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Biological evidence from excavations at Malmo Road, Kingston-upon-Hull

by

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Summary

A series of 20 samples of sediment and a small assemblage of bones were submitted. Subsamples from a selection of six samples were investigated for invertebrate and plant remains, but only one proved to contain any identifiable fossils and these were of limited interpretative value, merely confirming that the deposit was probably waterlain and suggesting that there may have been grazing land in the vicinity.

The bone assemblage proved to be of rather poor preservation and too small to be of value for detailed interpretation. Of interest was a single context of Romano-British date which yielded semi-articulated remains of sheep.

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Introduction

A series of 20 samples from excavations at Malmo Road, Kingston-upon-Hull, were taken for analysis of animal and plant remains; a modest collection of animal bone was also available for examination.

Methods

Subsamples of raw sediment were examined in the laboratory for plant and invertebrate animal remains. A 'rapid assessment' was carried out on six of the samples, selected as being the most promising for bioarchaeological analysis. From these, a 'test' subsample (Kenward *et al.* 1986) of 1 kg was taken and processed by paraffin flotation (Kenward *et al.* 1980) to extract insect remains. Plant remains were recorded from the flot from paraffin flotation and from the residue and washover. The remaining samples were described and their sedimentary characteristics recorded, but no further analysis was performed.

The samples and results of the analyses

The analyses carried out on each sample, and the remains recovered, are described below, together with a laboratory description of the sediment. A brief archaeological description and/or interpretation of the context is given in brackets where available. Samples are described in context number order.

Context 4 [fill of medieval construction cut 3]

Sample 5: mid grey-brown, moist, crumbly (working plastic), somewhat heterogeneous, slightly silty clay with modern invertebrate fauna, modern roots/rootlets, patches of black organic detritus (perhaps rich in manganese dioxide) and orange flecks, and a single charred cereal grain fragment. This deposit looks very 'disturbed' and may have been under cultivation or exposed to other kinds of disturbance, perhaps in recent times.

The 1 kg test subsample gave a flot barren of identifiable remains other than traces of charcoal, including short lengths of charred herbaceous stem less than 5 mm. (These resembled material seen in deposits of mid Anglian date from Flixborough, S. Humberside, but have yet to be identified.) Charred material was also present in small amounts in the small residue, again mostly herbaceous material, but with a few fragments of wood charcoal less than 5 mm. There was a single ?charred seed of *Atriplex* sp. and some fragments of charred organic material which may have been the interiors of very eroded charred cereal grains. Otherwise, the residue consisted of sand and stones to 10 mm.

Sample 169: light/mid, more or less orange-brown to blue-grey to black (locally), moist, stiff and crumbly (working plastic) clay with modern roots/rootlets and patches of black organic detritus (?with manganese staining).

A barren flot was obtained from the test subsample of this sample, too; even charcoal was absent. There was a little charred plant material in the washover, however, which included

short lengths of herbaceous stem material as in the other subsample from this context. For the rest, sand and stones made up the bulk of the residue, with a trace of coal and brick/tile less than 5 mm and a little very worn bone.

Context 8 [fill of medieval ditch 9]

Sample 17: varicoloured (mid yellowish-brown to mid grey), dry, brittle to crumbly, rather heterogeneous ash with modern roots/rootlets and lumps of mid orange-brown internally textured indurated clay; apparently a mixture of ash and burnt clay. Small black patches appear to be manganese dioxide or amorphous charcoal (evolution of oxygen when tested with hydrogen peroxide).

Context 16 [fill of medieval construction cut 15]

Sample 22: mid/dark grey-brown (mottled paler orange-brown on a mm-scale), just moist, stiff, becoming crumbly, working plastic clay with modern roots/rootlets, and very small brick/tile fragments.

Sample 175: mid/dark grey (locally orange-brown), moist, plastic clay with modern roots/rootlets and invertebrate burrows, a shell of the burrowing snail *Cecilioides acicula* {probably modern}, orange flecks of ?brick/tile or burnt clay and black patches of ?manganese dioxide.

