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ARCHAEOZOOLOGICAL ANALYSIS OF ANIMAL REMAINS FROM THE ROMAN FORTRESS CAMP IN NOVAE

Abstract: The article presents the results of an archaeozoological analysis of animal remains from Novae. Pig remains dominated the second–third century AD horizon. In the fourth and sixth century AD, cattle bones prevailed in the assemblage. Bird, fish, and wild mammal remains were low in number in all periods.

Key words: archaeozoology, Novae, meat, consumption

Animal remains from the excavation seasons in 2014, 2015 and 2016, carried out in the Roman legionary fortress in Novae (Bulgaria), were subjected to archaeozoological examination and analysis.[1] The assemblage, coming from different trenches and layers, dates overall from the first century AD to medieval times, but not all the recognized chronological periods yielded a sufficient number of bones to warrant statistical analysis. The present study thus concerns three periods for which such analyses could be carried out: second–third century AD, fourth century AD and sixth century AD.

Research methodology

Species identification was made on the grounds of diagnostic features observed on the bones, considered as characteristic of particular animal species.[2] Goat and sheep remains with no diagnostic features for making the distinction were classed together.

The percentage share of domesticated and wild mammals was calculated and presented in the form of distribution charts.

Anatomical identification of the bone remains was carried out, dividing the bones into seven groups:

- Head — skull, mandible, teeth, horn buds, antlers, hyoid bone;
- Trunk — vertebrae, sternum, ribs, sacrum;
- Anterior (fore-)limb, proximal part — shoulder blade, humeral, radial, ulnar bones;
- Anterior (fore-)limb, distal part — carpal, metacarpal bones;
- Posterior (hind) limb, proximal part — pelvis, femoral, tibial, fibular bones, patella;

[1] The project has been financed with resources provided by the National Science Center, Poland, allotted on the basis of decision DEC-2014/13/B/HS3/04836.

[2] Krysiak 1975; Hillson 1992; Collins, Halstead, Isaakidou 2002; Lasota-Moskalewska 2008; France 2009.

- Posterior (hind) limb, distal part — tarsal, metatarsal bones;
- Digits — phalanges I, II and III.

Anatomical distribution percentages were calculated for all cases where more than 30 bones were recorded. The number of bones per group was calculated as a percentage share of the total number of bone remains of a given species.

Carcass parts were identified as either attractive, that is, with a consumptional preference for the most muscled and fatty parts (trunk, proximal parts of forelimbs and hind limbs), and less attractive, that is, the head and the distal parts of limbs, and the phalanges.

Age-at-death of the animals (cattle, pigs, horses, goats and sheep) was determined based on growth and wear of permanent teeth.[3] Long bone epiphysis was estimated according to Jan Kolda.[4]

Sex was determined based on sexual dimorphism characteristics observed on the bones. For cattle bones, proportions were determined for the different metapodial bone dimensions.[5] For pig remains, the shape of the fangs and of the alveoli was of key importance.[6] The shape of horn buds was decisive in the case of goats and sheep.[7]

Height at the withers was calculated based on long bone measurements using coefficients established for cattle;[8] for cattle, pig, sheep, dog and horse;[9] and for goat.[10]

Animal morphology was estimated on a 100-point scale.[11] Bone measurements in centimeters were transposed into a point value between 0 and 100. The position on the scale determined the morphological type.

Pathological characteristics and changes on the bones were evaluated. Also noted were deformations that could be attributed to the use of animals by humans (e.g., harnessing).

All observable marks on the bones were described. This included marks left by processing for consumption (chopping, flaying and filleting), as well as individual craftsmanship (sawing and polishing).

Results
Second–third century AD

The number of identified specimens (NISP) reached 202 out of a total of 228 bones, demonstrating the good condition of the remains. The recognized remains included mammals (96%), birds (3%) and fish (1%). No other classes of animals were observed (Table 1, Chart 1). Mammals were divided into domesticated (99%) and wild (1%) species (Table 2, Chart 2). Wild mammals were represented by only two bones, a hare and a boar (Table 3). Most of the assemblage were bones of domesticated animals, including 41.7% pig and 40.6% cattle, followed by 12% goat and sheep, 4.2% horse and 1.6% dog (Table 4, Chart 3).

Pig

The most numerous group is made up of pig bones, altogether 80 specimens (41.7%). All parts of the carcass were represented (Table 5, Chart 4). Compared to the model skeleton for pigs,[12] there is a definite excess of proximal parts of the anterior limb: 25.6% compared to the model approximate 4%. More head bones and proximal parts of the posterior limbs are also present, while there is a statistically inadequate amount of phalanges (barely 1.3% compared to the model about 20%). There is also not enough distal parts of both anterior and posterior limbs, as well as trunk.

[3] Lutnicki 1972; Grant 1982.
[4] Kolda 1936.
[5] Howard 1963.
[6] Habermehl 1975, p. 135.
[7] Lasota-Moskalewska 2008, p. 166.
[8] Fock 1966.
[9] Driesch, Boessneck 1974.
[10] Schramm 1967.
[11] Lasota-Moskalewska 1982–1984.
[12] Lasota-Moskalewska 2008, p. 238.

Morphologically immature animals (under 3.5 years of age, at which point epiphysis fusion processes are completed) constituted 23.8% pig bones (Table 7). This is less than for most archaeological sites, where the number of young pigs fell in the range of 30–35%.

The sex of six individuals was determined: three males and three females (Table 8).

Marks on bones attesting to meat processing comprised seven traces of chopping and three of filleting (Table 10). Five bones revealed marks interpreted as gnawing by predators (dogs).

Cattle

Cattle remains were second-ranked in terms of number (40.6%). All parts of the carcass were represented among the remains (Table 6, Chart 5) and, similarly as with the pig remains, there was a surplus of proximal parts of both limbs and distal parts of posterior limbs. Deficiencies were noted with regard to the number of phalanges and trunk bones. Bones of the head and distal parts of the anterior limbs were recorded in model proportions.

Young individuals (under 3.5 years of age) constituted 2.6% of the cattle remains, that is, less than at most archaeological sites, where the percentage share ranged between 5% and 8%.

The sex of seven individuals was determined, two being males and five females (Table 8).

Measurements of cattle bones gave an indication of the morphological type of some of the individuals (Table 9). Bone length transposed onto the 100-point scale fell in the range between 43 and 100 (Chart 7), bone width between 38 and 85 (Chart 8). This puts the animals in the middle--sized (31–70 point range) to large (71–100 point range) cattle range with a slight superiority of middle-sized individuals. Distribution on both charts is close to the regular Gaussian model with the apex near 60 points and the span between about 40 and 85.

Long bone measurements gave a height at the withers between 117 cm (the lowest for a female) and 157 cm (highest for a male). Seven individuals were thus determined (Table 9).

Marks on the bones included all the kinds of marks reflecting meat processing for consumption: 16 marks of chopping, two of filleting, two of flaying and one of part burning (Table 10). Gnawing by predators was observed on two bones.

Goat/sheep

Bones of goats and sheep occupied third place in terms of the number (12%). Two of the 23 bones from this group were identified as sheep and one as a goat. Not all parts of the carcass were represented. Missing were the distal parts of posterior limbs (Table 6, Chart 6). Anatomical distribution charts could not be prepared because of the insufficient number of bones (22 anatomically recognized bones). Even so, a high frequency of trunk bones and proximal parts of anterior limbs (six each) was recorded in the face of the small number of phalanges (1 bone).

Young individuals (three identified) constituted 13% of all the sheep and goat remains (Table 7). This exceeded the usual percentage of morphologically immature individuals at other archaeological sites, comprised between 5% and 8%.

The length of goat metacarpals placed the height at the withers of the animal at 72 cm.

Marks on the bones included two examples of chopping and one of filleting (Table 10). Two bones also displayed marks of gnawing by predators.

