in the animals' fourth year (according to Silver 1969) are fused. The sequence in Chart 19 shows that virtually all bones that fuse in the beginning of the second year are fused, whereas about a third of the animals were slaughtered before their distal metacarpal would have fused at *c.* 2–2.5 years (Silver 1969). No difference in the frequency of fused metacarpals and fused distal radius occurs, and thus few animals were slaughtered in the period between the fusion of these two bones, *i.e.* between the middle of the second year and the end of the fourth (Silver 1969).

This kill-off pattern makes perfect sense from an economic point of view. A few animals would be slaughtered for meat production when sufficiently grown up but still relatively young ('bullocks'), whereas the majority would be kept until adult or elderly to be used for traction (mostly ploughing). This pattern of use has also been observed at the other Thetford sites studied by Gillian Jones and was widespread in early medieval Britain, at least until the 15th century (Albarella 1997a). Around Thetford in particular, where there was a predominance of arable land over pasture, teams of oxen for ploughing would have played a key role in the production of crops. Meat would have been a useful by-product, while cow milk was only occasionally used in these early stages of the Middle Ages (Trow-Smith 1957).

The cattle from Mill Lane were roughly similar in size to other animals from contemporary or semi-contemporary sites at Lincoln (Dobney *et al.* undated), West Cotton (Northamptonshire; Albarella and Davis 1994), Thetford and Norwich. Further, no obvious differences could be found between the size of cattle at Mill Lane (Albarella 1999b, fig. 9) and at the Early Saxon site at West Stow, Suffolk (Crabtree 1989). All these animals would have been small compared to modern, or even late medieval and post-medieval, livestock.

Comparison of ranges and means represents a rather crude method of evaluating possible size differences in animal populations. It is for this reason that a more detailed biometrical analysis was carried out on a few selected bones that offered a sufficient amount of metric data. The evidence from Mill Lane has been analysed in conjunction with that from Castle Mall. The latter is an ideal site for comparison, being a contemporary urban site within the same broad geographical area as Thetford.

Measurements of cattle metapodials confirm that there are no obvious size differences between the two sites (Albarella 1999b, fig. 10). The diagrams in Chart 20 are size-independent, measuring how robust rather than how large the bones are. The shape of cattle metapodials has been widely used to try to detect sex variation (*e.g.* Higham 1969; Howard 1963), the metacarpals in particular being strongly sexually dimorphic. However, differences in the shape of the metapodials also occur between different breeds (Fock 1966; Reichstein 1973; Albarella 1997b). The plot of the metacarpals shows a possibly significant variation in shape between the specimens from Mill Lane and Castle Mall. It is possible to draw a diagonal line that divides most of the Castle Mall (only 7% below the line) and the Mill Lane (as many as 78% below the line) specimens (Chart 20). This difference is not striking, but it is perceptible none the less. Specimens with a similar ratio between length

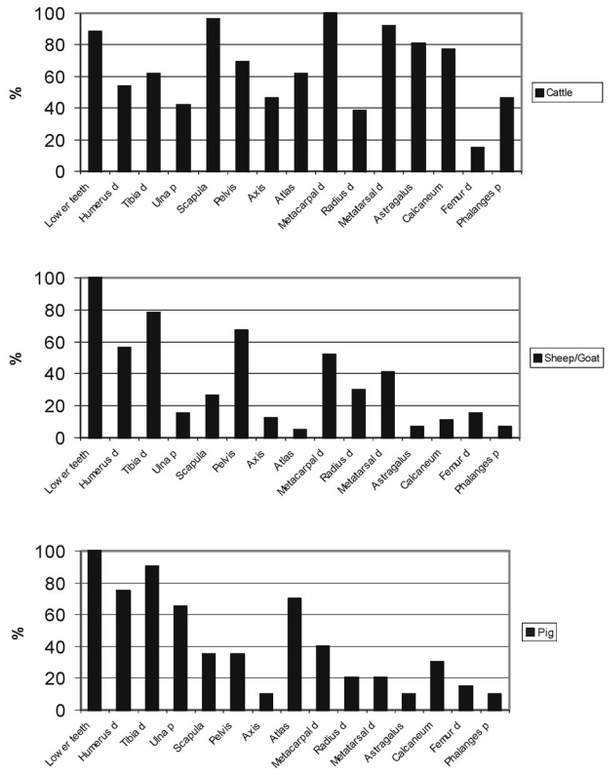


Chart 17 Thetford, Mill Lane. Percentage survival of the body parts of the main domestic mammals. Sequence based on Brain (1976). p – proximal; d – distal.

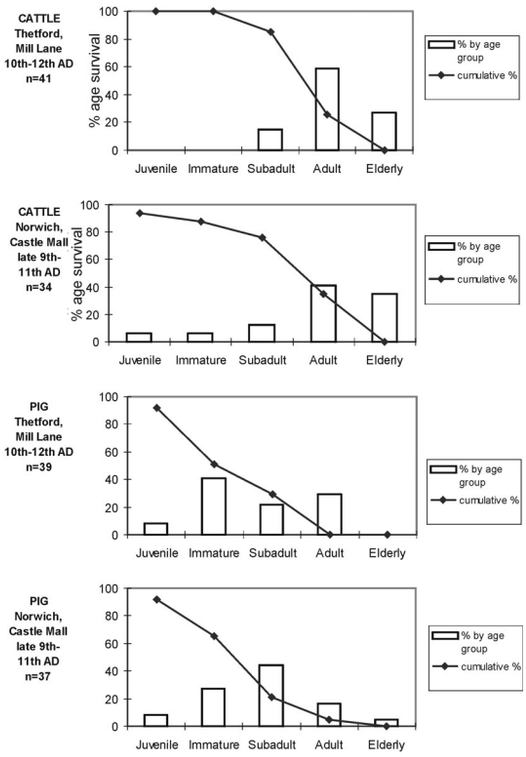
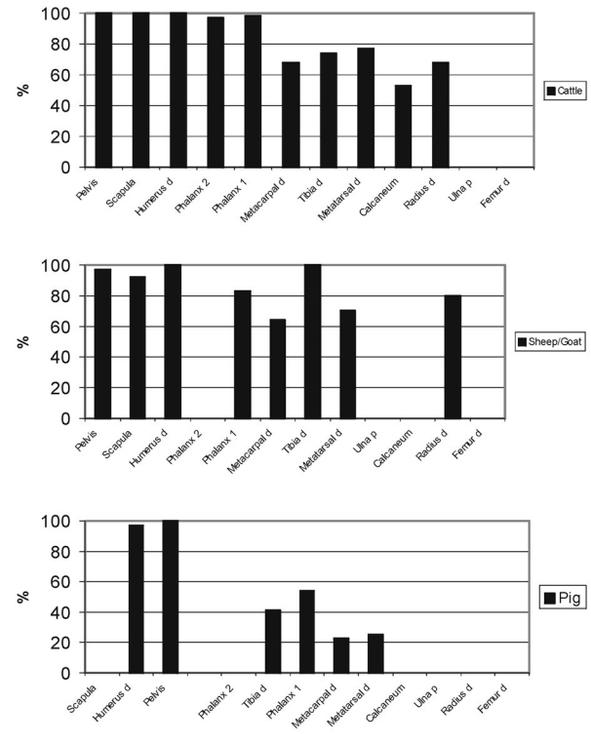


Chart 18 Distribution of cattle and pig mandibles by age stage at Thetford, Mill Lane and Norwich, Castle Mall. Age stages as defined by O'Connor (1988).



Fusion sequence based on Silver (1969). Bars are missing when the total number of epiphyses was lower than 10.

Chart 19 Thetford, Mill Lane. Percentage of fused/fusing epiphyses for the main domestic mammals.

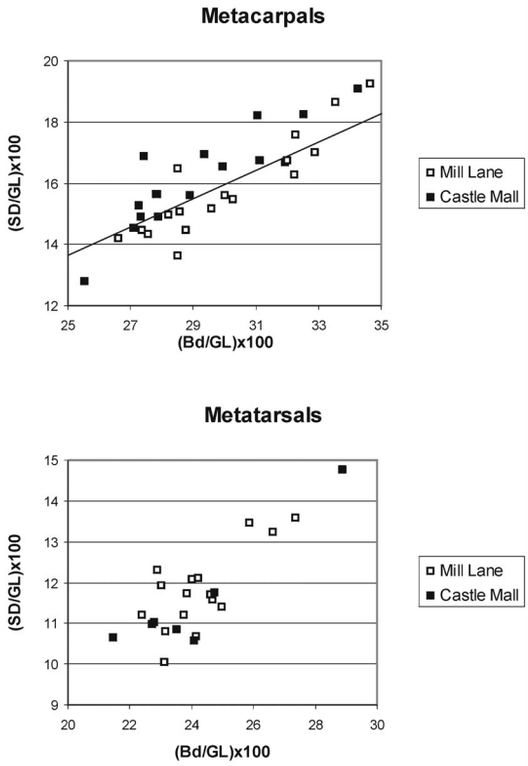


Chart 20 Shape of cattle metapodials at Thetford, Mill Lane (10th–12th century AD) and Norwich, Castle Mall (late 9th–11th century AD).

and distal width have a more slender shaft at Mill Lane than at Castle Mall. This is not a difference that is known to occur between different sex groups.

The next measurements to be compared are those of the astragalus. Once again no size difference could be noted between the Mill Lane and the Castle Mall specimens (Chart 21A and B). A wide overlap also occurs in the shape of the groups (Chart 21C) but a slight difference can be noted, the Mill Lane specimens appearing (like the metacarpals) more slender. If a horizontal line is drawn from the 56 value on the vertical axis, it is possible to see the difference more clearly: 81% of the specimens from Mill Lane but only 43% from Castle Mall fall below the line. No differences either in the size or shape of the horncores could be detected (Albarella 1999b, fig. 13).

A possible interpretation for the suggested shape difference between the cattle at the two sites is that the two towns were supplied with animals belonging to different populations. Norwich and Thetford had different catchment areas and, importantly, regional variation is detectable in Late Saxon and early medieval cattle. There is hardly any historical evidence for the presence of different cattle types in pre-Conquest times (Trow-Smith 1957), and therefore archaeology can offer its own contribution to addressing this problem. However, more extensive use of the metric data from the other studied assemblages in Thetford and Norwich is needed to corroborate this hypothesis.

Butchery marks were frequently recorded on the Thetford bones, partly as a consequence of the relatively well-preserved surface of many bones. A quarter of the cattle bones bore evidence of some form of butchery (Table 29). Most of the marks were probably related to the dismemberment of the carcass and subsequent jointing. A few long bones were chopped and burnt on the mid-shaft, presumably for the extraction of marrow. This technique is better known at prehistoric sites (Binford 1981), but it was also occasionally employed in later periods. Cut-marks were also observed on metapodials (but not on phalanges) and these are probably due to skinning. Ox hides are among the few items mentioned in the Domesday Survey as being produced in Thetford (Darby 1971, 141).

A number of horncores had been chopped or cut (but not sawn) at their bases, presumably for the extraction of the horn. However, a few were still attached to the skull. Since some of these also bore cut-marks, it is likely that in some cases it was possible to take the horn off the horncore without chopping the horncores off the skull. Evidence of boneworking was found on a few metapodials and tibia, which had either been sawn on the shaft or had had pieces of bone sawn off, perhaps as a consequence of an aborted attempt to work the bone. A metacarpal with a hole bored in its proximal end might have been used as a handle.

Pathological conditions of archaeological interest were rare. A few long bones had arthropathic ends, probably as a consequence of working stress or old age.

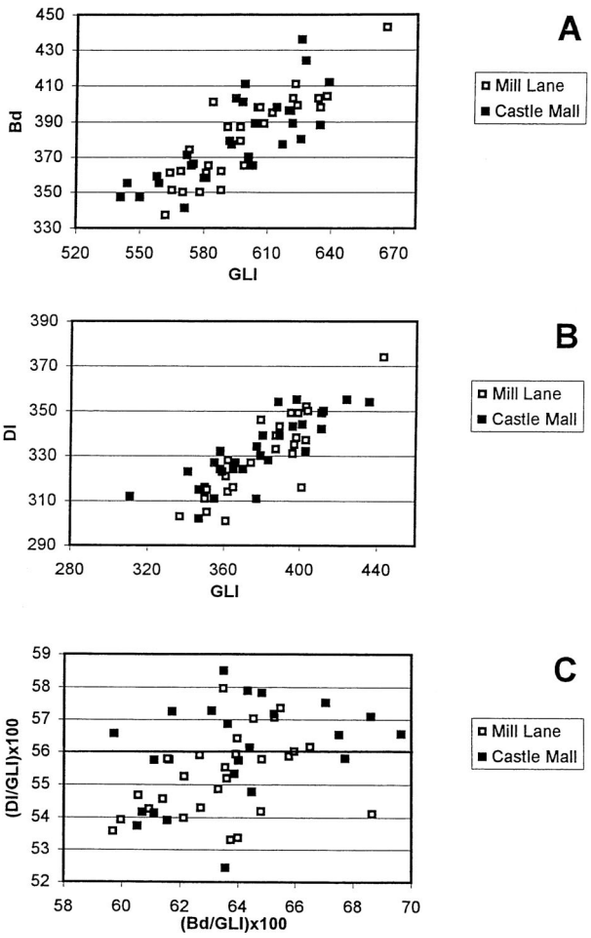


Chart 21 Size (A and B) and shape (C) of cattle astragali at Thetford, Mill Lane (10th–12th century AD) and Norwich, Castle Mall (late 9th–11th century AD). Measurements in tenths of mm.

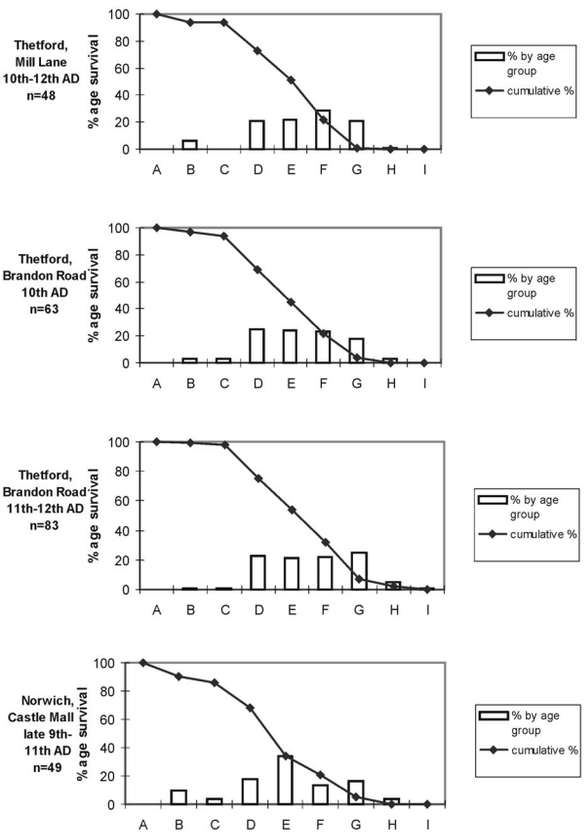
Sheep/goat

No attempt has been made so far in this report to distinguish between sheep and goat. However, a number of anatomical elements were selected for identification of these closely related species. In accordance with most British assemblages, sheep proved to be overwhelmingly more common. Only one 'countable' element (an unfused metacarpal) could be attributed to goat, and more than one hundred to sheep (Table 25). A much lower sheep:goat ratio was calculated on the basis of the horncores, with five out of 24 horncores belonging to goat. The higher ratio of goat horncores may be partly due to the fact that some of the sheep had been polled. However, this condition was not particularly common: only one of the 16 sheep frontal bones examined was hornless. Two polled sheep skulls were also found at Brandon Road (Jones G. 1993). No sign of the four-horned sheep recorded at Site 1092 (Jones G. 1984) was found at Mill Lane. A high frequency of goat horncores in assemblages that produced very few other goat remains has been noted on many other medieval sites, most remarkably at King's Lynn (Noddle 1977). The scarcity of goat bones and teeth and the presence of a fair number of goat horncores was also typical of the other Thetford sites, Site 1092 and Brandon Road (Jones G. 1984 and 1993). In the rest of this report the sheep/goat taxon will simply be referred to as 'sheep'.

The presence of these goat horncores may be attributed to the existence of an independent trade in goat horns for craft purposes (Jones G. 1993; Albarella 1997a 1999b). However, if this explains the imbalance between goat horncores and other parts of the skeleton, it does not resolve the problem posed by the extremely low number of goat bones. Although historical documents clearly indicate that sheep were much more common than goats, more than 7000 goats were kept in Norfolk and Suffolk in the 11th century according to the Domesday Book (Darby 1971, 142, 199). This would represent 8% of the whole sheep/goat population, and not less than 1% as suggested by the archaeological record for this period and the area. The goat was predominantly a milk animal, and one possibility is that goats were mainly kept in the countryside and only rarely imported to towns. However, the few medieval rural sites that have been studied, such as North Elmham (Noddle 1980), Wharram Percy (Pinter-Bellows 1992) and West Cotton (Albarella and Davis 1994), have also produced very few goat bones. A more detailed discussion of the 'problem of the missing goats' can be found in Albarella 1999a. Domesday Book reports no goats for Thetford, but goat skins are mentioned, along with ox hides, as one of the products of the town (Darby 1971). It is thus possible that the horncores would be imported into the town together with the skins and subsequently separated for further use.

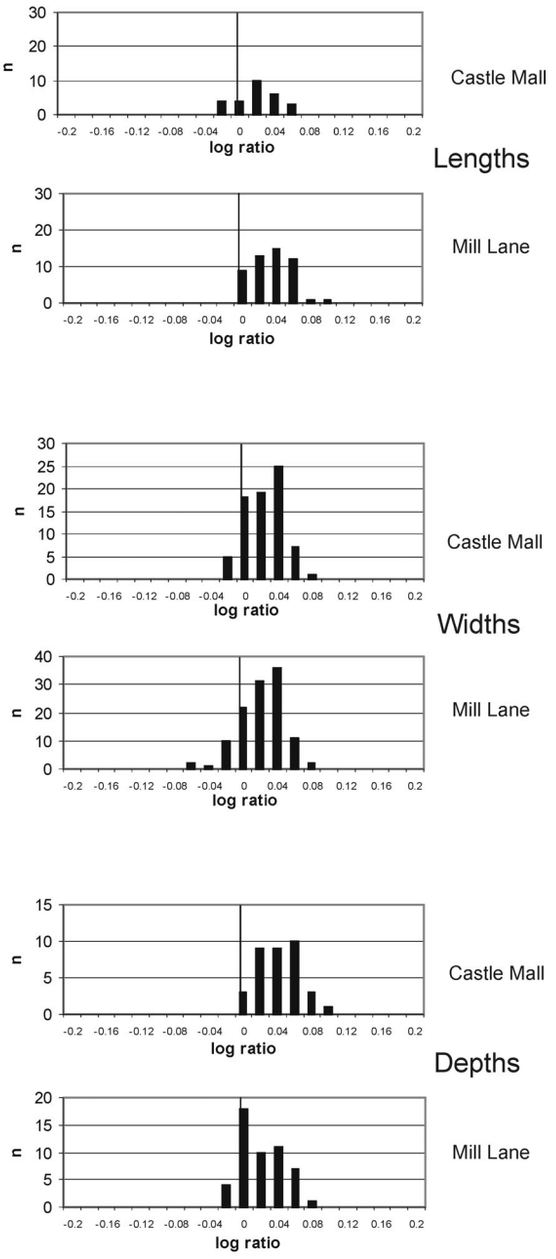
Unlike the goats, most sheep were probably processed on site as complete carcasses. The distribution of body parts fits Brain's (1976) sequence of taphonomic survival much better than does that of the cattle (Chart 17). The elements that are poorly represented at Mill Lane are those that do not survive well, or are subject to a recovery bias. The scarcity of small elements such as astragali, calcanea and phalanges is particularly striking. Teeth are the most common elements but are mainly represented by tooth rows, whereas loose teeth are rare and were probably generally overlooked during excavation. Overall, no obvious biases due to human activities are present in the distribution of the body parts. Sheep size vertebrae and ribs — which were not counted — were also commonly found. Both primary and secondary butchery refuse is present and so we must assume that whole carcasses were processed on site.

As with the cattle, we have a problem in establishing whether the sheep were kept on site or imported from afar. As mentioned above, we have historical evidence that sheep were kept in Thetford. Not only was there pastureland where they could graze but they would have almost



Approx. ages: A 0–2 months; B 2–6 months; C 6–12 months; D 1–2 years; E 2–3 years; F 3–4 years; G 4–6 years; H 6–8 years; I 8–10 years.

Chart 22 Distribution of sheep/goat mandibles by age stage at Mill Lane and other Late Saxon/early medieval sites in Norfolk. Age stage as defined by Payne (1973).



Lengths, widths and depths are compared with a standard sample of unimproved Shetland ewes (Davis 1996) (the '0' in the histograms), using the log ratio technique (Payne and Bull 1988). Shaft measurements are not included.

Chart 23 Comparison of sheep/goat measurements from Thetford, Mill Lane (10th–12th century AD) and Norwich, Castle Mall (late 9th–11th century AD).

certainly been folded on the cultivated land, where their precious manure would have helped maintain soil fertility. The archaeological evidence for on-site breeding is as scanty for sheep as it is for cattle, with only one bone that can be definitely defined as 'neonatal'; two more that were recorded as 'very young' probably belonged to animals a few weeks old. Some sheep were probably reared on site, but it is certainly possible that more animals were imported.

The variation in the age at which the sheep were slaughtered was quite considerable. This is consistent with what has been found at other contemporary sites, both inside and outside Thetford (Chart 22). There is an even distribution of specimens in the four mandibular wear stages D, C, E and F. This means that these animals were killed from the second up to the fifth or sixth year. Levels of wear on individual teeth confirm the scarcity of very young animals, with very few milk teeth present and no first molars in their early stages of wear (Albarella 1999b, table 13). The evidence of bone fusion (Chart 17) shows, surprisingly, that all distal tibiae were fused. This epiphysis fuses at about 1.2–2 years (Silver 1969) and therefore some of the sheep slaughtered in stage D (1–2 years old according to Payne 1973) would be expected to have unfused distal tibiae. However, a number of tibiae were recorded as 'fusing' and might therefore be consistent with animals at mandibular wear stage D. Most of these sheep were thus probably slaughtered towards the end, rather then the beginning, of their second year. Moreover, unfused distal tibiae may often have been destroyed by scavengers.

The variety of ages at which the sheep were slaughtered proves quite clearly that this was a multi-purpose animal: meat, wool and milk would have all been considered valuable products. Trow-Smith (1957, 60) suggests that milk and manure would have been the most important reasons for keeping sheep in Late Saxon times. Although our evidence is not inconsistent with this suggestion, it is quite clear that in this period there was no great specialisation in sheep husbandry. Subsequently, in later medieval times wool assumed greater importance, and most of the mortality curves analysed from archaeological sites of later periods are skewed towards mandibular wear stages F and G (*i.e.* animals 3–6 years old according to Payne 1973).

As in the case of cattle, there is no substantial variation in the size of sheep between Mill Lane and other contemporary sites in the area (Albarella 1999b, fig. 15), or even with the Early Saxon site at West Stow (Crabtree 1989). When a more detailed comparison with the Norwich material was carried out, however, a few interesting differences emerged. Davis (1996) has shown that there is a strong correlation between measurements taken along the same axis. Consequently sheep measurements were grouped in lengths, widths and depths in order to increase the size of each sample (Chart 23). The results show that the

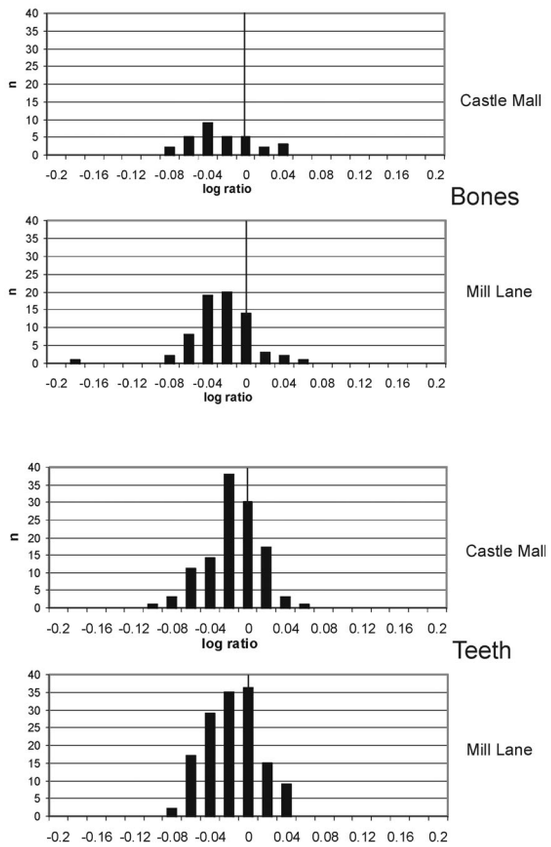
Thetford and the Norwich sheep, although comparable in size, were not as similar as they appeared on the basis of the mean and range of their measurements. No difference occurs between the two groups of widths, but the lengths are visibly greater at Mill Lane and the depths smaller than at Castle Mall. The difference between these two groups is significant at the 0.5 level for the lengths and at the 0.1 level for the depths according to a Student's t-test for samples of equal variance. (There was no significant difference in the variance between the two groups.) In other words, the Mill Lane sheep appear to have been more slender and long-legged, whilst the Castle Mall animals were somewhat shorter and stockier. A statistically significant difference was also noted between the lengths and widths and the lengths and depths of the Mill Lane specimens. This proves that the Mill Lane animals were not only more gracile than those from Castle Mall but also more gracile than the female Shetland sheep from which the standard measurement ('0' in Chart 23) used in this comparison is calculated (Davis 1996).

