

Vertebrate remains from excavations at the Minster Library, York

by

Deborah Jaques

Summary

Excavations at the site of the Minster Library extension produced a small assemblage of animal bone. Following an assessment of the material, funds were made available for further analysis of the tightly dated Roman material. Although most of the assemblage is of limited interpretative value, several points are worthy of note.

The presence of cattle scapulae exhibiting distinctive butchery marks complements evidence from early Roman assemblages from other sites in Britain and mainland Europe, and are regarded as evidence for salting, smoking or drying of shoulder joints. Additionally, split long-bone shafts (radii and metapodials in particular) were recorded which, again, are known from other Roman sites where they have been interpreted as debris from marrow extraction.

Notes (made during the assessment) regarding the medieval and post-medieval vertebrate remains can be found as an appendix. Components suggesting evidence of high status occupation were noted within the medieval assemblage.

Keywords: MINSTER LIBRARY; YORK; NORTH YORKSHIRE; ROMAN; MEDIEVAL; POST-MEDIEVAL; VERTEBRATE REMAINS; BUTCHERED SCAPULAE; BUTCHERY TECHNIQUES

Author's address:

Palaeoecology Research Services
Environmental Archaeology Unit
Department of Biology
University of York
PO Box 373
York YO10 5YW

Prepared for:

FAS
Department of Archaeology
University of York
Kings Manor
York
YO1 2EP

Telephone: (01904) 433843/46

Fax: (01904) 433850

12 September 1999

Vertebrate remains from excavations at the Minster Library site, York

Introduction

Deposits of early Roman to post-medieval date were excavated in 1997, prior to the building of an extension to the existing Minster Library, in York. The excavation was situated within the area of the Roman Fortress. Nine boxes of vertebrate remains were recovered, most of which were dated to the medieval period. An assessment of the material, carried out by the EAU earlier this year recommended that further work was not warranted, unless there was refinement of the dating framework (Jaques *et al.* 1999).

A tighter chronological framework was achieved for the material from the Roman deposits, which were combined into four groups (1st-2nd century AD, 2nd-3rd century AD, 3rd-4th century AD and 4th-5th AD). Of particular interest were Contexts 1251 and 1282, two 1st century primary deposits associated with the open drain, Feature 134. Material from these contexts and from the other 1st and 2nd century deposits was looked at in some detail. Table 1 contains a list of the contexts from which material was recorded and the date group to which they were assigned.

Few early Roman bone assemblages have been recorded from York, and even fewer have been published. Therefore, despite the small size of this assemblage, the tight dating and the location of the deposits from which the bones were recovered, render it of some importance.

Subsequent work on the phasing has also tightened the dating considerably for a number of the medieval deposits. Unfortunately funds were not available for analysis of this material. However, detailed notes concerning this and the post-medieval

assemblage (made during the assessment) can be found in Appendix 2.

Methods

Vertebrate data were recorded electronically directly into a series of tables using a purpose-built graphical input system and *Paradox* software. Briefly, semi-subjective, non-quantitative data were recorded for the material from each context regarding the state of preservation, colour, and the appearance of broken surfaces ('angularity'). Additionally, semi-quantitative information was recorded for each context concerning fragment size, dog gnawing, burning, butchery and fresh breaks.

Identification was carried out using the reference collections of the Environmental Archaeology Unit. Detailed recording of the assemblage followed the protocol outlined by Dobney *et al.* (in prep.). Selected elements ('A' bones) were recorded using the diagnostic zones method described by Dobney and Rielly (1988). Remaining elements which could be identified to species ('B' bones) were merely counted. Other fragments, (classified as 'unidentified') were, where possible, grouped into categories: large mammal (assumed to be horse, cow or large cervid), medium-sized mammal 1 (assumed to be sheep, pig or small cervid), medium-sized mammal 2 (assumed to represent dog, cat or hare) and unidentified bird. As well as counts of fragments, total weights were recorded for all identifiable and unidentifiable categories.

Caprovid tooth wear stages were recorded using those outlined by Payne (1973; 1987), and those for cattle and pigs followed the scheme of Grant (1982). Cattle, pig and caprovid mandibles were assigned to the

general age categories outlined by O'Connor (1989) whilst, in addition, recording of caprovid mandibles and isolated teeth were assigned to the age categories detailed by Payne (1973; 1987).

Mammal bones were described as 'juvenile' if the epiphyses were unfused and the associated shaft fragment appeared spongy and porous. They were recorded as 'neonatal' if they were also of small size.

Measurements (unless otherwise specified) followed von den Driesch (1976). Additional measurements, not detailed by von den Driesch, followed those described by the sheep-goat working-party (Davis 1992 and Dobney *et al.* in prep.). There were insufficient measurements for detailed analysis and discussion. All the measurements taken can be found in Appendix 1.

Although similarities between the bones of sheep and goat often make it difficult to distinguish between them, certain elements can readily be differentiated and recorded to species level with the aid of good comparative specimens and using the criteria outlined by Boessneck (1969). Differentiation was typically attempted for horncore, distal humerus, distal radius, metacarpal, distal tibia, calcaneum, astragalus, metatarsal and all phalanges.

Since the assemblages were small, a single standard method of species quantification for bone was employed: this involved simple fragment counts, where calculation of the total number of bone fragments involved the simple counting of all recorded identifiable fragments (number of individual skeletal parts or NISP). Unidentifiable fragments were recorded and quantified separately. At best, quantification using simple variations in numbers of fragments provides data of

limited value with regard to absolute numbers of individuals present in the assemblage.

