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ANIMAL BONES FROM EXCAVATIONS AT LEWTHWAITES LANE, CROWN & ANCHOR LANE AND OLD BUSH LANE, THE LANES, CARLISLE, 1982

Ms Sue Stallibrass

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Summary

This is the second of two archive reports for the five sites that will be covered in Volume 1 of the publication report on The Lanes. The excavations at Lewthwaites Lane etc. recovered material dating mainly from the earlier Roman (first/second centuries AD) and the Medieval (12th/13th centuries) periods.
During the Roman period, the area was part of the civilian settlement and the animal bones will form a contrast to the large quantities of material already recovered from military and quasi-military areas of the city.
The material from Lewthwaites Lane etc. consists mainly of domestic bone waste and refuse from cattle, sheep and pigs. No goat bones were identified. Bones of other species such as birds, deer and fish are relatively scarce.
Cattle bones dominate the Roman collection, but less so than in the military areas of the city. The cattle are very similar morphologically to those from the military areas, but the age distribution is different, consisting almost entirely of mature adults, with very few juveniles or sub-adults. The sheep and pig bones are predominantly from young animals. The collection closely resembles that from Old Grapes Lane.
An isolated mandible of a bear was recovered from a 12th/13th century post-trench. This jaw may have been a curiosity, kept from a dancing bear.

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Animal bones from excavations at Lewthwaites Lane trench A, Crown & Anchor Lane trench A, and Old Bush Lane trench B, The Lanes, Carlisle, 1981 - 1982

INTRODUCTION

Background to the project

The Lanes area consisted of a grid of narrow medieval lanes fronted by medieval and post-medieval buildings in the centre of the modern city of Carlisle. The whole area was demolished in the early 1980s and replaced by an under-cover shopping complex.

The excavations of trenches on Lewthwaites Lane (LEL-A), Crown & Anchor Lane (CAL-A) and Old Bush Lane (OBL-B) formed part of a major archaeological programme of excavation, building recording and documentary research for 2.4 hectares of The Lanes. The project was undertaken by the Carlisle Archaeological Unit under the direction of Mike McCarthy, and 25 trenches were excavated between 1978 and 1982. A further twenty trenches had watching briefs, and a small amount of material was excavated prior to the main project by Clack and Gosling in 1975 (McCarthy 1991).

Figure 1 shows the position of The Lanes with respect to the medieval city walls (N.B. all maps are taken from McCarthy 1991). It also shows how the city of Carlisle is situated on a tongue of land between the confluences of the Rivers Caldew and Petteril into the River Eden.

Figure 2 shows the distribution of the excavations undertaken in the southern half of the area of The Lanes between 1978-1982. These trenches are being studied as a group and will be reported on together in Volume 1 of the post-excavation monograph on The Lanes (McCarthy *in prep.*). Figure 2 shows how these excavations relate spatially to each other and to the street frontages.

Figure 3 presents the locations of known Roman remains discovered in Carlisle, particularly at sites that have produced major assemblages of animal bones, such as the fort at Annetwell Street (Stallibrass, 1991a & 1991b), the fort annexe at Castle Street (Rackham *et al*, 1991), and another area of civilian settlement at Blackfriars Street (Rackham 1990).

This report, on the animal bones recovered from excavations at Lewthwaites Lane, Crown & Anchor Lane and Old Bush Lane, is the second of a series that will form the archive reports for the whole of The Lanes project. The other report relating to Volume 1 covered excavations at Old Grapes Lane trenches A & B (Stallibrass 1992). A synthesis of the information obtained for these sites will be submitted as an Ancient Monuments Laboratory Report and will be published in Volume 1 of the excavation report (possibly in an abbreviated form).

Volume 2 will cover Roman remains from the northern half of the area, and Volume 3 will cover Medieval remains from the northern area. There may be a fourth volume synthesising the information from Volumes 1 - 3.

Some of the information pertaining to the Lewthwaites Lane group of trenches will be held over until the synthesis of the Volume 1 material, due to the very small sample sizes involved at any one site.

The positions of the sites

Lewthwaites Lane trench A (LEL-A) produced the bulk of the material studied for this report. Smaller amounts of material were recovered from Old Bush Lane (OBL-B), directly to the north of LEL-A but separated from it by the lane, and from Crown & Anchor Lane (CAL-A) approximately ten metres to the south of LEL-A (see Figure 2). The group of trenches lay to the north (and slightly west) of the Old Grapes Lane trenches (OGL A & B), almost forming a continuous north-south transect through the southern half of the Lanes area.

DATING AND PHASING

The Phases stretch from the prehistoric period (no animal bone), through the earlier Roman period until the turn of the 2nd/3rd Centuries AD. There appears to be a partial hiatus until the late 12th/ early 13th Centuries. These intervening phases have proved impossible to date so far. Coins are very rare, and pottery is scarce consisting mainly of Roman pottery that appears to be residual. The extreme scarcity or lack of medieval pottery in these layers may be significant, and may indicate that they date to the late Roman and/or the post-Roman /Anglian periods. The medieval period dates to the 12th/13th Centuries, and there is a small amount of post-medieval material.

Table 1: concordance of phases and dating for LEL-A, CAL-A & OBL-B

(C refers to Century AD)

OBL B Phase	CAL A Phase	LEL-A Phase	DATE	GROUP
	1	1	Old Ground Surface	**OGS**
2		2-5	late 1st C	
	2	6	AD 93-94	**late 1st/2nd C**
	3	7	Trajanic (AD 96-117)	
6		8	Hadrianic (AD 121-160)	
		9	late 2nd C	
		10	late 2nd C	
		11	late 2nd/3rd C	
		12	late 2nd/3rd C	
		13	late 2nd/3rd C	**late 2nd/3rd C**
		14	late 2nd/3rd C	
		15	late 2nd/3rd C	
		16	late 2nd/3rd C	
		17	3rd - 12th C	**3rd-12th C**
		18	3rd - 12th C	
		19	12th/13th C	
		20	12th/13th C	**12th/13th C**
		21	12th/13th C	**(medieval)**
		22	post-medieval	**post-medieval**
		23	post-medieval	

Some of these phases have approximate equivalents at the other recent excavations in Carlisle.

LEL-A: Phases 2 - 8 **late 1st/early 2nd C. AD**
CAL-A: Phases 2 and 3
OBL-B: Phases 2 and 6
are roughly contemporaneous with Phases 2-7 at Castle Street (AD early 70s - 140s/160), Phases 2-5 at Blackfriar's Street (*c.* AD 79 - 150/180s), and Phases 3-5 at Annetwell Street (AD 73/4 - 140).
At Old Grapes Lane A (phases 3-6) and OGL-B (phases 2-4D), there were gulleys, pits, soil deposits and surfaces, that were later overlain by two properties with boundaries (gulleys, ditched, fences and hedges) each enclosing a single timber building.

LEL-A: Phases 9-16 **late 2nd C / early 3rd C**
corresponds approximately to Phases 8 & 9 at Castle Street (mid-late 2nd C -late 2nd/mid 3rd C) and to Phases 6-8 (AD 150s/180s) and 9a-n (late 2nd/early 3rd C) at Blackfriar's Street. There was little activity at Annetwell Street at this time.

At Old Grapes Lane A (Phases 7-10) there is a possible abandonment phase with some demolition material followed by a metalled road. This itself was superseded by soil deposits, a building and various surfaces. At the same time at Old Grapes Lane B (Phases 4E-7B) there were soil spreads and a building represented by slots, gulleys, postholes etc.

Material dating to the later Roman period (*ie*: 3rd/4th/5th C) was recovered from Castle Street, Blackfriar's Street and Annetwell Street, but was not specifically identified from Lewthwaites Lane nor Old Grapes Lane.

LEL-A: Phases 17 & 18 **3rd-12th C**
the material from these phases was difficult to date. Similar problems were encountered at Old Grapes Lane in Phases 11-12 (at OGL-A) and Phase 8 (at OGL-B).

LEL-A: Phases 19-21 **12th/13th C**
At Old Grapes Lane in this period, the main features were a well (OGL-A Phase 13) and a series of pits (OGL-B Phase 9). The period of activity at OGL and LEL-A may overlap with some of the earlier material from Phases 13 onwards at Castle Street (Medieval).

LEL-A: Phase 22 **post-medieval**
no post-medieval material was recovered from Old Grapes Lane.

A brief synopsis of the stratigraphy of LEL-A, CAL-A & OBL-B

At LEL-A, phases 1 - 4 comprise a sequence of relatively wet silts and patchy surfaces of clay and gravel. These are cut by some slots and gulleys. By phase 5, a gulley split the site and appears to have been a boundary.

In phase 6, a central gulley flanked by fences running east-west split the site. There were a number of gravel surfaces and silt accumulations. At the same time at OBL-B (phases 2-7) there was a rectangular timber building with a north-south fence line to the east of it. This fence line is on exactly the same alignment and position as one in LEL-A, although the two are separated by the unexcavated area underneath the road. At CAL-A (phase 2), there was another property enclosing timber buildings, and it is possible that the east-west boundary of LEL-A forms its northern boundary.

At LEL-A in phases 7-9, and simultaneously at CAL-A in phase 3, these property boundaries and timber buildings were obliterated by overlying surfaces and soil deposits, with miscellaneous pits and gullies at LEL-A (but not at CAL-A). The surfaces were probably external as no indications of any walls were found.

In phase 10 at LEL-A, a major post-built timber structure was built on substantial clay and cobble foundations. The building appears to have been a courtyarded structure, and no floors were recovered, although various external features were recorded. This building extended into OBL-B, and similar, probably related features were found in CAL-A, but no animal bones have been studied for these (or any later) phases from either CAL-A or OBL-B. The building may have been a large private house at the junction of the roads through CAL-B and Scotch Street.

At LEL-A during phases 11-12, further changes were made to the layout and building plan. In phase 12B several walls and at least two rooms were present, including clay and earthern floors.

In LEL-A phase 13-20 there was a succession of poorly dated features including fragments of buildings plus numerous surfaces.

In phase 21 at LEL-A a large medieval post-built hall was erected, with its gable onto the Scotch Street frontage. There was little evidence for any floors from this building, which fits into the position of No. 65, Scotch Street, and was probably the 12th/13th Century precursor of the late 17th Century building that was demolished as part of the Lanes rebuilding programme in the 1980s.

Methods of recovery

Most of the animal bones were recovered by hand during excavation of a large (but unmeasured) quantity of stratified deposits, but a significant minority were recovered from the residues from bulk samples processed through a flotation machine using 500 mesh. Whenever possible, a minimum of 30 litres of sediment was processed, and many of the bulk samples contained 75 or 150 litres. The residues were picked through by members of the excavation team and, in effect, all bone fragments over 25mm long were recovered together with many that were between 10 and 25mm in maximum length. These are listed as 'sieved' fragments. The remaining residues (referred to in the rest of this report as the 'fine fraction') were sorted in the Durham University Department of Archaeology Biological Laboratory by Mr. Shaun Doran in 1991. Due to insufficient financial resources for this work, not all of the fine fraction residues could be sorted. This accounts for the lack of fine fraction material from LEL-A phases 2 and 6, and OBL-B phases 2 and 6.

The quantities of material

The material from LEL-A, CAL-A and OBL-B was assessed by the site director using stratigraphic criteria, and a total of 29 long bone boxes of animal bones was awarded Priority 1 (*ie*: 24 boxes from LEL-A and a further 3 boxes from CAL-A and 2 boxes from OBL-B).

All of the Priority 1 material was sent for analysis and has been catalogued and analysed for this report.

Table 2 shows how the quantities of bone considered in this report relate to the mode of retrieval. Table 3 gives the distributions of bone weights by phase and recovery method for the three sites.

Table 2: weights of animal bones from LEL-A, OBL-B & CAL-A

	LEL A		CAL A		OBL-B	
	weight (g)	**%**	**weight (g)**	**%**	**weight (g)**	**%**
hand-recovered	96,451	96%	10,724	82%	7,722	89%
sieved	4,163	4%	2276	17%	954	11%
'fine fraction'	143	0.1%	53	0.4%	-	
TOTALS	**100,757**		**13,053**		**8,676**	

The archive

The site archive, including the animal bones, will be stored in the Tullie House Museum, Carlisle.

RESEARCH PRIORITIES

The research priorities for the work relating to the Lanes project as a whole, and Volume 1 in particular, are given in detail in the archive report for Old Grapes Lane (Stallibrass, 1993a). A general summary is repeated below.

General priorities and aims for animal bone specialist work for the whole of the Lanes project.

1: To compare Roman material from The Lanes (a civilian settlement) with that from Annetwell Street (the fort), Castle Street (the fort annexe) and Blackfriars Street (a separate civilian area), in order to investigate potential differences in site function during the Roman occupation.

2: To compare the early (1st/2nd Centuries AD) and later (3rd/4th Centuries AD) Roman material within the Lanes (civilian area), and to compare the later Roman material from the Lanes with that from Castle Street, in order to study potential changes in civilian site function and status as the fort went through different phases of importance.

3: To compare material from different periods *ie*: the prehistoric (where present), Roman, Anglo/Scandinavian (where present), medieval and post-medieval periods, in order to investigate the development of Carlisle through time.

4: To investigate any changes in livestock types and husbandry patterns through time, in order to compare with other parts of Britain.

In addition there are other, more specific, research aims that relate to:

5: particular contexts or groups of deposit, in order to answer questions regarding aspects of stratigraphy or site function, and

6: particular bones of interest.

Because of small sample sizes, certain aspects have been recorded for Lewthwaites Lane etc. but are insufficient for analysis on their own. For these aspects, the material from Volume 1 as a whole will be pooled and analysed later. This refers particularly to scarce species such as horse, dog and cat; birds and small vertebrates.

The analyses undertaken for this group of material are identical to those undertaken for Old Grapes Lane, and this report follows the same format as the archive report for that site (Stallibrass, 1992).

PRESERVATION

When the animal bones were assessed (Stallibrass, unpublished, 1991), it was noted that their states of preservation ranged from one extreme to the other. Four states were identified: Excellent, Good, Brittle and Shot. These are defined as follows:

EXCELLENT: the bones are dense and robust, and their surfaces are as smooth as they are in life. All of their surface details such as muscle attachments, minor lesions, periosteal alterations etc. together with any post-mortem alterations such as fine knife cuts, carnivore toothmarks etc. are clearly visible.

