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THE ANIMAL BONES FROM THE ROMAN WELL AT RUDSTON, YORKSHIRE

by

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Introduction

The animal bones from the well were divided into four stratigraphical groups related to the history of the well. The filling from 81-99' belonging to the period when the well was in use, was divided arbitrarily into two groups. The lower W.1 comprised layers 279-271 and the upper W.2 comprised layers 269-266. Group W.3 comprised material from 60-81' associated with the initial collapse of the upper stonework. The last group W.4 came from between 6'-40' and belongs to the period during which the shaft gradually filled and the adjoining building collapsed. The bones from 60-40' are missing. The well was in use in the fourth century A.D. The upper layers W.4 are not dated but probably belong to the 5th and 6th centuries A.D.

The bones in groups 1-3 were largely fragmentary and distributed through the soil suggesting that they were a part of the domestic refuse. In group 4 however the bones were not generally disseminated but many were clustered indicating that they were from animals that had fallen into the shaft and were unable to escape, or that they had been deliberately placed there. In this deposit therefore a more appropriate method of recording has been used.

Groups 1-3 were examined separately following the procedures described by Chaplin (1971). The species present and the minimum number of animals for each of the principal bones of the body of each significant species was determined. Criteria for age estimation from the stage of fusion of the epiphyses of long bones and from the stage of eruption and wear of teeth were recorded. Dimension of individual bone types from all the deposits were measured together. The dimensions measured were those that might be of value in determining the sex of the animals, their stature and body dimensions, and as a comparison with those from other sites.

Results

Most of the bones are from domestic livestock with sheep and cattle being the most numerous followed by pigs and horses. Some bones of red deer were found in the food debris but the majority were from the upper filling W.4. Other smaller mammals, birds and reptiles/amphibians were present but these are dealt with separately as they are not numerically important.

The minimum number of animals of each major species is given for deposits 1-3 in Table 1. A full species list is given in Table __.

Deposit W.4 contained the following species:- sheep, cattle, horse, pig, Red deer, Roe deer, Field vole, badger and amphibian(species to be determined) of which largely complete skeletons of Red deer, badger, and Field vole were present.

The frequency of occurrence of the different parts of the body of the sheep, cattle, pigs and horses are shown in Tables 2 and 3. There is a disproportionate representation of the metacarpal and metatarsal of the bones of sheep in deposits 1 and 2 compared with other bones, and of cattle metatarsals in W2.

The occurrence of fused and unfused epiphyses of the principal bones for each of the demestic species is given in Tables 4 - 7. The epiphyses fuse to the shaft at different times for different bones thus providing a valuable means of estimating the age at death of the animals. There is some degree of individual variation in the age at fusion as well as between the sexes. Further, there are probably differences in this between ancient and modern stock. The method is therefore a relative one, hence the importnace of a large sample and the need to record data for each bone and epiphyses. The different epiphyses have been grouped into broad age categories to facilitate interpretation. Calculations from the prime data relating to killing are also included in the tables. The ages noted here are those given and discussed by Silver (1969) and represent an average of figures quoted for stock of this century.

It is generally possible to correlate the data from the limb bones with separate estimates based on the eruption and wear of the mandibular teeth. On this site however mandibular and maxillary fragments with teeth in situ are very few, although loose teeth of cattle, sheep, pigs and horses are more numerous. In the case of the pigs from W.1 and 2 there is a marked discrepancy in the age structure determined from limb bones and teeth. The limb bones clearly indicate only small young animals in W.1 but the loose teeth indicate both young and old animals (e.g. those with a well worn third molar). In W.2 however some more mature animals are indicated by the limb bones but it is the teeth alone that indicate the presence of fully adult animals. The possible reason for this difference is discussed below.

As far as domestic species are concerned the relative numbers of sheep, cattle, pigs and horse are much the same between groups 1 and 2. In both, the sheep metacarpal and metatarsal bones are about five times as numerous as the next most frequent bone. The killing pattern of the sheep is essentially similar between the two with about 60% being killed before full skeletal maturity. The figures do however suggest a greater incidence of killing of younger (age group B) stock in W.2.

With the exception of the large number of metatarsal bones relative to others in W.2 the frequency of the different cattle bones is similar in both groups. The killing pattern is also similar between the two with about 38% of the animals having been killed before full skeletal maturity. In W.2 the bulk of these were killed in age group C whereas in W.1 the bulk were killed later in age group D. An earlier killing of pigs in W.1 as compared to W.2 is also apparent.

The bones of the horses in both groups are less fragmented than those of cattle which suggests they have been treated differently before burial. It is possible that they were not butchered in the same way as the cattle or that the meat was used differently. With two exceptions the horses are fully grown with the epiphyses of the limb bones fused. The other two are also well grown animals.