Results

1st-2nd century

The animal bone assemblage dating to this period provided the largest group of fragments (518, of which 140 were identified to species) and included the vertebrate remains from the 1st century drain deposits (Table 2). In fact, the latter formed 60% of the assemblage.

Drain fills 1251 and 1282 (1st century)

A small assemblage of vertebrate remains was recovered from these two deposits, amounting to 75 identified and 236 unidentified fragments (Table 2). The bones were mainly well preserved, with sharp edges; however, both deposits contained a small proportion of fragments which were rather battered in appearance. This was more apparent in the material from Context 1282. On the whole, colour was recorded as mid to dark brown, although some fragments from Context 1251 were lighter in colour. The latter tended to be quite eroded and less well preserved. Little dog gnawing was evident and fresh breakage was negligible. Evidence of butchery (see below) was fairly extensive throughout the assemblage, particularly on cattle fragments.

The identified fragments consisted mainly of cattle, caprovid and pig remains (Table 2). A few dog fragments, probably representing the same individual, and single bones of goose and chicken were also identified.

Concentrating only on the counts for the three main domesticates, it can be seen that

cattle predominate, forming 54% of the assemblage (Table 4). Similarly the 'large mammal' component (assumed to represent mainly cattle remains) makes up 60% of the 'unidentified' assemblage, in comparison to the 'medium mammal 1' fragments, which make up only 16%. Bearing in mind the small size of the assemblage, it is apparent that the proportion of pig remains (26%) is quite high.

An examination of the skeletal elements represented for the three main domesticates (cattle, pig and caprovid) suggests that these deposits mostly contain domestic waste, with a higher proportion of major (scapulae, humeri, pelves and femora) and minor (radii, ulnae and tibiae) meat-bearing bones to non-meat-bearing elements (head and lower limb fragments).

Total assemblage from 1st-2nd century deposits

Combining the fragment counts of the material from the drain fills and those from the remaining 1st-2 century deposits shows little change in the overall proportions of the major domesticates (Table 4). Additionally, roe deer (*Capreolus capreolus* (L.)) and raven (*Corvus corax* L.) fragments were identified from Contexts 1335 and 1244 (Table 4).

The range of skeletal elements represented for cattle and caprovids shows a similar preponderance of meat-bearing bones, with a smaller proportion of lower limb fragments (Table 5). Mandibles, teeth and cranial fragments are far less abundant. Taking into account the fragments recorded in the 'large mammal' category, it is still clear that meat-bearing elements (pelves, shaft and rib fragments) are more prevalent.

Pig remains, again, are mainly represented by

meat-bearing elements; however, head fragments are present in similar quantities to lower limb elements.

This pattern suggests that the refuse disposed of in these deposits represents both domestic and butchery waste. The absence of large quantities of fragments from cattle and caprovid skulls may indicate that the heads of these animals were being sent elsewhere, probably for the utilisation of their horns. The small quantities of bone recovered by sieving do not contain numerous phalanges, from which it can be inferred that these bones are not simply under-represented but are actually absent. This could be because the skins of the animals were being sent on to other craftsmen with the phalanges still attached. It is also possible that heads may have been left attached to the hides explaining their absence.

Extensive butchery was noted on cattle fragments throughout these deposits; the pattern showing many of the distinctive features associated with the processing of cattle carcasses in the Roman period.

Of particular interest were the scapulae which were recovered from Contexts 1251 (drain fill) and 1244 (spread). A number of these had been trimmed around the glenoid cavity and evidence for the removal of the spinus was also apparent on some specimens. It has been suggested (O'Connor 1988; Dobney *et al.* 1996) that these scapulae represent the remains of cured shoulder joints, possibly brined or smoked. The trimming around the glenoid cavity possibly allowed access for the salt into the meat on the bone. Undertaken correctly, meat salted in this way would be preserved and could be stored for some considerable time (Dobney *et al.* 1996).

Cattle pelves were cut and chopped around both the acetabulum and the ilium, and split shafts (mainly radii and humeri) were particularly common. Metapodials tended to be chopped transversely, across the middle of the shaft, rather than split longitudinally. Additionally, chopped shaft fragments formed almost 25% of the 'large mammal' fraction. This systematic chopping of shaft fragments has been interpreted in a number of ways, but currently it is thought that the main purpose of this technique was for marrow extraction (Dobney *et al.* 1996; Stokes in press). Butchery marks were less evident on the remains of caprovids and pigs and no consistent pattern could be recognised.

Information regarding the age-at-death of the major domesticates was rather sparse as a result of the scarcity of mandibles. Wear stages from two adult cattle mandibles were recorded, indicating individuals aged approximately 8 years (after O'Connor 1989). Most of post-cranial cattle bones were also from skeletally mature animals.

Evidence available from fusion and tooth wear data for caprovids was very limited. Two mandibles indicated age-at-death of approximately 6-12 months and 2-3 years, whilst most skeletal elements were from adult individuals.

Data for pigs was equally scarce, but evidence from two mandibles and the fusion information suggests that most individuals were immature when slaughtered.

