

UNIVERSITÀ DEGLI STUDI DI NAPOLI “L’ORIENTALE”

DIPARTIMENTO ASIA, AFRICA E MEDITERRANEO

INSTITUTE OF ARCHAEOLOGY, SAMARKAND

(NATIONAL CENTRE FOR ARCHAEOLOGY)

UZBEK ACADEMY OF SCIENCES

ISMEO - ASSOCIAZIONE INTERNAZIONALE DI STUDI

SUL MEDITERRANEO E L’ORIENTE

Series Minor
XCV

**The Archaeological Project
in the Samarkand Area (Sogdiana):
Excavations at Kojtepa II (2013–2015)**

Edited by

BRUNO GENITO AND MUHKITAR PARDAEV



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Animal Exploitation and Breeding Strategies

ELENA MAINI, ELEONORA SERRONE

(Alma Mater, Università di Bologna, ArcheoLaBio - Centro di Ricerche di Bioarcheologia, Dipartimento Storia Culture Civiltà - DISCI)

Faunal remains from excavation campaigns of the joint Italian-Uzbek Archaeological Mission occurred between 2008 and 2015 were studied during 2017. The study of faunal remains allowed obtaining information about the breeding strategies and the exploitation of animal resources in the Samarkand oasis from ca. the 4th century BCE to the 4th century CE. Data were interpreted to attempt comparing two main broad periods of occupation: the first period, which includes Hellenistic and post-Hellenistic materials dating between the 4th and the 1st centuries BCE; and the second period, which covers the post-Hellenistic period and the so-called ‘nomadic’ phase, broadly dated between the 1st and the 4th centuries CE.¹

Methods and Purposes

Zooarchaeology is the discipline that studies animal remains (manly bones, teeth, antler and horn) retrieved during archaeological excavations, in order to obtain information about the re-

¹ The periodization used in this paper follows the chronological framework proposed by the excavators (see, *supra*, 1), all the materials fall in the period known as early antiquity, during which Samarcanda was definitely outside the Ku-

relationship between humans and the animal world in the past societies involving a great variety of aspects: economic, religious, artistic, and others (Cornwall 1956).

From a methodological point of view, the first step is the identification of the anatomical elements, followed by the identification of animal species using appropriate comparison procedures with the aim of comparative collections or anatomical comparative atlas.² The second step involves the evaluation of the age at death for each individual with an element allowing this assessment. The most widely applied techniques for age estimation are the evaluation of dental eruption, the substitution and successive wear of enamel in the occlusal surface of permanent teeth, and the epiphyseal fusion. The overall analysis of butchering trends allows to reconstruct the exploitation methods with specific reference to domestic animals (Curci 2008; De Grossi Mazzorin 2008).

Sex determination, as the age at death evaluation, can provide useful information about herds composition and management and, in a wider aspect, about the economic exploitation of animal resources. It is usually possible to define such a distinction in a very few cases, mainly thanks to morphological and osteometrical criteria based on the occurrence of specific skeletal elements that are not always present into an archaeological sample.

The osteological sample

The zooarchaeological analysis was conducted on 1153 animal remains, 431 of which were determined to species level, corresponding to 37,4% of entire osteological sample retrieved during the seven field seasons.

The faunal remains retrieved during the 2008 campaign were not considered in the zooarchaeological statistical analysis. In fact, those excavation trenches (Abdullaev, Genito 2014) are located in an over anthropized area and they might have likely included intru-

shan political-imperial formation but had probably contacts with the Kanjiu to which the levels referred found in Afrasiab (Rapin, Isamidinov 2013, 129–130, Šiškina 1994, 90).

² Species determination is based on Schmidt (1972), Barone (1976), and on the comparative collection of *ArcheoLaBio* - Centro di Ricerche di Bioarcheologia, Dipartimento Storia Culture Civiltà - DISCI, Università di Bologna—Ravenna Campus.

sive osteological elements from the modern layers, which can be hardly separated from the ancient ones. The majority of animal osteological elements therefore derived from Trench no. 6 excavated during the 2011 and 2012 seasons (Table 1).

