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Ancient Monuments Laboratory
Report 5/90

ANIMAL BONES FROM EXCAVATIONS IN 1972 AT CATTERICK SITE 434, NORTH YORKSHIRE.

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Summary

The site produced a small collection of animal bones from a Roman second-century military occupation and a slightly larger collection from a fourth-century civilian occupation. In both periods beef was the main meat supply, with smaller amounts of pork and young mutton and a little venison and poultry; more young mutton and poultry appear to have been eaten during the military occupation than during the later civilian occupation. Whether horse was eaten is uncertain.

In neither period is there evidence that the inhabitants of the site engaged in animal husbandry; instead, animals were probably bought from producers, then killed and butchered on-site. There are no obvious differences between the military and civilian bone assemblages in butchery and carcass disposal, in the size and type of the animals, which show little indication of the size increases that happened elsewhere in Roman Britain, or in the ages at which the animals were killed. Meat production was probably only a subsidiary aim in local cattle husbandry, but of greater importance in sheep and pig husbandry.

A Saxon bone assemblage is too small to come to any useful conclusion except that beef was again the main meat supply.

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1. Introduction

Excavations at Catterick Site 434 were carried out in 1972 by Mr. J.S. Wacher (Wilson, Wright and Hassall, 1973, in which the site is called Brompton-on-Swale). These revealed a set of defensive ditches around a bridgehead on the north bank of the River Swale where it was crossed by Dere Street, which were constructed during the second century and appear to have fallen into disuse by the Severan period. After this period of disuse, a suburb of the Roman town of *Cataractonium* grew up during the fourth century, and may have been occupied into the fifth century. Remains of a grubenhaus of sixth century date were also found.

Seven groups of bones were selected by Peter Wilson as sufficiently well-dated to be worth study (a full list of contexts from which bones were examined is given in Appendix 1):

Group	Phase	
A	2a, 2b	Demolition prior to construction of bridgehead defence/construction of bridgehead defence. Hadrianic/Antonine (second century).
B	3a	Primary silting and secondary fill of 'bridgehead' ditch. Severan (third century).
C	4 (incl. 4a, 4b)	Late building in Area P over 'bridgehead' ditch. Fourth century.
D	4 (incl. 4b)	Late building in Area R. Fourth century.
E	4 (incl. 4a, 4b)	Late building in Area Q. Fourth century.
F	4 (incl. 4b)	Late surface in Area R to south of the building that produced group D. Fourth century.
G	6	Grubenhaus in Area R. Sixth century.

The amount of residual pottery in the different contexts is unknown as pottery may have been discarded without record.

The main purpose of this report, apart from providing a summary description of the material, is to compare the assemblages from the military occupation of the site (groups A and B) with those from the later Roman civilian occupation (groups C-F) to see whether these differ in any way.

2. Methods

The collection is fairly small (12 boxes of bones from well-dated contexts, spanning several centuries); sieving was not used in recovering the bones, and reports on larger collections of Roman animal bones from Bainesse Farm and from Catterick Bridge are in preparation. It was therefore decided that a selective detailed record would first be made, and that further work would only be done if it appeared that it would add substantially to the results.

The following parts of the skeleton were chosen for the first record: mandibular teeth, distal humerus, distal radius, radial carpal, distal tibia, astragalus, calcaneum, distal metapodials and proximal second phalanx (for further details see Table 1). Most of these were chosen because they are robust and thus occur commonly, are relatively easily identified even when broken, and give useful measurements and ageing information; care was also taken to include bones from different parts of the body, and some smaller parts of the skeleton (e.g. radial carpal and mandibular incisors) to provide some check on recovery of smaller bones. Other parts of the skeleton were only noted selectively, e.g. when a scarcer species could be identified, or when the bone was of particular interest; these specimens are not included in the counts on which the figures and tables are based. Tooth eruption and wear data, fusion data and a limited range of measurements were recorded systematically for the selected parts of the skeleton (see Appendices 3-5); no systematic record was made of butchery.

The results of this first record (below) indicated that further work was unlikely to add very much, and so no further work was done.

3. Description and discussion

Animal bones were routinely recovered during excavation, though without sieving. The bones were generally in moderately good condition, though some were more battered, and some teeth were corroded, presumably by pockets of lower soil pH. Surfaces were not generally in very fresh condition, obscuring butchery marks to an extent that detailed recording would probably not have been very productive.

3.1. Species represented

A summary is given in Table 1, based on counts of the parts of the skeleton listed above. The following animals were identified:

Man: An edentate mandible in group C may have come from a disturbed grave.

Water vole: Identified from a distal tibia from group C.

Dog: A few fragments of medium-sized dogs were identified from the two largest groups (C and D). Relatively few of the bones of the other animals had been gnawed; a sheep/goat calcaneum is corroded in a way that is typical of bones that have passed through the digestive systems of dogs.

Cat: A feline proximal femur from group E is relatively small and gracile and, on that basis, probably from a domestic cat rather than from a wild cat.

Horse: Numerous lower (and upper) teeth show the features typical of horses; none suggested the presence of donkey or mule, and none of the bones is particularly small (Appendix 5).

Whether horse was eaten is uncertain: no butchery marks were noted on any of the horse bones, but this has little weight in view of the generally low frequency of butchery marks, which may be a consequence of the moderate condition of the surfaces of most of the bones.

Pig and ?wild boar: Pig bones, and especially pig jaws and teeth, are fairly common. The Roman pig teeth and bones are fairly small, as is typical of Roman domestic pigs (Figure 1); they appear to be a little smaller on average than Roman pigs from Castle Copse, in Wiltshire (Payne, in press). The small number of Saxon pig bones from the Phase 6 grubenhaus (group G) appear to be of similar size to those from groups A-F, apart from a pelvis which is much larger and probably from a wild boar.

Most of the Roman pigs were killed in their second or third years: none of the lower third molars is more than slightly worn (stage c or earlier of Grant, 1982) and the lower second molars are generally in early wear (16 out of 17 at stages c/d or earlier); a few mandibles and teeth are from animals in their first year, including two mandibles from fairly young piglets (dP_4 at stages b-d and M_1 unerupted or starting to erupt, indicating animals only a few months old).

Of the 17 lower permanent canines, 13 were male (12 isolated and 1 in mandible) and 4 were female (3 isolated and 1 in mandible). It is likely that a higher proportion of females were slaughtered than these figures suggest: isolated female canines are considerably smaller than male canines and thus likely to be under-represented as a result of recovery bias, and pigs produce so many offspring that there are usually plenty of surplus female piglets as well as males.

