EAST ANGLIAN ARCHAEOLOGY

OCCASIONAL PAPERS

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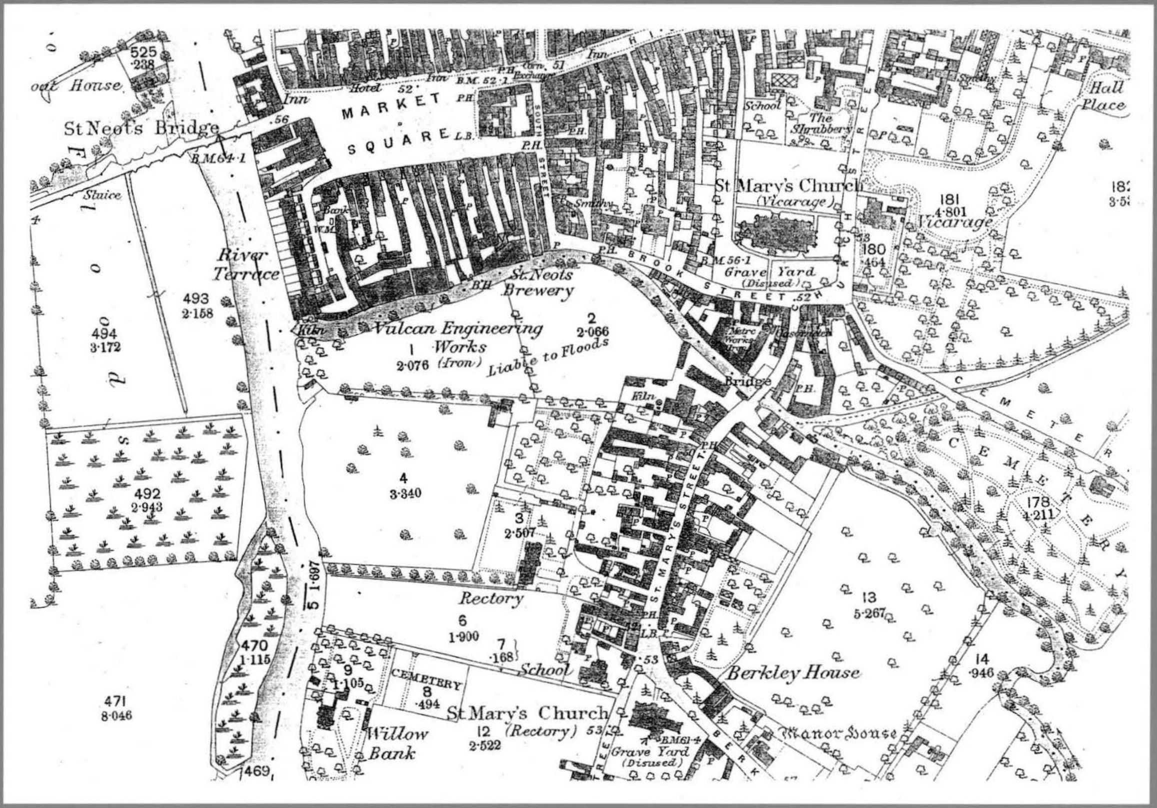

ST MARY'S STREET, ST NEOTS, CAMBRIDGESHIRE, ARCHAEOLOGICAL INVESTIGATIONS 1994–5

East Anglian Archaeology

Birmingham University
Field Archaeology Unit

EAST ANGLIAN ARCHAEOLOGY

St Mary's Street, St Neots, Cambridgeshire, Archaeological Investigations 1994–5

by A. E. Jones

with contributions by
S. Pinter-Bellows, L. Moffett, R. Roseff, S. Rátkai
and L. Bevan

illustrations by
M. Breedon and N. Dodds

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Cover illustration
Section of 1882 Ordnance Survey Map showing St Mary's Street, St Neots
(running south from St Mary's church)

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Summary

A former builders' merchant's yard, adjoining St Mary's Street and the Hen Brook at St Neots, was investigated by means of trial-trenching, a small area excavation and a watching brief, in advance of a housing development.

The subsoil was the river terrace sands and gravels. Three phases of activity were identified. The first phase included the medieval activity adjoining the street frontage, the earliest recorded episodes of alluviation, and the formation of a possible marsh deposit in the west of the site. In the second phase a brick terrace of houses was constructed in the 17th century on the street frontage, and the backplot area was used for tanning. The third phase includes all later activity recorded on the site, following its incorporation in 1889 into a builders' merchant's yard

Chapter 1. Introduction

I. The site

This report describes the results of archaeological investigations (Jones 1994; Jones 1995) of 0.7ha of land located to the west of St Mary's Street, St Neots, Cambridgeshire (centred on NGR. SP184600: Fig. 1A). The fieldwork was undertaken by Birmingham University Field Archaeology Unit on behalf of Bedfordshire Pilgrims Housing Association. The site was located to the south of the Hen Brook (Figs 1B–C), and the St Mary's Street frontage lay approximately 300m to the east of the confluence of the River Great Ouse and the Hen Brook.

The fieldwork was intended to identify any Saxon and medieval activity, both adjoining the street frontage and along the Hen Brook frontage, where evidence of the Saxon/medieval environment was sought from analysis of the soils and sediments. In the backplot area, to the rear of the retained buildings on the street frontage, evidence of industrial activity and rubbish disposal, from the medieval and post-medieval periods, was sought.

Research by Addyman has provided information concerning the location of Late Saxon settlement in St Neots, drawing on earlier work by Tebbutt (1933). The first extensive settlement (Addyman 1973, 49) dates from the Late Saxon period, and may have extended over an area of 8ha, defined on its western and northern sides respectively by the line of Church Street and Cambridge Street (*op. cit.*, 45; Rudd and Tebbutt 1973, Fig. 12). The Fox Brook may have formed the southern boundary of this settlement, although as is noted by Addyman, finds of Saxo-Norman pottery have been made to the south of the brook. Evidence of possible Saxon settlement outside this nucleus has also been found at St Neots and at Eynesbury. The close proximity to the centre of St Neots of the church of St. Mary Eynesbury, recorded in the Domesday survey, could indicate that Eynesbury, located to the south of the site, was a further Saxon settlement focus, a hypothesis supported by a 10th-century grant of land there to St Neots Priory (Addyman 1973, 51). The medieval town of St Neots was centred around the market place established in the 12th century to the north-west of the site, and at the junction between Church Street and Cambridge Street/High Street. A crossing of the Hen Brook, at Eynesbury Bridge, immediately to the north of the site, may also have provided a focal point for early settlement. A bridge here is referred to in a document of 1540 (VCH 1932, 338), and the remains of an earlier bridge wing wall over the ford were found during service trench excavations.

Tebbutt (1956, 81) describes the infilling of the natural valley surrounding the Hen Brook with dumped soil up to a depth of 1m, which was recorded along St Mary's Street southwards to St Mary's Church, Eynesbury. Tebbutt dated this episode of flood prevention to the 17th century, which suggests this levelling-up could have been a preparation for the construction of the present dwellings along St Mary's Street, originally timber framed and 17th-century in date (RCHM 1926, 84). The earliest available mapping (Eynesbury Enclosure Map, dated 1800), indicates that the majority of the western zone of the site was called 'Bulls Meadow', and was prone to seasonal flooding. The site was used as a wharf, and later a builders' merchant's yard during the 19th century.

II. Geology

The site lies between 160–200m to the east of the River Great Ouse (Fig. 1C), and just upstream from the confluence of the Hen Brook and the Fox Brook, to the east of the site. The underlying geology of the area comprises Jurassic Oxford Clay, consisting of clay and shales, with Jurassic Kellaway Beds, which are mainly sands (Edmonds and Dinham 1965). The lower-lying areas, adjoining the river, are covered in chalky glacial till dating to a pre-Devensian glaciation (Jones and Keen 1993, 149). The deposits overlying the chalky till, adjacent to the river, are river terrace deposits, described as first or second river terraces (Edmonds and Dinham 1965), and probably dating to the early Devensian. Alluvium is mapped either side of the river in a strip up to 1km in width. A recent evaluation to the north of the Hen Brook/Fox Brook confluence (Fig. 1C) identified water-lain silt deposits, provisionally dated to the 16th century, extending over 30m to the north of the present riverbank (Jones 1996, 8).

III. Excavation methods

Initial investigations comprised a desk-top study, followed by trial-trenching (Trenches A–J: Fig. 2), intended to test the areas of greatest archaeological potential within the site (Jones 1994; Jones 1995). A small area excavation (Trench K) was undertaken in advance of the construction groundworks, and the excavation of service trenches (Trenches 1–4) was monitored during a watching-brief. Trenches A, 1 and 3–4 examined the area adjoining the street frontage (Zone A). Trenches B–D, K and 2 were located to examine the backplot area (Zone B). The remaining trenches (E–J) were located to test the archaeological potential of the area bordering the Hen Brook and the extreme western zone of the site (Zone C).

In each trench the overburden was removed by a mechanical excavator with a toothless ditching bucket, to expose the top of the alluvium or the uppermost horizon of the archaeological deposits. The surfaces were cleaned and archaeological features and deposits were selectively hand-excavated. Machine-cut sondages were dug through the alluvium, to test its depth and composition and to locate the surface of the underlying gravel subsoil. Excavation was necessarily restricted by safety considerations, and by the high water-table. The underlying alluvial deposits and the sands and gravels were also examined by augering.

During the evaluation and excavation, 20 litre samples were collected from well-sealed and datable features for the recovery of charred plant remains to determine the viability of this material for further study, or any additional requirement for further sampling. Samples were also collected from waterlogged materials for pollen, insect remains and molluscan analysis in order to assist in the understanding of the development of the riverbank environment. Soils were described using standard soil survey methods and terminology (Hodgeson 1976).

Recording was by means of printed pro-forma recording sheets, plans, sections and photographs, now held in the archive. Features (e.g. pits, ditches, post-holes and walls) were recorded in sequences of three digit numbers prefixed by an '*F*'. Contexts (overall layers and feature fills) were recorded in sequences of four digit numbers. It is proposed to deposit the archive in the Cambridgeshire County Council approved archaeological store.

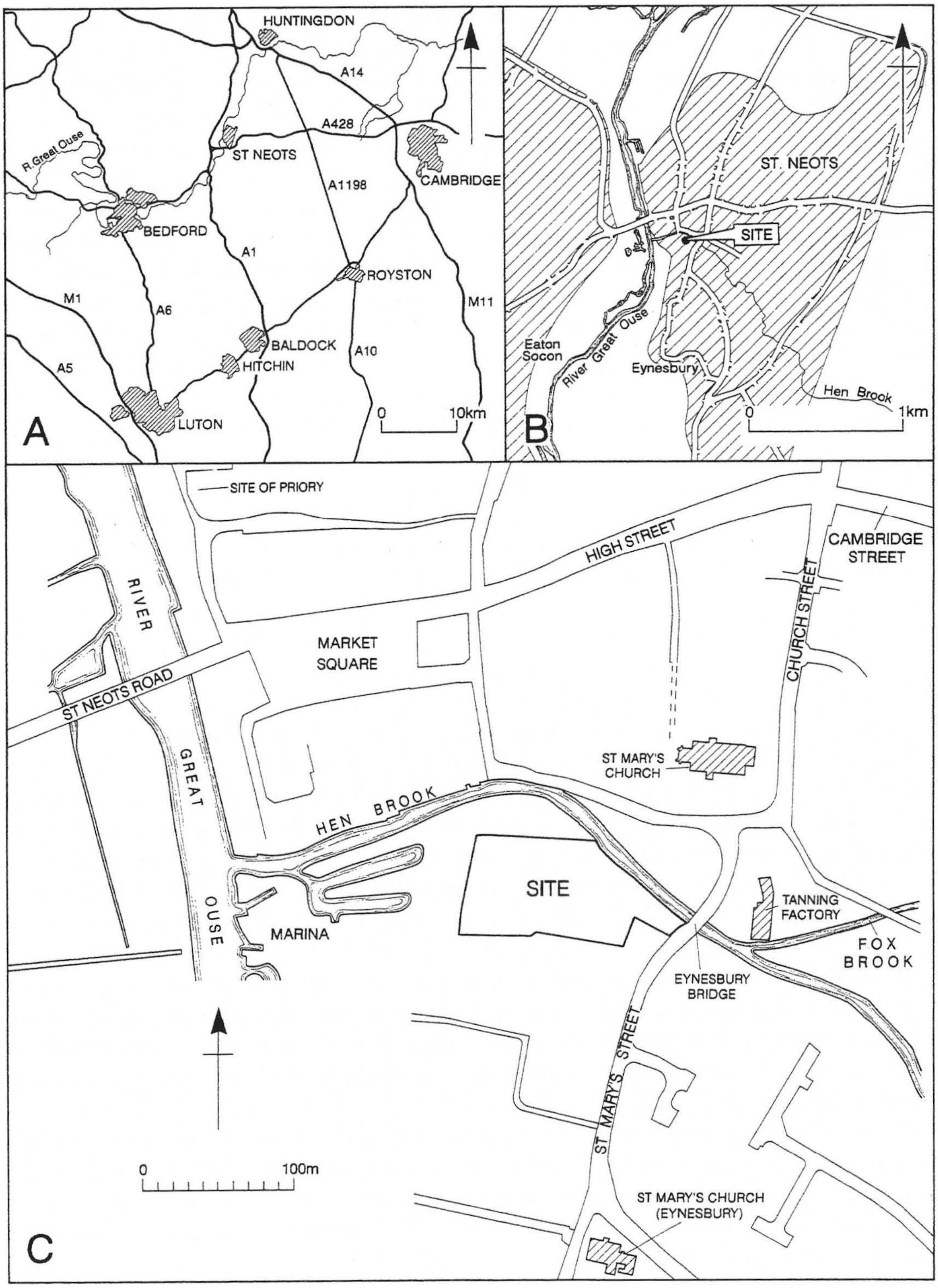


Figure 1 A The St Neots area B St Neots and the site C The site and its surroundings

Chapter 2. The Excavation Sequence

I. Phasing summary

The results of all investigations are here conflated to form a single phased sequence, which is described by Phase and Zone (Fig. 2). The phasing is defined as follows:

Phase 1 Medieval–early post-medieval activity, alluviation and marsh formation (Zones A and C). 13th-17th century.

Phase 2 Later post-medieval activity (Zones A–C). Later 17th-18th century.

Phase 3 19th-century activity (Zones A–C), associated with the use of the area as a builders' merchant's yard (not described below) 1889 onwards.

II. Excavated features

(Figs 3–4)

The subsoils

The subsoil in Zones A and B comprised orange sands and gravels, revealed at an average depth of 1.6m below the modern surface (at 13.74m AOD). The subsoils in Zone C are described in more detail. The underlying sands and gravels in Trench F *(1051)*, recorded at a depth of 1.95m below the modern surface (at 13.67m AOD), were sealed by a mixed layer of horizontally-laid stones *(1050)*, measuring 0.1m in depth. The stones were orientated at a right-angle to the present course of the Hen Brook. The earliest levels in Trench G were investigated by auger. The lowest deposit was a stony grey sand *(1017E)*, located at a depth of 2.5m below the modern surface (at 12.10m AOD), which became coarser in texture with depth. Above was a layer of orange sand *(1017D)*, measuring 0.3m in depth.

In Trench H, in the west of the site, the earliest layer recorded (at a depth of 1.2m below the modern surface, at 13.77m AOD) was a gleyed clay *(1031B/C)*, containing fragments of chalk measuring 50mm in diameter. This layer was recorded for a depth of 0.5m by augering. In Trench J, the earliest deposit recorded was a light brown clay-sand (*1040*), containing chalk fragments.

