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# Overall summary of Ribchester animal bone

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## Introduction

This part of the report concentrates on the zoological aspects of the total collection of animal bones recovered from excavations at Ribchester Roman fort in 1989-90, and on comparisons of this material with that from other sites. The data relating to site formation processes and preservation conditions, together with those regarding variations within a phase collection and any special deposits, have all been included in the main text or in the phase summary sections on animal bones. They will not be repeated here except where a precis is relevant to the site in general or to a specific topic under consideration. Readers are urged to consult the phase summaries in conjunction with this zoologically-biased summary, since they include many data that are not referred to here. Appendix 1 describes the methodology utilised for the recording and analysis of the material. Unless specifically mentioned to the contrary, all of the following discussions refer to the hand-recovered material. Although bulk sediment samples were taken and processed, most of these were very small for the purposes of animal bone analysis, and only specific items of interest are noted. Samples were inadequate for analyses of recovery biases.

## The quantities of material

Just over 150 kilogrammes of animal bone were recovered by hand, and a further 1 kilogramme of bone was sorted from the residues from sieved bulk sediment samples. Very approximately 5 kilogrammes of calcined bone fragments were collected separately during excavation and have been analysed separately (see discrete report on this material).

The hand-recovered material from contexts dating to Phases 4, 5 and later is often poorly preserved, and numbers of fragments are unstable. The total number of fragments from deposits dating from the pre-Roman period to Phase 3 inclusive is 5353, of which 3099 fragments (58%) have been recorded using the diagnostic zone method (see Appendix 1). A further 257 fragments were recorded from Phase 4 deposits, giving a total of 3356 fragments available for detailed analysis.

## The origins of the material

The excavated contexts lay on the boundary of the fort and in the area immediately outside of it, and are assumed to have contained material relating to activities undertaken within the fort itself as well as in the excavated area. Table BONEWGHT.WB1 shows how the material was distributed by weight between the main phases defined for the site. It is clear that the bulk of the bones derives from periods thought to have been associated with major alterations or clear-up operations, rather than to periods when the site was being utilised in a more routine manner. The distribution of the calcined bone fragments follows the same pattern, and this material is interpreted as being the remains of organic refuse (such as vegetable matter and animal bones) deliberately and thoroughly burnt, presumably in efforts to clear the ground.

The most parsimonious interpretation of the material generally is that the area was used for general refuse disposal, possibly in localised middens. These could have been intended as temporary accumulations, awaiting seasonal redistribution onto the arable fields, or may have been permanent deposits. Lying immediately outside of the fort, the area would have made a very convenient dumping ground for refuse generated inside of the fort itself, which presumably would have needed to have been kept relatively clear of noxious or bulky waste when it was in full use. When the area outside of the ditches was required for some more specific activities, the middens may have been regarded as undesirable, and may have been destroyed (by 'bonefires') or cleared away into the ditches, which needed to be backfilled when the fort boundaries were repositioned.

## **The date of the material**

Nearly all of the material derives from deposits dating to the late 1st - mid 2nd Centuries AD. There is very little animal bone recovered from deposits dating to the late 2nd Century or later, and this material is usually of mixed preservation conditions, which suggests that some of it may be residual. This has two implications: (1) there is no opportunity to compare early Roman material with mid or later Roman material for this collection from Ribchester, and (2) it is probably valid to consider the collection as a whole in comparisons with material from other sites. Although this may mean that a few bones of mid 2nd Century date are included with the main collection of late 1st/early 2nd Centuries, it also means that the maximum amount of material can be utilised.

## Comparable assemblages

Animal bone collections from similar sites of comparable date in the region are limited. The most relevant collections come from the fort at Papcastle, near Cockermouth, Cumbria, where the Phase 1 material dates to the late 1st/early 2nd century and was associated with industrial features, a structure and a large ditch (Mainland and Stallibrass, in press), and from Carlisle, Cumbria, where various sites have produced animal bone collections dating to the late 1st - early/mid 2nd Century, the most relevant of these being the fort at Annetwell Street (Stallibrass, 1991a & 1991b) and the military annexe at Castle Street (Rackham et al 1991). The forts at Kirkham and Lancaster have produced extremely little animal bone, and the animal bone material from Walton-le-Dale has not yet been analysed.

## The nature of the material

The animal bones derive overwhelmingly from carcases processed for food. There are no instances of any concentrations of craft waste deposits, no collections of toe bones that might indicate tannery waste, no collections of cattle horncores and no collections of worked antler. The calcined bone is distributed generally amongst the contexts and is not particularly associated with any hearths, nor has the bone been used as a flux in any industrial process.

Several deposits contain cattle bones that have been butchered in ways that are typical of Romano-British military sites, and indicate organised carcase processing. The main examples concern scapulae and lower limb bones of cattle. In some deposits, the glenoid processes of scapulae have been intensively trimmed by cleaver, and also bear frequent knife cut marks on their blades consistent with the filletting of raw meat. Occasionally, cattle scapulae blades have holes in them consistent with having been hung up on a hook, presumably during a curing or storage process. Cattle lower limb bones often occur in concentrations in which all of the bones have been split longitudinally, presumably for the extraction of marrow. Similar deposits have been found at Papcastle and at Castle Street, Carlisle.