GOOD: these bones are quite robust but they have lost the 'satin-like' smoothness of their surface texture and surface details may occasionally have been lost.

BRITTLE: these bones are very light in weight, and the bones are very brittle and easily broken (both in the past and during excavation and handling). In addition, the surfaces are often flaky or eroded. This surface destruction has often removed any anatomical or post-mortem details that might have been present. In addition to surface erosion, many of the bones are encrusted with soil minerals, obscuring the shape and surface of the bones.

SHOT: these bones are almost completely 'shot to pieces' ie: minerals have infiltrated between the lamellae and have led to severe exfoliation. The outer surfaces are often missing completely. The bones are highly fragmented and are generally completely unidentifiable by eye.

For the assessment, each bag of bone was classified as belonging primarily to one of these four categories. Some contexts produced several bags, each of which was recorded individually. Weights of calcined bones were negligible and were not recorded separately.

Table 4 presents the weights of bones by period and preservation type for LEL-A. All of the material selected for study from CAL-A and OBL-B dates to the late 1st C or to the period AD 117-160, and was excellently preserved. At LEL-A, it is clear that there is a pronounced shift between preservation types during the second Century. For the earlier periods (phases 2 - 8, late 1st C. AD - *c* AD 160) almost all of the bones were classified as Excellent. In the later second Century (post *c.* AD 160) the emphasis shifted, first to a mixture of Good and Brittle (phases 9 & 10), and then (by the late 2nd/3rd C, phases 11-16 onwards) to almost totally Brittle. This may be related to a change in building materials. In phase 10 the building at LEL-A was constructed on clay and cobble foundations which would have altered the drainage pattern at the site, but it is interesting to note that exactly the same change in preservation type was noticed at Old Grapes lane at exactly the same time period, whilst at that site there was no concommittant change in building materials.

THE SPECIES

Notes on identifications and recording.

1: Where possible, bones were identified specifically as sheep or goat. Out of a total of 383 sheep/goat bones, none were identified as goat whilst 86 bones were identified as sheep (22%). The remaining 297 bones could not be identified to species level. For the purposes of this report, it is assumed that the majority of the 297 'sheep/goat' bones derive from sheep, and the term 'sheep' will be used on the understanding that a very few (if any) goat bones are subsumed within the term.

2: Only bones or fragments retaining diagnostic anatomical zones were recorded (see Appendix 1). Vertebrae and ribs were recorded if they retained the defined zones, but could not always be identified to species level. Due to the extremely low frequency of other elements identified as horse or red deer, it is highly probable that (almost) all of the cattle-size vertebrae and ribs derive from cattle. Similarly, due to the extremely low frequency of identified roe deer bones, it is highly probable that (almost) all of the sheep-size vertebrae and ribs derive from sheep. Most of the pig vertebrae were identified specifically, but the ribs were recorded as pig-size. The pig-size ribs have been ascribed to taxon on morphological grounds as well as by size, since the size ranges of sheep-size and pig-size ribs overlap (particularly when juveniles of both species are present).

3: Fusion evidence has been recorded as one of four stages:

F: Fused

Fsg: Fusing *ie* the central portion of the epiphysis has begund to fuse with the diaphysis, but there is a gap between them around the outer edge of the bone

Fvis: Fusion line visible *ie* the epiphysis is fully joined onto the diaphysis, but the line of fusion is still visible (although no longer forming a gap)

UF: Unfused *ie* the epiphysis is completely separate from the diaphysis, even if it can be refitted.

For the tables of epiphyseal fusion, unfused counts include unfused diaphyses only (whether or not refittable epiphyses are present). The figure in brackets following the main number is the number of any 'extra' unfused epiphyses that cannot be accounted for by unfused diaphyses.

4: The bird bones will be discussed in detail for Volume 1 as a whole. The bones of domestic geese (which are thought to have been domesticated from wild greylag geese) cannot always be distinguished from bones of wild greylags. Some of the bones recorded in these tables as 'greylag' may, therefore, derive from domestic rather than wild geese. Only those bones that are clearly much larger than those of wild greylag have been recorded as 'domestic'. Further identification of the bird bones is being undertaken by Dr. Enid Allison and will form the basis of a separate Ancient Monuments Laboratory report.

5: The extremely scarce fish bones are being studied by Dr. Rebecca Nicholson and will also form the basis of a separate AML report.

6: The specialist reports will be integrated for the publication volume.

7: All measurements have been taken in accordance with von den Driesch (1976) unless otherwise stated.

The relative numbers of identified specimens from LEL-A

Table 5 presents the distributions of fragments recorded for the presence of anatomical zones. The recording methodology follows that used for Old Grapes lane (Stallibrass, 1992). Fragments retaining zones form a small fraction of the total numbers of fragments, and the species ratios are not strictly comparable with other types of recording, which would have taken too long for the time available. Thus, comparisons with Annetwell Street, for instance, are not strictly valid. For Volume 2 of The Lanes analysis, methods will be

utilised that can link the two systems, to make comparisons feasible. Table 5(i) lists the fragments recovered by hand (N=1757), Table 5(ii) lists the fragments recovered in Carlisle from the sieved samples (N=123, all from Roman deposits) and Table 5(iii) lists the fragments recovered from the fine fractions (N=14, all from Roman deposits).

The hand-recovered collection is heavily dominated by the bones of the three major domestic mammals: cattle, sheep and pigs. If the vertebrae and ribs are included as being from cattle, sheep and pigs, then these three species account for 95% of the total hand-recovered collection; without them, they still comprise 78%. Of the 1081 cattle, sheep and pig bones from the Roman levels (Phases 2-15), cattle bones form 60%, sheep bones 23% and pig bones 17%. If the vertebrae and ribs are included as being from the same taxa, the percentages are identical. For the rest of this report, it is assumed that the cattle-size vertebrae and ribs derive from cattle, that the sheep-size vertebrae and ribs derive from sheep, and that the pig-size vertebrae and ribs derive from pigs. The following ratios, therefore, include counts of vertebrae and ribs.

Table 5(i) shows that there is an increase in the relative importance of cattle compared to sheep between the earlier Roman period (late 1st/early 2nd C) and the middle Roman period (late 2nd/early 3rd C). The ratios change from *56:28:16* (Cattle: Sheep: Pigs, N=717) to *68:13:19* (C:S:P, N=327). In the medieval period (Phases 19-21) the dominance of cattle bones has increased even further, to *75:13:12* (C:S:P, N=433). The intervening phases (phases 17 & 18) which may date anywhere from the 3rd-12th Centuries, have intermediate ratios of *63:15:23* (C:S:P, N=160). These are closer to the Roman figures, but the sample size is small and should be treated with caution.

Splitting the Roman levels up into individual phases also reduces the sample sizes, reducing the reliability of the ratios, but the change noted in the pooled phases becomes even more marked, and the date of the change towards a greater reliance on cattle appears to occur between phase 7 (AD 96-117, *43:37:20*, C:S:P, N=299) and phase 8 (AD 121-160, *78:15:7*, C:S:P, N=268). The scarcity of pig bones in this phase is noticeable. The change noted for phase 8 is sustained in phases 9+10 (late 2nd C, *74:13:13*, C:S:P, N=189), but is reduced again in phases 11-15 (late 2nd/3rd C, *59:13:28*, C;S:P, N=138), although cattle bones are still relatively more important than they were in phases 2-5, 6 and 7. In the very earliest phases (phases 2-5), sheep bones outnumbered those of cattle, very slightly, but the sample size is extremely small (*33:39:28*, C:S:P, N=57), and the ratio is reversed in the next phase (phase 6, *48:29:23*, C:S:P, N+93). The data provided by material studied for Volume 2 of the Lanes project may serve to investigate this phenomenon, and to test whether or not it is a quirk of small sample sizes, or reflects a genuine change through time. King (1978) noted a general increase in the proportion of cattle and concomitant decrease in sheep through time during the Romano-British period.

The effects of recovery method

The effects of recovery bias can be seen by comparing the hand-recovered collection (Table 5(i)) with the material recovered from the sieved samples (Table 5(ii)). Although the proportion of the collections composed of bones from the three major domesticates are extremely similar (97% and 98% for the hand- recovered and sieved collections, respectively), the relative proportions of the three species themselves are significantly different. Figures can only be compared for the late 1st/early 2nd Centuries, since this is the only period for which both collections exist. In the hand-recovered collection, the ratio is 56:28:16% Cattle:Sheep:Pigs (N=717), whereas in the sieved sample, the ratio is 36:38:27% (N=120). It is very clear that the hand-recovered collection is biased towards the larger bones of cattle in preference to smaller bones of both sheep and pigs (even though the ratio in the sieved collection may itself be slightly inaccurate due to the small sample size).

The numbers of identifed bones recovered in the fine fraction are miniscule (N=14) and cannot be used for species ratios. The material does, however, suggest that small bird bones may have been overlooked in both the hand-recovered and sieved collections. Most of the identified mammal bones are loose teeth (mainly incisors, mainly deciduous) and small foot bones (such as juvenile pig sesamoids).

The relative numbers of identified specimens from CAL-A & OBL-B

Table 5(iv) gives the numbers of bones recovered by hand and from sieved samples from CAL-A and OBL-B. All of them derive from late 1st/early 2nd Century deposits. As in the collections from LEL-A, the three domesticates dominate the collections, forming 95% of the total collection of hand-recovered and sieved bones from the two sites. At CAL-A, phase 3 (AD 96-117) the ratio of cattle:sheep:pigs is 62:20:18% in the hand-recovered collection (N=215). The sample size for the sieved collection is extremely small (N=56) but shows the same distribution. It was noticed during recording that context 71 (a deposit) contained a particularly high proportion of cattle bones, which is reflected in the overall percentages combining the material from context 71 with that from context 80 (another deposit).

At OBL-B, nearly all of the bones come from pit 108 and date to AD 121-160. The ratio of cattle: sheep: pigs in the hand-recovered collection is 45:32:21% (N=114). This pit had an unusual collection of bones, including several sheep mandibles and horncores, several cattle scapulae and seven horse bones (probably all from one individual aged 4.5 - 5 years old at death). The species ratio from this pit, therefore, may not be representative of the general material at the site. Although the relative proportion of cattle is unusually low for a hand-recovered collection from the Lanes in this period (and contrasts in particular with the contemporaneous colection from LEL-A phase 8) it still reflects the general trend of cattle>sheep>pigs.

Cattle

Measurements

Detailed analyses of the bone measurements will be undertaken *en bloc* using data from all five sites for the publication report of Volume 1. As preliminary indications of the general size and type of the cattle, calculations of withers heights, measurements of distal metacarpals and measurements of horncore basal diameters are presented here. Linear regression statistics are given for some of the analyses and will be used to compare material from different sites in Carlisle in the overall report for the Lanes Volume 1.

Withers heights

Withers heights have been calculated for all complete long bones using factors given in von den Driesch & Boessneck (1974). The data are presented in Table 6 and Figure 4. There are 14 bones from Roman deposits, 12 of them from the 1st/2nd Century and two from the 2nd/3rd C. The mean withers height for the Roman sample is 1.049 m. (range = 0.933 - 1.208 m; Standard deviation = 0.071). The range is very similar to that seen at Old Grapes Lane, and the mean is also quite close (OGL mean= 1.078 m).

Horncores

A more detailed analysis will be undertaken with the collated material from Volume 1 of The Lanes. Preliminary results are presented in Figures 5 and 6.

The measurements that are used here are: least basal diameter (= von den Driesch's oro-aboral diameter, 45), greatest basal diameter (= von den Driesch's dorso-basal diameter, 46) and outer curvature (= von den Driesch's 47). Figure 5 plots a scattergram of the least against the greatest basal diameter. The 16 Roman measurements fall on a straight line with a high correlation coefficient: r=0.915 with 14 degrees of freedom. The regression slope of least on greatest basal diameter is 0.617 (SE=0.073) and the intercept is 3.92 (SE=3.09). The line has been plotted onto Figure 5.

All of the measurements fall within the usual range for the indigenous Iron Age 'Celtic shorthorn' cattle. There is no separate group of larger horncores as there was in Roman deposits in York (O'Connor, 1988).

The two 12th/13th Century and the two 3rd-12th Century pairs of measurements all lie along the same line within the same range.

Overall, the measurements are similar to those recorded at Old Grapes Lane.

Table 7: Summary statistics for cattle horncore basal measurements

	OGL-A & B (Roman) N=25		LEL-A etc (Roman) N=16	
mean of least basal diameter	32.4 mm	(SD=5.18)	30.0 mm	(SD=3.87)
mean of greatest basal diameter	45.4 mm	(SD=6.67)	42.2 mm	(SD=5.74)

Figure 6 plots the basal diameter index (greatest divided by least) against the length of the outer curvature for the complete horncores (N=7 1st/2nd C; N=3 2nd/3rd C; N=1 3rd-12th C & N=2 12th/13th C). At Old Grapes Lane, the larger sample of Roman horncores (N=17) appeared to form two groups, but this is not the case at LEL-A etc. where many of the outer lengths fill the 'gap' noted in the Old Grapes Lane material. At both sites, the basal diameter index ranges between 1.3 and 1.5 and seems to be independent of length of outer curvature. There are insufficient medieval horncores from LEL-A etc to test for a difference in basal shape between Roman and Medieval cattle horncores.

Metacarpals

At LEL-A, the post-cranial element that had the most numerous measureable examples for cattle is the metacarpal (Roman N=13; 3rd-12th C N=4; Medieval N=6). A further two 1st/2nd C examples derive from CAL-A. Figure 7 is a scattergam plotting the distal breadth at the fusion point on the diaphysis (BFd) against the distal breadth of the epiphysis (Bd). The Roman measurements have a high correlation coefficient: r=0.8943, with 13 degrees of freedom. The regression coefficient of BFd on Bd has a slope of 0.994 (SE=0.138) and an intercept of -4.247 (SE=7.145). Table 8 lists all measurements used in these statistics. Fourteen of the Roman bones have measurements that form a very tight distribution, but one (from LEL-A) is much larger. The bones from Roman levels at Old Grapes Lane showed a very similar pattern of distribution, which may be a reflection of sexual dimorphism. At LEL-A etc. the medieval and 3rd-12th Century material has measurements that fall along the same regression line but which demonstrate a rather different distribution. Further, well-dated, medieval material from the Lanes Volume 3 collections may help to clarify this difference. From LEL-A etc., the sample size is too small for any statistical comparisons to be made.