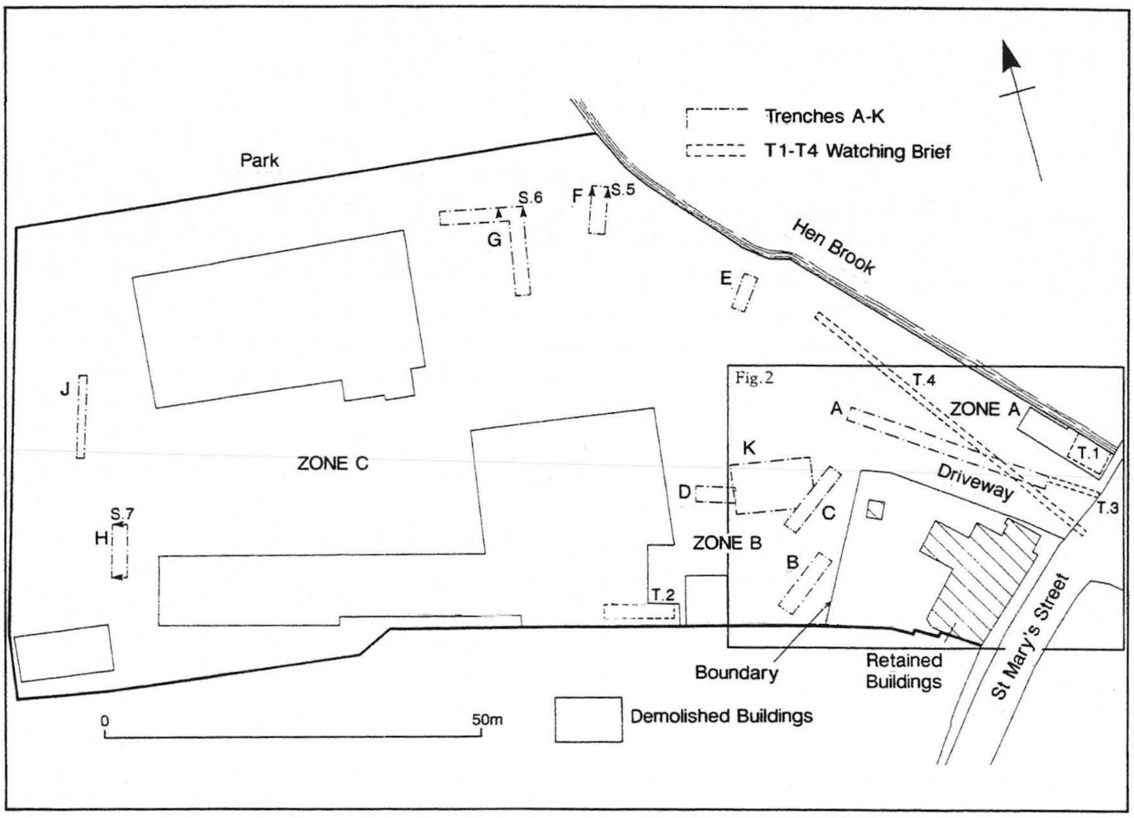


Figure 2 The site: areas investigated

Phase 1

Zone A

Possibly the earliest activity in the area adjoining the street frontage (Trench A) was represented by two features cutting the gravel subsoil *(1069)*. One was a shallow, truncated gully *(F110)*, aligned at an approximate right-angle to the axis of Trench A. The second was a shallow stake-hole *(F115)*. Both features were backfilled with dark grey-black clay-silt; neither contained any datable artefacts. After the infilling of features *F110* and *F115*, a layer of dark brown silt-clay-sand *(1052)* was dumped over the subsoil. This layer increased in depth away from the street frontage, and may have been deposited to counteract flooding. It was sealed by a layer of gravel *(1058)*, possibly forming a surface. Layer *1052* was also sealed by a deposit of dark orange mottled clay *(1056)*, which was cut by a hearth or oven *(F108)*, only partly exposed within the trench. This feature was sub-ovoid in plan, with a flat base which dipped just inside the eastern end of the trench. The lower oven fill was a layer of soft black charcoal *(1041)*, sealed by a layer of brown clay-sand *(1070)*.

Layer *1052* (Trench A) contained pottery which provided a *terminus post quem* in the 15th century. Fill *1041* of feature *F108* (Trench A) contained St Neots Ware with a *terminus post quem* in the 12th–14th century, a 14th–16th century grey ware sherd (possibly intrusive), and a large quantity of charred plant remains (discussed below p.20).

Zone B

A layer of yellow clay-silt *(1134)*, overlying the gravel in Trench K, may be ascribed to Phase 2, by analogy with the phasing suggested for the alluvial deposits in Zone C (p.7 below).

The earliest activity is represented by two rubbish pits *(F112, F212)*, both cutting the subsoil. Pit *F112* (Trench C) was backfilled with brown clay-silt *(1023)*. Pit *F212* (Trench K) was of irregular shape and was backfilled with brown silt-clay *(1132)*. Other areas of dark brown clay-silts (*1121, 1133*: Fig. 3), located in the bases of sondages, may represent further, undefined, rubbish pits.

This early activity was dated by pottery which provided a *terminus post quem* in the 15th century for feature *F112* (Trench C), and the 16th–17th centuries for feature *F212* (Trench K). The pottery from layer *1133* (Trench K) provided a *terminus post quem* in the 16th–17th century.

Zone C

The earliest deposit investigated in Trench E was a gleyed olive-grey clay-silt *(1004)*, recorded at a depth of 1.2m below the modern surface (at 13.77m AOD), sealed by a dark yellowish-brown sand-silt-clay *(1003)*. Layer *1050* in Trench F was sealed by a layer of gleyed yellow-brown silt-clay *(1049)*, which contained some stone fragments. Above was a further layer of similarly coloured silt-clay *(1048)*, including small shell fragments. In Trench G, Phase 1 sand layer *1017D*, recorded at a depth of 2.15m below the modern surface (at 12.46m AOD), was sealed by an olive-green clay-silt *(1017C)*, which was overlain in turn by further layers of gleyed olive-green clay-silt *(1017A–B)*, followed by a final layer of olive-green clay-silt *(1068)*, containing small shell fragments.

In Trench H, Phase 1 layer *1031B/C* was sealed by a very dark grey sand-silt-clay *(1029)*, recorded at a depth of 0.6m below the modern surface (at 14.55m AOD), containing small fragments of organic matter. A similar deposit *(1038/1039)* sealed Phase 1 deposit *1040* in Trench J, to the north of Trench H, although the undulating upper surface of layer *1029* in Trench H was not repeated in Trench J.

A pottery sherd in Fabric 1 recovered from layer *1004* (Trench E) provides a *terminus* in the 14th–15th century for the deposition of this layer; the only, albeit tentative, dating evidence obtained for the alluvial and marsh deposits ascribed to this phase. The mortar and brick fragments recovered from layers *1003, 1068* and *1030* also suggest a date in Phase 2 or 3 for this alluviation.

Phase 2

Zone A

The Phase 1 deposits in Trench A were sealed by dumped layers of dark-brown clay-silts *(1055, 1064)*. The earliest layer recorded in Trench 1 (adjoining the Hen Brook) was a grey silt-clay *(2009)*, recorded at a depth of 2m below the modern surface. It was sealed by a layer of brown silt-sand (2008). Above, was a layer of charcoal-rich silt *(2006)*, sealed by a layer of grey clay *(2007)*. This layer was overlain by a build-up of dark brown silt-clay soils *(2002–5)*, measuring approximately 1m in depth, also recorded (as *1055, 1064*) in the adjoining Trench A.

This build-up horizon was cut by brick wall footings *(F200, F205, F302)*, recorded in Trenches 1, 3 and 4 respectively, probably associated with the construction of buildings along the street frontage in the 17th century, and by a pit *(F109)*, in Trench A. Wall *F200* (in Trench 1) abutted the bridge over the Hen Brook (Plate I, p7).

Layers *2008* and *2009* (Trench 1) contained pottery providing a *terminus post quem* in the 17th century.

Zone B

In Trench K Phase 2 layer *1121* was cut by a pit *(F208)*, oval in plan and measuring 1.3m by 3m. It was backfilled with a homogenous deposit of cream-coloured lime *(2022)*. The form and fill of this pit, together with other excavated examples from Trenches C and K, suggest they were used for tanning. A summary of the process of tanning is provided in the discussion (p.24 below). These features were also associated with bone tanning waste (p. 20 below).

Further tanning activity was represented by pits *F114* and *F105* (Trench C). Pit *F114* was roughly circular in plan and measured a maximum of 1.4m in diameter. It was lined with plastic, blue-green clay*(1022B)*, and was backfilled with crumbly buff-white lime *(1022A)*. Pit *F105*, which adjoined feature *F114*,was straight-sided, but it was not fully exposed within the trench; its lining and fill were similar to those of feature *F114*. The contemporary ground surface *(1024)* to the north of pit *F105* had been trampled and mixed with lime during the use of these features.

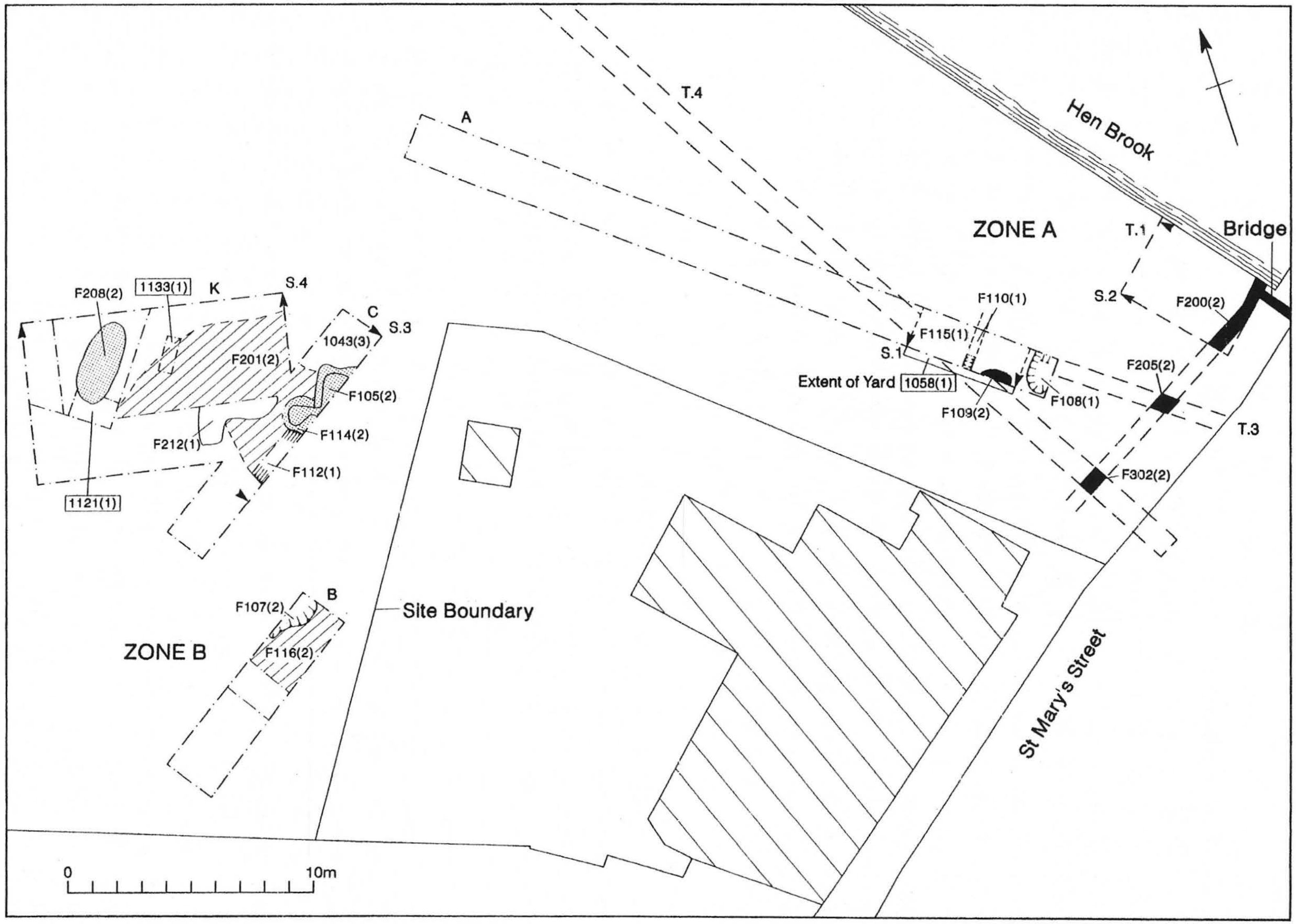


Figure 3 Simplified plan of main Phase 1-2 features (scale 1:250, phase numbers in brackets)

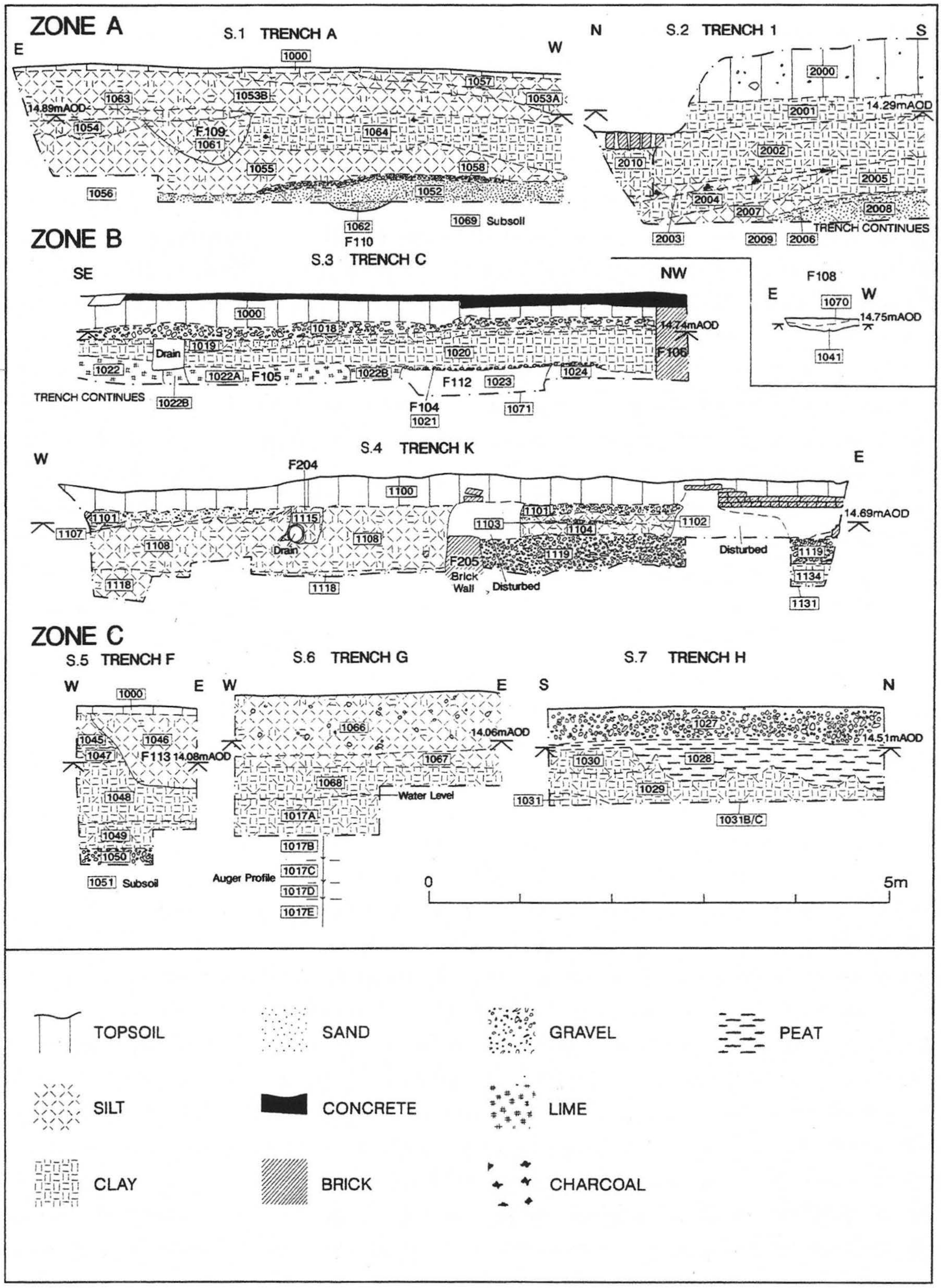
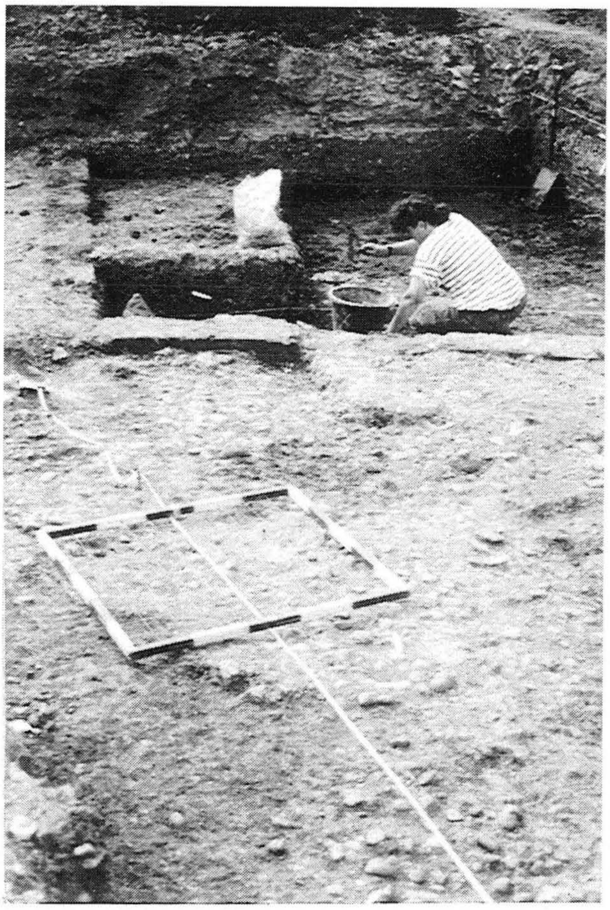


Figure 4 Sections (scale 1:75)

Plate I Trench 1: view north towards bridge (Photo: Cuttler)



Following the disuse of pit *F208* (Trench K), it was sealed by layers of clay-silt *(1118, 1120)* and gravel *(1125)*. Layer *1118* contained an assemblage of tanning waste, principally comprising 78 sheep bones. Tanning features *F105* and *F114* were also sealed by a layer of clay *(1020)*. Further dumps of soil *(1128, 1114, 1130, 1123*: not illustrated), including possible building rubble, were recorded in Trench K. These layers contained large quantities of tanning waste, mainly comprising sheep bones (*1128*: 147 fragments, *1123*: 112 fragments, *1114*: 41 fragments). This further dumping may have been intended as a preparation for the laying of a cobbled yard surface (*F201*: Trenches C and K: Plate II), *F116* (Trench B).