None of the bones of any of the other species present show any similar signs of intensive processing, although butchery marks are generally very frequent. For the pre-Roman period to Phase 3 (inclusive), 39% of the total fragments bear marks from butchery equipment. The cattle bones tend to have been butchered by heavy cleavers, with some evidence for the use of knives for defleshing or the removal of skins, whereas the sheep/goat and pig bones have been butchered almost exclusively by the use of knives. Ten percent of the total fragments have dog tooth marks on them. There are no differences in these rates of alteration between the collections from the ditches, the pits, and the 'other' context types.

**The species present**

The collection is dominated by the bones of the three main domestic food animals typical of all Romano-British military sites: cattle, sheep/goat and pig and, as usual, cattle is the commonest species identified. Table TOTSPEC.WB1 presents the distributions of recorded (zoned) bones by phase. Other species whose bones occur throughout the phases in lower numbers include horse and dog, fowl (domestic chicken) and red and roe deer. All of these species typically are represented by small numbers of bones at most Romano-British sites. The quantities and distribution of dog and horse bones at Ribchester will be commented on below. Other species whose bones occur occasionally at Ribchester are cat, hare (both probably wild), goose and duck (both of these could be either domestic or wild forms), and various wild birds: swan, raven, kite, black grouse and wood pigeon. The occurrence of these rarer species tends to be associated with the larger phase collections, and indicates a very low degree of exploitation of game resources, plus the presence of occasional scavengers.

The sieved material includes a few bones from small mammals and small birds, very few of which could be identified with certainty to species. They include mice and voles and small passerines, all of which could have lived in or around the site, and they do not give much indication of local habitats. It is noteworthy that no bones of watervole were recovered, and almost none of frogs or toads, despite the proximity of the site to wet habitats. This scarcity remains unexplained.

Fish bones have been reported upon separately (Nicholson). They were also extremely sparse, which is probably a reflection of the very small sample sizes processed from the site, together with the typically low numbers of fish bones recovered from any Romano-British military site.

**The main domestic species**

Table DOMSPEC.WB1 shows the ratios of the three main species by phase, using numbers of recorded (zoned) fragments. It is clear that cattle bones formed the bulk of the remains in all of the phases, although the precise ratios sometimes varied between context types within a phase (see individual phase summaries for details). The ratio of cattle:sheep/goat:pig fragments overall is 63:25:11%. (N=2490) , and would show an even greater dominance by cattle if all identifiable fragments had been recorded rather than only those retaining defined diagnostic zones (see discussion of methodology in Appendix 1). This pattern is typical for Romano-British military sites and is mirrored by collections at Papcastle, where the Phase 1 collection, dating to the late 1st/early 2nd centuries, had a ratio of 70:19:12% (N=241), and at Annetwell Street, Carlisle, where the Phase 3 collection, dating to the late 1st Century, had a ratio of 70:17:12% (N=5176). At both of these sites, all identifiable fragments were recorded, which has probably inflated the relative contribution of cattle bones.

## The cattle

The cattle bones appear to derive mainly from whole carcases processed at the site, but there are some discrepancies in the minimum numbers of elements from certain parts of the body (see Table CATELS and Figure MNELS). It is assumed that smaller bones are under-represented due to recovery biases, and that thin or cancellous bones have been preferentially destroyed by dog chewing and by trampling, at least to the point where either they were not recovered, or they have lost suitable diagnostic zones. The major limb bones of the skeleton show broadly similar Minimum Numbers of Elements (MNEs), regardless of whether they derive from front or hind limbs, and regardless of whether they derive from upper or lower limbs. Minimum Numbers of Elements for the humerus, radius and metacarpal are 50, 47 and 44 respectively. That for the pelvis is 39, and those for the femur, tibia and metatarsal are 45, 69 and 88. This high quantity of metatarsals compared to that of metacarpals is not understood, but is matched by a similar number of mandibles (MNE=80). It is possible that the metatarsals and mandibles represent secondary butchery waste, and that metacarpals tended to be included in joints of meat from the forelimb. Primary butchery waste, in the form of head and foot bones, is scarce. There are comparatively few skulls (MNE=13), horncores (MNE=14) and toe bones (MNE for the anterior first phalange is 28, and for the posterior first phalange the MNE=11). These paucities of head and foot bones suggest very strongly that many of the animals were being slaughtered and skinned elsewhere, or at least that the refuse from such activities was deposited elsewhere. The scarcity of horncores and phalanges may indicate their removal to industrial centres where horns and skins were processed. Tanning is a slow process, requiring at least a year, and produces noxious smells, and tanneries were (and still are) often located at the edges of settlements. The skinning marks on the metapodials indicate that the animals represented by their bones at the site were certainly utilised for their skins, but it is not possible to relate these bones to the leather remains found at the site. The cattle hides used for leather at Ribchester may have been processed locally, either by military or civilian personnel, from local stock, or may have been bought in from elsewhere, possibly from a military centre such as Catterick in North Yorkshire, where tanneries have been located. (APPARENTLY. DO YOU OR IAN PANTER HAVE A REFERENCE TO THIS?)