There were a few scraps of charcoal in the minute flot, together with a single charred cereal grain (perhaps wheat) and a charred *Brassica rapa*. The small residue gave a modest washover of charred material, most of it unidentifiable, but with a few very worn cereal grains including some likely to be bread/club wheat (*Triticum aestivo-compactum*), a charred legume, perhaps pea (*Pisum*), two charred *Atriplex* sp. seeds, a charred ribwort (*Plantago lanceolata*) seed and a fragment of an uncharred chickweed (*Stellaria media*) seed. Bones ... The rest of the residue consisted of sand and sand-sized concretions of finer sediment, with a little brick/tile to 5 mm, and a few stones to 15 mm.

Context 29 [fill of medieval ditch 28; cuts RB ditch 25]

Sample 40: mid grey-brown, moist, crumbly to stiff clay with modern roots/rootlets and invertebrate channels, traces of stones 2-20 mm, and some rotted fragments of snail shell.

The flot from the test subsample was barren, and the residue consisted of sand and stones to 25 mm (including chalk and oolitic limestone), worn brick/tile to 15 mm and a little abraded bone to 25 mm.

Context 38 [fill of medieval pit 37]

Sample 39: mid/dark grey-brown, moist clay with traces of stones 6-20 mm and patches of paler clay and dull grey 'sooty' material, and orange flecks (?burnt clay).

Context 46 [upper fill of medieval ditch 45]

Sample 172: mid grey-brown (locally with orange-brown patches), dry to moist, stiff to brittle to crumbly to plastic clay with modern roots/rootlets, traces of stones 2-20 mm (including chalk), very fragmentary snail shell and brick/tile.

Context 49 [layer sealing RB ditch 69]

Sample 173: light/mid orange-brown, locally mottled more yellowish, moist, stiff to crumbly to plastic clay with modern roots/rootlets, ?invertebrate burrows and traces of stones 2-20 mm, including chalk and flint.

Context 53 [fill of RB pit 52]

Sample 164: mid brown, dry, indurated to crumbly, slightly sandy clay with many modern roots/rootlets.

Context 61 [lower fill of medieval ditch 45]

Sample 171: a mixture of mid grey-brown and mid orange-brown, dry to moist, stiff and crumbly (working plastic) clay with modern roots/rootlets and traces of bone fragments >20 mm and snail shell.

Context 62 [fill of medieval ditch 205]

Sample 142: mid blue-grey/red-brown mottled (gleyed), moist, stiff, crumbly (working plastic) clay with common modern roots/rootlets and trace of bone >20 mm; strong indications of ancient/modern working by soil organisms.

Context 69 [fill of RB ditch 68, continuation of ditch 152]

Sample 167: mid grey-brown (locally more brown at mm-scale), moist, plastic and crumbly clay.

Context 87 [fill of medieval pit 86]

Sample 165: mid/dark grey-brown (mottled somewhat orange-brown), moist, crumbly (working plastic) clay with abundant modern roots/rootlets and invertebrate burrows, and traces of bone fragments >20 mm.

Context 101 [fill of RB ditch 78]

Sample 166: somewhat varicoloured (mid orange-brown to mid grey-brown to dark grey), moist, layered, crumbly (in parts) to stiff (in parts) clay with a high ash content, some modern root/rootlet fragments and traces of charcoal.

A few grains of sand and a trace of charcoal <1 mm were all that was present in the flot from the test subsample; the residue consisted mostly of ?daub or burnt soil in amorphous lumps

up to about 35 mm. There was a small fragment of pot to 15 mm, a trace of brick/tile to 5 and some black amorphous material which might be manganese dioxide or charcoal.

Context 135 [fill of RB timber slot 134]

Sample 107: mid grey-brown (with slight orange-brown mottling), moist, crumbly (rubbing plastic), somewhat calcareous silty clay, with traces of stones 2-6 mm, freshwater snails, shellfish fragments and brick/tile; apparently a waterlain deposit.