It thus seems that the Norwich and the Thetford sheep, like the cattle, were different from each other. It would probably be going too far to suggest that they represented different breeds, but at least we may talk of regional *types*. It is possible that different types of animals were supplied to the two towns.

The frequency of butchery marks on sheep bones was identical to that for cattle (Table 29). However, whereas in cattle chop-marks are slightly more common than cuts, the reverse is found on sheep bones. This is a situation commonly found on many sites, and is due to the different sizes of these two animals. The cattle carcass, being larger, needs to be chopped more intensively; while some of the separation of the sheep body can be carried out with a knife, the same operation will often require a heavier tool, such as a cleaver, in cattle. Some skulls and medium-sized vertebrae were chopped in half. This might suggest the existence of a distribution system for the meat at a scale larger than that of the individual household. However, in the case of the skull this phenomenon might also be explained by the need to extract, or cook, the brain.

Most of the sheep and goat horncores were chopped or cut at the base, which clearly indicates that horns were regularly used as working material. In contrast with the cattle, all the sheep frontal bones had their horncores chopped off. Perhaps it was more difficult to extract the sheep horn without removing the horncores from the skull.

The only pathological conditions of note were represented by depressions on some horncores ('thumbprints') and by one case of 'penning elbow'. The first condition has been linked to a calcium deficiency caused by environmental stresses such as malnutrition, pregnancy in advanced age or intensive milking (Hatting 1974; Albarella 1995). This last explanation seems to be the most likely one for the Thetford specimens. 'Penning elbow' is characterised by exostoses around the elbow joint, possibly due to trauma when the animals are put through pens (Baker and Brothwell 1980). Both these conditions were also noted at Castle Mall (Albarella *et al.* forthcoming).



Tooth and post-cranial bone measurements are compared with a standard sample of Neolithic domestic pigs (Albarella and Payne in prep.) (the '0' in the histograms), using the log ratio technique (Payne and Bull 1988).

Chart 24 Comparison of pig measurements from Thetford, Mill Lane (10th–12th century AD) and Norwich, Castle Mall (late 9th–11th century AD).

Pig

Nothing in the distribution of pig body parts suggests that only selected cuts of meat were imported to the site. Most anatomical elements are present, although, as in sheep, teeth predominate (Albarella 1999b, tables 6 and 7). This is very common in archaeological assemblages and is due to the fact that teeth are hard and preserve well, whereas postcranial pig bones tend to be porous and fragile, especially those deriving from young animals. The sequence of survival of body parts (Chart 17) is much more similar to that for sheep than for cattle, and it is not very different from the one proposed by Brain (1976). The similarity between the sheep and pig sequences suggests that the size of the carcass plays a key role in the survival of different elements. Differential recovery, more than any other factor, seems to have affected the formation of this assemblage.

It has been suggested above that most pigs were probably kept in the woods around the town. Whether they would have been slaughtered there or within the town is uncertain, but whole carcasses were probably processed on site.

The presence of two neonatal bones suggests that, as with cattle and sheep, a few animals were kept in the town, but these were probably a minority. Most animals were slaughtered before reaching full maturity, which is the typical pattern at most other sites (Chart 18). This strategy is typical for animals that are primarily exploited for their meat. However, at Thetford a fair number of animals were kept until their third year; by which time their fourth premolars would have been in wear and their distal tibiae and proximal first phalanges fused (Chart 19: see Silver 1969; Bull and Payne 1982). This indicates that these were slow-growing animals and very different from modern breeds, which are commonly slaughtered at the end of their first year or at the beginning of their second. The fact that post-medieval pigs were slaughtered at an earlier age than medieval animals is known from archaeological evidence (Albarella *et al*. 1997 and forthcoming; Albarella 1997a).

Thirty-eight out of 45 pig canines — the only element that displays obvious morphological differences between the two sexes — belonged to males. A predominance of males is typical of 'consumer' sites where the meat of young males would have been sold, whereas many females would have been kept on a 'producer' site for breeding. However, when the number of empty alveoli that could be sexed were counted, it showed that eight out of nine belonged to females. Therefore it seems that female canines dropped more easily from the alveoli and were then (being smaller) not as frequently collected as the male ones. It is thus possible that equal numbers of sows and boars were originally present in the assemblage. This would be consistent with a site at which people were keeping, as well as eating, the animals.

The pigs kept at Thetford certainly belonged to the small, lean, long-snouted type that was widespread in medieval times and is well known from contemporary pictorial evidence. They would have been comparable in size to the contemporary animals from Castle Mall, Norwich (Chart 24), which were smaller than the post-medieval pigs from the same site (Albarella *et al.* 1997 and forthcoming).

The tooth and bone measurements were combined and compared against a standard measurement, the '0' in Chart 24. This standard is a mean value derived from a Neolithic domestic population from Durrington Walls, Wiltshire (Albarella and Payne in prep.). Chart 24 shows that the Mill Lane and Castle Mall pigs were similar in size. It is also evident that the means of the tooth and postcranial bone measurements from both sites are roughly aligned along the same line. This means that the ratio between the bones and tooth measurements at both Mill Lane and Castle Mall is comparable to that of the Neolithic pigs

from Durrington. Post-medieval improved pig breeds had much larger bones but comparatively smaller teeth (Albarella and Davis 1996; Albarella 1997a; Dobney *et al.* undated). Thus it appears that the Late Saxon/early medieval pigs from Norfolk were more similar to prehistoric than to early modern animals.

The unimodal distribution of the pig measurements also shows that we are dealing with a single population, which, due to the small size of the animals, is certainly domestic. One non-measurable, unfused distal femur stood out on account of its huge size and another femur fragment definitely belonged to a very large animal. The fact that these two specimens, especially the unfused femur, were so obviously larger than the other bones from the assemblage suggests that they may have belonged to wild boars. This species did not become extinct in England until the 17th century (Clutton-Brock 1991). However, the overwhelming majority of the pigs were domestic.

Butchery marks are only slightly less frequent on pig bones than on bones of other species. As in sheep, cut-marks are marginally more common than other marks. As well as in terms of the distribution of body parts, the size of the animals seems to have been the most important factor in determining how a carcass was processed.

Other domestic mammals

The other domestic mammals found at Mill Lane are horse, dog and cat. The bones of these species were common but not abundant (Table 25).

The horse is referred to as 'equid' in the tables because the possibility that some bones belonged to the donkey (*Equus asinus*) cannot be entirely excluded. However, the few tooth rows that could be confidently identified to species were all attributed to horse. Most of the post-cranial bones were also rather large and horse-like. It is therefore likely that most, if not all, equid bones are of horse. Certain identifications of donkey bones for Saxon or medieval British sites are extremely rare. Donkeys are also rarely mentioned in the historic documents of the period, but they were by no means absent. Only four donkeys and one mule (*versus c.* 1700 horses) were recorded in the Domesday survey of Norfolk and Suffolk (Darby 1971, 142 and 199). One horse, and no donkeys, are recorded for Thetford.

With one exception (Table 25), horse bones were found in isolation rather than as partial skeletons, a situation which also occurred at Brandon Road (Jones G. 1993). Horse carcasses seem to have been disposed of in a similar way to those of cattle. Gnawing marks are common, and even butchery marks were found on a few bones (Table 29).

The remains of a horse skeleton found in Period 3 ring-ditch *2010* probably exemplify the way in which horse carcasses were disposed of. The skeleton was partially articulated and (with the exception of the scapulae, femurs and right fore-limb) complete. Gnawing marks were found on the humerus, the ulna and one tibia, whereas the other tibia bore clear signs of butchery, including a chop-mark on the proximal end and chop-marks, cut-marks and defleshing marks along the shaft. The disposition of the bones in the ditch looked rather haphazard, with the mandible and skull clearly separated from each other and the other elements scattered in the ditch, although some of these were still articulated. Perhaps the carcass was roughly butchered for feeding to dogs. The dogs would have fed on the horse body for a while, and disarticulated parts of the carcass, until the meat started rotting; this would have prompted burial of the parts of the carcass that had not been removed by the dogs.

It is possible that most of the horse carcasses were disposed of in a similar way. However, the presence of burning marks near the fracture (not necessarily caused by butchery) of a metacarpal might indicate a technique for the extraction of marrow similar to that described above for cattle. If this were the case, it would be more likely that the marrow would be used for feeding people than animals. Consumption of horsemeat was banned in the Christian world, but the occurrence of butchery marks on horse bones from Saxon and medieval sites suggests that this law might have been broken in periods of crisis. One horse scapula has a series of parallel transverse chop marks along its articular end and spine. No explanation for this intensive butchery activity could be found.

The Saxon horse was rather a small animal, and the Thetford specimens offer no exceptions to this. Withers heights calculated from nine complete long bones on the basis of the multiplying coefficients suggested by Vitt (1952) indicate a range from 127cm to 140cm. Today these animals, all smaller than 14 hands and 2 inches, would all be termed 'ponies'.

The size of the horses may have affected the way they were used. Undoubtedly in this period the more powerful oxen were still preferred as the main ploughing animals. Horses might have been used for lighter activities such as harrowing, but we have no firm historical evidence for the use of horses for this practice until the 12th century (Trow-Smith 1957, 64; Finberg 1972, 498). Although probably not an essential farm animal in this period, the horse would have certainly been very important as a pack animal, for riding and for military purposes.

Dog and cat were represented, both as isolated bones and as partial skeletons (Table 25). As at the St Barnabas site and at Brandon Road (Jones G. 1984, 1993) none of these bones bore any butchery marks (Table 29). Thus we have no direct evidence for the eating or skinning of these animals. There was a wide variability in the size of the dogs, with some very small animals but also a large dog found as a partial skeleton. Large dogs were probably used as guard animals, whereas smaller animals were probably kept as pets or for hunting small game (Sadler 1994). The cats may have served to control the spread of pests such as mice and rats.

Domestic birds

Bird bones are not as common as mammal bones, but this is largely due to recovery bias. It is therefore impossible to detect the extent to which they contributed to the diet of the local population. The domestic species are represented by domestic fowl, goose and duck. The status (domestic or wild) of the two last species is uncertain. However, since all goose bones were of the size of a greylag goose (*Anser anser*) and all duck bones were of the size of a mallard (*Anas platyrhynchos*), it is likely that most belonged to domestic forms. These two species are, respectively, the ancestors of the domestic goose and duck. However, the presence of a few wild geese or mallards cannot be ruled out.

The domestic fowl is by far the most common bird. This species of galliform is difficult to separate from the closely-related pheasant and Guinea fowl. However, the few bones that could be identified tended to rule out the presence of these two rarer species. It is therefore likely that most, if not all, galliform bones belong to the domestic fowl. Most of the domestic fowl bones were from adult birds and only three long bones had the porous ends typical of juvenile specimens. Of the thirteen recorded tarsometatarsi only one was spurred, a characteristic displayed by adult capons and cockerels. All the unspurred specimens (seven) were probably from females. However, five specimens have evidence of a spur scar, which seems to be typical of males that have not yet grown a spur (West 1985), although these may have already developed fully adult-looking bones (Sadler 1991). These might have been capons. One bone has the medullary deposit typical of hens in the laying period (Driver 1982). The presence of males, possible capons and females and the predominance of 'adult' specimens suggests that the fowl were kept for both meat and egg production. Only one bone was chopped, whereas cut-marks were quite frequent.

Most goose and duck bones were also adult-like. This suggests that these birds were also exploited for their eggs, and possibly their feathers (geese in particular). As at most contemporary and later sites, geese were more common than ducks. The meat of the former species was much more valued in medieval times than today (Grand and Delatouche 1950).

The abundance of domestic fowl, the predominance of geese over ducks, and the scarcity of juvenile birds are all consistent with what has been found at other Thetford sites (Jones G. 1984, 1993).

Wild species

Bones of wild animals were found, but not abundantly. Clearly hunting did not play an important role in the economy of Late Saxon and early medieval Thetford. Among the large game the most common species was the roe deer, with five 'countable' specimens. Red deer was also present (with one butchered proximal radius), although no 'countable' elements were found (Table 25). The roe deer remains consisted of a few postcranial bones and a fragment of antler. The absence of fallow deer (*Dama dama*), a species introduced by the Normans which spread rapidly, seems to confirm that most of the material analysed is of pre-Conquest date. The finding of two bones tentatively identified as wild boar has already been mentioned (above).

Smaller animals are represented by hare, which had been found previously at Thetford (Jones G. 1984, 1993), and the shelduck. This common and widespread large duck could easily have been caught in the wet or marshy areas that must have existed in the vicinity. Although this is the first shelduck found at Thetford, other waterfowl were previously recorded at the other sites. Perhaps more interesting is the presence of the bone of a sparrowhawk, a bird commonly used for falconry.

Although wild animals are scarce and suggest that hunting was not a very common activity, they are nevertheless interesting in highlighting a probable variation in the wealth and social status of the inhabitants of Thetford. Hunting (especially of deer) was a privilege of the aristocracy and the presence of a few deer bones suggests either that some inhabitants had hunting rights in the contiguous woodland, or that they had been granted a gift by a more powerful lord. In either case, these were not people of low status. The possibility of occasional poaching should also be considered.

Discussion and conclusions

Archaeological work on the south bank of the Little Ouse at Thetford has provided an opportunity to investigate aspects of Late Saxon and early medieval life in this important town. Since little activity occurred on the south bank after the 12th century, we have had a rare chance to investigate an urban area which has seen very little late medieval and post-medieval disturbance. The study of the animal bones from Mill Lane has been hampered slightly by the uncertainty in the dating of Period 4. However, we can be confident that the large majority of the material discussed in this report belongs to the 10th–11th centuries AD.

The results of this study are consistent with those of bone from the contemporary sites previously studied from Thetford. It is therefore possible to extend, within limits, the conclusions of our study to the town as a whole, or at least to that part of the town located south of the Little Ouse. Most of the bones studied in this report do not derive from discrete contexts that can be related to specific activities. Although this can be frustrating in any attempt to interpret the function of specific features or areas, it has the advantage of providing a general view of the use of the animals on a wider scale. For instance, the relative frequency of the main domestic animals is remarkably consistent between different areas and types of features at Mill Lane, and between different sites at Thetford. This can hardly be accidental, and we may thus be quite confident that it reflects the proportions of species exploited throughout the town.

An important point to bear in mind in our interpretation of the animal economy of Thetford is that the food supply for the town was likely to rely mainly on arable farming, as this seems to have been a general characteristic of the Late Saxon economy in East Anglia (Darby 1971, Finberg 1972). The main importance of the animals would therefore have been in support of arable farming, and traction power from oxen and manure from sheep would have been particularly important. Unfortunately we cannot quantify the extent to which meat and dairy products made a contribution to the peoples' diet. Most people would probably have had a predominantly vegetarian diet, but the social inequalities that probably existed within the town suggest that some of the wealthier inhabitants may have consumed a fair amount of meat. Beef was the most common meat, probably followed by pork and then mutton. Venison and wild boar meat would have been rare delicacies. The contribution of poultry to the diet is very difficult to assess because the frequency of all bird species may be grossly underestimated due to a recovery bias. However, even taking this into account, the relatively small amount of meat per specimen that these birds provided suggests that their contribution was probably small in comparison to that of the domestic mammals'. Similarly, the contribution of fish to the diet is difficult to assess. Marine and freshwater fishes were both consumed, with the former probably imported from the coast by river (below, *Fish bone*). The presence of this latter group indicates that some Thetford inhabitants had rights of access to the resources of local rivers. Freshwater fish was a highly valued food mainly consumed by the aristocracy, although not wholly restricted to them (Dyer 1989). As in the case of deer (above) it is also possible that freshwater fishes entered the town either as gifts or as a consequence of illicit activities.

The pig would probably have been the only domesticate primarily kept for meat. The analysis of kill-off patterns in cattle and sheep suggests that these were multi-purpose animals. A higher level of specialisation in the use of these species is more typical of later periods.

There has been considerable discussion regarding the provisioning of Saxon towns. Bourdillon (1994) and O'Connor (1994) have argued that animals were imported to *Hamwic* (Southampton) and *Eoforwic* (York) on the hoof. This assumption rests on the absence of perinatal and very young specimens, and on the presence of all parts of the body of the main domesticates in the archaeological assemblage. More recently Albarella *et al.* (1997; forthcoming) have suggested that some cattle, sheep and pigs were reared within Late Saxon Norwich, or at least in the area of the Castle Mall excavation. The bone assemblage from this last-named site, unlike those from Southampton and York, produced a few neonatal bones of the main domesticates. Neonatal cattle, sheep and pig bones were found at both Brandon Road and Mill Lane, although in very small numbers (possibly reflecting the smaller size of the assemblage) on this last site. It therefore appears that at Thetford we have a situation similar to that in Norwich, with some animals bred on site and others perhaps imported from the countryside. It is unlikely that neonatal animals would be traded for meat, unless this was to indulge aristocratic tastes (as in the case of the young kids found at Launceston Castle: Albarella and Davis 1996). A more likely scenario involves a trade in the skins of very young animals: even if the whole animal and not just the skin had been transported, however, this is more likely to have affected animals that were a few weeks old than foetal or neonatal animals.

The degree of urbanisation exhibited by Saxon and early medieval towns is not comparable to that of early modern towns. Large areas of open land must have been present within their areas, and these would have provided room for breeding and pasture of animals. The distinction between rural and urban sites was probably not as obvious as we may perceive it to be today. Consequently it may make little sense to try to establish a marked division between 'consumer' and 'producer' sites for this period.

One aspect of the zooarchaeology of Thetford that had not been explored before, and has produced interesting results at Mill Lane, is the difference in morphology between the livestock at Thetford and elsewhere. Unsurprisingly, no substantial differences in size existed between the Mill Lane animals and those from other contemporary sites in the area. However, intriguing differences are clear in the shape of the cattle and sheep at Mill Lane and at the contemporary site at Castle Mall, Norwich. Both cattle and sheep seem to have been of a more slender type at Thetford than at Norwich. Neither the archaeological nor the historical literature often mention regional variation in Saxon and early medieval livestock. Differences in size have in some cases been noted between Early and Late Saxon times (Bourdillon 1994), and in the historical literature there is the occasional reference to differences in colour between types of livestock (Trow-Smith 1957). However, we have scanty evidence for the presence of different breeds or regional types. The differences that we have noted between the Thetford and

Norwich livestock become striking if we take into account the relatively short distance (43km) between the two towns. The identification of regional types is not only of interest to our understanding of the history of livestock development but may also provide clues about the origin of the animals used on a particular site. However, the findings from Mill Lane and Castle Mall can only hint at the existence of such a difference. We need a more extended study that takes into account all of the available data from the other Thetford and Norwich sites.

Obviously this is not the only problem that needs addressing in the future. Another question is why sheep are less abundant in the archaeological record than the documents appear to indicate. To investigate this problem we need to understand how recovery biases affect the relative frequencies of different species in archaeological assemblages. Any further excavation of Late Saxon and early medieval deposits at Thetford is unlikely to provide any substantial new information unless an extended programme of wet coarse sieving is carried out. This would also improve our understanding of the role that smaller vertebrates such as birds and fish may have played in the economy of the town. Small mammals could also provide us with much-needed clues concerning the existence of different environments in different areas of the town.

Whatever further work can be done in the future, this animal bone assemblage has provided useful information on the life of the town and has contributed to our understanding of the Late Saxon and early medieval economy of Thetford, which is now one of the best known in England.

II. Fish bone

by Alison Locker

A small assemblage of fish bones and some scales was recovered from deposits of the 10th–11th centuries (Period 3) and the 11th–12th centuries (Period 4) (Table 30). The latter assemblage is smaller and less securely dated, containing some residual Period 3 material.

It is evident that the sieved deposits produced most of the fish bones, while hand-recovered bone favoured the large species. All the contexts are pit fills except for one (*4123*), an ashy demolition layer in Building C producing four herring bones and one eel bone.

The following species were identified: eel (*Anguilla anguilla*); herring (*Clupea harengus*); c.f. Pike (*Esox lucius*); Cyprinidae; cod (*Gadus morhua*); Gadidae; whiting (*Merlangius merlangus*); perch (*Perca fluviatilis*); mackerel (*Scomber scombrus*) and plaice/flounder (*Pleuronectes platessa/Platichthys flesus*).

Where feature fills were sieved both eel and herring were collected, and were evidently important food fish in both periods. Eels would have been trapped in the Little Ouse, and herrings caught in an abundant fishery prosecuted seasonally off the East Anglian coastline.

Other marine species included some large cod of 840mm, 1050mm and 1200mm total length (after Wheeler and Jones 1976), which are more common in Period 4 and may be suggestive of increased deep-water fishing. Some, at least, were brought to the sites with their heads on and may represent fresh fish. Flatfish could be caught on the coast, while whiting and mackerel were available in the North Sea. These marine species could all have been transported to Thetford by river from local coastal ports.

Freshwater species exploited include pike, perch and cyprinidae (possibly dace, *Leuciscus leuciscus*), all available in local rivers.

The species present in this small assemblage are similar to those found at other sites in Thetford, notably St Barnabas (Jones A.K.G. 1984) and Brandon Road (Jones A.K.G. 1993), which were dominated by marine species with local exploitation of eel, pike and cyprinids.

	Period 3		*Period 4*	
	Hand - collected	*Sieved*	*Hand - collected*	*Sieved*
Eel	–	27	–	6
Herring	–	38	–	17
Pike	3	3	2	–
Cyprinid	–	17	–	–
Cod	1	–	–	8
L Gadid	4	–	2	–
Whiting	1	–	–	–
Perch	1	–	–	–
Mackerel	–	6	–	–
Plaice/flo.	–	6	–	–
Total	**10**	**97**	**4**	**31**

Table 30 The fish identified in Periods 3 and 4 contexts

III. Human bone

by Sue Anderson

The remains of five individuals, consisting of two adults (one bone each), two sub-adults and one juvenile (these three articulated), were recovered during excavation. Two of the articulated skeletons (*4052* and *4293*) were found within grave cuts, while the third (*2110*) was in the backfill of another feature. Although this group is not sufficiently large to draw any conclusions about the general nature of the population from which it is derived, a few points concerning the individual skeletons can be made. It was not possible to identify the sex of the three articulated skeletons: all still showed a number of juvenile characteristics, and both sub-adults lacked the pelvis.

Ageing of two of the three skeletons was difficult due to differences in the available age-related indicators. One individual (*4052*) was probably around ten years of age (based on tooth eruption) but the lengths of the long bones suggest that s/he could have been up to five years older than this. Another (*4293*) had very heavy tooth wear in comparison with the estimated age from epiphyseal fusion and tooth eruption. In this case it is possible that fusion had been delayed for some ?pathological reason and that the individual was slightly older than the 20–23 years which has been estimated. Alternatively, this group may have been exposed to particularly abrasive foods. As tooth wear was also heavy in comparison with the age indicators (late teens or early twenties) for *2110*, the latter suggestion seems the most likely explanation.

Pathological changes were few, but this is not unusual for such a small group. The juvenile (*4052*) showed slight changes that could be indicative of iron deficiency anaemia. Enamel hypoplasia was noted in two individuals, but whether this condition is really related to disease or to malnutrition in childhood is debatable.

Skeleton *4246* had an unusual congenital or developmental anomaly which involved the separation into two halves of the first cervical vertebra (atlas) at the anterior midpoint, dividing the facet for the odontoid process of the axis. The anterior ossification centre of the atlas usually fuses at *c.* 6 years of age (Krogman 1978, 53). Osteoarthritic changes had occurred at the point where the two halves touched. Unfortunately the posterior arch was broken, so it is not known whether or not the bone was completely divided. Other than slight pain caused by inflammatory changes, it is unlikely that the condition affected this individual to any noticeable degree.

IV. Plant macrofossils and molluscs

by Peter Murphy

Introduction

To the west of Mill Lane the archaeological evidence indicated intensive activity, mainly of Late Saxon date. Features were cut into terrace sands and gravels of the River Little Ouse. Their fills were composed of re-worked sand and gravel and were all extremely well drained. Preservation of plant macrofossils was principally by charring, though some mineral-replaced material also occurred. The relatively good survival of bone and shell showed that base-rich conditions had been maintained, presumably as a result of refuse deposition, although the parent materials were leached and decalcified.

Most of the excavated fills were of relatively 'clean' sand and gravel, incorporating little domestic or other refuse. Sampling was therefore concentrated on pit fills with abundant charred material and/or bone, on features thought to relate to metalworking, and on the primary burnt fills of Buildings 1 and 2 which, it was thought, might relate to fire destruction of the buildings. Eighteen bulk samples were collected.

At Site 5761, machine trenches were cut to examine and sample wet valley sediments. The chief aim was to obtain palaeoecological data relating to land-use changes from the end of the Roman period into Anglo-Saxon times. Investigating vegetational and land-use changes in the 5th–7th centuries has recently been highlighted as a research priority for the Eastern Counties, and the need to enhance precision of radiocarbon dating by means of multiple determinations and mathematical (Bayesian) techniques has been emphasised (Murphy 1997; Murphy in Brown and Glazebrook (eds) 2000, 26 and 46). This site provided an ideal opportunity to implement these research aims, and with this aim in mind monolith samples were taken of the river valley sediments.