Later Phase 2 activity in Trench K was represented by the sealing of yard *F201* beneath deposits of building rubble *(1131, 1129, 1117, 1106)* and a deposit of lime *(1110)*, the latter either derived from tanning, or from a nearby limekiln (see below). Layers *1110* and *1106* contained 54 and 57 fragments of sheep bone respectively, derived from tanning waste. These deposits were sealed by an irregular gravel surface *(1119)*.

Deposits (not illustrated) possibly associated with the use of a limekiln, recorded in this location on the First Edition Ordnance Survey map of 1887, were recorded in Trench 2 (Fig. 1C). These comprised layers of charcoal *(2013)* and lime *(2014)*, overlain by layers of brick rubble (*2011* and *2012*), which may represent respectively the last use and demolition of the limekiln.

Fill layer *2022* within pit *F208* (Trench K) contained pottery providing a *terminus post quem* in the 17th century. The lining of pit *F114* (Trench C) contained pottery which provided a *terminus post quem* in the 16th century. Pottery from layer *1125* (Trench K) provides a *terminus post quem* for this dumping in the 17th century. Layer *1114* (Trench K) contained pottery providing a *terminus post quem* in the 16th–17th century.

Zone C

Phase 1 layer *1003* in Trench E was sealed by a layer of dark brown silt-clay-sand *(1002)*. Similar *layers (1047, 1067)* were recorded overlying the Phase 1 deposits *(1048, 1068)*, in Trenches F and G respectively.

The soils and sediments are discussed below (p.10).

Plate II Trench K: yard surface *F201* during excavation (Photo: Hewson)

Chapter 3. Finds

I. Glass Vessel
by L. Bevan

A fragment of wine-glass (not illustrated: from Phase 1 context *1119*, Trench K) comes from the intersection of the bowl and the stem, the remains of the latter suggesting a bulbous machine-blown stem, perhaps originally decorated with a lion's mask motif, a style of wine glass 'made in nearly every glass producing centre in Europe' (Moorhouse 1971, 63 and Fig. 27:1–3), with a date range from the mid-16th into the 17th century.

II. Pottery
by S. Rátkai
(Fig. 5)

Introduction
The aim of this report is to record the fabrics present and their quantity, and to date, where possible, activity on the site. In total there were 253 sherds recovered from the evaluation, excavation and watching brief. The majority of these were late medieval or post-medieval. All the sherds were examined macroscopically and divided into fabric groups. Sherds were recorded and quantified by sherd count and minimum number of rims.

The pottery was divided into 20 fabrics (Table 1). The type sherds were examined under x20 magnification. Only a brief fabric description is given below, as in general there were only a few sherds in each fabric so that there was not a large enough sample to be certain of the degree of variability within a fabric group. Known medieval and post-medieval types have been given a letter code and a brief description. Unless otherwise stated the sherds were undiagnostic.

Published sources were consulted for the region i.e. Hurst (1956), Addyman (1973), Coppack (1980), Jennings (1981) and Spoerry (1994).

The pottery database forms part of the archive. The type series is boxed with the pottery from the site.

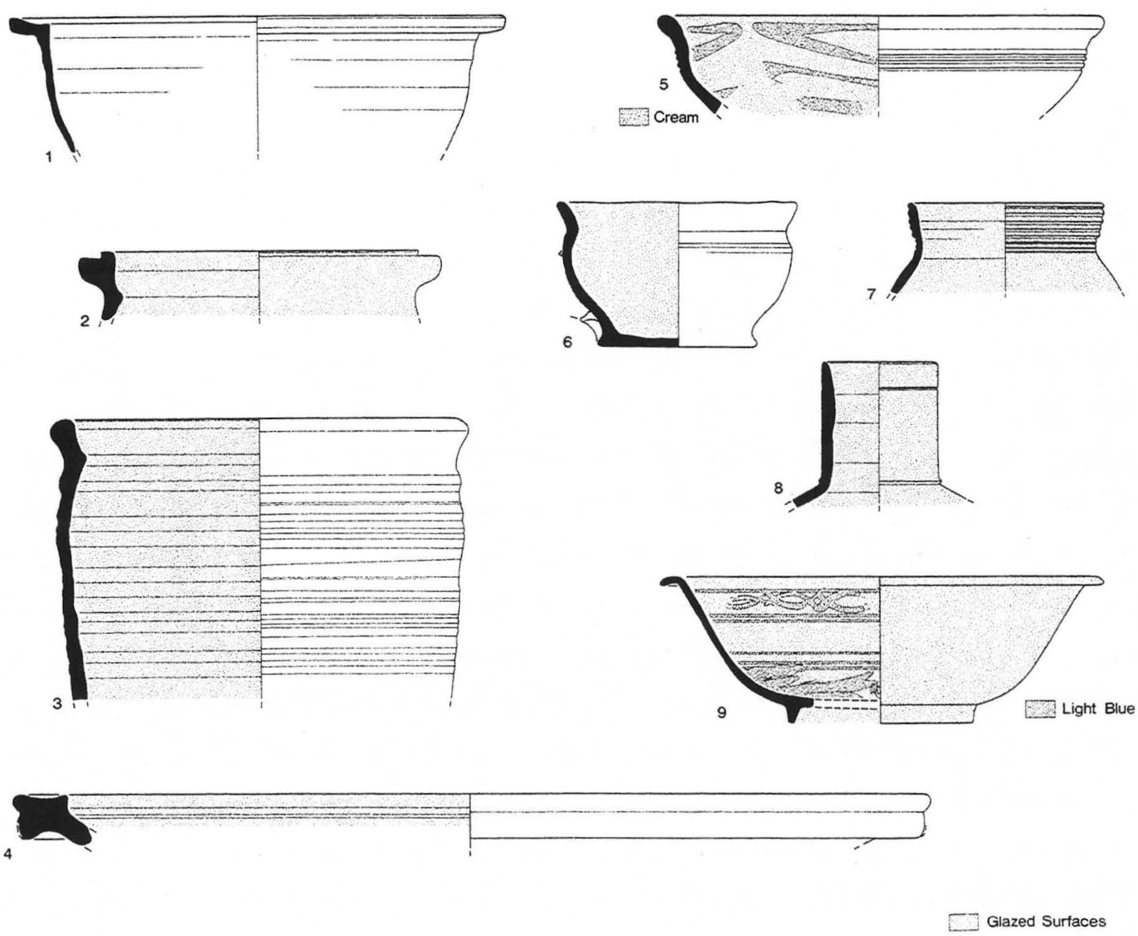


Figure 5 Pottery (scale 1:4)

The fabrics

Fabric 1. Fine oxidised sandy ware with sparse ?clay pellets. Orange surfaces and core, hand-made, wheel finished. A similar fabric 'Orange Sandy Ware' dating to the 14th–15th centuries was found at Denny Abbey (Coppack 1980). Sherds were largely unglazed and undiagnostic. There was a rim-body sherd from a bowl with a horizontal rim. (Fig. 5.1).

Fabric 1a. Fine sandy ware with ?clay pellets, with orange surfaces and pale grey core, unglazed, hand-made wheel finished, probably a variant of Fabric 1. 14th–15th centuries.

Fabric 2. Buff ware with sparse small quartz grains and sparse orange ferruginous inclusions, ?wheel-thrown ?14th–15th centuries. A single small rim sherd with a copper green glaze, probably came from a jug.

Fabric 2a. Grey ware with buff surfaces, sparse calcareous inclusions, sparse angular and sub-angular quartz. Many of the quartz grains are red. Hand-made ?Bourne, ?14th–15th centuries. Some sherds have a green glaze.

Fabric 3. Wheel-thrown, sandy, glazed red ware. The clay matrix contained sparse sand, sparse red ferruginous inclusions, sparse calcareous inclusions and sparse ?clay pellets. In thicker bodied sherds there can be a broad grey core. Glazes range from brownish olives through to tans and browns. The date range of this fabric is 16th–18th centuries. This was the dominant fabric on the site and produced the largest number of form sherds. Five jars were represented with a variety of rim form. All were glazed internally. Most of the rim sherds were unsuitable for illustration but a bifid rim with internal and external tan glaze, and a large section of a jar with internal glaze have been illustrated (Fig. 5.2 and Fig. 5.3). Other forms present were two pancheons (Fig. 5.4), a dish or platter, a bowl with internal slip decoration, (Fig. 5.5) and two cups, one very fragmentary with dark olive glaze and the other with an internal brown glaze (Fig. 5.6). There was also a ?jug with a short corrugated neck (Fig. 5.7). In addition there were two thick horizontal handles, presumably from large jars (not illustrated).

Fabric 4. Sandy grey ware with abundant sub-angular quartz, unglazed, east Midlands reduced ware tradition, 14th–16th centuries.

Fabric 5. Smooth pink to pinkish-grey ware with abundant small rounded quartz grains and very sparse ferruginous and calcareous inclusions. Cream or grey margins and grey core, ?wheel-thrown ?Potterspury, 14th–15th centuries. The sherds were unglazed.

Fabric 6. Fine calcareous ware, with sparse red clay pellets and sparse burnt out organic material. Pinkish brown surfaces and grey core, unglazed, hand-made, ?13th–15th centuries.

Fabric 8 Orange-brown sandy calcareous ware with orange margins and grey core, unglazed, hand-made. ?13–15th centuries.

Fabric 9. Grey ware with abundant, poorly sorted quartz grains and sparse organic material. Variable coloured margins and core ranging from light brown-dark grey, unglazed, east Midlands reduced ware tradition, 14th–16th centuries.

Fabric 9a. Similar fabric to the above but with large ?haematite fragments and sparse but coarse calcareous inclusions, east Midlands reduced ware tradition, 14th–16th centuries.

BLW. Blackware.

CW. Coarseware, sandy buff fabric, dark brown glaze, 17th–18th centuries.

ESTW. English stoneware, 18th century.

GSTW. German stoneware, 16th–17th centuries. There were two sherds of mid-16th-century Cologne stoneware. One of these was a complete rim and neck section (Fig. 5.8). The rim of this vessel was worn and chipped suggesting that it may once have had a metal mount. There was also a small sherd from a ?Bartmann type drinking vessel, probably of 17th century date.

MANG. Manganese mottled ware, late 17th–early 18th centuries.

MGW. Modern glazed wares, 19th–20th centuries.

STNEO. St Neots/developed St Neots. The temper varied from medium to coarse fossiliferous shell. The sherds were small and there were no form sherds. It was, therefore, difficult to date the sherds.

SLIP. Slipwares, late 17th–18th centuries.

TGE. Tin glazed earthenwares, 16th–18th centuries. Sherds were generally small but there was a substantial part of a bowl with a footring (Fig. 5.9). The bowl was decorated internally with a dark and light blue design. The central pattern seems to be in chinoiserie style, with a just discernible human head. A similar design can be seen in Jennings (1981, fig. 95.1498), described as English and dated to *c.*1680. There was also a second rim sherd, from context *1120* (Trench K), described by Dr A. Vince as 'Rim sherd of an Anglo-Netherlandish plate with decoration in light and dark cobalt blue. The back of the plate has a plain lead glaze whilst the front has a low tin content such that the glaze is not opaque. The lead-glazed back serves to date the piece between the late 16th and mid 17th century' (Dr A. Vince, *pers. comm.*).

Fabric	*Total*	*Fabric*	*Total*
1	6	BLW	45
1a	2	CW	1
2	2	ESTW	14
2a	1	GSTW	3
3	92	MANG	23
4	3	MGW	13
5	2	STNEO	9
6	3	SLIP	10
8	5	TGE	13
9	5		
9a	1	Total	253

Table 1. Pottery – quantification by fabric

Discussion

Most of the pottery was made up of body sherds and very few rims were present. However, the pottery was in good condition and showed little sign of abrasion. Form sherds were found mainly in the post-medieval (Phase 2) pottery.

The majority (225 sherds) of the pottery and of the fabrics were post-medieval. The dominant fabric was Fabric 3, sandy glazed red ware. This type of ware is common in East Anglia (see fabric type GRE in Jennings 1981), although manufactured at more than one site. A similar range of forms to those from St Neots can be seen in Jennings (1981) and in Baker *et al.* (1979).

Only five layers and feature fills were medieval in date, with most of the medieval pottery occurring residually. The medieval layers (*1004*: Tr. E, *1052*: Tr. A), and features *(F108, F112, F103)*, were all from the evaluation.

The earliest pottery from the site was represented by nine shell tempered sherds, of St Neots /developed St Neots type (fabric STNEO). Eight of the sherds came from the fill of feature *F108*, where they occurred with a grey ware sherd (Fabric 9) and a brick/tile fragment.

Since all of these sherds were small body sherds, forms could not be determined. It was therefore difficult to date the pottery other than very broadly i.e. 12th–14th centuries. since, given the nature of the rest of the assemblage, it is unlikely that these sherds are Pre-Conquest, or early Saxo-Norman.

Most of the post-medieval groups were 17th–18th-century in date. The largest post-medieval group of 107 sherds was of early 18th-century date and came from context *1128* (Tr. K). The pottery was made up of a variety of wares, mainly blackwares and Fabric 3. In addition there were slipwares, English stonewares, manganese mottled wares and tin glazed earthenwares. There were few diagnostic sherds but the assemblage was domestic in character, concerned with food storage and consumption.

The range of pottery is somewhat different from the assemblage from Hall Place, St Neots (Addyman and Marjoram 1972) which contained a greater quantity of reduced wares. There are no parallels for the horizontal handles in Fabric 3 and it is likely that there was a larger proportion of earlier pottery from Hall Place.

Unfortunately, the assemblage was small and the ceramic sequence was not good. Therefore the dating was based mainly on comparison with parallels from the area. The range of pottery would suggest that occupation or use of the area was sporadic before the 16th century. There was nothing in the pottery to suggest that it was associated with a particular activity, industrial or otherwise in the area. The assemblage fitted in well with the regional tradition and is important in providing a general survey of the range of fabrics in use within St Neots, where there is little published data.

III. Other finds

These mainly comprise brick, tile and iron fragments, not worthy of publication. Details may be found in the archive.

Chapter 4. Soil studies

by R. Roseff

I. The soils and sediments

The subsoils

(Fig. 4)

The subsoil in Zones A and B comprised orange sands and gravels, forming river terrace deposits, laid down in the early Devensian.

Trenches F–J located river bed, or glacial, deposits at a depth of 1.8m–2m below the present ground surface. In Trench F the lower sand unit *(1051)* contained fine black roots, similar to those of sedge or rush. This layer may be tentatively interpreted as a buried land surface at the edge of a stream bank. Layers *1050, 1017E–D, 1040* (in Trenches F, G and J respectively) consisted of layers of small, rounded, horizontally-lain stones and sand with small pieces of plant material and flecks of charcoal. The stones in Trench F *(1050)* lay at right angles to the present-day stream, suggesting that this was a former bed of the Hen Brook, now moved to the northwest.

In the west of the site, in Trench H, the lowest layer *(1031B/C)* was a dark grey clay with small chalk pieces, interpreted as a glacial till. This trench possibly exposed the western limit of the laterally migrating Hen Brook.

Phase 1

(Fig. 4)

In Trench F, adjacent to the Hen Brook, the stream-bed deposit *(1050)* was overlain by a yellow-brown, stone-free, clay measuring approximately 1.2m in depth *(1048, 1049)*, which may be interpreted as alluvium deposited by still, or slow moving, water. A similar layer was recorded in Trench K *(1134)*. In Trenches E and G–J, the lower layers overlying the stream-bed and glacial deposits was a gleyed olive-grey clay, with about 10% preserved organic matter (*1004, 1017, 1028, 1038/1039*: Trenches E, G, H, J respectively). This layer was 0.3m to 0.5m in depth and had an uneven, undulating surface. It was interpreted as a marsh deposit, the uneven surface being due to the hummock and dip morphology, perhaps suggestive of the *Glyceria* hummocks of a salt-marsh, or the sedge-dominated hummocks of more acid communities. The colour is possibly due to contamination by salts, and a salt marsh is suggested. The Ouse was tidal to St Neots up to the 17th century (Summers 1973, 18), although a test with silver nitrate, to indicate the presence of sodium chloride, proved negative (as would be anticipated, because silver nitrate would be leached away very quickly). A similar deposit, tentatively dated to the 16th century, was recorded during limited evaluation trenching to the north of the Hen Brook/Fox Brook confluence, to the east of the St Mary's Street site (Jones 1996, 8).