The main discrepancy in element frequency concerns the scapula, which has an MNE of double that of even the mandible and metatarsal ie: MNE=164. This emphasises the role of the scapula as a unit for meat processing, and suggests either that the fort at Ribchester was a processing site, or that it imported meat on scapulae, possibly cured for storage in some way such as salting, smoking or drying. Superabundances of scapulae have been noted at other military sites in the region, including Papcastle and Carlisle (Annetwell Street and Castle Street), but not at civilian sites (such as The Lanes, Carlisle: Stallibrass, 1993). The most parsimonious estimate of a Minimum Number of Individuals for cattle, based on the MNEs presented in Table CATELS, is 44 (based on the metatarsals), with an additional 38 individuals represented only by scapulae. These figures emphasise the importance of scapulae as a unit of meat at Romano-British military sites.

The ages of the cattle at Ribchester are also typical for Romano-British military sites, with an emphasis on mature cattle that could have been utilised for many purposes (including breeding, milking, traction etc) prior to their death or slaughter. Figure CATMWS shows the Mandibular Wear Scores (MWS) (Grant 1982) for the cattle mandibles from the site. These demonstrate a preponderance of adult jaws in all three main phases, with the majority of Wear Scores falling between 37 and 46, and only a few jaws deriving from juveniles or adolescents. Using Silver's (1969) ages of tooth eruption to calibrate the MWSs, the collection has jaws from two young individuals of less than 15-18 months, seven more from adolescents of 15/18 - 24/30 months, five at about 24/30 months, and 74 at more than 24/30 months. This gives a ratio of about 14 animals less than 2 - 2.5 years compared to 74 of more than 2 - 2.5 years. This ratio is confirmed by that provided by the numbers of deciduous and permanent last premolars. The permanent last premolar (P4) erupts at about 28-36 months, when it pushes the deciduous tooth out of the jaw. There are 21 deciduous and 79 permanent premolars. The overall ratio is about 1/5th juvenile/adolescent jaws to 4/5th adult jaws. Using the wear stages of all fully erupted lower third molars (M3, whether *in situ* or loose) and comparing these with Mainland's wear stages calibrated by dental annuli counts for the Papcastle material (Mainland & Stallibrass, forthcoming), nearly half of the jaws from animals of more than 24-30 months of age probably derive from fully adult animals, with a further one quarter to one third deriving from mature adults approaching about ten years of age, and a further tenth from senile animals of greater than ten yeras. Only 16% of the M3s derive from adolescents/young adults of approximately 2 - 4 years, and this figure emphases the relatively low incidence of jaws from animals of prime beef-producing age.

There are no mandibles with MWSs from neonatal calves. This pattern indicates that the animals were not managed as a milking herd. The dental ageing data are supported by the post-cranial material which is also dominated by the bones of fully adult animals. Only 13 of the 1572 cattle bones recorded for anatomical zones were noted as deriving from animals of very young ages (foetal to a few months). One is possibly foetal, five neonatal and a further seven of only a few weeks or months of age. Two of these (a metatarsal and a skull fragment) bear skinning marks, and it is possible that these very young carcases were imported for their skins rather than (or as well as) for their food value. The general lack of bones from very young individuals suggests very strongly that the cattle were brought in to the site rather than raised by people living there, as some neonatal deaths are inevitable regardless of levels of husbandry standards, and a 'home herd' would be expected to have produced the remains of several newborn individuals. The preservation conditions for most of the Ribchester deposits were so good, that the selective loss of neonatal bones is extremely unlikely, and cannot be used to explain their scarcity at the site.

Several of the cattle mandibles and loose teeth show malocclusion (see Plate COWTOOTH) caused by the premortem loss of one tooth, leading to the irregular wear of the corresponding tooth in the opposing jaw. Taken together with the generally mature ages of the mandibles, it seems likely that the Ribchester cattle were sold to the fort (or requisitioned) at the ends of their useful lives. Some of the metapodials show signs of splaying at their distal ends (3/20 = 15% metacarpals, and 2/37 = 5% metatarsals) as does the proximal end of an anterior proximal phalange (1/40 = 2.5%). Splaying of these elements is thought to indicate a response to heavy labour, such as that involved in ploughing or in pulling heavy loads. If the cattle had been bred for meat supply, they should have been culled just as they reached adulthood. There is very little evidence for animals of this age and, although the butchery marks indicate that most, if not all of the animals were utilised for food, it is very likely that food was very much the final product of these animals. There are no partial skeletons nor burials of cattle.