Context 137 [fill of RB ditch 136]

Sample 168: mid grey-brown (mottled more orange), nearly dry, crumbly to brittle clay with modern roots/rootlets, traces of stones 2-6 mm and charcoal.

Context 139 [fill of medieval ditch 138]

Sample 174: mid grey-brown and orange-brown, dry, brittle to stiff clay with abundant roots/rootlets, traces of stones 6-20 mm and burnt bone <20 mm.

Context 140 [lowermost material, exposed at 2.2 m (0.96 m OD)]

Sample 141: light/mid brown (internally reduced to dark grey-brown), moist, plastic fine sandy silty clay; clearly a waterlain deposit. A small amount was examined in a smear on a microscope slide and found to consist almost entirely of mineral material in the silt and clay grades, with a trace of possible organic debris of the same size. No diatoms, which would be characteristic of waterlain silts and clays, were observed.

Of the six samples from which test subsamples were examined, this was the only one to yield insect remains, although they were rare in the very small flot; a few further fossils were recovered from the residue during examination for plant remains and paraffin flotation appears to have been very inefficient. The beetles and bugs afforded evidence of aquatic deposition (there were four *Ochthebius* sp.), perhaps in an area of grazing land.

The very small residue consisted of unidentifiable fine plant detritus (amongst which there was a half-achene of celery-leaved crowfoot, *Ranunculus sceleratus*, a fragment of an *Atriplex* sp. seed, a grass caryopsis and a very worn *Sphagnum* leaf (all preserved by waterlogging). Two unidentifiable snail shell fragments and a fragmentary shell of the catholic snail *Carychium* sp. complete the biota obtained from this subsample. The remainder of the residue consisted of ?root channel casts - tubular concretions of sediment up to about 20 mm.

Context 144 [fill of RB feature 143]

Sample 170: light/mid yellow-grey-brown, moist, very crumbly ashy clay with modern roots/rootlets and traces of stones 2-6 mm.

Context 178 [upper fill of RB ditch 152]

Sample 180: mid orange-brown, dry to moist, crumbly ('crisp') ash and burnt clay (with a gritty texture rubbing smooth).

Context 179 [lower fill of RB ditch 152]

Sample 181: mid grey-brown, moist, plastic to stiff clay with modern roots/rootlets, traces of stones 2-20 mm (including chalk), charcoal and ?fragments of snail shell.

Discussion

Unfortunately, most of the deposits from this site were devoid of biological material preserved by 'waterlogging', although there were a few charred plant remains, mainly from the fills of two medieval construction cuts. A single deposit gave modest numbers of waterlogged invertebrate and plant remains, indicating deposition in water and perhaps the presence of grazing land in the vicinity.

The animal bones

A small assemblage of animal bones (only four standard sized boxes) was recovered from excavations at Malmo Road. Most of the assemblage (37 contexts) derived from the fills of ditches, pits and other features of presumed Romano-British date. The remainder (10 contexts) represented fills of ditches, pits and construction cuts of 12th/13th century date and the fill of a post-medieval feature.

A total of 1246 bone fragments were recovered, 481 (38.6%) identified to species. Of these, 408 identifiable and 1072 unidentifiable fragments came from Romano-British deposits, 68 and 169 respectively from general medieval contexts and only five fragments from post-medieval deposits.

Preservation of the assemblage appeared on the whole to fall between poor and fair with material from only two contexts (30 and 41) classified as having good preservation. A very large proportion of the assemblage showed extensive evidence of gnawing, mainly on the articular ends of long bones and this was consistent with the damage done by canids. This evidence implies that a large proportion of the animal bones were not incorporated into the deposits very rapidly and thus were perhaps left lying around on the surface for some time prior to burial. Almost none of the material showed any evidence of burning or charring and a mere two fragments (from contexts 29 - horse; and 34 - cattle) showed any evidence of butchery.