In the general frame of the site's economy, domestic animals resulted predominant. The sheep/goats group covers more than half of the total, followed by fewer cattle, pigs, and equids, the latter including horses, donkeys and their crossbreeds probably used as traction animals. The identification of a limited number of bird bones, mainly domestic galliformes, integrates the data about domestic animal exploitation (Graph 1).

For what concerns wild animals, they represented only an occasional resource. Tortoises was exploited in both periods, while a few osteological remains dating mainly to the first period testify to the hunt of marmot (*Marmota* sp.), which was probably exploited for its fur (Table 2).

Faunal composition of the first period: Hellenistic and post-Hellenistic (4th-1st centuries BCE)

A total of 436 osteological remains, 158 of which determined to the species level, were found in the Hellenistic and post-Hellenistic layers. In the faunal composition of this period, sheep/goat are the most represented domestic animals, followed by few remains of cattle, equids, and pigs. Wild animals have also been identified in this sample, including marmots, tortoises, and two bird remains (Table 3 and Graphs 2). Interestingly, the remains of two lambs, or young goats, and two sheep/goat knucklebones were found inside a jar dating to the Hellenistic period (3rd-2nd centuries BCE). One of the knucklebones shows traces of anthropogenic modification (Fig. 1).

Domestic Animals

The sheep/goats group is represented by 103 osteological remains. The MNI (Minimum Number of Individuals) revealed the presence of at least of 23 individuals, four of which confidently pertain to sheep and four to goats.³ For what concerns the age at death, among

³ For the distinction between sheep and goat, see Boessneck (1969); Halstead, Collins, Isaakidou (2002); Zeder, Pilaar (2010).

the immature individuals there were one fetus, four very young animals of maximum 2 months, one young between 4 and 6 months, one sub-adult of about 12 months, one sub-adult between 18 and 24 months, and two young individuals of indeterminable age. Among adult individuals, it was possible to recognize one goat and one sheep/goat about 2–4 year old, another sheep/goat 3–4 year old, and finally ten adult individuals, including 4 sheep and 3 goats, for which was not possible to determine a precise age range.⁴ It was possible to calculate the height at the withers only for sheep of the Hellenistic period, which resulted having had an average height of 81.64 cm that indicates medium-large animals (Graph 3 and Fig. 2).

The evaluation of culling profiles indicates that sheep/goats were often killed still young, probably to control the growth and composition of the flocks or to increase the production of milk.

Cattle are represented by nine remains only, referable to at least four individuals. The MNI shows the presence of one young individual and three adults of indeterminable age (Fig. 3). Four remains are related to one adult mule of indeterminable age (Fig. 4). Pigs are represented only by one lower incisor from a young individual.

Wild Animals

This sample included also wild animals, even if with a NISP (Number of Identified Specimens) much lower respect to that of domestic animals. In fact, only 22 remains of *Marmots sp.* from at least three different individuals and 17 remains of tortoises (*Agrionemys horsfieldii*) from at least two individuals (Figs. 5–6) have been identified.⁶ Birds are present with only two remains, not yet identified to species.

⁴ Age at death based on sheep/goat teeth wear was estimated following the method developed by Payne (1973); see also Silver (1969) and Grant (1982).

⁵ Age at death of oxen was estimated based on the degree of the long bones welding and on tooth eruption/wear following the methods developed by Barone (1976) and Grant in Wilson *et alii* (1982).

⁶ Although the archaeological data seems not presenting stratigraphic evidence for this hypothesis, due to the habits of both marmots and tortoises of digging deep burrows in the ground, we cannot completely exclude that their remains were not intrusive. We thank Prof. Massimo Delfino for the species determination of tortoises.

Faunal Composition of the second period: post-Hellenistic and 'Nomadic' (1st-4th centuries CE)

A total of 660 osteological remains belongs to the second period, 242 of which have been identified to species. The majority of determined bones resulted pertaining to domestic animals. Sheep/goats are, also in this period, the most represented animal group, followed by cattle, pigs, and equids. Wild species, including *Marmots* sp., tortoises and birds, are present in a percentage and with recurrences comparable to the previous period (Table 4 and Graph 4).