Group W3 is associated with the decay of the well and there is a distinct difference between the bone assemblage from this and the earlier groups. Both domestic and wild species are present. There were numerous fragments of cattle skulls. Pig and sheep are represented by most parts of the body. In addition there are at least six neonatal sheep. Three of these were found with their very friable bones together indicating that they were buried fairly rapidly. At least another three are represented by the majority of their bones and these may have been disturbed by soil movements or during excavation. These are termed neonatal as the proximal epiphyses of the metacarpals and metatarsals are not fused to the shafts. They could equally well be foetal but because of the decay in the ground and a lack of precise data about the neonatal skeleton in ancient sheep breeds we cannot at present decide between these alternatives on anatomical grounds. The Red deer is represented by parts of at least two young animals. In addition there are quite a few fragments of antlers which include one cast antler and portions of the cranium with antlers attached of three animals. In one of these the main antler beams have been cut off (see plate __).

Small mammals recovered included parts of several voles and also the skull and some limb bones of a weasel. The weasel skull (Plate __) is interesting as the right frontal bone in the orbital region shows blister-like lesions, the very thin bone of the blisters have broken in the ground. These lesions closely resemble those that can be produced by the adult stage of the parasitic nematode worm SKRJABINGYLUS NASICOLA (Leukart, 1842) which infests the nasal and frontal sinuses of stoats and weasels. A positive identification cannot be made from the bone alone but the characteristics of this specimen closely resemble the lesions produced by this parasite as described by Lewis (1967) and infestation is widespread, though of varying incidence (Duncan, 1976).

In deposit W.4 there were fragments of a few bones of sheep, cattle, horse and pig. There were the greater parts of the skeletons of two Red deer, a badger and substantial parts of the skeletons of a few Field voles and an amphibian (Species to be determined). The Roe deer is represented by a single cast antler.

Some bones of small mammals and of birds and amphibians were found in the well. The birds and amphibians are being examined further as the initial identifications of the former are somewhat unexpected (these include Corncrake, Raven and Buzzard) and we are having these checked. The Royal Scottish Museum comparative collection proved inadequate for the smaller birds and these too are being checked elsewhere. A report to be inserted at this point on the birds and amphibians will be forwarded. The small mammals identified from skulls, teeth and limb bones were as follows:-

In W.1 were fragmentary limb bones, skulls and jaws of Field mice, either, Apodemus sylvaticus or Apodemus flavicollis, the two not being separable from these bones. Bones of the Field vole Microtus agrestis were found in W.1, W.3 and W.4, and a Water vole Arvicola terrestris was found in W.3. A stoat Mustela erminea was found in W.3 - see above.

Bone Dimensions

Where possible various dimensions of the fragments were measured as an indication of size and also in order to possibly assess the sex of the animals. The distribution of values for some of these dimensions is shown in figs. . and the significance of these in relation to the sex and size of the animals is discussed below. The dimensions were as follows:- (All measurements are in millimetres (mm)).

Cattle

		Mean	Range	
Humerus:	Max. width of distal epiphysis	70.7	62-78	(N=18)
Radius:	Max. width of proximal epiphysis	73.1	62-78	(N=11)
Metacarpal:	Max. width of proximal epiphysis	50.3	41-58	(N=16)
Metacarpal:	Max. width of distal epiphysis	56.7	51-61	(N=7)
Tibia:	Max. width of distal epiphysis	55.8	49-59	(N=22)
Astragalus:	Max. length	59.7	54-64	(N=22)

Metatarsal: 1 complete: length 214, Maximum width of proximal epiphysis 45.3; Maximum width of distal epiphysis 54.1

		Mean	Range	
Horn cores:	Circumference of horn core at base	123	98-176	(N=11)

Horse

		Mean	Range	
Tibia:	Max. width of distal epiphysis	69.8	68.8-71.8	(N=5)
Humerus:	Max. width of distal epiphysis	71.5		(N=1)

Sheep

		Mean	Range	
Humerus:	Max. width of distal epiphysis	25.0	23.1-27.0	(N=25)
Radius:	Max. width of proximal epiphusis	25.4	24.0-27.6	(N=13)
Radius:	Max. width of distal epiphysis	23.7	21.3-25.5	(N=6)
Radius:	Max. length	132	130-134	(N=3)

Radius: Complete bones M.L: M.WP.E.: M.W.D.E.: 133: 25.5: 24.0:, 134: 25.8: 25.0:, 130: 25.0: 25.5.

		Mean	Range	
Metacarpal:	Max. width of proximal epiphysis	19.0	16.1-22.0	(N=169)
Metacarpal:	Max. width of distal epiphysis	21.1	20.0-23.2	(N=44)
Metacarpal:	Max: length	113.0	106-118	(N=19)

Complete bones: M.L.:, M.W.P.E.:, M.W.D.E.: as above. 114: 18.4: 20.0 112: 18.5: 20.6:, 116: 18.9: 21, 116: 19.9: 21.3, 118: 19.4, 21.0, 112: 19.3: -, 112: 18.2: 20.6, 107: 18.9: 21.1, 116: 19.0: 21.8, 110: 18.2: 21.1, 106: 18.0: 21.0, 116: 18.3: 21.9, 116: 19.9: 22.0, 118: 22.0: 23.0, 107: 19.0: 21.1, 112: 19.9: 22.9, 115: 19.0: 21.9, 115: 19.5: -, 109: - : 21.3.

Sheep cont.

