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Excavations at Mill Lane, Thetford, 1995

by Heather Wallis

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

4. Zoological, Environmental and Botanical Evidence

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

I. Mammal and bird bones

by Umberto Albarella
(Charts 15–24)

Introduction

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

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

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

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

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

Methods

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

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

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

Provenance and preservation

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

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

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

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

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

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

Frequency of species

(Charts 15–24)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

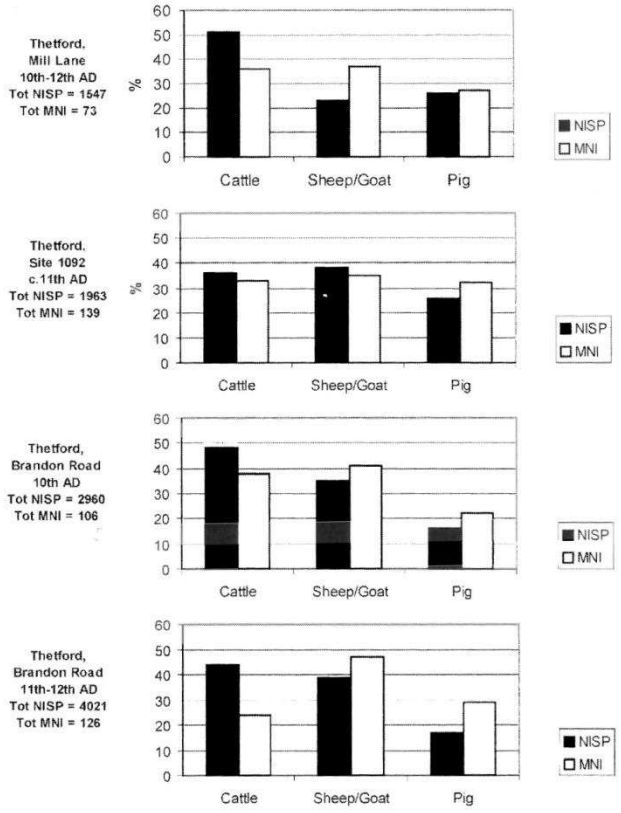


Chart 15 Frequency of the main domestic mammals at Mill Lane and other Late Saxon/early medieval sites in Thetford

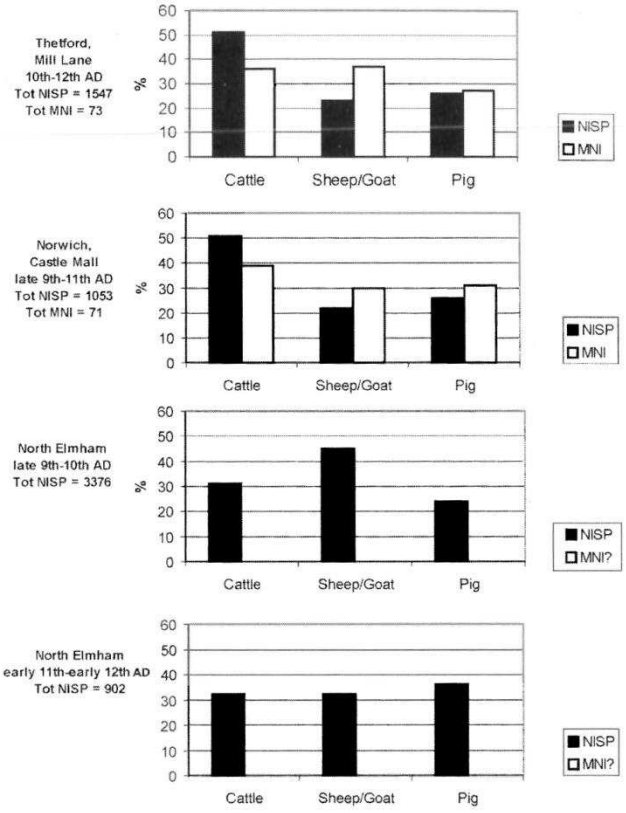


Chart 16 Frequency of the main domestic mammals at Mill Lane and other Late Saxon/early medieval sites in Norfolk