Horse

Eight horse bones made up for 4.2% of the assemblage. One bone demonstrated gnawing marks.

Dog

Dog bones, three identified, made up 1.6% of the material. Tibial bone length measurements determined withers height at 56 cm.

Wild mammals
There were two bones of wild mammals, one boar and one hare.

Birds
Six bones of birds made up 3% of the identified bones.

Fish
Two fish bones were determined.

Fourth century AD

The number of identified specimens (NISP) was 79 out of 83 (NISP). Both mammals and birds were represented in the assemblage (Table 11, Chart 9), mammals constituting an absolute majority (98.7%) and among these domesticated mammals. The largest number of bones, 47, belonged to cattle (60.3%) (Table 12, Chart 10). Next in line were pig bones, 18 (23.7%), goat/sheep, 6 bones (7.7%), horse, 6 bones (7.7%) and dog, one bone (1.3%).

Cattle
Cattle remains constituted 60.3% of the material. All parts of the carcass were represented (Table 13, Chart 11). Compared to the model anatomical distribution, there was a surplus of proximal parts of both limbs and of distal parts of the posterior limbs. A deficiency occurred in the case of trunk bones and phalanges. Distal parts of the anterior limbs and head represented model proportions.

The percentage of bones of morphologically immature animals was 6.4% (Table 15), well within the range recorded on most archaeological sites (between 5% and 8%).

Length measurements on the 100-point scale (Table 17) fell between 35 and 100 points (Chart 13). Width measurements were more clustered, between 46 and 67 points (Chart 14), the distribution being closer to the regular distribution with an apex near 53 points.

Measurements of the length of metacarpals of a female specimen gave a withers height of this individual at 111 cm (Table 17).

Nine bones showed chopping marks, three filleting (Table 18). Marks of gnawing by predators were recorded on nine bones.

Pig
Pig remains were in second place (23.1%). Not all the parts of the carcass were represented. Distal parts of the anterior limbs and phalanges were missing (Table 14, Chart 12). The largest number of bones represented the proximal parts of both limbs, while a few bones came from the trunk and distal parts of posterior limbs.

Young individuals made up for 11.1% of the pig remains (Table 15). This is less than on most archaeological sites, where the range recorded was between 30% and 35%.

One individual was determined to be a male (Table 16).

Marks on pig bones included chopping (one case) and gnawing by predators (four cases) (Table 18).

Goat/sheep
Goat/sheep bones constituted 7.7% of the bones of domesticated mammals; two bones were specifically identified as goats and one as sheep. Anatomical distribution charts could not be prepared because of the insufficient number of bones.

One bone belonged to a morphologically immature individual (Table 15).
Chopping marks were recorded on one bone (Table 18).

Horse
Horse bones made up for 7.7% of the bones of domesticated animals, but the overall number did not support an analysis of anatomical distribution. Not one of the bones could be used to determine age-at-death.

Gnawing by a predator was noted on one bone (Table 18).

Dog
One dog bone was recorded.

Birds
One bird bone was recorded, making for 1.3% of the assemblage (Table 11, Chart 9).

Sixth century AD

Bones from the sixth century AD counted 752, constituting the largest of the analyzed assemblage; of these 712 were identified to species (NISP). 99.2% of the bones represented mammals (Table 19, Chart 15). The percentage share of bird and fish bones was in both cases 0.4%. Domesticated mammals predominated: 686 bones making for 97.2% (Table 20, Chart 16), while wild mammals accounted for 20 bones (2.8%). Cattle were in first place among domesticated mammals, 59.8% (Table 21, Chart 17). Next in line were pig remains (20.4%), goat/sheep (11%), horse (8.2%) and dog (0.4%).

Cattle
The biggest group was formed by cattle remains. They represented all parts of the carcass (Table 23, Chart 18). A surplus compared to the distribution model concerned proximal parts of anterior limbs. Larger numbers of both parts of the posterior limbs were also present in the assemblage. A deficiency occurred in the number of bones from the trunk, the phalanges and the head. The distal parts of anterior limbs represented model proportions.

Remains of morphologically immature animals made for 6.3% of the cattle bones (Table 26), falling well within the accepted range (5–8%).

Sex determinations resulted in 14 individuals being identified to sex: 12 females, one male and one castrate, meaning an ox (Table 27).

Bone measurements transposed on a 100-point scale determined cattle morphology. Length was distributed from 0 to 100 points (Table 28, Chart 22), but 0 points occurred only once and the chart was skewed with more average results, the apex being around 56 points and span from 38 to 100 points. Superimposing width measurements on the 100 point scale produced a similarly skewed chart with the apex near 50 points and span from 15 to 100 (Chart 23).

Long bone measurements permitted the withers height to be determined for 15 individuals (Table 28). The lowest was a female, 113.4 cm high, the highest a male, 132.5 cm high.

Cattle bones revealed chopping marks in 42 cases, filleting in 10 cases and 1 example of flaying (Table 29). Gnawing by predators was observed on 11 bones.

Pig
The second largest group of bones represented pig remains (20.4%). They did not represent all parts of the carcass, phalanges being notably absent (Table 24, Chart 20), whereas there was

a surplus of proximal parts of both limbs as well as the head bones compared to the model distribution pattern. Trunk and distal parts did not make the mark compared to the model.

The percentage of young animals in the material was 23.6% (Table 26). This is slightly below average for pig remains (30–35%).

Sex determination was successful in the case of 12 individuals: nine males and three females (Table 27).

Talus measurements allowed the withers height of one individual to be calculated at 80 cm (Table 28).

Marks on the bones were interpreted as chopping in seven cases, filleting in four, and part burning in two (Table 29). Gnawing by predators was recorded in four cases.

Goat/sheep

Goat and sheep bones accounted for 11.2% of the domesticated mammals. They represented all parts of the carcass (Table 23, Chart 19). Compared to the distribution model, head bones were in surplus, as were the proximal parts of the limbs. Distal parts of limbs approached the distribution model, while trunk bones and phalanges were below standard.

Bones of young animals constituted 24.7% of all goat/sheep remains (Table 26). This percentage share was much larger than at most other archaeological sites.

Four individuals had the sex determined: three were males and one was a female (Table 27).

Long bone measurements allowed the withers height of two goats and two sheep to be determined. The goats were 62 and 64 cm high, the sheep 68.5 and 61 cm (Table 28).

Cut marks were observed on 13 bones (Table 29). Twelve of these were chopping marks, the last filleting. Gnawing by predators could be seen on three bones.

Horse

The percentage of horse remains accounted for 8.2% of domesticated mammals. An analysis of anatomical distribution demonstrated that all parts of the carcass were present (Table 25, Chart 21) and largely in keeping with the model distribution. Significant differences were noted practically only in the case of the proximal parts of both limbs, where a surplus of bones was noted.

Bones of morphologically immature individuals accounted for 8.9% (Table 26), clearly more than at most archaeological sites where the percentage share rather did not exceed 1%.

Measurement of metacarpals led to a withers height estimate for three individuals: 137 cm, 144 cm and 151 cm (Table 28).

Chopping marks were found on one bone and gnawing marks on another (Table 29).

Dog

Three bones of a dog constituted 0.4% of the domesticated mammals.

Wild mammals

The 20 bones of wild animals that were recorded accounted for 2.8% of mammal remains (Table 20). The set included 10 bones of deer, five of boar, three of fox and one each of roe deer and hare (Table 22).

Birds

Three bones of birds were recorded; they made for 0.4% of the assemblage (Table 19).

Fish

The three fish bones accounted for 0.4% of the assemblage (Table 19).