		Mean	Range	
Tibia:	Maximum width of distal epiphysis	22.5	20.9-23.8	(N=18)
Astragalus:	Maximum length	24.3	22.5-25.7	(N=25)
Calcaneum:	Maximum length	47.4	44-50.1	(N=12)
Metatarsal:	Max. width of proximal epiphysis	17.1	14.5-19.0	(N=166)
Metatarsal:	Max. width of distal epiphysis	20.7	19.2-23.5	(N=57)
Metatarsal:	Maximum length	123.5	115-130	(N=20)
Horn core:	Circumference of base of horn core	79MM	56-90	(N=14)

Dimensions of complete bones were:- M.L.: M.W.P.E.: M.W.D.E.

130: 18.9: 22.8, 123: 17.0: 20.1, 116: 17.0: 20.0, 123: 17.0: 20.0,
123: 17.0: 20.3, 116: 16.4: 20.3, 127: 17.6: 21.0, 127: 17.2: 20.7,
128: 17.9: 20.2, 126: 17.2: 19.9, 122: 16.5: 19.4, 125: 17.1: 20.3,
121: 16.0: 19.2, 125: 17.1: 20.0, 122: 17.5: 20.8, 128: 17.3: 21.0,
115: 17.2: 19.9, 130: 18.0: 22.0.

Interpretation and Discussion

Various evidence indicates that the bones from W.1 and W.2 represent refuse accumulated during the working life of the well. The nature of the fragments suggest that in general the bones of the cattle, sheep and pigs represent food refuse. This refuse is not however confirned solely to the meat joints but includes large numbers of the foot bones (metacarpals and metatarsals) which carry little useable flesh and are normally to be regarded as waste. In the case of the sheep there are 4-5 times as many animals represented by these bones than any other single bone. This is less marked in the case of the cattle from W.1 where neither metacarpals nor metatarsals are the most common bones. In W.2 however, the metatarsals but not metacarpals are from roughly twice as many animals as other bones. Intact cranial bones and mandibles were unusually absent from this site. Normally these generally strong bones survive well and are among the most frequently occurring parts of the skeleton. Loose teeth however were more frequent than is usually the case. We suggest that the lack of cranial bones and mandibles of both sheep, cattle and pigs in contrast to the abundance of teeth is due to the processing of the skulls, probably by boiling. Prolonged boiling of skulls and jaws causes them to break up and/or the teeth to fall out. Bone boiled in this way and discarded would not readily survive in the ground, the teeth, however, are much more durable and would survive. The nature and purpose of the processing of the heads and possibly also of the feet is not clear. The metapodial bones would in general survive prolonged boiling but would be weakened and would not survive burial as well as uncooked ones. Our experience of boiling heads and feet however leads us to believe that these robust metapodials have not been subject to prolonged boiling and there were no fragments which showed evidence of this. The heads of sheep, cattle and pigs contain not only such delicacies as the tongue and brain but are also well fleshed. Boiled heads produce a nutritious stew with a surprising amount of meat and fat. Today, apart from pigs heads, we do not usually use the heads in this way for human consumption. More usually they are utilised as dog food. A significant part of such a boil up is fat and gelatin both of which can be separated out. The meat and soft bone residue can be separated and provides a very good dog food, the soft bone is easily mashed or coped with by dogs. The teeth are hard, cannot be utilised and must be removed. If the heads were being processed for dog food it is strange that the metapodials were not also given to the dogs. None of these however show signs of gnawing.

We suggest that the lack of mandibles and skull bones and the abundance of loose teeth indicates that the heads were processed probably by boiling to provide food for either humans or dogs and for fat and gelatin. Only the waste teeth being thrown away and surviving amongst the other refuse.

The abundance of the other waste bones of sheep (the metapodials) compared to other limb bones indicates that of the animals killed and butchered on the site only about 1/5 of the carcasses found their way back into the well as food debris. The same is true of the cattle, just over a half of those killed and dressed out on the site are represented by meat bones in the well. It is unlikely that waste bones would have been moved very far from the point of slaughter to be processed or disposed of and it is possible that the killing and processing was done in the immediate vicinity of the well.

The importance of the animals to the community must be assessed in different ways. In terms of the numbers of animals slaughtered whose bones are at least in part here, there were 173 sheep, 66 cattle, 15 pigs and 10 horses. These represent both meat, hides and fleece, fat, gelatin, etc. In terms of potential food the more numerous sheep are of much lesser importance than the cattle. In Table 7 we have made an estimate which indicates the order of magnitude of the meat yield from each species and where it was utilised.

Table 7. Approximate Carcass Yields for W.1 and W.2.

	Minimum Nos.	Est. dressed Carcass Wt. (lbs)	Total Carcass Wt. Yield (lbs)	% Yield	Amount Eaten (lbs.)	Amount Exported (lbs.)
Cattle	66	300	19800	71%	15048 (73%)	5346 (27%)
Sheep	173	25	4325	15.5%	908 (21%)	3416 (79%)
Pig	15	50	750	2.7%	?	?
Horse	10	300	3000	10.8%	?	?
			27875	100%		

Cattle provided 19800 lbs. of meat, some 71% of the total. Sheep supplied 15.5% and horses and pigs 10.8% and 2.7% respectively. But of this yield from animals slaughtered there is a difference in the dispersal.