This marsh deposit was overlain by a dark yellowish-brown, stone-free, gleyed clay (*1003* and *1068*, Trenches A and G respectively), containing flecks of mortar and brick. This layer is interpeted as alluvium, laid down by overbank flooding.

A pottery fragment recovered from context *1004* (in Trench E) provides a *terminus post quem* in the 14th–15th century for the deposition of this layer; the only dating evidence obtained for the alluvial and marsh deposits ascribed to this phase. The mortar and brick recovered from alluvial layers *1003, 1068* and *1030* also suggest a date in Phase 1 or 2 for this alluviation.

Phase 2

(Fig. 4)

Extensive post-medieval alluviation was recorded adjoining the Hen Brook (*e.g.* layers *2009, 2008, 2005*: Trench 1), revealed at a depth of between 1.3m to 2m below the modern surface. Along the Hen Brook frontage was a layer (*1001, 1047, 1067*: Trenches E, F and G respectively) whose stone-free, clayey texture, and its similarity in texture with the underlying alluvium, indicated it was formed *in situ*, on alluvium. It may be suggested that its structure and very dark brown colour suggested that it was a soil at least 200–300 years old, providing a tentative *terminus ante quem* for the deposition of the underlying alluvium. These Phase 2 deposits were sealed by Phase 3 layers.

II. Discussion

There has been an increasing interest in the study of alluvium amongst archaeologists and Quaternary scientists generally over the last 25 years. This has arisen largely because of the realisation that increase in sediment load in rivers, and its subsequent deposition as alluvium, has been largely due to dramatic and extensive landscape clearance and/or changing agricultural practices carried out in the catchment upstream.

Little work has been done on the alluviation of the River Great Ouse. Robinson (1992) defined a sequence which began with a rising water table in the Roman period, followed in the Saxon period by flooding but no alluviation. There was extensive alluviation in the medieval period, while the post-medieval period was characterised by flooding, but again no alluviation.

The alluvium found during excavations at St Mary's Street was deep adjoining the Hen Brook and in Zones A/B, but it did not appear to extend for a great distance to the west. However, the catchment of the Hen Brook is small (approximately 60 square km), and a large expanse of alluvium would not necessarily be expected here, although this area may have also received additional alluvium deposited by the River Great Ouse, banking upstream at times of flood. The deposition of the alluvium overlying the marsh (identified in Trenches E, G, H and J), would have altered the morphology of the Hen Brook. Before the deposition of alluvium, the Hen Brook was likely to have been a wide shallow stream, possibly divided into two or more channels, winding through a marshy area. After alluviation, the Brook would have been confined to a single channel, subject to seasonal flooding. It may be suggested that this change occurred in the post-medieval period. During the medieval period, Zone C would have been marshy, low-lying land, while no evidence of a marshy environment was found over the remainder of the site. The evidence from Trench F *(1050)* also suggests that a former course of the Hen Brook lay at a right-angle to its present course.

Chapter 5. Zoological and Botanical Evidence

I. Animal bone

by S. Pinter-Bellows

Introduction

The fieldwork produced a total of 1241 animal bones and bone fragments. The majority of the faunal material, 98% (1213 fragments), came from Phase 2-3 (post-medieval) features and contexts; the other 2% (28 fragments) came from Phase 1 (medieval) features and contexts. The mammal and bird species recorded are tabulated (Table 2). Further details of the animal bone are provided (Fig. 6-11, Tables 3–6, and Appendix Tables 1–3). Some bones were also assigned to the higher order category sheep/goat.

A selective detailed record was made for the assemblage, with further work being done only where it could add substantially to the results. For a full description of the methods used see Davis (1992). In brief, all mandibular teeth and a restricted suite of articular ends/ epiphyses and metaphyses of the girdle, limb and foot bones were always recorded and used in counts. Other parts of the skeleton were only noted selectively, *e.g.* when a scarcer species could be identified, or where the bone was of particular interest. To calculate the proportion of the bone which was unidentified, a count was made of the number of unrecorded, but identifiable, bones.

Tooth eruption and wear data, fusion data, and a limited range of measurements were recorded systematically for selected parts of the skeleton; pathology and butchery data were noted where present, but counts of bones affected and not affected were not made for non-selected parts of the body. All the material was recorded following Jones *et al.* (1979). Dental eruption and attrition data were recorded using the wear stages defined by Grant (1982) for cattle and pig, and the stages defined by Payne (1973; 1987) for sheep/goats. Epiphysial union data follow Silver (1969). Measurements follow von den Driesch (1976) with additions as described in Davis (1992). Withers height was calculated following von den Driesch and Boessneck (1974). Two methods of quantification to estimate the relative importance of the major animal species were used: simple fragment counts (often termed number of identified specimens per taxon, NISP) and minimum numbers of individuals (MNI, following Gilbert and Steinfeld 1977, 333).

Preservation and taphonomy

The animal bones were routinely hand-recovered during excavation: bones were also found in sieved soil samples from contexts *1118*: Trench K, *2007, 2008, 2009*: Trench 1. The sieved samples showed that the hand collection was good, with smaller bones from the

Animal Species	*Medieval*	*Post-Medieval*	
	NISP	*NISP*	*MNI*
Horse (*Equus caballus*)	-	2	1
Cow (*Bos taurus*)	1	341	7
Pig (*Sus scrofa*)	1	6	1
Sheep (*Ovis aries*)	7	122	*
Sheep/Goat	2	200	56
Dog (*Canis* sp. domestic)	1	2	1
Domestic Fowl (*Gallus* sp.)	-	2	1
Pigeon (*Columba* sp.)	-	1	1
Rodent	-	1	1
Identified Mammal	14	449 *	
Identified Bird	-	4 *	
Unidentified Mammal	2	387	
Unidentified Bird	-	2	
Unidentified Fish	-	1	
Total	28	1213	71

As all identified bones were that of sheep, in the estimating of minimum number of individuals sheep and sheep/goat have been calculated together

While a selected record was made, in order to be able to calculate the proportion of the bones which were unidentified fragments, a count was kept on the number of unrecorded identified skeletal elements.

Table 2. List of animal species for medieval and post-medieval periods

Elements	Sieved Contexts: Sieved Area N	%	Sieved Contexts: Hand Collected Area N	%	Hand Collected Contexts N	%
Carpals	0	-	0	-	0	-
Tarsals	1	.04%	0	-	0	-
Proximal Phalanx	1	.04%	5	3%	115	13%
Medial Phalanx	0	-	0	-	26	3%
Distal Phalanx	3	1%	1	.06%	10	1%
Loose Teeth	3	1%	1	.06%	1	.01%
Total Bones	210		149		854	

Table 3. Recovery of small bones from sieved and hand collected contexts

larger species being found by both methods. Table 3 indicates that very few of the smaller bones, such as phalanges, carpals, tarsals, and loose teeth, were found by either method.

The preservation of bone was excellent. The bones are typically hard with smooth surfaces. Unidentified bone fragments make up 32% of the total (23% if the sieved samples are excluded), which is less than the average found on sites of all descriptions. Less than 0.01% of the bone (9 bones) was burnt (all Phase 2–3). Gnawing was observed on 1.1% of the bones (13 bones, all post-medieval bone). The typical pattern of partial-digestion by dogs and pigs (as described by Payne and Munson 1985) was seen on five phalanges or carpals. However, this same appearance, with the outer table of the bone eaten away, was seen on four sheep metapodials at the distal end and continuing partly up the shaft. Since these bones are larger than those normally swallowed whole by dogs and pigs, and gnawing marks are usually more uniform, other explanations must be sought.

Species abundance

The species identified are listed in Table 2 (a complete listing of species and elements found for each phase can be found in Appendix Table 1). The bulk of the identifiable bones belong to the domestic mammal species, the majority being sheep and sheep/goat with a small number of cattle, pig, and horse. When the adult sheep/goat metacarpals are plotted, using Payne's (1969) method for metrically separating sheep from goat metacarpals (Fig. 6), none of the metacarpals is outside the parameters for sheep metacarpals. There is also a very small number of chicken, pigeon, dog and rodent bones. The distribution pattern of the elements, described below, makes it clear that the sheep bones are biased by the selection of a few parts of the skeleton, which indicates the specialised nature of the assemblage. Thus discussion of the relative importance of the major animal species is of little value.

Distribution of skeletal elements

The distribution of skeletal elements for the post-medieval cattle and sheep which were selectively recorded is summarised in Fig. 7. The calculations for this distribution follow O'Connor (1991), though using more elements. The elements chosen for this calculation come from different parts of the body and include some smaller parts of the skeleton. The expected total for elements (E) has been calculated by taking the total count of the elements (compensating for elements of which there are more than two in the skeleton: first phalanx, and first and second mandibular molars taken together) and dividing by the number of elements involved to obtain an expected total; assuming that all the elements are equally abundant. (For an example of the calculation see the end of the distribution of skeletal elements in Appendix Table 2.) The observed value (O) is then divided by this calculated expected value to show whether the number of specimens of a given element in the sample was relatively under-represented (O/E <1.00), or over-represented (O/E >1.00).

Factors such as a variation of the thickness of the cortical bone and the amount of trabecular bone, do not explain the pattern seen. The number of bones from meat-bearing parts of the carcass was generally very low. The assemblage consists almost entirely of metapodials, with few of the smaller carpals, tarsals and phalanges being present (all foot bones were tabulated whether they were part of the selected record or not). Only in contexts with very small numbers of bones were foot bones the only bones found, whilst, in the remainder of the contexts, the ranges of species and skeletal elements were relatively equally distributed. Of those elements not selectively recorded, the only one which was found in large enough numbers to require an explanation was the horn cores. While mandible and other parts of the skull were scarce, cattle and sheep horn cores were found in greater numbers than the tibia, though still below an O/E value of 1.00. While there are very few bones from Phase 1 contexts, they also appear to follow the same pattern.

The fragmentation pattern of the metapodial was examined to determine where the foot was separated from the rest of the carcass (Table 4). The recorded fragmentation suggests that complete metapodials were brought onto the site. The greater number of proximal than distal fragments recovered probably relates to the damage to the more susceptible unfused metapodia; more signs of dog gnawing were found at the distal than proximal end. Division of proximal and distal fragments also most often happened in this narrowest area of the

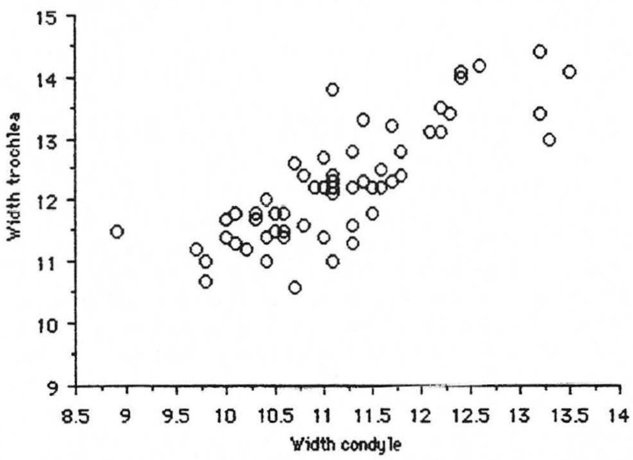


Figure 6 Sheep/goat metacarpal condyle shape

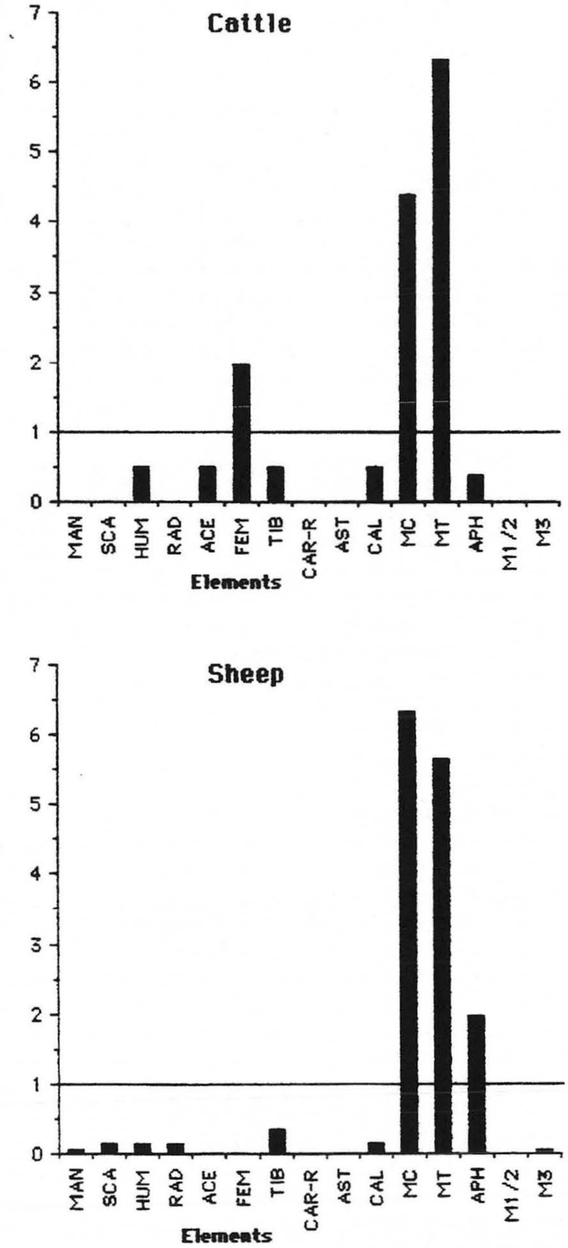


Figure 7 O/E for cattle and sheep (Phases 2–3)

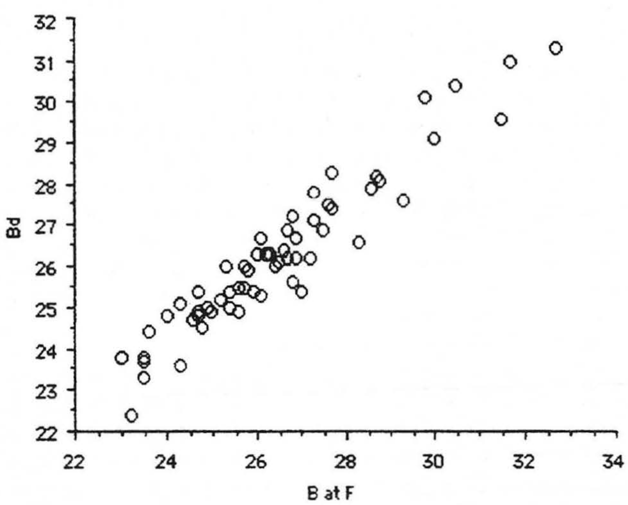


Figure 8 Sheep metacarpal distal shape

Cattle Metapodia Frag. Desc.	*N.*	*Percentage*	*Sheep Metapodia* Frag. Desc.	*N.*	*Percentage*
Proximal	19	46%	Proximal	114	37%
Distal	21	51%	Distal	90	28%
Whole	1	2%	Whole	108	35%
			Sheep Prox. and Dist. Metapodia Frags.		
			Frag. Desc.	*N.*	*Percentage*
			Prox., <.5	25	22%
			Prox., =.5	16	14%
			Prox., >.5	73	64%
			Dist., <.5	51	57%
			Dist., =.5	21	23%
			Dist., >.5	18	20%

Table 4. Percentages of proximal, medial and distal metapodial fragments for cattle and sheep

bone. The distribution of the metapodial fragments was found to be relatively equal throughout the contexts.

Ageing

Because of the scarcity of teeth, the kill pattern of the animals has been estimated from epiphysial data only. Interpretation of ageing data from epiphysial union has several drawbacks. Unfused ends often do not survive as well as fused ones, so information can be lost, introducing a bias in the data; and once a bone fuses it is impossible to distinguish one newly fused from a young animal with one which has been long fused from an old animal. Only the foot bones were numerous enough to be examined from cattle and sheep; pig bones were not found in large enough numbers. Table 5 summarises the pattern for the Phase 2–3 cattle and sheep.