Discussion

The bone assemblage from Novae represents three different periods. The first (second–third century AD) corresponds to Novae's functioning as a Roman fort, the seat of the I *Italica* legion. In the fourth century AD, the garrison was reduced and the first civil architecture was raised in place of the old legionary buildings. Novae's era of prosperity ended with the Goth invasion of the Balkans in 376–378. As for the third period, the sixth century AD, Novae was a civil town then, an important river harbor on the Danube and episcopal see. It was even called "Ravenna of the East" in the times of Justinian (527–565 AD).

The meat consumption model in Novae is surprisingly stable despite the 500 years covered by the three periods. Mammals, for the most part domesticated animals, were the principal source of meat. Birds, fish and wild animals were at a premium, very scarce indeed and even absent altogether, as in the second period, in the fourth century AD (although one should admit that it was the smallest assemblage, comprising barely 79 bones, hence consumption cannot be excluded despite the lack of evidence).

The first period (second–third century AD) witnessed a balance between cattle and pig remains. Considering that cattle dominated the assemblage from the first century AD, analyzed by Anna Gręzak and Alicja Lasota-Moskalewska,[13] one should see a change here, possibly due to numerous military conflicts, in which the Empire was embroiled in the second and third century AD. Of all the animals bred for meat, pigs are the only species to have litters more often than once a year; they also have the most piglets in a litter and quickly increase body mass.[14] Thus pig breeding was the most obvious solution, assuming that the objective was to acquire large quantities of meat for soldiers in the shortest possible time. The percentage of bones of young animals was slightly less than the average for both cattle and pig, which is also the rule, as it is not viable economically to slaughter a large number of young animals. Analyzing anatomical distribution, for pigs as much as for cattle, we observe a significant surplus of proximal parts of limbs. This form of distribution of the bones is typical of consumption set on meat. These parts (along with the trunk) are attractive for consumers because of the large amount of muscle tissue (shoulder, haunch, knuckles). The anatomical distribution for pigs as well as cattle revealed all parts of the carcass, including phalanges, indicating that at least some individuals were slaughtered and quartered on site. No phalanges would have been discovered most probably had all the meat been brought to camp in the form of prepared cuts, this because phalanges usually get cut off when flaying the skin. The number of sexed animals is small, so the only conclusion to be made is that adult females predominated in the cattle category, which is the correct structure for livestock breeding at this time. Varro wrote in his *De re rustica* (2.5.18): "As to the number of bulls and cows, the rule is that there be, to every sixty cows, one yearling bull and one two-year-old".[15] The cattle was of the middle-sized and large variety, a more or less uniform population (between 40 and 80 points on the 100-point scale) with a certain number of very large individuals (100 points on the scale). It was most likely Italian long-horned cattle characterized by a huge skeleton and large body mass as described by Sándor Bökönyi.[16] In the opinion of this researcher, cattle of this variety became common in Pannonia and the other European provinces after the Roman conquest.

Goat meat and mutton was consumed much less often than pork and beef. Young animals were more frequent as well. Eating lamb meat was more of an occasional thing. The morphotype determined for one goat revealed it to be a large individual, 72 cm high at the withers.

[13] Gręzak, Lasota-Moskalewska 1996.
[14] Lasota-Moskalewska 2008, p. 250.
[15] Translation after: Loeb Classical Library, 1934 (http://-penelope.uchicago.edu/Thayer/E/Roman/Texts/Varro/de_Re_Rustica/2*.html).
[16] Bökönyi 1982.

Marks typical of chopping, filleting, flaying and burning were observed on the bones of all four species. Gnawing marks on some bones attested to the practice of throwing bones to the dogs.

Horse and dog remains were few and bore no marks indicative of processing for the purpose of consumption. Horses were either for riding or as draft animals, whereas dogs may have been used to guard the herds.

The consumption model changed in the fourth century AD. Cattle now predominated the record of faunal remains, although this result cannot be accepted as a certainty in view of the earlier analyzed assemblage from the *principia*, which was also from the fourth century AD.[17] It was found for that assemblage that goat/sheep predominated, followed by pig in second place. Further assemblages from the fourth century are needed for study in order to understand the consumption model for this period in Novae. In the set studied in this paper, cattle bones constituted 60% of all domestic mammals. Pig remains accounted for more than two times less of the bones. The anatomical distribution study pointed to a consumption preference for the best cuts, that is, proximal parts of both limbs. The presence of all parts of the cattle carcass indicated that the animals were slaughtered on the spot. The same cannot be said with certainty for sheep and goats because phalanges were not identified in the record. The number of bones of calves is similar to that from other sites, even while there are less young pigs, sheep and goats than at other sites. The slaughtered cattle represented a fairly uniform morphotype: middle-sized with a fairly frequent occurrence still of large animals belonging to the long-horned variety from Pannonia (only one measurement on the 100-point scale, but there were more bones in the assemblage that belonged to this kind of cattle but were not measurable). Sheep and goat bones were rare. Typical consumption marks were observed on bones of cattle, pigs, goats and sheep. These were not found on the bones of dogs and horses, these being utilitarian animals in this period as in the previous one.

In the sixth century AD, when the camp in Novae ultimately lost its military character, cattle remains continued to predominate in the assemblage, topping pig remains three times over, which leaves no doubt as to the preference for beef as compared to pork. Goat meat and mutton were consumed the least often. The anatomical distribution of cattle remains indicated a huge surplus of the proximal parts of the anterior limbs compared to the model distribution and a reverse proportion in the case of phalanges. Therefore, large quantities of shoulder and shin had to have been brought already after slaughter and skinning. Haunches must have also been brought judging by the disproportion regarding the model pattern for the proximal parts of posterior limbs. A significant low was noted in the case of trunk bones, meaning that the cuts of meat came without the vertebra and ribs, having already been butchered elsewhere. The same went for pigs and goats/sheep (and no phalanges were recorded for pigs). Most of the meat was imported already in the form of a butchered carcass. The anatomical distribution for horse bone was the only one to come close to the model pattern. Since these animals were not consumed, there was no reason for bringing in any additional parts or for butchering the ones present any more than needed. The herd structure for cattle was rather traditional, the number of young individuals not exceeding the norm. A little less young pigs was represented in the assemblage than is the rule. As for goats and sheep, there was much more than usual. It would appear that once goat and sheep meat were consumed, the preference was for lamb meat. This shows that sheep were bred for meat rather than for wool, and this in turn shows a pastoral form of breeding. The male to female proportions in the herds reveals a 6-to-1 ratio for cattle (12 females to 2 males), exactly as suggested by Varro. Males predominated in the pig category, but there is no data for the proportions in pig breeding in antiquity and hence it is difficult to say whether this was a natural one. Cattle morphology remained largely unchanged as compared to the earlier period with middle-sized and large individuals dominating the record. A distribution close to the model one indicates a rather stable breeding situation. Very

[17] Grężak, Piątkowska-Małecka 2000.

large individuals, which can be identified with Italian longhorned cattle, were still present. The two goats with determined morphology turned out to belong to the small variant. Typical post--consumptional marks were observed on the bones of cattle, pigs, goats and sheep. Dogs and horses were most likely not consumed in this period as well. Horses were rather robust, measuring (three individuals recorded) from 137 cm to 151 cm at the withers. In the sixth century AD, more wild mammal bones were recorded, but still the overall number is very low. This set shows that hunting around Novae was centered on deer, roe deer, boars, foxes and hares.

The overall dietary conclusion from the present study is that meat of domesticated mammals was consumed in Novae, both when it was a Roman fort and when it was a Byzantine town. Birds and fish were not common in the diet. The consumption model changed over time, from a balance between beef and pork to a clear preference for beef. Venison was extremely rare on the table during this entire period.