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

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

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

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

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

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

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

Cattle

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

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

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

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

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

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

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

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

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

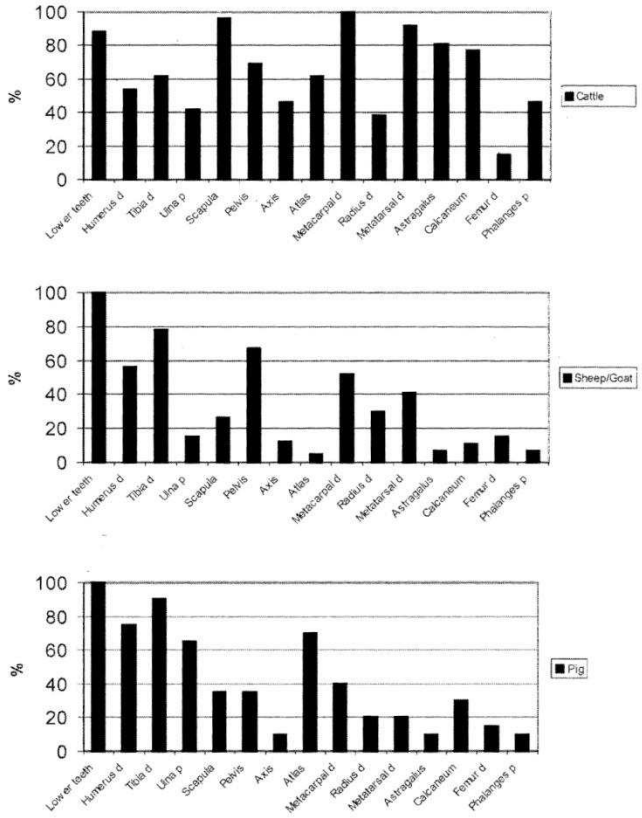


Chart 17 Thetford, Mill Lane. Percentage survival of the body parts of the main domestic mammals. Sequence based on Brain (1976). p – proximal; d – distal.

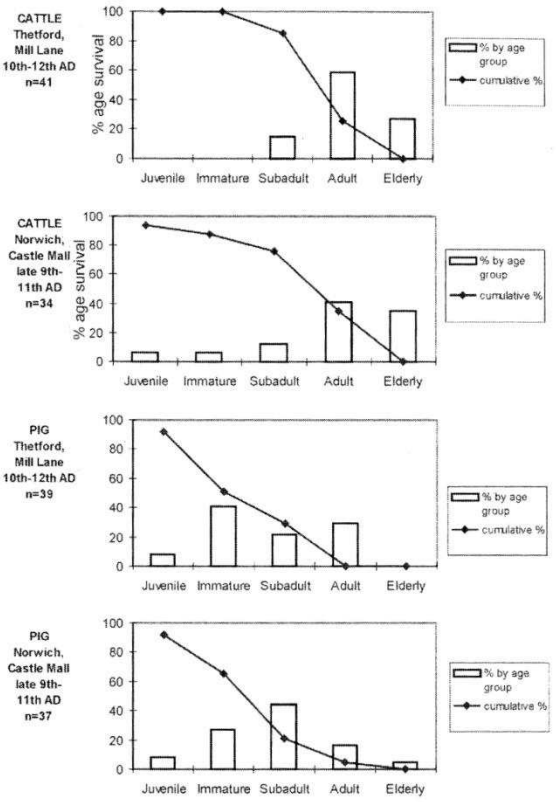
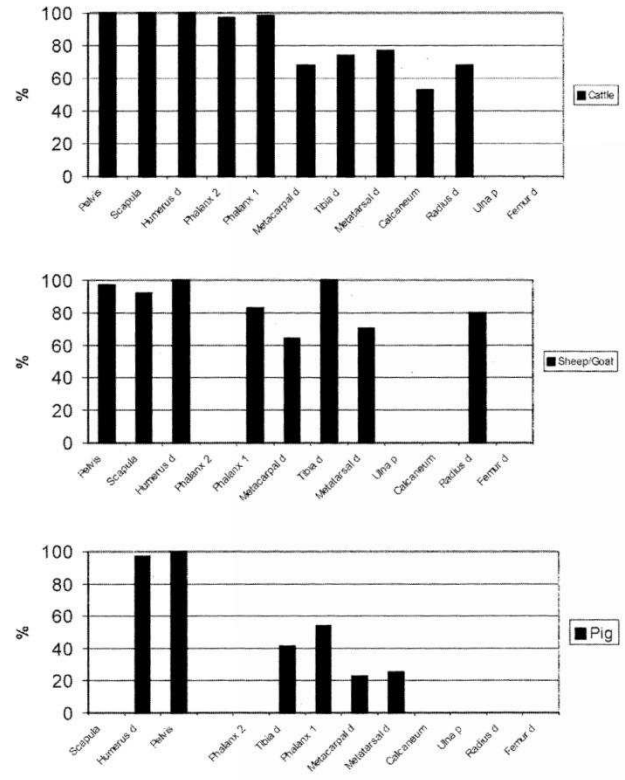