All bone fragments were viewed and, where possible, identifications to species were made using comparative material at the Environmental Archaeology Unit. Measurements were taken using dial callipers, following von den Driesch (1976), but additional metapodial measurements followed Davis (1992). Recording of tooth eruption and attrition followed Grant (1983) and classification of epiphyseal fusion followed Silver (1969). In addition any distinctive butchery marks and signs of pathological lesions or injury were recorded in detail.

All notes and archive material pertaining to the bones are stored at the Environmental Archaeology Unit, University of York.

Species representation

A limited range of species was recovered from the site (Table 1) and not surprisingly included the remains of major domestic mammals, i.e. cattle, sheep, pig, horse and dog. In addition, two possible red deer (*Cervus elaphus*) fragments were recovered from Romano-British deposits. A large proportion of the caprovid remains were identified as sheep whereas no positive identifications of goat were made. It is therefore assumed that the majority of those fragments identified only as caprovid were sheep.

All the bird remains recorded were from Romano-British features and included a single fragment of domestic fowl (*Gallus gallus* f. domestic), two fragments of duck, possibly mallard (*Anas platyrhynchos*), and a single fragment of goose (*Anser anser*). Apart from possible wild duck, the only other wild species present was a single proximal radius fragment, identified as cormorant (*Phalacrocorax carbo*).

However, since all material was obtained by hand collection, with no systematic recovery procedures undertaken on the site, small mammals, birds and fish remains would almost certainly have been missed. In addition, calculation of the relative frequencies of species is fraught with problems, since a recovery bias in favour of larger species and elements inevitably exists.

Sheep remains were by far the most common domestic animal, representing 78% (377 fragments) of the total identifiable fraction. Cattle made up 14.3% (69 fragments), pig 2.1% (10 fragments), horse 2.3% (11 fragments) and canid 0.6% (3 fragments). However the dominance of sheep was exaggerated by the presence of what appeared to be a dump of semi-articulated limbs in a single Romano-British ditch fill (context 21). Here were found a total of 248 identifiable fragments (76% of all caprovid remains from this period).

When regarding the number of unidentifiable fragments (Table 2) a similar frequency is observed, with sheep-sized fragments inflated by the presence of numerous rib and vertebral fragments from context 21. With such a small assemblage the quantification of species abundance is not very informative.

Little can be said about the representation of different carcass elements of the major domestic animals (Table 3). It would appear that the majority of cattle elements were represented in the assemblage although only very small numbers of bones were present. Similarly most caprovid elements were represented, although there did appear to be a preponderance of forelimbs (i.e. radius and humerus fragments). Smaller elements such as phalanges and carpals may well have been under-represented because of the lack of systematic recovery techniques. This is made obvious when considering the semi-articulated sheep remains from context 21. Here soil matrix containing the bones was also collected and subsequently wet-sieved at the EAU, and as a result many more phalanges and carpals were recovered.

Age at death

With such limited numbers of fragments, little detailed information is available on age at death of the domestic animals (Table 4). The largest group providing this information comprised the remains of sheep from Romano-British deposits and consisted of 103

epiphyseal fragments. Of these 58 (56.3%) were fused and 45 (43.7%) unfused. When breaking this information down into fusion categories, it is clear that the majority of caprovids (43%) were killed as sub-adults, between one and three years of age. No young lambs were present and a small proportion (approximately 17%) had reached maturity and probably represented adult breeding ewes. However the lack of systematic recovery, and the fact that juvenile bones are also less robust than adult fragments, may have resulted in younger animals being under-represented.

There were few cattle fragments for which ageing information was available. However, it would appear that neonatal, juvenile and adult individuals were all present. The few pig fragments indicated the presence of immature animals only.

Viewing the eruption and attrition rates of the few mandibles and isolated teeth provided little additional evidence, although more mature sheep were apparently represented (Table 5).

Special deposit (Context 21)

As has already been mentioned, most of the sheep remains (248) from the site were recovered from context 21. This deposit appeared to contain the semi-articulated remains of four to five individuals, all exclusively identified as sheep. Although again the greater part of the skeleton was represented, there appeared to be a preponderance of complete hind limbs with forelimbs appearing more fragmented. Only four mandible fragments were recovered and no horn-cores.