Only five Roman, one 3rd-12th C and three Medieval cattle metacarpals retain their full length as well as their distal breadth. The data are plotted in Figure 8 which shows that the sample is small and highly variable. Again, these measurements will be collated for the whole of Volume 1, and re-investigated.

Sex ratio

The complete metacarpals were analysed using Howard's (1962) shape indices. Compared to her figures for Bos longifrons ('Celtic shorthorns'), three of the Roman metacarpals from LEL-A etc. are from females and two from males. The indices for the two larger bones lie between Howard's figures for castrates and a bull. In this, extremely small, sample therefore, the suggested sex ratio is 3:2 females: males. The distal breadths (Bd &

BFd) on their own, however, show a continuum of measurements (see Figure 7). Howard's indices indicate that the smallest measurements derive from female bones whilst the larger ones derive from males (no attempt has been made to distinguish between castrates and bulls on the figure). The isolated large bone was not complete and could not be assessed using Howard's system.

Table 9 presents the information regarding measurements and visual assessments of cattle pelves. Only seven pelves could be measured at their acetabular rims. Of these, five are judged to be from females and only two from males. One further bone was assessed by eye for morphological characteristics. This was unfused at the acetabulum, and must derive from a young individual, probably less than about ten months old when it died (Silver, 1969). The visual assessment suggests that this bone may be from a young male, giving an overall ratio of 5:3 females: males, similar to that suggested from the metacarpals.

Dental data.

Figure 9 shows the distributions for Mandibular Wear Scores (MWSs) (Grant, 1982) for cattle alongside the equivalent distributions for sheep and pigs (which will be discussed below).

Only eleven Roman cattle mandibles have complete MWSs (ten from the 1st/2nd C and one from the 2nd/3rd C). Of the 1st/2nd C examples, six come from LEL-A and four from CAL-A. There are no examples from OBL-B. Three mandibles from the 3rd-12th Centuries and three more from the 12th/13th Centuries also have MWSs. There are no obvious pairs of jaws. Figure 9 shows a clear bias towards high scores, with 14 of the scores lying between 36 (when all three molars are in full wear) and 54 (at which stage all three molars are worn down to gum level). There are no MWSs from very young calves, and only three from juveniles (MWS=21/22). These three jaws each has the third lower molar (M_3) either in the bone crypt or half erupted, suggesting that the animals were approximately 2-2.5 years old when they died (Silver, 1969). Ages cannot be ascribed to the other jaws, although it is clear that all of them had been in use for some time since the fourth lower premolar erupted (at *circa* 3 years), and the jaw with a MWS of 54 clearly belonged to an aged animal that would not have been able to chew food for very much longer due to the exceptionally worn state of its teeth.

This small sample shows that the majority of the cattle (in all periods) were kept well into maturity. This suggests either that there was no problem in overwintering livestock, or that juveniles were sent elsewhere for slaughter/fattening. If juveniles had been slaughtered *in situ*, it is likely that primary butchery would also have taken place, leading to the local deposition of their jaws. Whilst the three jaws with MWS of 21/22 may well represent animals slaughtered at the prime age for meat, it is clear that the majority of animals represented by jaws had been kept primarily for other purposes such as breeding, milking or traction before being killed (or suffering natural deaths).

The necessity for jaws to be more or less complete in order for MWSs to be recorded tends to favour the more robust adult jaws in preference to immature mandibles. Using all of the teeth (whether *in situ* or loose) the ratio of deciduous:permanent last lower premolars for the Roman period is 4 dp_4s: 24 P_4s, which confirms the predominance of fully adult jaws. All four of the dp_4s come from 1st/2nd Century deposits at LEL-A. In fact, this ratio reduces slightly the relevant importance of juveniles in the Roman collection, from 18% (using the MWS) to 14%, suggesting that the predominance of mature jaws indicated by the MWSs is genuine, rather than a reflection of any preservation and recovery biases.

Congenital abnormalities

Eighteen Roman cattle mandibles retain the portion that should contain the second lower premolar (P_2). In three mandibles, there is no alveolus present (nor any indication that it has infilled) suggesting that approximately 17% of the individuals congenitally lacked P_2.

One of the 24 Roman lower third molars (M_3s) lacks its third column, whilst another tooth has a reduced third column, together forming 8% of the total. In addition, three of the 24 Roman third molars lack the buccal pillar (12.5%), as do two of the eight Medieval teeth (25%).

An incidental effect of the lack of this pillar is the inability of the tooth wear score for affected M_3s to extend beyond Grant's (1982) stage 'g'. It is probable, therefore, that the high MWSs for cattle jaws are, in fact, *under*estimates of the relative wear stages of some of the jaws. This emphasises even more the importance of elderly animals in this collection.

Fusion data.

Table 10 presents the epiphyseal fusion data for the cattle bones from LEL-A. Material from CAL-A and OBL-B has not been included, due to evidence that certain parts of the skeleton were selectively deposited in the studied contexts, which might lead to a bias in the overal ratios of fusion stages (see below). The fusion evidence from LEL-A confirms the dental evidence suggesting that the majority of the cattle were killed when adult. For the epiphyses that fuse before 3 - 3.5 years in modern cattle (data taken from Silver, 1969), three-quarters (77%) of the examples are fused. In the group that would be expected to fuse at approximately 3.5 - 4 years, this proportion is reduced to 61%. This trend is continued by the last epiphyses to fuse: those of cattle pelves and cattle-sized vertebrae. These epiphyses fuse at about 4.5 - 5 years and only 44% of them are fused. In this group, eleven epiphyses (16%) were in the process of fusing, or still retained the line of fusion, indicating that some of the animals died at about this age.

Figure 10 presents percentage survival curves for cattle, sheep and pigs based on their epiphyseal fusion data. It shows that at least 79% of the cattle bones derive from animals that survived beyond the time at which epiphyseal fusion is complete (*circa* 5 years of age). The shape of the curve suggests that the main period for slaughter (prior to *circa* five years of age) occurred between the ages of 40 - 60 months, with very few bones deriving from animals that died at less than 3 - 3.5 years of age.

This estimation is very similar to the proportions derived from the Mandibular Wear Scores and from the ratio of $dp_4 : P_4$ (see above). This close agreement beteen the methods suggests that the mandibular and post-cranial material may derive from the same animals. This is not always the case, since primary butchery can lead to the deposition of jaws of slaughtered animals whose post-cranial carcases are exported and deposited elsewhere. Analyses of relative frequencies of skeletal parts will be undertaken for the whole of the Volume 1 material, in order to maximise the sample size.

Discussion of cattle bones from OGL A & B

Types:

The Romano-British cattle bones all appear to derive from typical 'Celtic shorthorns': small cattle with small horncores. The horncore and metacarpal measurements are extremely similar to those recorded for Old Grapes Lane.

The few Medieval examples of metacarpals and horncores show greater ranges in size.

Ages:

The dental and epiphyseal fusion data support each other with regard to the age structure of the dead cattle represented at Lewthwaites Lane. Both emphasise the predominance of fully adult animals (approximately three-quarters of the bones derive from mature adults), with no evidence for any young calves, and very little evidence for juveniles.

Comparison with the military sites in Carlisle:

This emphasis on mature cattle contrasts with the evidence from the military sites, where mature adults are roughly equalled in number by sub-adult animals, presumably raised primarily for meat.

On the other hand, the sizes of the animals at the military and civilian sites appear to be very similar. The metrical similarities of the cattle bones will be tested statistically when the whole of The Lanes material is catalogued, to investigate whether or not the bones might have derived from a single population.

The incidences of congenital abnormalities of cattle teeth are very similar to those seen in the military material at Annetwell Street.

Sheep

Measurements

Withers heights

Table 11 and Figure 11 present the evidence for withers heights of sheep, using all fully fused complete long bones and factors given in von den Driesch & Boessneck (1974). For the Roman examples (N=10) the calculated withers heights range from 0.55 - 0.66m with an average of 0.59m. There was only one suitable bone from Medieval deposits. The distribution is very similar to that seen at Old Grapes Lane. All of these bones were identified specifically as deriving from sheep rather than goats.

Metacarpals

The most frequent available pair of measurements for sheep metacarpals at LEL-A is the proximal breadth (Bp) and the proximal depth (Dp). These are plotted as a scattergram in Figure 12 and the measurements are listed in Table 12. There are 14 Roman examples (11 of which date to the 1st/2nd C) and 3 Medieval examples. The correlation coefficient for the Roman sheep measurements is r=0.777 with 12 degrees of freedom. The regression coefficient of Dp on Bp has a slope of 0.627 (SE=0.147) and an intercept of 1.570 (SE=1.937). Most of the bones were identified specifically as sheep. None were identified as goat.

Six of the metacarpals are fused distally and one is unfused. The others are incomplete and their distal fusion status is unknown. The single unfused bone has one of the largest pairs of measurements and may be from a young male.

The two Medieval examples fall within the range of the Roman bones.

Sex ratio

Table 13 presents the measurements of the midshaft diameter of the ilium (SD) and of the acetabular rim height, together with visual assessments of the sex of the sheep pelves. Eight Roman sheep pelves could be measured for rim heights (all from the 1st/2nd C), and these give a good correlation with the visual assessments, suggesting the presence of bones from four ewes, and four probable wethers (male castrates). A ninth pelvis fragment (of an ilium) from1st/2nd C deposits at CAL-A was thought to be from a male due to the length and curve of the ilial shaft. The diameter of the ilial shaft does not appear to correlate with the rim height measurements and may be independent of sex.

Very few fragments of sheep horncore and/or skull were recovered.

Dental data

Figure 9 shows the Mandibular Wear Scores for sheep jaws (Grant, 1982). Twenty-seven Roman mandibles could be scored, twenty-six of them dating to the 1st/2nd Centuries.

Five of these were recovered at OBL-B in pit 108. No sufficiently complete mandibles were recovered from CAL-A. The Roman sheep scores are more widely distributed than those for the cattle jaws, ranging from 3 to 48. All of the dp_4s are from sheep not goats.

Using the tooth eruption data for these jaws in conjunction with Silver's (1969) modern data, the mandible with MWS= 3 derives from a lamb that died before M_1 had fully erupted (*ie*: <3 months). The three MWSs at 11-17 derive from animals that died as M_2 was in the process of forming and erupting. This puts the age at death at approximately 9-12 months. A further ten mandibles have MWSs=20-27, with the M_3 about to erupt, which Silver puts at 18-24 months. The remaining 13 scores of between 30-48 derive from animals that were over 24 months old when they died. Between MWS=30-32, the first two cusps of M3 come into wear. By MWS=35 all three cusps are in wear. This gives a ratio of 14:13 below and above two years of age at death. This ratio is extremely similar to that seen at Old Grapes Lane (21:23). Again, as seen at Old Grapes Lane, there is an emphasis on the death/slaughter of young animals of approximately 18-24 months old. Given a spring birth season, this time of death would have occurred in the animals' second autumn, after they had given one wool clip. It is unlikely, although possible, that some of the females might have given birth to one lamb before they died. The sex ratio of the age groups is, however, unknown.

In the Roman collection there are almost equal numbers of deciduous: permanent last lower premolars (ie: 17 dp_4s: 19 P_4s = 47:53%), reinforcing the evidence from the Mandibular Wear Scores for equal numbers of juveniles and adults (the P_4 erupts at about 2 years).

The single occurrences of MWSs from deposits dating to the 3rd-12th and the 12th/13th Centuries fall within the upper end of the range of scores at 37 and 36 respectively.

Fusion data

Table 14 gives the epiphyseal fusion data for sheep from LEL-A, and the Roman data are plotted as a percentage survival curve in Figure 10. The Medieval data are extremely sparse (N=19 *cf.* N=106) and are not considered further. The Roman collection is small, but is consistent with that recorded at Old Grapes Lane.

In the Roman deposits, there are almost no unfused examples of epiphyses that fuse before 10-16 months (using Silver's modern comparisons, Silver, 1969). But almost one third of the epiphyses in the next group (expected to be fused by 1.5 - 2/2.3 years) are unfused. In the group expected to be fused by 3 - 3.5 years, 60% are unfused, as are 73% of the vertebrae.

The shape of the survival curve in Figure 10 demonstrates the loss of animals in their second year, although this loss is not quite as pronounced as it was in the larger sample from Old Grapes Lane.

Discussion of the sheep bones from OGL A & B

Types:

Very little can be said about the type(s) of sheep represented, except that at least some of the animals were horned.

Ages:

The sheep mandibular and post-cranial data both suggest that there was a steady cull of juvenile animals, and very occasional deaths of very young lambs, but that the majority (approximately two-thirds) of the animals died when fully adult.

The fusion data suggest that two thirds of the sheep survived beyond skeletal maturity at 4-5 years. Yet the Mandibular Wear Scores and the ratio of dp_4s to P_4s both suggested that only half of the sheep survived beyond the age of two years. This discrepancy could be due to random error and small sample sizes, but could also be explained in terms of

preferential slaughter and export of young animals, whose post-cranial bones were deposited elsewhere. This hypothesis will be investigated in the final report on Volume 1 of the Lanes, when data from all of the sites will be pooled, giving a sample that is large enough to investigate reletive frequencies of different skeletal elements. The group of sheep mandibles from OBL-B pit 108 have MWSs of 3, 23, 24, 31 & 31. Three of these would have come from animals of less than two years, and two from animals of just over two years of age when they died. This group, therefore, fits the general pattern for the dental data and cannot be used to explain the discrepancy between dental and fusion evidence.

Although the wear stages do not represent regular periods of time, the application of tooth eruption ages to the scores does suggest that at least some of the younger animals might have been killed during the autumn/winter of their first or second year. Seasonal killing of the adult animals cannot be investigated by this method.

Comparison with the military sites in Carlisle:

The age distribution for sheep is extremely similar to that seen during Period 3 of the fort at Annetwell Street (see Stallibrass, 1991a, Figure 13).

Pigs

Measurements

None of the bones was fully fused, and so no withers heights have been calculated.

Only six lower second molars (M_2s) from Roman deposits are measureable. This sample size is considered too small for analysis. There are no examples of measureable lower third molars (M_3s).

