New Data on Animal Exploitation at Shahr-i Sokhta (Iran): Preliminary Results from the Analysis of Animal Remains Found in Area 33

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Abstract

This paper presents the results of recent zooarchaeological analyses conducted at Shahr-i Sokhta (Iran) as part of the MAIPS project, which developed from cooperation between the University of the Salento and the Iranian Center for Archaeological Research and seeks to apply a multidisciplinary approach to the study of the Hirmand valley, Shahr-i Sokhta and their archaeological contexts. Between 2017 and 2019, archaeological research was carried out in the area known as Area 33, bringing to light stratigraphic deposits and domestic features dated to periods III and II (ca. 3000 to 2450 BC). Using the diagnostic zones method, about 800 animal remains were recorded; they contribute to a better understanding of animal exploitation at the site from the fourth to the second millennia BC. A more refined chronology, based on new archaeological excavations and 14C dating, allowed us to group the faunal data into three main chronological phases and to establish the broad stability of husbandry strategies over time.

1. Introduction

This paper presents zooarchaeological analyses currently being performed at Shahr-i Sokhta (Iran) as part of the MAIPS project and as part of a PhD research project which is being carried out by one of the authors. Arising from cooperation between the University of the Salento and the Iranian Center for Archaeological Research, the project aims to apply a multidisciplinary approach to the study of the Hirmand valley, Shahr-i Sokhta and their archaeological contexts.

Since 2017, archaeological research has been carried out in the area known as Area 33, bringing to light stratigraphic deposits and domestic features dated to periods II and III (Salvatori - Tosi 2005). This paper discusses the preliminary results of the analyses of the animal remains collected between 2017 and 2019.

2. Materials and methods

All the animal remains were identified. Mammal and bird remains were recorded and counted before undergoing quantification analysis using a selective diagnostic zone approach (Davis 1992; Albarella - Davis 1994) with minor modifications.[1] The scientific nomenclature of domestic animals follows Gentry - Clutton-Brock - Groves (2004).

Attempts were made to distinguish between sheep and goats on the basis of teeth and post-cranial elements using the criteria described in Boessneck (1964; 1969), Kratochvil (1969), Payne (1985), Halstead - Collins - Isaakidou (2002), Prummel - Frisch (1986) and Zeder - Lapham (2010).

1. The mammals 'diagnostic zones' include: cranium (zygomaticus), atlas, axis, scapula (glenoid articulation), distal humerus, proximal radius, proximal ulna, carpals 2-3, distal metacarpal (ungulates), third and fourth metacarpals (suids and carnivores), pelvis (acetabulum, ischial part), distal femur, distal tibia, astragalus (lateral half), calcaneum (sustentaculum), scafocuboid, distal metatarsal (ungulates), third and fourth metatarsals (suids and carnivores), distal metapodial (ungulates), third and fourth metapodials (suids and carnivores) and the proximal parts of the 1st, 2nd and 3rd phalanges. For birds, the following were always recorded: scapula (articular end), proximal coracoid, distal humerus, proximal ulna, proximal carpometacarpus, distal femur, distal tibiotarsus, and distal tarsometatarsus. Horncores and antlers were also identified but not used for quantification analysis. The proximal head of the humerus, distal part of the radius, distal ulna, proximal head of the femur and proximal tibia were recorded and used in the ageing and other analyses but not used for quantification. All other fragments of interest – such as non-countable elements from rarer species or parts displaying butchery/processing marks or pathological conditions – were always recorded but not used for quantification analysis.

Mortality data were derived from the long bones' state of epiphyseal fusion in accordance with Silver (1969) for cattle and Bullock - Rackham (1982) for caprines, and from wear stages of mandibular teeth, following Grant (1982) for cattle, and Payne (1973; 1987) for sheep/goats. Cattle mandibles were also assigned to the general age categories outlined by O'Connor (2003: 160) and caprine mandibles to those of Payne (1973).

Bones and teeth were measured in accordance with the criteria described in von den Driesch (1976), Davis (1992) and Albarella - Davis (1994).