Domestic Animals

Sheep/goats are present in the sample of the post-Hellenistic and 'Nomadic' period with 151 remains from at least 20 individuals, including 3 sheep and 3 goats. Among them there were one young individual between 0 and 2 months and one between 6 and 12 months, one sub-adult between 12 and 18 months and six between 18 and 24 months (two of which referable to sheep), and two young individuals of indeterminable age. Among the adults, there were one adult between 3 and 4 years, two adults between 4 and 6 years (one of which recognize as a sheep), and six adults of indeterminable age (three of which recognized as goats) (Graph 5 and Figs. 7–8). The evaluation of culling profiles indicates that sheep/goats were killed at all age ranges to optimize meat production and/or secondary products yield, probably in relation to seasonality or to different socioeconomic needs.

The remains of cattle are instead 51 from at least seven individuals of different age. It was possible to identify one young individual less than 4 month old, one young less than 2 year old, two young adults between 2 and 3 years, one adult more than 4 year old, and two adults of indeterminable age. Both NISP and MNI point out that in this period the exploitation of cattle increased. The same trend happened to pigs, which for this period have a NISP greater than the sample of the first period (4th–1st centuries BCE). The 20 pig remains resulted belonging to least 6 individuals, including a very young individual between 0 and 2 months, one young around 2 months and one between 4 and 6 months, a young male of indeterminable age, and two adults more than 3 year old, one of

which was a male.⁷ It was possible to determine the sex of the male individual thanks to the presence of a lower jaw canine (Fig. 9).⁸

Equids present a NISP equal to six. The calculation of MNI has predicted the presence of at least four individuals: two horses, including a young adult and two donkeys of indeterminable age.⁹

Wild Animals

The remains of wild animals, in the second period decrease respect to the previous period. In fact, only one remains of a small mammal was recognized, for which it was not possible to recognize the species. Moreover, the sample included also 11 remains of tortoises, attributable to at least three individuals, and two fragments of bird bones not determinable.

Taphonomic Analysis

The analysis of all traces present on the bones was carried out in parallel with the anatomical and species determination. Burning traces were found on 17 remains belonging to both periods. Marks related to slaughtering practices are instead present on five skeletal remains only, including two oxen *humeri* with numerous subparallel striae resulting from actions of scarification. Saw traces were detected on a goat horncore (Fig. 2), while cut-marks derived from the dismembering of carcasses are present on a sheep/goat lower jaw and on the distal part of a knucklebone (Fig. 10).

Final Remarks

In the steppes, subsistence economy was likely already based on the harmonization between irrigated agriculture and semi-nomadic pastoralism, with the flocks providing not only meat but also secondary products, such as wool, leather and milk. This hypothesis was already

⁷ For the slaughtering trends of pigs, see Wilson *et alii* (1982).

⁸ The teeth of the animals, in some cases, have a decided sexual dimorphism. For example, in the suids, the male's canines are larger than those of the female, and are characterized by a very different morphology even in the roots De Grossi Mazzorin (2008).

⁹ Following Baxter (1998).

proved by the zooarchaeological analysis carried out by the authors on the faunal remains from the comparable nearby site of Kafir Kala (Serrone *et alii* in press). Domestic animals were predominant in both sites, but at Kojtepa the breeding economy resulted more differentiated, mainly due to the implementation of a different exploitation strategy of sheep/goats. Sheep and goats reach almost 80% percent of the NISP at Kafir Kala, while they count for 64% at Kojtepa. At both sites, they are followed by less cattle, horses, pigs, and by a small number of domestic galliformes. Domestic dogs and cats seem to have been completely absent at Kojtepa, while they were found at Kafir Kala even if restricted to the Islamic occupation (Serrone *et alii* in press).