Sex ratio

Lower permanent canine teeth have been used to assess the sex ratio of the pigs in the Roman levels. There are seven male and two female teeth *in situ*, plus a further one male and two female mandibles in which the teeth have fallen out of their alveoli (*post mortem*), giving an overall ratio of 8:4 males:females.

In the medieval layers, there are four mandibles retaining adult male canines.

Dental data

Figure 9 presents a bar graph of the Mandibular Wear Scores for pigs. There is a range of scores from very young piglet (MWS=4) to young adult (MWS=32). There are no scores from mature adults. This emphasises the juvenile ages of the pigs compared to the cattle and sheep. 'Calibrating' the MWSs with Silver's (1969) modern data on tooth eruption, the two Roman mandibles with MWS=4 & 5 have only just acquired the first molar (M_1). This puts the animals at about 4-6 months of age at death. A further two jaws have scores of 8-11 and both have the M_2 visible in the crypt. Silver gives the age of eruption of M_2 as 7-13 months, so these jaws derive from animals that probably had not quite reached one year old when they died. There is a group of four Roman mandibles with MWS=19-27. These all have M_3 visible in its crypt. Silver gives an eruption age for M_3 of 17-22 months. The mandible with WMS=32 has the M_3 up, with the anterior cusps just in wear, suggesting that the pig was about two years old when it died. Pigs are sexually mature at six months, and so it is possible that some of the animals may have been used to produce one or two litters before they died, but there is a notable absence of any mature breeding stock.

The ratio of deciduous: permanent lower last premolars is not suitable for comparing juvenile with adult pigs, since P_4 erupts before M_3 (at 12-16 months). The P_4 is already erupted at MWS=19 in this collection. The ratio of 4 dp_4s: 4 P_4s, therefore, is comparing

animals of either side of one year, rather than juveniles to adults. It correlates exactly with the ratio shown by the Mandibular Wear Scores (4<12: 4>18).

It is interesting to note that at least three of the four deciduous premolars derive from young females, who must have died before the age of one year. They may have been surplus stock, killed for meat, or may have been culled because of failure to get in pig.

The medieval collection is extremely small and only contains one permanent fourth premolar.

Fusion data

Table 15 presents the epiphyseal fusion data for pigs. The pattern of fused and unfused epiphyses contrasts strongly with those for cattle and sheep. Even in the youngest age group (<12 months), 20% of the epiphyses are unfused. This trend continues in the next age group (<2-2.5 years: 65% unfused) and, in the age groups of <3.5 years, all 18 epiphyses are unfused.

Figure 10 presents the percentage survival curves for pigs, compared with those for cattle and sheep. The pig curve shows that animals died throughout the period from birth to skeletal maturity with, perhaps, an emphasis on pigs aged between approximately 12 - 24 months. This pattern fits that shown by the Mandibular Wear Scores. In contrast to the cattle (79% surviving) and sheep (65% surviving), a maximum of only 44% of the pig bones derive from animals that might have survived beyond the age at which their vertebral epiphyses fuse (*circa* 5 years). Since all of the recorded vertebrae are unfused, the actual percentage surviving beyond five years may well be zero, but the fused examples of early-fusing epiphyses cannot be aged precisely.

Discussion of pig bones from OGL A & B

Types:

Due to the small sample sizes of measureable bones or teeth, and to the lack of complete skulls, nothing can be said concerning the types of pigs represented, except that there are no obviously large bones that might appear to derive from wild animals.

Ages:

The pig bones and teeth overwhelmingly suggest the presence of juveniles and sub-adults, with a notable lack of mature breeding stock. At least some of the slaughtered juveniles were females.

Comparison with the military sites in Carlisle:

The pig bones from LEL-A are very similar to those from Annetweel Street.

A NOTE ON SOME OF THE MATERIAL FROM THE FINE FRACTION

The residues from only eight of the bulk samples from LEL-A and four of those from CAL-A have been sorted for small bones in the fine fraction. This precludes the use of this material as a control for recovery bias in the hand-recovered and sieved samples. Occasional fragments were recovered that show typical erosion and polishing caused by passage through a carnivore's gut, but none of the samples had more than one or two examples out of several hundred fragments. As at Old Grapes Lane, some fragments had a black shiny deposit adhering to parts of their surfaces and Huntley (pers. comm.) thinks that this may be due to the presence of bran in the same deposits.

NOTES ON OTHER ASPECTS OF INTEREST

In addition to the bones that could be recorded for epiphyseal fusion evidence, there are occasional bones that derive from very young animals. Unlike the collection from Old Grapes Lane, there were no examples of neonatal animal from LEL-A, CAL-A or OBL-B. The youngest bones appear to derive (judging by their sizes and textures) to derive from young calves, lambs or piglets that were a few weeks old when they died.

The single occurrence of a bear bone is a complete mandible from a post-trench (context 28) in Phase 21A at LEL-A. The length and width of the P_4, M_1, M_2 and M_3 are 12.1 x 6.1; 21.4 x 10.8; 21.8 x 13.2 and 18.6 x 13.5 mm respectively. The length of the tooth row from P_4 - M_3 is 76.0 mm (von den Driesch measurement 8) and the jaw length (von den Driesch measurement 6) is 190 mm. The jaw is from an adult animal, with quite worn M_1 and M_2 but very little wear on the P_4 and M_3. Since the jaw is an isolated find, it is possible that this mandible was a curiousity that had been kept for some time before being deposited amongst otherwise ordinary bone refuse. The date of the deposit is 12th/13th Century. At this time, wild bears were extremely scarce in Britain, and the jaw may have been saved from a captive 'show' bear. There are no signs of any cut marks anywhere on the bone.

Although most of the bones recovered from Lewthwaites lane, Crown & Anchor Lane and Old Bush Lane appear to be ordinary domestic waste and refuse deposits, there are occasional deposits that appear to be more specialised. At LEL-A in phase 19B (12th/13th Century) pit 85 contained several foot bones (metapodials, astragali etc.) of red deer, roe deer and cattle mixed in with more 'ordinary' refuse. In the same phase, surface 87 also contained a horse metapodial plus three cattle astragali mixed in with ordinary refuse. These small concentrations of foot bones from four large species of ungulates may represent waste from a tanners workshop. There were no offcuts of worked bones associated with the collections, and so it is less likely that the bones derive from a bone workshop.

Other unusual deposits have already been noted above, such as the pit (108) at OBL-B that contained large numbers of cattle scapulae and sheep mandibles. Some of the cattle scapulae have been trimmed around the glenoid and/or perforated in the centre of the blade. Both of these patterns of alteration were noted at the military site at Annetwell Street (Stallibrass, 1991a & 1991b) and are thought to relate to processing of meat on scapulae, possibly by smoking. At Annetwell Street, cattle scapulae were far more numerous than any other cattle skeletal element, and are though to have been imported to the site for processing/ready processed. The date of pit 108 (OBL-B phase 6, AD 121-160) is similar to that of the second timber fort at Annetwell Street (AD 105-140). Whether the civilian site at The Lanes supplied such 'processed' meat to the fort will be investigated later for the grouped material for Volume 1, when relative frequencies of skeletal elements are analysed.

It has been noticeable at the Lanes generally that pits are more likely to have 'non-ordinary' collections of bones in them, perhaps suggesting that particularly noxious waste or artisan's waste tended to be disposed of in a different manner to ordinary domestic waste.

A partially complete cattle skull from posthole 639 at LEL-A (phase 4: late 2st C) shows very clear signs of having been poleaxed, indicating not only that it was deliberately slaughtered, but also the method of slaughter.

SUMMARY AND DISCUSSION

This material from excavations at Lewthaites Lane (LEL-A), Crown & Anchor Lane (CAL-A) and Old Bush Lane (OBL-B) forms the second part of the data set that will be available for The Lanes as a whole, and completes the archive for material from the southern group of sites, which will be considered together in Volume 1 of the publication report. The collection considered here is slightly smaller than that from the Old Grapes Lane trenches and tends to confirm the results gained from their analysis (Stallibrass, 1992).

The bulk of the material dates to the 1st and 2nd Centuries AD and is dominated by the bones of the three major British domesticates: cattle, sheep and pigs. The precise ratios of these species are difficult to ascertain due to small sample sizes and the use of three different recovery techniques.

Although cattle bones dominate the hand-recovered collection (as at the military sites in Carlisle), it is difficult to compare the civilian and military collections directly, since a more selective recording technique had to be used at LEL-A etc. in order to cut down on recording time. It would be very valuable if direct comparisons could be made, and this could be done in the future either by recording more details for LEL-A, or by selectively reworking the archive for the other sites. Subjectively, the collections from Lewthwaites Lane etc., as at Old Grapes Lane, appear to have a more even representation of cattle, sheep and pigs than was seen at, for instance, the fort at Annetwell Street. Due to the differences in body size, however, it is probable that cattle still provided more meat than either sheep or pigs.

The ageing analyses for LEL-A etc confirm those for the OGL material. They demonstrate that a difference existed between the military sites, where sub-adult and mature adult cattle were represented in roughly equal proportions, and the civilian site of The Lanes where the cattle bones derive overwhelmingly from mature, if not senile, adults. The sub-adult cattle at the fort were probably killed for meat and may have been supplied to the military rather than raised internally. It is possible that cattle scapulae were processed in the civilian settlement and traded to the military (this will be investigated further). The size and morphology of the cattle bones in the civilian and military areas of Carlisle are very similar, as are the incidences of congenital traits such as the absence of P_2 and the reduction or loss of the third column of M_3. This suggests that the livestock may have had a common origin.

The inter-relatedness of the civilian and military areas of Roman Carlisle is further emphasised by the presence at LEL-A etc.(as at OGL and Annetwell Street) of several cattle long bones that are charred midshaft.

The ageing for sheep bones and jaws suggest that people at LEL-A etc. were breeding and slaughtering their own livestock. Perhaps surprisingly, approximately half of the sheep died when they were less than two years of age. This implies that the people living in the area of The Lanes were able to eat prime young mutton and did not necessarily live off old, tough animals that had outlived any other usefulness. Similarly, the pig bones and teeth are all from young animals. The lack of any indication of mature breeding stock is surprising. Whilst it is possible that people imported young animals/carcases purely for meat, the presence of bones from foetal and neonatal piglets at Old Grapes Lane suggests that the civilians were, in fact, raising their own pigs. Where the bones of the mature animals have been deposited is unknown. The collection of pig bones at the fort was also dominated by young bones.

The preservation conditions at LEL-A etc. were generally excellent for the Roman deposits, but there is a very marked change from waterlogged conditions to much drier conditions at approximately AD 160. Precisely the same change was noted, at the same date, at Annetwell Street, and may relate to regional or local changes in climate and/or water-table. It cannot be explained entirely by changes in construction materials.

The change in preservation type means that most of the medieval material (which forms a minor part of the collection) is poorly preserved. Because of these differences and the small sample size, the medieval material has been recorded but not analysed. Analysis will await the recording of more medieval material from the other sites in The Lanes. Within the medieval collection there is a single bear jaw, which may have been a curiousity kept from a 'dancing' show bear rather than the remains of a hunted wild bear.

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Table 3: Weights of bone, by recovery method

all weights are in g

LEL-A

DATE	PHASE	HAND recovered	SIEVED	FINE FRACTION	TOTALS
late 1st C	2	693	566	-	1259
late 1st C	4	1946	-	-	1946
late 1st C	5	2340	-	-	2340
AD 93-94	6	5861	657	-	6518
AD 96-117	7	13820	1864	35.8	15720
AD 121-160	8	18412	1076	28.9	19517
late 2nd C	9	3661	-	-	3661
late 2nd C	10	8597	-	-	8597
2nd-3rd C	11	1347	-	-	1347
2nd-3rd C	12	4154	-	-	4154
2nd-3rd C	13	1070	-	-	1070
2nd-3rd C	14	315	-	-	315
2nd-3rd C	15	218	-	-	218
2nd-3rd C	16	10	-	-	10
3rd-12th C	17	712	-	-	712
3rd-12th C	18	9308	-	-	9308
12th/13th C	19	13513	-	7.8	13521
12th/13th C	20	2440	-	-	2440
12th/13th C	21	6391	-	70.6	6462
post-medieval	22	1643	-	-	1643

CAL-A

late 1st C	2	128	-	-	128
AD 96-117	3	10596	2276	53.2	12925

OBL-B

late 1st C	2	0	18	-	18
AD 121-160	6	7722	936	-	8658

Table 4: Weights of bones from LEL-A by period and preservation type

PHASE & DATE		EXCELLENT		GOOD		BRITTLE		SHOT		TOTALS	
		g.	%	g.	%	g.	%	g.	%	g.	%
2-6	late 1st C	11920	12%	143	0.1%	-	-	-	-	12063	12%
7	AD 96-117	13847	14%	1873	2%	-	-	-	-	15720	16%
8	AD 121-160	16121	16%	1465	1%	1730	2%	201	0.2%	19517	19%
9.10	late 2nd C	1998	2%	6508	6%	3629	4%	123	0.1%	12258	12%
11-16	late 2nd/3rd C	333	0.3%	1940	2%	4836	5%	5	0%	7114	7%
17.18	3rd - 12th C	-	-	88	0.1%	9932	10%	-	-	10020	10%
19-21	12th/13th C	-	-	130	0.1%	20675	21%	1617	1.6%	22422	22%
22	post-medieval	-	-	-		1443	1%	200	0.2%	1643	2%
	TOTALS	44219	44%	12147	12%	42245	42%	2146	2%	100757	

Table 5(i): Distribution of bones recovered by hand from LEL-A

DATE	late 1st/ early 2nd	late 2nd /3rd	3rd-12th	12th/13th	post-med	
PHASE	2 - 8	9-15	17,18	19,20,21	22	TOTALS
SPECIES						
CATTLE	321	180	82	272	28	883
SHEEP/GOAT	115	26	14	41	7	203
SHEEP	38	13	5	6	1	63
PIG	92	48	30	44	3	217
CATTLE-SIZED	83	41	19	51		194
SHEEP-SIZED	46	4	5	10	1	66
PIG-SIZED	22	15	5	9	1	52
HORSE		2	2	7	3	14
DOG	5	4		2		11
RED DEER	2	5	2	9		18
ROE DEER	4	1		1		6
BEAR				1		1
BADGER	1					1
FOWL	9	1	1	7		18
FOWL-SIZED	1					1
GOOSE, Anser			1	2		3
GOOSE, Branta	2					2
GOOSE, DOMESTIC				1		1
GOOSE, SMALL	1					1
GOOSE-SIZED					1	1
SWAN-SIZED				1		1
WOODCOCK					1	1
TOTALS	742	340	166	464	46	1758

Table 5(ii): bones recovered from sieved samples from LEL-A

(all date to the late 1st/early 2nd C)

DATE (AD):	late 1st C		93/4	97-117	121-160	Totals
PHASE:	2	4	6	7	8	
CATTLE	6		2	12	16	36
SHEEP/GOAT	6			24	2	32
SHEEP	1	1		1	1	4
PIG	4		2	23		29
CATTLE-SIZED			1	5	1	7
SHEEP-SIZED				7	2	9
PIG-SIZED				2	1	3
FOWL				3		3
Totals	17	1	5	77	23	123

Table 5(iii): bones recovered from fine fractions from LEL-A

PHASE	7	8
	AD 96-117	AD 121-160
SHEEP/GOAT	2	
PIG	4	
SHEEP-SIZED	1	1
DUCK *cf* mallard		1
PASSERINE*	1	
BIRD	4	

PASSERINE* carpometacarpus of a bird slightly smaller than a redwing but slightly larger than a meadow pipit or wheatear.