Methods

The bulk samples were processed in a bulk sieving/flotation tank, using 0.5mm meshes throughout. The residues were fully sorted, primarily to extract small bone. During the assessment phase, five petri dishes of flot from each sample were scanned under a binocular microscope at low power, noting the presence of charred and mineral-replaced plant macrofossils and other materials. Following assessment, eight samples including relatively large and potentially interpretable plant macrofossil assemblages were selected for analysis. The flots, or sub-samples of them, were sorted under a binocular microscope and material extracted was identified by comparison with modern reference specimens. Results are given in Table 31. Nomenclature follows Stace (1991), Kerney and Cameron (1979) and Kerney (1975). All samples included at least some intrusive modern material: roots, fruits and seeds (mainly of Chenopodiaceae, *Fumaria officinalis* and *Sambucus nigra*) and arthropods.

The monolith sample was sub-divided at appropriate vertical intervals, mostly 5cm, providing sub-samples of *c*. 500cm^3. Macrofossils were extracted from these sub-samples following the methods of Kenward *et al.* (1980). Results are presented in Table 32.

Results from archaeological features

Results from assessment of the bulk sample flots have been given in a separate report (site archive), but a brief summary will be given here, together with the results from analysis.

Two fills of Building C were examined (contexts *4123*, *4124*). The excavator thought that these samples might include charred thatch and/or constructional wood from destruction of the building by fire. The flots contained small amounts of charcoal, charred hawthorn fruitstones (*Crataegus monogyna*) and hazel nutshell (*Corylus avellana*), besides some burnt mollusc shells including those of *Carychium* sp. and *Discus rotundatus*. Siliceous concretions were noted, suggesting that burning occurred in well-oxygenated conditions, so that any remains of thatch or flooring materials had burnt to ash, and only the most durable macrofossils had survived in a charred form. For this reason, no analysis was undertaken.

Five deposits thought to relate to Late Saxon metalworking were examined (*4002* Hearth D; *4004* Hearth A; *1019* Period 4 pit *1024*; *2100* Period 4 pit 2109; *1148* Period 3 pit *1149*: samples 102, 103, 110, 113, 117). Most of these samples included abundant charcoal, including ericaceous stems (heathers) and metal/slag residues. Charred cereal grains were consistently present, and in samples 110 and 117 were common, implying that the latter two deposits, at least, were related in part to cereal processing (Table 31). Sample 110 produced relatively abundant charred grains of oats, with some associated florets of the common oat (*Avena sativa*). Other cereal remains included a barley grain (*Hordeum* sp.) and rye rachis nodes (*Secale cereale*). Weed seeds were uncommon, apart from large grass caryopses, indicating that a cleaned batch of oats, with some contaminants, was represented. Most of the oat grains and the barley grain had germinated before charring. Sample 117 included smaller amounts of cereals, including oats, rye and bread-type wheat (*Triticum aestivum* s.l.), with hazel nutshell, an elder seed (*Sambucus nigra*) and some weed seeds. In addition to ericaceous stems, both samples also produced capsules of ling (*Calluna vulgaris*), indicating the use of heathers as fuel. Palynology (below, *Pollen*) demonstrates high percentages of Ericales pollen (heathers *etc*.) throughout the adjacent peat sequence, and it is plain that local heathland vegetation was exploited as a fuel source.

An assemblage of charred germinated oats with some barley and traces of other cereals also came from a Late Saxon pit fill (*9074* Period 4 pit *9075*, sample 115), and it is very similar in composition to the sample from sample 110 (Table 31). Both samples are thought to represent charred malt. Charred deposits of germinated oats and/or barley have been reported from other Late Saxon/early medieval sites in Eastern England (*e.g.* Buttermarket, Ipswich (Murphy 1991), Flaxengate, Lincoln (Moffett 1996)). The Buttermarket deposits, from a burnt early medieval cellar, are confidently interpreted as an oats/barley malt intended for brewing, and the material from Flaxengate can probably be similarly interpreted. Charred assemblages from medieval malting kilns in Norfolk at Alms Lane, Norwich (Murphy 1985) and Redcastle Furze, Thetford (Murphy 1995) indicate that by about the 14th century barley had become the main cereal used for malting. It is interesting to note that at Alms Lane, as at Mill Lane, malt drying was undertaken at the same site and at the same time as metalworking. Although these processes are obviously different in terms of technology and the temperatures required, they both require fuel and water, so the location of such small-scale industries at the same site is understandable.

The flots from other pit fills included variable amounts of charcoal, with some ericaceous stems, charred cereals and weed seeds. Sample 100 (*6004*, Period 3 pit *6002*) included a well-preserved assemblage of charred heather remains, large Poaceae culms, rare cereal and pulse remains, and abundant charred fruits/seeds (including weed and grassland species, as well as water plantain *Alisma plantago-aquatica*). Burnt mollusc shells, comprising terrestrial, marsh and freshwater

species, were associated. Interpretation is problematic, though a mixed assemblage of charred residues of plant material derived from valley floor vegetation, heathland and crop waste is plainly represented. This might have been derived from fuel, thatching or flooring materials.

In other pit fills (*1179*, Period 3 pit *1160*; *1021*, Period 3 pit *1025*; *9027*, Period 4 pit *9028*: samples 107, 109, 112) charred cereals were more abundant, and remains of pulses were present (Fabaceae indet.). The latter context also produced charred remains of hazel, sloe (*Prunus spinosa*), bramble/raspberry (*Rubus* sp.) and elder. Weed seeds were relatively uncommon. Charred residues from domestic food preparation and consumption appear to be indicated.

Mineral-replaced seeds were noted in sample 109 (*1021*), and scraps of avian eggshell, fish and other bones, mineralised faecal concretions and mineral-replaced arthropods were observed. Although the basal fill could not be excavated and sampled, for safety reasons, it seems probable that this feature was a latrine pit. The primary fill of a chalk-lined feature (context *1011*, Period 5 pit *1012*: sample 101) produced only a small flot including charcoal, a few cereal grain fragments and a shell of *Succinea* sp. It was not analysed.

The valley sediments

About 1m of coarse dark sand with flint pebbles overlapped peat. This deposit was thought to represent slope-wash and mass movement of sandy soil from the adjacent terrace caused by intense human activity, probably of Late Saxon and later date, relating to development of the town.

The contact with the subjacent peat was sharp but the peat itself was initially undated, and on site it was therefore unclear at first to what extent its study would be relevant to the objectives of the project. However, an initial indication of date was provided by a sherd of 1st–2nd century Roman samian ware found in the peat at +9.69m OD (about 33cm in the monolith sample). The sherd was fresh, with sharp unabraded edges; it provided a *terminus post quem* at least for the peat at this level, and probably a reliable date for it. The top of the peat at this point evidently dated to between the early Roman and Late Saxon periods. A 50 x 10 x 10cm monolith for macrofossil analysis was collected across the peat/sand contact, with its top at +9.97m OD, parallel to three 25cm sampling boxes (below, *Pollen*) collected for pollen analysis and radiocarbon dating.

The 50cm monolith showed the following deposits:

0–11cm	Dark greyish-brown sand with sub-angular and rounded flints up to 45mm; 'clean' brown sand lens up to 10mm thick near base; sharp boundary.
11–14cm	Dark greyish-brown organic mud; occasional shell fragments; thin (4mm) paler clay lens near base; sharp boundary.
14–50cm	Very dark brown peat.

The trench sides were unstable and the trial pit was rapidly filling with water at the time of the study. For reasons of safety it was not possible to examine deeper sediments, though the peat depth certainly continued for at least 1m more.

A primary aim of sampling this sediment sequence, within the context of the project, was to investigate local vegetational and land-use changes in the period leading up to, and associated with, the establishment of the town of Thetford. In addition, a key research question in East Anglia is the extent of woodland regeneration occurring in the post-Roman period: this has clear implications in terms of the continuity or otherwise of land-use during the 5th century (Murphy 1997; Murphy in Brown and Glazebrook 2000, 26 and 46). This question is best addressed by identifying sediments of appropriate date at numerous sites and focusing analytical resources on them, rather than dissipating resources on analysis of long sediment sequences at a smaller number of sites. The section at Mill Lane is therefore not simply of local interest, but contributes to addressing a wider research question.

Pollen analysis of the sediments (below) provides data on local, extra-local and regional vegetation. Macrofossils would have had a more restricted catchment, and can be taken to indicate vegetation and land-use in the immediate vicinity (Table 32). The following account relates only to this local catchment.

The most striking feature of the macrofossil assemblages from the peat at 14–50cm is their consistency (though macrofossil densities in the peats were lower than had been anticipated and the counts obtained are not as large as might be wished). There is, however, no real evidence for any local vegetation changes at all. Despite the valley location of the site, no remains of alder (*Alnus glutinosa*) or willows (*Salix* spp), which are frequently common in East Anglian valley peats, were noted.

The results indicate consistently open conditions on the floodplain, with vegetation of mire and swamp plants such as sedges (*Carex* spp), spike-rush (*Eleocharis* sp), marsh pennywort (*Hydrocotyle vulgaris*), yellow flag (*Iris pseudacorus*), rushes (*Juncus* spp), gipsywort (*Lycopus europaeus*), mint (probably water mint *Mentha* sp.), lesser spearwort (*Ranunculus flammula*) and celery-leaved crowfoot (*Ranunculus sceleratus*). Macrofossils of aquatic plants, including stoneworts (Charophyta), duckweed (*Lemna* sp.) and water crowfoot (*Ranunculus* subg. *Batrachium*), were rare: they may indicate pools on the floodplain surface or overbank flooding from the river. Weed and grassland vegetation was present on the adjacent terrace, and the only scrub species — sparsely represented — was elder (*Sambucus nigra*). The implication in terms of land-use is that open floodplain vegetation was maintained locally, and the establishment of trees and shrubs was prevented throughout this period, presumably by grazing. There is no evidence for any phase of site abandonment and development of valley-floor woodland. Despite the valley location of the site, no remains of alder (*Alnus glutinosa*) or willows (*Salix* spp), which are frequently common in East Anglian valley peats, were noted at this level. Greig (p.106, below) did note a single alder fruit from lower in the sequence, at 74cm, but this is of Bronze Age date.

Although small amounts of charcoal were present throughout, charred cereal remains were noted in the peat only at 30–35cm. They were not well preserved, but included a very fragmentary charred glume base, probably of spelt (*Triticum spelta*). The Posterior Density Estimate of *cal AD 50–330 (at 95% confidence)* for peat at 30–31cm (below, *Radiocarbon dating*; Table 36), together with the freshly fractured sherd of samian ware at 33cm, make it plain that Roman cultural material was being introduced into the peat at this depth, presumably from a nearby settlement.

The sediments above 14cm were more minerogenic (organic mud at 11–14cm, sand at 0–11cm), implying increased local soil disturbance and inwash. The change in sedimentation is likely to have related to the establishment of the town of Thetford. The sediments were also calcareous, including a few shells of the freshwater molluscs *Bithynia* sp. and *Valvata* sp. Plant macrofossils were sparser, perhaps due to fluctuating water levels resulting in microbial degradation of plant material — particularly at 0–11cm, where the commonest macrofossils were the very durable seeds of elder (*Sambucus nigra*).

The sample at 11–14cm did, however, include seeds and capsule fragments of flax (*Linum usitatissimum*). Given the location of the site, in a river valley, these macrofossils are probably related to the cultivation and/or retting of fibre crops, as at Staunch Meadow, Brandon, where flax seeds, capsules and stem waste were found in valley floor peats of Middle Saxon date (Carr *et al*. 1988). These remains of flax came from immediately below a sample of fruits of *Raphanus raphanistrum* that was submitted for radiocarbon dating (OxA-8376; 770±55 BP; cal AD 1160–1380: Table 36), but above a sample dated to cal AD 780–1030 (OxA-8377; 1095±55BP: Table 36). The former date is believed to be unreliable (see above), but it is reasonable to suppose that the flax remains related to Late Saxon fibre production.

Sample no.	*100*	*107*	*109*	*110*	*112*	*114*	*115*	*117*
Context no.	*6004*	*1179*	*1021*	*1019*	*9027*	*3033*	*9074*	*1148*
Context type	*Pit*	*Pit*	*Pit*	*Metalwork-ing feature?*	*Grave-like cut*	*Pit*	*Pit*	*'Feature'*
Cereals								
Avena sp. (ca)	7	1	128	86*	-	7	105*	2
Avena sp.(flo)	-	-	-	-	-	-	3	-
Avena sp. (fb)	2	-	-	3	-	-	5	-
Avena sp. (awn)	x	x	-	-	-	-	x	x
Avena sativa L. (flo)	-	-	-	5	-	-	-	-
Avena sativa L. (fb)	-	-	-	3	-	-	3	-
Hordeum sp. (ca)	-	4	4	1*	4	9	14*	-
Hordeum sp. (rn)	-	-	-	-	-	1	-	-
Secale cereale L. (ca)	2	36	7	-	3	9	3	28
Secale cereale L. (rn)	7	37	2	3	-	3	-	7
Triticum sp. (ca)	-	2	2	2	32	-	29	3
Cereal indet. (ca)	1	53	21	10	19	8	3	16
Cereal/large grass (cn)	4	3	-	-	-	1	-	-
Pulses								
Fabaceae indet.	1	-	-	-	-	-	-	-
Fabaceae indet. (co)	-	-	2	1	-	-	-	-
Fabaceae indet. (co fr)	-	4	-	-	-	-	-	-
Vicia/*Pisum* sp.	-	-	-	-	-	1	-	-
Nutshells/fruitstones								
Corylus avellana L.	x	x	x	x	x	x	x	x
Prunus spinosa L.	-	-	-	-	1	-	-	-
Rubus sp.	-	-	-	-	1	-	-	-
Sambucus nigra L.	-	-	-	-	2	-	-	1
Herbs (weeds/grassland)								
Agrostemma githago L.	1	4	-	-	1	-	-	-
Anthemis cotula L.	2	-	-	-	-	-	-	-
Atriplex patula/*hastata*	2	-	-	-	-	-	-	-
Bromus mollis/*secalinus*	3	-	-	1	2	-	5	1
Bromus/*Avena* sp.	2	-	-	-	-	-	-	-
Carex sp. (bifacial)	-	-	-	-	6	-	-	-
Carex sp. (large, trigonous)	7	-	-	-	-	-	-	-
Carex sp. (small, trigonous)	2	1	-	-	-	-	-	-
Centaurea sp.	2	-	-	1	-	-	-	-
Chenopodium album L.	11	-	3	-	9	1	2	-
Chenopodiaceae indet.	-	-	-	2	-	-	-	-
Cyperaceae indet. (si sk)	-	-	-	-	-	2	-	-
Fallopia convolvulus (L.) A. Love	7	3	1	-	6	-	2	-
Galium sp.	-	1	-	-	-	-	-	-
Lapsana communis L.	-	-	-	-	-	-	1	-
Lithospermum arvense L.	1	-	-	-	-	-	-	-
Lolium-type	-	-	-	17	-	-	14	-
Malva sp.	17	-	-	2	-	-	-	-
Medicago/*Trifolium*/Lotus type	-	-	-	-	-	-	-	1
Montia fontana subsp. minor Hayw.	-	1	-	-	-	-	-	-
Persicaria sp.	1	-	-	-	1	-	-	-
Poaceae indet. (small)	63	2	-	-	-	-	-	-
Poaceae indet. (large)	-	-	-	-	-	8	-	4
Polygonum aviculare L.	2	-	-	-	-	-	1	-
Prunella vulgaris L.	2	-	-	-	-	-	-	-
Raphanus raphanistrum L.	-	1	-	-	-	-	-	-
Reseda sp.	2	1	-	2	-	-	-	-
Rumex acetosella L.	-	1	1	-	-	-	-	2
Rumex sp.	13	1	-	-	-	-	-	-
Sherardia arvensis L.	3	-	-	-	-	-	-	-
Silene sp.	-	-	-	-	-	-	-	1
Solanum nigrum L.	5	-	-	-	cf 18	-	-	-
Spergula arvensis L.	-	-	-	1	-	-	-	2
Stellaria graminea/*palustris*	1	-	-	-	-	-	-	-
Stellaria media-type	180	-	-	-	56	-	-	-
Tripleurospermum inodorum (L.) Schultz-Bip.	1	-	-	1	-	-	-	-
Vicia/*Lathyrus* sp.	-	-1	-	2co/1s	2	-	1co/1s	1

Sample no.	*100*	*107*	*109*	*110*	*112*	*114*	*115*	*117*
Context no.	*6004*	*1179*	*1021*	*1019*	*9027*	*3033*	*9074*	*1148*
Context type	*Pit*	*Pit*	*Pit*	*Metalwork-ing feature?*	*Grave-like cut*	*Pit*	*Pit*	*'Feature'*
Heathland species								
Calluna vulgaris (L.) Hull. (flo/sht)	x	xx	x	x	-	-	-	x
Ericaceae indet. (stems)	xxx	xx	x	xx	x	xx	x	x
Aquatic								
Alisma plantago-aquatica L.	2	-	-	-	-	-	-	-
Mineral-replaced plant remains								
Indeterminate seeds	-	2	11	1	-	-	-	1
Chenopodicaeae indet.	-	-	1	-	-	-	-	-
Lamiaceae indet.	-	-	-	-	1	-	-	-
Lithospermum sp.	-	-	2	-	-	-	-	-
Poaceae indet.	-	-	2	-	-	-	-	-
Raphanus raphanistrum L.	-	-	1	-	-	-	-	-
Stems	-	-	x	-	-	-	-	-
Other charred plant material								
Charcoal <2mm	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx
Charcoal >2mm	xx	xx	x	xxx	x	xx	x	xx
Charred root/stem/rhizome	xx	xxx	x	x	x	x	x	x
Indet. inflorescence frags.	x	-	-	-	-	-	x	-
Indet. seeds	17	13	2	2	24	5	5	1
Molluscs								
Anisus vortex (L.)	-	-	-	-	-	-	1	-
Bithynia sp.	-	-	-	-	-	-	1	-
Carychium sp.	1	-	-	-	-	-	-	-
Cecilioides acicula L.	x	x	x	x	x	x	x	x
Helicella itala L.	-	-	-	-	-	-	1	-
Lauria cylindracea da Costa	1	-	-	-	-	-	-	-
Pupilla muscorum (L.)	1	-	-	-	-	-	-	2
Succineidae indet.	3	-	-	-	-	-	-	-
Trichia hispida group	-	4	-	1	-	-	-	1
Vallonia costata Mueller	-	-	1	-	-	-	-	-
Valvata cristata Mueller	1	-	-	-	-	-	-	-
Vertigo substriata (Jeffreys)	-	-	-	-	-	-	-	1
Other microfossils and animal remains								
Foraminifera	-	-	x	-	-	-	-	-
Ostracods	-	-	x	-	-	-	-	-
Avian eggshell	x	-	x	-	-	-	-	-
Fish bones	-	-	xx	x	-	xx	x	xx
Bone fragments	-	-	x	x	x	x	x	x
Mineral-replaced concretions	-	-	x	-	-	-	-	-
Mineral-replaced arthropods	-	-	x	x	-	-	-	-
Other								
Black porous 'cokey' material	-	-	x	-	xx	x	x	-
Tarrry droplets	x	-	-	x	x	-	-	-
Hammer scale	-	-	-	-	-	x	-	-
?Metallic residue	-	-	-	-	x	-	-	-
Metallic globules	-	-	-	x	-	xx	x	x
Siliceous globules	-	x	x	-	-	-	-	-
Slag	-	-	-	-	-	x	-	-
Small coal fragments	x	-	x	-x	-	x	x	-
Vitrified material	x	-	-	xx	x	x	-	-
Sample volume (litres)	**15**	**30**	**30**	**10**	**15**	**30**	**30**	**30**
Flot volume (litres)	**0.2**	**0.5**	**0.7**	**0.8**	**0.1**	**0.5**	**0.3**	**0.7**
% flot sorted.	**12.5**	**50**	**25**	**50**	**50**	**50**	**25**	**50**

Plant taxa are represented by fruits or seeds, except where indicated. Preservation was by charring, again except where indicated.
Germinated (sprouted) cereal grains are indicated by an asterisk.
Abbreviations: ca – caryopsis; cap – capsule; cn – culm nodes; co – cotyledons; fb – floret bases; flo – florets including grains; fr – fragments; gb – glume base; oo – oogonia; rn – rachis nodes; seg – segment; sht – shoots; si sk – silica skeletons.

Table 31 Plant macrofossils from archaeological features

Depth (cm)	*0–11*	*11–14*	*14–20*	*20–25*	*25–30*	*30–35*	*35–40*	*40–45*	*45–50*
Crop plants									
Cereal indet. (ca, ch)	1	-	-	-	-	1	-	-	-
Hordeum sp. (ca, ch)	-	-	-	-	-	1	-	-	-
Linum usitatissimum L. (s)	-	2	-	-	-	-	-	-	-
Linum usitatissimum L. (cap seg)	-	9	-	-	-	-	-	-	-
Triticum sp. (ca. ch)	-	-	-	-	-	1	-	-	-
Triticum sp. (gb, ch)	-	-	-	-	-	1	-	-	-
Herbs (weeds/grassland)									
Brassica sp.	1	-	-	-	-	-	-	-	-
Chenopodiaceae indet..	-	1	-	-	2	-	-	-	-
Chenopodium album L.	1	-	-	-	-	-	-	-	-
Cirsium/Carduus sp.	-	-	-	-	-	-	-	1	-
Persicaria lapathifolia (L.) Gray	1	-	-	-	-	-	-	-	-
Persicaria sp.	-	-	2	1	1	-	-	-	-
Poaceae indet.	-	-	-	-	-	-	1	3	1
Potentilla anserina L.	-	-	2	3	1	-	-	-	-
Potentilla erecta (L.) Rausch	-	-	5	8	20	-	-	-	-
Ranunculus acris/repens/bulbosus	-	-	-	4	13	2	1	6	2
Ranunculus sp.	1	-	7	-	-	-	-	-	-
Raphanus raphanistrum L.	-	-	-	-	-	1	-	-	-
Rumex acetosella L.	-	-	-	-	-	-	2	12	1
Rumex sp. (ch)	-	-	-	-	-	1	-	-	-
Urtica dioica L.	1	5	17	8	5	1	3	5	7
Wetland and aquatic plants									
Apium sp.	-	-	-	1	-	-	-	-	-
Carex sp. (bifacial)	-	-	2	7	4	-	-	-	-
Carex sp. (trifacial)	-	-	-	-	-	4	-	-	-
Charophyta (oo)	1	2	4	-	-	-	-	-	-
Eleocharis palustris/uniglumis	-	-	3	15	18	4	12	1	3
Hydrocotyle vulgaris L.	-	-	7	10	25	25	-	-	1
Iris pseudacorus L.	-	-	-	1	1	-	-	-	-
Juncus spp.	-	5	41	18	19	12	68	69	12
Lemna sp.	-	1	-	-	-	-	-	-	-
Lycopus europaeus L.	-	-	1	-	-	-	-	-	-
Mentha sp.	-	-	9	2	12	16	29	16	29
Ranunculus flammula L.	-	-	2	18	32	7	-	-	-
Ranunculus sceleratus L.	-	3	-	1	1	-	-1	27	4
Ranunculus subg. *Batrachium*	-	-	-	-	-	-	-	4	1
Trees/shrubs									
Sambucus nigra L.	26	6	1	4	1	-	-	-	-
Other plant macrofossils									
Twigs	-	-	-	x	-	-	-	-	-
Charcoal	x	x	x	x	x	x	x	x	x
Indeterminate seeds *etc*.	-	2	18	11	3	10	1	3	3/1(ch)
Molluscs	-	-	-	-	-	-	-	-	-
Bithynia sp.	-	1	-	-	-	-	-	-	-
Valvata sp.	-	1	-	-	-	-	-	-	-

Plant taxa are represented by fruits or seeds except where indicated.
Abbreviations: ca – caryopsis; cap seg – capsule segment; ch – charred; gb – glume base; oo – oogonia; s – seed.

Table 32 Plant macrofossils from valley sediment

V. Pollen

by James Grieg
(Figs 48 and 49)

Methods

A 75cm sample in three 25cm boxes was taken going from the top of the peat where it was merging with the sandy topsoil (9.97m OD), down to the deepest point that could be reached in the flooding pit. A further *c*. 250cm thickness of peat was seen but could not be sampled, and the base of the peat layer was not reached. When the monolith boxes were dug away, a sherd of Roman samian ware was revealed at 9.69m OD (*c*. 33cm on the pollen diagram: Fig. 48).

Pollen sub-samples at intervals of 0.5cm were collected from the top two sample boxes, thought to cover the Saxon period (0–25cm and 25–50cm: 100 samples), before the radiocarbon material was taken (below, *Radiocarbon dates*), which removed all the remaining organic material in some cases.

The peaty material was gently broken down by rubbing between fingers, in warm water. The slurry was washed over from a 2-litre beaker to separate the sand from the organic material. The latter was then sieved on a 300µ mesh to remove fine organic material, and sorted in water using a PZO microscope. The organic material sorted was a) charcoal fragments, which were present in all samples, and b) seeds of non-aquatic plants. The findings have been listed in Table 33, together with some other observations about each sample.