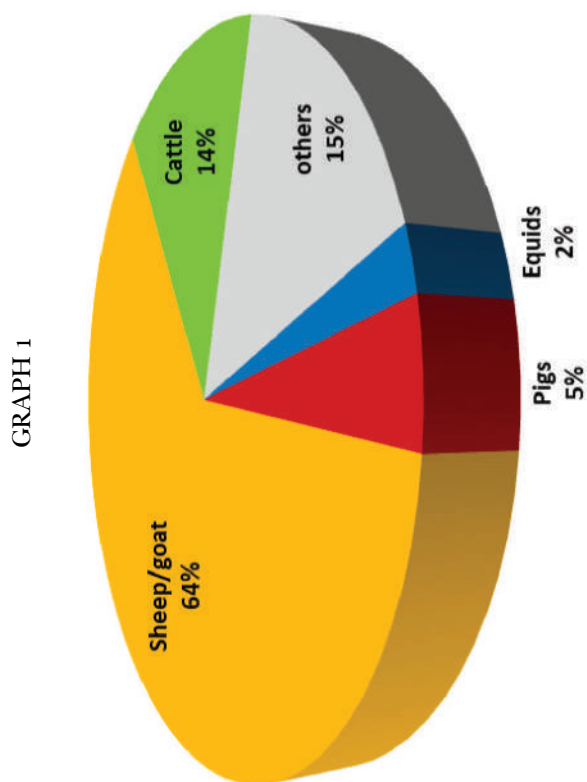
A diachronic analysis comparing the two periods of occupation shows that the animal economy, while remaining extremely conservative in principle, became more diversified during the post-Hellenistic and ‘Nomadic’ phases (1st–4th centuries CE). The earliest phases in the Hellenistic and post-Hellenistic period (4th–1st centuries BCE) show an almost exclusive exploitation of sheep/goats, which were often killed still rather young. From the post-Hellenistic period onward, there is evidence for an increment in the exploitation of pigs and oxen as food resources and of a more diversified kill-off pattern of goats and sheep, which increased the diet variability. Dairy resource played therefore a more significant role in the earliest phases, while cattle and pigs—butchered for their meat—began taking greater relevance from the post-Hellenistic period.

Acknowledgments

The authors wish to thank, first of all, Prof. Bruno Genito and Muhktar Pardaev, co-directors of the joint Uzbek-Italian Archaeological Mission in the Samarkand Area. We wish to thank also Prof. Antonio Curci, Director of *ArcheoLaBio*- Centro di Ricerche di Bioarcheologia, Dipartimento Storia Culture Civiltà - DISCI, Università di Bologna, for his constant support, and Dr. Simone Mantellini, director of excavations at Kafir Kala.

Trench	Excavation years						Total
	2009	2011	2012	2013	2014	2015	
TR 1	122	0	0	0	0	0	122
TR 2	7	0	0	0	0	0	7
TR 3	1	0	0	0	0	0	1
TR 4	18	0	0	0	0	0	18
TR 5	0	96	6	0	0	0	102
TR 6	0	363	110	0	0	0	473
TR 10	0	0	0	45	0	0	45
TR 11	0	0	0	6	16	0	22
TR 12	0	0	0	0	56	0	56
TR 13	0	0	0	0	3	0	3
TR 14	0	0	0	0	74	0	74
TR 14-16	0	0	0	0	2	0	2
TR 15	0	0	0	0	8	1	9
TR 16	0	0	0	0	11	0	11
TR 17	0	0	0	0	17	0	17
TR 19	0	0	0	0	0	27	27
TR 19-20	0	0	0	0	0	4	4
TR 20	0	0	0	0	0	1	1
TR 20-22	0	0	0	0	0	1	1
TR 21	0	0	0	0	0	21	21
TR 23	0	0	0	0	0	16	16
TR 24	0	0	0	0	0	15	15
Total	148	459	116	51	187	86	1047

Table 1 - Kojtepa. Faunal remains divided by trench and excavation Seasons.



Graph 1 - Kojtepa. Overall faunal composition divided by NISP.