Chart 18 Distribution of cattle and pig mandibles by age stage at Thetford, Mill Lane and Norwich, Castle Mall. Age stages as defined by O'Connor (1988).



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

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

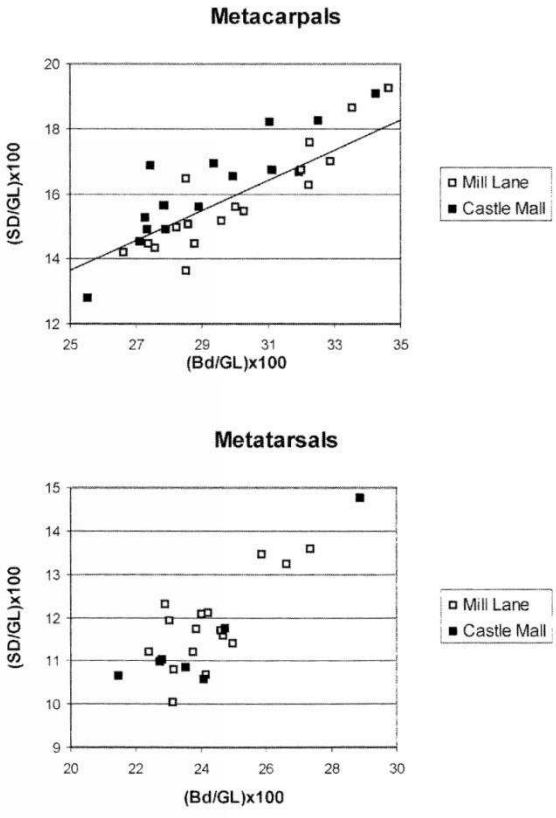


Chart 20 Shape of cattle metapodials at Thetford, Mill Lane (10th–12th century AD) and Norwich, Castle Mall (late 9th–11th century AD).