A number of elements from opposite sides of the body almost certainly belonged to the same individual and this suggests that these animals were buried whole or mostly complete, with ribs, vertebrae, skull and scapulae being more adversely affected by taphonomic processes. Most were immature and only one femur fragment showed any signs of possible butchery. The presence of large numbers of 'meat-bearing' bones suggests an explanation other than normal butchery or kitchen waste for the origin of these bones. Although no evidence of pathology was noted on any of these remains, they may represent the deliberate disposal of diseased animals or those that had already succumbed to some misfortune.

Biometry

Table 6 lists the measurements taken during analysis and Table 7 shows withers height calculations for sheep from context 21. Cattle measurements are few in number but those that are available (Proximal-latero/medial width of metatarsal) suggest that values fall between the mid and upper range of size for Romano-British cattle recovered from a range of other sites (Noddle 1984; Rielly 1988; Grant 1984; Maltby 1979; Thawley 1982; Coy and Maltby 1983; Noddle, 1984; Gilchrist unpublished).

Sheep remains, although few in number, indicate the presence of rather small gracile individuals. Calculation of withers heights for complete metatarsals and comparisons of proximal breadth measurements for the same indicate that the sheep at Malmo Rd. are similar in size to other Romano-British and Roman material.

Discussion

The absence of a large animal bone assemblage from Malmo Rd., coupled with the lack of systematic recovery procedures, renders the data collected of relatively low value. Assumptions about the relative frequencies of species or elements is difficult on so small an assemblage, so conclusions must be tentative. However the range and supposed relative frequencies species recovered is not unusual for a site of this period.

Limited age at death data indicate that most of the sheep were killed as sub-adults, as were perhaps the cattle. Biometrical analysis also showed that both sheep and cattle were of similar stature to other assemblages of this date, in particular that from excavations at North Cave, N. Humberside (Gilchrist, unpublished).

The remains of semi-articulated sheep from context 21 is interesting and suggests that whole or part animals were dumped without being butchered or utilised in any way and may well suggest the presence of diseased animals or perhaps a ritualistic deposit.

The site is similar to North Cave, Humberside and it has been suggested that small archaeological sites with ditched enclosures were utilised for stock-rearing (Dent 1983). Animal burials and 'special deposits' have also been noted at other sites in the region, i.e. Wetwang Slack, Garton Slack, Hayton, Langton, Rudston and Bleaklands Nook (Gilchrist, unpublished). A larger, more systematically recovered assemblage is needed before more detailed interpretation is possible.

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Table 1- Total fragment counts per species for each period represented

Roman period. (A = fragment counts excluding special context 21,
B = fragment counts for context 21 only)

Species	A	B
Cattle (<i>Bos f. domestic</i>)	55	1
Sheep (<i>Ovis f. domestic.</i>)	9	248
Sheep/goat (<i>Ovis/Capra sp.</i>)	69	0
Pig (<i>Sus f. domestic.</i>)	8	0
Horse (<i>Equus f. domestic</i>)	8	0
?Deer (cf. <i>Cervus elaphus.</i>)	2	0
Dog (<i>Canis f. domestic</i>)	3	0
Domestic fowl (<i>Gallus f. domestic</i>)	1	0
Goose (<i>Anser anser</i>)	1	0
?Mallard (cf. <i>Anas platyrhynchos</i>)	2	0
?Cormorant (cf. <i>Phalacrocorax carbo</i>)	1	0
Total	<u>159</u>	<u>249</u>

Medieval period.

Cattle (<i>Bos f. domestic</i>)	13
Sheep (<i>Ovis f. domestic.</i>)	2
Sheep/goat (<i>Ovis /Capra .</i>)	49
Pig (<i>Sus f. domestic.</i>)	2
Horse (<i>Equus f. domestic</i>)	2
Total	<u>68</u>

Post Medieval period.