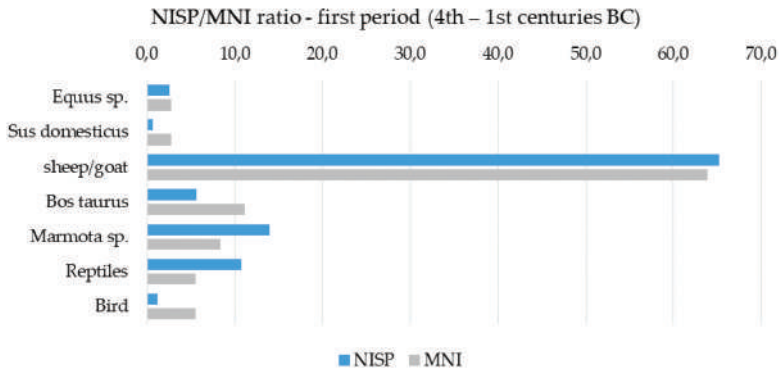
Taxa & animal groups	Period A: Hellenistic and Late/post Hellenist phases (4 th -1 st cent. BC)				Period B: Late and Post Hellenist phases (1 st -4 th cent. AD)				2 nd cent. BC- 2 nd cent. AD				TOTAL			
	NISP	% NISP	MNI	% MNI	NISP	% NISP	MNI	% MNI	NISP	% NISP	MNI	% MNI	NISP	% NISP	MNI	% MNI
<i>Equus</i> sp.	4		1		6		20		0		0		10		5	
<i>Sus domestica</i>	2,5	0,6	1	2,8	2,5	8,3	6	4	0	0	0	0	21	4,9	7	8,0
Sheep/Goat	91	65,2	4	15	140	62,4	3	13	19	61,3	4	40	250	64,0	32	36,4
<i>Ovis aries</i>	7	4	4	63,9	6	3	3	45,2	0	9,7	0	30	13	7	10	8,0
<i>Capra hircus</i>	5	4	4	63,9	5	3	3	45,2	3	9,7	0	30	13	7	10	8,0
<i>Bos taurus</i>	9	5,7	4	11,1	51	21,1	7	16,7	0	0	0	0	60	13,9	11	12,5
<i>Marmota</i> sp./ Small mammals	22	13,9	3	8,3	1	0,4	1	2,4	6	19,4	1	10	29	6,7	5	5,7
Reptiles	17	10,8	2	5,6	11	4,5	3	7,1	2	6,5	1	10	30	7,0	6	6,8
Birds	2	1,3	2	5,6	2	0,8	2	4,8	1	3,2	1	10	5	1,2	5	5,7
Total	158				242				31				431			
Undetermined bones	278				418				26				722			
Total	436				660				57				1153			

Table 2 - Kojtepa. Animal remains divided by chronological phases.

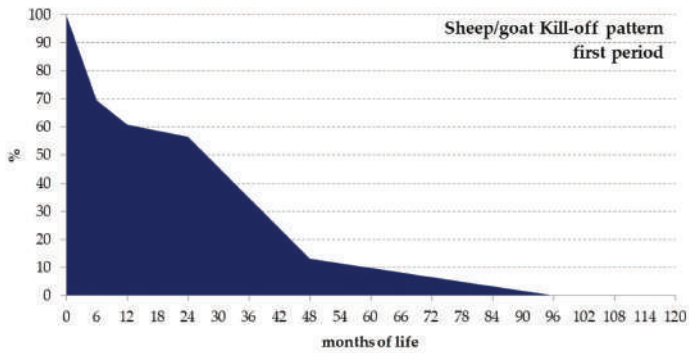
TAXA	Equids	Pig	Sheep/ Goats	Sheep	Goat	Cattle	TOTALE
Anatomical elements							
Horns and antlers					2		2
Cranium			1				1
Maxillary							0
Upper teeth			6				6
Mandible			7				7
Lower teeth		1	1			2	4
Undet. teeth	3		1			1	5
Atlas			4				4
Axis			3				3
Scapula			3				3
Humerus			11			1	12
Radius			6				6
Ulna			1				1
Carpal						1	1
Metacarpal			2				2
Pelvis			7			1	8
Femur			6				6
Tibia			8	3	1	1	13
Calcaneus	1		1	1			3
Astragalus			5	3	2		10
Tarsal			2				2
Metatarsal			3				3
Metapodial			5				5
Phalanx I			3			1	4
Phalanx II			4				4
Phalanx III			1			1	2
Others							0
TOTAL	4	1	91	7	5	9	117

Table 3 - Kojtepa. Anatomical elements recurrence (NISP) by species/group in the first period (Hellenistic and post-Hellenistic phases).