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

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

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

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

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

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

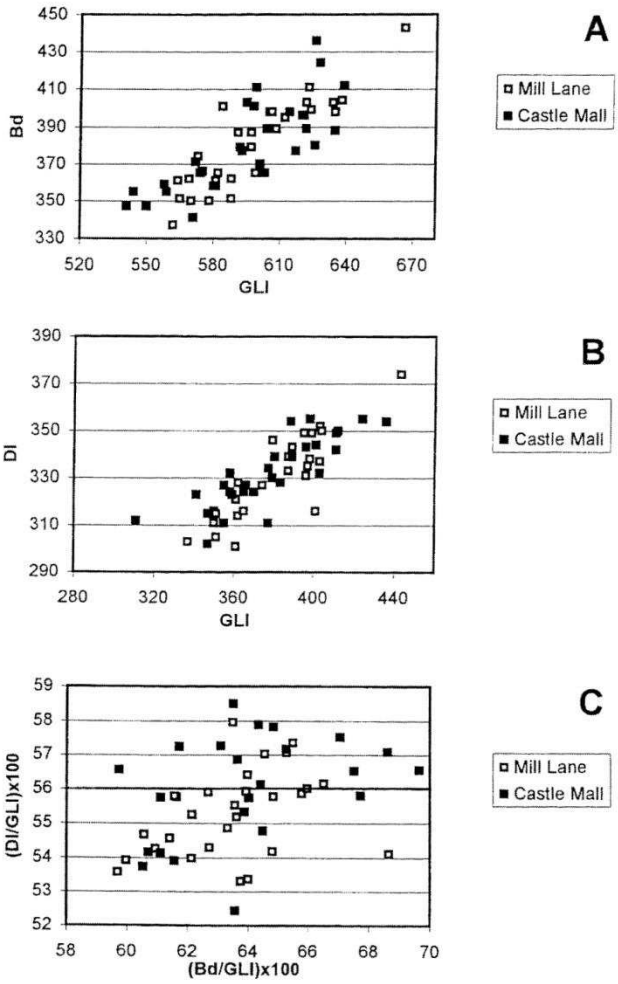


Chart 21 Size (A and B) and shape (C) of cattle astragali at Thetford, Mill Lane (10th–12th century AD) and Norwich, Castle Mall (late 9th–11th century AD). Measurements in tenths of mm.