Red and roe deer: Roe deer was identified from groups B (a distal tibia) and C (an unfused distal metatarsal); a red deer second phalanx was identified from group C, and red deer antler fragments from groups D and G (a large broken shed antler).

Cattle: Cattle bones outnumber those of all the other animals. They are similar in size to those at other Roman sites; the distribution of Roman cattle metapodial measurements, with a peak of smaller specimens and a few larger outliers, resembles that at a number of other sites and suggests that the bones are mostly those of cows, with only a few bulls or oxen (Figure 2).

Tooth eruption and wear data indicate that few cattle were killed before the later part of the second year, and many were four to five years old or older: few of the lower first and second molars from the Roman phases are in early wear (only 10 out of 69 are at stage f or earlier of Grant, 1982), many are in later wear (36 out of 69 at stage k or beyond), and only 13 out of 31 lower third molars are earlier than stage g.

Absent or reduced third pillars were noted on 4 of the 33 Roman lower third molars, giving a frequency of 12%; frequencies between 10% and 20% are common in Roman assemblages, though the condition is relatively uncommon in modern breeds. The only Saxon lower third molar is normal.

Sheep/goat: Sheep/goat bones are well represented. Twenty bones and teeth were positively identified as sheep and only one as goat, indicating that goat was relatively scarce. The sheep were similar in size to those from many other Roman sites: the distal breadth of sheep/goat tibiae averages 23.6 mm (n=16) as compared with 23.1-23.9 mm for different phases of Roman Exeter (Maltby, 1979). The tibiae from the fourth century groups (n=11) are slightly (but not significantly) smaller than those from the earlier groups (n=5); in this respect Catterick appears to resemble Exeter, where the size of the sheep is fairly stable during the Roman period, and differs from sites in central and south-east England where sheep from third/fourth century contexts appear to be appreciably larger than those from the first and second centuries (e.g. Colchester: Luff, 1982).

Most of the sheep/goat mandibles and mandibular teeth are from animals less than two years old: 16 out of 18 Roman mandibles have unreplaced milk molars and unerupted third molars, and nearly half the 62 lower first and second molars are in early stages of wear (stage 8 or earlier of Payne, 1987); most of the mandibles have M_2 in early wear, indicating that they were killed in the second year. Fusion data for the sheep/goat tibiae are in apparent contradiction to this: 22 out of 24 distal tibiae from the Roman phases are fused (16) or fusing (6). One possibility is that this reflects higher destruction and lower recovery rates for unfused specimens, and a kill-off peak during the later part of the second year, when the distal tibia was fused but the milk molars had not yet been replaced; another, in view of the relative abundance of distal tibiae, is that legs of mutton, possibly smoked, may have been brought onto the site.

Birds: The small number of bird bones include a few bones of chicken and duck, a distal humerus of a goose, and a femur of a raven.

3.2. The assemblages

Figure 3 reveals clear differences between pig, cattle and sheep/goat in the relative representation of different parts of the skeleton in the Roman bone assemblages (see also Appendix 2 for more detailed data): pig mandibles and teeth are much commoner than postcranial bones, while cattle and some sheep/goat postcranial bones are relatively common. Smaller bones such as incisors, radial carpals and second phalanges are generally relatively scarce or absent. It would be possible to explain these differences by different butchery and disposal practices: the scarcity of pig postcranial bones, for instance, might be taken to suggest that pig joints were taken off the site, or pig heads were brought onto the site; and the relative abundance of sheep/goat distal tibiae might be thought to suggest that smoked mutton hams were brought onto the site. Simpler, however, and probably to be preferred for that reason at least as a working hypothesis, is the suggestion that most of these differences have been produced by a combination of lower recovery rates for smaller bones during

excavation, and differential preservation, which typically affects pig postcranial bones more than sheep and cattle especially when, as in this case, a high proportion of them are immature.

Once allowance has been made for differential preservation of weaker parts of the skeleton and lower recovery rates for smaller bones, there is nothing to indicate any specialised pattern of butchery or disposal apart, perhaps, for the relative abundance of sheep distal tibiae; the assemblages appear to be generally consistent with killing and unspecialised butchery on site, and there is no obvious difference in this respect between the Roman military and civilian assemblages (though the military assemblage is so small that only a very striking pattern would have produced an obvious difference). The butchery marks that were noted are consistent with this: knife cuts and the marks of cleavers were seen in both assemblages, with no obviously unusual pattern of occurrence or distribution.

Sheep/goat and bird bones are relatively much commoner in the early Roman military assemblage than in the later Roman civilian assemblage, which is dominated by cattle (Figure 4); there are no indications of any considerable differences between the different fourth century groups (Table 1). The counts and percentages given in Table 1 and Figure 4 almost certainly overestimate the relative abundance of cattle and horse as a result of recovery and preservation biasses; it is likely that sheep/goat, pigs and especially birds were all relatively commoner than the figures suggest. Nonetheless, once allowance has been made for meat yield, beef would probably have been the staple meat supply at all periods.

Cattle usually dominate later Roman bone assemblages, reflecting, it has been suggested, increasing Romanisation (King, 1984). The relatively high percentage of sheep/goat in the earlier military assemblage is more unexpected, since cattle usually also strongly dominate earlier Roman military bone assemblages. The small size of the Catterick military assemblage argues caution, but it is worth noting that sheep/goat are often commoner in assemblages from auxiliary sites (King, op. cit., Fig. 1); this could be taken to indicate that the Catterick bridgehead was manned by auxiliaries rather than by legionaries.

The ages at which the cattle, sheep/goats and pigs were killed in both Roman assemblages suggests, as might be expected, that these were consumer communities within a market economy rather than communities that produced their own food. The younger ages at which the pigs and sheep/goats were killed suggests that they were probably raised for sale for meat (the sheep could also be culled shearling rams from flocks managed to produce both meat and wool). The rather older and more varied ages at which the cattle were killed suggests that they may not have been raised primarily for meat, but instead that cattle husbandry was probably multi-purpose, and that milk and labour were probably just as important as meat production. The cattle sold for meat were probably surplus animals, mainly barren and less productive cows which were still young enough to be marketable for meat; oxen may have been too valuable to have been sold for meat while still young enough to be saleable. The absence of very young (perinatal) bones and teeth is consistent with this, suggesting that animals were not bred on the site; but the assemblage is too small and preservation not good enough to make this a strong argument.