2nd-3rd century

Deposits from 12 contexts, of 2nd-3rd century date, produced a very small assemblage of 26 identified and 70 unidentified fragments (Table 3). Preservation of this material did not differ

significantly from the earlier assemblage. Numbers of fragments were insufficient to provide useful zooarchaeological data; however, cattle fragments were still the most numerous, with pig and horse remains also present. No caprovid fragments were identified but some 'medium-sized mammal' rib and shaft fragments were recorded. One red deer (*Cervus elaphus* L.) tibia, representing an immature individual, was noted from Context 1166. Two horse mandibles, one almost complete, were recovered from Context 1211. These bones almost certainly originate from the same individual.

Butchered fragments were noted but showed no consistent patterns, although a single cattle scapula was recorded with a trimmed glenoid.

Data regarding age-at-death were insufficient for meaningful interpretation.

3rd-4th century

A total of 176 fragments (77 of which were identified to species) was recovered from the sixteen deposits dated to this period (Table 3). As with material from previous periods, the preservation was good, with a small component of slightly battered and rounded fragments. The latter suggest the presence of a minor component of residual or reworked material.

Although numbers were small, cattle fragments were the most numerous remains (52%), with an apparently high proportion of pigs (29%, Table 4). A small quantity of horse and dog remains was recorded, along with a single red deer antler tine.

An examination of the representation of the

various skeletal elements for cattle shows a higher proportion of head and lower limb elements than seen in the earlier assemblages (Table 5). Viewing the large mammal fraction, it is evident that a range of elements was present. However, numbers of fragments are too small for useful interpretation.

Butchery techniques similar to those recorded from the early assemblages were also noted for this period. Cattle metapodials, previously transversely chopped, show evidence for being split longitudinally, not unlike the cattle radii from the 1st-2nd century group. Additionally, two horncores (one cow, one caprovid) were clearly deliberately removed from the skull.

The paucity of age-at-death data precludes any detailed analysis of the age at which the main domesticates were slaughtered. However, a single elderly cattle mandible was present, whilst a pig mandible and an isolated tooth indicated the presence of two adult individuals.

4th-5th century

Material from this period amounted to only 24 identified and 35 unidentified fragments from a total of 10 contexts. A single human incisor was identified from Context 1125, which indicates the likely presence of reworked material. Clearly the small size of the assemblage renders the vertebrate material from this period of little interpretative value.

Discussion

Although the assemblage from this site is small, there are a number of useful points which can be drawn from analysis of the

vertebrate remains.

The bulk of the assemblage is dated to the 1st and 2nd centuries AD, a period when the main Roman presence in York would have been of a military nature. Indeed, the site itself was situated within the area of the fortress. Analysis of the vertebrate remains hints at a military supply based on beef, with pork and mutton providing only a small proportion of the diet. This contrasts with evidence from most Iron Age and rural Romano-British assemblages (King 1978; Rackham 1985) which suggest a greater emphasis on caprovids. This evidence fits well with the general pattern of the period and the type of site from which it was recovered. According to a survey of animal bone assemblages from Roman and Romano-British sites in Britain (King 1978), a preponderance of cattle appears to be a characteristic of military sites. Although documentary evidence suggests bacon formed a large part of the Roman military diet (Davies 1971), the high proportion of pig remains at the present site is, however, rather unusual for military sites in Britain and in York has only been noted from early to mid Roman bone assemblages at Blake Street (O'Connor 1987).

The pattern of butchery and carcass reduction, only really hinted at by this assemblage, has been recorded elsewhere from numerous sites. The General Accident site in York (O'Connor) produced high proportions of cattle scapulae from mid to late 2nd century deposits showing similar characteristic damage as that displayed by scapulae from the Minster Library. This practice is not unique to York and has been recorded from 1st century deposits in Lincoln (Dobney *et al.*), 2nd century deposits at Papcastle, Cumbria (Mainland and Stallibrass 1990) and numerous sites on the Continent (Lauwerier 1988). Similarly,

the systematic chopping of all major elements and the splitting of most long bones for the extraction of marrow is also a phenomenon recorded from many sites in this region (O'Connor 1988; Hamshaw-Thomas *et al.* 1998), elsewhere in Britain (Dobney *et al.* 1996; Mainland and Stallibrass 1990) and on the Continent (van Mensch 1974; Lauwerier 1988).

Although small, the assemblage of Roman bones from the Minster Library excavation shows a similar range of characteristics to others from Britain and Northern Europe (i.e. cattle dominated, systematic and extensive butchery linked with marrow fat extraction, and cured shoulder joints). However, the high number of pig remains is unusual for Britain and may indicate the presence of high status individuals. These could perhaps be officers, based at the fort who, unlike the regular troops (of northern European extraction), may well have originated in the southern Mediterranean where pig meat was favoured.

References

Boessneck, J. (1969) Osteological differences between sheep (*Ovis aries* Linné) and goat (*Capra hircus* Linné), pp. 331-58 in Brothwell, D. and Higgs, E. S. (eds.), *Science in Archaeology*. London: Thames and Hudson.

Davies, R. W. (1971). *The Roman military diet*. *Britannia* **2**, 122-142.

Davis, S. J. M. (1992). A rapid method for recording information about mammal bones from archaeological sites. *Ancient Monuments Laboratory Report* **19/92**. London.

Dobney, K., Jaques, D. and Johnstone, C. (in preparation). [Protocol for recording animal bone from Flixborough]. *Reports from the Environmental Archaeology Unit, York*.

Dobney, K., Jaques, D. and Irving, B. (1996). Of

butchers and breeds. Report on vertebrate remains from various sites in the City of Lincoln. *Lincoln Archaeological Studies* **5**, vi + 215 pp.