Horse (<i>Equus f. domestic</i>)	1
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Table 2 - Total unidentified fragments from each period

Roman period (A = number of fragments excluding context 21, B = number of fragments from context 21).

Fragment description	A	B
Cattle-sized shaft	57	0
Cattle-sized vertebra	5	0
Cattle-sized rib	20	0
Sheep-sized shaft	41	189
Sheep-sized vertebra	7	100
Sheep-sized rib	25	115
Unidentified	104	*
Total	<u>259</u>	<u>404</u>

* The only completely unidentifiable fragments from context 21 were numerous tiny (<1cm) flakes.

Medieval period.

Cattle-sized shaft	12
Cattle-sized vertebra	1
Cattle-sized ribs	2
Sheep-sized shaft	23
Sheep-sized vertebra	10
Sheep-sized rib	4
Unidentified	49
Total	<u>101</u>

Post Medieval period.

Unidentified	4
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Table 3 - Carcass components

Numbers in brackets are those obtained from context 21

Element	Cattle	Sheep	Sheep/ Goat	Pig	Horse
Horn core	0	0	1	-	-
Skull frags.	2	(20)	7	0	0
Loose max. teeth.	7	(15)	24	1	1
Loose mand. teeth.	4	(5)	9	0	2
Mandibles with teeth.	4	(4)	8	3	0
Scapula	6	(5)	4	1	0
Humerus	4	2 (10)	12	0	1
Radius	5	2 (12)	13	1	2
Ulna	4	(4)	2	0	1
Carpals	2 (1)	(29)	1	1	1
Metacarpal	7	2 (8)	3	0	0
Innominate	3	(33)	5	0	0
Femur	1	(10)	3	0	1
Patella	0	(3)	0	0	0
Tibia	4	(10)	8	1	0
Calcaneum	1	(6)	1	2	0
Astragalus	2	2 (7)	1	0	1
Nav. cub.	2	(5)	0	0	0
Metatarsal	3	3 (9)	7	0	0
Phalange 1	3	(18)	6	0	0
Phalange 2	0	(9)	2	0	1
Phalange 3	2	(7)	1	0	1
Hyoid	1	0	0	0	0

Table 4 - Epiphyseal fusion of cattle and caprovid bones

Cattle

	fused	unfused	%fused
Early	6	2	75
Int.	2	2	50
Late	-	2	0

Key

Early fusing bones - Scapula (glenoid cavity) distal humerus, proximal radius, phalanges 1+2

Intermediate fusing - distal metacarpal, distal metatarsal, distal tibia, tuber calcis.

Late fusing - Proximal humerus, distal radius, olecranon tuberosity, proximal and distal femur, proximal tibia.

Sheep/goat

	fused	unfused	%fused
Early	20	0	100
Int. 1	17	12	58.6
Int. 2	16	13	55.2
Late	5	24	17.2

Key

Early fusing - Scapula (glenoid cavity) proximal radius, distal humerus.

Intermediate fusing 1 - phalanges 1+2, distal metacarpal.

Intermediate fusing 2 - distal tibia, distal metatarsal, olecranon tuberosity, proximal femur, tuber calcis.

Late fusing - distal radius, proximal humerus, distal femur, proximal tibia.

Table 5 - Tooth wear stages of major domesticates (after Grant, 1982)

1 - Cattle

	dp₄	P₄	M_{1/2}	M₃
erupting	-	-	-	1
a	-	-	-	-
b	-	-	1	-
c	1	-	1	-
d	-	-	1	-
e	-	-	1	-
f	-	-	-	-
g	1	-	-	-
h	-	-	1	-
j	-	-	-	-
k	1	-	-	-
l	-	-	-	-
m	-	-	-	-
n	-	-	-	-

2- Sheep/goat

	dp₄	P₄	M_{1/2}	M₃
a	-	-	-	1
b	-	-	-	-
c	-	-	1	1
d	-	1	-	-
e	-	-	-	1
f	-	-	2	3
g	2	3	-	10
h	-	-	-	-
j	1	-	-	-
k	1	-	-	-
l	-	-	-	-
m	-	-	-	-
n	-	-	-	-