The Saxon assemblage is relatively small (Table 1, Figure 4). Cattle bones are again commoner than those of any other animal, and the range of species represented is similar to that in the Roman assemblages; otherwise little can be said.

4. Conclusions

Both in the second-century military occupation and in the fourth century civilian suburb, beef was the main meat supply, with smaller amounts of pork and young mutton and a little venison and poultry. Whether horse was eaten is uncertain.

More young mutton and poultry may have been consumed during the military occupation, but the military bone assemblage is so small that this can only be a very tentative conclusion. In neither period is there any evidence that the inhabitants of the site engaged in animal husbandry; instead, animals were probably bought from producers, then killed and butchered on-site. There are no obvious differences between the military and civilian bone assemblages in butchery and carcass disposal, in the size and type of the animals, which show little indication of the size increases that happened elsewhere in Roman Britain, or in the ages at which the animals were killed. Meat production was probably only a subsidiary aim in local cattle husbandry, but of greater importance in sheep and pig husbandry.

The Saxon bone assemblage is too small to come to any useful conclusion except that beef was again the main meat supply.

5. Material and archive

The animal bones will be stored in the Yorkshire Museum, York. The records on which this report is based are deposited at the Ancient Monuments Laboratory.

6. Acknowledgements

I am grateful to Peter Wilson and Anne Thompson for information about the site, to Barbara West for help with the identification of the bird bones, and to Justine Bayley, Simon Davis, Bruce Levitan, Terry O'Connor, Rosemary Payne, Clifford Price, Barbara West and Peter Wilson for reading and commenting on earlier drafts of this report.

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Figure 1: Log ratio distributions for pig and ?wild boar tooth and bone measurements from Catterick Site 434 (following Payne and Bull, in press). The method is one that compares measurements of different bones with the same measurements in a standard population and relates them all to a common standard; larger bones give higher values. Prehistoric and Roman domestic pigs are generally considerably smaller than wild boar.

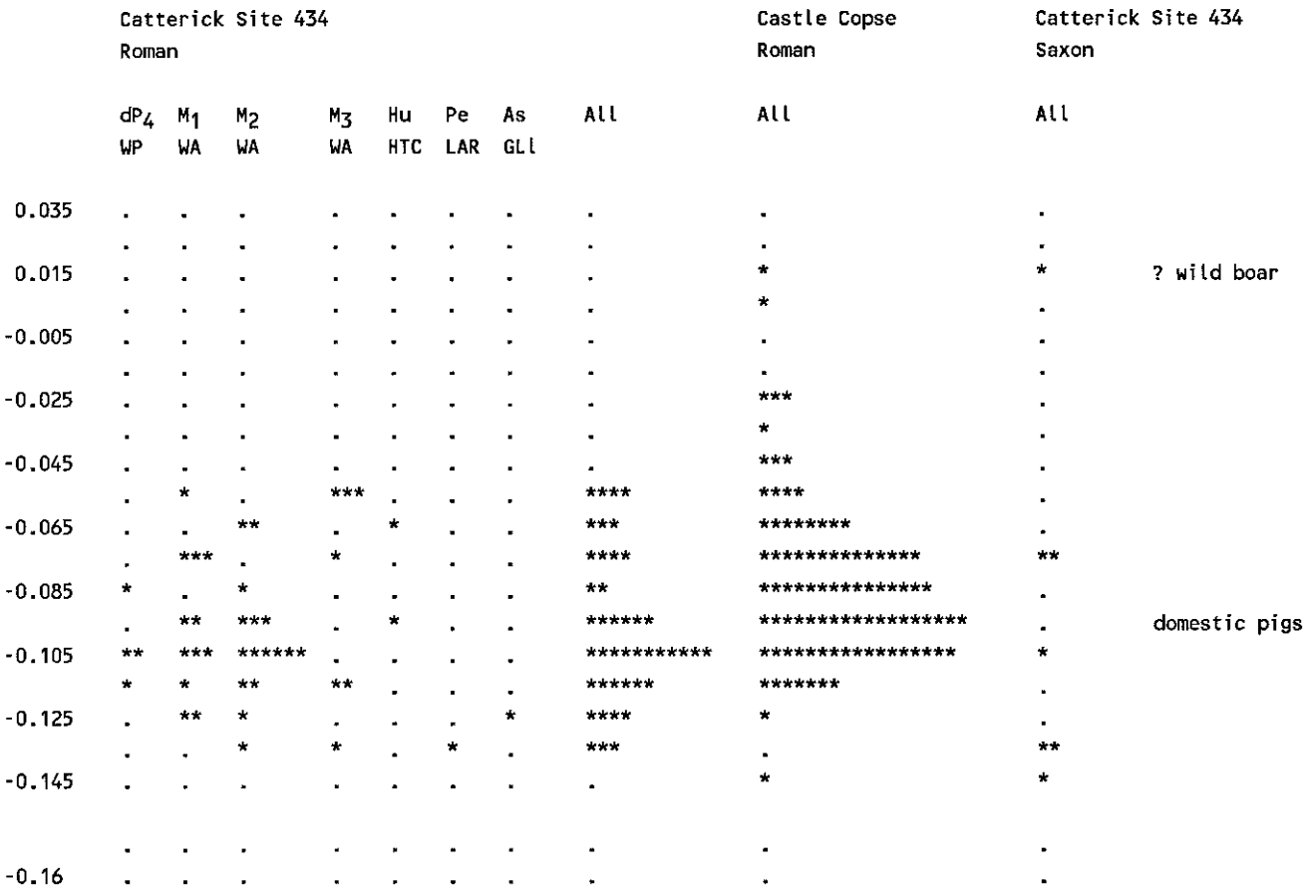

Figure 2: Distributions of distal metapodial widths for the Roman cattle from Catterick Site 434.