Dobney, K. and Rielly, K. (1988). A method for recording archaeological animal bones: the use of diagnostic zones. *Circaea* **5**, 79-96.

Grant, A. (1982). *The use of tooth wear as a guide to the age of domestic ungulates*, pp. 91-108 in Wilson, B., Grigson, C. and Payne, S. (eds.), *Ageing and sexing animal bones from archaeological sites*. *British Archaeological Reports, British Series* **109**. Oxford.

Hamshaw-Thomas, J. and Jaques, D., with contributions from Carrott, J., Dobney, K., Hall, A., Issitt, M., Johnstone, C. and Large, F. (1998). Technical report: Vertebrate and other biological remains from excavations at Welton Road, Brough, East Riding of Yorkshire. *Reports from the Environmental Archaeology Unit, York* **98/24**, 22 pp. + 10 pp. appendices.

Jaques, D., Large, F., Worthy, D., Hall, A. and Carrott, J. (1999). Assessment of biological remains from York Minster Library (site code: YML97). *Reports from the Environmental Archaeology Unit, York* **99/6**, 10 pp

King, A. C. (1978). A comparative survey of bone assemblages from Roman sites in Britain. *Bulletin of the Institute of Archaeology, University of London* **15**, 207-232.

Lauwerier, R. C. G. M. (1988). Animals in Roman times in the Dutch Eastern River area. *Nederlandse Oudheden 12/Project Oostelijk Rivierengebied* **1**. Amersfoort.

Mainland, I. and Stallibrass, S. (1990). The animal bone from the 1984 excavations of the Romano-British settlement at Papcastle, Cumbria. *Ancient Monuments Laboratory Report* **4/90**. London.

O'Connor, T. P. (1987). Bones from Roman to medieval deposits at the City Garage, 9 Blake Street, York (1975.6). *Ancient Monuments Laboratory Report* **196/87**. London.

O'Connor, T. P. (1988). Bones from the General Accident site, Tanner Row. *The Archaeology of York* **15** (2), 61-136 + plates III-VII + Fiche 1. London:

Council for British Archaeology.

O'Connor, T. P. (1989). Bones from Anglo-Scandinavian levels at 16-22 Coppergate. *The Archaeology of York* **15** (3), 137-207 + Plates VII-XI. London: Council for British Archaeology.

Payne, S. (1973). Kill-off patterns in sheep and goats: the mandibles from Asvan Kale. *Anatolian Studies* **23**, 281-303.

Payne, S. (1987). Reference codes for the wear state in the mandibular cheek teeth of sheep and goats. *Journal of Archaeological Science* **14**, 609-14.

Rackham, D. J. (1985). An analysis and interpretation of the sample of animal bones from Thorpe Thewles, Cleveland. *Ancient Monuments Laboratory Report Old Series* **4567**. London.

Stokes, P. R. G. (in press). The butcher, the cook and the archaeologist.

van Mensch, P. (1974). A Roman soup kitchen at Zwammerdam? *Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek* **24**, 159-165.

von den Driesch, A. (1976). A guide to the measurement of animal bones from archaeological sites. *Peabody Museum Bulletin* **1**. Cambridge Mass.: Harvard University.

Table 1. A list of contexts from which the vertebrate remains were recorded, showing the date group to which each context was assigned.

Context	Context description	Pottery/Stratigraphic date	Date group
1118	surface	4-5C	4-5C
1119	spread	4-5C	4-5C
1125	backfill of robber trench	4-5C	4-5C
1126	backfill of ditch	4-5C	4-5C
1128	surface	4-5C	4-5C
1146	mortar surface	4-5C?	4-5C
1151	layer	4-5C	4-5C
1152	wall	4C	4-5C
1154	layer	3-4C	3-4C
1156	backfill of pit	4-5C	4-5C
1157	backfill	3C	2-3C
1164	layer	3-4C	3-4C
1165	layer	3-4C	3-4C
1166	surface	2-3C	2-3C
1168	backfill of scoop	3-4C	3-4C
1172	backfill of pit	3-4C	3-4C
1175	backfill of pit	3-4C	3-4C
1180	backfill of drain	3-4C	3-4C
1181	spread	3-4C	3-4C
1182	backfill of drain	2-3C	2-3C
1185	layer	3-4C	3-4C
1188	backfill of pit	3-4C?	3-4C
1190	surface	4C	4-5C
1192	layer	2-3C	2-3C
1193	layer	2-3C	2-3C
1196	backfill	3-4C	3-4C
1199	backfill of gully	3-4C	3-4C
1203	surface	3-4C	3-4C
1211	layer	2-3C	2-3C
1214	layer	3-4C	3-4C
1216	layer	2C	1-2C
1219	layer	2-3C	2-3C
1221	backfill	2C	1-2C
1222	dump	2C	1-2C
1224	backfill of scoop	2-3C	2-3C
1225	deposit	2C	1-2C
1226	deposit	2C	1-2C
1227	layer	3-4C	3-4C
1230	surface	2-3C	2-3C
1233	deposit	2-3C	2-3C
1244	layer	2C	1-2C