The majority of the cattle metapodials (73%, calculated from 16 metapodia, a minimum of only five individuals,) were fused, the animals being at least approximately three years old, (assuming that fusion took place at the same time as in modern animals); data from the one calcaneum could hint at these fused metapodials all being over approximately four years of age, though perhaps going up to ten years plus. Of the 27% of the unfused metapodials (calculated from seven metapodia, a minimum of only three individuals), data from the phalanges could have the animals aged approximately at least one-and-a-half years old (the three phalanges could all come from one animal). However, with such small numbers the most that can be interpreted from this data is that the majority were aged over three years.

	epiphysis	*Unfused shaft*	*Fusing*	*Fused*	*% fused*
Cow					
Early Fusing Elements					
Phalanx 1, proximal	-	-	-	3	100%
Middle Fusing Elements					
Metacarpal, distal	-	1		8	
Metatarsal, distal	-	5	1	7	73%
Late Fusing Elements					
Calcaneum, proximal	-	-	-	1	100%
Sheep/Goat					
Early Fusing Elements					
Phalanx 1, proximal	1	12	1	88	88%
Middle Fusing Elements					
Metacarpal, distal	-	27.5	1	65	
Metatarsal, distal	-	34	-	51	
Metapodia, distal	1	3.5	-	2	69%
Late Fusing Elements					
Calcaneum, proximal	-	-	-	2	100%
Note: for unfused elements either the shaft or epiphysis is used depending which has the greater number					

Table 5. Epiphysial fusion data for post-medieval period

Measurement	*Mean*	*S.D.*	*C. of V.*	*Min.*	*Max.*	*N*	*Site*
Metacarpal							
GL	**121.6**	**9.7**	**0.1**	**103.8**	**142.1**	**41**	**St Neots**
	127.0	-	8.4	110.0	150.3	20	Launceston Castle
	116.8	6.8	-	107.0	134.6	38	Walmgate
	118.7	7.5	6.4	102.0	128.0	17	Exeter
Bp	**23.4**	**1.7**	**0.07**	**20.2**	**28.1**	**39**	**St Neots**
	22.0	0.9	-	20.3	24.3	38	Walmgate
	22.5	1.9	8.4	19.4	26.7	26	
SD	**14.1**	**1.5**	**0.1**	**11.7**	**19.3**	**40**	**St Neots**
	14.8	-	11.4	12.0	17.7	21	Launceston Castle
	13.2	1.0	-	11.4	16.0	38	Walmgate
DD	**0.5**	**1.0**	**0.1**	**7.8**	**12.5**	**57**	**St Neots**
B at F	**26.5**	**2.2**	**0.1**	**23.0**	**32.7**	**64**	**St Neots**
	25.2	1.1	-	23.0	27.3	38	Walmgate
	25.1	2.0	8.0	20.6	28.5	21	Exeter
Bd	**26.2**	**1.9**	**0.1**	**22.4**	**31.3**	**59**	**St Neots**
	26.1	-	8.8	22.0	30.7	30	Launceston Castle
	25.0	1.3	-	22.2	28.5	38	Walmgate
Ddm	**16.3**	**1.2**	**0.1**	**14.3**	**19.4**	**48**	**St Neots**
	16.0	-	7.1	14.2	18.4	19	Launceston Castle
	15.6	0.7	-	14.2	17.1	38	Walmgate
1	**11.2**	**1.0**	**0.1**	**8.9**	**13.5**	**59**	**St Neots**
	10.4	0.6	-	9.3	11.4	38	Walmgate
BFdm	**12.2**	**0.9**	**0.1**	**10.6**	**14.4**	**60**	**St Neots**
Stature	**594.5**	**47.3**	**0.08**	**507.6**	**694.9**	**41**	**St Neots**
	621.0	-	-	537.9	735.0	20	Launceston Caste
	571.2	-	-	523.2	658.2	38	Walmgate
	580.4	-	-	498.8	625.9	17	Exeter
Metatarsal							
GL	**135.0**	**10.0**	**0.1**	**119.2**	**157.0**	**20**	**St Neots**
	131.6	-	6.7	119.0	149.5	22	Launceston Castle
	126.5	9.1	-	104.8	145.1	20	Walmgate
	120.4	7.1	5.9	109.0	129.0	7	Exeter
Bp	**21.0**	**1.5**	**0.1**	**18.5**	**24.6**	**22**	**St Neots**
	20.3	1.4	-	17.6	23.3	20	Walmgate
	19.8	0.7	3.3	18.9	21.0	12	Exeter
SD	**12.2**	**1.4**	**0.1**	**10.0**	**16.1**	**25**	**St Neots**
	12.2	-	11.0	10.6	15.6	20	Launceston Castle
	11.2	0.8	-	10.0	12.5	20	Walmgate
DD	**10.3**	**1.0**	**0.1**	**8.8**	**13.0**	**46**	**St Neots**
B at F	**25.0**	**1.9**	**0.1**	**21.5**	**30.3**	**49**	**St Neots**
	23.5	1.5	-	20.4	27.2	20	Walmgate
	23.1	0.9	4.0	22.0	24.7	7	Exeter
Bd	**25.3**	**1.8**	**0.1**	**21.8**	**29.4**	**45**	**St Neots**
	24.3	-	7.8	21.6	28.0	30	Launceston Castle
	23.2	1.6	-	20.0	26.9	20	Walmgate
Ddm	**16.8**	**1.7**	**0.1**	**14.8**	**25.6**	**39**	**St Neots**
	15.9	-	5.1	14.9	17.9	15	Launceston Castle
	15.7	0.8	-	14.5	17.6	20	Walmgate
1	**10.5**	**0.9**	**0.1**	**9.2**	**13.1**	**46**	**St Neots**
	9.9	0.6	-	8.7	11.7	20	Walmgate
BFdm	**11.9**	**0.9**	**0.1**	**10.3**	**13.8**	**44**	**St Neots**
Stature	**613.0**	**45.4**	**0.07**	**541.2**	**712.8**	**20**	**St Neots**
	597.5	-	-	540.3	678.7	22	Launceston Castle
	574.3	-	-	475.8	658.8	20	Walmgate
	546.6	-	-	494.9	585.7	7	Exeter
Tibia							
Bd	**27.5**	**2.3**	**0.1**	**25.8**	**31.4**	**5**	**St Neots**
	25.9	-	6.6	22.1	30.6	77	Launceston Castle
26.7	2.2	8.3	22.9	30.4	17		Exeter

Note: Date ranges Launceston Castle, 1660–1840; Exeter, 1700–1800; Walmgate, York, early 18th century

Table 6. Summary metapodial and tibial sheep measurements for St Neots and other sites.

The majority of the sheep metapodials (69%, calculated from 119 metapodia, a minimum of 33 animals), were fused, the animals being at least approximately two-and-a-half years old. Although data from the two calcanea could hint at them all being over approximately three-and-a-half years of age, perhaps being aged up to eight years plus. Of the 31% unfused metapodials (calculated from 65 metapodia, a minimum of 17 animals), data from the phalanges suggest 12% of the animals (calculated from 12 phalanges, a minimum of two animals) were aged under approximately one-and-a-quarter years, and 19% (calculated from 89 phalanges, a minimum of 12 animals) were approximately aged over one-and-a-quarter years.

The epiphysis data suggest the majority of the cattle and sheep were animals at least slightly older than prime meat age (two to three years); though the statistically insignificant number of calcanea suggest that the animals could be even older, having first been kept for wool, milk, haulage, or breeding. From the epiphysis data alone, the age of the adult animals cannot be accurately estimated. There is also evidence of adolescent cattle or of juvenile and adolescent sheep.

Measurements

Measurements can be used to investigate the sex ratio of a species and changes in breeds. Table 6 provides a summary of the sheep metapodial and tibia measurements, and a comparison with other sites. Individual measurements for all species and elements are listed in Appendix Table 3.

Two methods have been employed to test the sex ratio of the sheep present on site, from their sexual size-dimorphism. The first considers the shape of the distal metacarpal, the smaller belonging to females and wethers (castrates), the larger belonging to males. Fig. 8 plots the distal width at the point of fusion against the distal epiphysial width (Higham 1968). The figure shows that the majority are relatively small (bottom left), with a smaller group of larger metacarpals (top right). This suggests that the majority are females and wethers. The second method considers the relative size of metacarpals, theoretically those of female animals should be short and slender, those of male animals short and wide, and wethers' long and relatively slender to intermediate (Crabtree 1990, 38). Fig. 9 plots the ratio of minimum shaft width to length against the ratio of maximum distal width to length producing a diagram which is shape dependent and size independent (Albarella and Davis 1994a following Higham 1968). The results do not show clear groupings. However, the majority of the plots run diagonally from bottom left to top right; with those at the bottom left relatively long and wide, and those at the top right short and slender. The one exception is plotted in the top right which is shorter and wider. It would appear then that almost all the animals are females and wethers, and it is possible to speculate that the majority are wethers.

If the majority were wethers, then the sex ratio pattern is the type which would be found if the majority of the sheep had been kept for wool. Wethers grow the thickest wool and are much easier to handle than intact males (Ryder 1983). They would most likely be older animals with fused calcanea. If the majority were females, they could have been kept for either meat or wool and/or be females which were culled because they proved not to be good breeders. If the sheep had been used for meat then they would most likely have been younger animals with unfused calcanea; if they had been kept for wool or for breeding then they would most likely be older animals with fused calcanea.

Work by Albarella and Davis (1994b), on many bones including the distal humerus and tibia, tentatively concluded that sheep throughout England gradually increased in size between the 15th and 17th–18th centuries. The St Neots, Phase 2–3, sheep distal tibia mean width of 27.5mm is as large as that found on any of the 17th–18th century sites they studied, which implies that the sheep from this site had been subject to the same 'improvements' as sheep elsewhere (Table 6). Comparison of the measurements of metapodials and tibia using t-tests with sites at Launceston Castle (Albarella and Davis 1994b) and Exeter (Maltby 1979) from the medieval period showed significant differences in size; while those from Launceston Castle, Walmgate, York (O'Connor 1984) and Exeter, from the later post-medieval period, showed no significant differences in size. Comparison of the tibia distal breadth (Bd) can be seen in Fig. 10.

In cattle, Albarella and Davis (1994b) found that when a general increase in size took place, there was a decrease in the width of the metatarsal at the distal end, although the ratio of shaft width to length remained constant. Because of insufficient numbers, Albarella and Davis were unable to do this same comparison on the sheep bones and the same problem was found during study of the sheep from the St Neots site. However, it is possible to compare a plot of the metatarsal indices of robustness (the same ratios that were examined to ascertain the metacarpal shape, see above) for the Launceston Castle and St Neots sites (Fig. 11). This figure shows that during the post-medieval period the sheep from these two sites were of comparable size and the same shape.

From the complete metapodials, withers height was estimated at 603mm. The St Neots sheep are similar in size to the sheep from Walmgate, York (O'Connor 1984, 42), which were suggested to be sheep of slow-maturing stock, similar to modern hill breeds, and that a mature ewe would have reached around 40–50 kg liveweight.

Butchery

Very few butchery marks were found on the animal bones in this assemblage. The butchery marks observed were found on cattle and sheep bones. All the bones were those associated with meat removal except for butchery marks on horn cores. The cattle bones showed the following marks: one fragment of horn core is chopped at the base, one proximal radius has the lateral section of the articular surface chopped off, four vertebrae have been chopped in half sagittally and one rib has several knife cuts. The sheep bones showed even fewer butchery marks: one distal tibia has the medial half of the articular surface chopped off and three horn

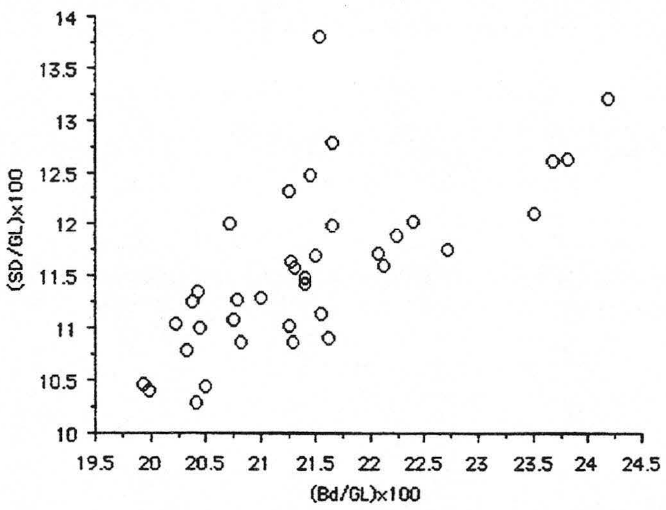


Figure 9 Sheep metacarpal shape

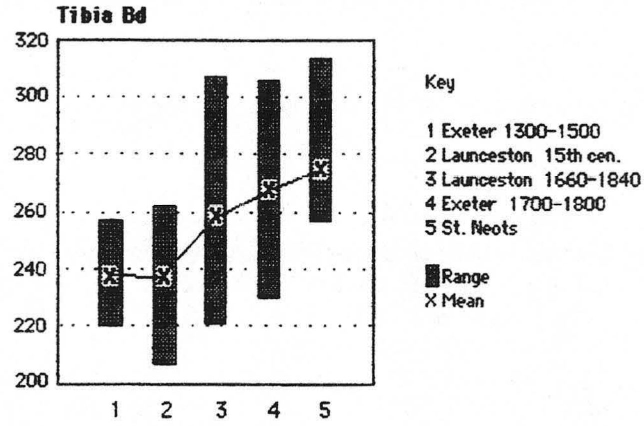


Figure 10 Sheep/goat metacarpal shape from St Neots, Exeter and Launceston

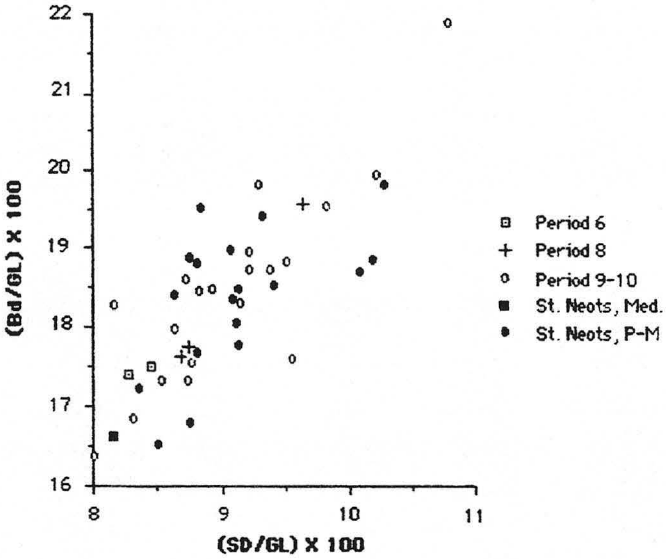


Figure 11 Sheep metatarsal shape from St Neots and Launceston Castle

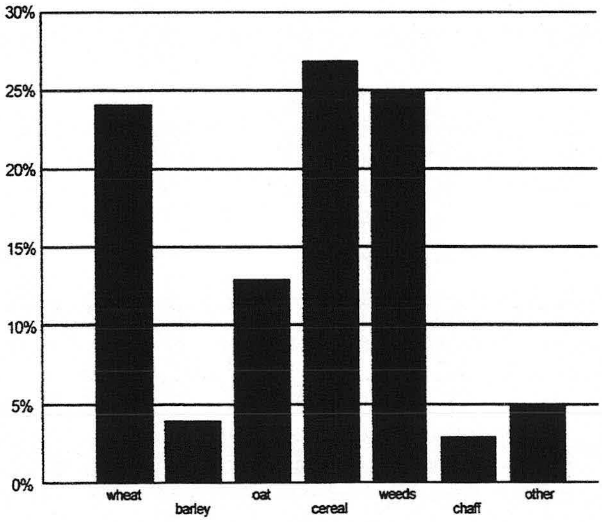


Figure 12 Composition of the sample from *F108*

cores were chopped diagonally along one side of the base. The absence of cut or knife marks on the proximal ends of the metapodials found in this excellently-preserved assemblage suggests that the foot bones were separated from the rest of the carcass somewhere among the carpals and tarsals; these bones were few, and no butchery marks occur on them.

Discussion

The predominance of metapodials and phalanges suggests the assemblage is tannery waste, or primary butchery waste. If this was primary butchery waste, the initial removal of non-meat baring bones, one would expect representation of all non-meat bearing bones, including skull fragments and caudal (tail) vertebrae; while the disproportion of metapodials, phalanges, and horn cores only is considered a sign of tannery waste (O'Connor 1984; Serjeantson 1989). Comparing the St Neots site with these indicators, there are very few mandibles or loose mandibular teeth and examination of the bones not selectively recorded shows very few other fragments from the skull and only two caudal vertebrae. The disproportion of metapodials and phalanges is very great, especially in the sheep (the number of cattle bones in general were small). There is not a large number of horn cores, although the discovery of a large quantity of horn cores was noted by workmen during construction. It could also be that horn cores were being sold on to a horner.

Various tanneries show different portions of the foot to still have been attached when the skins were delivered. Numerous sheep phalanges were found in a pit at Bewell House, Hereford (Noddle 1985). At Walmgate, York, the numbers of phalanges was higher than the number of metapodials, so it is suggested that some of the skins were delivered with both metapodials and phalanges attached, while others had attached phalanges only (O'Connor 1984). Tannery remains found in the Rye town ditch (Kyllo 1981) included larger numbers of metapodials. Where metapodials were present, superficial knife cuts were sometimes found medio-laterally or obliquely around the midshaft, e.g. Walmgate, York (O'Connor 1984) and at Lurk Lane, Beverley (Scott 1992), although at the St Neots site, as at Hall Garth, Beverley (P. Armstrong *pers. comm.*) these knife cuts were not apparent. It has been suggested that foot bones were kept with the skin, even though they added to the weight of an already heavy skin, because the foot bones were used for the extraction of neatsfoot oil. This oil was used for the dressing of leather and some tanneries may have wanted to ensure their own supplies (Serjeantson 1989).