Tables and charts

No. bones: number of bones studied
Bd: breadth of distal end
Bp: breadth of proximal end
GL: maximum length
Sd: width of shaft

Table 1. Division into classes, second–third century AD

Class	No. bones	%
Mammals	194	96%
Birds	6	3%
Fish	2	1%

Table 2. Mammals: domesticated and wild, second–third century AD

Class	No. bones	%
Domesticated	192	99%
Wild	2	1%

Table 3. Wild mammals, second–third century AD

Species	No. bones
Boar	1
Hare	1

Table 4. Domesticated mammals, second–third century AD

Species	No. bones	%
Cattle	78	40.6%
Pig	80	41.7%
Goat/sheep	23	12.0%
Horse	8	4.2%
Dog	3	1.6%

Table 5. Pig: anatomical distribution, second–third century AD

Part of carcass	No. bones	%	Model
Head	22	28.2%	20%
Trunk	22	28.2%	34%
Anterior limb, proximal	20	25.6%	4%
Anterior limb, distal	2	2.6%	10%
Posterior limb, proximal	8	10.3%	3%
Posterior limb, distal	3	3.8%	9%
Phalanx	1	1.3%	20%

Table 6. Cattle and goat/sheep: anatomical distribution, second–third century AD

Part of carcass	Cattle		Goat/sheep	Model
	No. bones	%	No. bones	
Head	16	21.1%	3	20%
Trunk	16	21.1%	6	43%
Anterior limb, proximal	17	22.4%	6	5%
Anterior limb, distal	5	6.6%	4	8%
Posterior limb, proximal	11	14.5%	2	3%
Posterior limb, distal	10	13.2%	0	7%
Phalanx	1	1.3%	1	14%

Table 7. Age-at-death, second–third century AD

Age	Cattle		Pig		Goat/sheep	
	No. bones	%	No. bones	%	No. bones	%
Young	2	2.6%	19	23.8%	3	13.0%
Mature and indeterminate	76	97.4%	61	76.3%	20	87.0%

Table 8. Sex, second–third century AD

Species	Male	Female
Pig	3	3
Cattle	2	5

Table 9. Morphology, second–third century AD

Species	Bone	Measurement (cm)	100 point scale	Height at the withers (cm)
Cattle	Phalanx I	GL-5.73	43	
Cattle	Shoulder blade	SLC-5.76	78	
Cattle	Calcaneus	GL-14.05	100	
Cattle	Humerus	Bd-6.95	38	

Cattle	Talus	GLI-7.0	60	
Cattle	Talus	GLI-6.4	45	
Cattle	Talus	GLI-6.97	60	
Cattle	Metacarpals	Bp-5.64, Bd-5.8, Sd-3.24, GL-19.5	46, 40, 52, 56	117
Cattle	Metacarpals	Bp-7.05, Bd-7.33, Sd-3.83, GL-23.0	81, 78, 82, 100	144
Cattle	Metacarpals	Bp-5.86, Bd-6.28, Sd-3.45, GL-20.6	52, 51, 62, 70	124
Cattle	Metacarpals	Bp-5.7, Sd-3.17, GL-20.3	48, 47, 68	122
Cattle	Metacarpals	Bd-6.62, Sd-3.76, GL-21	61, 77, 75	126
Cattle	Metatarsals	Bp-4.82, Bd-5.73, Sd-2.87, GL-22.6	61, 62, 64, 56	136
Cattle	Metatarsals	Bp-5.06, Bd-6.4, Sd-3.25, GL-25.1	69, 83, 85, 81	157
Cattle	Metatarsals	Bd-5.3	47	
Goat	Metacarpals	GL-12.6		72
Dog	Tibia	GL-19.1		56

Table 10. Marks on bones, second–third century AD

Species	Chopping	Filleting	Part burning	Flaying	Gnawing
Cattle	16	2	1	2	2
Pig	7	3	0	0	5
Goat/sheep	2	1	0	0	2
Horse	0	0	0	0	1

Table 11. Division into classes, fourth century AD

Class	No. bones	%
Mammals	78	98.7%
Birds	1	1.3%

Table 12. Domesticated mammals, fourth century AD

Species	No. bones	%
Cattle	47	60.3%
Pig	18	23.1%
Goat/sheep	6	7.7%
Horse	6	7.7%
Dog	1	1.3%

Table 13. Cattle: anatomical distribution, fourth century AD

Part of carcass	No. bones	%	Model
Head	9	19.1%	20%
Trunk	11	23.4%	43%
Anterior limb, proximal	8	17.0%	5%
Anterior limb, distal	3	6.4%	8%
Posterior limb, proximal	8	17.0%	3%
Posterior limb, distal	6	12.8%	7%
Phalanx	2	4.3%	14%

Table 14. Pig: anatomical distribution, fourth century AD

Part of carcass	No. bones	Model
Head	3	20%
Trunk	2	34%
Anterior limb, proximal	6	4%
Anterior limb, distal	0	10%
Posterior limb, proximal	5	3%
Posterior limb, distal	2	9%
Phalanx	0	20%

Table 15. Age-at-death, fourth century AD

	Young		Mature and indeterminate	
Species	No. bones	%	No. bones	%
Cattle	3	6.4%	44	93.6%
Goat/sheep	1	16.7%	5	83.3%
Pig	2	11.1%	16	88.9%

Table 16. Sex, fourth century AD

Species	Male	Female
Pig	1	–

Table 17. Morphology, fourth century AD

Species	Bone	Measurement (cm)	100 point scale	Height at the withers (cm)
Cattle	Phalanx I	GL-6.1	52	
Cattle	Phalanx I	GL-5.43	36	
Cattle	Calcaneus	GL-14.1	100	
Cattle	Tibia	Bd-6.73	55	
Cattle	Talus	GLI-6.96	59	

Cattle	Metacarpals	Bp-5.95	53	
Cattle	Metacarpals	Bp-6.05, Bd-6.06, Sd-3.54, GL-17.8	56, 46, 67, 35	111
Cattle	Metatarsals	Bp-4.8, Sd-2.64	60, 52	

Table 18. Marks on bones, fourth century AD

Species	Chopping	Filleting	Gnawing
Cattle	9	3	9
Pig	1	0	4
Horse	0	0	1
Goat/sheep	1	0	0

Table 19. Division into classes, sixth century AD

Class	No. bones	%
Mammals	706	99.2%
Birds	3	0.4%
Fish	3	0.4%

Table 20. Mammals, sixth century AD

Class	No. bones	%
Domesticated	686	97.2%
Wild	20	2.8%

Table 21. Domesticated mammals, sixth century AD

Species	No. bones	%
Cattle	410	59.8%
Pig	140	20.4%
Goat/sheep	77	11.2%
Horse	56	8.2%
Dog	3	0.4%

Table 22. Wild mammals, sixth century AD

Species	No. bones
Deer	10
Boar	5
Fox	3
Roe deer	1
Hare	1

Table 23. Cattle and goat/sheep: anatomical distribution, sixth century AD

Part of carcass	Cattle		Goat/sheep		Model
	No. bones	%	No. bones	%	
Head	63	15.7%	20	27%	20%
Trunk	59	14.7%	9	12%	43%
Anterior limb, proximal	135	33.6%	17	23%	5%
Anterior limb, distal	29	7.2%	7	9%	8%
Posterior limb, proximal	61	15.2%	12	16%	3%
Posterior limb, distal	50	12.4%	8	11%	7%
Phalanx	5	1.2%	1	1%	14%

Table 24. Pig: anatomical distribution, sixth century AD

Part of carcass	No. bones	%	Model
Head	51	36.4%	20%
Trunk	18	12.9%	34%
Anterior limb, distal	36	25.7%	4%
Anterior limb, distal	8	5.7%	10%
Posterior limb, proximal	18	12.9%	3%
Posterior limb, distal	9	6.4%	9%
Phalanx	0	0.0%	20%

Table 25. Horse: anatomical distribution, sixth century AD

Part of carcass	No. bones	%	Model
Head	10	18.2%	23%
Trunk	21	38.2%	43%
Anterior limb, proximal	7	12.7%	4%
Anterior limb, distal	5	9.1%	11%
Posterior limb, proximal	5	9.1%	3%
Posterior limb, distal	3	5.5%	10%
Phalanx	4	7.3%	6%