3 - Pig

	dp₄	P₄	M_{1/2}	M₃
eruptin	-	-	-	1
g	-	-	-	-
a	-	-	-	-
b	-	-	1	-
c	-	-	1	1
d	-	-	1	-
e	-	-	2	-
f	-	-	-	-
g	-	-	-	-
h	-	-	-	-
i	-	-	-	-
j	-	-	-	1
k	-	-	-	-
l	-	-	-	-
m	-	-	-	-
n	-	-	-	-

Table 6 - Biometry archive (after von den Driesch 1976)
 (Numerical codings for metapodials after Davis, 1992)
 (For Horn cores: GD=Greatest Diameter, MD=Minimum Diameter)

Cattle

Metacarpal

Cntxt.	Bp	Dp
54	50.02	30.82

Metatarsal

Cntxt.	Bp	Dp	GLI	b	4	5	6
23	51.60	48.08	-	-	-	-	-
7	41.78	35.54	≈200	21.62	19.20	26.36	24.72

Sheep/goat

Horn core

Cntxt.	GD	MD
7	33.62	20.50

Humerus

Cntxt.	Bp	Bd	BT
77	29.24	-	-
49	-	32.00	-
41	-	27.96	-
26	-	28.66	27.28
7	-	25.90	25.74
21	-	27.38	26.64
21	-	27.76	26.40
21	-	28.00	26.58

Radius

Cntxt.	Bp	Bd	BFp	BFd
21	29.02	-	25.70	-
21	-	27.60	-	25.70
21	-	27.26	-	23.74

Metacarpal

Cntx t.	GI	Bp	Dp	Bd	SD	1	2	4	5
77	-	19.9 2	14.0 0	-	-	-	-	-	-
21	-	20.9 0	15.4 0	-	-	-	-	-	-
21	114. 7	20.8 1	15.2 8	23.9 2	13.6 2	9.52	14.0 8	10.0 8	14.4 1
21	-	24.3 2	17.1 6	-	-	-	-	-	-

Tibia

Cntxt.	Bd	Dd
21	25.20	19.96
21	24.44	18.60
21	24.42	18.64

Astragalus

Cntxt.	GLI	GLm
87	28.58	26.50
53	26.82	26.50
21	25.96	23.36
21	29.98	24.46
21	27.10	26.04
21	27.96	27.64
21	25.22	-
21	-	23.66
21	27.68	25.60

Calcaneum

Cntxt.	GL	GB
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21	47.38	17.58
21	51.80	18.38
21	50.00	16.60
21	50.40	16.20

Metatarsal

Cntx	GL	Bp	Dp	Bd	SD	1	2	4	5
t. 77	-	18.1 2	17.8 0	-	-	-	-	-	-
29	-	-	-	29.0 0	-	-	-	9.52	14.6 0
21	132. 5	20.3 2	19.9 6	23.1 6	12.3 8	9.90	16.0 0	9.24	15.1 6
21	129. 7	18.7 2	19.5 0	-	12.8	9.34	14.4 2	-	-
21	-	-	-	24.2 4	12.1 2	10.5 6	16.5 4	9.70	15.7 2
21	130. 2	20.1 3	19.8 0	-	-	-	-	10.1 0	15.8 0
21	130. 4	18.6 4	19.6 0	-	12.3 6	9.44	14.5 2	-	-
21	128. 0	19.3 4	18.4 8	23.2 4	-	9.58	15.2 4	9.06	14.2 0

Pig

Metacarpal 4

Cntxt.	Bp
118	12.98

Horse

Humerus

Cntxt.	Bd
85	67.00

Phalange 2

Cntxt.	GL	Bp
29	42.70	47.42

Table 7. Withers heights of sheep (measurements in centimetres)

	Number	Range	Inferred height range	Mean inferred height
Metacarpal	1	11.47	-	55.5
Metatarsals	5	12.80-13.25	57.7-59.8	58.7