Butchery marks on the recorded cattle bones are very frequent, with virtually half of the material (49%) bearing cutmarks. This suggests the intensive use of the cattle carcases. In contrast, the number of recorded cattle bones bearing marks from dog teeth is low (only 7%), which might imply that cattle bones were disposed of quite quickly into deposits where they were inaccessible to scavenging dogs (eg the waterlogged ditches).

Some of the cattle long bones, particularly metapodials, are scorched or charred at some point on their shaft. Sometimes the bone is also chopped or broken through at this point. Apart from three mandibles and one radius, all of the affected bones are metapodials: seven metacarpals and 16 metatarsals. These are distributed throughout all of the phases from Phase 1:2 to Phase 4:1. Experiments by Paul Stokes (pers. com.) suggest that this trait may be associated with heating of the bone in order to facilitate the removal of the marrow from the central cavity. The trait has been noted at other military and civilian Romano-British sites in the region, particularly Carlisle (Annetwell Street and The Lanes) and may relate to a regional culinary habit. Occasional instances are known of further south, particularly regarding mandibles (eg Leicester: Gidney 1991), but the incidence seems to be particularly high in the north and west of England, and the emphasis on metapodials also seems to be a regional custom.

Some of the cattle jaws demonstrate congenital traits that have been noted at other Romano-British sites in the north-west of England (and elsewhere). Of 47 cattle mandibles that have the region of the bone where the second permanent premolar (P2) would be expected, 9 (19%) have no trace of the tooth ever having been present. A similar proportion (17%, N=24) was noted for late 1st/mid 2nd Century material from the civilian area of The Lanes, Carlisle (Stallibrass, 1993), with another comparable figure of 16% (N=62) observed for late 1st century material from the fort at Annetwell Street, Carlisle.

Another congenital trait that seems to be more common in Romano-British than in medieval cattle is the congenital absence or reduction of the third column of the third lower molar (M3). At Ribchester, there are no instances of an M3 without a third column, but five of the 106 M3s have reduced third columns (5%). Also, 6 (6%) of the M3s have no pillar on the labial side between the first and second column. The absence of this column can lead to Wear Stages being underestimated as Grant's system involves the wear of this pillar in later stages. Given the small number of teeth involved, the overall pattern of MWSs is unlikely to be seriously biased.

Some of the cattle bones show minor lesions in their articular surfaces (see Baker and Brothwell, 1980). The aetiology of these lesions is unclear, and they may or may not be congenital. Apart from two mandibular condyles (2/55 = 4%), three proximal phalanges (1/40 = 2.5% proximal end, and 2/39 = 5% distal end) and one naviculo-cuboid (1/5 = 20%), the main bones affected are metapodials. For the metacarpal, 4/44 = 9% proximal, and 3/20 = 15% distal ends are affected, whilst the comparable numbers for the metatarsal are 12/60 = 20% proximal ends and 6/37 = 16% distal ends (neonatal and poorly preserved bones have not been included in the ratios). High incidences of these lesions have been found in metapodials and occasional other elements from other Romano-British sites in the north and west of England where preservation conditions permit the observation of minor surface alterations to bones. Although they have not been noted in large numbers at many other sites, it is possible that this is due to observer bias in recording techniques. Alternatively, the high incidences in the north and west could reflect a genuinely regional characteristic, and help to ascertain whether the animals were raised relatively locally rather than imported (alive or dead) from the south or east of the country.

Apart from occasional abnormal wear patterns on the teeth, and one instance of a tooth (P4) having been lost during life and the alveolus healed over, there are no obvious instances of pathology on any of the cattle bones.

The pelves and metapodials have been studied for sexual dimorphism in morphology and size. Sample sizes are small but the results consistently indicate a roughly equal number of bones from males and females. The height of the acetabular rim of the pelvis taken together with the morphology of the pubis indicates the remains of five females and six males. The morphology of complete metapodials (using Howard, 1962) shows a ratio of two females and two males represented by complete metacarpals, and a ratio of four females, one male castrate and two male castrate/females represented by complete metatarsals. These are slightly unexpected ratios given the age distribution indicated by the Mandibular Wear Scores, for which a ratio more heavily biased towards females might be expected. Animals culled at a fully mature age are often barren cows whose breeding and milking capacities have declined. Males are often associated with meat-based husbandry patterns in which they are culled as they reach full size (about three years of age). Although there are some mandibles from individuals of this age, the preponderence derives from older animals, and this collection may include the remains of some older plough oxen together with those of cows.