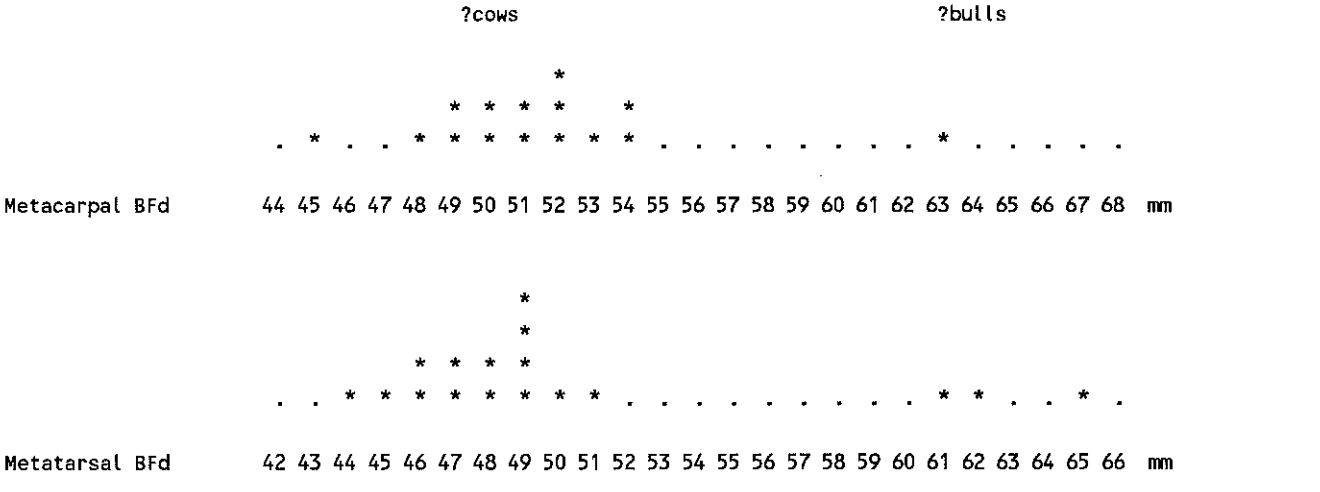

Figure 3: Relative representation of different parts of the skeleton of the common domestic animals at Catterick Site 434.

	PIG	CATTLE		SHEEP/GOAT	
	Roman	Roman military	Roman civilian	Roman military	Roman civilian
	Groups A-F	Groups A,B	Groups C-F	Groups A,B	Groups C-F
Mandible	**********	**	*******	******	******
Lower incisor	***	+	**	.	.
Lower canine	*******				
Lower milk molar/premolar	***	**	*********	****	****
Lower molar	*******	***	**********	***	*********
Humerus distal	**	.	*********	**	****
Radius distal	*	*	******	***	*
Radial carpal	.	.	.	.	.
Tibia distal	***	*	*******	***	*********
Astragalus	**	*	**********	*	**
Calcaneum	*	*	**********	*	***
Axial metapodial distal	*	**	**********	*	**
Axial phalanx 2	.	.	***	.	.

For each part of the skeleton an index figure has been calculated by dividing the number of identified specimens by the frequency of that part in the skeleton: e.g. the count for distal humerus is divided by 2, the count for cattle second phalanges by 8, and the count for sheep/goat lower molars by 6. If all the parts of the skeleton were similarly represented, the lines of asterisks would be of equal length.

Figure 4: Relative representation of bones of the different animals in the main periods of occupation of Catterick Site 434.

	Groups A, B Military Roman C2-3		Groups C-F Civilian Roman C4		Group G Saxon C6	
Horse	6%	*	5%	*	1%	+
Pig (and ?wild boar)	14%	***	13%	***	14%	***
Cattle	31%	******	61%	**********	45%	*********
Sheep/goat	38%	*******	19%	****	37%	*******
Bird	9%	**	+	+	1%	+
Other	1%	+	2%	+	1%	+
n	99		522		71	

Table 1: Catterick Site 434, summary of identified bones.

Group	A	B	C	D	E	F	G	Total
Phase	2	3	4	4	4	4	6	
Date	C2	C2-3	C4	C4	C4	C4	C6	
Man	.	.	+	.	.	.	.	+
Water vole	.	.	1	.	.	.	.	1
Large rodent	.	.	.	1	.	.	.	1
Dog	.	.	+	1	.	.	.	1
Cat	.	.	.	.	+	.	.	+
Horse	3	3	13	10	2	.	1	32
Pig	11	3	41+[4]	20	5	4	10	94+[4]
Wild boar	.	.	.	.	.	.	?+	?+
Red deer	.	.	1	a	.	.	a	1
Roe deer	.	1	1	.	.	.	.	2
Cattle	20	11	178	121	15	7	32	384
Sheep/Goat	18	20	59	25	12	1	26	161
(Sheep)	(3)	(2)	(7)	(5)	(2)	(1)	.	(20)
(Goat)	.	.	.	.	.	.	(1)	(1)
Cattle/Horse	.	.	1	3	.	.	1	5
Goose	1	.	.	.	.	.	.	1
Duck	2	1	.	.	.	.	.	3
Chicken	2	2	.	+	.	.	1	5
Raven	+	.	.	.	.	.	.	+
Unid. bird	1	.	.	.	+	.	.	1
Total	58	41	295+[4]	181	34	12	71	692+[4]

Notes: [] = group of bones found in association. () = also included in the figures for sheep/goat. + = identified from a non-countable bone (see below).

The counts are based on the following parts of the skeleton:

a) In general, and, specifically, for sheep, goat, cattle and deer: distal humerus, distal radius, radial carpal, distal tibia, astragalus, calcaneum, distal metapodials and proximal second phalanx, all only when at least part of the articular or fusion surface is present; mandibular teeth only when at least half the tooth is present; and mandibles only when including at least one tooth of which more than half is present.

b) for pig, the same except that di3 and dc are not counted.

c) for horse, the same except that incisors and canines are not counted.

d) for carnivores, the same, except that incisors, canines and premolars are not counted.

e) for birds, only distal humerus, distal radius, distal carpometacarpus, distal tibiotarsus and distal tarsometatarsus are counted.

f) fish bones were not present; different conventions would have applied.

Appendix 1: Catterick Site 434, list of bone bags examined.

Group A. Phase 2a, 2b: Demolition prior to construction of bridgehead defence/construction of bridgehead defence. Hadrianic/Antonine.

Context	Comments
P III 8	
P III 17	
P III 18	
P III 24	
P III 37	
P III 39	
P IV 7	
P IV 8	
P V 6	
P V 14	
P VII 6	
P VII 8	
P VIII 3	

Group B. Phase 3a: Primary silting and secondary fill of 'bridgehead' ditch. Severan.

Context	Comments
P III 11	
P III 29	
P III 30	2 bags
P III 31	
P III 32	2 bags

Group C. Phase 4 (incl. 4a, 4b): Late building in P over 'bridgehead' ditch. Fourth century.