This is measured by comparing the greatest minimum number of animals shown by a well fleshed bone (e.g. the humerus) with the greatest minimum shown by a waste bone. The comparison, minimum number animals (meat bones) as a percentage of minumum number of animals (waste bones) is 73% for cattle but only 21% for sheep. Thus numerically far more sheep carcasses were dispersed than cattle suggesting a dietary preference for beef. We do not know how far dispersed means in this case, it could be to a distant market, or elsewhere on the estate. The yield from the pigs is small and their minor role in the economy may well reflect the environment and activity of the estate. Their numbers suggest that a few may have been kept around the farmyard rather than that there was a herd of them.

The horses are almost certainly meat animals. They have however not been cut up in the same way as the cattle for their limb bones are less broken, suggesting that the meat was cut off the bone. All appear to be of a similar maturity. They are fully grown but not aged, there is little roughening of the sites of muscle and tendon insertion or of other general features indicative of age or heavy work, nor is there any sign of disease or injury. Some 10 animals are represented and all could have been ridden or worked. Why they were killed at that stage rather than earlier is a mystery but it seems unlikely that they had been reared with their carcass in mind for then they would have been slaughtered earlier. Had they died suddently from disease they would probably not have been cut up to this extent. On balance it is perhaps more likely that they were animals that failed to come up to a special standard or which developed some undesirable condition or behaviour not apparent from their bones.

It is probable that the bones in the well are from animals produced and managed by the estate which were slaughtered primarily for food. What else was produced and marketed on the hoof we cannot tell. In examining the management system behind this stock, the age and sex of the animals is important. In Table 4 the epiphyses of the limb bones have been used in an analysis of slaughtering relative to age. Approximately 62% of the cattle were allowed to mature and of the remainder most were killed in groups C and D which would be animals well grown but not skeletally mature. Such a twofold selection suggests deliberate management with meat quality in mind, as well as the maintenance of a mature productive herd. It is likely that the majority of those killed at the well grown stage were castrates but we have no proof of this. Of the older animals there are too few measurable examples of any one bone type and too few complete examples to enable the sex to be determined.

The killing pattern of the sheep is different between the two deposits and this is the only significant difference noted between them. In both there are killings or natural deaths of between 8 and 11% of young animals. In W.1 and W.2 the proportion killed in the middle age group is 15% and 31% respectively, this age group covering in modern animals those aged $1\frac{1}{2}$-$2\frac{1}{2}$ years. There is then further killing at 36% in group 1 and 20% in group 2 of animals aged $2\frac{1}{2}$-$3\frac{1}{2}$ years. In both deposits this then leaves roughly 40% of the animals to be killed after this time. This 60% killing clearly indicates a carcass oriented management of the flock and the production of wool. It is possible that there is here some evidence of a selection for wool quality. The wool from a castrate is of high quality and the heaviest yields come with the more mature body. In W.1 more animals reach the $2\frac{1}{2}$-$3\frac{1}{2}$ year group thus giving an extra clip as compared with W.2 where the emphasis is on the $1\frac{1}{2}$-$2\frac{1}{2}$ year group which would give a smaller carcass and fleece, but one of higher quality.

The flock as a whole would comprise both castrated males and females. In a wool oriented economy castrated males are also kept into old age, and it is only meat and other specialist requirements that require younger animals to be killed. In ~~Tables~~ Figs 1-4 dimensions of the bones are plotted in order to assess the sex structure of the sample. All are dimensions of the metapodial bones. The proximal end of the bone is fused at birth so that this dimension covers animals of all ages in the sample. The distal epiphyses however fuse in age group B and it is interesting to compare the dispersal of the measurements between the two extremities. In both the metacarpal and the metatarsal the proximal values show a largely regular distribution about the median value but the distal values in comparison are very unevenly distributed. This suggests that there are some animals included in the proximal values that are different from those in the distal groups. These differences are likely to be associated either with breed type, sexual status or nutritional status. The distribution of the values of the range for proximal epiphyses is similar between groups 1 and 2 but for distal values W.1 has more values in the lower half of the range than does W.2. It is suggested on this basis that the animals whose distal epiphyses are fused form a discrete group amongst the sheep as a whole and this may relate to their sex. The sheep in group 1 with fused distal epiphyses would also seem to differ slightly in bone dimensions from those in group 2. Given the correspondence of the proximal dimensions between groups 1 and 2 it is probable that this relates either to sexual status or nutrition, but it is not clear which of these animals are females and which are castrates.

An earlier killing of the stock in W.2 as compared with W.1 is also seen in the cattle and the pigs. In the former although the percentage left to mature fully is the same between W.1 and W.2 some 33% of the killing in W.1 is found in age group D whereas in W.2 it is only 10% most (24%) having been killed in group C. There would thus seem to be a distinct shift in management practices between the two groups. Whether this was due to the introduction of different or improved strains of stock with faster growth rates, changes in the availability of fodder or improvements in feeding techniques we cannot say. With the exception of the slight size differences in the sheep bones between W.1 and W.2 which could be associated with any of the above factors the bones give no indication of the nature of the change.