From the monolith boxes, sub-samples were prepared for pollen analysis by fine filtration to remove small particles and swirling to remove sand, acetolysed, stained and mounted in glycerol jelly, according to standard methods (Fægri and Iversen 1989). Moderate counts of 99–290 land pollen grains were made per sample, identifications being checked against the writer's comprehensive reference collection and with the use of the standard literature (Andrew 1984, Fægri and Iversen 1989). Pollen has been listed, with nomenclature according to Bennett (1994).

Dating

Nine samples of identified plant remains were dated at the Oxford Radiocarbon Accelerator Unit in 1999, (below, *Radiocarbon dating*). The dating resolution is roughly 4cm/century, or about 62 years between samples spaced at 2.5cm.

Plant macrofossils extracted for potential radiocarbon dating are listed in Table 34. Macrofossils of non-aquatic species were submitted. The vegetation indicated by the seed floras contains only one truly aquatic plant, *Ranunculus* subg. *Batrachium* (water crowfoot). There are, however, numbers of mire and swamp plants which may well have grown on the spot or close by, such as *Ranunculus sceleratus* (celery-leaved water crowfoot), *R. flammula* (lesser spearwort), *Persicaria minor* (small water-pepper), *Hydrocotyle vulgari*s (marsh pennywort), *Mentha* sp. (probably *M. aquatica*, water mint), *Eleocharis* sp. (spike-rush), *Schoenoplectus* (club-rush), Carices (sedges) and *Glyceria* (sweet-grass). These may represent either local swamp vegetation or that which grew along the banks of the Little Ouse, which could have been washed into the forming peat during times of flooding.

The closeness of the dry landscape to the peat beds is shown by the presence of a number of plants of relatively dry land, which include *Ranunculus acris/repens/bulbosus* (buttercups), *Alnus glutinosa* (alder), *Urtica dioica* (nettle), *Chenopodium* sp. (goosefoot), *Raphanus raphanistrum* (wild radish), *Potentilla erecta* (tormentil) and *Prunella vulgaris* (self-heal). Charred cereal grains were found at 30cm.

The range of taxa closely matches that obtained by Murphy (above, *Plant macrofossils*), although there are some differences with respect to species occurring at low frequencies.

Pollen

(Fig. 48)

The pollen diagram (Fig. 48) has been drawn up using the *TILIA* programme (Grimm 1990, 1991). It shows, in black, the pollen curves of taxa that were included in the pollen sum: trees, shrubs and herbs mainly of dry land.

Sample depth (cm)	*Sample no. THD*	*Description*
0–1	0	Humified peat with a little sand. A little charcoal present. A water snail present, so somewhat calcareous. Slag particles noted. Seeds and charcoal sampled for radiocarbon dating.
5–6	5	Humified peat with a little sand; some charcoal present. Seeds and charcoal sampled for radiocarbon dating.
10–11	10	Humified peat with a little sand. Large number of *Raphanus* seeds collected for dating.
15–16	15	Humified peat with a little sand, and calcium carbonate. Some mollusc fragments. Small fragment of red brick or pot noticed. Seeds and charcoal sampled for dating.
20–21	20	Humified peat with a little sand; small amounts of charcoal including grass seed, as if from a bonfire. Seeds and charcoal collected for dating.
30–31	30	Humified peat with a little sand, some charcoal. A relatively large seed flora, some of which were charred. Just below this, at 33cm, a piece of Samian ware in the section provided a *terminus post quem* indication that this must be Roman period or later.
45–46	45	Humified peat with a little sand, with only a few flecks of charcoal. A reasonable seed flora.
60–61	60	Humified peat with some wood including little twigs. The rest of the wood looked as it could have been from roots; these were considered unsuitable for dating and therefore not collected. Plenty of seeds, which were collected for dating, but those of *Ranunculus* subg. *Batrachium* (water crowfoot) were not collected in case this aquatic plant had used dead carbonate in the water for photosynthesis, which would lead to a dating offset of unknown magnitude.
74–75	75	Humified peat with a little sand and some small chalk particles. Seeds and charcoal were collected for radiocarbon dating.

Table 33 Description of organic materials present in pollen sample

These black curves are exaggerated 5x in stippled curves to show up some small changes more clearly. The open curves show the percentages of taxa excluded from the pollen sum, mainly local flora of aquatic and wetland plants, and fern spores. These were left out of the pollen sum so that fluctuations in this mainly local wetland pollen do not obscure changes happening in the pollen from the (occupied) dry land. The pollen has been grouped into recognisable vegetation groups where possible, to aid interpretation.

Although it is usual to divide pollen diagrams into zones of similar pollen spectra, the changes in this diagram are quite subtle. Therefore, the general interpretation is discussed first, followed by a section on changes with time.

The results are discussed below in the following order: evidence of trees; woodland and scrub; heath; arable land and crops; grasslands; swamp and aquatic vegetation.

Trees and shrubs, woodland and carr

There is a moderate amount of tree and shrub pollen throughout the sequence. It seems to represent a number of different kinds of woodland. The sandy land of the Breckland was mainly wooded with *Quercus* (oak), *Corylus* (hazel) and *Betula* (birch) (Peglar 1992): this is probably why these are well represented, while *Tilia* (lime) and *Ulmus* (elm) which grow more on clay or loess soils are visible only as a trace, mainly at the beginning of the sequence.

At the time of the beginning of the sequence in the Bronze Age (1320–1040 cal. BC) tree pollen is around 40%, suggesting that human activities had already had a considerable effect in reducing the local wildwood. Other perhaps more secondary or managed woods with *Fraxinus* (ash) probably existed. *Quercus* (oak) and *Alnus* (alder) together with *Salix* (willow) probably also grew as carr along the river valley, and this woodland was often the last to be cleared, but the best represented in pollen diagrams from such sites. *Sambucus nigra* (elder) was probably local as well, as its seeds and those of alder were present among the macrofossils (Table 34). Other, secondary, woods contained *Fagus* (beech), while *Pinus* (pine) and *Betula* (birch) could have been present in various woods, as well as on heathland.

Heathland

Ericales (heathers) pollen percentages are substantial throughout most of the diagram, indicating the presence of local heathland and/or the bringing in to the site of heather. There were no heather macrofossils in the peat, so there was probably no heathland vegetation in the immediate surroundings of the valley mire. However, heather remains were found in the archaeological samples from the excavated site in Mill Lane and at other sites in Thetford (Fryer and Murphy 1999; Murphy 1998), so heather was being used nearby. There are plenty of indications of recent extensive heathland around Thetford in the form of place-names, so the pollen record is as expected. Heath develops as a result of grazing on rather poor sandy soil, and heathers spread because they can survive these conditions relatively well, so this record shows changes to the amount of grazed heath. If it is not grazed, heathland gradually reverts to woodland.

Farmed land

Some arable and other open land is shown by a small continuous Cerealia-type pollen record, which represents mostly cereals except rye. *Secale* type (rye) was present in the upper levels. Cereal pollen could have come either from growing crops in the land around Thetford or have been distributed by the storage, processing and use of cereal products on the site. In any case, cereals represent human activity. Further cultivated plants are recorded in a macrofossil find of possible *Triticum* (wheat) and of *Brassica* sp. (mustards *etc*.: Table 34), and of *Linum usitatissimum* (flax: Table 32) macrofossils. The absence of flax from the pollen record could be due to the fact that it is a very low pollen producer. Weeds of cultivated land such as Caryophyllaceae (chickweeds *etc*.), Chenopodiaceae (goosefoot *etc*.), *Rumex* (docks and sorrels), Brassicaceae (crucifers, including wild radish, below), *Artemisia* (mugwort), *Aster*-t (daisies *etc*.) and *Anthemis*-t (mayweeds *etc*.) are recorded in small pollen records. These pollen types generally increase and decrease together with the cereals, providing evidence that they come from plants of similar habitats, and most of them are well-known indicators of cultivated or fallow land (Behre 1981). Further evidence of the exact identity of some of them comes from the seed finds of weeds of cultivated ground from the same groups as some of the pollen types, such as *Chenopodium* sp. (goosefoot) (Chenopodiaceae), *Rumex acetosella* (sheep's sorrel) (*Rumex*) and *Raphanus raphanistru*m (wild radish) (Brassicaceae). The macrofossil evidence confirms the pollen record and shows — since seeds travel less far than pollen — that at least some crops and their weeds grew or were processed close to the mire.

Meadow and pasture, grazing land, fallow land

Grassland is indicated by a number of pollen records of characteristic grassland plants such as *Centaurea nigra* (knapweed), *Lotus* (bird's-foot trefoil), *Trifolium pratense* (red clover), *Plantago lanceolata* (ribwort plantain), *Ranunculus* type (buttercups *etc*.) and *Potentilla* type (cinquefoils, includes tormentil: see below). The large amounts of Cichorioidae pollen (includes hawkweeds, dandelions *etc*.) as well as Poaceae (grasses) may also represent grassland, as well as some other habitats. Macrofossils of *Ranunculus* sect *Ranunculus*, (which includes meadow buttercups), *Potentilla erecta* (tormentil) and *Prunella vulgaris* (self-heal) also probably represent grassland of various kinds. Some of the other herbs in the pollen diagram may also represent grassland, as well as a range of other habitats.

There are some records indicating calcareous grassland, such as *Centaurea scabiosa* (greater knapweed) and *Sanguisorba minor* (lesser burnet). The local substrate is of sands and gravels, and it is thought that bone survived well on the archaeological site because rubbish had raised the pH sufficiently. Perhaps there was some base-rich material scattered about to provide a niche for this element of the flora.

Fallow land was probably part of the farming practice during the time covered by the study, and may be represented partly by various weeds and partly by grassland plants (Behre 1981).

Damp ground

A number of the pollen records represent herbs of rather damp land, especially when the corresponding macrofossil records provide further ecological indications. Caryophyllaceae (*Stellaria graminea/palustris* stitchwort), Brassicaceae (*cf. Rorippa* sp., yellow-cress), Apiaceae (*Apium cf. inundatum*), *Mentha* tp. *(Mentha* sp., mint) and *Persicaria maculosa* type (*P. minor*, *P. persicaria*), as well as those represented by pollen records alone, including *Lythrum* (loosestrife), *Filipendula* (meadowsweet), *Persicaria bistorta* (bistort), and those with macrofossil records alone, such as *Hypericum* sp. (St John's wort) and *Lycopus europaeus* (gypsywort).

Wetland and aquatic plants; riverside vegetation

Wetland herbs and aquatic plants include a large Cyperaceae record at 50% (not in the pollen sum), which corresponds to macrofossil finds of various species of *Carex* (sedge) and *Eleocharis* (spike-rush) and a range of wetland and aquatic taxa part of the local swamp plant community which grew on the spot, such as *Sparganium* (bur-reed), and *Typha latifolia*. Some of the Poaceae (grass) pollen, such as the *Glyceria* (sweet-grass) recorded among the macrofossils, probably originated from local swamp vegetation. The wetland and swamp vegetation of the deposit as it formed is likely to be the best represented in the results, yet archaeologically it is the least interesting part of the deposit.

Spores

There are slight records of *Polypodium* (polypody) and *Pteridium* (bracken) throughout the sequence. The latter may represent the grassland and heathland aspects of the landscape indicated by the pollen.

Parasite ova

Ova of the intestinal parasite *Trichuris* were seen in some samples. Although these worms infest animals as well as humans, the presence of ova suggests contamination with sewage. This provides further evidence of human activity in the locality.

Sample depth (cm)	*1*	*5*	*10*	*15*	*20*	*30*	*45*	*60*	*74*	
Sample no.	*0*	*5*	*10*	*15*	*20*	*30*	*45*	*60*	*75*	
Ranunculus	-	-	-	-	-	2	1	2	3	buttercup
Ranunculus flammula L.	-	-	-	-	3	7	-	-	-	lsr spearwort
Ranunculus sceleratus L.	-	-	-	-	-	-	21	9	3	crowfoot
R. subg. *Batrachium*	-	-	-	-	-	-	-	9	-	water crowfoot
Urtica dioica L.	-	-	-	-	3	-	24	-	-	nettle
Alnus glutinosa (L.) Gaertner	-	-	-	-	-	-	-	-	1	alder
Chenopodium sp.	1	-	-	-	-	-	2	-	3	fat hen
cf. *Montia*										
Fontana ssp. minor Hayw.	-	-	-	-	-	-	-	-	+	blinks
Stellaria graminea/palustris	-	-	-	-	-	-	-	1	-	stitchwort
Persicaria cf.*minor* (Hudson) Opiz	-	-	-	-	1	-	3	-	1	persicaria
Rumex acetosella L.	-	-	-	-	-	-	-	-	1	sheep's sorrel
Rumex sp.	-	-	-	-	-	1*	-	-	2*	dock
Hypericum sp.	-	-	-	-	-	-	-	1	-	St John's wort
Brassica sp.	-	-	1	-	-	-	-	-	-	cabbages *etc*.
Raphanus raphanistrum L.	-	-	28	-	-	1*	-	-	-	wild radish
cf. *Rorippa* sp.	-	-	1	-	-	-	-	1	-	?yellow-cress
Potentilla erecta (L.) Räusch	-	-	-	-	8	-	-	-	-	tormentil
Potentilla anserina L.	-	-	-	-	-	-	-	1	-	silverweed
Hydrocotyle vulgaris L.	-	-	-	1	-	10	-	-	1	pennywort
Apium cf. *inundatum* (L.) H.G. Reichenb	-	-	-	-	-	-	-	-	1	fools' watercress
Prunella vulgaris L	-	-	-	-	-	1	-	-	-	self-heal
Lycopus europaeus L.	-	-	-	-	-	-	-	1	3	gypsywort
Mentha sp.	-	-	-	-	-	3	15	30	14	(?water mint)
cf. *Lamium* sp.	-	-	-	1	-	-	-	-	-	dead-nettle
Galium sp.	-	-	-	-	-	-	-	-	+	bedstraw
Sambucus nigra L.	2	1	2	3	-	-	-	-	-	elder
Cirsium sp.	-	-	-	-	-	-	-	-	1	thistle
Alisma sp.	-	-	-	-	-	-	-	3	-	water plantain
Juncus sp.	-	-	-	-	+	-	+	+	+	rush
Eleocharis sp.	-	-	-	-	2	3	-	48	18	spike-rush
lacustris (L.) Palla	-	-	-	-	-	-	-	1	5	
Carex subg *Vignea* (P. Beauv. ex Lestib.) Kuek	-	-	-	1	1	-	-	2	-	sedges
Carex subg. *Carex* (P. Beauv. ex Lestib.) Kuek	-	-	-	-	-	-	1	4	10	sedges
Glyceria sp.	-	-	-	-	-	-	-	4	5	flote-grass
Poaceae nfi	-	-	-	-	-	-	-	+	-	grasses
?*Triticum* sp.	-	-	-	-	-	2*	-	-	-	wheat?
charcoal fragments	+	+	+	+	+	+	(+)	(+)	+	

Samples were extracted from depths of 0–1cm, 5–6cm, 10–11cm, 15–16cm, 20–21cm, 30–31cm, 50–51cm, 60–61cm, and 70–71cm.
* indicates charred remains

Table 34 Plant list; names and order according to Kent (1992)

Date estimate	*Depth range (cm)*	*Events, Thetford*	*Events, other sites (local, regional)*
c. AD 1100–1250	0–7.5	less cereals more heathers medieval decline here	further early medieval expansion of settlement elsewhere
c. AD 810	17.5	More cereals Saxon expansion	also at Stafford Lammascote Rd, Cookley
c. AD 680	20	woodland clearance Saxon expansion	
c. AD 450–600	22.5–25	more trees and shrubs, overgrown landscape Dark Ages	regrowth of woodland and scrub at Stafford, Cookley, Diss, Quidenham, Old Buckenham and Sea Meres (Peglar 1992) and in other pollen diagrams; cessation of crops
c. AD 50–350	27.5–35	low tree pollen Roman period; Samian ware at 33cm	Roman period accurately identified in very few pollen diagrams
c. 450 BC	45	woodland reduction Iron Age	woodland reduction at Crosby Warren (Holland 1975)
c. 1000–800 BC	55–60	increased cereals more farming Bronze Age	
c. 1100 BC	67.5	Woodland reduction	
c. 1200 BC	75	start of sequence	

Table 35 Summary of vegetational changes at Thetford and other sites

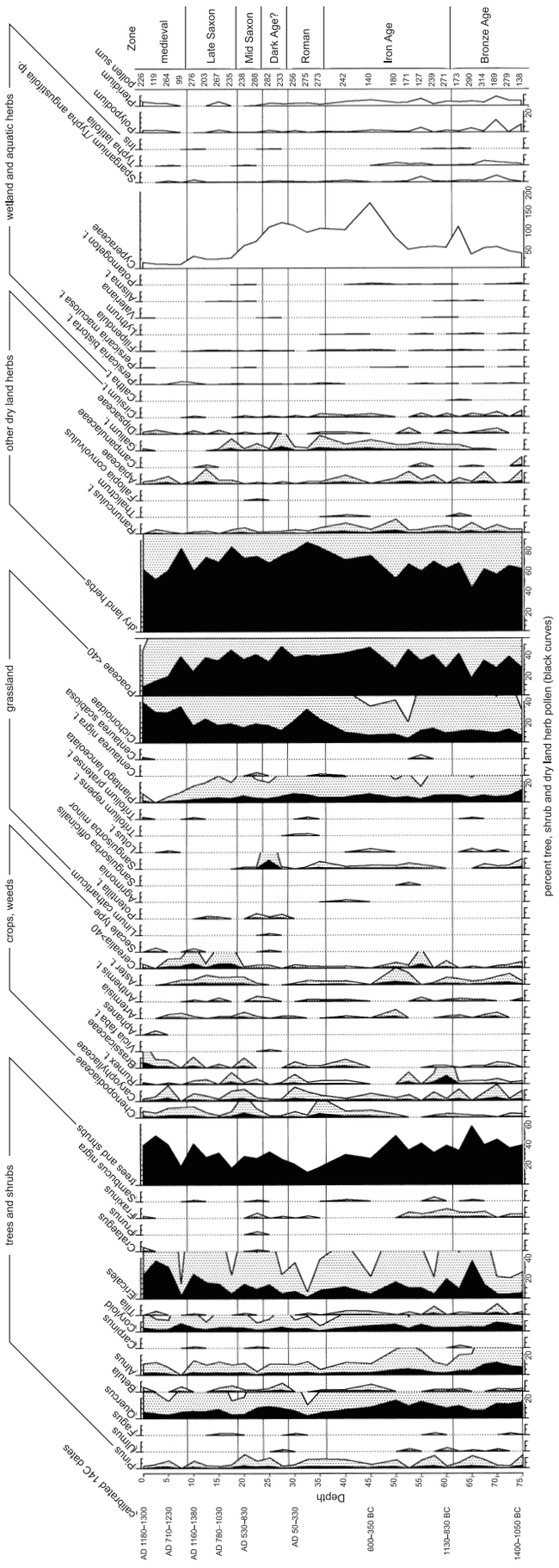


Figure 48 Pollen diagram

Conclusions

Change over time
(Fig. 49)
The date/depth graph (Fig. 49) allows an approximation of the date represented by any point on the pollen diagram, and construction of a fairly exact chronology of events.

Bronze Age
(1320–1040 to 1100–700 cal. BC; 75–57.5cm)
The beginning of the sequence (75–70cm) has slightly higher tree pollen, at around 40% than later, indicating that there was more woodland in the earliest period. There is evidence of clearance of some of this woodland from around 1100 BC/67.5cm which affects *Quercus* (oak), *Alnus* (alder) and *Corylus* (hazel), together with an increase in Ericales (heathers). This probably shows a change from woodland to heathland which would have been caused by increasing grazing, preventing regeneration of trees. There is slightly more cereal pollen and *Rumex* at 60cm and 55cm (around 950–850 BC), which is probably a sign of an increase in arable farming.

Iron Age
(1100–700 cal. BC to 150 cal. BC–cal. AD 150; 57.5–35cm)
There are few noticeable changes during this period except for the slight reduction in tree pollen from about 450 BC/45cm, representing a phase of increased occupation.

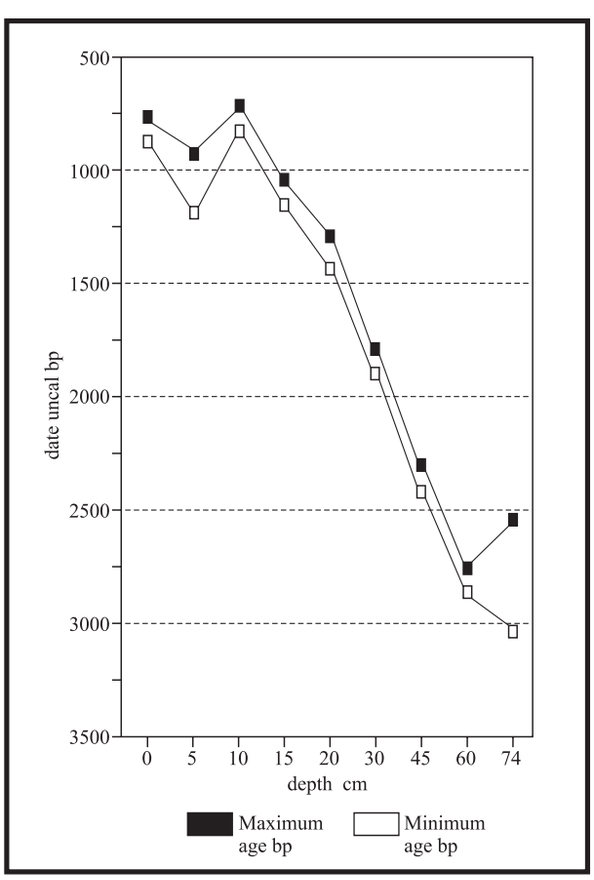


Figure 49 Date/depth graph showing calibrated date ranges plotted against depth from the peat deposits

Roman
(150 cal. BC–cal. AD 150 to cal. AD 200–500; 35–27.5cm)
The fairly wide date ranges make it hard to pinpoint the Roman period using the radiocarbon dates alone, but there is further evidence from a sherd of samian ware in the peat section at 33cm. The lowest values of *Quercus* and Ericales and the end of a near-continuous *Tilia* (lime) record at 32.5cm coincide with a peak in Cichorioidae at 32.5–35cm. This may represent increased arable use of the land in Roman times, resulting in more meadow and less woodland and heath. Some charred cereals found in the peat at 30cm also provide evidence of farming. Corn dryers and other evidence of Roman occupation north of the river has been found at St Nicholas' Street, along with associated plant remains (Fryer and Murphy 1999).

?Earliest Saxon
(cal. AD 150–500 to 300–600, 27.5–25cm)
This date range is also quite wide, but it is likely that the period AD 400–600 falls within this part of the sequence. There is a slight increase in trees, mainly *Quercus* (oak) at 30–22.5cm, *Pinus* at 25–20cm and *Betula* (birch) at 27.5cm. This suggests a reduction in occupation of the land and therefore grazing, felling or other use of woodland. Records of crops and weeds show some reductions with a gap in the cereal pollen record at 27.7cm and reductions in Chenopodiaceae and Caryophyllaceae, and gaps in *Rumex*, Brassicaceae, *Anthemis*, *Aster* and *Artemisia*. However, a grain of *Vicia faba* (bean) was found, and a probable *Secale* (rye) at cal AD 300–600/25cm. These are typical Saxon crops, which may therefore indicate the arrival of a Saxon population.

The evidence seems to suggest that occupation gradually became less in the late Roman period and later, while Saxon settlers entered eastern England during the mid to late 5th century in sufficient numbers to take over the region (Dark and Dark 1997, 135–6).

Middle Saxon
(cal. AD 450–750 to cal. AD 530–870; 22.5–20cm)
At 22.5cm/cal. AD 450–750 there are small pollen records of *Prunus* (sloe or cherry), *Crataegus* (hawthorn), *Fraxinus* (ash) and *Sambucus* (elder) at 22.5cm The small records of sloe and hawthorn are more important than they appear since these species are small producers of pollen, and they probably represent the spread of scrub on to abandoned land as though the pressure of settlement was still low. There is a dip in the *Quercus* (oak) curve at 20cm and 17.5cm, which seems to indicate some woodland cutting or grazing, and similarly a slight increase in Ericales (heathers), which would indicate an expansion in heathland. There are more signs of crops and weeds again, with increased Chenopodiaceae, *Artemisia* and *Aster* and the return of Brassicaceae at 20cm, and increased Cerealia and Aster at 17.5cm. The occurrence of ova of the parasite *Trichuris* at 22.5cm, 20cm and 17.5cm shows that the water was being contaminated by sewage, providing further evidence of nearby occupation. The Cyperaceae record, which includes sedges, becomes low, showing either that the mire by the river was being reclaimed or that it was grazed so that the sedges did not flower so much. All this seems to amount to evidence of increasing occupation of the area.

Later Saxon
(cal. AD 650–950 to cal. AD 950–1100; 17.5–10cm)
Reduction in pine and increased levels of Ericales may mean that there was more grazing on sandy land, causing a spread of heathland. *Pteridium* (bracken) becomes discontinuous, which could either mean that there was less bracken or that it was being gathered for use. Cereal pollen is a maximum at 17.5cm, 15cm and 10cm and *Trichuris* is present at 17.5cm, 12.5cm and 10cm, which shows increasing occupation. This seems to coincide with the later Saxon expansion of Thetford, and the occupation of the Mill Lane site. This expansion seems to have been rather local, with little evidence of it at some sites to the north of the river such as St Nicholas' Street (Fryer and Murphy 1999).