The sample from LEL-A phase 7 is from deposit 550, and that from phase 8 is from pit 530. No other samples produced identifiable material.

From CAL-A, the fine fraction from a sample from deposit 71 (phase 3B, AD 96-117) produced three incisors from a dog and two right mandibles of *Apodemus* sp. (woodmouse or yellow-necked mouse).

Table 5(iv): Distribution of bones recovered by hand and from sieved samples from CAL-A and OBL-B

SITE:	CAL-A		CAL-A		OBL-B	OBL-B	
PHASE:	3		6		2	6	
DATE:	AD 96-117		AD 121-160		late 1st C	AD 121-160	
RECOVERY:	by hand	sieved	by hand	sieved	sieved	by hand	sieved
SPECIES							
CATTLE	108	27	1		1	40	3
SHEEP/GOAT	21	7	4	1	2	26	
SHEEP	12	2	2			3	
PIG	38	8	2			17	2
CATTLE-SIZED	25	7				11	
SHEEP-SIZED	10	5				8	
PIG-SIZED	1					7	
HORSE	2					7	
DOG	2	2					
RED DEER	1						
ROE DEER	1						
BIRD	1						
TOTALS	222	58	9	1	3	119	5

Table 6: Cattle withers heights from LEL-A, CAL-A & OBL-B

measurements are as defined by von den Driesch (1976)

SITE	PHASE		DATE (Century AD)	ELEMENT	FUSION		GL (in mm)	factor	WITHERS HEIGHT (in m)
LELA	2	C	1/2	Metacarpal	PF	DF	153	6.1	0.933
LELA	8	E	1/2	Metatarsal	PF	DFvis	184	5.4	0.993
LELA	5		1/2	Metatarsal	PF	DF	186	5.4	1.004
CALA	3	A	1/2	Metacarpal	PF	DF	165	6.1	1.006
OBLB	6		1/2	Radius	PF	DF	236	4.3	1.014
LELA	4		1/2	Metacarpal	PF	DF	168	6.1	1.024
LELA	6	A-E	1/2	Metatarsal	PF	DF	191	5.4	1.031
LELA	6	A-E	1/2	Metatarsal	PF	DF	192	5.4	1.036
LELA	6	A-E	1/2	Metatarsal	PF	DF	198	5.4	1.069
LELA	6	A-E	1/2	Tibia	PF	DF	322	3.45	1.110
CALA	3	A	1/2	Metacarpal	PF	DF	184	6.1	1.122
LELA	8	E-F	1/2	Humerus	PF	DF	(GLC)240	4.77	1.144
LELA	10	B	2/3	Metacarpal	PF	DF	161	6.1	0.982
LELA	12	B	2/3	Radius/ulna	PF	DFsg	281	4.3	1.208
LELA	18		3-12	Metacarpal	PF	DF	191	6.1	1.165
LELA	18		3-12	Metatarsal	PF	DF	219	5.4	1.182
LELA	19	B	12/13	Metacarpal	PF	DF	170	6.1	1.037
LELA	21	B	12/13	Metatarsal	PF	DF	203	5.4	1.096
LELA	19	B	12/13	Metacarpal	PF	DF	182	6.1	1.110
LELA	21	B	12/13	Metatarsal	PF	DF	212	5.4	1.144
LELA	21	B	12/13	Metacarpal	PF	DF	202	6.1	1.232

	all Roman	1st/2nd C
N	14	12
average	1.049	1.041
minimum	0.933	0.933
maximum	1.208	1.208
Standard Deviation	0.071	0.058

Table 8: Measurements for cattle metacarpals used in statistical analyses and Figures 7 & 8

all measurements are in mm.

SITE	PHASE	DATE	distal breadth Bd	distal breadth at fusion point BFd	greatest length GL	Index 1 Bd*100 /GL	Index 2 SD*100 /GL
LEL-A	2	1st/2nd C	53.7	48.5	153	35.1	20.5
LEL-A	4	1st/2nd C	50.3	44.1	168	29.9	14.9
LEL-A	5	1st/2nd C	50.7	45.7			
LEL-A	7	1st/2nd C	46.7	44.1			
LEL-A	7	1st/2nd C	49.5	46.4			
LEL-A	7	1st/2nd C	52.9	47.3			
LEL-A	7	1st/2nd C	51.4	46.3			
LEL-A	7	1st/2nd C	58.0	56.9			
LEL-A	8	1st/2nd C	48.6	42.4			
CAL-A	3	1st/2nd C	47.3	43.8	165	28.7	16.1
CAL-A	3	1st/2nd C	53.4	50.0	184	29.0	17.0
LEL-A	10	2nd/3rd C	54.4	49.6			
LEL-A	10	2nd/3rd C	55.3	48.1	161	34.3	18.4
LEL-A	11	2nd/3rd C	49.3	45.0			
LEL-A	12	2nd/3rd C	54.3	49.1			
LEL-A	18	3rd-12th C	49.8	46.6			
LEL-A	18	3rd-12th C	61.6	52.5			
LEL-A	18	3rd-12th C	50.0	47.4			
LEL-A	18	3rd-12th C	64.2	56.6	191	33.6	19.5
LEL-A	19	12th/13th C	46.9	42.5			
LEL-A	19	12th/13th C	57.2	50.5			
LEL-A	19	12th/13th C	58.2	51.7			
LEL-A	19	12th/13th C	49.1	44.8	170	28.9	14.5
LEL-A	19	12th/13th C	55.2	51.9	182	30.3	18.0
LEL-A	21	12th/13th C	64.6	61.2	202	32.0	17.9

Summary statistics for Roman bones only:
(using all available measurements)

	Bd	BFd	GL
N	15	17	5
average	51.7	46.2	166
minimum	46.7	35.4	153
maximum	58.0	56.9	184
standard deviation	3.08	4.32	10.23

Table 9: Cattle pelvis measurements from LELA-A, OBL-B and CAL-A

SITE	PHASE	DATE (Century)	fusion of acetabulum	SD (in mm)	RIM HEIGHT (in mm)	visual identification of sex
LEL-A	8 C	1st/2nd		37.1		
LEL-A	8 C	1st/2nd	AF	38.0		
LEL-A	8 D	1st/2nd	AF	36.1		
LEL-A	8 E	1st/2nd	AF	44.4		
LEL-A	10 A	2nd/3rd	AF	31.2		
LEL-A	10 A	2nd/3rd	AF	32.9		
LEL-A	10 B	2nd/3rd	AF	38.3		
LEL-A	10 B	2nd/3rd		40.8		
LEL-A	12 A	2nd/3rd		31.7		
LEL-A	20	12th/13th		28.5		
LEL-A	20	12th/13th	AF	37.3		
OBL-B	6	1st/2nd	AUF	29.7		MALE?
LEL-A	8 C	1st/2nd	AF	36.2	5.2	FEMALE
LEL-A	8 D	1st/2nd	AF		6.1	FEMALE
LEL-A	7 A	1st/2nd	AF		8.5	FEMALE
LEL-A	8 D	1st/2nd	AF		12.4	FEMALE
LEL-A	7 A	1st/2nd	AF		12.8	FEMALE
LEL-A	6 A	1st/2nd	AF		22.0	MALE
CAL-A	3 B	1st/2nd	AF		27.7	MALE

Key

AF	ACETABULUM FUSED
AUF	ACETABULUM UNFUSED
SD	MIDSHAFT DIAMETER OF ILIUM

TABLE 10: LEL-A: CATTLE EPIPHYSEAL FUSION DATA

	ROMAN				MEDIEVAL			
	F	Fsg	Fvis	UF(ep)	F	Fsg	Fvis	UF(ep)
7 - 10 mths								
scapula tub.	22	-	-	-	3	-	-	-
acetabulum	28	-	-	-	8	-	-	-
TOTALS	50				11			
12 - 18 mths								
humerus d.	14	-	-	1	8	-	-	-
radius p.	16	-	-	1	5	-	-	-
1st phalange p.	16	-	-	2	7	-	-	-
2nd phalange p.	6	-	-	-	2	-	-	-
TOTALS	52			4	22			
2 - 2.5 /3 yrs								
tibia d.	8	1	1	2	2	-	-	-
metacarpal d.	13	-	-	1	5	-	-	1
metatarsal d.	12	-	1	3	5	1	-	-
TOTALS	33	1	2	6	12	1		1
3 - 3.5 yrs								
calcaneum	4	-	-	1	2	1	-	1
femur p.	13	1	3	-(3)	4	-	-	-
TOTALS	17	1	3	1(3)	6	1		1
3.5 - 4 yrs								
humerus p.	6	-	1	-	-	-	-	-
radius d.	10	1	2	2	1	-	-	2
ulna p.	1	-	-	-	-	-	-	-
ulna d.	-	-	-	2	-	-	-	-
femur d	6	2	-	5(1)	1	-	-	1(1)
tibia p.	-	-	-	-	1	-	-	-
TOTALS	23	3	3	9(1)	3			3(1)
4.5 - 5 yrs								
pelvis: pubis	1	1	-	1	-	-	-	-
pelvis: ischium	1	-	-	-	-	-	-	-
vertebrae (p/d)	28	6	4	26(2)	9	5	-	17(1)
TOTALS	30	7	4	27(2)	9	5	-	17(1)

Table 11: Sheep withers heights from LEL-A & CAL-A

(all bones were specifically identified as sheep)

measurements are as defined by von den Driesch (1976)

SITE	PHASE		DATE (Century AD)	ELEMENT	FUSION		GL (in mm)	factor	WITHERS HEIGHT (in m)
LELA	5		1/2	Metacarpal	PF	DF	116	4.89	0.567
LELA	6	D	1/2	Metacarpal	PF	DF	126	4.89	0.616
LELA	6	D	1/2	Metacarpal	PF	DF	126	4.89	0.616
LELA	7	A	1/2	Metacarpal	PF	DF	116	4.89	0.567
LEL-A	7	A	1/2	Metacarpal	PF	DF	128	4.89	0.626
LELA	10	B	2/3	Metacarpal	PF	DF	114	4.89	0.557
LELA	8	C	1/2	Metatarsal	PF	DF	145	4.54	0.658
CALA	3	A	1/2	Metatarsal	PF	DF	129	4.54	0.586
LELA	10	A	2/3	Metatarsal	PF	DF	127	4.54	0.577
LELA	10	B	2/3	Metatarsal	PF	DF	121	4.54	0.549
LELA	18		3-12	Metatarsal	PF	DF	136	4.54	0.617

all Roman

N	10
average	0.592
minimum	0.549
maximum	0.658
Standard Deviation	33.51

Table 12: Sheep metacarpal measurements from LEL-A & CAL-A

(no bones were specifically identified as goat)

measurements are as defined by von den Driesch (1976)
and are given in mm

SITE	PHASE		DATE (Century AD)	FUSION		Bp	Dp	Bd
LEL-A	5		1/2	PF	DF	19.1	13.4	21.0
LEL-A	6	C	1/2	PF		20.6	14.0	
LEL-A	6	D	1/2	PF	DF	21.3	15.3	24.2
LEL-A	6	D	1/2	PF	DF	21.4	15.3	24.0
LEL-A	7	A	1/2	PF	DF	20.7	15.5	22.9
LEL-A	7	A	1/2	PF	DF	21.6	15.0	24.2
LEL-A	8	C	1/2	PF	DUF	20.8	15.5	
LEL-A	8	D	1/2	PF		20.4	14.9	
LEL-A	8	F	1/2	PF		21.8	14.9	
CAL-A	3	A	1/2	PF		18.4	12.9	
CAL-A	3	A	1/2	PF		20.0	14.2	
LEL-A	10	B	2/3	PF	DF	18.2	14.1	
LEL-A	11		2/3	PF		21.3	16.7	
LEL-A	11		2/3	PF		22.4	15.9	
LEL-A	20		12/13	PF		20.6	14.4	
LEL-A	21		12/13	PF		21.6	16.4	

Summary statistics for Roman sheep metacarpals
(using all available measurements):

	Bp	Dp	Bd
N	16	14	6
average	20.4	14.8	23.2
minimum	18.2	12.9	21.0
maximum	22.4	16.7	24.2
Standard Deviation	1.23	0.98	1.15

Table 13: Sheep pelvis measurements from LEL -A, OBL-B and CAL-A

SITE	PHASE	DATE (Century)	fusion of acetabulum	SD (in mm)	RIM HEIGHT (in mm)	visual identification of sex
LEL-A	7 A	1st/2nd	AF	10.9		
LEL-A	7 A	1st/2nd	AF	12.1		
LEL-A	7 A	1st/2nd	AF	13.1		
LEL-A	11	2nd/3rd		13.2		
LEL-A	18	3rd-12th		15.8		
LEL-A	21 B	12th/13th	AF	17.6		
LEL-A	7 A	1st/2nd	AF	13.5	2.1	FEMALE
LEL-A	6C-7A	1st/2nd	AF	13.2	2.2	FEMALE
LEL-A	7 B	1st/2nd	AF	13.2	3.1	FEMALE
LEL-A	2 C	1st/2nd	AF		3.2	FEMALE
LEL-A	5	1st/2nd	AF	12.8	5.0	CASTRATE?
LEL-A	7 A	1st/2nd	AF	14.0	5.4	CASTRATE?
LEL-A	7 A	1st/2nd	AF	12.6	5.5	CASTRATE?
LEL-A	5	1st/2nd	AF	14.2	6.1	CASTRATE?
CAL-A	3 A	1st/2nd		14.5		MALE?
LEL-A	19 B	12th/13th	AF	12.9	3.2	FEMALE