Context	Comments
P I 4	
P I 7	3 bags
P I 7a	
P I 8	
P I 8a	
P I 9	
P I 11	
P I 12	
P I 14	
P I 17a	
P I 18a	
P III 4	
P III 7	
P III 13	
P III 16a	
P IV 4	
P V 4	

Group D. Phase 4 (incl. 4b): Late building in R. Fourth century.

Context	Comments
R II 3	
R II 4	2 bags
R II 5	
R II 6	
R II 6B	
R II 7	
R II 7B	
R II 8	
R III 3	
R IV 3	2 bags
R IV 4	2 bags
R IV 5	
R IV 6	
R VI 2	
R VII 2	

Group E. Phase 4 (incl. 4a, 4b): Late building in Q. Fourth century.

Context	Comments
Q I 5	
Q III 3	
Q IV 3	2 bags
Q IV 4	
Q IV 5	
Q VII 3	

Group F. Phase 4 (incl. 4b): Late surface in R to south of the building that produced group D. Fourth century.

Context	Comments
R V 2	
R V 3	
R V 4	
R V 6	

Group G. Phase 6: Grubenhaus in R. Sixth century.

Context	Comments
R V 5	
R VIII 3	
R VIII 6	
R VIII Postholes	

Appendix 2: Catterick Site 434, relative abundance of different parts of the skeleton of the commoner animals.

HORSE

	All groups
Mandible	1
Lower milk molar	.
Lower premolar+molar	16+(6)
Humerus distal	1
Radius distal	1
Radial carpal	.
Axial metacarpal distal	.
Tibia distal	5
Astragalus	2
Calcaneum	1
Axial metatarsal distal	2
Axial metapodial distal	2+(2)
Phalanx 2	1
Total	32

PIG

Group	A	B	C	D	E	F	G	Total
Phase	2	3	4	4	4	4	6	
Date	C2	C2-3	C4	C4	C4	C4	C6	
Mandible	5	1	12	6	2	2	4	32
Lower milk incisor	.	.	1	.	.	.	.	1
Lower permanent incisor	1+(4)	1+(3)	7	2	.	.	.	11+(7)
Lower permanent canine	2+(1)	1+(1)	6	2	.	1	3	15+(2)
Lower milk molar	.	.	.+(2)	.+(5)	.	.	.	.+(7)
Lower premolar	.+(1)	.+(3)	.+(10)	3+(1)	.	.	.+(3)	3+(18)
Molar	.+(5)	.	6+(16)	4+(8)	1+(2)	.(4)	1+(9)	12+(44)
Humerus distal	1	.	1+[1]	.	.	1	.	3+[1]
Radius distal	.	.	.+[1]	1	.	.	.	1+[1]
Radial carpal	.	.	.	.	.	.	.	.
Axial metacarpal distal	1	.	.	1	.	.	1	3
Tibia distal	.	.	3+[2]	.	.	.	.	3+[2]
Astragalus	.	.	1	1	1	.	.	3
Calcaneum	.	.	2	.	.	.	1	3
Axial metatarsal distal	1	.	1	.	1	.	.	3
Axial metapodial distal	.+(2)	.	1+(1)	.+(1)	.+(1)	.	.+(1)	1+(6)
Axial phalanx 2	.	.	.	.	.	.	.	.
Total	11	3	41+[4]	20	5	4	10	94+[4]

Note: [] = group of bones found in association.
() = for teeth, counts in parentheses are of teeth in jaws; for metapodia counts in parentheses are of specimens also listed separately as metacarpals and metatarsals.

Appendix 2: Catterick Site 434, relative abundance of different parts of the skeleton of the commoner animals, continued.

CATTLE

Group	A	B	C	D	E	F	G	Total
Phase	2	3	4	4	4	4	6	
Date	C2	C2-3	C4	C4	C4	C4	C6	
Mandible	1	3	6	7	.	.	2	19
Lower milk incisor	.	.	.	.	.	.	1	1
Lower permanent incisor	2	1	4	6+(1)	5	.	3	21+(1)
Lower milk molar	.	.	2	5	.	.	4+(2)	11+(2)
Lower premolar	2	.+(7)	18+(7)	13+(5)	1	.	4+(3)	38+(22)
Lower molar	7+(2)	.+(6)	43+(3)	36+(8)	1	1	5+(2)	93+(21)
Humerus distal	.	.	12	3	1	1	.	17
Radius distal	.	1	5	6	1	.	1	14
Radial carpal	.	.	.	.	.	.	.	.
Metacarpal distal	1	1	13	6	1	1	1	24
Tibia distal	1	1	10	4	.	.	1	17
Astragalus	.	2	17	7	1	.	4	31
Calcaneum	.	1	18	11	2	2	1	35
Metatarsal distal	4	.	12	7	1	.	2	26
Metapodial distal	.+(5)	.+(1)	2+(25)	3+(13)	.+(2)	1+(1)	1+(3)	7+(50)
Phalanx 2	2	1	16	7	1	1	2	30
Total	20	11	178	121	15	7	32	384

Note: [] = group of bones found in association.
() = for teeth, counts in parentheses are of teeth in jaws; for metapodia counts in parentheses are of specimens also listed separately as metacarpals and metatarsals.

Appendix 2: Catterick Site 434, relative abundance of different parts of the skeleton of the commoner animals, continued.

SHEEP/GOAT

Group	A	B	C	D	E	F	G	Total	(sheep)	(goat)
Phase	2	3	4	4	4	4	6			
Date	C2	C2-3	C4	C4	C4	C4	C6			
Mandible	6	6	5	3	3	.	8	31	(2+?5)	(1+?1)
Lower milk incisor	.	.	.	.	.	.	.	.	.	.
Lower permanent incisor	.	.	.	.	.	.	1+(2)	1+(2)	.	.
Lower milk molar	1+(11)	1+(9)	2+(6)	.+(7)	.+(3)	.	.+(12)	4+(36)	(.+?3)	(.+?1)
Lower premolar	.+(1)	.	2+(1)	.	.+(2)	.	2+(4)	4+(8)	.	.
Lower molar	2+(10)	1+(6)	27+(5)	9+(3)	3+(5)	.	14+(11)	56+(40)	.	.
Humerus distal	2	1	5	.	3	.	.	11	(2+?3)	.
Radius distal	2	3	.	1	.	.	.	6	.	.
Radial carpal	.	.	.	.	.	.	.	.	.	.
Metacarpal distal	.	1	2	1	.	1	.	5	(3)	.
Tibia distal	3	3	9	7	2	.	1	25	(2+?6)	.
Astragalus	1	.	2	1	.	.	.	4	(3+?1)	.
Calcaneum	1	.	3	1	1	.	.	6	(3+?1)	.
Metatarsal distal	.	4	2	2	.	.	.	8	(5)	.
Metapodial distal	.	.+(5)	.+(4)	.+(3)	.	.+(1)	.	.+(13)	.	.
Phalanx 2	.	.	.	.	.	.	.	.	.	.
Total	18	20	59	25	12	1	26	161	(20+?19)	(1+?2)

Note: [] = group of bones found in association.
() = for teeth, counts in parentheses are of teeth in jaws; for metapodia counts in parentheses are of specimens also listed separately as metacarpals and metatarsals.