Medieval
(cal. AD 1000–1200 to cal. AD 1150–1300; 7.5–0cm)
There is further increase in Ericales and therefore of heath. Cichorioidae increases while *Plantago lanceolata* (ribwort plantain), Poaceae (grasses) and Cyperaceae decrease, maybe representing a change in the type of open land from meadow to heath. Cereal pollen and a number of weed records decline, which suggests that there was less occupation of this area. The main activity in Thetford at this time seems to have been in the part of the town to the north of the river, including the St Nicholas' Street (Fryer and Murphy 1999) site, and the Mill Lane area seems to have gone into decline.

Local environments
Thetford lies at the boundaries of several different kinds of landscape. To the south and east, there is a landscape dominated by agricultural land and small villages; this has clearly been occupied for a very long time, and its woodland is quite extensive in some places, as at Fakenham Wood. Possibly this woodland was used for pannage, as numerous pig bones were found at this site (p.96–7, above). Heathland is a traditional part of the landscape, judging by the frequency of 'heath' place names. To the north and west the land is now largely under planted woodland, but the relative scarcity of villages suggests that this area (Thetford Warren and Croxton Heath) never supported much farming and may have been grazed as heathland. Finally, along the rivers Thet and Little Ouse there would be a local riverine carr woodland and wetland flora on the river banks.

The results of these pollen analyses probably reflect parts of the regional environments, with woodland and farmland mainly to the south and east, as shown by tree and shrub pollen, crops, weeds and grassland plants, and heathland with heathers, pine, bracken and grasses to the north and west. Carr woodland and wetland vegetation, with oak, alder and willow together with wetland and aquatic plants, would have grown very locally, as well as along the riverbanks of the Rivers Thet and Little Ouse to the north and south.

Correlation with other sites
The regional landscape history of the Breckland is revealed to some extent in pollen diagrams from sites such as Diss Mere on the Chalky Boulder Clay to the east, and also by some Fenland sites such as Haddenham to the west of the Breckland, and Hockham Mere, which can be taken to represent the Breckland itself (Peglar 1992, Bennett 1983); the Hockham Mere results are fairly typical of traditional pollen diagrams, with coarse resolution and few dates in the period of greatest archaeological interest, over the last 2000 years. Much wildwood seems to have gone in the Bronze Age and Iron Age. The other sites show that the main regional woodland clearance episodes were at *c*. 400 cal. BC (Iron Age), *c.* cal. AD 50 (Roman) and *c.* cal. AD 550 (Saxon), while heathland started to develop from *c*. 1800 cal. BC. Arable farming did not become important until *c.* cal AD 50, although by *c.* cal AD 500 a number of crops are in evidence, including *Cannabis* and *Linum* (Peglar 1992). The Thetford river alluvium, with its much smaller pollen catchment, provides a more local picture, right in the Breckland area. A summary of the vegetational changes at Thetford and other sites in the region is presented in Table 35.

The transition from the Roman to the Saxon period is recorded in detail at two other closely dated sites. One, at Lammascote Road, Stafford, like that at Thetford is also adjacent to a Saxon town (Greig 1999). The other, Cookley (Suffolk), is not near any known settlement (Greig in prep.). In each case the Roman landscape seems to have had relatively little woodland. After the Roman period these sites seem to confirm the finding at Thetford that there are signs of a spread of woodland and scrub, seen in small increases in a number of pollen records such as *Quercus* (oak), *Betula* (birch) and *Fraxinus* (ash). There is also a reduction in cereals and weeds of cultivated land such as Chenopodiaceae (goosefoot), *Anthemis* type (including mayweeds) and *Aster* type (including daisies), and sometimes even a break in otherwise continuous records. This provides evidence that previously cultivated land was being abandoned and overgrown with scrub at this time in different parts of the country, indicating that this was a general trend.

Further evidence regarding the abandonment of land comes from the pollen profile from the ditch of Metchley Roman fort, West Midlands (Greig 2000). These results show a typical occupied Roman landscape at the beginning of the sequence, which was overgrown by scrub as the result of abandonment, and reverted to woodland before being re-occupied subsequently at an uncertain date. It is interesting to speculate whether the occupation of the land decreased during the later part of the Roman period, or if this was mainly after the 'official' end of the Roman period in AD 410.

In the Thetford, Cookley and Stafford pollen diagrams, the beginning of the Saxon period is shown by a slight decrease in tree and shrub pollen, and by a great increase in rye and other cereals which, along with an increase in weeds at around AD 850, forms a very distinctive pollen horizon This is more clearly apparent at Cookley and Stafford than at Thetford. This evidence indicates that areas of woodland and scrub were being cleared again for fields, and that more crops were being grown. It is hard to be sure whether the strength of the records show the amount of cereal farming and processing at each of the three sites, or how close it was to the place where the pollen core was taken, as the pollen records seem mainly to illuminate rather local events. However, the similarity in the changes observed at three different sites shows that this particular farming phase was not just a local Thetford phenomenon.

The medieval period results from Cookley and Stafford both have records of *Centaurea cyanus* (cornflower),

although this was not found at Thetford. Cornflower appears sometime later than the Saxon increase in cereal records at Stafford and Cookley: at Cookley this may be dated around AD 1000 so cornflower might have been expected in the top part of the Thetford sequence, which is later than this. A possible explanation for the absence of cornflower pollen is that cereal records are reduced at the top of the Thetford diagram from around AD 1100–1250: the cornflower, which is much less abundant than the cereal pollen, might not have shown up among such slight records. *Cannabis* (hemp) and *Vicia faba* (bean) pollen was present at the top of the Cookley and Stafford diagrams, and again these may not be represented at Thetford due to the decline in activity there. The reduced evidence for farming could signify the decline of Thetford, and in particular the area of Mill Lane, after its Saxon heyday. Even that ubiquitous sign of human activity *Plantago lanceolata* (ribwort plantain) declines, while evidence of heathland increases.

The results reflect general trends, as seen at other sites, but are also relevant to the immediate local environment. There is information about all the major archaeological periods at Mill Lane, and changes in settlement pattern and in the nature of the settlement are both reflected.

Early Saxon flots from the nearby site at Melford Meadows, Brettenham, did not contain any heathers: the charcoal present was mostly oak, but other trees were also used as fuel (Robinson 2002, 110). This lack of evidence for the use of heather accords with the presence of a more wooded environment, when heathland was relatively less widespread.

VI. Radiocarbon dates

by Alex Bayliss
(Figs 50–2)

Nine samples, consisting of bulked identifiable terrestrial plant macrofossils, were dated at the Oxford Radiocarbon Accelerator Unit in 1999. They were processed according to methods outlined in Hedges *et al.* (1989) and measured using Accelerator Mass Spectrometry (Bronk Ramsey and Hedges 1997). The results are quoted in accordance with the international standard known as the Trondheim Convention (Stuiver and Kra 1986). They are conventional radiocarbon ages (Stuiver and Polach 1977).

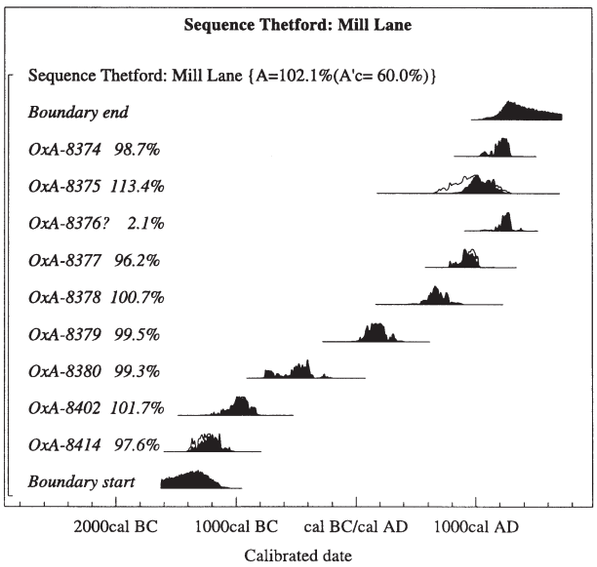
The simple calibrated date ranges of the radiocarbon results (Table 36) have been calculated according to the maximum intercept method (Stuiver and Reimer 1986) and are quoted in the form recommended by Mook (1986), with the end-points rounded outwards to ten years. The probability distributions shown in outline in Figures 50–2 are simple calibrations and have been calculated according to the method of Stuiver and Reimer (1993). All calculations have been performed using the radiocarbon calibration and analysis program OxCal (v3.5) (Bronk Ramsey 1995, 1998, forthcoming) and the dataset of Stuiver *et al*. (1998).

In this instance, however, we have more information about the chronology of the peat sequence than that provided simply by the radiocarbon determinations. The relative dates of the samples are known from the stratigraphic sequence of the material. This information can be integrated with the radiocarbon results using a Bayesian approach (Litton and Buck 1994; Buck *et al.* 1996) to provide posterior density estimates of the dates of the levels in the pollen core. In order to do this reliably it is necessary to model the rate of sediment accumulation: otherwise, the statistical scatter of the measurements may spread the posterior density distributions evenly across plateau in the calibration curve, irrespective of the actual age of the material dated (Steier and Rom 2000).

The selection of an appropriate age–depth model for Thetford is difficult, both in theory and practice. Many different models for peat growth exist, although the majority of the work has been undertaken in relation to raised bogs (Bennett 1994; Clymo 1984, 1991, 1992). Most applications also ignore the basic fact that radiocarbon age determinations have to be calibrated to turn them into calendar time. Recently approaches have been suggested which integrate models of peat growth with calibrated radiocarbon dates (Christen *et al.* 1995*;* Kilian *et al.* 2000), although these examples relate to raised bogs and may not be appropriate in the case of

Lab. No.	*Sample depth*	*Material*	*Radiocarbon age (BP) d13C (‰)*	*Calibrated date range (95% confidence)*	*Posterior density estimate (95% probability)*	
OxA-8374	0–1cm	seeds, mostly *Sambucus nigra*	815±55	–25.8	cal. AD 1040–1290	*cal. AD 1180–1300*
OxA-8375	5–6cm	seeds, mostly *Sambucus nigra*	1050±130	–25.5	cal. AD 680–1260	*cal. AD 710–1230*
OxA-8376	10–11cm	seeds, including *Raphanus raphanistrum*	770±55	–28.0	cal. AD 1160–1380	–
OxA-8377	15–16cm	seeds, mostly *Sambucus nigra*	1095±55	–25.3	cal. AD 780–1030	*cal. AD 780–1030*
OxA-8378	20–21cm	seeds, mainly *Potentilla erecta*	1365±75	–27.1	cal. AD 540–810	*cal. AD 530–830 (93.5%)*
OxA-8379	30–31cm	seeds various	1850±55	–27.1	cal. AD 20–330	*cal. AD 50–330*
OxA-8380	45–46cm	seeds, including *Ranunculus sceleratus*, *Utrica dioica*, *Mentha ?aquatica*	2370±60	–26.6	770–260 cal. BC	*600–350 cal. BC (70%)*
OxA-8402	60–61cm	twigs, not identified	2815±55	–27.7	1190–830 cal. BC	*1130–830 cal. BC*
OxA-8414	74–75cm	seeds, including *Eleocharis* sp. and *Mentha* sp.	3000±45	–27.3	1400–1050 cal. BC	*1320–1040 cal. BC (88.9%)*

Table 36 Radiocarbon dates



Each distribution represents the relative probability that the event occurs at a particular time. For each radiocarbon date, two distributions have been plotted: one in outline which is the result of simple radiocarbon calibration, and a solid one based on the chronological model used. (The 'event' associated with OxA-8377, for example, is the growth of the seeds which were dated.) The large square brackets down the left hand side and the OxCal keywords define the overall model exactly.

Figure 50 Probability distributions of dates from the pollen sequence with a model of a relatively constant accumulation rate of sediment, with OXA-8376 excluded on the basis that the sample was intrusive.

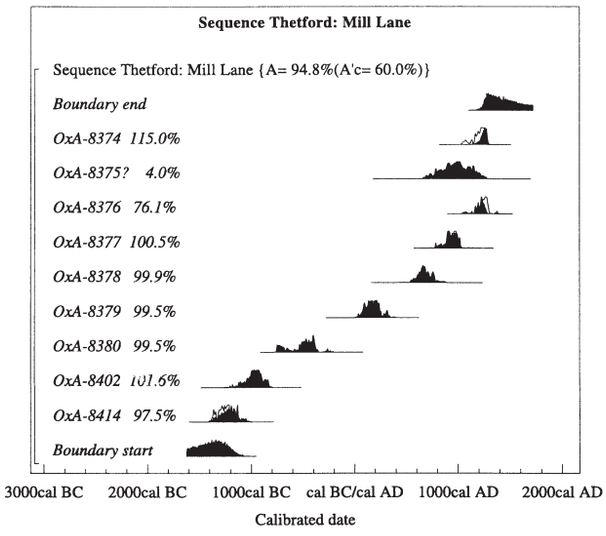


Figure 51 Probability distributions from the pollen sequence, with OxA-8375 excluded on the basis that the sample comprised in-washed older material. The format is identical to that of Fig. 50.

Thetford. At present the software necessary to implement these approaches is also not generally available.

The models shown in Figs 50 and 51 assume that the accumulation rate of sediment was relatively constant, and that we have dated a random sample from this activity. The former may be true, especially as the deposits cover a relatively short period of time and do not show any lithostratigraphic changes that may suggest a change in deposition rate. The latter is certainly *not* true, as we carefully selected radiocarbon samples to date environmental events apparent from the pollen evidence. Sampling was also concentrated towards the top of the sequence, where the sediments are contemporary with the archaeological sequence recorded at the Mill Lane site. In fact the posterior density distributions seem to be reasonably robust against the approach adopted, as if no mathematical distribution is imposed on the model the results are very similar (Fig. 52).

A more serious problem is presented by the inversion of dates at 5–6cm and 10–11cm. The index of agreement for OxA-8376 (A=28.7%) is too low for this sample to be of the same date as the stratigraphic position from which it was recovered, and brings down the overall agreement for the model undesirably (A=59.5%). If this macrofossil is

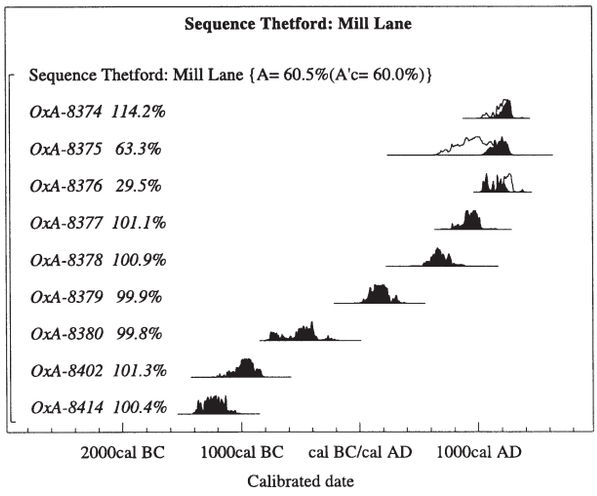


Figure 52 Probability distribution of dates from the pollen sequence with no model of sediment accumulation selected. The format is identical to that of Fig. 50.

regarded as intrusive, then the overall agreement for the model improves substantially (A=102.1%; Fig. 52) and it can be seen that the probability that OxA-8376 actually dates the level at 10–11cm is only 2.1%. Unfortunately, it is also possible that OxA-8376 is actually of the same age as that deposit and instead that OxA-8375 dates older material that was washed into the level at 5–6cm. The model incorporating this interpretation is shown in Fig. 52. The overall agreement for this model is good (A=94.8%), and the probability that OxA-8375 is not residual only 4%.

Since the levels exhibiting the dating inversion are close to the top of the monolith, and to the topsoil, it is perhaps more likely that OxA-8376 represents intrusive material, especially as seeds of *Sambucus nigra* of the same date as the level from which they were recovered are demonstrably present elsewhere in the core. For this reason, we consider the model shown in Fig. 52 to provide the best estimate of the chronology of the pollen sequence currently available.

It is the posterior density estimates from this model that are listed in Table 36. These ranges have also been used to plot the depth/date graph in Fig. 49.

This analysis suggests that the sampled sequence spans the Bronze Age to medieval periods, with deposits above 20cm broadly contemporary with the excavated settlement evidence at Mill Lane. The top of the peat layer is post-Conquest in date.

5. General Discussion

by Heather Wallis

I. Introduction

The modern redevelopment of Mill Lane has provided an opportunity to investigate a large area of the town on the south bank of the river. Previous archaeological investigations in the vicinity were mostly carried out before modern excavation and recording techniques had developed, while the more recent excavations have centred on the west of the town or the area to the north of the river. Although much is already known of the general trends in the development and decline of Late Saxon Thetford further detailed information about the settlement pattern within the town has been revealed at Mill Lane, along with evidence of a strong craft base for the economy.

There is little doubt that the origins of the development and success of Thetford throughout the Late Saxon period lie in its location on the Rivers Thet and Ouse, both of which were navigable. There were early fording points to the east at Nuns' Bridges and to the west near Red Castle. The location of these fords has influenced the siting of settlements from the Iron Age through to the present day. Importantly, the fieldwork has permitted the examination of the pollen record in deposits close to the river, allowing the changes in the environment from the Bronze Age through to the Late Saxon period to be compared with known changes in settlement.

II. Bronze Age

Environmental evidence from meres and fens across Norfolk showns that much of the ancient wildwood was being destroyed during the Bronze Age. This was a process that started in the Neolithic, but accelerated particularly during the later Bronze Age as arable farming and pasture was expanded to provide food for an ever-growing population (Lawson and Wymer 1993, 30). This acceleration was visible in the results of the pollen analysis from Mill Lane, which indicated a change from woodland to heathland and an increase in arable farming *c*. 950–850 BC.

By far the greatest quantity of archaeological material from this period has been found beyond the limits of the town. Significant quantities of flint and pottery from the Later Neolithic and Bronze Age were retrieved from the excavations at Fison Way to the north of the town (Healy 1992a, 147; Healy 1992b, 149). Although a number of barrows are present around Thetford, activity of this period is not greatly represented in the archaeological record of the town itself, the only indication being the recovery of a few arrowheads and struck flints of Late Neolithic–Early Bronze Age type and some Bronze Age pottery sherds from excavations at Thetford Castle in 1962 (Davies and Gregory 1991, 13).

III. Iron Age

The earliest major occupation in Thetford dates to the Iron Age, when a fort was constructed on the north bank of the river 0.4km from the excavation site. This lay adjacent to the point where the Icknield Way crossed the river (now called Nuns' Bridges) and is thought to date from the Middle Iron Age (Davies and Gregory 1991, 29). Other early activity was revealed by excavation to the north of the present town at Fison Way, where a large ceremonial or religious centre dating to the 1st century BC–1st century AD was excavated (Gregory 1992).

Despite the Mill Lane site's proximity to the major Iron Age route, and the location of an Iron Age hillfort on the opposite bank of the river, only a single sherd of pottery of this date was found.

During the Iron Age the general trend across eastern England was for an increase in the area under cultivation, leading to the permanent clearance of woodland and the development of heathland in the Breckland area of Norfolk (Green 1993, 32). The pollen record from Mill Lane, however, does not give any indication that such changes were taking place locally, as a fairly stable environment is indicated throughout this period. The only noticeable change is a slight reduction in tree pollen from *c*. 450 BC (the start of the Middle Iron Age, a period defined as *c*. 450–*c*. 100BC: Davies 1996, 65). It is during this period that the earthwork fort on the north bank of the river, opposite the Mill Lane site, is thought to have been built. This dating is based on the pottery recovered from the excavations at Thetford Castle (Gregory 1991, 15). Excavation to the east of Nuns' Bridges on the north bank of the river has revealed pits also thought to be of Middle Iron Age date (Davies and Gregory 1991, 28–9). It is probably the presence of this activity close to the Mill Lane site that is reflected in the pollen record. Therefore an early Middle Iron Age date can be suggested for the construction of the fort.

The only other excavated evidence of activity of this date from Thetford comes from Guildhall Street where a single, possibly votive, pit was recorded (Andrews and Penn 1999, 89).

IV. Roman

The Icknield Way continued in use throughout the Romano-British period, bringing traffic across the rivers at Thetford, although many other routes became established, including the Peddars Way some 8km to the east. Although no major Roman settlement is known at Thetford, a pattern of small farmsteads is emerging as excavation continues in the area. Roman occupation is known at Redcastle Furze (Andrews 1995, 7–11) and Brandon Road (Dallas 1993, 7), both to the west, and at St Nicholas' Street (Andrews and Penn 1999, 63) on the north bank of the river, where it has been suggested that Romano-British activity may have been focused around the line of a precursor of Whitehart Street leading to the main river crossing. To the east, recent excavation at Melford Meadows, Brettenham, has identified further occupation of this period: the evidence here has been interpreted as a small settlement, based on an unspecialised mixed farming economy (Mudd 2002, 112).

This increase in occupation, and therefore in demands on land, is reflected in the pollen record from Mill Lane, which shows evidence for a reduction in heathland and woodland and an increase in meadow. Charred cereal grains in the record indicate that the immediate vicinity was probably utilised for mixed farming.

There was little material evidence of Roman occupation at Mill Lane. Finds included five coins, four of them heavily worn and of 4th-century date, and three sherds of pottery. The only non-residual item found was a single fresh sherd of samian ware found within the pollen monolith sample.

V. Early Saxon

Current evidence shows that Early Saxon occupation was mainly located towards the west of Thetford, near the Red Castle. Excavation has revealed evidence of occupation at Brandon Road (Dallas 1993) and Redcastle Furze (Andrews 1995). Sunken-featured buildings and pits dating to the 6th and 7th centuries were present on both of these sites. Sunken-featured buildings, pits and ovens have been recorded to the east of the town at Melford Meadows (Mudd 2002), where the dating evidence points to Early Saxon occupation beginning in the 5th–6th centuries and continuing into the 6th–7th centuries. Excavations early in the 19th century revealed Early Saxon burials at the site of St Margaret's church (Dunmore with Carr 1976, 5), to the south-west of the town.

Overall, the distributions of Roman and Early Saxon sites appear similar, with settlement of both periods seen at Brandon Road, Redcastle Furze and Melford Meadows, although at none of these sites has it been suggested that occupation was continuous from one period to the next, with reoccupation of the valley sites being more likely.

There was no evidence of activity at Mill Lane during this period. The pollen record indicates an increase in the number of trees in the area, and therefore a reduction in the amount of meadow available for grazing. Evidence of cultivation was also absent. Given the similar distributions of occupation in the Roman and Early Saxon periods, this difference in the pollen record could reflect a change in the economic basis of settlement. The decrease in cereals is consistent with the evidence from Melford Meadows (Mudd 2002, 115), but does not show the increase in pasture evident in pollen sequences from Breckland sites at Hockham Mere and Seamere, and in pollen cores from other meres at Saham Toney, Stow Bedon, Old Buckenham and Diss (Williamson 1993, 58).

VI. Middle Saxon

Known Middle Saxon occupation lay in the area of Red Castle, with occasional stray finds recorded to the north of the river (Penn 1993, 46) including a gilded disc fragment, an ansate brooch, a fragment of a glass vessel and a Carolingian denier from St Nicholas' Street, all dating to either the 8th or the 9th century (Andrews and Penn 1999, 22–3). Evidence from the town overall is sparse. Indeed, the summary of Middle Saxon finds given in Andrews (1995, 25) noted only 135 sherds of pottery from sites both north and south of the river.

The pollen results from Mill Lane, however, indicate that further land was being cleared both for arable and pastoral use. This is shown by a decline in woodland and an increase in heathland, along with increases in both crops and weeds. A decrease in sedges also suggests that the river margins were being grazed at this time.

This implied increase in the productive use of the land suggests that there was a rise in demand for both crops and animal produce. While this could be the result of growth in the local population, archaeological excavation to date has not revealed a significant increase in occupation, although as-yet undiscovered settlements may have existed along the river valley. Alternatively occupation areas and population numbers could have remained relatively stable, with the increased demand for land relating to an increase in craft and trade opportunities. It has been suggested that the Iron Age fort on the north bank of the river was used at this time as a point of exchange (Andrews 1995, 26–7) as the finds from St Nicholas' Street are of relatively high status, indicating the presence of wealth within the economy.

VII. Viking influence

It was during the 9th century that Thetford experienced an explosion in population and activity. The earliest written reference to Thetford is in the Anglo-Saxon Chronicle, recording that the Viking army took up winter quarters there in AD 869. East Anglia fell to the Danes in 870 and remained in Viking hands until 917. Viking raiding resumed in the late 10th century, and Thetford was sacked in 1004 and 1010. Despite this, traces of Danish influence at Thetford are few. Their impact is only seen directly in the style of metalwork, both imported and locally produced. The Mill Lane site produced four items of metalwork that were imported from the Continent, or were heavily influenced by Continental styles. Two lead plate brooches, one showing Carolingian influence (SF161) and one in Borre style (SF437), date to the 10th century. A decorated strap-end and a copper alloy Everswinkel brooch may be dated stylistically to *c*. 800. More recently, in 1995/6, a broad-bladed axe of Viking type, dated to the 11th century, was found 250m to the west of Mill Lane at Saxon Place (Masefield and Masefield 1997).