Context	Context description	Pottery/Stratigraphic date	Date group
1246	backfill of pit	3-4C	3-4C
1247	layer	2C	1-2C
1251	fill of drain	1-2C	1-2C
1259	deposit/make-up	1-2C	1-2C
1270	layer	2C	1-2C
1274	layer	2-3C	2-3C
1275	backfill of gully	1C	1-2C
1278	backfill of gully	1C	1-2C
1282	fill of gully	1C	1-2C
1283	layer	2-3C	2-3C
1290	layer	1-2C	1-2C
1296	layer	1-2C	1-2C
1303	foundation	2C	1-2C
1334	surface	2C	1-2C
1335	deposit	2C	1-2C
1341	layer	2C	1-2C
1342	layer	2C	1-2C
1346	surface	2C	1-2C
1352	surface	2C	1-2C
1356	surface?	1-2C	1-2C
1357	spread	1-2C	1-2C
1358	layer	1C	1-2C
1359	backfill	1C	1-2C
1360	layer	1C	1-2C
1361	layer	1C	1-2C

Table 1 continued

Table 2. Total number of bone fragments from 1st century drain fills 1251 and 1282, from Minster Library, York.

Species		1251	1282	Total
<i>Canis</i> f. domestic	dog	3	-	3
cf. <i>Equus</i> f. domestic	?horse	-	1	1
<i>Sus</i> f. domestic	pig	12	6	18
<i>Bos</i> f. domestic	cattle	17	20	37
Caprovid	sheep/goat	5	4	9
<i>Ovis</i> f. domestic	sheep	2	3	5
<i>Anser</i> sp.	goose	1	-	1
<i>Gallus</i> f. domestic	chicken	1	-	1
<i>Sub-total</i>		<i>41</i>	<i>34</i>	<i>75</i>
Large mammal		89	53	142
Medium mammal 1		22	15	37
Medium mammal 2		2	-	2
Unidentified		21	34	55
<i>Sub-total</i>		<i>134</i>	<i>102</i>	<i>236</i>
Total		175	135	311

Table 3. Total fragment counts of bones from Roman date groups, from Minster Library, York (totals for 1st-2nd century deposits includes the counts for the drain fills).

Species		1-2C	2-3C	3-4C	4-5C	Total
<i>Canis f. domestic</i>	dog	5	-	3	-	8
<i>Equus f. domestic</i>	horse	-	5	4	1	10
cf. <i>Equus f. domestic</i>	?horse	1	-	-	-	1
<i>Sus f. domestic</i>	pig	31	7	20	5	63
<i>Cervus elaphus</i> L.	red deer	-	1	1	-	2
<i>Capreolus capreolus</i> (L.)	roe deer	1	-	-	-	1
<i>Bos f. domestic</i>	cattle	69	13	36	13	131
Caprovid	sheep/goat	18	-	9	2	29
<i>Ovis f. domestic</i>	sheep	9	-	4	2	15
<i>Anser</i> sp.	goose	1	-	-	-	1
<i>Corvus corax</i> L.	raven	2	-	-	-	2
<i>Gallus f. domestic</i>	chicken	3	-	-	-	3
<i>Homo sapiens</i>	human	-	-	-	1	1
<i>Sub-total</i>		140	26	77	24	267
Large mammal		231	28	63	27	322
Medium mammal 1		75	16	23	8	114
Medium mammal 2		5	-	-	-	5
Unidentified bird		-	1	1	-	2
Unidentified		67	25	12	-	104
<i>Sub-total</i>		378	70	99	35	582
Total		518	96	176	59	849

Table 4. Total fragment counts and frequencies of the main domestic mammals by period, from Minster Library, York (totals for 1st-2nd century deposits include the counts for the drain fills).

Species	1C (drain fills)		1-2C		2-3C		3-4C		4-5C	
	no.	%	no.	%	no.	%	no.	%	no.	%
Cattle	37	54	69	54	13	65	36	52	13	59
Caprovid	14	20	27	21	0	0	13	19	4	18
Pig	18	26	31	25	7	35	20	29	5	23

Table 5. Numbers of fragments for cattle, caprovids and pigs by body part groups from selected periods, from Minster Library, York.

1C drain fills

	cattle	sheep/goat	pig
Heads	1	0	4
Major meat-bearing (scapulae, humeri, pelves and femora)	14	7	5
Minor meat-bearing (radii, ulnae and tibiae)	8	4	6
Lower limbs	14	3	3

1-2C

	cattle	sheep/goat	pig
Heads	6	2	7
Major meat-bearing (scapulae, humeri, pelves and femora)	20	10	7
Minor meat-bearing (radii, ulnae and tibiae)	18	7	11
Lower limbs	25	8	6

3-4C

	cattle	sheep/goat	pig
Heads	10	2	5
Major meat-bearing (scapulae, humeri, pelves and femora)	5	4	5
Minor meat-bearing (radii, ulnae and tibiae)	6	4	4
Lower limbs	15	3	6

Appendix 1.

Minster Library, York: Biometrical archive (measurements following von den Driesch 1976 and Dobney et al. in prep.).