Appendix 3: Catterick Site 434, mandible and mandibular tooth ageing data.

PIG (following Grant, 1982)

Mandibles:

Group	Date	dP_4	P_4	M_1	M_2	M_3	Sex
A	C2	.	.	c/d	a(HE)	.	.
A	C2	.	.	c/d	c/d	a(EV)	.
B	C2-3	.	b/h	.	.	.	female
C	C4	.	.	.	c/d	(b)	.
C	C4	j/m	.	c/d	.	.	.
C	C4	.	.	g/h	a(JU)	.	.
C	C4	.	b/h	.	c/d	.	.
C	C4	.	a(J)	.	.	.	male
C	C4	.	a(J)	g/h	.	.	.
C	C4	.	.	g/h	c/d	.	?female
C	C4	.	b/h	.	.	.	male
C	C4	.	a(J)	g/h	c/d	a(EV)	male
C	C4	.	.	.	g/h	(c)	.
C	C4	.	.	g/h	c/d	.	.
D	C4	.	-	-	c/d	.	male
D	C4	(b)	.	a(V)	.	.	.
D	C4	.	.	g/h	c/d	.	.
D	C4	.	.	.	.	b	.
D	C4	e/f	.	a(JJ)	.	.	.
D	C4	d	.	a(E)	.	.	.
E	C4	.	.	.	.	(c)	.
E	C4	.	.	.	c/d	.	.
F	C4	.	.	.	c/d	a(HE)	.
F	C4	.	.	.	c/d	a(V)	.
G	C6	.	b/h	j/n	g/h	-	.
G	C6	.	.	.	e/f	b	.
G	C6	.	b/h	j/n	g/h	.	.
G	C6	.	.	b	a(V)	.	.

Appendix 3: Catterick Site 434, mandible and mandibular tooth ageing data, continued.

Pig, continued

Individual teeth (including both loose teeth and those in mandibles):

dP_4 wear stage	a	b-d	e-h	j-m	unstaged	total
Roman	.	2	1	1	.	4
Saxon	.	.	.	.	.	.
Total	.	2	1	1	.	4

P_4 wear stage	a	b/h	unstaged	total
Roman	3	5	2	10
Saxon	.	2	.	2
Total	3	7	2	12

M_1 wear stage	a	b	c/d	e/f	g/h	j/n	unstaged	total
Roman	3	1	4	.	7	.	1	16
Saxon	.	1	.	.	.	2	.	3
Total	3	2	4	.	7	2	1	19

M_2 wear stage	a	b	c/d	e/f	g/h	j/n	unstaged	total
Roman	2	.	14	.	1	.	.	17
Saxon	1	.	1	1	2	.	.	5
Total	3	.	15	1	3	.	.	22

M_3 wear stage	a	(b)	(c)	>c	unstaged		total
Roman	8	2	2	.	.	.	12
Saxon	.	1	.	.	1		2
Total	8	3	2	.	1	.	14

Appendix 3: Catterick Site 434, mandible and mandibular tooth ageing data, continued.

CATTLE (following Grant, 1982)

Mandibles:

Group	Date	M_1	M_2	M_3
A	C2	k/m	k/m	.
B	C2-3	j	j	e/f
B	C2-3	k/m	.	.
B	C2-3	k/m	j	.
C	C4	j	g/h	.
C	C45	.	.	j
D	C4	g/h	f	.
D	C4	k/m	k/m	.
D	C4	g/h	f	.
D	C4	.	f/h	d/e
G	C6	k/m	.	.
G	C6	g/h	.	.

Individual teeth (including both loose teeth and those in mandibles):

dP_4	wear stage	a	b-e	f-k	>k	unstaged	total
	Roman	.	.	5	.	.	5
	Saxon	.	.	4	.	.	4
	Total	.	.	9	.	.	9

$M_{1/2}$	wear stage	a	b-e	f	g-h	j	k-m	>m	unstaged	total
	Roman	.	5	5	7	16	36	.	4	73
	Saxon	.	1	.	3	.	2	.	.	6
	Total	.	6	5	10	16	38	.	4	79

M_3	wear stage	a	b-f	g-h	j	k-m	unstaged	total
	Roman	5	8	8	5	5	2	33
	Saxon	.	.	1	.	.	.	1
	Total	5	8	9	5	5	2	34

Appendix 3: Catterick Site 434, mandible and mandibular tooth ageing data, continued.

SHEEP/GOAT (following Payne 1973 and Payne 1987)

Mandibles:

Group	Date	dP_4	P_4	M_1	M_2	M_3	Stage	Sheep/goat
A	C2	16L	.	9A	.	.	C/D	?sheep
A	C2	.	0(V)	.	.	.	D/E	.
A	C2	17L	.	9A	6A	.	D	.
A	C2	17M	.	9A	7A	0(V)	D	?sheep
A	C2	13L	.	0(HE)	.	.	B	sheep
A	C2	.	.	9A	7A	0(V)	.	.
B	C2-3	.	.	7A	.	.	.	.
B	C2-3	12Z	.	0(EV)	.	.	B	.
B	C2-3	13L	.	1B	.	.	C	?sheep
B	C2-3	11/14	.	.	.	.	B/D	?sheep
B	C2-3	18L	.	9A	7A	0(V)	D	.
C	C4	.	.	9A		.	.	.
C	C4	.	12S	12A	9A	.	F/G	.
C	C4	13L	.	.	.	.	B/C	sheep
C	C4	13L	.	.	.	.	B/C	.
C	C4	16L	.	9A	4A	.	D	.
D	C4	14L	.	.	.	.	C/D	?sheep
D	C4	17M	.	9A	5A	.	D	.
D	C4	16L	.	9A	.	.	C/D	.
E	C4	.	12S	15A	9A	11G	G	.
E	C4	14L	.	.	.	.	C/D	.
E	C4	.	.	9A	7A	.	.	.
G	C6	16L	.	9A	5A	.	D	.
G	C6	16L	.	.	.	.	C/D	.
G	C6	.	9A	9A	9A	7Z	F	.
G	C6	.	15A	15A	15A	.	H/I	.
G	C6	14L	.	9A	.	.	C/D	.
G	C6	16L	.	.	.	.	C/D	.
G	C6	18L	.	9A	6A	0(EE)	D	.
G	C6	4/5	.	.	.	.	B	goat

Appendix 3: Catterick Site 434, mandible and mandibular tooth ageing data, continued.