Key

AF ACETABULUM FUSED
SD MIDSHAFT DIAMETER OF ILIUM

TABLE 14: SHEEP EPIPHYSEAL FUSION DATA

	ROMAN				MEDIEVAL			
	F	Fsg	Fvis	UF(ep)	F	Fsg	Fvis	UF(ep)
6 - 10 mths								
scapula tub.	8	-	-	-	2	-	-	-
acetabulum	15	-	-	-	4	-	-	-
TOTALS	23				6			
10 - 16 mths								
humerus d.	5	-	1	1	5	1	-	1
radius p.	7	-	-	-	-	-	-	-
1st phalange p.	-	-	-	1	-	-	-	-
2nd phalange p.	-	-	-	-	-	-	-	-
TOTALS	12			2	5	1		1
1.5 - 2 /2.3 yrs								
tibia d.	7	-	2	3	-	-	-	-
metacarpal d.	5	-	-	3	1	-	-	-
metatarsal d.	4	-	-	2	-	-	-	-
TOTALS	16		2	8	1	-	-	-
2.5 - 3 yrs								
ulna p.	-	1	-	1	1	-	-	-
ulna d.	-	-	-	-	-	-	-	-
calcaneum	3	-	-	-	-	-	-	-
femur p.	-	1	-	1	-	-	-	-
TOTALS	3	2		2	1	-		
3 - 3.5 yrs								
humerus p.	-	-	-		-	-	-	-
radius d.	2	-	-	3	1	-	-	1
pelvis: pubis	-	1	-	1	-	-	-	-
pelvis: ilium	1	-	-	-	-	-	-	-
pelvis: ischium	-	-	-	-	-	-	-	-
femur d	-	-	-		-	-	-	-
tibia p.	-	-	-	2	-	-	-	-
TOTALS	3	1		6	1	-	-	1
4 - 5 yrs								
vertebrae (p/d)	5	1	1	19	-	-	-	2
TOTALS	5	1	1	19				2

TABLE 15: PIG EPIPHYSEAL FUSION DATA

	ROMAN				MEDIEVAL			
	F	Fsg	Fvis	UF(ep)	F	Fsg	Fvis	UF(ep)
12 mths								
scapula tub.	4	2	-	1	-	-	-	-
humerus d.	3	-	1	2	-	-	-	1
radius p.	3	-	-	1	-	-	-	-
acetabulum	8	-	-	2	2	-	-	-
2nd phalange p.	2	1	-	-	-	-	-	-
TOTALS	20	3	1	6	2			1
2 - 2.5 yrs								
metacarpal d.	3	-	2	4	1	-	-	2
metatarsal d.	2	-	-	7	-	-	-	2
tibia d.	1	-	-	3(1)	-	-	-	1
fibula d.	-	-	-	1(2)	-	-	-	-
calcaneum	-	-	-	1	-	-	-	2
1st phalange p.	1	-	-	1	-	-	-	-
TOTALS	7		2	17(3)	1			7
3.5 yrs								
humerus p.	-	-	-	1	-	-	-	-
radius d.	-	-	-	2	-	-	-	-
ulna p.	-	-	-	3	-	-	-	1
ulna d.	-	-	-	1	-	-	-	-
femur p.	-	-	-	-(1)	-	-	-	-
femur d	-	-	-	1	-	-	-	-(1)
tibia p.	-	-	-	1	-	-	-	-
fibula p.	-	-	-	-	-	-	-	-
TOTALS				9(1)				1(1)
4 - 7 yrs								
pelvis: pubis	-	-	-	-	-	-	-	-
pelvis: ischium	-	-	-	2	-	-	-	-
vertebrae (p/d)	-	-	-	7	-	-	-	-
TOTALS				9				

FIGURE 1: The situation of The Lanes in Carlisle.

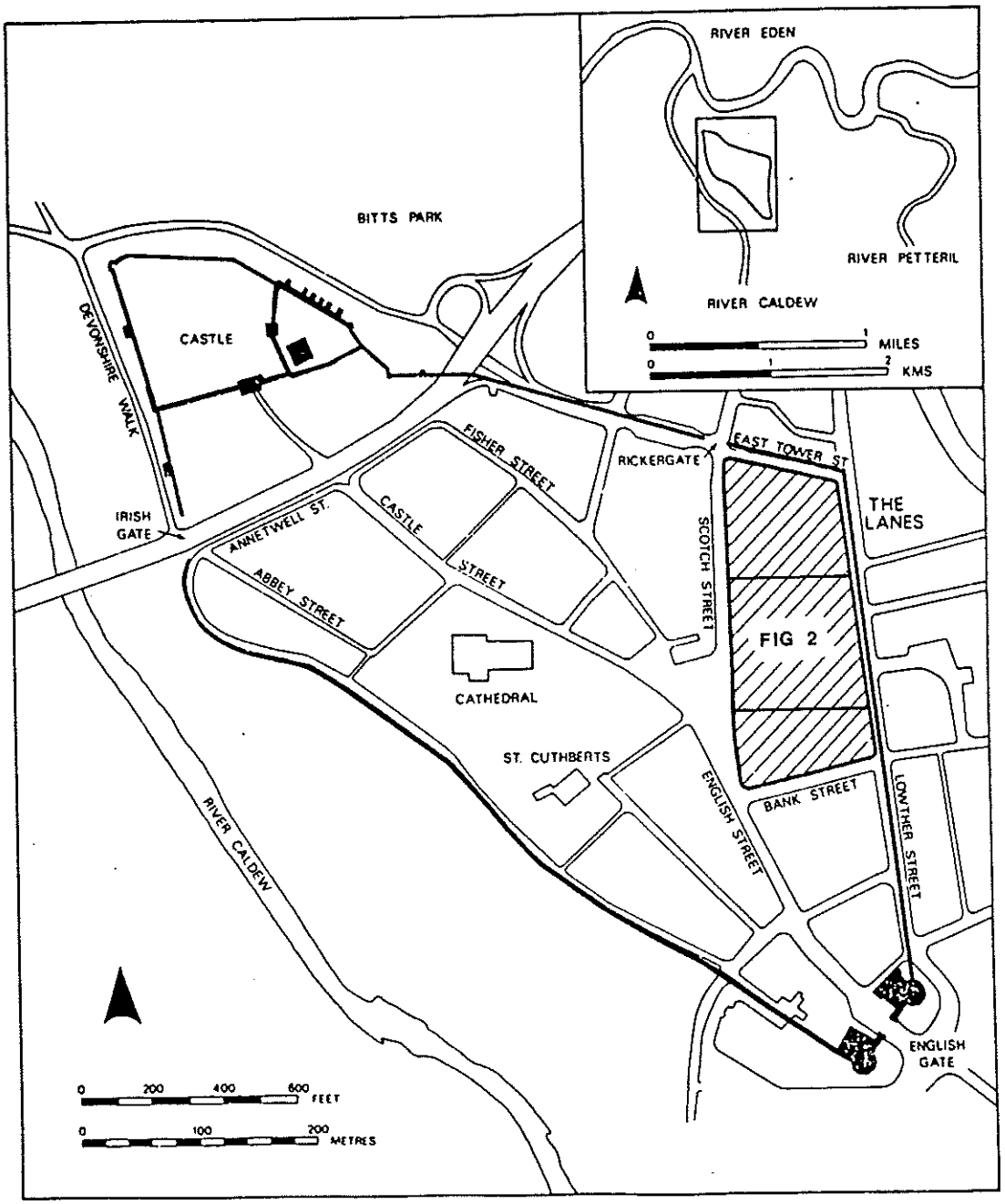


FIGURE 2: The southern group of excavation trenches in The Lanes.

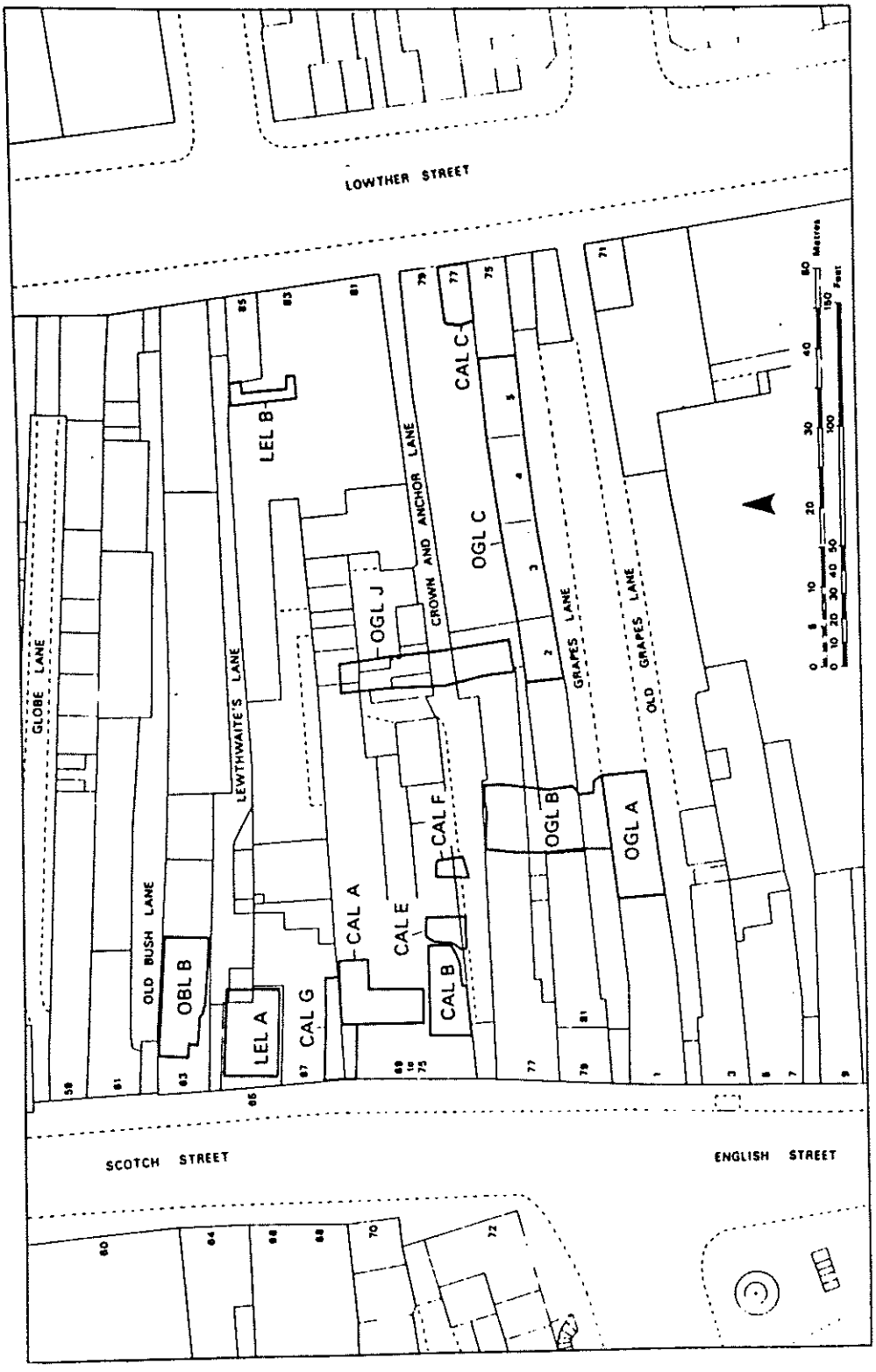


FIGURE 3: Roman remains recovered from Carlisle.

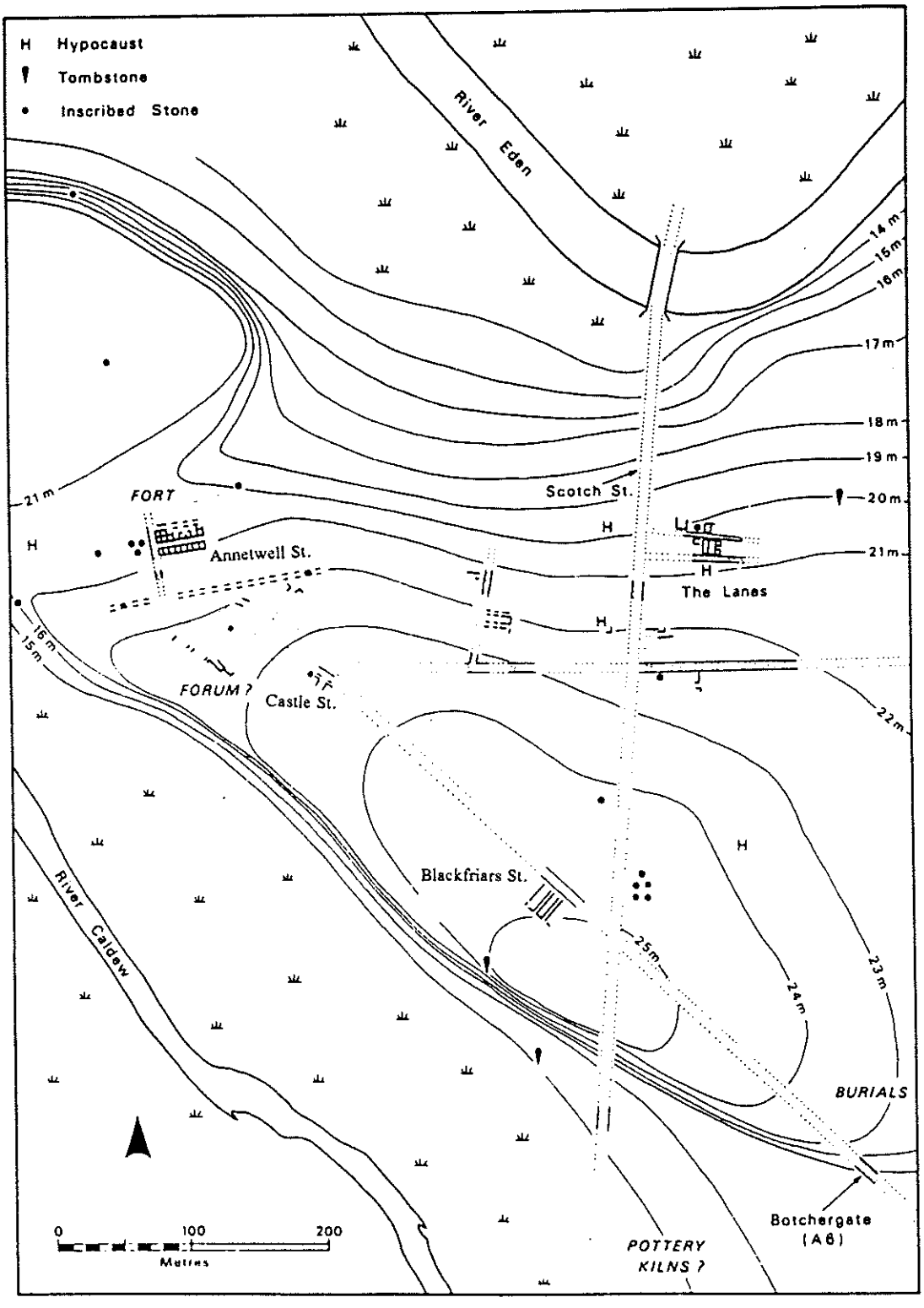


FIGURE 4: Bar graph of cattle withers heights.