There is little that can be said from these bones about the conformation of the animals. Both the sheep and the cattle were horned and were not large animals. Zalkin (1960 and 1961) has determined indices for the calculation of withers height from metapodial bone dimensions in Kalmyk cattle and Romanov sheep. These can be used to give an approximate indication of height in the Rudston animals. The single complete cattle matatarsal gives a height of 117 cm. using the average value of 5.47 x length as the sex is not known. For sheep, values of 4.86 and 4.68 x length are given for the calculation of the withers height from the length of the metacarpals and metatarsals respectively. From metacarpal lengths the calculated mean height is 55 cm. (range 51-57 cm) and from metatarsals the mean is 58 cm (range 54-61 cm).

These animals are smaller than those from a number of sites and the following examples illustrate this. For cattle the width of the distal epiphysis of the metacarpal ranged from 41-58 mm. compared with 50-64 mm. from the Saxon farm at Whitehall, London (Chaplin, 1976) 51-65 mm. 16th Century, Southwark (Chaplin & Harman, 1976) and 48-65 mm. 17th-18th Century, St. Mary's, Edinburgh (Chaplin & Barnetson, 1975). Other dimensions useful for comparison are the width of the distal epiphysis of the humerus, 62-78 mm. compared with 75-99 mm. for Whitehall and 63-78 mm. late and Post Medieval, Edinburgh High Street (Chaplin & Barnetson, 1975); and the maximum width of the distal epiphysis of the tibia, 49-59 mm., 54-68 mm. and 47-64 mm. respectively. Thus the dimensions of the cattle bones are smaller on average than those from the Saxon Farm at Whitehall, London, but generally similar to those from medieval and Post medieval levels in Edinburgh.

Of the sheep bones the distal width of the humerus ranges from 23-27 mm. compared with 28-36 mm. from Saxon Whitehall, 24-34 mm. from Medieval levels at Merton Priory, Surrey (Chaplin in lit.) 25-30 mm. for 15th-16th Century sheep and 27-31 mm. for 16th-17th century sheep from Edinburgh. The distal width of the tibia ranged from 21-24 mm. compared with 25-32 mm. for Whitehall, 23-27 mm. at Merton and 22-28 mm. and 24-28 mm. for the Edinburgh animals. The length of the metacarpals ranges from 106-118 mm. compared with 120-130 mm. at Whitehall and of metatarsals 115-130 mm. compared with 128-147 at Whitehall. The sheep are thus smaller than the Saxon ones from Whitehall and the other sites but the significance of this is not yet clear.

In W.3 and 4 the character of the bone changes and there is less available for study. In view of the size of these samples only a few conclusions concerning the economy etc. can be drawn. In W.3 the bone is mixed with debris indicating the collapse of parts of the well. The bone is mostly from the large domestic animals, cattle and sheep, with some pig and horse together with Red deer. These would all appear to be food debris but with some additions. There are portions of Red deer antler from at least six stags, only one specimen is a cast antler, the remainder are from stags killed with hard antlers (i.e. roughly between August and April). There are no other bones from these individuals and the antler was being utilised as the pieces show cut and saw marks. Red deer antler was a very important raw material in ancient times and the antler was traded widely. It is not certain whether the present pieces are traded items or were obtained locally. The presence of other Red deer bones at this and higher levels in the well would suggest however that Red deer were present in the area and were hunted.

Sheep were as numerous as cattle in the sample and there is a suggestion from the age analysis that a higher percentage (c. 55%) of sheep were being kept well into maturity than in the earlier levels (c.40%). The cattle data is inconclusive. A feature of the deposit is the number of perinatal sheep (i.e. lambs) present. At least 9 bodies were distinguished. There is insufficient data about the neonatal skeleton of these primitive sheep for us to determine whether these are newborn lambs or advanced foetuses. Their presence would suggest one of two things. If these are advanced foetuses they indicate the killing or death of pregnant ewes about April which were then cut up and their innards thrown into the shaft. This time of year is one of severe nutritional stress for the pregnant ewe whether living free or confined and kept on fodder. Deaths from nutritional insufficiency would not be unexpected in a poor year. This is however not a time of year for the killing of ewes for meat. The other possibility is that the area adjoining the well was used as a lambing fold. If modern practice were followed the ewes would have been folded onto clean new grass about lambing time. Nutritional and other stress could arise from this and deaths might occur to both pregnant and lactating ewes. Equally, lambs stillborn or dying from whatever cause would then be disposed of down the well shaft. Nine deaths in a lambing flock would be considered reasonable.

The small mammals recovered from the well suggest a change in the adjoining ground cover from the period of W1 & 2 through W.3 into W.4 . The conditions implied by the small mammals from W.3 would support the possibility of the area forming a temporary lambing fold. In W.1 & 2 the Field mouse (Apodemus sp.) is with the exception of a single specimen of the Field vole (Microtus agrestis) the only small mammal present. This species occupies a variety of habitats including woodland, scrub, gardens and fields but is rarely found in open grassland where the Field vole is at all common. In W.3 there are no bones of the Field mouse but the Field vole is well represented. The Field vole has a very limited home range and its preferred habitat is rough grassland and pasture and its main food is grass. The Bank vole (Clethrionomys glareolus) occupies a greater variety of habitats than the Field vole and is more catholic in its diet. Its absence from all levels of the well is significant and the replacement of the Field mouse by the Field vole - a much more specialised animal - suggests a change in the ground cover to rough grassland or pasture in the area adjoining the well.