The measurements of the cattle bones at Ribchester are typical for Romano-British material from military sites in the north and west of England during the 1st and 2nd Centuries AD (see Luff, 1982 and Stallibrass, 1991b). The few horncores that were recovered fit the Celtic shorthorn pattern that was ubiquitous throughout Britain and Europe from the Iron Age through to the migration period. The withers heights have been calculated using all available complete longbones together with conversion factors provided by Matolcsi (1970, quoted in Driesch & Boessneck, 1974) and Zalkin (1960: factors for bones from animals of unknown sex). Only 15 withers heights could be calculated and they range from 0.97m to 1.21m (average = 1.07m). The data are presented in Table CATWITH.WB1 and Figure CATWITH, but are too few to permit any comparisons between the phases. Eleven of the bones utilised are metapodials, for which Howard's sexual indices have been calculated. For these, the withers heights of the 'definite' females range from 0.97m to 1.10m, whilst the 'definite' castrates have withers heights of 1.03m and 1.16m. A male metatarsal that is possibly from an entire animal (bull) or from a castrate gives a withers height estimate of 1.13m, and the two metatarsals that could be from castrates or from females give withers height estimates of 1.21m and 1.00m. Although these figures confirm the general sexual dimorphism of larger males and smaller females for cattle, they also demonstrate that sizes of castrates and females can overlap.

When all of the cattle distal metacarpal measurements are considered (regardless of whether or not the bone is complete), the distribution of distal width measurements across the condyles (Bd) again shows a split into two groups (see Figure CATMCBD). Here the ratio is 11 smaller measurements to six slightly larger measurements. Calibration with Howard's indices shows that the two female metacarpals lie in the smaller range and the two metacarpals from castrates lie in the larger range. A scattergram of distal metacarpal widths, comparing widths across the condyles with widths across the diaphysial fusion point, shows an identical pattern and is not included in this report. This ratio, suggesting the presence of twice as many females as males, fits with the interpretation of the mandibular age distribution. Although the sample of metatarsals is larger, they have not been analysed in a similar manner since the degree of sexual dimorphism is less pronounced in the hindlimb than in the forelimb, and the results might be difficult to interpret because of the degree of overlap in the measurements of males (particularly castrates) and females.

## **The sheep/goat**

Of the 633 sheep/goat bones recorded for anatomical zones, 191 (30%) were identified as deriving specifically from sheep, and only five bones (<1%) were identified as goat. The bulk of the other sheep/goat bones almost certainly derive from sheep. The goat bones form an interesting group. All of them derive from heads or feet rather than the main carcase, and some are from very young individuals. There is one horncore with cut marks, which might have been imported for craftwork. There is a mature mandible (with M3 up and in full wear) and there are two mandibles from kids who died before the M1 had erupted (possibly at onlya few days or weeks of age, ie: well before three months old). The fifth bone is a neonatal bone that has fine knife marks on it suggestive of skin removal. The bones were recovered from a variety of contexts dating from Phases 1:2, 2:2 and 3.

It is possible that the bones all derive from skins imported to the site, rather than from entire carcases deposited there. Goat leather was very important for Roman military establishments, and yet there is generally a dearth of goat bones from the sites where the leather would have been needed. Driel-Murray (1985) cites the need for nearly 70 goat skins to make one standard sized tent for eight soldiers. Although goat leather has been recovered from sites in the north or west of Britain (such as Vindolanda), the bones that must have 'accompanied' the carcases from which these skins were taken are notable for their absence from most Romano-British sites, whether military or civilian. This suggests that goat leather may have been imported, possibly from continental Europe or even further afield within the Roman Empire (such as Spain, North Africa or the eastern empire), where the climate is warmer and drier, and more suitable for goat raising. Alternative explanations for the goat bones found at Ribchester include the possible requirement of goats for religious ceremonies or sacrifices, the possibility that goats were military mascots, and the possibility that a few goats were always kept to provide milk for sick or injured soldiers. This latter explanation would fit with the age distribution noted for the Ribchester remains, but does not explain the element distribution.

The sheep bones appear to derive from whole carcases (see Table CATELS and Figure MNELS) although skulls and toe bones may be under-represented. The paucity of toe bones could be due to a bias during excavation against the recovery of small bones, but the scarcity of skull bones may be a genuine reflection of the nature of the assemblage in the ground prior to excavation, and could reflect a real scarcity of primary butchery waste. The relatively high representation of tibia has been noted elswhere for sheep/goat and is though to relate to the robust nature of this element, but the low representation of the humerus is unexpected, since the distal half of this bone is also robust, and skeletally adjacent elements (the scapula and the radius) are both well represented. Otherwise, the general distribution fits that of whole carcases where small and/or fragile bones are under-represented due to taphonomic factors. There are no 'special' deposits of any particular parts of the body, no collections of split long bones, and no instances of bones charred or scorched along their shafts. The collection appears to be overwhelmingly one of food refuse. The bones are generally more intact than those of cattle, and there are no partial or complete skeletons.