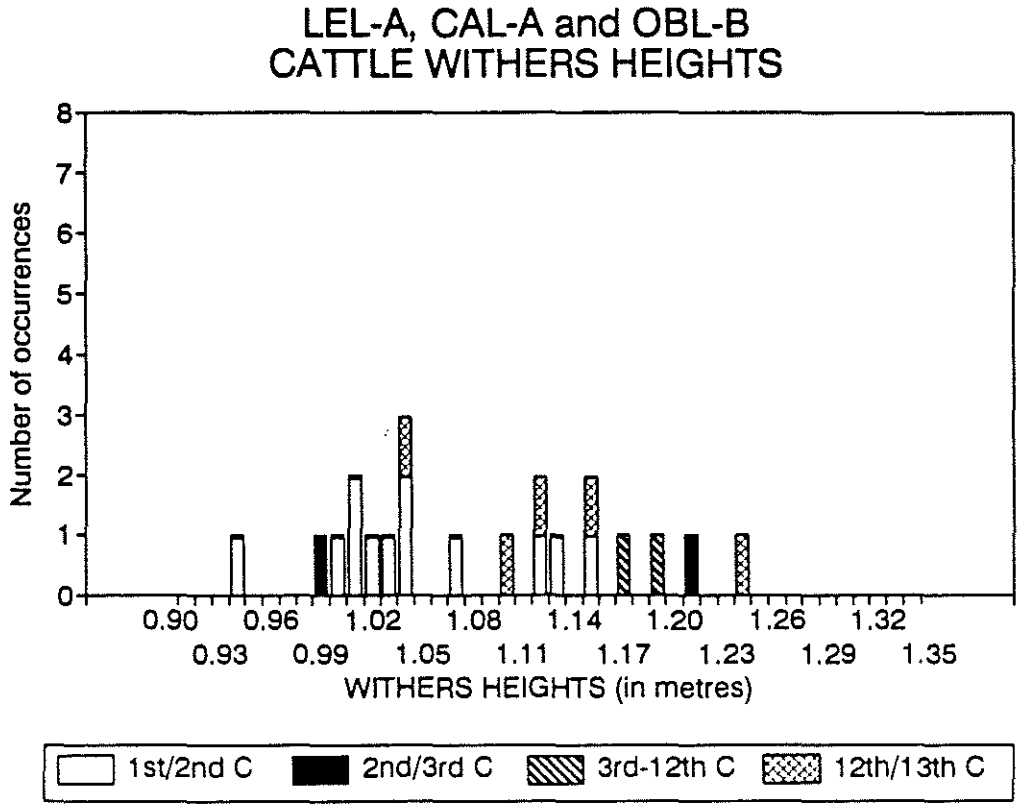


FIGURE 5: Scattergram of cattle horncore measurements: greatest and least basal diameters.

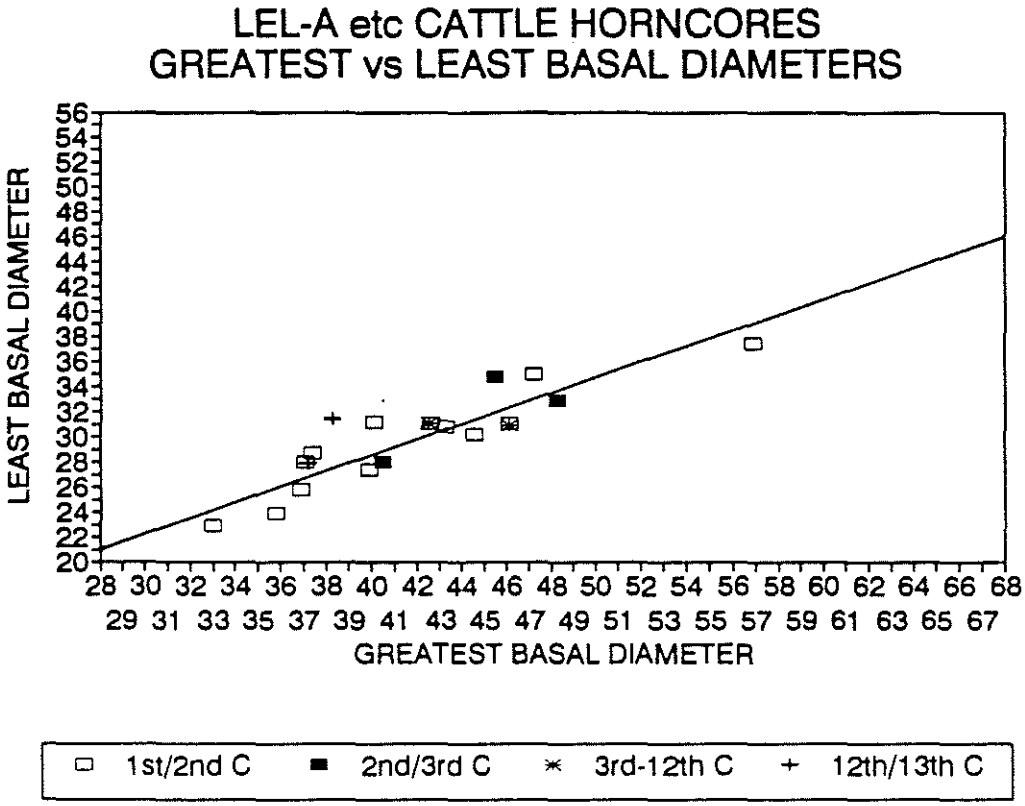


FIGURE 6: Scattergram of cattle horncore measurements: length of outer curvature against basal diameter index.

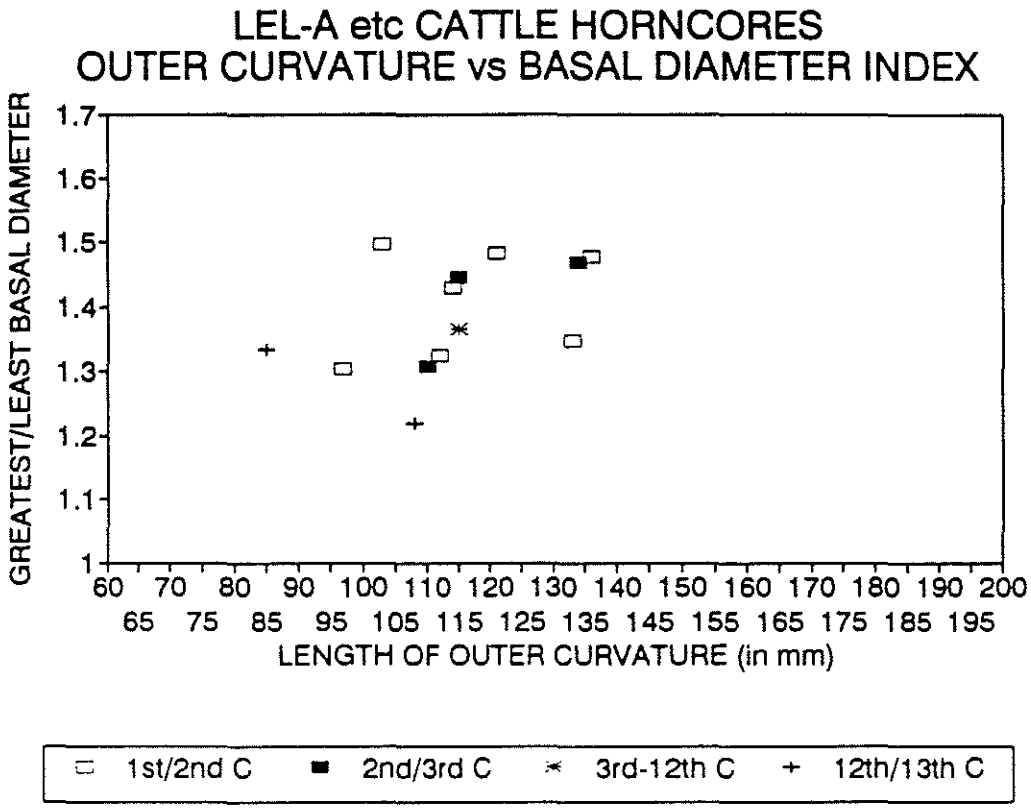


FIGURE 7: Scattergram of cattle metacarpal distal breadth (Bd) and distal breadth at fusion point (BFd) measurements.

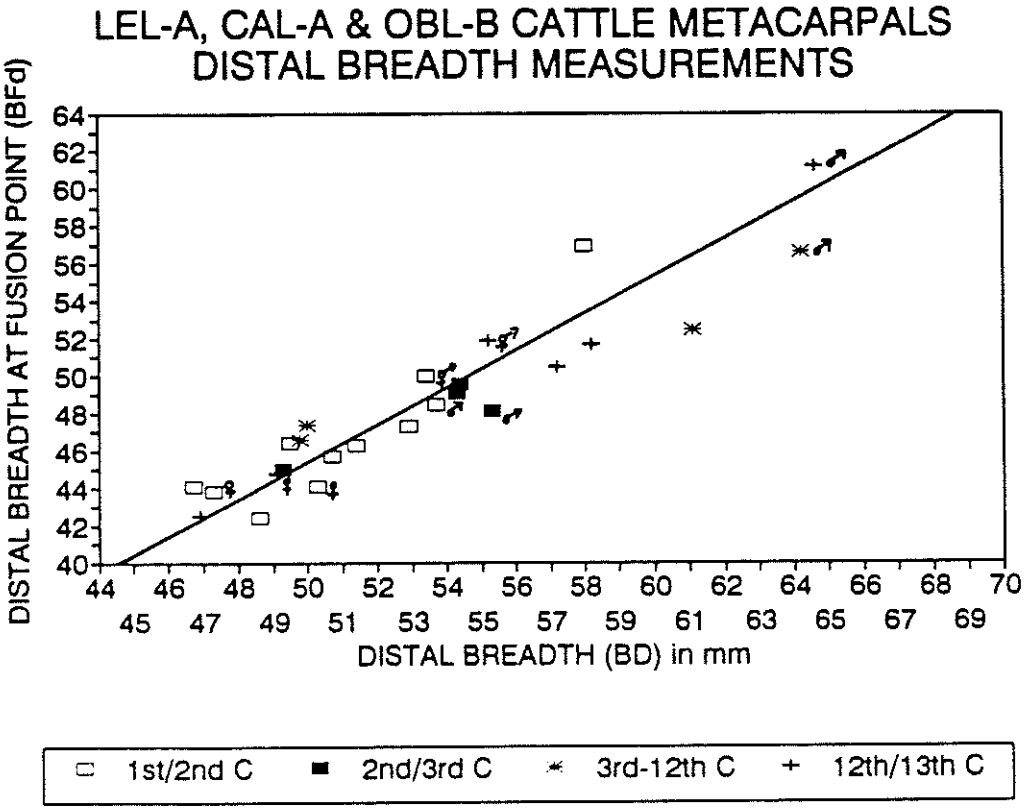


FIGURE 8: Scattergram of cattle metacarpal distal breadth (Bd) and greatest length (GL) measurements.