The smaller number of phalanges compared to metapodials and the general scattering throughout all the contexts of other skeletal elements and species suggests that these deposits are of a secondary rather than a primary nature, containing also a very small number of food bones and general waste from other sources. It is probable that very small bones were not recovered.

Conclusion

The faunal assemblages from both Phase 1 and Phase 2–3 appear to be tannery waste, although this interpretation must remain tentative for the medieval period because of the small number of bones. These particular secondary deposits suggest that sheepskin was more important than cattle skin to this tannery. The majority of the Phase 2–3 skins came from mainly female and wether sheep, perhaps past prime meat age. These sheep appear to be some of the larger 'improved' sheep which had started to be bred. Sheepskin may have been selected for tanning because butchers were selling mature mutton from sheep which were sold after one or two shearings of wool. Alternatively, it is possible that sheepskin was selected because the size of the skin was more important than its quality.

II. Charred plant remains

by L. Moffett

Method

Samples taken for charred plant remains were processed by water flotation, collecting the flot on a 0.5mm mesh sieve. When dry, the flots were scanned under a binocular microscope and their potential for further analysis was assessed (Moffett 1995). It was decided that only the flot from fill *1041* of medieval hearth *F108* (Phase 2, Trench A) produced sufficient material to warrant further analysis. Details of the samples not selected for further analysis are tabulated (Table 7).

This flot produced approximately 500 ml. of charred material including wood charcoal. A sub-sample of 30 ml (about 6%) of the flot was analysed, producing a total of 173 items. The material was identified using a low-power binocular microscope at up to x50 magnification. Identifications were made by reference to the modern comparative collection in the archaeobotany laboratory at the University of Birmingham. The results of the analysis are given in Table 8 and Fig. 12.

Results

About 70% of the sub-sample consisted of cereal grains, 25% was weed seeds and the remainder was a small amount of wheat chaff and other, mostly unidentified, items. Preservation was only moderate. The most common cereal in the sample was wheat, probably all free-threshing wheat, although the grains were too poorly preserved for this to be certain. A clump of silicified awn fragments resembled wheat awns. The very small amount of rachis material was not sufficiently well-preserved for definite species identification to be made, but it did suggest that both species of free-threshing wheat (*Triticum turgidum/durum* and *Triticum aestivum*) might have been present. A few grains could have been rye, but the poor state of preservation makes it unclear whether this

Phase of fieldwork	*Wat. br.*	*Wat. br.*	*Wat. br.*	*Exc.*	*Exc.*
Context:	*2007*	*2008*	*2009*	*1132*	*1118*
Sample size (litres)	*21*	*17*	*19*	*16*	*15*
Flot size (mls)	*4000*	*300*	*400*	*50*	*110*
Amount scanned (mls)	*100*	*50*	*50*	*50*	*50*
Context type	*charcoal-rich silt*	*levelling-up deposit*	*grey alluvial clay*	*pit fill*	*dark brown clay silt*
Date	*C17–18*	*C16*	*C16–17*	*C19*	*C16*
Triticum sp. (free-threshing wheat)	-	+	+	+	no charred plant remains
Hordeum vulgare (barley)	-	+	+	+	
Cereal indet.	-	-	-	-	
Prunus spinosa (sloc)	+	-	-	-	
Vicia faba (bean)	-	-	-	+	
Pisum sativum (pea)	+	-	-	-	
Vicia/Pisum/Lathyrus (bean/pea/vetch/vetchling)	-	-	+	-	

Note: + = present

Table 7. Charred plant remains from samples not fully analysed

Plant	*Amount*	*Common name*
Cereals		
Triticum cf. turgidum/durum rachis	1	rivet/macaroni wheat
Triticum cf. *aestivum* s.l. rachis	1	bread wheat
Triticum sp. free-threshing rachises	3	free-threshing wheat
Triticum sp. free-threshing	5	free-threshing wheat
Triticum sp. germinated	2	
Triticum sp.	35	wheat
cf. *Triticum* sp. silicified awn fragments (not counted)	+	wheat
Triticum/Secale	4	wheat/rye
cf. *Secale cereale* L.	1	? rye
Hordeum vulgare L. hulled germinated	4	hulled barley
Hordeum vulgare L. indet. germinated	2	barley
Hordeum vulgare L. indet.	1	barley
Avena sp. germinated	7	oat
Avena sp.	5	oat
Avena/large Poaceae germinated	5	oat/large grass
Avena/large Poaceae	5	oat large grass
Cereal indet.	41	cereal
Other plants		
cf. *Brassica/Sinapis*	2	cabbage/turnip/charlock
Vicia tetrasperma (L.) Schreber	1	smooth tare
Vicia/Pisum/Lathyrus	2	vetch/pea/vetchling
Vicia/Lathyrus	4	vetch/vetchling
Medicago lupulina L.	6	black medick
Melilotus/Medicago/Trifolium	11	melilot/medick/clover
cf. *Bupleurum rotundifolium* L.	1	hare's ear
Lithospermum arvense L.	2	corn gromwell
Euphrasia/Odontites	1	eyebright/bartsia
Galium sp.	1	bedstraw
Anthemis cotula L.	3	stinking mayweed
Eleocharis palustris/uniglumis	1	spike-rush
cf. L. germinated	5	darnel
POACEAE	3	grasses
POACEAE germinated	2	grasses
Unidentified	6	unidentified
Total items:	173	

Note: Volume of flot=500 ml., volume analysed=30 ml. (6%) All items are seeds in the broadest sense, unless otherwise noted. Taxonomy follows Stace 1991

Table 8. The charred plant remains from feature *F108*

crop was present. Oat (*Avena sp.*) was the next most common cereal. It is not possible to distinguish wild oat from cultivated oat on the basis of their grains, but it is assumed here that most of the oat grains are likely to represent a crop. It was also not always possible to distinguish oat grains from other large grass seeds (identified as *Avena*/large *Poaceae*), but in calculating the percentages of cereal grains it was assumed that most of these grains were also oat. Oat grains, therefore, are possibly somewhat over-represented in the percentages given in Fig. 12. The other cereal present was hulled barley (*Hordeum vulgare*). The other items in the sample were mainly arable weeds likely to have been growing in crop fields.

Most of the few barley grains, about half of the oat grains and a couple of wheat grains had germinated, as had some of the darnel and other grass seeds. The growing shoot produces a groove down the dorsal side of germinated grains which is characteristic and usually easy to see on hulled cereals, such as hulled barley and common oat, where the enclosing chaff parts remain on the grain after threshing and hold the growing shoot close to the grain. It is less easy to see the dorsal groove on free-threshing wheats where the shoot is free to grow away from the grain. Thus it is possible that more of the wheat had germinated, but that this was not detected. All of the cereal shoots had detached from the grains and none was found, so it is not possible to tell from the length of the shoots how far the germination had gone.

Discussion

Roughly a quarter of the identified grains had germinated. These germinated grains could indicate that grain in danger of spoiling was being dried to prevent further damage. It is also possible, but less likely, that they represent small-scale drying of malt, mixed, perhaps, with material from other activities. Although barley is the cereal now usually used for malting, medieval maltsters used wheat and oats also (Corran 1975) and often used dredge, a mix of oats and barley. Oats and wheat were the two main cereals found in a malting kiln at Boteler's Castle in Warwickshire, but the percentage of identifiably sprouted grains was higher (Moffett 1998). Cereals could also have been parched in the hearth to make milling easier, especially if the milling was being done on a small scale. Although people often took their grain to the miller to be ground, sometimes under compulsion of law (Holt 1988), finds of hand querns are common on medieval sites and suggest that some milling was done at home. Barley and oats also need to be coarsely milled to remove their tightly-adhering chaff parts if they are to be used for human food, and this process is also sometimes easier if the grain is hardened first by parching, especially if it is not fully ripe.

Although very little chaff material was found, it is still possible that the chaff-like by-products of crop processing were used as tinder to start fires. Some unthreshed cereal grains could also have been included with this material. Chaff remains tend to be under-represented relative to cereal grains because they do not generally survive charring as well, though the degree of under-representation depends on the conditions under which the material was charred (Boardman and Jones 1990). Free-threshing rachis material also may survive poorly because the rachises remain joined together and are apt to get caught in the upper, aerobic portions of the fire, when they are more likely to burn completely away (Hillman 1978). The presence of a clump of silicified awn fragments lends support to the possibility that other chaff material did not survive exposure to fire. The weed seeds may also have been associated with chaff material as they are mostly small seeds liable to be separated out of a fully-processed grain crop, though no such processing would be perfect. It is possible therefore that a much larger amount of chaff material may have originally been present, of which only traces remain.

III. Other environmental evidence

Samples were also collected for potential recovery of pollen, beetles, mollusca and diatoms. The results of preliminary analysis indicate that they were either not present, or not present in large enough numbers to be useful environmental indicators.

Chapter 6. Discussion

I. Introduction

These results derive from a small sample of the total site area. However, the targeted nature of the investigations has allowed important information to be obtained concerning the use of the street frontage, and the backplot area, and changes in the environs of the Hen Brook. The data are of particular importance set against the comparative dearth of information for medieval and early post-medieval St Neots, and, in particular, for the development of its small-scale industry.

II. Medieval settlement and economy

No evidence of Saxon activity was encountered. The earliest features encountered in Trench A were stake-hole *F115* and gully *F110*, both cut into the gravel subsoil *(1069)*. The overlying layer of silt-clay-sand *(1052)* may have been deposited to counteract flooding and contained pottery providing an approximate *terminus ante quem* in the 15th century for this activity. Later medieval activity was represented by feature *F108*, which may have been an oven used for crop processing. Later medieval activity also extended into the backplot area, where a rubbish-pit *(F112)*, containing pottery providing a *terminus* in the 15th century, was found.

The results of the investigations are significant in confirming medieval activity on the site, although the relative paucity of the medieval features and artifacts, and the absence of evidence of contemporary structures and plot-divisions suggest that this early activity was neither intense, nor long-lived. The proximity of the adjacent Hen Brook crossing, established no later than AD 1540 (VCH 1932, 338), may have provided a stimulus for post-medieval activity on the site, despite the marshy and low-lying nature of the adjoining land.

Of particular interest was the recovery of information concerning the medieval economy. The assemblage of charred plant remains recovered from feature *F108* comprised wheat, hulled barley and oats. Analysis of this assemblage (p.21), suggests a number of alternative interpretations for the use of this feature, including the drying of grain in danger of spoiling, small-scale malting, or small-scale parching to facilitate milling. The character of the medieval animal bone assemblage, which included tanning waste, could suggest that the well-defined Phase 2 tanning industry was first established here in the medieval period. However, no Phase 1 tanning features were found to confirm this activity *in situ*, and the medieval to post-medieval continuity of this industry cannot be proven on the present evidence.

III. Post-medieval settlement and economy

Excavation adjoining the street frontage identified a deliberate, massive 17th-century soil build-up *(1053–1055)*, also recorded by Tebbutt (1956, 81), in preparation for the layout of buildings on the street frontage. The brick footings recorded during the watching brief probably belonged to the terrace of houses built in the 17th century along the street frontage, which could have abutted the bridge (*F200, F205, F302*: Trenches 1, 3 and 4, respectively).

The discoveries made in Trenches B, C and K relate to the small-scale industrial use of the backplot area after the construction of the 17th-century buildings on the street frontage. Although it was not possible to define the individual plot boundaries within the limited areas available for investigation, important information was obtained concerning the use of this area for tanning. The evidence for Phase 2 tanning is threefold, comprising tanning-pits *(F208, F105, F114)*, redeposited soils containing lime used in tanning, and a large assemblage of bone waste. However, the *in situ* tanning deposits derived from only three pits, and no trace of any leatherworking waste was found.

Two of the tanning-pits *(F114, F105)* were lined with clay. Although only one complete pit was recorded, the form of the features could be seen to vary. One was circular *(F114)*, the second was oval *(F208)*, and the third *(F105)*, although not fully exposed, was straight-sided and possibly square or rectangular. Similar variation in the form of tanning-pits is recorded in the archaeological literature, *e.g.* at Northampton (Williams 1973, Figs 5–60), where square, rectangular and circular tanning features are recorded. This variation in form might suggest that the pits were associated with different stages in the pre-tanning, or tanning, process. The size and shape of a tanning feature might also suggest which animal hides were being processed: a circular pit at Northampton (*op. cit*: fig. 60, G73), of similar size to feature *F114* at St Neots, was interpreted as being of a size suitable for the tanning of sheep hides.

It was usual, until the middle of the last century, for hides to be purchased by the tanner from the local butcher, 'with hooves, horns and other appendages still attached' (Thomson 1981, 162). The tanning waste from the St Neots site includes horn cores, and there was evidence that the feet had not been removed from the carcasses prior to their delivery to the tannery. It has been suggested above (p.20) that the foot bones may have been retained on the carcass to allow the extraction of neatsfoot oil from the foot bones. This oil was also used in tanning.

Pre-tanning treatment of the fresh hides initially involved their immersion in pits backfilled with lime, to remove fat and hair (Schofield and Vince 1994, 119), lime being one of the materials permitted by the Leather Act of 1563 to be used in the preparation of leather (Thomson 1981, 163). Once the hair was loosened from the hide by immersion in lime, the hide was scraped, and either dumped into a lime solution or immersed in a mixture of human urine, bird droppings and dog dung (Williams 1973, 101), before being further scraped with a knife. The hides were then washed and further cleansed, and re-washed again, in preparation for tanning proper, which involved the immersion of hides in a series of vats containing increasing strengths of tanning liquors (Thomson 1981, 164), often derived from oak bark. The finished product could then be sold in the local market, after quality examination and certification.

Although only a part of the St Neots tanning complex was exposed by excavation, it is nevertheless possible tentatively to ascribe differing tanning functions to the diverse features recorded, by analogy with published examples. Pit *F208*, which was unlined, may have been a liming pit, used in the 'pre-tanning' stages of hide preparation. The form and size of pits *F105* and *F114*, and their clay linings (see Williams 1973, fig. 59, G69–70, and G73 and G82), suggest that they may have contained tanning liquors. These pits may have been backfilled with lime after a change of use, or after their disuse.

Analysis of the bone assemblage (p.13) indicates that female wether sheep predominated in this tannery. The sheep were probably originally kept for meat or wool, or proved not to be good breeders.

Tanning was an important and specialised trade in the medieval period. It has been calculated that one-third of the urban population was occupied in tanning, textile and leather working by the end of the medieval period (Patten 1978, 164). Tanning was an important adjunct to livestock production, and tanneries are recorded in most towns where sheep were marketed and slaughtered (Hughes and Litherland 1994, 169).

The location of the site on the outskirts of early post-medieval St Neots, and offering easy access to the River Great Ouse, dredged in the 17th century (VCH 1932, 315), may have proved attractive to tanning and also to other small-scale industrial activities. The raw material (animal hide) could easily be imported by boat, and a large open area was available for storage of raw materials. Running water for washing the hides, which was required at different stages in the pre-tanning and tanning processes (Thomson 1981, 163), could also be obtained from the nearby Hen Brook. A post-medieval tannery at Lewes, in East Sussex was located adjoining the town brook (Cherry 1975, 258), and a tannery at Canterbury (Egan 1985, 19) was sited adjoining the River Stour. Furthermore, tanning, which involved the use of urine or faeces, may have been confined to liminal positions on the outskirts of towns in the post-medieval, as well as the medieval, period (Schofield and Vince 1994, 53), because of the noxious smells produced.

Although conclusive evidence for other contemporary industrial activity was not found on the site, tanning was often conducted 'symbiotically' with other trades (Schofield and Leech 1987, 72 and Carver 1987, Fig. 58). The small number of horn cores recovered from the tanning complex may hint at horn working in the environs of the excavated site. Horn working was less noxious, and may have been carried out in workshops on street frontages (Schofield and Vince 1994, 111). Another possibly associated activity is carpentry, and in particular bark-working (*op. cit*, 108), bark being another raw material required in the tanning process, but the case for such activity on the St Mary's Street site remains unproven.

Later 18th-century tanning activity may have been conducted here, or transferred to the brick-built 'tanning factory' constructed in the angle between Church Street and Hen Brook (Tebbuts Ltd. 1949, 2). These premises continued to be known as 'Fellmongers Yard' into the present century, when they were purchased by Tebbutts Builders Merchants.

The site formed part of the premises of the company owning the Ouse Navigation. The Navigation Company is first recorded in 1793 when Suzanna Palmer was admitted to Eynesbury manor (Tebbutt 1978, 314). In the early 18th century the site was used as a wharf, and also for the repair of barges. A document of 1816 recorded the ownership of Palmer and Franklin, proprietors of the Ouse Navigation. A pamphlet prepared to celebrate the diamond jubilee of Tebbutts Builders Merchants in 1949, prepared by local antiquarian C. F. Tebbutt, records the 18th-century trade of the wharf as including coal from Newcastle, barques from Scandinavia, wood from Norway, Sweden and Russia, slate from Wales, and wine from France, Portugal and Spain (Tebbuts Ltd. 1949, 2). Local produce handled at the wharf included corn, flour, other agricultural produce, and chalk for lime-burning. The limekiln, first recorded in 1834, provided material for 'penning' the brickwork of sluices along the Ouse (*op. cit.* 2).