The weasel is a hunter of small mammals, birds etc. and is found in a variety of habitats and would have been at home in any of these conditions. The presence of the water vole implies a stream or large pond nearby or else the body might have been carried in by a dog etc. The Gypsey race about a mile away could well have provided a suitable habitat.

In the period of W.4 we are now dealing with a fairly shallow shaft and the nature of the opening is very relevant to the question of how the bones associated with this phase got there. The Field vole is the only rodent present but frogs/toads are also present possibly indicating surface water or boggy conditions in the shaft . Alternatively the shaft could have formed a giant pitfall trap for frogs and toads living nearby or on the latters annual migration to water to breed. The pitfall effect would also explain the presence of the badger but is less likely to account for the bodies of the two young red deer which would be unlikely to venture into such an area. The presence of both red deer and badger suggest woodland nearby. If they came naturally to the shaft and fell in it it would suggest that the well area was not in use by or disturbed much by man. This would imply the presence of a particularly attractive food source or the presence of surface water. Bramble, creepers like Convolvulous, Roses, Ivy or cultivated plants in general might prove such an attraction. The persistence of the remains of the Field vole however indicate that the more immediate vicinity of the well at least remained as grassland. Normally this would soon revert to scrub so it may reasonably be assumed that the grassland habitat was being maintained by the grazing of sheep and/or cattle.

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Table 1. The minimum number of each spe^ies in deposits 1 - 3 of Rudston Well.

Deposit	Sheep	Cattle	Pig	Horse	Deer	Small Memmal
W1	60	19	8	3	-	P
W2	113	47	7	7	P	P
W3	10	10	2	2	P	P

Table 8. Full list of species recorded from the Well to follow when final species list including birds is confirmed.

Table 2. The minimum number of sheep and cattle as determined from each of the principal bones of the body in deposits W1-3 of Rudston Well.

	Sheep			Cattle		
Bone	W1	W2	W3	W1	W2	W3
Cranium	P	P	P	P	P	P
Mandible	4	-	4	3	P	3
Scapula	6	9	4	8	16	7
Humerus	15	21	7	19	22	5
Radius	8	19	8	15	20	10
Ulna	3	4	2	4	6	1
Metacarpal	48	113	8	8	24	9
Innominate	7	10	4	8	18	3
Femur	9	8	9	7	25	3
Tibia	14	17	10	15	26	4
Calcaneum	13	15	4	2	13	0
Astragalus	14	14	6	6	22	2
Metatarsal	60	111	10	15	47	4

Table 3. The minimum number of pigs and horses determined from each of the principal bones of the body in deposits W1-3 of Rudston Well.

	Pigs			Horses		
Bone	W1	W2	W3	W1	W2	W3
Cranium	-	-	-	-	-	1
Mandible	3	6	2	P	P	P
Scapula	6	2	1	2	2	0
Humerus	2	4	1	2	7	0
Radius	5	2	1	2	6	0
Ulna	6	2	2	0	3	0
Metacarpal	P	P	P	3	7	2
Innominate	0	0	1	2	4	0
Femur	6	0	1	2	3	0
Tibia	8	5	1	3	6	1
Calcaneum	15	1	1	0	4	1
Astragalus	5	7	1	0	6	1
Metatarsal	P	P	1	1	6	2

Table 4 Rudston Well. Cattle. Age criteria and killing estimates from the fusion of the epiphyses of the limb bones.

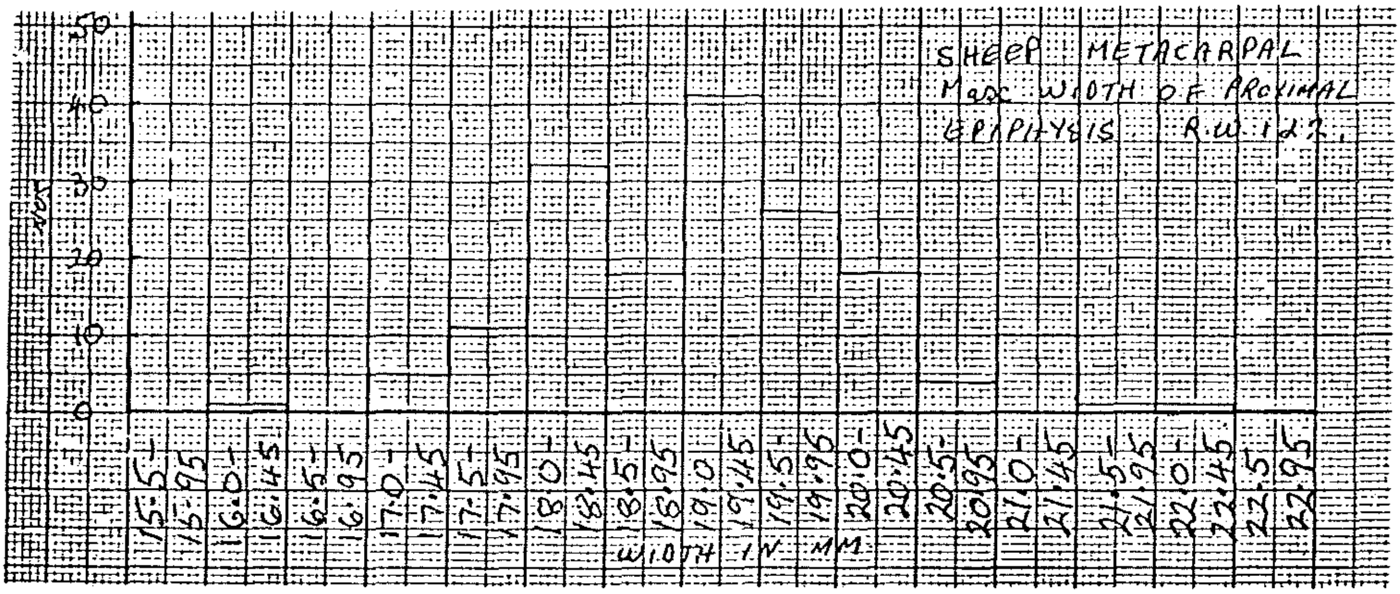
Age group	Deposit Reference	No. fused	No. unfused	% unfused	% killed in age range	% killed less than
A	W1	8	0	0	0	0
7-10	W2	14	2	13%	13%	13%
months	W3	6	0	0	0	0
B	W1	26	1	4%	4%	4%
12-18	W2	34	1	3%	-	3%
months	W3	22	1	5%	5%	5%
C	W1	18	2	5%	1%	5%
24-36	W2	41	15	27%	24%	27%
months	W3	7	3	30%	25%	-
D	W1	20	12	38%	33%	38%
36-38	W2	52	31	37%	10%	37%
months	W3	7	1	13%	-	-