Date	Context	Bone id	Species	Element	45.0	46.0	BC
2-3C	1230	109	Bos f. domestic	horncore	37.9	27.4	107.8

Date	Context	Bone id	Species	Element	GLP	SLC
1-2C	1251	7	Sus f. domestic	scapula	27.8	-
1-2C	1251	14	Caprovid	scapula	31.3	17.3
3-4C	1172	191	Caprovid	scapula	27.9	19.2

Date	Context	Bone id	Species	Element	BT	HT	HTC
1-2C	1282	49	Bos f. domestic	humerus	65.8	-	-
2-3C	1157	199	Bos f. domestic	humerus	66.4	39.1	29.4
3-4C	1181	214	Bos f. domestic	humerus	66.4	40.4	30.8
4-5C	1151	250	Bos f. domestic	humerus	62.2	36.1	27.3
1-2C	1282	69	Ovis f. domestic	humerus	26.7	17.6	13.7
3-4C	1172	190	Ovis f. domestic	humerus	28.7	18.3	15.5
4-5C	1125	254	Ovis f. domestic	humerus	29.0	16.9	13.3
4-5C	1125	255	Ovis f. domestic	humerus	27.9	17.8	14.4
3-4C	1175	156	Sus f. domestic	humerus	33.9	-	17.4

Date	Context	Bone id	Species	Element	GL	SD	BFp	Bp	BFd	Bd
1-2C	1282	42	Bos cf. domestic	radius	-	-	-	-	58.1	59.3
1-2C	1282	43	Bos cf. domestic	radius	-	-	-	-	57.6	59.3
1-2C	1244	78	Bos f. domestic	radius	266.0	-	-	-	65.0	67.5
1-2C	1226	119	Bos f. domestic	radius	-	-	73.5	-	-	-
3-4C	1172	165	Bos f. domestic	radius	-	33.0	-	-	54.7	55.9
3-4C	1172	166	Bos f. domestic	radius	-	-	-	-	60.6	61.1
1-2C	1282	68	Caprovid	radius	-	-	27.5	29.2	-	-
1-2C	1251	15	Ovis f. domestic	radius	149.4	-	-	-	-	-
1-2C	1251	16	Ovis f. domestic	radius	137.7	13.9	-	-	19.4	23.3
1-2C	1222	126	Ovis f. domestic	radius	-	-	-	-	25.9	26.1
3-4C	1180	210	Ovis f. domestic	radius	-	-	-	-	24.2	25.1
1-2C	1244	91	Sus f. domestic	radius	-	12.1	-	22.6	-	-
1-2C	1251	23	Canis f. domestic	radius	-	10.2	-	-	-	18.3

Date	Context	Bone id	Species	Element	GL	SD	Bd	Dd
1-2C	1216	117	Bos f. domestic	tibia	-	-	51.0	37.0
3-4C	1172	167	Bos f. domestic	tibia	-	23.0	54.2	39.5
3-4C	1188	232	Ovis f. domestic	tibia	-	10.1	22.9	18.2
1-2C	1282	62	Sus f. domestic	tibia	-	12.7	26.8	23.5

3-4C	1172	182	Sus f. domestic	tibia	-	-	28.2	-
1-2C	1244	94	Canis f. domestic	tibia	159.5	9.7	19.6	14.0

Date	Context	Bone id	Species	Element	Bd	DI	GLI
1-2C	1282	57	Bos cf. domestic	astragalus	35.4	32.7	58.2
3-4C	1172	176	Bos f. domestic	astragalus	39.8	-	-
3-4C	1196	234	Bos f. domestic	astragalus	39.4	34.6	61.5

Date	Context	Bone id	Species	Element	C	C+D	DS	GL
1-2C	1244	84	Bos f. domestic	calcaneum	25.4	45.8	36.4	122.3
1-2C	1251	24	Bos cf. domestic	calcaneum	28.2	49.4	39.3	-
1-2C	1282	50	Bos cf. domestic	calcaneum	-	-	30.4	-
3-4C	1175	157	Bos f. domestic	calcaneum	23.7	43.7	36.5	-
1-2C	1244	90	Sus f. domestic	calcaneum	10.9	-	20.6	-
1-2C	1251	5	Sus f. domestic	calcaneum	12.8	29.3	22.3	-

Date	Context	Bone id	Species	Element	GL	SD	BFp	DFp	BFd	Dd	Dem	Dvm	Dim
1-2C	1251	31	Bos cf. domestic	metacarpal	-	-	51.5	31.9	-	-	-	-	-
1-2C	1251	32	Bos cf. domestic	metacarpal	-	-	49.9	30.4	-	-	-	-	-
1-2C	1282	47	Bos cf. domestic	metacarpal	-	-	52.3	31.9	-	-	-	-	-
1-2C	1282	48	Bos cf. domestic	metacarpal	-	-	-	-	61.2	31.5	23.0	30.8	28.4
1-2C	1270	105	Bos f. domestic	metacarpal	-	-	52.3	32.5	-	-	-	-	-
1-2C	1360	137	Bos f. domestic	metacarpal	187.8	26.6	49.5	29.9	48.9	27.4	22.2	28.0	25.4
2-3C	1230	108	Bos f. domestic	metacarpal	195.7	32.3	60.1	34.6	62.9	-	25.8	-	28.5
2-3C	1157	198	Bos f. domestic	metacarpal	-	30.9	51.1	29.9	-	-	-	-	-
1-2C	1259	98	Caprovid	metacarpal	-	12.3	20.7	15.2	-	-	-	-	-
1-2C	1341	102	Ovis f. domestic	metacarpal	-	11.2	-	-	22.1	14.1	9.9	13.9	12.6
1-2C	1270	106	Ovis f. domestic	metacarpal	-	11.5	-	-	22.6	14.1	9.5	14.0	12.0