Table 26. Age-at-death, sixth century AD

Age	Cattle		Pig		Goat/sheep		Horse	
	No. bones	%	No. bones	%	No. bones	%	No. bones	%
Young	26	6.3%	33	23.6%	19	24.7%	5	8.9%
Mature and indeterminate	384	93.7%	107	76.4%	58	75.3%	51	91.1%

Table. 27. Sex, sixth century AD

Species	Male	Castrate	Female
Cattle	1	1	12
Pig	9	0	3
Goat/sheep	3	0	1

Table 28. Morphology, sixth century AD

Species	Bone	Measurement (cm)	100 point scale	Height at the withers (cm)
Cattle	Phalanx I	GL-6.2	55	
Cattle	Phalanx I	GL-5.55	39	
Cattle	Shoulder blade	SLC-5.62	76	
Cattle	Calcaneus	GL-14.25	100	
Cattle	Calcaneus	GL-14.4	100	
Cattle	Calcaneus	Gl-13.8	95	
Cattle	Calcaneus	GL-13.8	95	
Cattle	Calcaneus	GL-13.4	85	
Cattle	Calcaneus	GL-13.2	80	
Cattle	Tibia	Bd-6.5	50	
Cattle	Tibia	Bd-6.5	50	
Cattle	Tibia	Bp-6.72	18	
Cattle	Tibia	Bd-6.71	54	
Cattle	Tibia	Bd-7.5	70	
Cattle	Tibia	Bd-6.0	40	
Cattle	Radius	Bd-6.95	73	
Cattle	Radius	Bp-7.6	15	
Cattle	Radius	Bd-7.45	86	
Cattle	Radius	Bd-8.7	100	
Cattle	Radius	Bd-8.3	100	
Cattle	Radius	Bp-7.74	18	
Cattle	Radius	Bp-9.22	56	
Cattle	Radius	Bp-9.2	55	
Cattle	Radius	Bp-9.1	52	
Cattle	Radius	Bp-7.4, Bd-6.63, GL-26.9	10, 65, 0	116
Cattle	Humerus	Bd-7.9	58	
Cattle	Humerus	Bd-7.26	42	
Cattle	Humerus	Bd-7.91	58	
Cattle	Humerus	Bd-7.5	50	
Cattle	Humerus	Bd-5.82	16	
Cattle	Humerus	Bd-9.46	88	
Cattle	Humerus	Bd-7.8	56	

Cattle	Humerus	Bd-7.15	42	
Cattle	Humerus	Bd-7.26	43	
Cattle	Humerus	Bd-7.06	40	
Cattle	Humerus	Bd-8.2	64	
Cattle	Humerus	Bd-6.86	37	
Cattle	Humerus	Bd-7.4	48	
Cattle	Talus	GLI-6.88	56	
Cattle	Talus	GLI-6.1	38	
Cattle	Talus	GLI-7.1	62	
Cattle	Talus	GLI-6.99	59	
Cattle	Talus	GLI-6.8	55	
Cattle	Talus	GLI-7.52	73	
Cattle	Talus	GLI-6.37	43	
Cattle	Talus	GLl-6.82	56	
Cattle	Metacarpals	Bp-7.21, Bd-7.6, Sd-4.2, GL-21.2	85, 85, 100, 78	132.5
Cattle	Metacarpals	Bp-6.5, Sd-3.89	68, 85	
Cattle	Metacarpals	Bp-4.83, Sd-2.7	26, 25	
Cattle	Metacarpals	Bp-6.11, Sd-3.84	58, 82	
Cattle	Metacarpals	Bp-6.0, Bd-5.82, Sd-3.4, GL-19.5	55, 40, 60, 56	117
Cattle	Metacarpals	Bd-4.42.	6	
Cattle	Metacarpals	Bp-5.9	52	
Cattle	Metacarpals	Bp-5.9, Bd-5.92, Sd-3.26, GL-20.9	52, 43, 53, 72	125.4
Cattle	Metacarpals	Bp-7.02	81	
Cattle	Metacarpals	Bd-5.7	38	
Cattle	Metacarpals	Bp-6.8	75	
Cattle	Metacarpals	Bp-6.34	63	
Cattle	Metacarpals	Bp-5.4	40	
Cattle	Metacarpals	Bp-5.63, Bd-5.8, Sd-3.21, GL-20.4	46, 40, 50, 69	122.4
Cattle	Metacarpals	Bp-5.94, Sd-3.44, GL-20.0	53, 62, 63	120
Cattle	Metacarpals	Bp-5.61, Bd-5.34, Sd-3.04, GL-18.9	45, 28, 42, 49	113.4
Cattle	Metacarpals	Sd-4.34	100	
Cattle	Metacarpals	Sd-3.33	56	
Cattle	Metacarpals	Bp-5.82, Bd-5.83, Sd-3.15, GL-19.9	51, 41, 47, 62	119.4
Cattle	Metacarpals	Bp-5.42, Bd-5.45, Sd-2.88, GL-19.7	41, 31, 34, 59	118
Cattle	Metacarpals	Bp-5.85, Sd-3.2	52, 50	
Cattle	Metacarpals	Bp-6.1, Bd-6.4, Sd-3.36, GL-20.5	58, 55, 58, 69	128
Cattle	Metacarpals	Bp-6.75, Bd-6.9, Sd-3.94, GL-21.2	73, 68, 87, 79	127
Cattle	Metacarpals	Bp-5.8, Sd-3.27, GL-21.6	50, 53, 82	129.6
Cattle	Metacarpals	Bp-5.83	51	
Cattle	Metatarsals	Bp-5.36, Sd-2.84	78, 62	
Cattle	Metatarsals	Bp-5.5, Sd-3.17	82, 78	
Cattle	Metatarsals	Bd-5.8	62	

Cattle	Metatarsals	Bp-4.44, Sd-2.52	48, 46	
Cattle	Metatarsals	Bp-4.5	50	
Cattle	Metatarsals	Bd-5.76	62	
Cattle	Metatarsals	Bd-7.1	100	
Cattle	Metatarsals	Bd-6.16	74	
Cattle	Metatarsals	Bp-4.51, Bd-5.2, Sd-2.57, GL-22.1	50, 43, 48, 51	118
Cattle	Metatarsals	Bp-4.2	40	
Cattle	Metatarsals	Bp-5.34	77	
Cattle	Metatarsals	Bd-5.73	61	
Cattle	Metatarsals	Bp-3.97	33	
Cattle	Metatarsals	Bp-4.16	38	
Cattle	Metatarsals	Bd-6.2	77	
Cattle	Metatarsals	Bd-7.7	100	
Cattle	Metatarsals	Bd-5.95, Sd-2.95	69, 68	
Cattle	Metatarsals	Bd-5.44	51	
Cattle	Metatarsals	Bp-4.66, Sd-2.6	54, 50	
Cattle	Metatarsals	Bp-4.71, Bd-5.2, Sd-2.65, GL-22.9	57, 43, 52, 51	122.5
Cattle	Metatarsals	Bp-4.88	62	
Cattle	Metatarsals	Bp-4.72, Bd-5.38, Sd-2.61, GL-22.1	58, 49, 50, 51	118
Cattle	Metatarsals	Bp-4.32, Sd-2.62	43, 51	
Cattle	Metatarsals	Bp-5.34, Sd-3.1	78, 75	
Cattle	Femoral	Bd-10.33	73	
Cattle	Femoral	Bd-8.6	30	
Cattle	Femoral	Bd-9.3	47	
Horse	Metacarpals	GL-21.4		137
Horse	Metacarpals	GL-22.5		144
Horse	Metacarpals	GL-23.6		151
Goat	Metacarpals	GL-13.8		79
Goat	Metacarpals	GL-11.1		64
Goat	Metacarpals	GL-10.78		62
Sheep	Metacarpals	GL-14.92		68.5
Sheep	Metacarpals	GL-12.41		61
Pig	Talus	GLI-4.52		80