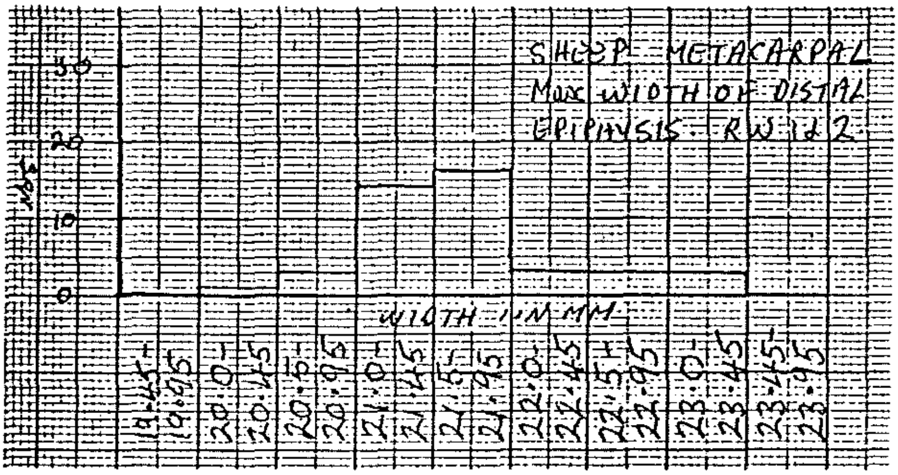
Table 5 Rudston Well. Sheep. Age criteria from epiphyseal fusion and killing estimates calculated from this.

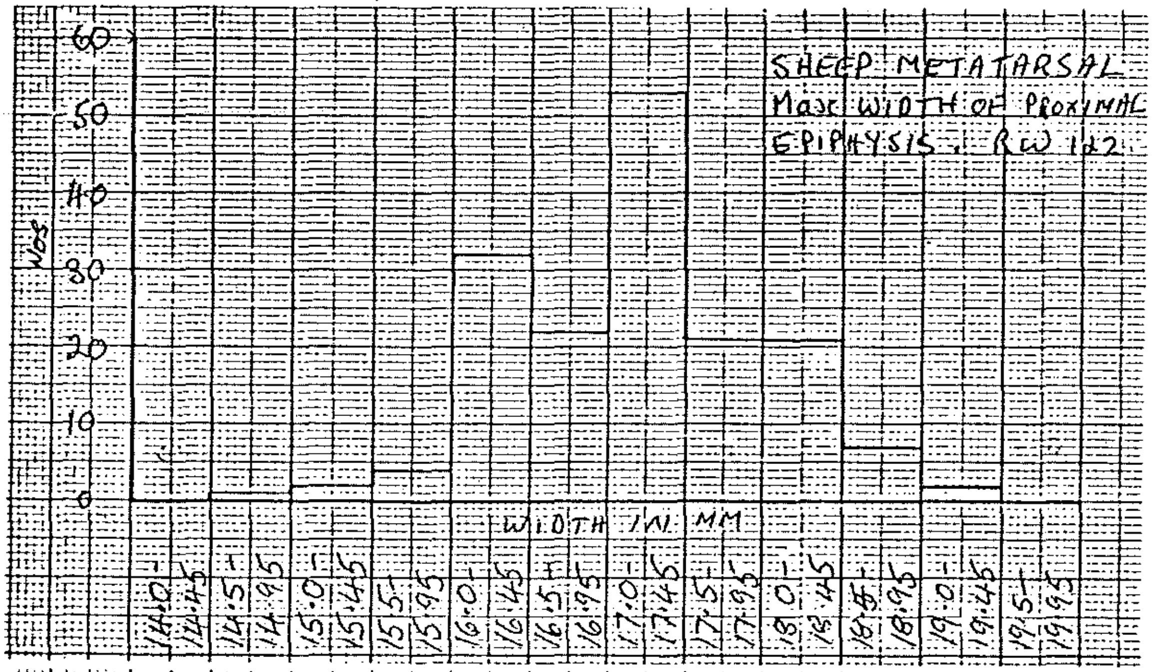
Age group	Deposit Reference	No. fused	No. unfused	% unfused	% killed in age range	% killed less than
A	W1	25	3	11%	11%	11%
under	W2	47	4	8%	8%	8%
10 months	W3	21	0	0	0	0
B	W1	61	21	26%	15%	26%
18-30	W2	99	63	39%	31%	39%
months	W3	11	2	15%	15%	15%
C	W1	16	26	62%	36%	62%
30-42	W2	22	32	59%	20%	59%
months	W3	11	9	45%	30%	45%