The number of identified specimens (NISP) was calculated for all taxa but the minimum number of individual (MNI) was only calculated for the most common taxa. The MNI was calculated by simply dividing the total number of fragments of each element by the number present in the body. This was facilitated by the recording system, considering only non-repeatable fragments.

The animal remains were generally found in a fair state of preservation, albeit fragmented, partly due to the high incidence of salt crystals at the site, which corroded the bones. Signs of gnawing by rodents were observed frequently while those of carnivores were less frequent.

More than 2000 animal fragments were recovered, of which about 800 were recorded and analysed.

A more refined chronology, based on new stratigraphic data and ^{14}C dates (see Ascalone in this volume) allowed us to group the faunal data into three main chronological phases that proved to be evenly balanced (Fig. 1):

- Layer 4 (ca. 3000-2850 BC), corresponding to SIS II.6 (Salvatori - Tosi 2005) and associated with the 'Western Building' and 'Eastern Building', with an NISP of 316 (38%);
- Layer 3 (ca. 2850-2620 BC) corresponding to SIS II.5a and associated with the 'House of the Courts', with an NISP of 335 (41%);
- Layer 1 (ca. 2600-2450 BC), corresponding to SIS III.4-3 and associated with 'Building 33', with an NISP of 175 (21%).

No animal remains were found in the layers dated to Layer 2 (ca. 2620-2600 BC), referred to as the 'Squatter phase', but this is not surprising as this

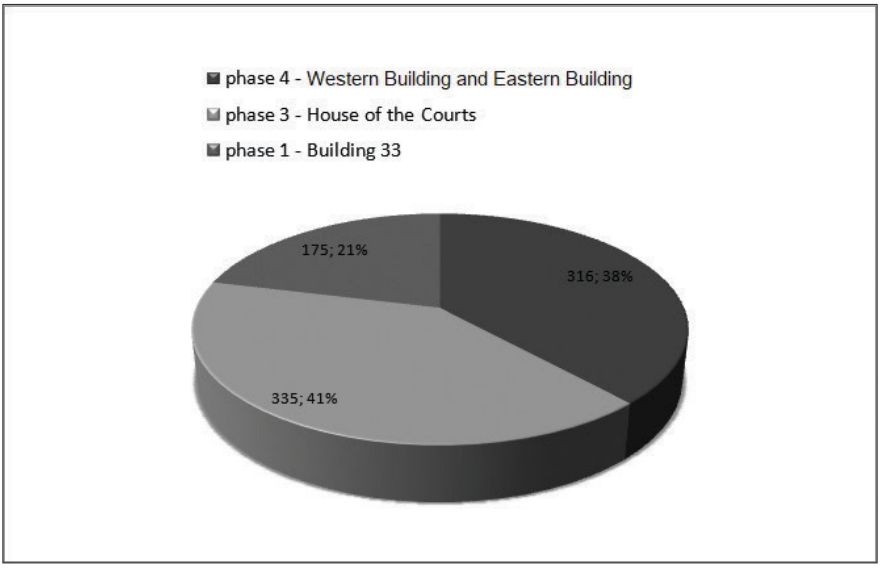

Fig. 1: Shahr-i Sokhta, Area 33. Stratigraphic provenance of animal remains.

corresponds to a of abandonment of the area, which was used for metalworking activities (Ascalone in press).

3. Overview of the assemblage

In terms of both NISPs and MNIs, the animal bone assemblages are dominated by the remains of the main domestic animals (Tab. 2). In all phases, sheep and goats were the most common species, followed by cattle, whereas pigs were completely absent. The frequency of cattle increases over time, at the expense of caprines, when the division into phases is taken into account (Fig. 2).

Dogs were also recorded in all phases but with fewer remains than the other domesticated animals.

Wild species of mammals and birds, as well as fish, are present, albeit in smaller numbers. Rodent bones are significantly represented but must be interpreted as the remains of scavengers, unlike those of the other animals, which were exploited by the inhabitants of Shahr-i Sokhta.