GRAPH 2 and 3



Graph 2 - Kojtepa. Faunal composition ratios in the first period (Hellenistic and post-Hellenistic phases).



Graph 3 - Kojtepa. Sheep/goats kill-off pattern in the first period (Hellenistic and post-Hellenistic phases).



Fig. 1 - Kojtepa. Perforated sheep/goat knucklebone.



Fig. 2 - Kojtepa. Goat horncore with cut-marks.



Fig. 3 - Kojtepa. *Bos calcaneus*.



Fig. 4 - Kojtepa. Mule lower teeth.



Fig. 5 - Kojtepa. Marmot skulls.

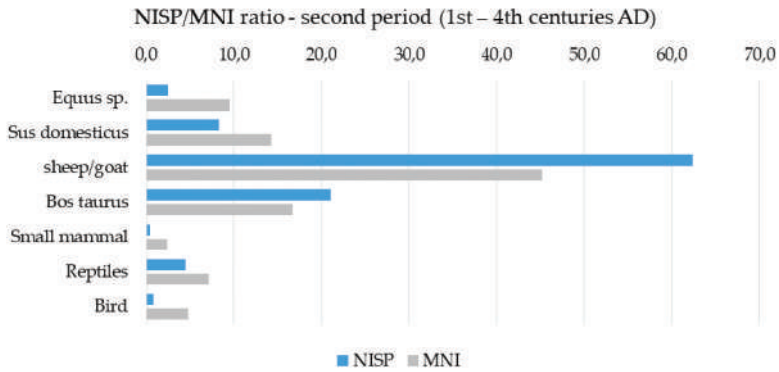


Fig. 6 - Carapax and plastron of a terrestrial turtle *Testudo (Agrionemys) horsfieldii*.

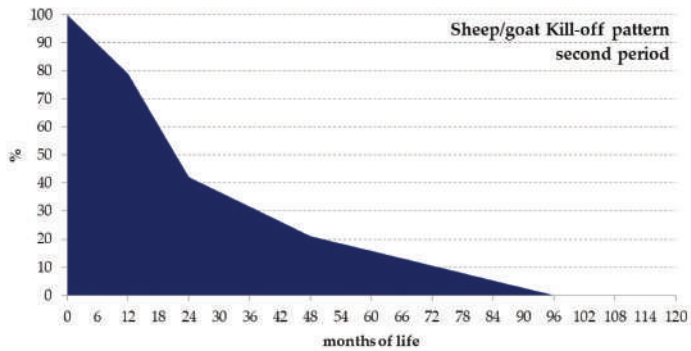
TAXA							
Anatomical elements	Equids	Pig	Sheep&Goat	Sheep	Goat	Cattle	TOTALE
Horns and antlers			4	1	4	1	10
Cranium		5	4			3	12
Maxillary		3	3			1	7
Upper teeth		4	14			4	22
Mandible	1	1	15	3		4	24
Lower teeth	2	3	4			9	18
Undet. teeth		2	9			5	16
Atlas						1	1
Axis			3				3
Scapula			4				4
Humerus			10			2	12
Radius			11			1	12
Ulna						1	1
Carpal						1	1
Metacarpal	1	1	4				6
Pelvis			7			4	11
Femur			15			1	16
Tibia	1		9	1			11
Calcaneus			2			1	3
Astragalus				1		1	2
Tarsal							0
Metatarsal	1		4			1	6
Metapodial			6			3	9
Phalanx I			3		1	4	8
Phalanx II			8			2	10
Phalanx III		1	1			1	3
Others							0
TOTAL	6	20	140	6	5	51	228

Table 4 - Kojtepa. Anatomical elements recurrence (NISP) by species/group in the second period (post-Hellenistic and 'Nomadic' phases).

GRAPH 4 and 5



Graph 4 - Kojtepa. Faunal composition ratios in the second period (post-Hellenistic and 'Nomadic' phases).



Graph 5 - Kojtepa. Sheep/goats kill-off pattern in the second period (post-Hellenistic and 'Nomadic' phases).



Fig. 7 - Mandibles from sheep and goats of different age.



Fig. 8 - Goat horncore.



Fig. 9 - Juvenile pig upper jaw.