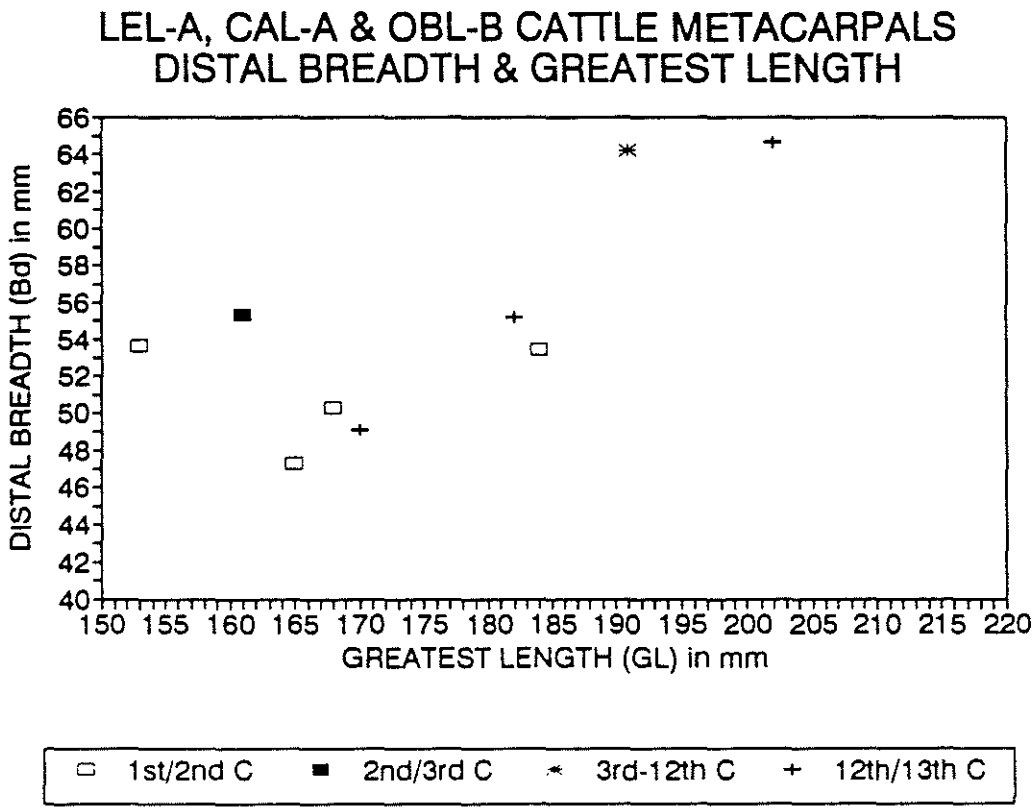
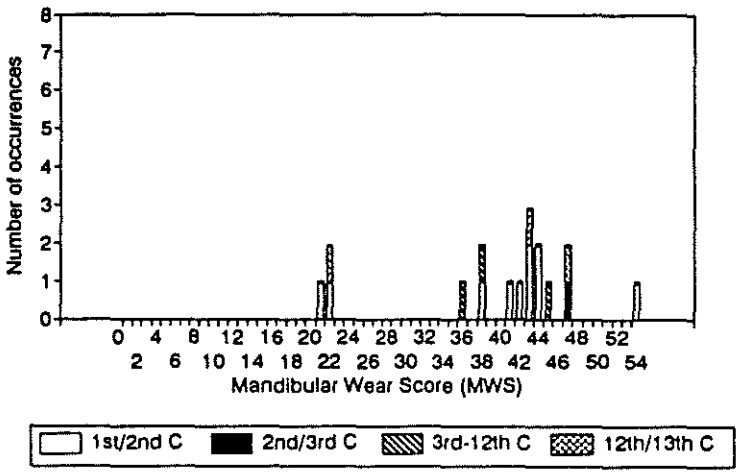
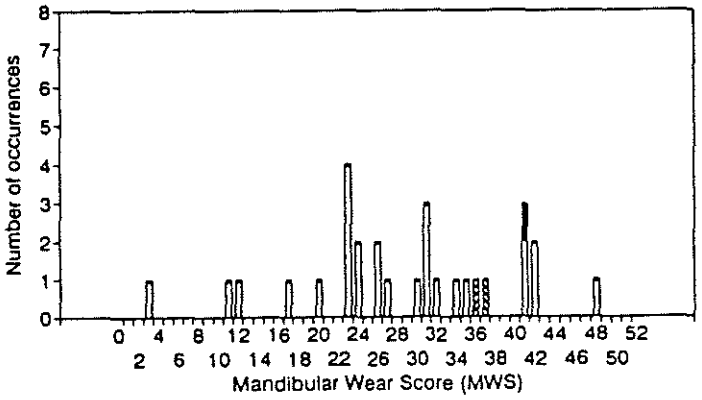


FIGURE 9: Bar graphs of cattle, sheep and pig Mandibular Wear Scores (MWSs).

LEL-A etc CATTLE MANDIBULAR WEAR SCORES (MWS) sensu Grant 1982



LEL-A etc SHEEP MANDIBULAR WEAR SCORES (MWS) sensu Grant 1982



LEL-A etc PIG MANDIBULAR WEAR SCORES (MWS) sensu Grant 1982

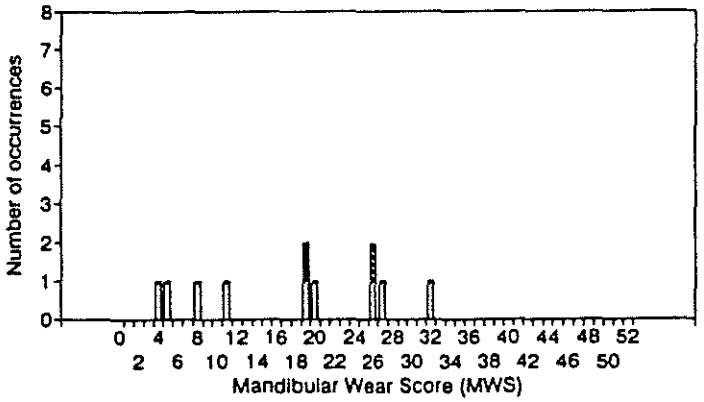


FIGURE 10: Percentage survival curves for cattle, sheep and pigs, based on epiphyseal fusion data (Roman only).

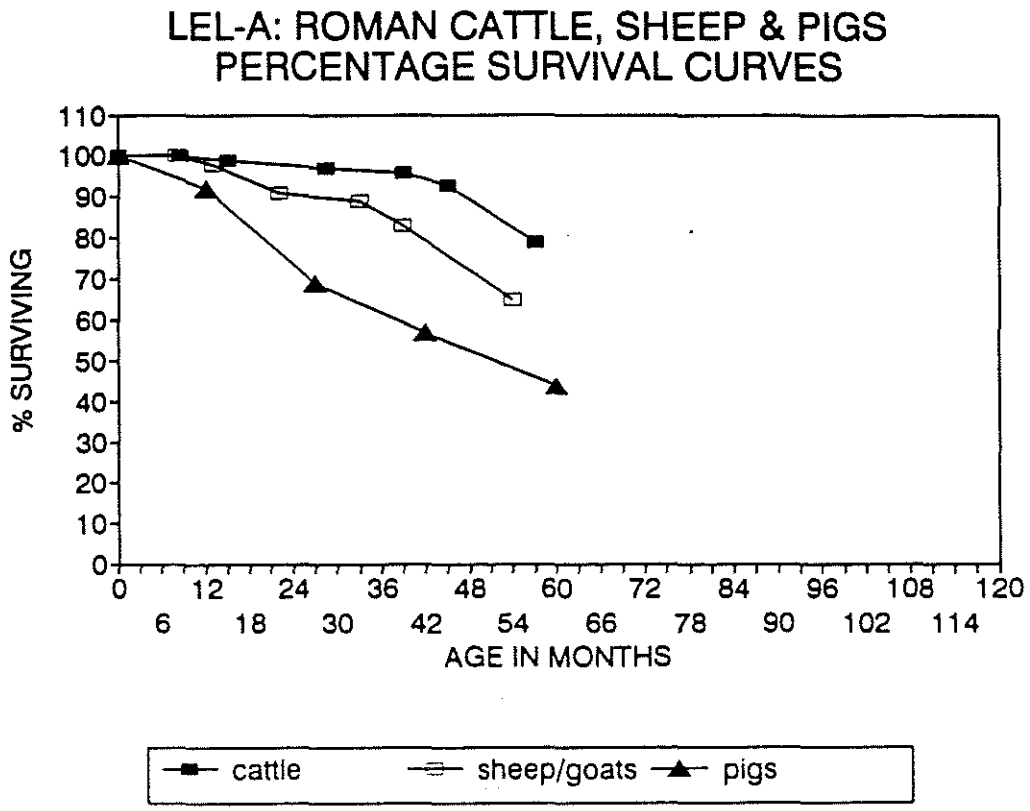


FIGURE 11: Bar graph of sheep withers heights.

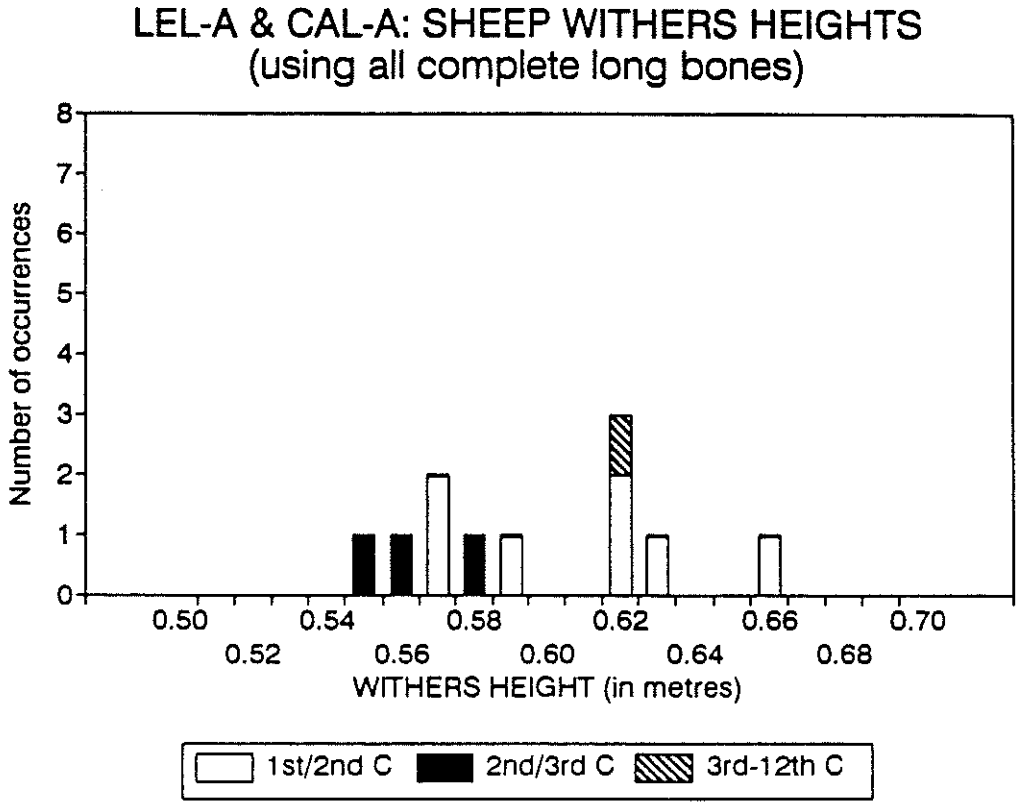
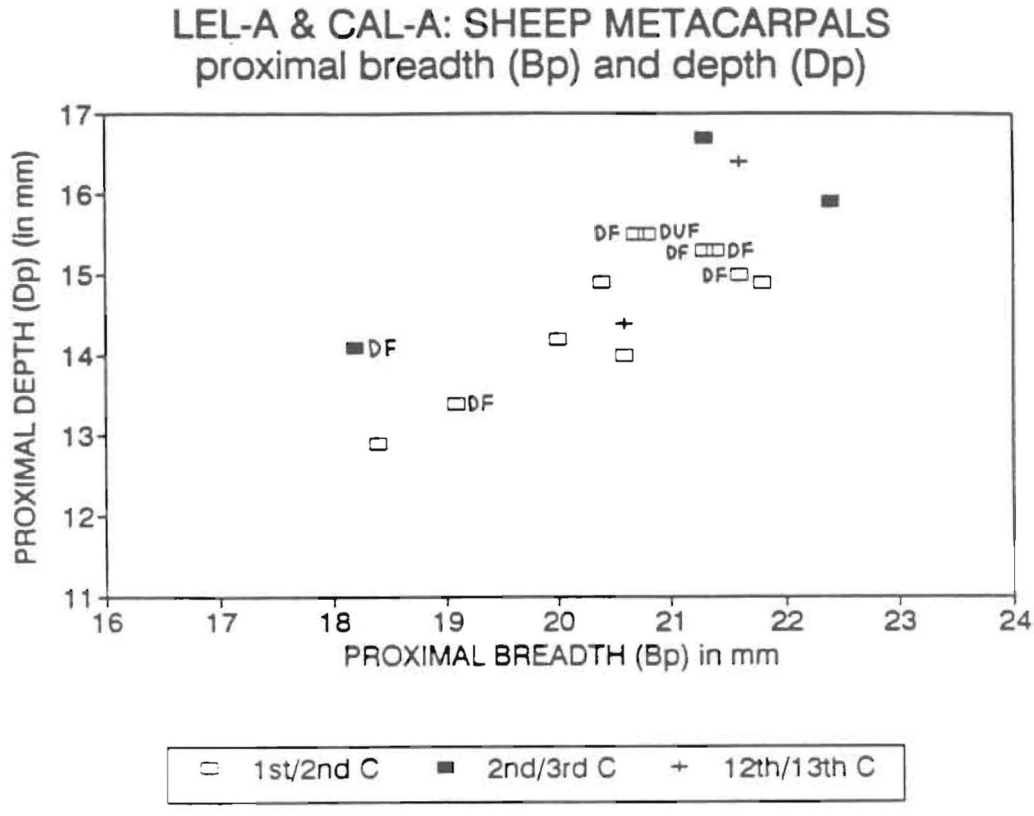


FIGURE 12: Scattergram of sheep metacarpal proximal breadth (Bp) and proximal depth (Dp) measurements.



APPENDIX 1: the anatomical zones recorded for this collection

in each case, the zone is recorded if more than 50% of it is present

each fragment is only counted once in the tables of identifications, regardless of how many zones are present. The zone information will be used to calculate minimum numbers for each element, which will be used in the overall report on The Lanes, Volume 1, to compare relative frequencies of skeletal elements.

any fragment not retaining any of the zones listed below has not been included in any of the bone counts. The only record of these fragments is in the bone weights.

1. for all long bones (including metapodials), each proximal or distal end is recorded (either as a fused epiphysis or as an unfused metaphysis)

2. vertebrae are recorded in the same way

3. the proximal articulation of each rib is recorded similarly.

4. any fragments of carpals, tarsals, the patella, sesamoids and phalanges are recorded once, regardless of whether or not they are complete. In effect, they are always either complete or substantially so (ie: >50% is present).

5. loose teeth are recorded if more than 50% is present (loose pieces of enamel are not recorded)

6. for the humerus, the presence of the deltoid muscle attachment is recorded (since proximal epiphyses survive so rarely)

7. similarly, for the femur, the supracondylar fossa is recorded, since the distal epiphysis has poor survival.

8. for the scapula, the glenoid and the neck are recorded as two separate zones. In effect, the neck is recorded if the muscle attachment is more than 50% present.

9. for the pelvis, the acetabulum is recorded if the ilial segment is present; the ilium is recorded if the midpoint of the shaft is present, and the ischium and pubis are recorded in the same way.

10. for the mandible, the condyle forms one zone, the angle another, the tooth row a third, the diastema a fourth and the symphysis a fifth.

11. for the skull, the basioccipital, zygomatic arch and maxilla (M1) each forms a separate zone.

12. for a horncore, the base, midpoint and tip are each recorded. Judging the midpoint is slightly subjective, but has been found to be effective in separating out those horncores that have been chopped through near the base from those that are substantially complete but which have had their tips broken off.