Table 29. Marks on bones, sixth century AD

Species	**Chopping**	**Filleting**	**Part burning**	**Flaying**	**Gnawing**
Cattle	42	10	0	1	11
Pig	7	4	2	0	4
Goat/sheep	12	1	0	0	3
Horse	1	0	0	0	1

Chart 1. Division into classes, second–third century AD

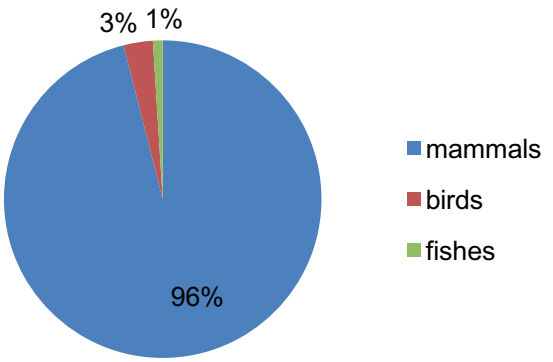


Chart 2. Mammals: domesticated and wild, second–third century AD

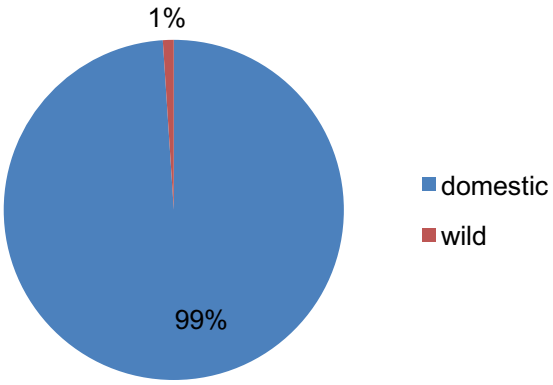


Chart 3. Domesticated mammals, second–third century AD

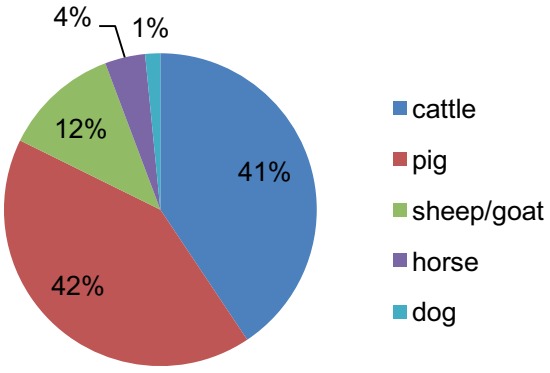


Chart 4. Pig: anatomical distribution, second–third century AD

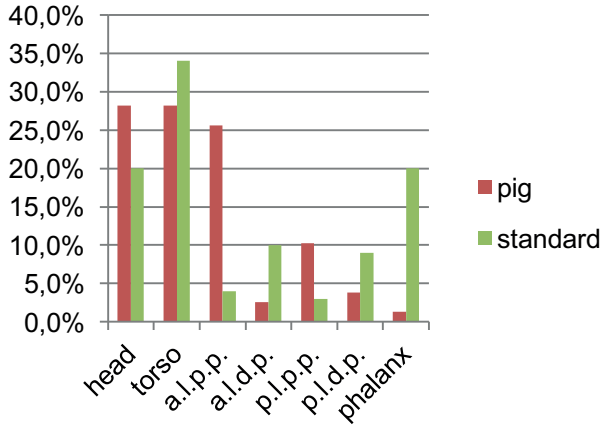


Chart 5. Cattle: anatomical distribution, second–third century AD

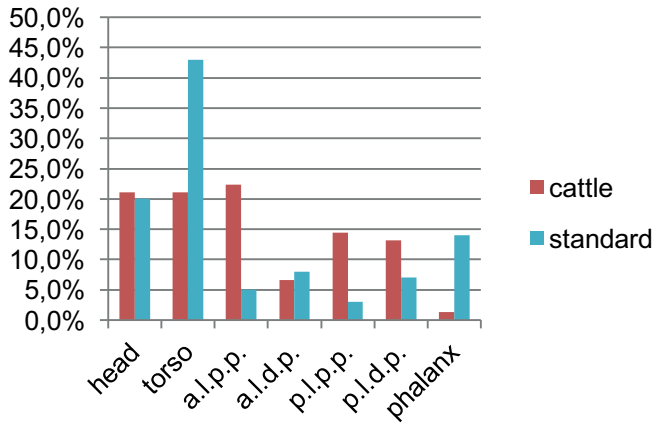


Chart 6. Goat/sheep: anatomical distribution, second–third century AD

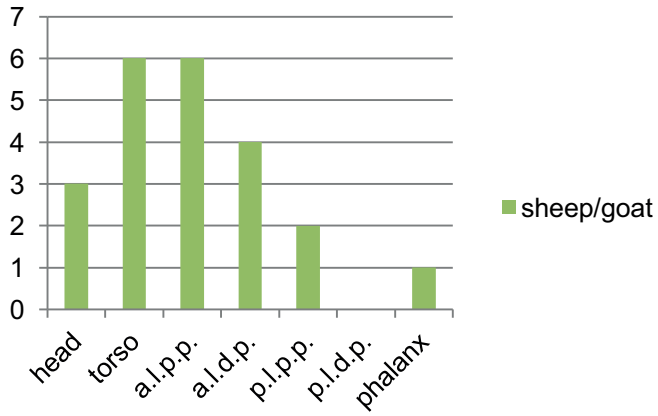


Chart 7. Cattle: 100-point scale. Length measurements, second–third century AD

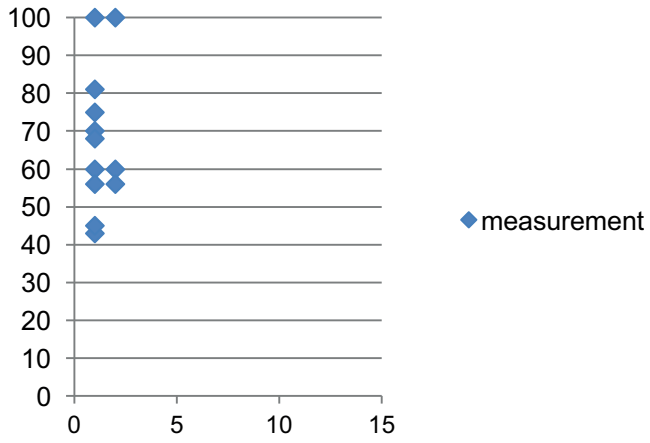


Chart 8. Cattle: 100-point scale. Width measurements, second–third century AD

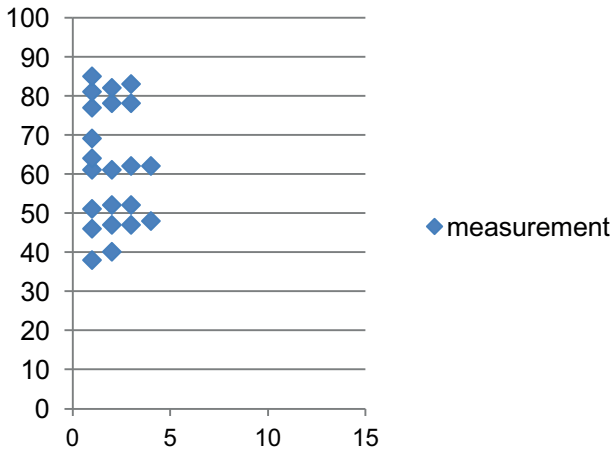


Chart 9. Division into classes, fourth century AD

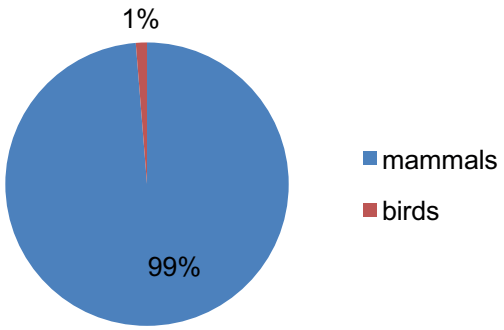


Chart 10. Domesticated mammals, fourth century AD

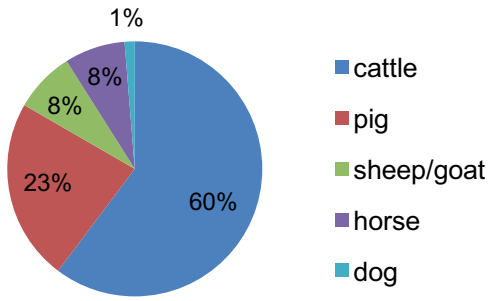


Chart 11. Cattle: anatomical distribution, fourth century AD

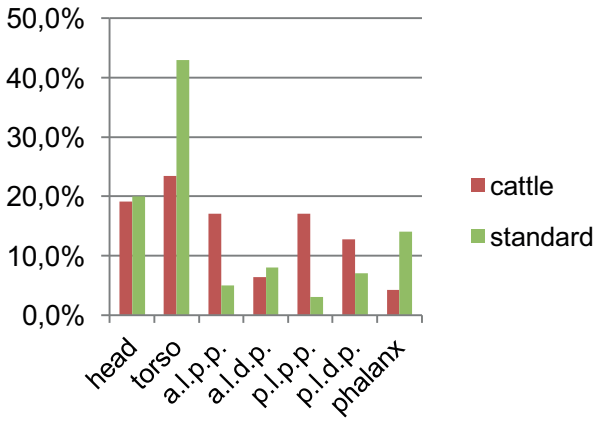


Chart 12. Pig: anatomical distribution, fourth century AD