Sheep/goat, continued

Individual teeth, including both loose teeth and those in mandibles:

dP_4	wear stage	0-12	13	14	16	>16	unstaged	total
	Roman	2	4	4	3	5	1	19
	Saxon	1	.	1	3	1	.	6
	Total	3	4	5	6	6	1	25

P_4	wear stage	0	1-4	5-8	9	11-12	>12	unstaged	total
	Roman	1	.	.	.	3	.	.	4
	Saxon	.	.	1	1	.	1	.	3
	Total	1	.	1	1	3	1	.	7

$M_{1/2}$	wear stage	0	1-4	5-8	9	>9	unstaged	total
	Roman	2	7	20	31	2	.	62
	cumulative %age	3%	15%	47%	97%	100%		
	Saxon	.	1	5	12	3	.	21
	Total	2	8	25	43	5	.	83

M_3	wear stage	0	1-4	5-10	11	>11	unstaged	total
	Roman	4	1	1	1	.	1	8
	Saxon	2	.	1	1	.	.	4
	Total	6	1	2	2	.	1	12

Appendix 4: Catterick Site 434, epiphysial fusion data.

PIG (Roman only)

	fused	fusing	unfused shaft	unfused epiphysis	%fused
humerus distal	2	.	1	.	
phalanx 2 proximal	.	.	.	.	-
metapodial distal	1	.	5	.	
tibia distal	.	1	2	.	-
calcaneum	.	.	1	.	
radius distal	.	.	1	.	-

CATTLE (Roman only)

	fused	fusing	unfused shaft	unfused epiphysis	%fused
humerus distal	17	.	.	.	
phalanx 2 proximal	27	2	.	.	100%
metapodial distal	46	.	5	.	
tibia distal	13	2	1	.	91%
calcaneum	8	.	4	.	
radius distal	7	1	4	.	67%

SHEEP/GOAT (Roman only)

	fused	fusing	unfused shaft	unfused epiphysis	%fused
humerus distal	9	1	1	.	
phalanx 2 proximal	.	.	.	.	91%
metapodial distal	7	1	5	.	
tibia distal	16	6	2	.	81%
calcaneum	4	1	.	.	
radius distal	2	.	4	1	64%

Appendix 5: Catterick Site 434, list of measurements.

HORSE

Humerus

Group	Date	BT	HTC
C	C4	.	29.8

Radius

Group	Date	Bd
D	C4	65.2+

Tibia

Group	Date	Bd
C	C4	61.6
E	C4	69.7

Metatarsal

Group	Date	BFd	GL	SD
A	C2	.	258	29.0
D	C4	47.2	263	29.5

Astragalus

Group	Date	BFd	Ll	Lm
C	C4	(50.2)	.	58.7
C	C4	(48.8)	.	55.4

Metapodial

Group	Date	BFd
A	C2	(51.5)
D	C4	42.2

Appendix 5: Catterick Site 434, list of measurements, continued.

PIG AND ?WILD BOAR

Mandible

Group	Date	dP_4WP	P_4W	M_1WA	M_2WA	M_3WA	
A	C2	.	.	8.9	12.3	.	
A	C2	.	.	8.9	11.5	.	
B	C2-3	.	8.5	.	.	.	female
C	C4	.	.	9.9*	.	.	
C	C4	.	.	.	.	16.0	
C	C4	7.9	.	9.3	.	.	
C	C4	.	.	9.4	12.2	.	
C	C4	.	7.7	.	12.5	.	
C	C4	.	.	9.5*	.	.	
C	C4	.	.	.	11.7*	.	
C	C4	.	.	.	.	13.3	
C	C4	.	9.3	.	.	.	male
C	C4	.	9.2	10.5	.	.	
C	C4	.	.	.	11.9	.	?female
C	C4	.	.	.	12.3*	.	
C	C4	.	8.5	.	.	.	male
C	C4	.	8.7	9.4	12.4	.	male
C	C4	.	.	.	12.3	13.9	
C	C4	.	.	9.6	12.4	.	
D	C4	.	7.9*	.	.	.	
D	C4	.	.	9.2*	.	.	
D	C4	.	.	.	12.0*	.	
D	C4	.	8.8	.	13.5	.	male
D	C4	7.7	.	.	.	.	
D	C4	.	8.2*	.	.	.	
D	C4	.	.	10.1	13.4	.	
D	C4	.	.	.	.	16.0	
D	C4	.	8.9*	.	.	.	
D	C4	.	.	.	.	14.0	
D	C4	.	.	.	.	15.3	
D	C4	8.3+	.	(10.0)	.	.	
D	C4	7.9	.	.	.	.	
E	C4	.	.	.	.	16.1	
E	C4	.	.	.	12.9	.	
F	C4	.	.	.	12.7	.	
F	C4	.	.	.	12.7	.	
G	C6	.	8.3	.	13.3	.	
G	C6	.	.	.	11.6	14.4	
G	C6	.	7.6	.	11.3	.	
G	C6	.	.	9.9	.	.	
G	C6	.	.	.	11.5*	.	

Appendix 5: Catterick Site 434, list of measurements, continued.

Pig and ?wild boar, continued

Humerus

Group	Date	Bd	BT	HTC
A	C2	40.9	.	18.2
F	C4	36.5	26.3	19.4

Pelvis

Group	Date	LAR	
A	C2	26.8	
G	C6	37.7	?wild boar

Astragalus

Group	Date	GLl
C	C4	36.3

ROE DEER

Tibia

Group	Date	BdP
B	C2-3	27.5

Appendix 5: Catterick Site 434, list of measurements, continued.