Date	Context	Bone id	Species	Element	GL	SD	BFp	DFp	BFd	Dd	Dem	Dvm	Dim
1-2C	1251	33	Bos f. domestic	metatarsal	-	-	41.0	39.7	-	-	-	-	-
1-2C	1251	34	Bos f. domestic	metatarsal	-	-	-	-	48.7	28.7	21.4	28.5	25.4
1-2C	1251	35	Bos f. domestic	metatarsal	-	-	-	-	49.1	28.9	21.4	29.2	25.0
1-2C	1282	52	Bos f. domestic	metatarsal	-	-	-	-	47.9	-	-	-	-
1-2C	1244	86	Bos f. domestic	metatarsal	-	-	41.6	38.5	-	-	-	-	-
1-2C	1259	99	Bos f. domestic	metatarsal	-	-	-	-	54.4	30.4	22.9	30.5	27.3
1-2C	1360	138	Bos f. domestic	metatarsal	-	-	42.3	42.1	-	-	-	-	-
2-3C	1192	148	Bos f. domestic	metatarsal	-	-	47.1	44.4	-	-	-	-	-
3-4C	1172	158	Bos f. domestic	metatarsal	198.4	20.6	39.9	36.1	45.1	25.5	19.0	25.9	22.1
3-4C	1172	159	Bos f. domestic	metatarsal	-	-	43.0	42.0	-	-	-	-	-
3-4C	1172	160	Bos f. domestic	metatarsal	-	-	41.0	41.8	-	-	-	-	-
4-5C	1118	239	Bos f. domestic	metatarsal	-	-	-	-	49.1	-	20.0	26.5	24.7
4-5C	1126	244	Bos f. domestic	metatarsal	-	-	-	-	49.9	28.6	21.0	28.5	25.3
1-2C	1360	139	Caprovid	metatarsal	-	11.7	-	-	22.4	-	-	-	-
1-2C	1282	70	Ovis f. domestic	metatarsal	-	11.4	-	-	21.9	-	10.1	15.0	13.1
3-4C	1227	229	Caprovid	metatarsal	-	11.8	19.8	20.3	-	-	-	-	-

Date	Context	Bone id	Species	Element	GL	Bp	Bd
2-3C	1192	149	Sus f. domestic	metatarsal 3	-	16.0	-
3-4C	1172	188	Sus f. domestic	metatarsal 4	80.7	-	14.1
3-4C	1172	187	Sus f. domestic	metacarpal 4	68.2	14.5	15.1

Date	Context	Bone id	Species	Element	SC	Bd
1-2C	1251	13	Anser sp.	humerus	11.2	24.0

Date	Context	Bone id	Species	Element	GL	Dip	Did	Bp	SC
1-2C	1244	95	Corvus corax L.	ulna	-	-	13.2	-	6.2
1-2C	1352	136	Gallus f. domestic	ulna	73.2	13.5	9.7	8.7	4.3

Date	Context	Bone id	Species	Element	GL	SC	Bp	Bd
1-2C	1251	11	Gallus f. domestic	tarsometatarsus	-	-	-	14.2
1-2C	1341	104	Gallus f. domestic	tarsometatarsus	82.1	7.2	13.1	13.6

Appendix 2.

Notes made during the assessment (January 1999) on the medieval and post-medieval bone assemblages from Minster Library, York.

Key: Meas. = number of measurable fragments; Mand. = mandibles with teeth in situ; Teeth = isolated mandibular teeth of use for providing age-at-death information; Frags. = total number of fragments for each context.

Context	Context description	Date	Meas.	Mand.	Teeth	Frags.	Notes
1017	dark earth	5-10C	3			114	Rather battered in appearance, quite fragmented, 1 burnt fragment. Species present include main domesticates, ?hare and dog. Also ?sieved material, 63 fragments, most unidentified - includes small mammal, fish and pig and caprovid teeth.
1019	backfill of robber trench	17C?				5	
1022	make-up	13-14C?			1	5	Cattle includes butchered fragments.
1026	spread	15C	1			12	Preservation poor. Goose humerus present - gnawed.
1027	backfill of trench	16C	1			1	Rabbit tibia.
1034	layer	16C				1	Medium mammal rib fragment.
1036	surface	16-17C	25	1		166	Teal skull, duck , fowl = 30 incl juvenile and sub-adult, geese, hare, rabbit, fish, dog, red and fallow + domestics - cattle juvenile phalanges and metapodials - butchery and domestic waste.
1038	layer	16C	25	3	2	129	Preservation fair to poor. Main domesticates, swan humerus (possibly mute), cat. Range of elements but few cow juvenile metapodials, large mammal split tibiae and femur?. Quite mixed.
1039	layer	16C	18	1	3	96	Fair to poor preservation. Main domesticates, fallow deer tibia, femur x 2, goose. Juvenile cattle metapodials. Butchery waste/some domestic refuse.
1040	layer	15C?	3		8	65	Preservation - mostly poor. Human shaft fragment. Main domesticates, including split large mammal size metapodials and radii, gadid vertebra, horse. Some fragments with concretions - greenish hue.