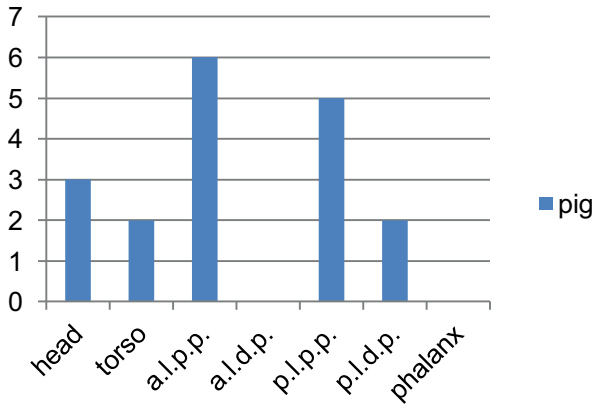


Chart 13. Cattle: 100-point scale. Length measurements, fourth century AD

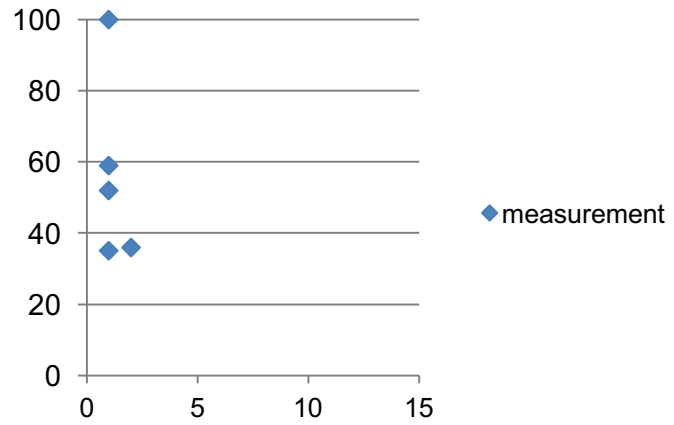


Chart 14. Cattle: 100-point scale. Width measurements, fourth century AD

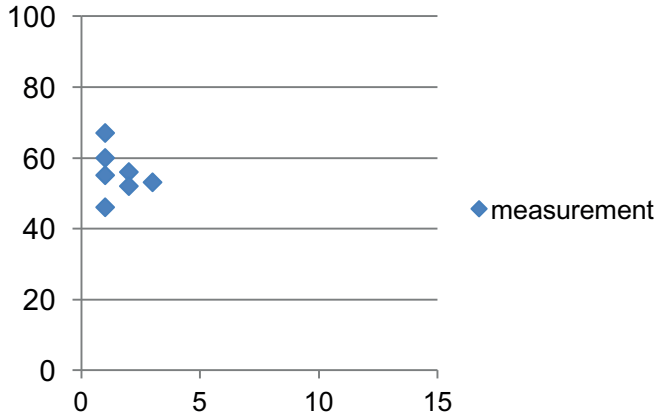


Chart 15. Division into classes, sixth century AD

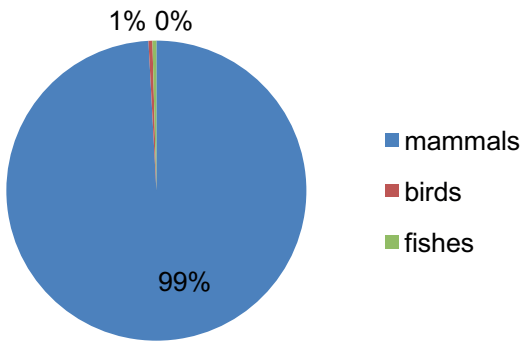


Chart 16. Mammals, sixth century AD

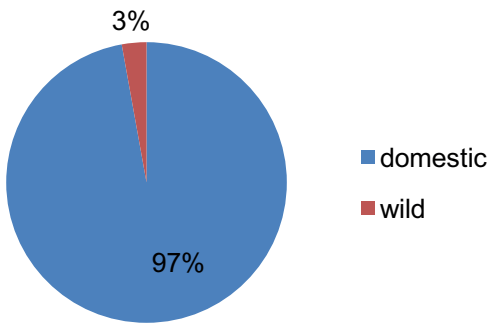


Chart 17. Domesticated mammals, sixth century AD

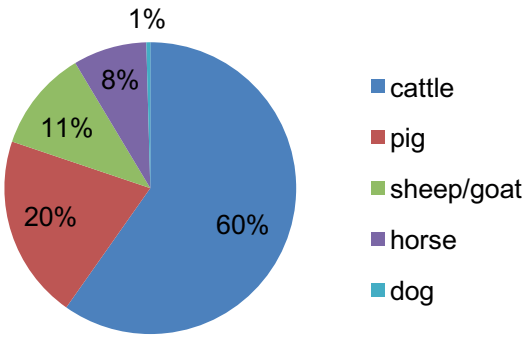


Chart 18. Cattle: anatomical distribution, sixth century AD

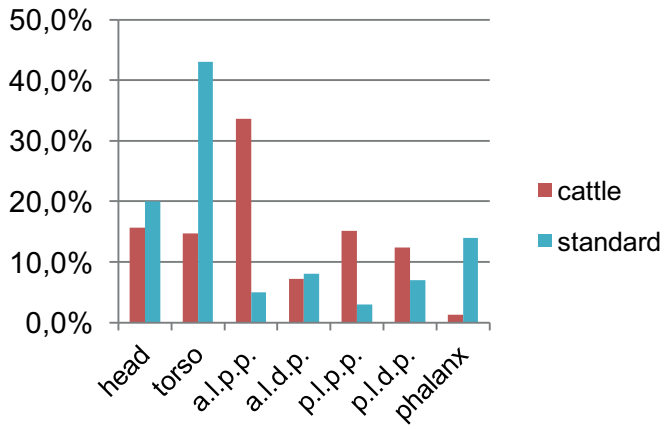


Chart 19. Goat/sheep: anatomical distribution, sixth century AD

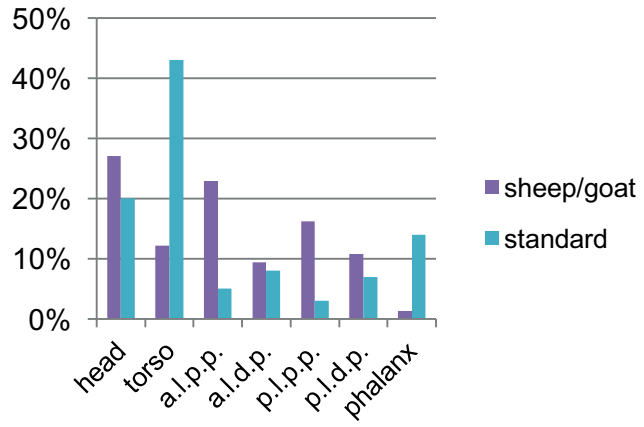


Chart 20. Pig: anatomical distribution, sixth century AD

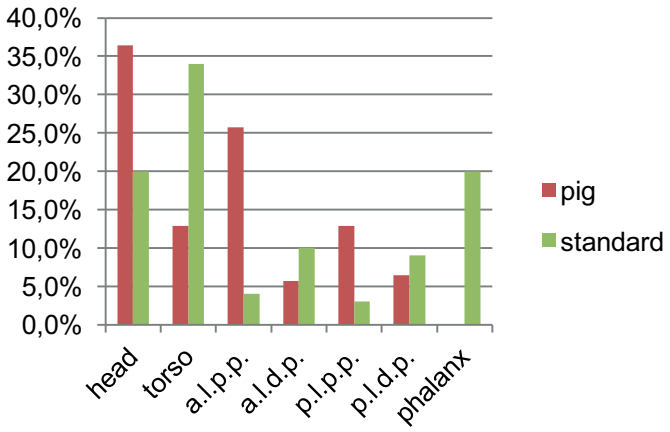


Chart 21. Horse: anatomical distribution, sixth century AD

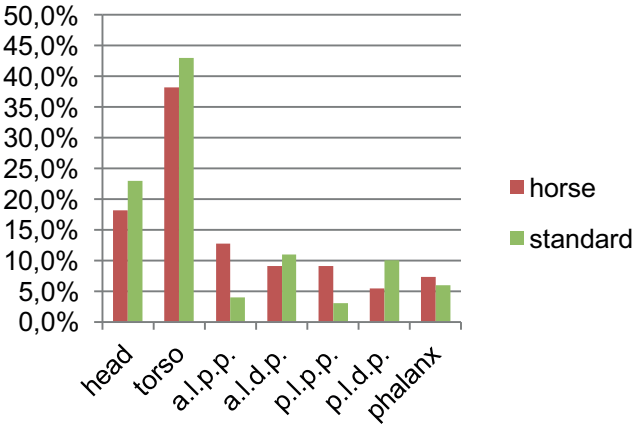


Chart 22. Cattle: 100-point scale. Length measurements, sixth century AD

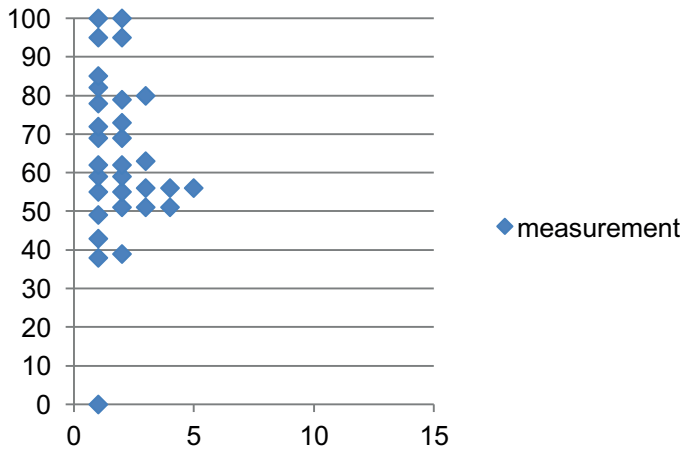
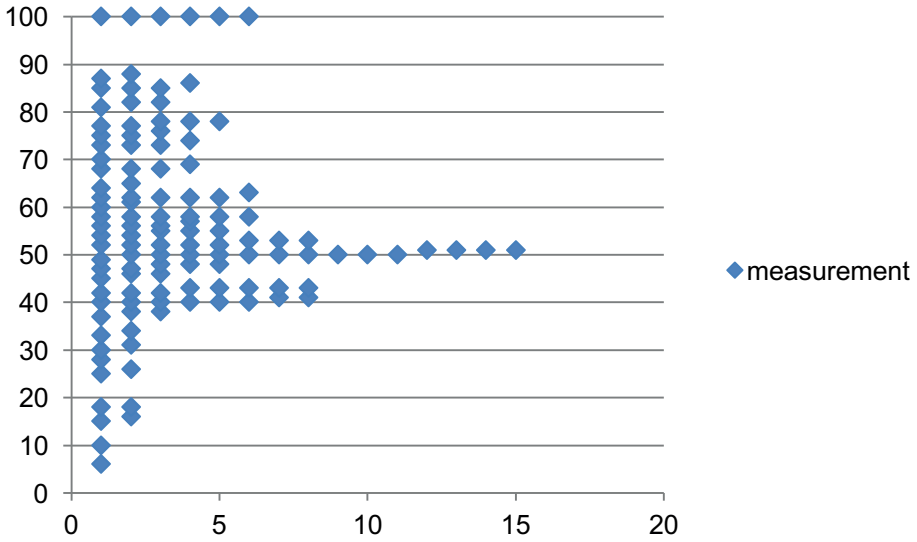


Chart 23. Cattle: 100-point scale. Width measurements, sixth century AD



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Streszczenie

Analiza archeozoologiczna szczątków zwierzęcych z obozu rzymskiego w Novae