Scandinavian presence in the area affected the development and growth of Thetford, although the exact nature of its influence on the expansion of the town is difficult to characterise. It is generally agreed that the economic development of the town was boosted by their presence (Margeson 1996, 56), which may have spurred the establishment of the Thetford pottery industry (Margeson 1997, 27). It is also possible, but by no means certain, that the Danish inspired the construction and later refurbishment of Thetford's defences.

VIII. Late Saxon/early medieval

The sudden growth of Thetford during the early years of this period has been observed in many excavations across the town. The evidence for this period at Mill Lane includes the presence of both post-hole and sunken-featured buildings, along with enclosure ditches and a mass of pits of varying sizes. Craft and industry were strongly represented in the archaeological record with the evidence for metalworking dominating throughout this period, although other crafts needed to maintain a community was also represented. Defensive ditches were constructed on the north and south banks of the river. That on the north encircled only *c*.15ha while a much larger area (*c*.60ha) was encompassed to the south. Excavation has suggested that

these original defences may have been broadly contemporary, with an early 10th-century date propose for both the northern circuit (Crowson 1999, 11) and parts of the southern circuit (Rogerson and Dallas 1984, 63). That on the northern bank was extended towards the east, to the edge of the Iron Age fort earthworks, during the 11th century (Andrews 1999, 91), while the southern defences appear to have been quickly abandoned as occupation activities spread out across the backfilled ditches and beyond (Rogerson and Dallas 1984, 63).

Site layout

Within the excavated area, the topography of the site was a major influence on the position of the Late Saxon activity. During this period the river would have dominated the local landscape since Mill Lane, which separates Sites 1022 and 5761, was not established until at least the 12th–14th centuries. From the edge of the river terrace the natural terrain rises gently to the west, reaching a peak towards the centre of the site (where Areas 4, 5 and 9 were located) before dipping away to the north and west. This affected not only the location of the Late Saxon occupation, as the majority of buildings and structures stood on the higher ground, but also the survival of archaeological deposits, since those on high ground have been truncated by more recent activity while those on the lower slopes have been sealed by a gradual build-up of soils. The general location of features away from the river indicates that it was not of major importance to the settlement in this area, a more probable focus for riverside activities being near the central fording point at Bridge Street.

Two probable trackways crossing the site have been defined (Fig. 5). Track A leads in the general direction of St Etheldreda's Church to the north while Track B leaves the site to the south. No metalled surfaces like those found at Brandon Road (Dallas 1993, 14–16) were recorded, although this is possibly due to truncation. The occasional encroachment of features into the area of the tracks suggests that these were not major roads, but that they provided local access to and from more major routes. This is perhaps not surprising: with major river crossings located to the north and south of the site, and with no evidence of any riverside activity in this area, a major west-to-east road here would have been unnecessary. The main north-to-south route is likely to have followed a similar line to that of Bury Road, *c*. 30m to the west of the site.

A number of enclosures were identified. Enclosures A and C were the only areas to contain evidence of substantial buildings. Enclosure B was remarkably devoid of features and livestock may have been kept here. A few features were clearly associated primarily with metalworking and these were located mainly in the western and northern parts of the site, intermixed with domestic waste pits and other features. Apart from this, and despite study of the distributions of the different types of finds (pottery, fired clay and daub, slag and animal bone), it has not been possible to identify areas that were used for distinct, differing functions. The distribution of the artefacts is heavily biased towards the open areas, however, with over three-quarters of the stratified small finds coming from Open Areas A, B and D.

The sequence of construction of the main post-hole and sunken-featured building can be reconstructed. The pottery has hinted that the post-hole buildings (Buildings A and B) and features located mainly in Enclosure A may have been slightly earlier than many of the other features. In turn, the two sunken-featured buildings were located too close to each other to have been used simultaneously, with Building C being earlier than Building D. A further post-hole building (Building E) had been cut into the backfill of the later of these. This indicates that there was a continuous sequence of buildings on the site, from the earlier part of the 10th century to the mid-11th century. Settlement on this site was thus far from intense, with perhaps only a single building in use at any one time, the remainder of the area being occupied by craft activities and waste pits with some areas being left open for agriculture or animal husbandry.

The buildings

There was little evidence to indicate the precise functions of the surviving buildings. No floor surfaces or hearths were present within the post-hole buildings. As particular waste pits could not be firmly associated with individual buildings their contents could not be taken as an indication of the structures' functions: domestic, craft, industrial or storage. Only two of the post-hole structures — Buildings A and B — appear to have been of suitable size for habitation. The other post-hole buildings were smaller and less substantial in their construction and may have served as storage or sheltered areas for craft or subsistence activities, or for sheltering animals.

The two sunken-featured buildings on the site lay within the normal size range of these features at Thetford. The simpler of the two was constructed with the major post supports located in the base of the cellar. The more complex building also featured a ramped or stepped entranceway along with evidence of post supports and wattle and daub walls, which appear to have been whitewashed. Similar buildings have been found on many other excavated sites in Thetford. Another 'ramped' building was excavated at Brandon Road, although in this case the entrance was on the short axis of the 'cellar' (Dallas 1993, 25, 40, fig. 63). Hut 3 at GMK Site 1 had steps leading down into it, although these were aligned on the long axis of the building (Rogerson and Dallas 1984 7–11). Other entranceways to such buildings have been found elsewhere, such as at London (Horsman, Milne and Milne 1988).

Over the years there has been much discussion of the possible uses to which the sunken areas within such buildings were put, and whether they formed the living area of the building or additional storage space. Details of the construction of these buildings from London have been examined and three main types identified, distinguished from each other by their below-ground depth and the postulated structural strength of the posts (Horsman 1988). The depths of the buildings at Mill Lane indicate that they were more than just buildings with slightly sunken floors. In fact, they were probably once deeper than the 1.2m and 1.4m excavated depths, as truncation in this part of the site had removed the level of the Saxon ground surface. The lack of floor surfaces and hearths makes it unlikely that the lower areas of the buildings were used as living space, indicating that the sunken areas were cellars below floored rooms. Not all of the post-holes were substantial enough to hold timbers of load-bearing size. (Horsman suggests a minimum diameter of 0.2m would have been required to support an upper occupied area.)

Although there was no surviving evidence that would indicate the function of the sunken areas of these buildings, deposits in the base of the larger of the two suggests that its demolition may have been deliberate. The large ash deposit

at the base of Building C is probably the remains of a bonfire. The lack of surviving environmental evidence indicates that it had burnt in well-oxygenated conditions, turning all combustible material to ash. This may well represent the disposal of any non-recyclable materials from the building, such as thatch, reed and wattle.

This sequence of buildings, along with the large number of intercutting features, particularly in the northern and western parts of the site, indicates a continuum of occupation throughout this period. The original purpose of most of the pits is not known, but they were used for the disposal of cess and rubbish over at least two centuries. There is, however, a noticeable decline in activity into the early medieval period, with no buildings recorded and a reduction in the number of other features. This is in contrast to the evidence from Brandon Road (Dallas 1993, figs 7 and 8), which indicates comparable densities of occupation from the 10th to 11th centuries and the 11th to 12th centuries. The evidence at Mill Lane, however, may be somewhat distorted due to the difficulty involved in dating features closely within the 11th century itself. In this later period there was a distinct increase in the proportion of features associated with metalworking and it is apparent that this area was now almost exclusively used for this industry, with clear evidence for a reduction in other craft activities.

Metalworking

Domesday Book makes no mention of industries in Thetford, except for those represented by the mills and the mint (Dallas 1993, 219). Much archaeological evidence of craft and industry has, however, been uncovered through excavation. At Mill Lane there was evidence for various industrial and craft activities. Of these, metalworking predominated, being represented in the majority of the stratified finds assemblages.

Evidence of both ironworking and non-ferrous metalworking took the form not only of slags and residues, but also of crucible fragments and *in situ* hearths. Both iron smelting and smithing were undertaken throughout the 10th–12th centuries, along with the processing of copper alloy and silver. In general the evidence for iron smelting falls into the earlier part of this period, while the production of copper alloy objects is mainly represented in the later contexts. The bulk of the metalworking debris was recovered from contexts in Area 1, although a concentration of hearth bottoms was noted in the Area 4 assemblage. Smelting debris did not appear in any noticeable concentrations and was present across the majority of the site. There was a concentration of crucible fragments in Area 1, although this distribution reflects the presence of a single pit (*1024*) which contained 80% of the crucible assemblage.

Despite analysis of the crucibles it has not been possible, in most cases, to identify the types of alloy that they held; this may be attributed to the skill of the metalworkers, however, who were able to leave the crucibles very clean. The size of the crucibles would have allowed only limited amounts of molten metal to be produced at any one time, indicating that only small items could have been made. The presence of litharge cake and a possible lead charger offer clear evidence of silver refining, and it can be suggested that this may have represented the recycling of metals rather than the production of silver from ore.

Silver refining is an important and unusual activity that is often associated with the production of coins. It is known from both coin and documentary evidence that Thetford had a mint, although the recovery of the coin die from the Mill Lane excavations provides the first direct archaeological evidence for this. The first coins that can definitely be associated with the Thetford mint date to the reign of Eadgar (959–975), with a continuous sequence recorded until Henry II (1154–1189) (Crosby 1984, 22). The occurrence of a coin die from the site along with evidence for silver refining suggests this may have seen a moneyer's workshop, while the presence of other ferrous and non-ferrous metalworking evidence makes the context of this find similar to that of other 10th-century dies found at York (Ottaway 1992, 471–506) and Lincoln (Blackburn and Mann 1995, 201–2).

Evidence of metalworking, including crucibles for copper alloy working, has been found on many sites excavated on the south bank of the river, particularly that nearby at St Barnabas' (Rogerson and Dallas 1984) and at Knocker's various sites, along with quantities of smithing and smelting slag. Metalworking tools, such as a hammer, chisel punches and a file, have also been found at these sites; at Mill Lane tongs and punches were recovered. It is interesting to note that, apart from the later evidence of silver refining at Guildhall Street, where crucibles, hearth lining and 20kg of litharge cake dating to the 12th to 13th century have been found, there is virtually no evidence for any craft or industry on the north bank of the river, where domestic activity predominated (Andrews and Penn 1999, 92). This contrasts with the areas south of the river, where nearly every excavation of Late Saxon deposits has produced industrial evidence.

It is usually considered that smelting processes were carried out beyond the bounds of a settlement, at a location where the basic necessary elements of wood and water were readily available. This would also have avoided fuel requirements for smelting competing with a town's demand for domestic fuel. The location of smelting activities within Thetford suggests that fuel supply was not an issue here, however. It has already been noted that adjacent woodland supported pigs as a food source and this could also have been exploited to provide fuel. Evidence from the flotation samples shows that heather was often used as a source of fuel, and this would have complemented the wood supply. Certainly the pollen evidence shows a continued decline in the number of trees within the immediate vicinity, and an increase in heathland. Although heather was evidently available close to the site, the escalating fuel needs of an expanding town, with its associated industrial activities, were probably being met by ever-greater exploitation of the resources of the surrounding countryside.

Other crafts

Other craft activities were undertaken at Mill Lane during the Late Saxon period. In particular a number of artefacts relating to textile working were recovered, including tweezers, spindle whorls, fibre-processing spikes, needles, pinbeaters and a linen smoother. One noticeable feature of the Mill Lane finds assemblage was the absence of shears, which have been found in some numbers elsewhere in Thetford (Goodall 1984, 87, fig.126; Goodall and Ottaway 1993, 102, fig. 120). A woodworking axe and chisel were also found, as well as awls for leather working.Evidence of antler working at Mill Lane was scarce, with only five

pieces being found; prior to this excavation, however, only four pieces relating to the working of antler had previously been found in Thetford. One of these was from Brandon Road and the remainder were from Site 1092, where they were associated with a large quantity of boneworking debris, probably within a workshop area (Rogerson and Dallas 1984, 199).

While the metalworking debris indicates production on a relatively large scale, textile and leatherworking was probably undertaken at a much more domestic level. This evidence compares well with the findings from previous excavations, which suggest that most areas of the town saw a range of small-scale craft activities (Rogerson and Dallas 1984, 198), the main exception to this pattern being the pottery kilns (Site 5756), which were part of a major industry.

Agriculture

In contrast to the evidence for crafts and industry, there was little direct indication for agricultural activity, the only associated finds being an iron sickle and a rake tine; this dearth of finds is despite the probability that areas of the site could have been kept available for such activities. It is during this period that the recorded cereal pollen reaches its maximum, showing an increase in cultivation in order to meet the need the needs of a growing population. A number of harness fittings including a cheek piece and bridle links, as well as horseshoes and nails, were recovered, indicating the use of traction beasts.

The animal bone assemblage shows that both primary and secondary butchery of cattle and sheep was taking place here. Pigs were almost certainly kept off site in local woodland, the presence of which is indicated in the pollen sequence; as with the other species present, whole carcasses were processed on site.

Sheep were a valuable resource, as a multi-purpose animal providing wool, meat, milk and manure. An increase in heathland pollens suggests that areas were available in the vicinity for grazing, although it is also possible that bracken was gathered. Very few wild animals were present in the faunal assemblage, indicating that hunting did not play a major role in feeding the town. Eel and herring and imported marine species indicate links to the North Sea.

The frequencies of animal species at Mill Lane and at St Barnabas' are remarkably similar, whereas Brandon Road in the 11th–12th centuries had a slightly higher frequency of sheep/goat. Domesday Book's mention of the numbers of sheep and plough teams suggests that the town could have been largely self-sufficient; although fairly densely populated, it included large areas of arable and pasture land (Darby 1971, 140). As at Thetford, animals were imported on the hoof to Southampton and York (Bourdillon 1994, O'Connor 1994), although at Norwich there is also evidence that some were reared on site (Albarella 1997). The presence of some neonatal bones at both Mill Lane and Brandon Road suggests a similar situation in Thetford.

Economy

The local craft and agricultural basis of the economy was such that imported products appear to have played a very limited role. The pottery assemblage was dominated by the local industry; this provided for all needs until the 11th century, when the variety of products increased to include local rural and regional wares. A wider regional influence is indicated by 10th-century coins from the mints at Norwich and Lincoln. The only coin from the local mint at Thetford is of 11th-century date. Continental trade is represented by the presence of Rhenish quernstones, although these are typical of Late Saxon settlements in East Anglia and could have been brought into Thetford from other parts of the region. As already mentioned, only a few of the metal artefacts found were imported from the Continent.

Recreation and domestic activity

Leisure activities were not highly represented on the site, as only four bone skates, a chess piece, four buzz-bones and one ceramic gaming piece were found. A typical, but small assemblage of personal artefacts was found, which included only six items of bone or bone and antler (three combs, two comb teeth and a pin) and a number of metal artefacts in the form of brooches, buckles, strap-ends and hooked tags. Household items represented included spits, a bucket and locks. Apart from the crucibles, the pottery assemblage was entirely domestic in nature, although few crafts other than metalworking would have required specialist vessels.

Churches

During the Late Saxon period it is probable that two churches were built adjacent to the site — St Etheldreda's to the north-east and St Edmund's to the south-west — although the dedication of the latter is uncertain (Davison 1993, 209). St Etheldreda's is of pre-Conquest date and listed in the Domesday Book under the Abbot of Ely, and is one of only two parishes that were recorded as having land on both sides of the river (Davison 1993, 209). Excavation of three trenches across the site of ?St Edmund's in 1957 revealed foundations which appear to represent a simple tower-nave type church of *c.* 1000–1100 (Heywood 1984, 52). These footings overlay pits and burials of 10th- or 11th-century date which are contemporary with the activity revealed at Mill Lane. Burials associated with St Etheldreda's were recorded to the north of the site in 1980 (Rogerson and Dallas 1984, 64), but the two burials found at Mill Lane were not associated with either church. Such isolated burials are not unusual in Thetford, and many have been recorded south of the river. Some of these are in concentrations, as at Williamson Crescent (Rogerson and Dallas 1984, 53), while others, like those at Mill Lane, are single 'stray' burials (as at GMK Site 2, Rogerson and Dallas 1984, 198).

Norman influence

The Late Saxon population were also influenced during this period by changes in the political situation resulting from the Norman invasion. It is difficult to characterise the impact this event had on the town, as it is impossible to draw a distinction between pre- and post-Conquest culture from the archaeological evidence alone. This is a common problem: even in Norwich, where the Norman impact on the town is clearly evident, it is virtually impossible to date recorded activity on many sites as pre- or post-Conquest. The most obvious changes that took place in Thetford were the remodelling of the Iron Age fort at Castle Hill, sometime between 1067 and 1069, and the construction of a second castle at Red Castle between 1135 and 1150. These castles, one at the eastern river crossing and one at the western river crossing, emphasise the continuing importance of controlling trade routes.

Thetford reached its apogee in the middle years of the 11th century, and for a while the East Anglian See was located here. It is clear, however, that the arrival of the Normans failed to maintain and stimulate the town's growth. The See had been moved to Norwich by 1096, and the decline and gradual abandonment of most of Thetford south of the river began.

IX. Medieval

Medieval activity was clearly focused in two distinct areas of the Mill Lane site, towards the east and the north. This period saw the establishment of Mill Lane as a main thoroughfare and the continued use of St Etheldreda's, and possibly ?St Edmunds, churches nearby. As the evidence for the dedication of the southern church to St Edmund is slight, it is impossible to be confident that records indicating a 15th-century demise of St Edmund's actually refer to the church located adjacent to the excavation. There is certainly no evidence from the Mill Lane excavations that any activity continued close to it. More is known of St Etheldreda's, as this parish was united with St Mary's in the 16th century (Davison 1993, 209), and features of this period are located close by. These include an oven, a chalk-lined pit and a lined well, all of which were of an industrial nature and could have been associated with each other.

Similar features have been excavated elsewhere in Thetford. At Brandon Road one square and four rectangular chalk-lined features were excavated, with the pottery suggesting a late 14th–early 15th century date (Dallas 1993, 45). Some of these had mortared sides and bases which suggests that they were tanks, or possibly served some industrial purpose. Seventeen ovens or drying kilns of 12th–16th century date were also recorded at Brandon Road and may have been used for drying grain for malting, and possibly brewing (Dallas 1993, 54). At Redcastle Furze (Andrews 1995, 78–9) ovens dating to the 13th–14th centuries were also found. It has been suggested that these were used for malting, although the absence of hearths over which the malt could have been boiled suggests that ale was not brewed on the site (Andrews 1995, 85). This comparison suggests that malting could also have been taking place at Mill Lane.

Wall footings, floor surfaces and a well were all located along the west of Mill Lane, close to the street frontage. The footings were not substantial, comprising flint and chalk in a very sandy mortar, suggesting that the upstanding structure could be of cob or half-timbered construction (as at Brandon Road: Dallas 1993, 54). Very few finds were associated with this building and its function remains unknown. Similar buildings, although larger and more substantial, have been excavated at Redcastle Furze (Andrews 1995).

The presence of occupation of this date at Mill Lane is in contrast to the archaeological evidence from many of the nearby sites, particularly those excavated by Group Captain Knocker (Rogerson and Dallas 1984) where no medieval or later activity was recorded. Evidence of settlement into the medieval period on the south bank of the river has only been identified at three other sites: Brandon Road, St Barnabas's (Dallas 1993) and Redcastle Furze. (Andrews 1995). Brandon Road and Redcastle Furze are both located at the extreme western edge of the town, while the St Barnabas excavations (intended to explore the town defences) lay to the south of the present site but again took place near a church.

The results of this excavation, then, lend weight to the idea that the decline of occupation progressed from the periphery of the south bank settlement towards the centre, with isolated pockets persisting around the existing churches. The greatest concentration of activity in the period may have been located at the central bridging point at Bridge Street, in an area which has not yet been explored archaeologically.

X. Conclusions

The Mill Lane excavation has added considerably not only to our understanding of Late Saxon Thetford, but also to our knowledge of the pre-Saxon environment and of the nature of subsequent medieval settlement on the south bank of the river.

The early environment of this locality is largely consistent with evidence from other areas of south Norfolk, with changes in the pollen record reflecting the broad variations in intensity of occupation.

The Late Saxon town in this area was established on unoccupied land during the 10th century, with activity on the site peaking in the 11th century. The evidence shows that the site at Mill Lane was in many ways typical of Late Saxon Thetford and can best be likened to the earliest phase of Late Saxon activity at Brandon Road, which was loosely arranged and not overcrowded (Dallas 1993, 56). The site produced evidence for a mixture of domestic, craft and industrial activities, with metalworking playing a key role. Importantly, not only were iron smithing and smelting activities identified, but also the processing of copper alloys and silver. The discovery of a coin die could indicate that this was the location of a workshop for one of the Thetford moneyers. It is also noticeable that while evidence of domestic habitation decreased in the later 11th and early 12th centuries the number of metalworking hearths increased, suggesting that this area became more specialised as the population retreated. The town can therefore be seen as a busy and industrious place, which was largely self-sufficient through utilisation of its local resources.

Despite general decline in the 12th century, the medieval period saw the establishment of Mill Lane as a thoroughfare. Small-scale occupation was established alongside it while other pockets of activity persisted on the south bank, particularly in areas close to churches. The demise of the town of Thetford at this time appears to have been swift, and was closely linked to the growth of other major centres in the region (Bury St Edmunds and Norwich) which were favoured by wealthy and influential patrons.

Bibliography

Ager, B., 1995 'Recent acquisitions of Late Merovingian and Carolingian metalwork in the Department of Medieval and Later Antiquities of the British Museum', *Archaeologisches Korresponenzblatt* 25, 1995, 252–63

Albarella, U., 1995 'Depressions on sheep horncores', *Journal of Archaeological Science* 22, 699–704

Albarella, U., 1997a 'Size, power, wool and veal: zooarchaeological evidence for late medieval innovations', in De Boe, G. and Verhaeghe, F. (eds), *Environment and Subsistence in Medieval Europe*, Papers of the Medieval Europe Brugge 1997 Conference Volume 9. Brugge, 19–30 (Institute for the Archaeological Heritage of Flanders)

Albarella, U., 1997b 'Shape variation of cattle metapodials: age, sex or breed? Some examples from medieval and post-medieval sites', *Anthropozoologica* 25–6, 37–47

Albarella, U., 1999a '"The mistery of husbandry": medieval animals and the problem of integrating historical and archaeological evidence', *Antiquity* 73, 867–75

Albarella, U., 1999b *The Late Saxon and Early Medieval Mammal and Bird Bones Excavated in 1995 from Mill Lane, Thetford*, Ancient Monuments Laboratory Report 5/99

Albarella, U., Beech, M. and Mulville, J., 1997 *The Saxon, Medieval and Post-Medieval Mammal and Bird Bones Excavated 1989-91 from Castle Mall, Norwich, Norfolk*, Ancient Monuments Laboratory Rep. 72/97

Albarella, U., Beech, M. and Mulville, J., forthcoming 'Mammal and bird bone from the Castle Mall Site, excluding the Barbican well (Site 777N)', in Albarella, U., Beech, M., Locker, A., Moreno-Garcia, M., Mulville, J. and Curl, J., with Shepherd Popescu, E., *Norwich Castle: Excavations and Historical Survey 1987–98. Part 3, A Zooarchaeological Study*, E. Anglian Archaeol. Occ. Pap.