CATTLE

Humerus

Group	Date	HTC	BT
C	C4	33.5	.
C	C4	33.5	73.0
C	C4	30.2	.
C	C4	32.2	.
C	C4	29.2	.
C	C4	31.4	(69.5)
C	C4	26.4	60.3
C	C4	29.6	.
C	C4	29.8	65.6
D	C4	(30.0)	.
D	C4	30.1	(66.5)
D	C4	27.6	(79.2)
F	C4	33.1	.

Radius

Group	Date	Bd	GL
B	C2-3	60.3+	235
C	C4	58.1+	.
D	C4	77.8	.
E	C4	60.5+	.

Metacarpal

Group	Date	BFd	GL	SD
A	C2	53.7	188	29.6
B	C2-3	52.0	167	28.3
C	C4	51.5	.	.
C	C4	54.6	.	.
C	C4	63.1	.	.
C	C4	48.9+	.	.
C	C4	52.3+	178	28.7
C	C4	50.6+	.	.
D	C4	49.5	179+	26.4
D	C4	45.0+	169+	(24.3)
D	C4	49.7	.	.
D	C4	54.8+	.	.
D	C4	52.8	.	.
E	C4	51.9	.	.
F	C4	50.8+	.	.

Appendix 5: Catterick Site 434, list of measurements, continued.

Cattle, continued

Tibia

Group	Date	BdP	
C	C4	52.7	fusing
C	C4	53.7	
C	C4	51.3	
C	C4	55.1+	
C	C4	65.1+	
C	C4	51.5+	fusing
C	C4	55.5+	
C	C4	60.4	
G	C4	56.9	

Astragalus

Group	Date	GLl	
B	C2-3	58.0	
C	C4	66.0	
C	C4	60.3	
C	C4	62.3+	
C	C4	65.2	
C	C4	59.0	
C	C4	61.4+	
C	C4	65.6	
C	C4	65.6	
C	C4	60.2	slightly burnt
C	C4	60.2+	
C	C4	56.9	
C	C4	62.4	
C	C4	62.1	
D	C4	(60.5)	
D	C4	61.1	
D	C4	58.8	
G	C4	67.0	
G	C4	62.1	
G	C4	60.5	

Calcaneum

Group	Date	GL
B	C2-3	117.0
C	C4	121.0
E	C4	149.6
E	C4	123.2+

Appendix 5: Catterick Site 434, list of measurements, continued.

Cattle, continued

Metatarsal

Group	Date	BFd	GL	SD
A	C2	48.0	.	.
A	C2	48.4	.	.
A	C2	49.8	.	.
A	C2	65.3	.	.
C	C4	.	(203)	.
C	C4	46.9	203	22.5
C	C4	49.0	(203)	22.5
C	C4	47.9+	.	.
C	C4	47.2+	.	.
C	C4	51.7+	.	.
C	C4	44.7+	205	21.3
C	C4	45.6	202	21.0
C	C4	50.8	.	.
D	C4	49.1	.	.
D	C4	61.3	226+	30.7
D	C4	46.5	.	.
D	C4	62.3	.	.
D	C4	(49.5)	.	.
G	C6	48.3+	.	.

Appendix 5: Catterick Site 434, list of measurements, continued.

SHEEP/GOAT

Humerus

Group	Date	HTC	BT	
A	C2	11.1	22.2	sheep
A	C2	11.6	.	?sheep, fusing
C	C4	12.3	24.0	??goat
C	C4	12.0	23.9	?sheep
E	C4	12.9	.	
E	C4	12.9	26.3	sheep
E	C4	13.4	26.4	?sheep

Radius

Group	Date	Bd	GL	SD
B	C2-3	(25.3)	140+	14.6
D	C4	27.1	141	14.9

Metacarpal

Group	Date	BFd	GL	SD	
D	C4	21.8	.	.	sheep
F	C4	23.4	118.9	13.0	sheep

Tibia

Group		BdP	
A	C2	(24.4)	
A	C2	23.1	?sheep
B	C2-3	25.0	fusing
B	C2-3	24.7	?sheep
B	C2-3	24.3	
C	C4	22.3	
C	C4	24.3	?sheep
C	C4	23.5	?sheep, fusing, slightly burnt
C	C4	22.2	
C	C4	22.8	sheep
D	C4	23.0	sheep, slightly burnt
D	C4	21.6+	
D	C4	24.6	?sheep
D	C4	23.2+	
E	C4	23.6+	
E	C4	24.8	fusing
G	C6	(25.2)	

Appendix 5: Catterick Site 434, list of measurements, continued.

Sheep/goat, continued

Astragalus

Group	Date	GLl	
A	C2	25.4	?sheep
C	C4	24.3	sheep
C	C4	25.3	sheep, ?slightly burnt
D	C4	26.1	sheep

Calcaneum

Group	Date	GL	
A	C2	48.2	sheep
C	C4	54.5	sheep
E	C4	49.3	sheep

Metatarsal

Group	Date	BFd	GL	SD	
B	C2-3	20.4	.	.	sheep
B	C2-3	20.5	120.9	10.3	sheep
C	C4	21.0	126.5	10.4	sheep
D	C4	21.2	.	.	sheep

Appendix 5: Catterick Site 434, list of measurements, continued.

DUCK

Radius

Group	Date	GL
A	C2	73.3

Carpometacarpus

Group	Date	GL
A	C2	55.4

CHICKEN

Humerus

Group	Date	GL
B	C2-3	61.5

Femur

Group	Date	GL
D	C4	76.9

Tarsometatarsus

Group	Date	GL
A	C2	79.5

RAVEN

Femur

Group	Date	GL
A	C2	70.5

Notes: All measurements are expressed in millimetres; bones are fused unless otherwise stated.
Unless otherwise specified, definitions follow von den Driesch (1976).
For pigs, measurements follow Payne and Bull (in press).
Humerus: HTC is the minimum diameter of the distal articulation at its central constriction (Payne and Bull, in press: Figs. 1.8 and 8a; = Duerst, 1926: measurement 21).
Tibia: BdP is the breadth of the distal end taken at right angles to the articular grooves (Payne and Bull, in press: Fig. 1.14).
Metapodia: BFd is the distal articular breadth (i.e. taken across the condyle(s), not across the fusion plane (= Duerst, 1926: measurement 15).

() = measurement approximate but within +/- 2%; + = chipped or abraded, measurement up to 2% too small; * = loose tooth, identification based on size.