It is noteworthy that, despite the overall lower numbers of bones used in these calculations (N=601 sheep/goat bones compared to N=1017 cattle bones), the most parsimonious estimates of Minimum Numbers of Individuals (MNIs) for sheep/goat and cattle are almost identical (MNI=44 for cattle, whilst MNI=42 for sheep/goat). This reflects the greater degree of fragmentation encountered by the cattle bones, and indicates that, even when recording is limited to fragments retaining defined diagnostic zones, bones of cattle can be over-represented due to differences in fragmentation patterns. The ratio of the major species suggested by the most parsimonious estimates of Minimum Numbers of Individuals is 44:42:14 cattle:sheep/goat:pig (this ratio is coincidentally the same for absolute numbers and percentages, ie N=100). The greater size of a cattle carcase compared to that of a sheep/goat or pig means that, despite roughly equal numbers of cattle and sheep/goats being represented as whole carcases, the total amounts of meat supplied by the three species would have been dominated by that from cattle, particularly if the 76 'extra' scapulae represent meat consumed at the site rather than processed for export.

The age distribution contrasts with that of the cattle but is, again, typical of Romano-British military sites. Figure SGMWS presents the Mandibular Wear Scores (MWSs) for 50 mandibles, 46 from Phases 1 - 3 (late 1st/early 2nd centuries) and a further four from Phase 4 (later 2nd Century). Overall, the mandibles divide 25:25 between those deriving from animals that died before they reached the age of 18-

24 months, and those that died beyond this age (using Silver, 1969). The younger individuals comprised six animals (two kids and four lambs) of less than 3 months of age at death, four lambs of less than 9-12 months and fifteen lambs or shearlings of less than 18-24 months. This greater emphasis on younger individuals is confirmed by the post-cranial data, which include nine neonatal bones and a further 31 bones from individuals that were only a few weeks or months old when they died. This age distribution is indicative of animals raised or bought in for a meat supply, and contrasts with the age distribution identified for cattle.

The sex ratio indicated by pelvic morphology and measurements is dominated by females (10 females, plus one possible female, and only one male pelvis). All of these pelves derive from animals of more than a few months of age, and it is possible that they relate to the older individuals rather than to the younger animals, in which case they may derive from barren ewes rather than sheep primarily kept to provide meat. The heavy bias towards female pelves is unexpected from the interpretation of the age distribution, and is usually associated with a flock of breeding ewes or a milking flock rather than with a flock raised for supplying meat. The sex ratio of the younger animals (of less than about one year) is unknown, but the lack of neonatal mandibles implies that the sheep/goats were not kept as a milking flock.

The mandibles do not show the incidence of tooth loss shown by the cattle, possibly due to the younger average age of the sheep, and cases of pathology are scarce. One metatarsal has been broken and has much extra bone deposited around the break. Plate SGMT illustrates the external appearance of this bone, for which the break was identified by radiography.

The incidence of sheep/goat bones bearing butchery marks is much lower than that for cattle bones (27% compared to 49%) which probably simply reflects the smaller size of a sheep or goat carcase (which requires fewer divisions to form units suitable for cooking or consumption), together with the absence of longitudinally split long bones. In contrast, the incidence of bones with dog tooth marks is considerably higher than that for cattle bones (ie 23% compared to 7%), which probably indicates difference in patterns of disposal of the bones of these two species.

The morphological and metrical characteristics of the sheep bones show that they were slightly built animals typical of the indigenous Iron Age and Romano-British sheep. A few sheep (and one goat) horncores were found, but no instances of any polled skulls were recovered.

Calculations of withers heights are presented in Table SGWITH.WB1 and Figure SGWITHER. The graph is bimodal, suggesting that bones from males and females are present in the collection in roughly equal numbers, or that two types of sheep are represented. It was noticed during cataloguing that the metapodials, in particular, appeared to have a range of morphological types, some of the bones having particular slender shafts, more like a modern North Ronaldsay sheep than the modern Soay sheep that are often used as comparisons for Iron Age and Romano-British sheep. The possible discrepancy in sex ratios indicated by the pelvic data and the withers heights is difficult to test with certainty, but a scattergram of the proximal breadths and widths of the sheep/goat metacarpals indicates approximately equal numbers of bones falling into each of two groups, just like the withers heights (see Figure SGMC). Of the 37 bones, 22 fall within the group with narrower proximal breadths and 15 in the group with wider proximal breadths. This would normally be interpreted as a ratio of approximately 2:1 females to males. The apparent under-representation of male pelves, therefore, remains unresolved, unless it is an extreme form of small sample bias or a factor relaing to the age ranges involved (the proximal metacarpals could well include bones from animals that died at immature ages).

**The pigs**

The main function of pigs in any husbandry system is one of meat provider and a typical assemblage comprises the bones of almost exclusively young animals. At Ribchester the Mandibular Wear Scores (MWSs) show just such a pattern (see Figure TOTGMWS). Only three of the seventeen suitable mandibles have the M3 fully erupted, and these are all in light wear. Only one jaw derives from an mature animal (a female). Plate PIGMAND shows how gracile this jawbone is. Since the M1 is absent, and there are no comparable mandibles with complete molar dentition, it is not possible to include this jaw in the MWS analysis. The M2 is at Grant's stage 'm' and the M3 is at stage 'e'. Even this bone is not from a particularly elderly animal.