Fig. 10 - Sheep/goat knucklebone with cut-marks.

APPENDIX

KOJTEPA			
Measurements (in mm) following Driesch von den (1976) method			
Trench	SU	anatomical element	measures
Equids			
TR 6	49	metacarpus	Bd: 46,0
TR 10	120	tibia	Bd: 53,4
Pig			
TR 6	65; 49	V metacarpus	GL: 52,1
Sheep			
TR 1	5	astragalus	GL: 28,4; GLm: 27,0; Dl: 16,3; Dm: 16,0; Bd: 19,0
TR5	63	tibia	Bd: 29,8
	67	calcaneus	GL: 61,2; GB: 21,4
TR 6	65	tibia	Bd: 31,8
	64	astragalus	GLm: 30,0; Dm: 18,7
Inside the jar	74	astragalus	GL: 28,3; GLm: 27,9; Dl: 16,0; Dm: 17,4; Bd: 19,3
		astragalus	GL: 30,8; GLm: 29,6; Dl: 16,7; Dm: 18,2; Bd: 20,0
Goat			
TR 6	49	I st phalanx	Glpe: 34,8; Bp: 12,6; SD: 09,7; Bd: 11,6
	60	astragalus	GL: 26,6; GLm: 25,9; Dl: 15,0; Dm: 17,1; Bd: 18,6
TR 12	181	astragalus	GL: 28,5; GLm: 27,7; Dl: 16,0; Dm: 16,9; Bd: 18,9
TR 19–20	401	astragalus	GL: 30,0; GLm: 29,0; Dl: 16,4; Dm: 17,6; Bd: 20,0
		astragalus	GLm: 28,8; Dm: 16,7
	413	metapodial	Bd: 26,3
Sheep/goat			
TR 1	11	axis	BFcr: 37,9; SBV: 20,6
	11	axis	BFcr: 55,0
	7	II nd phalanx	GL: 20,3; Bp: 12,0; SD: 10,0; Bd: 09,6
	11	astragalus	GL: 25,4; GLm: 25,0; Dl: 24,7; Dm: 14,9; Bd: 12,1
TR 2	29	tibia	Bd: 28,9
TR 5	69	astragalus	GLm: 28,3; Dm: 18,0

TR 6	57	scapula	GLp: 36,6; LG: 26,0; BG: 23,2; SLC: 23,4
	79	femur	Bp: 42,9; DC: 20,0
	81	femur	DC: 21,4
	49	metapodial	Bd: 24,0
	69	I st phalanx	GLpe: 33,8; Bp: 11,9; SD: 10,5; Bd: 10,9
TR 11	106	II nd phalanx	GL: 17,9; Bp: 09,5; SD: 07,7; Bd: 08,8
		II nd phalanx	GL: 18,0; Bp: 09,3; SD: 06,9; Bd: 07,8
TR 14	1	radius	Bp: 30,9
		II nd phalanx	GL: 19,0; Bp: 10,5; SD: 07,7; Bd: 08,5
		II nd phalanx	GL: 21,0; Bp: 12,1; SD: 09,0; Bd: 08,9
TR 17	1	scapula	GLp: 36,8; LG: 26,7; BG: 26,0
TR 19	401	metapodial	Bd: 24,8
	61	II nd phalanx	GL: 21,3; Bp: 11,8; SD: 09,0; Bd: 09,5
sieving		astragalus	GL: 27,6; GLm: 26,3; DI: 15,4; Dm: 15,5; Bd: 18,0
Cattle			
TR 6	31; 49	I st phalanx	Bp: 26,2; SD: 21,7; Bd: 24,2
	69	I st phalanx	GLpe: 49,0; Bp: 26,1; SD: 22,6; Bd: 25,7
	49	III rd phalanx	Ld: 45,3; MBS: 17,6
TR 10	120	calcagheus	GL: 127,0; GB: 42,7
TR 12	181	I st phalanx	GLpe: 57,4; SD: 23,0; Bd: 26,5
Inside the jar	74	III rd phalanx	DLS: 54,6; Ld: 44,0; MBS: 17,2
Bird			
TR 6	43	tibiotarsus	Dd: 10,3

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