Albarella, U. and Davis, S., 1994 *The Saxon and Medieval Animal Bones Excavated 1985–1989 from West Cotton, Northamptonshire*, Ancient Monuments Laboratory Report 17/94

Albarella, U. and Davis, S., 1996 'Mammals and bird bones from Launceston Castle; decline in status and the rise of agriculture', *Circaea* 12 (1), 1–156

Albarella, U. and Payne, S., in prep. *The Pigs from Durrington Walls, a Neolithic data-base*

Ambrosiani, K., 1981 *Viking Age Combs, Comb Making and Comb Makers in the Light of Finds from Birka and Ribe*, Stockholm Studies in Archaeology 2 (Stockholm)

Andrew, R., 1984 *A Practical Pollen Guide to the British Flora*, Quaternary Research Association Technical Guide 1 (Cambridge)

Andrews, P., 1995 *Excavations at Redcastle Furze, Thetford, 1988–9*, E. Anglian Archaeol. 72

Andrews, P. and Penn, K.J., 1999 *Excavations in Thetford, North of the River, 1989–90*, E. Anglian Archaeol. 87

Archibald, M.M., 1984 'Coins', in Zarnecki, G., Holt, J. and Holland, T. (eds), *English Romanesque Art 1066-1200*, 320–41 (London)

Archibald, M.M., 1995 'Coins and jettons', in Andrews, P., *Excavations at Redcastle Furze, Thetford, 1988–9*, E. Anglian Archaeol. 72, 87–89

Archibald, M.M., Lang, J.R.S. and Milne, G., 1995 'Four early medieval coin dies from the London waterfront', *Numismatic Chronicle* 155, 163–200

Armstrong, P., Tomlinson, D. and Evans, D.H., 1991 *Excavations at Lurk Lane, Beverley, 1979–82*, Sheffield Excavation Reports 1 (Sheffield)

Arwidsson, G. and Berg, G., 1983 *The Mastermyr Find. A Viking Age Tool Chest from Gotland* (Stockholm)

Ayers, B.S., 1987 *Excavations at St Martin-at-Palace Plain, Norwich, 1981*, E. Anglian Archaeol. 37

Backhouse, J., Turner, D.H. and Webster, L. (eds), 1984 *The Golden Age of Anglo Saxon Art 966–1066* (London: British Museum Publications)

Baker, J. and Brothwell, D., 1980 *Animal Diseases in Archaeology* (London: Academic)

Bayley, J., 1982 'Non-ferrous metal and glassworking in Anglo-Scandinavian England: an interim statement', *PACT* 7(2) 487-96

Bayley, J., 1984 'Metalworking evidence', in Rogerson, A. and Dallas, C., *Excavations in Thetford 1928–59 and 1973–80, E. Anglian Archaeol*. 22, 107–8

Bayley, J., 1991 *Evidence for metalworking from pit 157, Site 25295, Thetford, Norfolk*, Ancient Monuments Laboratory Report 126/91

Bayley, J., 1992a *Anglo-Scandinavian Non-Ferrous Metalworking from 16–22 Coppergate*, The Archaeology of York, The Small Finds 17/7 (London: Council for British Archaeology)

Bayley, J., 1992b 'Metalworking ceramics', *Medieval Ceramics* 16, 3–10

Bayley, J., Freestone, I., Jenner, A. and Vince, A., 1991 'Metallurgy', in Vince, A. (ed.), *Aspects of Saxo-Norman London 2: Finds and Environmental Evidence*, London Middlesex Archaeol. Soc. Spec. Pap. 12, 389–405

Behre, K-E., 1981 'The interpretation of anthropogenic indicators in pollen diagrams', *Pollen et Spores* 23(2), 225–45

Bennett, K.D., 1983 'Devensian late glacial and Flandrian vegetation history at Hockham Mere, Norfolk, England', *New Phytologist* 95, 457–87

Bennett, K.D., 1994 'Confidence intervals for age estimates and deposition times in late Quaternary sediment sequences', *The Holocene*, B, 337–48

Biddle, M. (ed.), 1976 *Winchester in the Early Middle Ages*, Winchester Studies 1 (Oxford)

Biddle, M., 1990 *Object and Economy in Medieval Winchester*, Winchester Studies 7ii (Oxford)

Binford, L., 1981 *Bones. Ancient Men and Modern Myths* (London: Academic)

Blackburn, M. and Lyon, S., 1986 'Regional die-production in Cnut's *Quatrefoil* issue', in Blackburn, M. (ed.), *Anglo-Saxon Monetary History*, 223–72 (Leicester)

Blackburn, M., 1999 — 'Anglo-Saxon and medieval coins', in Andrews, P. and Penn, K.J., *Excavations in Thetford, North of the River, 1989–90*. E. Anglian Archaeol. 87, 38

Blackburn, M. and Mann, J., 1995 — 'A late Anglo-Saxon coin die from Flaxengate, Lincoln', *Numismatic Chronicle* 155, 201–8

Blades, N., 1995 — *Copper Alloys from English Archaeological Sites AD 400–1600: An analytical study using ICP-AES*, unpublished Ph.D. thesis, Royal Holloway College, University of London

Blockley, K., Blockley, M., Blockley, P., Frere, S.S. and Stow, S., 1995 — *Excavations in the Marlowe Car Park and Surrounding Areas*, The Archaeology of Canterbury 5 (Whitstable)

Blomqvist, R., 1942 — 'Kammar från Lunds medeltid', *Kulturen* 1942, 133–62

Blunt, C.E., Stewart, B.H.I.H. and Lyon, C.S.S., 1989 — *Coinage in Tenth-Century England* (Oxford)

Bourdillon, J., 1994 — 'The animal provisioning of Saxon Southampton', in Rackham, J. (ed.), *Environment and Economy in Anglo-Saxon England*, Counc. Brit. Archaeol. Res. Rep. 89, 120–5

Brain, C., 1976 — 'Some principles in the interpretation of bone accumulations associated with man', in Isaac, G. and McCown, E. (eds), *Human Origins*, 97–116

Bronk Ramsey, C., 1995 — 'Radiocarbon calibration and analysis of stratigraphy', *Radiocarbon* 36, 425–30

Bronk Ramsey, C., 1998 — 'Probability and dating', *Radiocarbon* 40, 461–74

Bronk Ramsey, C., 2001 — 'Development of the radiocarbon calibration program OxCal', *Radiocarbon*

Bronk Ramsey, C., and Hedges, R.E.M., 1997 — 'Hybrid ion sources: radiocarbon measurements from microgram to milligram', *Nuclear Instruments and Methods in Physics Research* B, 123, 539–5

Brown, D., 1990 — 'Weaving tools', in Biddle, M., *Object and Economy in Medieval Winchester*, Winchester Studies 7ii, 225–32 (Oxford)

Brown, D. and Lawson, G., 1990 — 'Toggles', in Biddle, M., *Object and Economy in Medieval Winchester*, Winchester Studies 7ii, 589–91 (Oxford)

Brown, N. and Glazebrook, J. (eds), 2000 — *Research and Archaeology: A Framework for the Eastern Counties 2: Research Agenda and Strategy*, E. Anglian Archaeol. Occ. Pap. 8

Brownsword, R. and Pitt, E.H., 1981 — 'Medieval "bell-metal" mortars — a misnomer', *The Metallurgist and Materials Technologist*, April 1981, 184–5

Buck, C.B., Cavanagh, W.G. and Litton, C.D., 1996 — *Bayesian Approach to Interpreting Archaeological Data* (Chichester)

Bull, G. and Payne, S., 1982 — 'Tooth eruption and epiphyseal fusion in pigs and wild boars', in Wilson, B., Grigson, C. and Payne, S. (eds), *Ageing and Sexing Animal Bones from Archaeological Sites*, Brit. Archaeol. Rep. Brit. Ser. 109, 55–72 (Oxford)

Bushe Fox, J.P., 1949 — *Fourth Report on the Excavations of the Roman Fort at Richborough, Kent*, Rep. Res. Comm. Soc. Antiq. London XVI

Carr, R., Tester, A. and Murphy, P., 1988 — 'The Middle Saxon settlement at Staunch Meadow, Brandon', *Antiquity* 62, 371–7

Carson, R.A.G., 1949 — 'The mint of Thetford', *Numismatic Chronicle* 6th ser., 9, 189–237

Caruth, J. and Anderson, S., 1997 — *St Saviour's Hospital, Bury St Edmunds (BSE 013): A Report on the Archaeological Excavations 1989–1994*, Suffolk County Council Archaeology Service Rep. 97/20

Christen, J.A., Clymo, R.S. and Litton, C.D., 1995 — 'A Bayesian approach to the use of C dates in the estimation of the age of peat', *Radiocarbon* 37, 431–42

Cinthio, M. 1976 — 'Isläggar', in Mårtensson, A.W. (ed.), *Uppgrävt förflutet för PKbanken i Lund*, Archaeologica Lundensia 7, 383–6

Clark, J. (ed.), 1995 — *The Medieval Horse and its Equipment c. 1150–c. 1450*, Medieval Finds from Excavations in London 5

Clason, A.T., 1980 — 'Worked Bone and Antler Objects from Dorestad, Hoogstraat I', in van Es, W.A. and Verwers, W.J.H., *Excavations at Dorestad 1, The Harbour, Hoogstraat I*, Nederlandse Oudheden 9 (Amersfoort), 238–47

Clutton-Brock, J., 1991 — 'Extinct species', in Corbet, G. and Harris, S. (eds), *The Handbook of British Mammals*, 571–5 (Oxford)

Clymo, R.S., 1984 — 'The limits to peat bog growth', *Phil. Trans Roy. Soc London* B, 303, 605–54

Clymo, R.S., 1991 — 'Peat growth', in Shane, L.C.K. and Cushing, B.J. (eds), *Quaternary Landscapes*, 76–112 (University of Minnesota)

Clymo, R.S., 1992 — 'Models of peat growth', *Suo*, 43, 127–36

Cnotliwy, E., 1970 — 'Pracownie grzebiennicze na Srebrnym Wzgȩrzu w Wolinie', *Materialy Zachodniopomorskie* 16, 209–87

Corbett, W.M., 1973 — *Breckland Forest Soils*, Soil Survey, Special Survey 7 (Harpenden)

Cotter, J.P., 2000 — *Post-Roman Pottery from Excavations in Colchester, 1971–85*, Colchester Archaeol. Rep. 7 (Colchester)

Crabtree, P., 1989 — *West Stow, Suffolk: Early Anglo-Saxon Animal Husbandry*, E. Anglian Archaeol. 47

Crosby, A., 1986 — *A History of Thetford* (Chichester)

Cunliffe, B., 1984 — *Danebury: an Iron Age Hillfort in Hampshire*, Counc. Brit. Archaeol. Res. Rep. 52 (London)

Dallas, C., 1984 — 'The pottery', in Rogerson, A. and Dallas, C., *Excavations in Thetford 1948–59 and 1973–80*, E. Anglian Archaeol. 22, 117–66

Dallas, C., 1993 — *Excavations in Thetford by B.K. Davison between 1964 and 1970*, E. Anglian Archaeol. 62

Darby, H., 1971 — *The Domesday Geography of Eastern England* (Cambridge University Press)

Dark, K and Dark, P., 1997 — *The Landscape of Roman Britain* (Stroud: Sutton)

Davies, J.A., 1996 — 'Where Eagles Dare: the Iron Age of Norfolk', *Proc. Prehist. Soc*. 62, 63–92

Davies, J.A. and Gregory, A., 1991 'Excavations at Thetford Castle, 1962 and 1985–6', in Davies, J.A., Gregory, A., Lawson, A.J., Rickett, R. and Rogerson, A., *The Iron Age Forts of Norfolk*, E. Anglian Archaeol. 54, 1–30

Davis, S., 1992 *A Rapid Method for Recording Information about Mammal Bones from Archaeological Sites*, Ancient Monuments Laboratory Report 19/92

Davis, S., 1996 'Measurements of a group of adult female Shetland sheep skeletons from a single flock: a baseline for zoo-archaeologists', *J. Archaeol. Sci*. 23, 593–612

Davison, A., 1993 'The documentary evidence', in Dallas, C., *Excavations in Thetford by B K Davison between 1964 and 1970*, E. Anglian Archaeol. 62, 194–217

Dobney, K., Jaques, D. and Irving, B., undated *Of Butchers and Breeds: Report on vertebrate remains from various sites in the City of Lincoln*, Lincoln Archaeological Studies 5

Driver, J., 1982 'Medullary bone as an indicator of sex in bird remains from archaeological sites', in Wilson, B., Grigson, C. and Payne, S. (eds), *Ageing and Sexing Animal Bones from Archaeological Sites*, Brit. Archaeol. Rep. Brit. Ser. 109, 251-4 (Oxford)

Drury, P., 1993 'Ceramic building material', in Margeson, S.M., *Norwich Households: The Medieval and Post-Medieval Finds from the Norwich Survey 1971–1978*, E. Anglian Archaeol. 58, 163–8

Dunlevy, M., 1988 'A classification of early Irish combs', *Proceedings of the Royal Irish Academy* 88C, 341–422

Dunmore, S. and Carr, R., 1976 *The Late Saxon Town of Thetford: An Archaeological and Historical Survey*, E. Anglian Archaeol. 4

Dyer, C., 1989 'The consumption of freshwater fish in medieval England', in Aston, M. (ed.), *Medieval Fish, Fisheries and Fish Ponds in England*, Brit. Archaeol. Rep. Brit. Ser. 182, 27–38 (Oxford)

Egan, G. and Pritchard, F., 1991 *Medieval Finds from excavations in London: 3. Dress Accessories c. 1150–c. 1450* (London)

English Heritage, 1991 *Management of Archaeological Projects 2*

Fægri, K. and Iversen, J., 1989 *Textbook of Pollen Analysis*, 4th edn (K. Fægri, P.E. Kaland and K. Krzywinski eds) (Chichester: Wiley)

Finberg, H., 1972 'Anglo-Saxon England to 1042', in Finberg, H. (ed.), *The Agrarian History of England and Wales. I.ii: A.D. 43–1042*, 383–525 (Cambridge University Press)

Fock, J., 1966 *Metrische Untersuchungen an Metapodien einiger Europaischer Rinderrassen*, Dissertation, University of Munich

Foreman, M., 1991 'The bone and antler', in Armstrong, P., Tomlinson, D. and Evans, D.H., *Excavations at Lurk Lane, Beverley, 1979–82*, Sheffield Excavation Reports 1, 183–96 (Sheffield)

Freestone, I. and Tite, M., 1986 'Refractories in the ancient and pre-industrial World', in Kingery, W.D. (ed.), *High Technology Ceramics: Past, Present and Future*, Ceramics and Civilisation 3, 35–63 (Westerville, Ohio)

Frick, H.J., 1992/3 'Karolingischottonische Scheibenfibeln des nordlichen Formenkreises. Offa. Berichte und Mitteilungen zur Urgeschichte', *Frühgeschichte und Mittelalterarchaologie*, Band 49/50, 243–464

Friedenson, S. and Friedenson, V., 1995 'Early Saxon spindle-whorls', in Rickett, R., *The Anglo-Saxon Cemetery at Spong Hill, North Elmham, Part VII, Roman and Early Saxon Settlement*, E. Anglian Archaeol. 73, 138–9

Fryer, V. and Murphy, P., 1999 'Plant macrofossils and molluscs', in Andrews, P. and Penn, K.J., *Excavations in Thetford, North of the River, 1989–90*, E. Anglian Archaeol. 87, 60–3

Goodall, A.R., 1993 'Non-ferrous metal objects', in Dallas, C., *Excavations in Theford by B.K. Davison between 1964 and 1970*, E. Anglian Archaeol. 62, 95–6

Goodall, I.H., 1984 'Iron objects', in Rogerson, A. and Dallas, C., Excavations in Thetford 1948-59 and 1973-80, E. Anglian Archaeol. 22, 77–106

Goodall, I.H. and Ottaway, P., 1993 'Iron objects', in Dallas, C., *Excavations in Thetford by B.K. Davison between 1964 and 1970*, E. Anglian Archaeol. 62, 96–116

Graham-Campbell, J., 1980 *Viking Artefacts: A Select Catalogue* (London)

Graham-Campbell, J., 1992 'Anglo-Norman equestrian equipment in 11th century England', *Anglo-Norman Studies XIV, Proceedings of the Battle Conference*, 77–89

Graham-Campbell, J., Batey, C., Clarke, H., Page, R.I. and Price, N.S. (eds), 1994 'The Legend of Sigurd', *Time Life Cultural Atlas of the Viking World*, 112–33 (Oxford)

Grand, R. and Delatouche, R., 1950 *L'agriculture au moyen age, de la fin de l'empire romain au XVI siècle* (Paris: Boccard)

Grant, A., 1988 'Animal resources', in Astill, G. and Grant, A. (eds), *The Countryside of Medieval England*, 149–261 (Oxford: Blackwell)

Green, B., 1993 'The Iron Age', in Wade-Martins, P. (ed.), *An Historical Atlas of Norfolk*, 32–3 (Norwich)

Green, E.B. and Clarke, R.R., 1963 Excavations at Thetford Castle 1962, *Norfolk Res. Comm. Bull.*, 1961–2

Gregory, A.K., 1991 'Excavations at Thetford Castle 1962', in Davies, J.A., Gregory, A.K., Lawson, A.J., Rickett, R. and Rogerson, A., *The Iron Age Forts of Norfolk*, E. Anglian Archaeol. 54, 3–16

Gregory, A.K., 1992 *Excavations in Thetford 1980–82, Fison Way*, E. Anglian Archaeol. 53

Greig, J., 1999 *Provisional Report on Pollen from a 1.7m Core from Stafford, Lammascote Road* (unpublished)

Greig, J., 2000 *Roman Birmingham — A Report on Pollen and Plant Macrofossils from Metchley fort (MAU99), Edgbaston, Birmingham* (unpublished)

Greig, J., in prep. *A Pollen Profile from Cookley, near Stourport, Worcestershire* (unpublished)

Griffiths, N., 1995 'Harness pendants and associated fittings', in Clarke, J. (ed.), *The Medieval Horse and its Equipment c. 1150–c. 1450, Medieval Finds from Excavations in London 5*, 61–70

Grigson, C. 1982 'Sex and age determination of some bones and teeth of domestic cattle: a review of the literature', in Wilson, B., Grigson, C. and Payne, S. (eds), *Ageing and Sexing Animal Bones from Archaeological Sites*, Brit. Archaeol. Rep Brit. Ser. 109, 7–24 (Oxford)

Grimm, E.C., 1990 'TILIA and TILIAGRAPH. PC spreadsheet and graphics software for pollen data', *INQUA working group on data-handling methods, Newsletter* 4, 5–7

Grimm, E.C., 1991 *TILIA and TILIAGRAPH* (Springfield, Illinois: State Museum)

Haarnagel, W., 1959 'Die einheimische frühgeschichtliche und mittelalterliche Keramik aus den Wurten "Hessens" und "Emden" und ihre zeitliche Gliederung', *Prehistorisches Zeitschrift* 37, 41–57

Hall, R., 1984 *The Viking Dig: the Excavations at York* (London)

Hamilton, J.R.C., 1956 *Excavations at Jarlshof, Shetland*, Minist. Works Archaeol. Rep. 1 (Edinburgh)

Hassall, M. and Rhodes, J., 1974 'Excavations at the new Market Hall, Gloucester 1966–7', *Trans Bristol Gloucester Archaeol. Soc*. 93, 15–100

Hattatt, R., 1989 *Ancient Brooches and Other Artefacts* (Oxford)

Hatting, T., 1974 'The influence of castration on sheep horns', in Clason, A. (ed.), *Archaeozoological Studies*, 345–51 (Amsterdam: Elsevier)

Healy, F., 1992a 'Lithic material', in Gregory, A.K., *Excavation in Thetford 1980–82, Fison Way*, E. Anglian Archaeol. 53, 143–7

Healy, F., 1992b 'Pre-Iron Age pottery', in Gregory, A.K., *Excavation in Thetford 1980–82, Fison Way*, E. Anglian Archaeol. 53, 148–53

Hedges, R.E.M., Bronk Ramsey, C. and Housley, R.A., 1989 'The Oxford Accelerator Mass Spectrometry facility: technical developments in routine dating', *Archaeometry* 31, 99–113

Henderson, A.M., 1949 'Small objects in metal, bone, glass *etc*.' in Bushe-Fox, J.P., *Fourth Report on the Excavations of the Roman Fort at Richborough, Kent*, Rep. Res. Comm. Soc. Antiq. London XVI, 106–60

Heywood, S., 1984 'Discussion', in Rogerson, A. and Dallas, C., *Excavations in Thetford 1948–59 and 1973–80*, E. Anglian Archaeol. 22, 52

Higham, C., 1969 'The metrical attributes of two samples of bovine limb bones', *Journal of Zoology, London* 157, 63–74

Hinton, D.A., 1974 *A Catalogue of the Anglo-Saxon Ornamental Metalwork 700–100 in the Department of Antiquities, Ashmolean Museum* (Oxford: Clarendon)

Hinton, D.A., 1990 'Hooked tags', in Biddle, M., *Object and Economy in Medieval Winchester*, Winchester Studies 7ii, 548–52 (Oxford)

Holdsworth, J., 1978 *Selected Pottery Groups AD 650–1780*, The Archaeology of York 16/1 (London: Council for British Archaeology)

Horsman, V., 1988 'The timber buildings', in Horsman, V., Milne, C. and Milne, G., *Building and Street Development, Aspects of Saxo-Norman London* 1, 66–70 (London)

Horsman, V., Milne, C. and Milne, G., 1988 *Building and Street Development*, Aspects of Saxo-Norman London 1 (London)

Hörter, F., Michels, F.X. and Röder, J., 1951 'Die Geschichte der Basalt Lava Industrie von Mayen und Niedermendig', in *Jahrbuch fur Geschichte Kultur des Mittelheins und seiner Nachbargebiete* 2–3, 1–32

Howard, M., 1963 'The metrical determination of the metapodials and skulls of cattle', in Mourant, A. and Zeuner, F. (eds), *Man and Cattle*, 91–100 (London: Royal Anthropological Institute of Great Britain and Ireland)

Hruby, V., 1957 'Slovanske kostene, predmety a jejich vyroba na morave', *Pamatky Archeologicke* 48, 118–217

Hurst, J., 1976 'The pottery', in Wilson, D.M. (ed.), *The Archaeology of Anglo-Saxon England*, 283–348 (Cambridge University Press)

Jankuhn, H., 1943 *Die Ausgrabungen in Haithabu 1937–9* (Berlin)

Jennings, S., 1981 *Eighteen Centuries of Pottery from Norwich*, E. Anglian Archaeol. 13

Jennings, S. 1983 'The pottery', in Ayers, B., Murphy, P., Atkin, M. and Jennings, S., *Waterfront Excavation and Thetford Ware Production, Norwich*, E. Anglian Archaeol. 17, 74–91

Jones, A.K.G., 1984 'Fish bones', in Rogerson, A. and Dallas, C., *Excavations in Thetford 1948–59 and 1973–80*, E. Anglian Archaeol. 22, 192–4

Jones, A.K.G., 1993 'Fish remains', in Dallas, C., *Excavations in Thetford by B.K. Davison between 1964 and 1970*, E. Anglian Archaeol. 62, 191

Jones, G., 1984 'Animal bones', in Rogerson, A. and Dallas, C., *Excavations in Thetford 1948-59 and 1973-80*, E. Anglian Archaeol. 22, 187-92

Jones, G., 1993 'Animal and bird bone', in Dallas, C., *Excavations in Thetford by B.K. Davison between 1964 and 1970*, E. Anglian Archaeol. 62, 176-91

Jones, G., 1994 'Mammal and bird bone', in Ayers, B., *Excavations at Fishergate, Norwich, 1985*, E. Anglian Archaeol. 68, 37-42

Jonsson, K., 1987 *The New Era. The Reformation of the Late Anglo-Saxon Coinage* (Stockholm)

Keller, C., 1995 'Pingsdorf-type ware — an introduction', *Medieval Ceramics* 19, 19–28

Kent, D.H., 1992 *List of Vascular Plants of the British Isles* (London: Botanical Society of the British Isles)

Kenward, H.K., Hall, A.R. and Jones, A.K.G., 1980 'A tested set of techniques for the extraction of plant and animal macrofossils from waterlogged archaeological deposits', *Science and Archaeology* 22, 3–15

Kerney, M.P., 1975 'A list of the fresh and brackish-water mollusca of the British Isles', *Journal of Conchology* 29, 26–8

Kerney, M.P. and Cameron, R.A.D., 1979 *A Field Guide to the Land Snails of Britain and North-West Europe* (London: Collins)

Kilian, M.R., van Geel, B. and van der Plicht, J., 2000 'C AMS wiggle matching of raised bog deposits and models of peat accumulation', *Quaternary Science Reviews* 19, 1011–33

Kilmurry, K., 1980 *The Pottery Industry of Stamford, Lincs, c. AD 850–1250*, Brit. Archaeol. Rep. Brit. Ser. 84 (Oxford)

Kluge-Pinsker, A., 1991 *Schachspiel und Trictrac. Zeugnisse mittelalterlicher Spielfreude aus salischer Zeit*, Romisch-Germanishes Zentralmuseum Monographien 30 (Sigmaringen)

Knocker, G.M., 1967 'Excavations at Redcastle, Thetford', *Norfolk Archaeol*. 34, 119–86

Krogman, W., 1978 *The Human Skeleton in Forensic Medicine* (Illinois: C.C. Thomas)

Krüger, T., 1982 'Das Brett- und Wurfelspiel der Spätlatenzeit und romischen Kairserzeit im freien Germanien, Neue Ausgrabungen und Forschungen', *Niedersachsen* 15, 135–324

Lawson, A.J. and Wymer, J.J., 1993 'The Bronze Age', in Wade-Martins, P. (ed.), *An Historical Atlas of Norfolk*, 30–1 (Norwich)

Lehmkuhl, U., 1982 'Archeozoologische und typologische Untersuchungen an durchlochten Schweine-metapodien von slawischen Fundplätzen in Mecklenburg', *Bodendenkmalpflege in Mecklenburg* 30, 199–222

Linder, I.M., 1994 *The Art of Chess Pieces* (Moscow)

Little, A., 1994 'The pottery from Sites 22954 and 24054', in Leah, M., *The Late Saxon and Medieval Pottery Industry of Grimston, Norfolk: Excavations 1962–92*, E. Anglian Archaeol. 64, 84–101

Little, A., 1995 'The pottery', in Andrews, P., *Excavations at Redcastle Furze, Thetford, 1988–9*, E. Anglian Archaeol. 72, 101–16

Litton, C.D., and Buck, C.B., 1994 'The Bayesian approach to the interpretation of archaeological data', *Archaeometery* 37, 1–24

Mårtensson, A.W., 1976 *Uppgrävt förflutet för PKbanken i Lund*, Archaeologica Lundensia 7 (Lund)

MacGregor, A., 1975 'Problems in the interpretation of microscopic wear patterns: the evidence from bone skates', *J. Archaeol. Sci.* 2, 385–90

MacGregor, A., 1976 'Bone skates: a review of the evidence', *Archaeol. J.* 133, 57–74

MacGregor, A., 1982 *Anglo-Scandinavian Finds from Lloyds Bank, Pavement and other Sites*, The Archaeology of York 17/3 (London: Council for British Archaeology)

MacGregor, A., 1985 *Bone, Antler, Ivory and Horn. The technology of skeletal materials since the Roman period* (London)

Manning, W.H., 1985 *Catalogue of the Romano-British Iron Tools, Fittings and Weapons in the British Museum* (London: British Museum)

Margeson, S.M., 1988 'A bird-shaped brooch from Stoke Holy Cross', *Norfolk Archaeol*. 40, 199

Margeson, S.M., 1993 *Norwich Households: The Medieval and Post-Medieval Finds from Norwich Survey Excavations 1971–1978*, E. Anglian Archaeol. 58

Margeson, S.M., 1996 'Viking settlement in Norfolk: a study of new evidence', in Margeson, S.M., Ayers, B., and Heywood, S. (eds), *A Festival of Norfolk Archaeology*, 47–57 (Norwich)

Margeson, S.M., 1997 *The Vikings in Norfolk* (Norwich)

Margeson, S.M., 1999 'Gilded disc fragment', in Andrews, P. and Penn, K.J., *Excavations in Thetford, North of the River, 1989–90*, E. Anglian Archaeol. 87, 40

Masefield, G. and Masefield, R., 1997 'Metal objects', in *Saxon Place, Thetford. An Archaeological Watching Brief* (RPS Clouston, unpublished report)

McDonnell, J.G., 1989 'Iron and its alloys in the fifth to eleventh centuries AD in England', *World Archaeology* 20(3), 373–82

Metcalf, D.M., 1993 'Coins and jettons', in Dallas, C., *Excavations in Thetford by B.K. Davison between 1964 and 1970*, E. Anglian Archaeol. 62, 95

Mills, J.M., and Moore, D.T., in prep. 'Whetstones/honestones', in Shepherd Popescu, E., *Norwich Castle: Excavations and Historical Survey, 1987-98. Volume 1: Anglo-Saxon to c. 1345*, E. Anglian Archaeol.