The canine teeth indicate a sex ratio of 7:13 females:males. Due to the early age at which pigs can breed, there is no need for a heavy bias towards the culling of young males (females can provide a litter or two before being slaughtered before they reach full dental maturity), and this pattern is perfectly consistent with the use of pigs as a food supply.

The post-cranial data support the dental evidence for a prepoderance of young animals, and include nine bones from animals that were only a few weeks old when they died, although there are no instances of any foetal or neonatal bones. This latter piece of evidence may suggest that the pigs were not home raised but were bought in. Neonatal piglets have very little meat on them, but suckling pigs are quite a delicacy and may have been purchased deliberately for food. Home raised piglets would almost inevitably include accidental neonatal deaths and their absence from this collection could be significant.

The relative frequencies of elements (see Table CATELS and Figure MNELS) show that, just like the cattle and sheep/goats, all of the larger and more robust bones of the skeleton are present in roughly equal numbers. Similarly, the scarcity of skull bones may suggest that some primary butchery waste was discarded elsewhere.

The incidence of cut bones of pig (30%) is very similar to that for sheep/goat (whose carcases are of a similar size to those of young pigs). Similarly, the incidence of dog gnawing of pig bones (17%) is also much closer to that of sheep/goat bones than to that of cattle bones, suggesting that sheep/goat and pig carcases may have been treated in broadly similar ways to each other, contrasting with the much larger carcases of cattle.

The immaturity of the bones precludes the use of measurements but the overall small size and gracility of the bones suggest that they all derive from domestic pigs rather than wild boar.

There are no partial skeletons and no obvious examples of pathology.

**The horses and dogs**

The phase summaries have already considered the nature of the horse and dog remains, with specific reference to the ditch deposits. See, in particular, the summary for Phase 3.

Table TOTSPEC.WB1 shows very clearly how the horse bones are concentrated in Phase 2:2 and Phase 3. The numbers of horse bones in these phases are far greater than would be expected on most Romano-British sites, whether military or civilian, where the normal 'background' frequency of horse bones is about 1% or less (as at Papcastle). In addition, the presence of partial carcases rather than isolated teeth and bones, together with the age distribution of young individuals (rather than elderly animals) marks out the Ribchester collection as something special. The most likely explanation for the presence of these bones is that military horses associated with the cavalry unit known to have been stationed at Ribchester were culled if unsuitable for military service (see Hyland, 1990). However, the numbers of these horses should not be overestimated, despite the frequency of their bones. Calculations of Minimum Numbers of Elements (MNEs) in the same manner as that utilised for cattle etc gives a greatest estimate of 13 (for the mandible), which could derive from seven horses for the whole site. The equivalent calculations are MNI=44 for cattle (excluding scapulae), MNI=42 for sheep/goat, and MNI-14 for pig.

Unlike the bones of cattle, sheep/goat and pig, many of the horse bones derive from partial carcases (especially in Phase 3 and in Phase 2:2), and many of them are absolutely or virtually complete. The incidence of cutmarks is very low: only 4, possibly five, (2 - 3%) of the 195 recorded bones have cutmarks. Some of the marks are almost certai
nly related to the removal of the skin rather than to defleshing, but cutmarks on a pair of mandibles and a femur from Phase 3 are far more likely to represent meat removal (see Plate HORSEMAND). The consumption of horseflesh by humans was considered to be taboo in the Roman period, but there is no way of testing whether the horseflesh removed from some of these bones at Ribchester was consumed by people or fed to dogs.

The incidence of horse bones chewed by dogs is similar to the site average (10%) and demonstrates that at least some of the horse remains were accessible to scavengers. None of the partial skeletons were recovered from stratigraphic features that could be interpreted as burial pits.

The dog bones appear to derive from a variety of burials or casually discarded carcases, all of which have been subsequently disturbed. As is typical for the Romano-British period, they range considerably in size and shape (see Harcourt 1974). One of the bones, a femur from Phase 3, is particularly small and gracile but, unusually for such a small animal, is from a straight legged rather than a bandy legged dog (see Plate DOGFEM1). Another femur, from a medium sized animal, has an unusually shaped lower shaft, which swells in a regular manner from the midshaft down towards the distal epiphysis (which is missing). Plate DOGFEM2 shows the outward appearance of this bone. Radiography showed the inside of the marrow cavity to mirror the outer wall of the bone, but did not give any indication as to what might have caused this swelling.

Apart from one bone that has marks consistent with the removal of skin rather than flesh, none of the dog bones bear any butchery marks. Only one dog bone has any dog gnawing marks on it. These facts emphasise the probability that dogs were disposed of as whole corpses in graves, although the remains recovered from Ribchester all seem to have been subsequently disturbed (prior to their excavation in 1989).