In 1878 the site was let as a carpenters' yard and wharf, and amalgamated, in the following year, with another adjoining parcel of land to the south which contained the limekiln. The site was acquired by the firm of C. G. Tebbutt in 1889.

IV. Conclusion

These investigations have provided an important insight into the development of the natural landscape along the Hen Brook. The potential of the street frontage area to contain some, albeit limited, evidence of medieval activity has been confirmed. The discovery of a tanning industry makes an important contribution to the study of the emergence of small-scale industry in St Neots in the medieval and early post-medieval period. The results also have a wider significance as an important new component of the growing database detailing early post-medieval industry and animal husbandry at a county and regional level.

Appendix

Appendix Table 1. Species and Elements found in each phase

Species	*Element*	*Unsided*	*L*	*R*	*Total*
Medieval					
COW	JAW		1		1
PIG	C	1			1
SHEEP	MC		4	2	6
	MT			1	1
S/G	ACE			1	1
	MT	1			1
DOG	HUM		1		1
Post-medieval					
HORSE	M	1			1
	MC	1		1	
COW	ACE		1		1
	APH	3			3
	CAL			1	1
	FEM	2	1	1	4
	HUM	1			1
	I	1			1
	MC	3	3	3	9
	MT	5	3	5	13
	TIB		1		1
PIG	FEM		1		1
	HUM		1	1	2
	M1			1	1
	RAD			1	1
	TIB			1	1
SHEEP	CAL		1	1	2
	HUM		1	1	2
	MC	1	27.5	39.5	63
	MT	2	24	23	49
	RAD			2	2
	SCA			1	1
S/G	APH	108			108
	I			1	1
	JAW			1	1
	M3			1	1
	MC	7.5	10	11.5	29
	MT	14	4	11	29
	MP	5			5
	SCA			1	1
	TIB		2	3	5
DOG	HUM		1		1
	TIB			1	1
RODENT	HUM			1	1
CHICKEN	TIB			1	1
	TMT		1		1
PIGEON	ULN		1		1

Appendix Table 2. Distribution of skeletal elements for cattle and sheep in the post-medieval period

	Cattle		**Sheep**	
	Total	*O/E*	*Total*	*O/E*
Mandible	0	0	1	0.07
Scapula, glenoid	0	0	2	0.14
Humerus, distal	1	0.49	2	0.14
Radius, distal	0	0	2	0.14
Acetabulum	1	0.49	0	0
Femur, distal	4	1.95	0	0
Tibia, distal	1	0.49	5	0.36
Radial Carpal	0	0	0	0
Astragalus	0	0	0	0
Calcaneum	1	0.49	2	0.14
Metacarpal, distal	9	4.39	87.5	6.34
Metatarsal, distal	13	6.34	78	5.65
Phalanx, first	0.75	0.37	27	1.96
Molars, lower first and second*	0	0	0	0
Molar, lower third*	0	0	1	0.07

* The counts of the teeth include those in the jaws.

The species total will not equal the total from the list of animals table because permanent incisors were not included in this table.

An example of the calculations. For cattle the total counts for the elements are added up, after dividing the number of first phalanges by 4 and the combined total of first and second molars by 2, giving a total of 30.75. This total is divided by the number of elements being used (15) giving an expected total, if the elements were all equally abundant, of 2.05. The observed values (O) are then divided by this calculated expected value (E) to show when the elements are under- or over-represented relative to one another.

Appendix Table 3. Animal bone measurements for the medieval and post-medieval periods

Medieval										
Cow	Horncore	44 - 192.0	45 - 63.8	46 - 52.9						
Sheep	Horncore	40 - 82.0	41 - 28.1	42 - 18.1	43 - 83.0					
	Metacarpal				DD - 8.0	B at F - 23.4	Bd - 22.9	Ddm - 14.5	1 - 9.9	BFdm - 10.6
					DD - 10.1	B at F - 28.9	Bd - 27.7	Ddm - 17.2	1 - 11.9	BFdm - 12.0
		GL - 105.5	Bp - 20.4	SD - 12.9	DD - 7.8	B at F - 23.3	Bd - 23.3	Ddm - 14.7	1 - 10.1	
		GL - 115.4	Bp - 22.5	SD - 15.0	DD - 10.0	B at F - 26.3	Bd - 25.7	Ddm - 15.1	1 - 10.6	BFdm - 11.5
					DD - 9.3	B at F - 28.2	Bd - 27.4	Ddm - 16.4	1 - 11.1	BFdm - 12.8
		GL - 109.9	Bp - 21.7	SD - 13.1	DD - 8.6	B at F - 24.3	Bd - 24.1	Ddm - 15.1	1 - 9.9	BFdm - 11.1
	Metatarsal	GL - 139.9	Bp - 20.9	SD - 11.4	DD - 9.6	B at F - 23.5	Bd - 23.2		1 - 10.1	BFdm - 11.0
Sheep/Goat	Acetabulum	LA - 25.7	MW - 3.0							
Dog	Humerus	GL - 221.0	Bp - 42.8	Dp - 56.3	SD - 19.8	Bd - 48.3	BT - 30.2	HTC - 18.5		
Post-Medieval										
Horse	Metacarpal	DD - 23.7	Bd - 50.0	Dd - 36.9						
Cow	Horncore	44 - 169.0	45 - 56.4	46 - 48.1						
	Acetabulum	LA - 66.5	MW - 8.1							
	First Phalanx	GLpe - 69.3		SD - 27.7	Bd - 31.6					
		GLpe - 54.1	Bp - 28.9	SD - 23.9	Bd - 26.5					
		GLpe - 58.4	Bp - 27.3	SD - 24.0	Bd - 27.5					
	Calcaneus	GL - 136.0	GB - 42.0							

Cow cont.	Metacarpal					B at F - 47.9	Bd - 52.7			
					DD - 21.0	B at F - 50.8	Bd - 54.8		1 - 24.5	BFdm - 25.7
					DD - 21.2	B at F - 51.9				
					DD - 21.9	B at F - 55.8	Bd - 59.2	Ddm - 31.3	1 - 24.2	BFdm - 28.0
						B at F - 62.9	Bd - 63.7	Ddm - 33.2	1 - 27.1	BFdm - 29.1
					DD - 22.0	B at F - 58.2	Bd - 60.5	Ddm - 33.1	1 - 26.8	BFdm - 28.7
					DD - 22.8	B at F - 58.8	Bd - 63.0			
					DD - 23.8	B at F - 61.8	Bd - 68.9		1 - 27.6	BFdm - 33.6
	Metatarsal				DD - 22.7	B at F - 46.4	Bd - 50.1	Ddm - 29.0	1 - 21.8	BFdm - 23.8
					DD - 24.8	B at F - 45.7	Bd - 48.3	Ddm - 28.3	1 - 20.6	BFdm - 23.1
					DD - 23.3	B at F - 47.1	Bd - 49.1		1 - 21.6	BFdm - 21.6
					DD - 24.8	B at F - 50.6	Bd - 53.2		1 - 24.2	BFdm - 25.8
					DD - 24.2	B at F - 49.3	Bd - 53.6	Ddm - 30.8	1 - 22.4	BFdm - 25.9
					DD - 23.0	B at F - 49.2	Bd - 52.9		1 - 22.4	BFdm - 24.9
					DD - 24.2	B at F - 47.9	Bd - 50.0	Ddm - 30.0	1 - 22.6	BFdm - 23.5
					DD - 25.2	B at F - 51.9	Bd - 51.6	Ddm - 30.6	1 - 22.1	BFdm - 24.7
	Tibia	Bd - 61.9								
		Bd - 32.6								
Sheep	Horncore				43 - 54.0					
		40 - 88.0	41 - 27.9	42 - 19.6	43 - 65.0					
		40 - 101.0	41 - 35.6	42 - 22.1						
		40 - 80.0	41 - 25.3	42 - 21.0	43 - 87.0					
		40 - 98.0	41 - 34.6	42 - 23.8	43 - 101.0					
	Calcaneus	GL - 59.7	GB - 20.5							
		GL - 51.7	17.7							
	Humerus	Bd - 30.1	BT - 29.2	HTC - 15.8						
		Bd - 28.2	BT - 26.9	HTC - 14.7						
	Metacarpal	GL - 118.4	Bp - 22.1	SD - 12.4	DD - 9.0	B at F - 24.3	Bd - 23.6	Ddm - 15.0	1 - 10.7	BFdm - 10.6
		GL - 119.1	Bp - 21.1	SD - 12.4	DD - 9.1	B at F - 23.5	Bd - 23.8	Ddm - 15.5	1 - 10.1	BFdm - 11.3
		GL - 120.7	Bp - 23.1	SD - 14.5	DD - 9.7	B at F - 24.9	Bd - 25.0	Ddm - 15.7	1 - 10.6	BFdm - 11.8
		GL - 123.4	Bp - 23.0	SD - 14.0	DD - 9.3	B at F - 25.2	Bd - 25.2	Ddm - 15.7	1 - 10.8	BFdm - 11.6
		GL - 115.7	Bp - 24.2	SD - 14.0	DD - 9.3	B at F - 26.8	Bd - 27.2	Ddm - 16.9	1 - 11.3	BFdm - 12.8
		GL - 114.0	Bp - 22.9	SD - 13.4	DD - 8.5	B at F - 25.8	Bd - 25.9			BFdm - 12.0
		GL - 138.6			DD - 11.8	B at F - 32.7	Bd - 31.3		1 - 13.2	BFdm - 14.4
					DD - 10.0	B at F - 27.3	Bd - 27.8	Ddm - 17.4	1 - 12.1	BFdm - 13.1
					DD - 11.6	B at F - 30.0	Bd - 29.1	Ddm - 18.7	1 - 12.4	BFdm - 14.0

Sheep	Metacarpal cont.				DD - 12.5	B at F - 31.7	Bd - 31.0	Ddm - 19.4	1 - 13.5	BFdm - 14.1
						B at F - 26.8	Bd - 25.6		1 - 10.0	BFdm - 11.7
					DD - 8.6	B at F - 26.9	Bd - 26.7	Ddm - 16.4	1 - 10.7	BFdm - 12.6
						B at F - 26.7	Bd - 26.2		1 - 11.7	BFdm - 12.3
						B at F - 27.0	Bd - 25.4	Ddm - 16.7	1 - 11.5	BFdm - 11.8
					DD - 9.3	B at F - 25.4	Bd - 25.0	Ddm - 15.4	1 - 8.9	BFdm - 11.5
		GL - 142.0	Bp - 27.5	SD - 16.3	DD - 10.6	B at F - 30.5	Bd - 30.4	Ddm - 18.7	1 - 13.2	BFdm - 13.4
		GL - 139.8	Bp - 28.1	SD - 19.3	DD - 11.7	B at F - 29.8	Bd - 30.1	Ddm - 18.9	1 - 12.6	BFdm - 14.2
		GL - 111.1	Bp - 23.8	SD - 14.0	DD - 9.2	B at F - 26.3	Bd - 26.3	Ddm - 16.0	1 - 11.1	BFdm - 12.3
					DD - 10.0	B at F - 24.8	Bd - 24.5	Ddm - 16.4	1 - 10.6	BFdm - 11.4
						B at F - 24.0	Bd - 24.8	Ddm - 15.9	1 - 11.0	BFdm - 11.4
		GL - 132.4	Bp - 24.06	SD - 14.3	DD - 9.5	B at F - 26.7	Bd - 26.9	Ddm - 16.8	1 - 11.7	BFdm - 12.3
		GL - 118.2	Bp - 23.1	SD - 13.5	DD - 8.6	B at F - 26.1	Bd - 25.3	Ddm - 15.3	1 - 10.5	BFdm - 11.8
					DD - 9.2	B at F - 27.5	Bd - 26.9	Ddm - 15.9	1 - 11.6	BFdm - 12.2
						B at F - 28.8	Bd - 28.1	Ddm - 18.0	1 - 11.7	BFdm - 13.2
		GL - 111.9	Bp - 22.2	SD - 13.3	DD - 8.8	B at F - 25.6	Bd - 24.9	Ddm - 15.1	1 - 10.1	BFdm - 11.8
		GL - 116.2	Bp - 22.1	SD - 12.8	DD - 8.3	B at F - 24.6	Bd - 24.7	Ddm - 14.8	1 - 10.0	BFdm - 11.4
		GL - 126.7	Bp - 24.2	SD - 14.3	DD - 9.7	B at F - 28.3	Bd - 26.6	Ddm - 16.5	1 - 11.4	BFdm - 12.3
					DD - 9.2	B at F - 26.4	Bd - 26.0	Ddm - 15.9	1 - 11.3	BFdm - 12.2
					DD - 10.4	B at F - 27.7	Bd - 28.3	Ddm - 17.4	1 - 12.3	BFdm - 13.4
		GL - 117.9	Bp - 23.5	SD - 14.7	DD - 10.1	B at F - 27.7		Ddm - 16.5	1 - 11.1	BFdm - 13.8
		GL - 122.5	Bp - 23.5	SD - 14.2	DD - 8.9	B at F - 26.5	Bd - 26.1	Ddm - 16.1	1 - 11.0	BFdm - 12.7
		GL - 142.1		SD - 17.1	DD - 10.9	B at F - 31.2		Ddm - 18.2	1 - 13.3	BFdm - 13.0
		GL - 128.3	Bp - 23.8	SD - 13.4	DD - 9.7	B at F - 26.0	Bd - 26.3			
					DD - 9.0	B at F - 23.6				
		GL - 135.7	Bp - 25.4	SD - 15.3	DD - 10.2	B at F - 28.7	Bd - 28.2	Ddm - 17.4	1 - 12.2	BFdm - 13.5
		GL - 129.4	Bp - 25.3	SD - 15.9	DD - 10.0	B at F - 29.3				
					DD - 11.6	B at F - 31.5	Bd - 29.6		1 - 12.4	BFdm - 14.1
						B at F - 29.3	Bd - 27.6		1 - 11.6	BFdm - 12.5
		GL - 103.8	Bp - 22.0	SD - 13.7	DD - 8.1	B at F - 24.3	Bd - 25.1	Ddm - 15.0	1 - 10.4	BFdm - 11.4
					DD - 9.3	B at F - 25.7	Bd - 25.5	Ddm - 16.1	1 - 11.3	BFdm - 11.6
					DD - 9.3	B at F - 27.2	Bd - 26.2		1 - 11.1	BFdm - 12.2
		GL - 127.5	Bp - 25.1	SD - 15.7	DD - 9.5	B at F - 27.3	Bd - 27.1		1 - 10.8	BFdm - 12.4
					DD - 9.8	B at F - 26.9	Bd - 26.2	Ddm - 15.8	1 - 10.3	BFdm - 11.8
					DD - 9.9	B at F - 26.1	Bd - 26.7	Ddm - 16.1	1 - 11.1	BFdm - 12.4
						B at F - 25.3	Bd - 26.0	Ddm - 15.7	1 - 11.5	BFdm - 12.2
		GL - 117.2	Bp - 24.4	SD - 14.8	DD - 9.7	B at F - 28.6	Bd - 27.9	Ddm - 17.0	1 - 11.4	BFdm - 13.3
		GL - 110.2	Bp - 21.3	SD - 12.9	DD - 7.9	B at F - 23.5	Bd - 23.7	Ddm - 14.3	1 - 9.7	BFdm - 11.2
		GL - 112.1	Bp - 22.1	SD - 13.0	DD - 7.8	B at F - 24.7	Bd - 24.8	Ddm - 15.1	1 - 10.5	BFdm - 11.5
		GL - 125.2	Bp - 22.8	SD - 14.1	DD - 9.1	B at F - 25.6	Bd - 25.5	Ddm - 16.0	1 - 11.1	BFdm - 11.0
		GL - 109.5	Bp - 21.5	SD - 11.9	DD - 8.4	B at F - 23.5	Bd - 23.3	Ddm - 14.8	1 - 9.8	BFdm - 11.0
		GL - 115.0	Bp - 22.8	SD - 13.8	DD - 8.6	B at F - 24.7	Bd - 24.9	Ddm - 15.6	1 - 10.4	BFdm - 11.0
		GL - 117.3	Bp - 22.9	SD - 15.0	DD - 9.7	B at F - 25.9	Bd - 25.4	Ddm - 15.3	1 - 10.4	BFdm - 12.0
		GL - 122.6	Bp - 24.0	SD - 15.3	DD - 10.2	B at F - 26.2	Bd - 26.3	Ddm - 16.5	1 - 11.1	BFdm - 12.1