Artykuł przedstawia wyniki analizy kości zwierzęcych, pochodzących z wykopalisk archeologicznych w rzymskim obozie legionowym w Novae (Bułgaria). Szczątki pochodzą z warstw datowanych na II–III, IV oraz VI stulecie naszej ery. Analiza przeprowadzona została zgodnie z obowiązującymi w archeozoologii standardami obejmującymi określenie wieku, płci, morfologii, wysokości w kłębie itd.

Na podstawie badanego materiału wywnioskowano, że w pierwszym z omawianych okresów — II–III w. n.e., kiedy obóz w Novae był siedzibą I legionu Italskiego — konsumowano głównie mięso ssaków udomowionych, z lekką przewagą wieprzowiny nad wołowiną. Biorąc pod uwagę także rozkład anatomiczny szczątków świni, w którym dominują części bliższe kończyn, można powiedzieć, że panował wówczas model hodowli nastawiony na szybkie uzyskiwanie mięsa.

Wśród szczątków z IV w. n.e. przeważały kości bydlęce. Ustalenie jednolitego modelu konsumpcji dla tego okresu nie jest jednak możliwe, jako że w innym materiale z tego okresu najwięcej było szczątków kóz i owiec.

W ostatnim z analizowanych materiałów, datowanym na VI w. n.e., także dominowały szczątki bydlęce, ze zdecydowaną przewagą nad kośćmi świń oraz kóz i owiec. W tym okresie, kiedy Novae przeżywało okres świetności jako miasto cywilne, podstawą konsumpcji mięsa była wołowina.

We wszystkich omawianych okresach model konsumpcji mięsa był jednak podobny — dominowały ssaki udomowione, niewiele zaś jadano dziczyzny, ptaków oraz ryb.

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