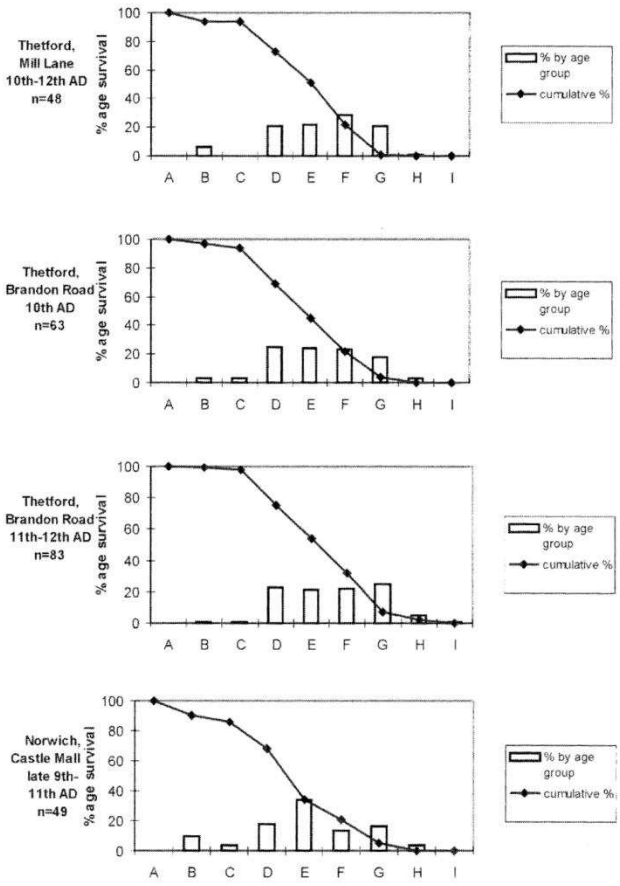
Sheep/goat

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

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

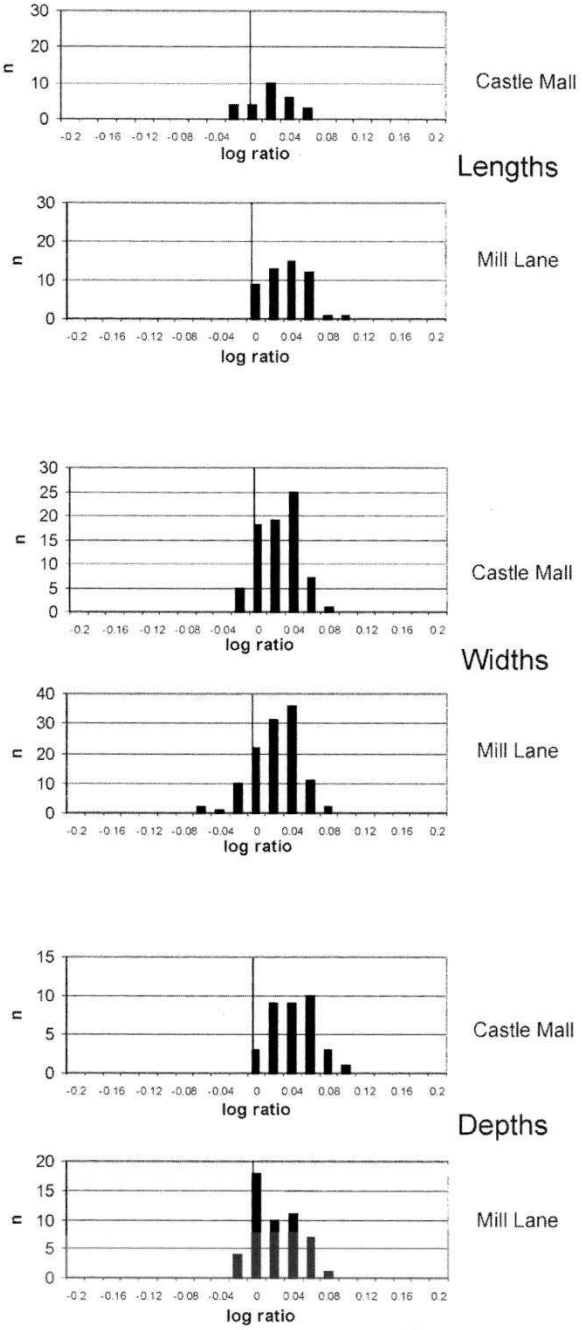
Unlike the goats, most sheep were probably processed on site as complete carcasses. The distribution of body parts fits Brain's (1976) sequence of taphonomic survival much better than does that of the cattle (Chart 17). The elements that are poorly represented at Mill Lane are those that do not survive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

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



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

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



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

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

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

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

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

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

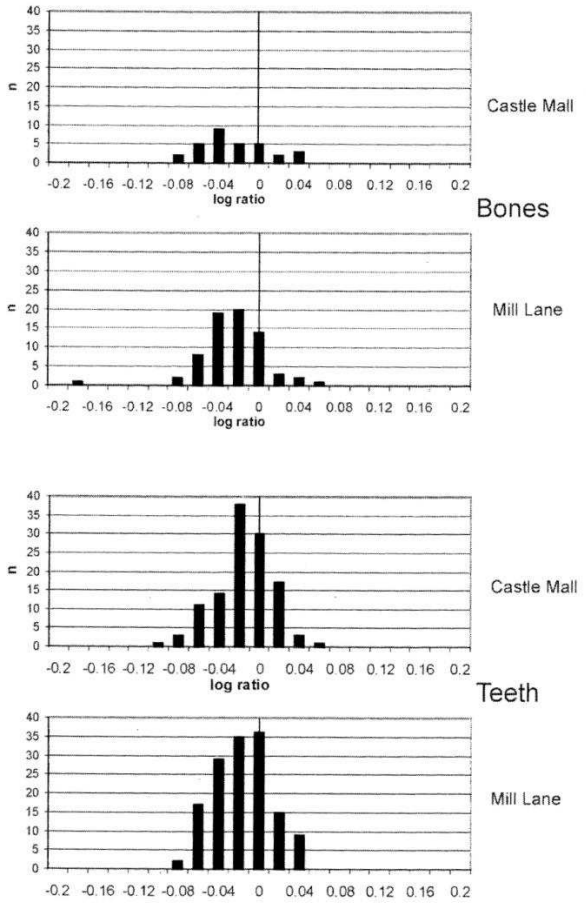
Thetford and the Norwich sheep, although comparable in size, were not as similar as they appeared on the basis of the mean and range of their measurements. No difference occurs between the two groups of widths, but the lengths are visibly greater at Mill Lane and the depths smaller than at Castle Mall.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

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

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

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

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



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

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

Pig

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

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

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

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

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

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

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

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

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

Other domestic mammals

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

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

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

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

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

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

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

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

Domestic birds

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

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

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

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

Wild species

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

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

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

Discussion and conclusions

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

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

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

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

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

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

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

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

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

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

II. Fish bone

by Alison Locker

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

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

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

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

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

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

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

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

Table 30 The fish identified in Periods 3 and 4 contexts

III. Human bone

by Sue Anderson

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

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

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

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