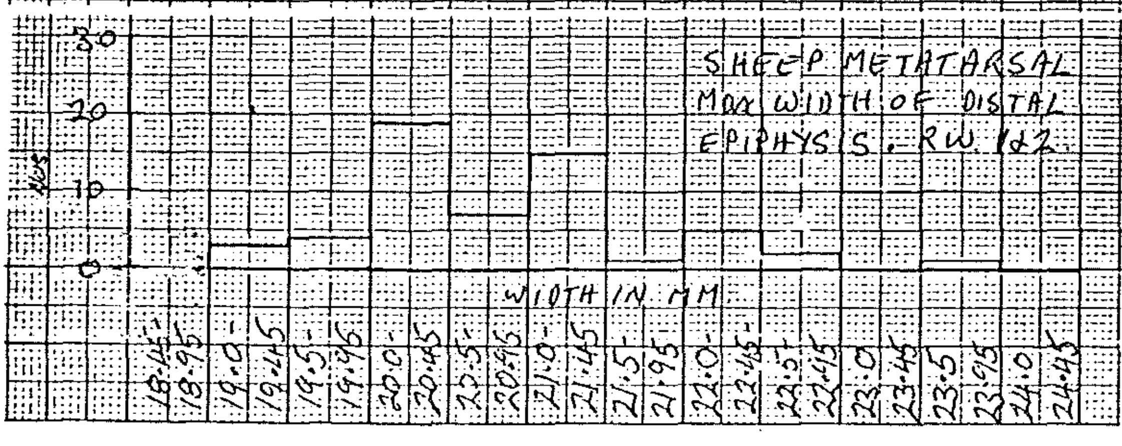
Table 6 Rudston Well, Horse. Age criteria from the fusion of the epiphyses of the limb bones

Age (in months)	Bone	No fused			No unfused		
		W1	W2	W3	W1	W2	W3
15-24	Humerus d.	1	5	-	0	0	-
	Radius p.	2	6	-	0	0	-
	Metacarpal d.	1	4	) 3	0	0	) 0
	Metatarsal d.	1	3	)	0	0	)
	Tibia d.	3	6	-	0	0	-
36-42	Radius d.	1	5	-	0	0	-
	Ulna p.	0	1	-	0	0	-
	Femur p.	2	2	-	0	0	-
	d.	-	0	-	-	2	-
	Tibia p.	0	0	-	0	0	-
	Calcaneum	0	2	-	0	0	-
	Humerus p.	0	0	-	2	0	-


SHEEP METACARPAL
Max WIDTH OF PROXIMAL
EPIPHYSIS R.W. 122.
NOS
0
10
20
30
40
50
15.5-15.95
16.0-16.45
16.5-16.95
17.0-17.45
17.5-17.95
18.0-18.45
18.5-18.95
19.0-19.45
19.5-19.96
20.0-20.45
20.5-20.95
21.0-21.45
21.5-21.95
22.0-22.45
22.5-22.95
WIDTH IN MM


SHEEP METACARPAL
Max WIDTH OF DISTAL
EPIPHYSIS RW 122.
NOS
0
10
20
30
WIDTH IN MM
19.45-19.95
20.0-20.45
20.5-20.95
21.0-21.45
21.5-21.95
22.0-22.45
22.5-22.95
23.0-23.45
23.45-23.95


SHEEP METATARSAL
Max WIDTH OF PROXIMAL
EPIPHYSIS. RW 122.
NOS
0
10
20
30
40
50
60
WIDTH IN MM
14.0-14.45
14.5-14.95
15.0-15.45
15.5-15.95
16.0-16.45
16.5-16.95
17.0-17.45
17.5-17.95
18.0-18.45
18.5-18.95
19.0-19.45
19.5-19.95


SHEEP METATARSAL
Max WIDTH OF DISTAL
EPIPHYSIS. RW. 122.
NOS
0
10
20
30
WIDTH IN MM
18.45-18.95
19.0-19.45
19.5-19.96
20.0-20.45
20.5-20.95
21.0-21.45
21.5-21.95
22.0-22.45
22.5-22.95
23.0-23.45
23.5-23.95
24.0-24.45