## General summary

Please read this summary in conjunction with the phase summaries, as data and conclusions are not repeated. The animal bones recovered from Ribchester Roman fort are typical of such collections from similar sites in the north-west of England in that the material is dominated by the bones of the three major domestic animals: cattle, sheep/goat and pig (in that order), and that the remains appear to be refuse from food preparation and consumption. The cattle bones are from predominantly mature individuals that were probably utilised fully before they arrived at the fort. There is some indication for a regional bias in the genetic make up of the cattle and in the manner of their consumption. Some of the animals may not have been of the best quality when they were slaughtered, to judge by the incidence of dental malocclusion, although there is very little evidence of any other form of pathology. In contrast, the sheep were almost exclusively raised primarily for meat provision, as were the pigs. A few bones of other species, including some wild birds, were recovered from the larger collections. The relative abundance of horse bones, together with their young ages and the relative completeness of the carcases, may relate to the presence of a unit of cavalry at the fort, and contrasts with the nature of horse remains found at most other Romano-British sites. The remains of these large animals together with the remains of several disturbed carcases of dogs, and the presence of notable quantities of calcined bones from many of the contexts, may indicate that this area of the site was utilised as a dumping ground immediately outside of the main fort that was periodically cleared up when the area was required for some more intensive function such as industrial activity. Almost all of the animal bones derive from contexts dating to the late 1st/early 2nd centuries, and it has not been possible to compare this 'early' material with mid or late Roman material from the site.

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APPENDIX 1: Methods of recording used for analysis of animal bones

(1) All sheep/goat bones were examined with regard to species identification using modern comparative material held in the Biological Laboratory of the Department of Archaeology, University of Durham, or held privately by the author or Ms Louisa Gidney (to whom, grateful thanks), and by reference to Boessneck (1969).

(2) Measurements of bones were taken in accordance with Driesch (1976).

(3) Ages of tooth eruption and epiphysial fusion used for estimates of age at death are taken from Silver's (1969) data for modern animals.

(4) Unique anatomical zones recorded for this collection were recorded as follows:

- In each case, the zone is recorded if more than 50% of it is present.
- Each fragment is only counted <u>once</u> in the tables of identifications, regardless of how many zones are present. The zone information has been used to calculate minimum numbers for each element, in order to compare the relative frequencies of the skeletal elements.
- Any fragment <u>not</u> retaining any of the zones listed below has <u>not</u> been included in any of the bone counts. The only record of these fragments is in the bone weights.

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

♦ vertebrae are recorded in the same way

♦ the proximal articulation of each rib is recorded similarly.

♦ 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).

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

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

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

♦ 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.

♦ 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.

♦ 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.

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

♦ 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.

APPENDIX 1 (continued)

List of abbreviations used in figures for anatomical elements.

| | |
|---|---|
| Hc | Horncore (cattle and sheep/goat only) |
| Fb | Fibula (pig only) |
| Sk | Skull |
| Md | Mandible |
| Hy | Hyoid |
| Sc | Scapula |
| Hu | Humerus |
| Ra | Radius |
| Ul | Ulna |
| Cp | Carpals |
| Mc | Metacarpal |
| Pv | Pelvis (innominate) |
| Fe | Femur |
| Pt | Patella |
| Ti | Tibia |
| As | Astragalus |
| Ca | Calcaneum |
| Mt | Metatarsal |
| P1 | 1st Phalange |
| P2 | 2nd Phalange |
| P3 | 3rd Phalange |
| Ss | Sesamoids |
| Ri | Ribs |
| At | Atlas vertebra |
| Ax | Axis vertebra |
| Cv | Cervical vertebrae |
| Tv | Thoracic vertebrae |
| Lv | Lumbar vertebrae |
| Sa | Sacrum |

N.B. For the material from the ditches all identifiable fragments were recorded, whether or not they retained the defined anatomical zones. This was to maximise the potential information that could be obtained from the material, and to permit the direct comparison of this material with that from other sites, most of which had been recorded, by a variety of workers, in a similar way. For all subsequent analyses, only bones retaining relevant zones were catalogued. In the analyses and discussions of the ditches, therefore, all of the data have been included (see the individual phase summaries), whereas in the discussions and comparisons of the material from a phase as a whole, or from the site as a whole, only zoned fragments have been considered.

The effect of the zoned-only method of recording is to reduce the representation of the more fragmented species (in this case, cattle) compared to the all-identifiable-fragments method. For instance, the collection from the Punic Ditch in Phase 3 has a ratio of cattle: sheep/goat: pig of 55:27:17 (N=725) using the all-identifiable fragments method that is reduced to 48:32:20 (N=566) in the zoned-only method.

Captions to plates

Plate COWTOOTH: A cattle upper molar showing uneven wear due to the loss of the opposing tooth in the lower jaw.

Plate SGMT: A sheep/goat metatarsal that has broken and healed over with excessive bony growth.

Plate PIGMAND: An adult pig mandible. Note the small, gracile size and shape.

Plate DOGFEM1: A femur of a very small, straight-legged dog (centre) compared with modern examples from a cairn terrier (left) and a domestic cat (right).

Plate DOGFEM2: A femur from a medium sized dog. The distal half of the shaft is splayed (aetiology unknown).