Sheep	Metacarpal cont.	GL - 127.4	Bp - 23.5	SD - 13.1	DD - 8.9	B at F - 25.7	Bd - 26.0	Ddm - 17.3	1 - 11.8	BFdm - 12.4
		GL - 122.3	Bp - 24.4	SD - 14.7	DD - 10.5	B at F - 27.7	Bd - 27.4		1 - 12.2	BFdm - 13.1
		GL - 123.1	Bp - 23.2	SD - 13.6	DD - 8.9	B at F - 25.0	Bd - 24.9	Ddm - 15.8	1 - 11.3	BFdm - 11.3
		GL - 110.1	Bp - 20.2	SD - 12.0	DD - 8.6	B at F - 23.0	Bd - 23.8		1 - 10.2	BFdm - 11.2
		GL - 119.4	Bp - 22.6	SD - 13.9	DD - 8.9	B at F - 25.4	Bd - 25.4	Ddm - 16.0	1 - 10.9	BFdm - 12.2
		GL - 115.1	Bp - 23.2	SD - 13.5	DD - 8.6	B at F - 24.7	Bd - 25.4		1 - 10.3	BFdm - 11.7
		GL - 107.6	Bp - 20.3	SD - 11.7	DD - 7.9	B at F - 23.2	Bd - 22.4	Ddm - 14.6	1 - 9.8	BFdm - 10.7
		GL - 113.2	Bp - 22.1	SD - 12.6	DD - 8.0	B at F - 23.6	Bd - 24.4	Ddm - 15.3	1 - 10.6	BFdm - 11.5
		GL - 132.6	Bp - 24.9	SD - 14.7	DD - 9.8	B at F - 27.6	Bd - 27.5	Ddm - 17.0	1 - 11.8	BFdm - 12.8
					DD - 8.5	B at F - 23.7				
		GL - 129.1	Bp - 25.4	SD - 14.2	DD - 10.4	B at F - 26.6	Bd - 26.4		1 - 11.0	BFdm - 12.2
	Metatarsal	GL - 157.0	Bp - 23.9	SD - 16.1	DD - 12.2	B at F - 29.7	Bd - 29.4	Ddm - 17.8	1 - 11.2	BFdm - 13.7
						B at F - 24.7	Bd - 24.7		1 - 10.0	BFdm - 11.2
						B at F - 24.0	Bd - 25.4	Ddm - 16.2	1 - 10.6	BFdm - 11.8
		GL - 139.1	Bp - 21.0	SD - 12.1	DD - 10.4	B at F - 24.2	Bd - 24.6	Ddm - 17.0	1 - 11.3	BFdm - 11.9
			Bp - 22.5	SD - 13.1	DD - 11.3	B at F - 25.7	Bd - 26.4	Ddm - 16.5	1 - 9.7	BFdm - 12.8
					DD - 11.5	B at F - 26.1	Bd - 25.4	Ddm - 18.3	1 - 12.1	BFdm - 11.9
					DD - 12.3	B at F - 28.3	Bd - 27.0	Ddm - 18.1	1 - 11.5	BFdm - 12.8
					DD - 9.4	B at F - 24.8	Bd - 25.4	Ddm - 16.3	1 - 9.9	BFdm - 12.1
		GL - 125.4	Bp - 20.7	SD - 11.5	DD - 10.2	B at F - 25.7	Bd - 23.8	Ddm - 15.8	1 - 10.7	
		GL - 132.5	Bp - 20.2	SD - 12.0	DD - 10.3	B at F - 24.0	Bd - 23.8	Ddm - 16.1	1 - 10.8	BFdm - 11.0
					DD - 10.6	B at F - 26.0	Bd - 26.3	Ddm - 16.3	1 - 10.4	BFdm - 12.4
					DD - 10.5	B at F - 25.2	Bd - 25.9	Ddm - 16.9	1 - 10.5	BFdm - 11.8
					DD - 10.2	B at F - 25.3	Bd - 25.1	Ddm - 15.5	1 - 9.7	BFdm - 11.6
					DD - 9.8	B at F - 23.9	Bd - 24.5	Ddm - 17.1	1 - 10.1	BFdm - 12.0
		GL - 137.4	Bp - 21.8	SD - 12.9	DD - 10.7	B at F - 25.7	Bd - 26.6	Ddm - 17.2	1 - 10.6	BFdm - 12.7
					DD - 11.6	B at F - 26.3	Bd - 26.2	Ddm - 18.0	1 - 11.9	BFdm - 12.3
					DD - 10.2	B at F - 24.4	Bd - 24.9	Ddm - 17.0	1 - 10.4	BFdm - 11.6
					DD - 10.2	B at F - 26.2	Bd - 25.7	Ddm - 16.3	1 - 10.9	BFdm - 12.4
						B at F - 27.4	Bd - 28.4		1 - 11.1	BFdm - 13.1
					DD - 10.5	B at F - 26.6	Bd - 27.3	Ddm - 17.5	1 - 11.6	BFdm - 13.1
		GL - 148.7	Bp - 24.6	SD - 15.3	DD - 13.0	B at F - 30.3	Bd - 29.4	Ddm - 18.2	1 - 12.8	BFdm - 13.6
		GL - 134.7	Bp - 22.1	SD - 13.6	DD - 11.0	B at F - 25.6	Bd - 25.0	Ddm - 16.4	1 - 10.3	BFdm - 11.7
				SD - 10.3	DD - 9.3	B at F - 23.9	Bd - 23.9		1 - 9.8	BFdm - 11.0
		GL - 151.1	Bp - 21.5	SD - 12.7	DD - 10.4	B at F - 26.1	Bd - 26.1	Ddm - 17.7	1 - 11.5	BFdm - 12.2
		GL - 143.8	Bp - 20.4	SD - 12.6	DD - 10.8	B at F - 24.0	Bd - 24.2		1 - 9.8	BFdm - 11.4
		GL - 142.3	Bp - 22.5	SD - 13.5	DD - 11.3	B at F - 26.7	Bd - 26.3	Ddm - 16.2	1 - 10.3	BFdm - 12.3
					DD - 10.0	B at F - 24.8	Bd - 24.6	Ddm - 16.9	1 - 10.8	BFdm - 11.5
					DD - 13.0	B at F - 28.6	Bd - 29.1		1 - 13.1	BFdm - 13.8
					DD - 8.9	B at F - 21.7	Bd - 22.7	Ddm - 14.8	1 - 9.5	BFdm - 10.6
					DD - 10.8	B at F - 23.6				
				SD - 12.7	DD - 10.0	B at F - 25.8	Bd - 26.1	Ddm - 16.8	1 - 10.5	BFdm - 12.6
			Bp - 20.2	SD - 11.3	DD - 9.7	B at F - 23.9				

Sheep	Metatarsal cont.				DD - 9.8	B at F - 25.2	Bd - 25.2	Ddm - 16.2	1 - 10.0	BFdm - 11.5
					DD - 10.3	B at F - 24.8	Bd - 24.6	Ddm - 16.4	1 - 10.7	BFdm - 11.5
				SD - 11.9	DD - 9.7	B at F - 24.7	Bd - 24.9	Ddm - 15.9	1 - 10.1	
		GL - 127.0	Bp - 20.4	SD - 11.5	DD - 9.1	B at F - 23.0	Bd - 23.5	Ddm - 15.8	1 - 10.1	BFdm - 10.8
		GL - 131.8	Bp - 19.6	SD - 11.2	DD - 9.7	B at F - 21.7	Bd - 21.8	Ddm - 25.6	1 - 9.5	BFdm - 10.3
		GL - 119.2	Bp - 18.5	SD - 10.3	DD - 9.1	B at F - 21.5	Bd - 21.9	Ddm - 14.9	1 - 9.5	BFdm - 10.3
		GL - 129.9	Bp - 19.8	SD - 11.5	DD - 9.9	B at F - 22.4		Ddm - 16.2	1 - 10.1	BFdm - 10.4
		GL - 128.4	Bp - 19.5	SD - 10.0	DD - 8.8	B at F - 23.5	Bd - 23.5	Ddm - 15.7	1 - 9.3	BFdm - 11.1
		GL - 130.3	Bp - 20.0	SD - 11.5	DD - 9.5	B at F - 24.1	Bd - 24.5	Ddm - 15.4	1 - 9.7	BFdm - 11.5
		GL - 119.9	Bp - 20.4	SD - 10.7	DD - 9.3	B at F - 22.9	Bd - 23.5		1 - 9.3	BFdm - 10.6
		GL - 135.7	Bp - 21.2	SD - 12.0	DD - 9.7	B at F - 25.4	Bd - 25.6	Ddm - 16.8	1 - 10.0	BFdm - 12.4
		GL - 127.6	Bp - 19.4	SD - 11.7	DD - 9.9	B at F - 23.4	Bd - 23.2	Ddm - 15.0	1 - 9.3	BFdm - 10.8
		GL - 138.8	Bp - 20.7	SD - 12.7	DD - 10.9	B at F - 25.2	Bd - 24.7	Ddm - 16.6	1 - 10.4	BFdm - 11.3
					DD - 9.6	B at F - 23.7	Bd - 23.7		1 - 9.2	BFdm - 11.4
					DD - 9.5	B at F - 23.8	Bd - 24.0	Ddm - 16.5	1 - 10.2	BFdm - 11.5
					DD - 9.4	B at F - 22.4				
					DD - 11.7	B at F - 27.9	Bd - 28.5	Ddm - 17.2	1 - 11.4	BFdm - 13.7
	Radius	Bd - 28.0	BFd - 24.0							
		Bd - 28.4	BFd - 26.4							
	Scapula	GLP - 33.8	LG - 26.5	BG - 22.5						
Sheep/Goat	First Phalanx	GLpe - 38.8								
				SD - 9.8	Bd - 11.5					
		GLpe - 38.2	Bp - 13.0	SD - 11.0	Bd - 12.5					
		GLpe - 33.3	Bp - 12.6	SD - 11.1	Bd - 11.9					
		GLpe - 35.8	Bp - 11.8	SD - 10.5	Bd - 11.4					
		GLpe -35.0	Bp - 12.2	SD - 10.0	Bd - 11.8					
		GLpe - 36.5	Bp - 13.0	SD - 10.8	Bd - 12.2					
		GLpe - 32.2	Bp - 12.0	SD - 9.9	Bd - 10.8					
		GLpe - 37.9	Bp - 12.6	SD - 10.8	Bd - 12.4					
		GLpe - 38.2	Bp - 12.7	SD - 11.0	Bd - 12.8					
		GLpe - 37.4	Bp - 13.1	SD - 10.6	Bd - 12.8					
		GLpe - 35.4	Bp - 12.1	SD - 9.8	Bd - 11.7					
		GLpe - 40.5	Bp - 14.6	SD - 12.6	14.6					
		GLpe - 37.9	Bp - 15.3	SD - 12.5	Bd - 12.8					
		GLpe - 38.6	Bp - 13.6	SD - 10.8	Bd - 12.4					
		GLpe - 39.1	Bp - 14.4	SD - 11.5	Bd - 13.3					
		GLpe - 37.2	Bp - 12.8	SD - 10.3	Bd - 12.7					
		GLpe - 39.5	Bp - 12.7	SD - 10.4	Bd - 12.2					
		GLpe - 35.4	Bp - 12.1	SD - 9.4	Bd - 11.0					
		GLpe - 32.8	Bp - 12.4	SD - 10.1	Bd - 11.9					

Sheep/Goat	First Phalanx cont.	GLpe - 38.0	Bp - 11.6	SD - 9.3	Bd - 11.3
		GLpe - 39.5	Bp - 12.7	SD - 9.5	Bd - 12.0
		GLpe - 34.5	Bp - 12.0	SD - 10.7	Bd - 11.6
		GLpe - 34.7	Bp - 11.9	SD - 10.3	Bd - 11.6
		GLpe -30.8	Bp - 10.4	SD - 9.5	Bd - 10.6
		GLpe - 38.8	Bp - 13.1	SD - 10.7	Bd - 12.4
		GLpe - 33.1	Bp - 10.5	SD - 8.1	Bd - 9.6
		GLpe - 39.1	Bp - 12.5	SD - 10.1	Bd - 11.9
		GLpe - 34.2	Bp - 12.4	SD - 10.0	Bd - 11.2
		GLpe - 36.4	Bp - 11.5	SD - 9.6	Bd - 10.7
		GLpe - 33.2		SD - 9.0	
		GLpe - 31.2		SD - 9.3	
		GLpe - 32.0	Bp - 11.3	SD - 9.4	Bd - 11.1
		GLpe - 37.5	Bp - 13.1	SD - 11.4	Bd - 12.7
		GLpe - 39.1	Bp - 15.0	SD - 11.9	Bd - 13.4
		GLpe - 33.0	Bp - 11.9	SD - 9.9	Bd - 11.0
		GLpe - 33.7	Bp - 12.3	SD - 9.5	Bd - 11.4
		GLpe - 37.8	Bp - 13.1	SD - 10.8	Bd - 12.8
		GLpe - 33.9	Bp - 12.1	SD - 9.9	Bd - 11.2
		GLpe - 32.4	Bp - 12.5	SD - 10.5	Bd - 11.4
		GLpe - 35.2	Bp - 13.2	SD - 10.0	Bd - 11.9
		GLpe - 36.1	Bp - 11.5	SD - 8.8	Bd - 10.2
		GLpe - 36.5	Bp - 12.1	SD - 10.8	Bd - 12.3
		GLpe - 37.9	Bp - 12.0	SD - 9.7	Bd - 11.5
		GLpe - 35.2	Bp - 12.1	SD - 10.2	Bd - 12.1
		GLpe - 34.9	Bp - 12.0	SD - 10.1	Bd - 11.1
			Bp - 11.5	SD - 9.3	Bd - 10.6
		GLpe - 33.1	Bp - 11.7	SD - 9.5	Bd - 12.5
		GLpe - 36.2	Bp - 13.2	SD - 11.0	Bd - 13.1
		GLpe - 40.7	Bp -13.0	SD - 10.1	Bd - 11.8
		GLpe - 35.5	Bp - 11.3	SD - 8.4	
		GLpe - 37.5	Bp - 12.3	SD - 9.4	Bd - 11.3
		GLpe - 35.8			Bd - 12.5
		GLpe - 38.8	Bp - 14.6		
		GLpe - 32.6	Bp - 12.7	SD - 9.8	Bd - 11.4
		GLpe - 35.4	Bp - 12.2		Bd - 11.5
		GLpe - 36.5	Bp - 11.9	SD - 9.5	Bd - 10.9
		GLpe - 35.8	Bp - 12.2	SD - 10.6	Bd - 12.3
		GLpe - 35.6	Bp - 12.8	SD - 35.7	Bd - 12.3
		GLpe - 29.3	Bp - 11.6	SD - 9.6	Bd - 10.7
		GLpe - 33.8	Bp - 11.7	SD - 9.5	Bd - 10.9
		GLpe - 35.9	Bp - 12.3	SD - 10.5	Bd - 12.2
		GLpe - 36.7	Bp - 12.6	SD - 10.2	Bd - 12.0
		GLpe - 35.8	Bp - 12.0	SD - 9.6	Bd - 10.9

Sheep/Goat	First Phalanx cont.	GLpe - 32.2	Bp - 12.9	SD - 11.4	Bd - 11.5			
		GLpe - 31.0	Bp - 12.1	SD - 9.3	Bd - 10.9			
			Bp - 12.0	SD - 10.0				
		GLpe - 34.6	Bp - 12.0	SD - 10.3	Bd - 11.2			
		GLpe - 41.6	Bp - 10.0	SD - 12.3	Bd - 13.5			
		GLpe - 37.0	Bp - 12.2	SD - 10.6	Bd - 11.9			
		GLpe - 36.7	Bp - 12.1	SD - 9.5	Bd - 11.2			
		GLpe - 35.9	Bp - 12.9	SD - 10.5	Bd - 12.4			
		GLpe - 37.4	Bp - 12.1	SD - 10.0	Bd - 11.3			
		GLpe - 31.7	Bp - 12.2	SD - 9.6	Bd - 11.0			
		GLpe - 35.1	Bp - 12.7	SD - 10.2	Bd - 11.8			
		GLpe - 41.2	Bp - 12.9	SD - 10.8	Bd - 11.9			
		GLpe - 35.0	Bp - 11.4	SD - 10.2	Bd - 11.3			
		GLpe - 34.6	Bp - 12.1	SD - 9.4	Bd - 10.9			
		GLpe - 35.1	Bp - 11.4	SD - 8.8	Bd - 10.6			
		GLpe - 34.9	Bp - 11.9	SD - 9.7	Bd - 11.1			
		GLpe - 36.8	Bp - 12.6		Bd - 11.9			
		GLpe - 34.1	Bp - 12.3	SD - 10.6				
		GLpe - 35.1	Bp - 11.3	SD - 9.3				
		GLpe - 37.8	Bp - 12.7	SD - 10.1	Bd - 11.3			
				SD - 8.8	Bd - 10.6			
		GLpe - 53.2	Bp - 26.8	SD - 23.2	Bd - 26.0			
	Third molar	L - 19.4	W1 - 7.0					
	Tibia	Bd - 26.2						
		Bd - 31.4						
		Bd - 27.7						
		Bd - 25.8						
		Bd - 26.3						
Dog	Humerus	GL - 212.0	Bp - 42.4	Dp - 52.2	SD - 19.3	Bd - 44.3	BT - 25.5	HTC - 15.8
	Tibia	Bd - 20.4						
	Ulna	GL - 153.9						
Chicken	Tibia	Did - 12.6						
	Tarsometatarsus	GL - 69.9	Bp - 12.7	SC - 5.9	Bd - 13.3			

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