Context	Context description	Date	Meas.	Mand.	Teeth	Frag.	Notes
1041	layer	16C	29	1	4	255	Preservation fair to poor, blotchy, with concretions. Butchery waste. ?swan phalanx, red deer femur, metatarsal, fallow deer = 2 metatarsals, tibia, femur, pelvis, tarsal. Caprovid - lots of metapodials and radii. Cattle juvenile metapodials. Cattle horncore and cranial fragments. Butchery waste.
1043	layer	16C?	4	2	3	41	Variable preservation = good to poor. Main domesticates, fowl and goose.
1046	backfill of pit	16C				2	2 unidentified fragments
1047	make-up	16C	1			3	Variable preservation. Dog tibia, 2 unidentified fragments.
1048	surface	14-15C				1	Preservation poor. Cattle mandible fragment.
1051	backfill of pit	15C	1			8	Preservation poor to good.
1057	layer	14-15C?	4			55	Preservation mostly fair, few battered fragments, concretions on some surfaces. Cattle split shafts including metapodials - lots of chopped fragments - ?butchery waste.
1058	backfill of posthole	15C				1	Cow maxillary molar
1061	backfill	13-14C	1		1	19	Preservation mostly fair. Slight mixed appearance. Major domesticates present.
1062	backfill	13-14C	1		1	5	Preservation mostly fair to good. Concretions on bone surface. Major domesticates present.
1063	spread	15C?				2	
1067	make-up	16C	3			13	Preservation fair, colour mixed. ?fallow deer pelvis fragment, main domesticates and chicken
1076	layer	16C	5	1	1	30	Preservation variable, a bit battered. Red deer tibia, large dog mandible and tibia, horse, cow and caprovids
1078	layer	16C	3		7	92	Fragmented and battered - concretions. Main domesticates, cat, fowl, fish, horse. Lying around on surface prior to deposition?
1079	backfill of ditch	16C	3	1		30	Preservation fair to poor, slightly battered appearance, some concretions on bones. Red deer metatarsal, tibia, femur, fallow metatarsal, pig and cow

Context	Context description	Date	Meas.	Mand.	Teeth	Frag.	Notes
1080	backfill of ditch	16C	4		1	19	Pres fair to good - concretions on surface. Fallow metatarsal, red deer metatarsal, main domesticates
1081	dark earth	5-10C	18	6	14	201	Pres fair to good - fish (Salmonid), main domesticates - mainly butchery waste - mandibles, teeth, phalanges and metapodials
1084	spread	15C	1			1	Very good preservation. Roe deer humerus - almost greasy.
1086	layer	12C?				5	Preservation good, slightly battered fragments.
1088	backfill of pit	15C				3	
1089	make-up	13-14C	1			5	
1090	dark earth	5-10C	7	1	12	95	Pres fair to good. Lots of teeth and phalanges. Human baby rib, hare, fowl, duck and main domesticates.
1096	backfill of pit	15C	1			7	Preservation fair to good, slightly battered appearance. Main domesticates.
1097	backfill of gully	11-12C?				2	
1098	spread	15C	7		2	70	Preservation - very variable, good to poor. Goose, caprovid, horse, pig, cow. Cattle scapula with hook damage.
1100	layer	14-15C?	7			21	Preservation fair, some battered fragments, some concretions on bone, dog gnawing. Dog (juvenile), caprovid, pig and cow.
1101	backfill of scoop	15C?				2	
1103	fill of gully	15C?				20	Preservation fair, includes burnt fragments. Pig and cow.
1104	spread	15C?				5	Preservation fair, bit battered, concretions on some bones.
1107	spread	15C?	16	3	6	241	Preservation - variable, concretions, quite fragmented. Main domesticates, horse and dog. Also ?sieved material, 90 fragments - one third burnt. 3 amphibian fragments, 1 vole, ?brill vert.
1109	backfill of pit	12-13C?				5	
1110	layer	5-10C?				7	Pig, caprovid, corvid (jackdaw size).
1111	backfill of posthole	5-10C?				4	
1115	backfill of robber trench	16C	1		1	3	
1121	backfill of pit	12-13C?				1	Caprovid M3

Context	Context description	Date	Meas.	Mand.	Teeth	Frag.	Notes
1124	backfill of post-hole	5-10C		1		3	
1130	backfill of ditch	11-12C	1			6	Preservation fair to good. Cattle and caprovid.
1131	backfill of pit	14-15C?	21	5	1	86	Preservation fair to good. Dog gnawing, lots of butchery. Red deer antler - huge burr, tines sawn off. Horse, pig, caprovid (3 horncores), cow including juvenile.
1133	layer	12-13C?				3	
1134	layer	5-10C	1		1	25	Preservation fair, bit battered in appearance. ?red deer antler, caprovid, cow, pig.
1135	backfill of robber trench	5-10C	3			17	Preservation fair, bit battered in appearance and rounded. Horse metatarsal ?chopped
1139	backfill of ditch	11-12C	7	2	3	38	Preservation variable, good/fair, some battered. Dog gnawing. Cat. fowl, red deer calcaneum, dog ulna, radius, metapodial - greyhound size, main domesticates.
1140	backfill of pit	5-10C				7	Preservation poor, concretions on bone, battered appearance.
1144	backfill of pit	5-10C?	1			1	Very good preservation
1149	backfill of ditch	16C	3		1	4	
1150	backfill of ditch	16C	4		1	43	Preservation fair to poor, concretions, battered, split shafts, quite fragmented, main domesticates and dog.
1159	backfill of scoop	5-10C				2	
1161	backfill of scoop	15C?	3		2	13	Preservation fair to good. Green concretions on some bones. Main domesticates.
1163	make-up	13-14C?	1			4	Preservation good. Raven ulna ?scorched.
1179	fill of ditch	16C	1	4	1	33	Preservation variable, fragments battered and rounded. Concretions. ?red deer antler, fowl, horse and main domesticates.
1284	backfill of pit	12C?				1	