Mitchener, M., 1988 *Jetons, Medalets and Tokens: The Medieval Period and Nuremburg* (London)

Moffett, L.C., 1996 *Plant Remains from Flaxengate, Lincoln*, Ancient Monuments Laboratory Report 50/96

Mook, W.G., 1986 'Business meeting: recommendations/resolutions adopted by the Twelfth International Radiocarbon Conference', *Radiocarbon* 28, 799

Moore, D.T., and Ellis, S.E., 1984 'Stone objects', in Rogerson, A., and Dallas, C., *Excavations in Thetford 1948–59 and 1973–80*, E. Anglian Archaeol. 22, 107–11

Mudd, A., 2002 *Excavations at Melford Meadows, Brettenham, 1994*, E. Anglian Archaeol. 99

Murphy, P., 1985 'The plant remains', in Atkin, M., *Excavations on Alms Lane (Site 302N)*, E. Anglian Archaeol. 26, 228–34

Murphy, P. 1991 *Ipswich, Suffolk: Plant Macrofossils from Sites IAS 3104 (Buttermarket), IAS 3201 (ABC Cinema) and IAS 5203 (Greyfriars Road)*, Ancient Monuments Laboratory Report 33/91

Murphy, P., 1995 'Plant macrofossils', in Andrews, P., *Excavations at Redcastle Furze, Thetford, 1988–9*, E. Anglian Archaeol. 72, 131–4

Murphy, P., 1997 'Environment and economy', in Wade, K., 'Anglo-Saxon and medieval (rural)', in Glazebrook, J. (ed.), *Research and Archaeology: A Framework for the Eastern Counties. 1: Resource Assessment*, E. Anglian Archaeol. Occ. Pap. 3, 54–5

Murray, H.J.R., 1913 *A History of Chess* (Oxford)

Mynard, D.C., 1994 *Medieval Sites in Milton Keynes*, Buckinghamshire Archaeol. Soc. Monogr. Ser. 6 (Aylesbury)

Noddle, B., 1977 'Mammal bones', in Clarke, H. and Carter, A., *Excavations in King's Lynn 1963–1970*, 378–99 (London: Society for Medieval Archaeology)

Noddle, B., 1980 'Identification and interpretation of the mammal bones', in Wade-Martins, P., *Excavations at North Elmham Park, 1967–1972*, E. Anglian Archaeol. 9, 377–409

North, I. and North, J.J., 1980 *English Hammered Coinage, Vol. 1*, 2nd edn (London)

O'Connor, T., 1988 *Bones from the General Accident Site, Tanner Row*, The Archaeology of York 15/2 (London: Council for British Archaeology)

O'Connor, T., 1994 '8th–11th century economy and environment in York', in Rackham, J. (ed.), *Environment and Economy in Anglo-Saxon England*, Counc. Brit. Archaeol. Res. Rep. 89, 136–47

Ottaway, P., 1992 — *Anglo-Scandinavian Ironwork from 16–22 Coppergate*, The Archaeology of York Volume 17: The small finds, fasc. 6 (London: Council for British Archaeology)

Øye, I., 1988 — *Textile Equipment and its Working Environment, Bryggen in Bergen c. 1150–1500*, The Bryggen Papers, Main Series 2, Oslo

Payne, S. 1973 — 'Kill-off patterns in sheep and goats: the mandibles from Aºvan Kale', *Anatolian Studies* 23, 281–303

Pedersen, A., 1996/7 — 'Riding gear from Late Viking-age Denmark', *Journal of Danish Archaeology* 13, 133–60

Peglar, S., 1992 — *The Development of the Cultural Landscape of East Anglia, UK*, Ph.D. thesis, Bergen University, Norway

Peglar, S., 1993 — 'The development of the cultural landscape around Diss Mere, Norfolk, UK, during the past 7000 years', *Review of Palaeobotany and Palynology* 76, 1–47

Penn, K.J., 1993 — 'Saxon Thetford', in Wade-Martins, P. (ed.), *An Historical Atlas of Norfolk*, 46–7 (Norwich)

Pinter-Bellows, S., 1992 — 'The vertebrate remains from sites 94 and 95', in Milne, G. and Richards, J. (eds.), *Wharram: A study of Settlement on the Yorkshire Wolds, Vol. 7. Two Anglo-Saxon Buildings and Associated Finds*, York University Archaeological Publications 9, 69–79

Pirie, E.J.E., 1986 — *Post-Roman Coins from York Excavations 1971–81,* The Archaeology of York 18/1 (London: Council for British Archaeology)

Pritchard, F., 1991 — 'Small finds', in Vince, A.G. (ed.), *Finds and Environmental Evidence, Aspects of Saxo-Norman London II*, 120–278 (London)

Reichstein, H., 1973 — 'Untersuchungen zur Variabilität Frühgeschichtlicher Rinder Mitteleuropas', in Matolcsi, J. (ed.), *Domestikationforschung und Geschichte der Haustiere*, 325–40 (Budapest: Akademiai Kiado)

Riddler, I.D., 1991 — *London Skates* (unpublished archive report, Department of Urban Archaeology, London)

Riddler, I.D., 1993 — 'Saxon worked bone', in Williams, R.J. (ed.), *Pennyland and Hartigans*, Buckinghamshire Archaeol. Soc. Monogr. 4, 107–19

Riddler, I.D., 1995 — 'Anglo-Norman chess', in de Voogt, A.J. (ed.), *New Approaches to Board Games Research: Asian Origins and Future Perspectives*, International Institute for Asian Studies, Working Papers Series 3, 99–110 (Leiden)

Riddler, I.D., 1996 — 'The antler waste', in Williams, R.J., Hart, P.J. and Williams, A.T.L., *Wavendon Gate: A Late Iron Age and Roman Settlement in Milton Keynes*, Buckinghamshire Archaeology Society Monograph 10

Riddler, I.D., 1997 — 'The parallel-piped die', in Wilmott, T. (ed.), *Birdoswald: A Fort on Hadrian's Wall, Excavations 1987–1992*, Engl. Heritage Archaeol. Rep. 14, 297–8

Riddler, I.D., forthcoming a — 'Objects and waste of bone, antler and ivory', in Russel, A. (ed.), *Excavations at Lower High Street, Southampton*

Riddler, I.D., forthcoming b — 'The small finds', in Parfitt, K. (ed.), *Excavations at Townwall Street, Dover, 1996*, Canterbury Archaeol. Trust Occ. Pap.

Riddler, I.D., Trzaska-Nartowski, N.I.A. and Hatton, S., forthcoming — *An Early Medieval Craft. Objects and Waste of Bone, Antler and Ivory from Ipswich Excavations, 1974–1994*

Rigold, S.E., 1984 — 'Coins and jettons', in Rogerson, A. and Dallas, C., *Excavation in Thetford 1948–59 and 1973–80*, E. Anglian Archaeol. 22, 66–8

Robinson, M., 2002 — 'Plant remains', in Mudd, A., *Excavations at Melford Meadows, Brettenham, 1994*, E. Anglian Archaeol. 99, 108–10

Roes, A., 1963 — *Bone and Antler Objects from the Frisian Terp Mounds* (Haarlem)

Rogerson, A. and Adams, N., 1978 — 'A Saxo-Norman pottery kiln at Bircham', *E. Anglian Archaeol.* 8, 33–44

Rogerson, A. and Dallas, C., 1984 — *Excavations in Thetford 1948–59 and 1973–80*, E. Anglian Archaeol. 22

Rulewicz, M., 1958 — 'Wczesnosredniowieczne zabawki i przedmioty do gier z Pomorza Zachodniego (Z badan prowadzonych w latach 1947–1958)', *Materialy Zachodniopomorskie* 4, 303–54

Sadler, P., 1991 — 'The use of tarsometatarsi in sexing and ageing domestic fowl (*Gallus gallus* L.), and recognising five-toed breeds in archaeological material', *Circaea* 8, 41–8

Sadler, P., 1994 — 'Useful small dogs', *Circaea* 11(1), 6

Schwarz-Mackensen, G., 1976 — 'Die Knochennadeln von Haithabu', in Schietzel, K. (ed.), *Berichte über die Ausgrabungen in Haithabu* 9, 1–94 (Neumünster)

Silver, I., 1969 — 'The ageing of domestic animals', in Brothwell, D. and Higgs, E. (eds), *Science in Archaeology*, 2nd edn, 283–302 (London)

Spencer, B., 1980 — *Medieval Pilgrim Badges From Norfolk* (Norwich: Norfolk Museums Service)

Stace, C., 1991 — *A New Flora of the British Isles* (Cambridge University Press)

Steier, P. and Rom, W., 2000 — 'The use of Bayesian statistics for C dates of chronologically ordered samples: a critical analysis'. *Radiocarbon* 42(2), 183–98

Stuiver, M., and Kra, R., 1986 — 'Editorial comment', *Radiocarbon* 28(2B), ii

Stuiver, M., and Polach, H.A., 1977 — 'Reporting of C data', *Radiocarbon* 19, 355–63

Stuiver, M., and Reimer, P.J., 1986 — 'A computer program for radiocarbon age calculation', *Radiocarbon* 28, 1022–30

Stuiver, M. and Reimer, P.J., 1993 — 'Extended C data base and revised CALIB 3.0 'C age calibration program', *Radiocarbon* 35, 215–30

Stuiver, M., Reimer, P.J., Bard, B., Beck, J.W, Burr, G.S., Hughen, K.A., Kromer, B., McCormac, F.G., van der Plicht, J. and Spurk, M., 1998 — 'INTCAL98 radiocarbon age calibration, 24,000–0 cal BP', *Radiocarbon* 40, 104–84

Tempel, W.D., 1969 — *Die Dreilagenkamme aus Haithabu. Studien zu den Kämmen der Wikingerzeit im Nordseekustengebiet und Skandinavien*, unpublished dissertation, University of Göttingen

Trow-Smith, R., 1957 — *A History of British Livestock Husbandry to 1700* (London)

Ulbricht, I., 1984 — 'Die Verarbeitung von Knochen, Geweih und Horn im mittelalterlichen Schleswig', *Ausgrabungen in Schleswig, Berichte und Studien* 3 (Neumunster)

Vince, A. and Bayley, J., 1983 — 'A Late Saxon glass finger ring from the City of London', *Trans London Middlesex Archaeol. Soc.* 34, 93–4

Vitt, V., 1952 — 'Loshadi Pezyryksich kurganov. Sovetskaja', *Archeologija* 16, 163–205

Wade, K., 1976 — 'Excavations at Langhale, Kirstead, Norfolk', *E. Anglian Archaeol.* 2, 101–30

Wade-Martins, P., 1980 — *Excavations in North Elmham Park, 1967–1972*, E. Anglian Archaeol. 9

Walker, H., 1995 — 'The medieval and post-medieval pottery', in Wymer, J. and Brown, N., *Excavations at North Shoebury: Settlement and Economy in South-East Essex 1500 BC–AD 1500*, E. Anglian Archaeol. 75, 102–24

Wallis, H., 1997 — *Mill Lane, Thetford: Assessment Report and Updated Project Design* (unpublished)

Wallis, H., in prep. — *Excavations in Coslany, Norwich*

Walton Rogers, P., 1993 — 'Spindle whorls', in Rogers, N.S.H., *Anglian and Other Finds from Fishergate*, The Archaeology of York 17/9, 1268 (London: Council for British Archaeology)

Walton Rogers, P., 1997 — *Textile Production at 16–22 Coppergate*, The Archaeology of York, the Small Finds 17/11 (London: Council for British Archaeology)

Wamers, E., 1994a — *A Die Frühmittelalterlichen Lesefunde aus der Löhrstrasse (Basustelle Hilton II) in Mainz*, Archaologische Denkmalpflege (Mainz)

Wamers, E., 1994b — 'Fibel und Fibeltracht', in Hoops, J., *Reallexikon der Germanischen Alterumskunde*, Band 8 section 5/6

Waterman, D.M., 1959 — Late Saxon, Viking and Early Medieval finds from York, *Archaeologia* 97, 59–105

West, B., 1985 — 'Chicken legs revisited', *Circaea* 3(1), 11–14

Wheeler, A. and Jones, A.K.G., 1976 — 'Fish remains', in Rogerson, A., 'Excavations at Fuller's Hill, Great Yarmouth', *E. Anglian Archaeol*. 2, 208–23

Whitehead, R., 1996 — *Buckles 1250–1800* (Chelmsford)

Williams, D., 1999 — 'Some recent finds from Surrey', *Surrey Archaeol. Collect*. 86, 171–97

Williamson, T., 1993 — *The Origins of Norfolk* (Manchester University Press)

Wilson, D.M., 1964 — *Anglo-Saxon Ornamental Metalwork 700–1100*, Brit. Mus. Cat. Antiq., Later Saxon Period 1 (London)

Wilson, P.R., Cardwell, P., Cramp, R.J., Evans, J., Taylor-Wilson, R.H., Thompson, A. and Wacher, J.S., 1996 — 'Early Anglian Catterick and Catraeth', *Med. Archaeol.* 40, 1–61

Winter, F., 1907 — *Die Kämme aller Zeiten* (Leipzig)

Woodland, M., 1990 — 'Spindle-whorls', in Biddle, M., *Object and Economy in Medieval Winchester*, Winchester Studies 7ii, 216–25 (Oxford)

Young, J., 1989 — 'The pottery', in Miles, P., Young, J. and Wacher, J., *A Late Saxon Kiln Site at Silver Street, Lincoln*, The Archaeology of Lincoln, Vol. XVII-3 (London: Council for British Archaeology/City of Lincoln Archaeological Unit)

Index

Locations of figures, charts and plates are indicated by page references in italic type.

East Anglian Archaeology

is a serial publication sponsored by the Scole Archaeological Committee. Norfolk, Suffolk and Essex Archaeology Services, the Norwich Survey and the Fenland Project all contribute volumes to the series. It is the main vehicle for publishing final reports on archaeological excavations and surveys in the region. For information about titles in the series, visit **www.eaareports.org.uk**. Reports can be obtained from:

Phil McMichael, Essex County Council Archaeology Section
Fairfield Court, Fairfield Road, Braintree, Essex CM7 3YQ

Reports available so far:

No.1, 1975 Suffolk: various papers
No.2, 1976 Norfolk: various papers
No.3, 1977 Suffolk: various papers
No.4, 1976 Norfolk: Late Saxon town of Thetford
No.5, 1977 Norfolk: various papers on Roman sites
No.6, 1977 Norfolk: Spong Hill Anglo-Saxon cemetery, Part I
No.7, 1978 Norfolk: Bergh Apton Anglo-Saxon cemetery
No.8, 1978 Norfolk: various papers
No.9, 1980 Norfolk: North Elmham Park
No.10, 1980 Norfolk: village sites in Launditch Hundred
No.11, 1981 Norfolk: Spong Hill, Part II: Catalogue of Cremations
No.12, 1981 The barrows of East Anglia
No.13, 1981 Norwich: Eighteen centuries of pottery from Norwich
No.14, 1982 Norfolk: various papers
No.15, 1982 Norwich: Excavations in Norwich 1971–1978; Part I
No.16, 1982 Norfolk: Beaker domestic sites in the Fen-edge and East Anglia
No.17, 1983 Norfolk: Waterfront excavations and Thetford-type Ware production, Norwich
No.18, 1983 Norfolk: The archaeology of Witton
No.19, 1983 Norfolk: Two post-medieval earthenware pottery groups from Fulmodeston
No.20, 1983 Norfolk: Burgh Castle: excavation by Charles Green, 1958–61
No.21, 1984 Norfolk: Spong Hill, Part III: Catalogue of Inhumations
No.22, 1984 Norfolk: Excavations in Thetford, 1948–59 and 1973–80
No.23, 1985 Norfolk: Excavations at Brancaster 1974 and 1977
No.24, 1985 Suffolk: West Stow, the Anglo-Saxon village
No.25, 1985 Essex: Excavations by Mr H.P.Cooper on the Roman site at Hill Farm, Gestingthorpe, Essex
No.26, 1985 Norwich: Excavations in Norwich 1971–78; Part II
No.27, 1985 Cambridgeshire: The Fenland Project No.1: Archaeology and Environment in the Lower Welland Valley
No.28, 1985 Norfolk: Excavations within the north-east bailey of Norwich Castle, 1978
No.29, 1986 Norfolk: Barrow excavations in Norfolk, 1950–82
No.30, 1986 Norfolk: Excavations at Thornham, Warham, Wighton and Caistor St Edmund, Norfolk
No.31, 1986 Norfolk: Settlement, religion and industry on the Fen-edge; three Romano-British sites in Norfolk
No.32, 1987 Norfolk: Three Norman Churches in Norfolk
No.33, 1987 Essex: Excavation of a Cropmark Enclosure Complex at Woodham Walter, Essex, 1976 and An Assessment of Excavated Enclosures in Essex
No.34, 1987 Norfolk: Spong Hill, Part IV: Catalogue of Cremations
No.35, 1987 Cambridgeshire: The Fenland Project No.2: Fenland Landscapes and Settlement, Peterborough–March
No.36, 1987 Norfolk: The Anglo-Saxon Cemetery at Morningthorpe
No.37, 1987 Norfolk: Excavations at St Martin-at-Palace Plain, Norwich, 1981
No.38, 1987 Suffolk: The Anglo-Saxon Cemetery at Westgarth Gardens, Bury St Edmunds
No.39, 1988 Norfolk: Spong Hill, Part VI: Occupation during the 7th–2nd millennia BC
No.40, 1988 Suffolk: Burgh: The Iron Age and Roman Enclosure
No.41, 1988 Essex: Excavations at Great Dunmow, Essex: a Romano-British small town in the Trinovantian Civitas
No.42, 1988 Essex: Archaeology and Environment in South Essex, Rescue Archaeology along the Gray's By-pass 1979–80
No.43, 1988 Essex: Excavation at the North Ring, Mucking, Essex: A Late Bronze Age Enclosure
No.44, 1988 Norfolk: Six Deserted Villages in Norfolk
No.45, 1988 Norfolk: The Fenland Project No. 3: Marshland and the Nar Valley, Norfolk
No.46, 1989 Norfolk: The Deserted Medieval Village of Thuxton
No.47, 1989 Suffolk: West Stow: Early Anglo-Saxon Animal Husbandry
No.48, 1989 Suffolk: West Stow, Suffolk: The Prehistoric and Romano-British Occupations
No.49, 1990 Norfolk: The Evolution of Settlement in Three Parishes in South-East Norfolk
No.50, 1993 Proceedings of the Flatlands and Wetlands Conference
No.51, 1991 Norfolk: The Ruined and Disused Churches of Norfolk
No.52, 1991 Norfolk: The Fenland Project No. 4, The Wissey Embayment and Fen Causeway
No.53, 1992 Norfolk: Excavations in Thetford, 1980–82, Fison Way
No.54, 1992 Norfolk: The Iron Age Forts of Norfolk
No.55, 1992 Lincolnshire: The Fenland Project No.5: Lincolnshire Survey, The South-West Fens
No.56, 1992 Cambridgeshire: The Fenland Project No.6: The South-Western Cambridgeshire Fens
No.57, 1993 Norfolk and Lincolnshire: Excavations at Redgate Hill Hunstanton; and Tattershall Thorpe
No.58, 1993 Norwich: Households: The Medieval and Post-Medieval Finds from Norwich Survey Excavations 1971–1978
No.59, 1993 Fenland: The South-West Fen Dyke Survey Project 1982–86
No.60, 1993 Norfolk: Caister-on-Sea: Excavations by Charles Green, 1951–55
No.61, 1993 Fenland: The Fenland Project No.7: Excavations in Peterborough and the Lower Welland Valley 1960–1969
No.62, 1993 Norfolk: Excavations in Thetford by B.K. Davison, between 1964 and 1970
No.63, 1993 Norfolk: Illington: A Study of a Breckland Parish and its Anglo-Saxon Cemetery
No.64, 1994 Norfolk: The Late Saxon and Medieval Pottery Industry of Grimston: Excavations 1962–92
No.65, 1993 Suffolk: Settlements on Hill-tops: Seven Prehistoric Sites in Suffolk
No.66, 1993 Lincolnshire: The Fenland Project No.8: Lincolnshire Survey, the Northern Fen-Edge
No.67, 1994 Norfolk: Spong Hill, Part V: Catalogue of Cremations
No.68, 1994 Norfolk: Excavations at Fishergate, Norwich 1985
No.69, 1994 Norfolk: Spong Hill, Part VIII: The Cremations
No.70, 1994 Fenland: The Fenland Project No.9: Flandrian Environmental Change in Fenland
No.71, 1995 Essex: The Archaeology of the Essex Coast Vol.I: The Hullbridge Survey Project
No.72, 1995 Norfolk: Excavations at Redcastle Furze, Thetford, 1988–9
No.73, 1995 Norfolk: Spong Hill, Part VII: Iron Age, Roman and Early Saxon Settlement
No.74, 1995 Norfolk: A Late Neolithic, Saxon and Medieval Site at Middle Harling
No.75, 1995 Essex: North Shoebury: Settlement and Economy in South-east Essex 1500–AD1500
No.76, 1996 Nene Valley: Orton Hall Farm: A Roman and Early Anglo-Saxon Farmstead
No.77, 1996 Norfolk: Barrow Excavations in Norfolk, 1984–88
No.78, 1996 Norfolk:The Fenland Project No.11: The Wissey Embayment: Evidence for pre-Iron Age Occupation
No.79, 1996 Cambridgeshire: The Fenland Project No.10: Cambridgeshire Survey, the Isle of Ely and Wisbech
No.80, 1997 Norfolk: Barton Bendish and Caldecote: fieldwork in south-west Norfolk
No.81, 1997 Norfolk: Castle Rising Castle
No.82, 1998 Essex: Archaeology and the Landscape in the Lower Blackwater Valley
No.83, 1998 Essex: Excavations south of Chignall Roman Villa 1977–81
No.84, 1998 Suffolk: A Corpus of Anglo-Saxon Material
No.85, 1998 Suffolk: Towards a Landscape History of Walsham le Willows
No.86, 1998 Essex: Excavations at the Orsett 'Cock' Enclosure
No.87, 1999 Norfolk: Excavations in Thetford, North of the River, 1989–90
No.88, 1999 Essex: Excavations at Ivy Chimneys, Witham 1978–83
No.89, 1999 Lincolnshire: Salterns: Excavations at Helpringham, Holbeach St Johns and Bicker Haven
No.90, 1999 Essex:The Archaeology of Ardleigh, Excavations 1955–80

No.91, 2000 Norfolk: Excavations on the Norwich Southern Bypass, 1989–91 Part I Bixley, Caistor St Edmund, Trowse
No.92, 2000 Norfolk: Excavations on the Norwich Southern Bypass, 1989–91 Part II Harford Farm Anglo-Saxon Cemetery
No.93, 2001 Norfolk: Excavations on the Snettisham Bypass, 1989
No.94, 2001 Lincolnshire: Excavations at Billingborough, 1975–8
No.95, 2001 Suffolk: Snape Anglo-Saxon Cemetery: Excavations and Surveys
No.96, 2001 Norfolk: Two Medieval Churches in Norfolk
No.97, 2001 Cambridgeshire: Monument 97, Orton Longueville
No.98, 2002 Essex: Excavations at Little Oakley, 1951–78
No.99, 2002 Norfolk: Excavations at Melford Meadows, Brettenham, 1994
No.100, 2002 Norwich: Excavations in Norwich 1971–78, Part III
No.101, 2002 Norfolk: Medieval Armorial Horse Furniture in Norfolk
No.102, 2002 Norfolk: Baconsthorpe Castle, Excavations and Finds, 1951–1972
No.103, 2003 Cambridgeshire: Excavations at the Wardy Hill Ringwork, Coveney, Ely
No.104, 2003 Norfolk: Earthworks of Norfolk
No.105 2003 Essex: Excavations at Great Holts Farm, 1992–4
No.106 2004 Suffolk: Romano-British Settlement at Hacheston
No.107 2004 Essex: Excavations at Stansted Airport, 1986–91
No.108, 2004 Norfolk: Excavations at Mill Lane, Thetford, 1995