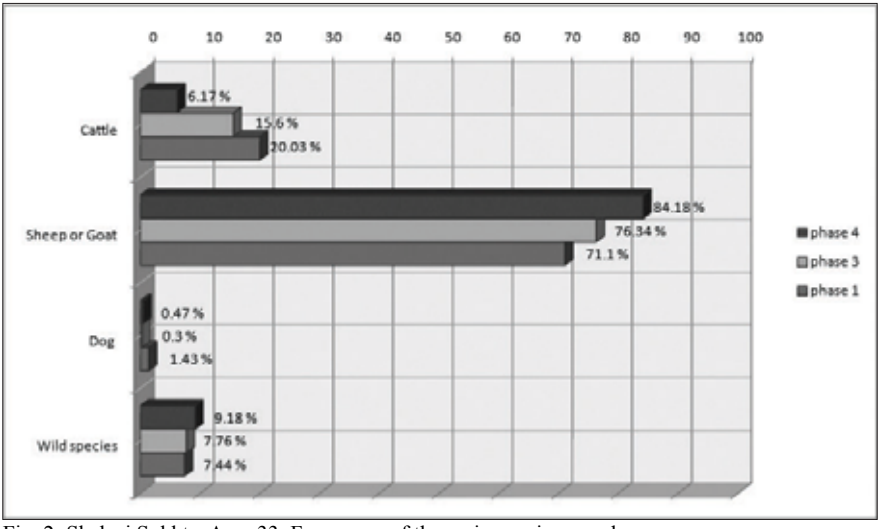

Fig. 2: Shahr-i Sokhta, Area 33. Frequency of the main species per phase.

Cattle

The cattle remains were identified as belonging to humped cattle. Both the NISP and MNI suggest an increase in frequency over time, passing from ca 7% to 22% of the remains and from two to four individuals (Tab. 3).

The frequency of skeletal elements per phase was calculated using the MNI rather than the NISP, to eliminate bias arising from elements that occur more frequently in the body. For Layers 4 and 3, the highest MNIs were calculated from forelimb bones (humerus or radius), and for phase 1 from hindlimb elements (pelvis and calcaneum). Few remains of teeth and cranial elements were found. Only two fragments of horncores were identified.

Examining the data on epiphyseal fusion (Tab. 4), the proportion of cattle that had reached skeletal maturity before death was high. However, in Layers 4 and 3, some bones belonged to sub-adult (18-36 months) and young (12-18 months) individuals, while in Phase 1 only one of the remains is from an animal aged less than 36 months. These data suggest that cattle were used as draught animals in all phases, with a minor interest in beef production. The data from teeth wear stages are consistent with those of the fusion of epiphyses (Tab. 5).

Butchery marks were observed on just two cattle bones (an astragalus from Layer 4 and a calcaneum from Layer 3). No traces of burning were found, the only exception being three phalanges from Layer 3 (Fig. 3).

A total of 49 vertebrae and 50 large ribs were also identified as probably belonging to cattle, currently the only large mammal species identified in this area. No thoracic vertebrae with spina bifida were noted, and very few ribs and vertebrae show butchery marks.

Few biometric data are available; however, they show that the majority of bones belonged to small specimens and only one calcaneum was from a larger individual.

Caprines

Sheep and goats are largely dominant in all phases, although their frequency decreases over time from 93% to 78% in terms of the NISP of the main domesticates and from 16 to 11 individuals on the basis of the MNI. Sheep are always more numerous than goats (Fig. 4), although for a large amount of the caprine remains it was not possible to distinguish between the two genera.

All body parts are represented, but the most frequently preserved element is the distal humerus (Tab. 6). Few fragments of horncores were found, the majority belonging to goats.

Analysis of epiphyseal fusion suggests that in all phases, most caprines reached the age of five. Only 3-8% of individuals were slaughtered before reaching the first year of age and just under a third between the first and the fourth years of age (Tab. 7). These data suggest that caprines were generally managed so as to maintain herd numbers and were exploited for secondary products (mainly fleeces and hides). They were slaughtered at the age when the quality of fleeces and hides usually declines (4-6 years).

Tooth wear stage data confirm the results of the epiphyseal fusion analysis but enable better interpretation of the use of sheep and goats, which may have been exploited for different purposes.

Fig. 3: Shahr-i Sokhta, Area 33. Three burnt cattle first phalanges from US 34, phase 3 - 'House of the Courts' .

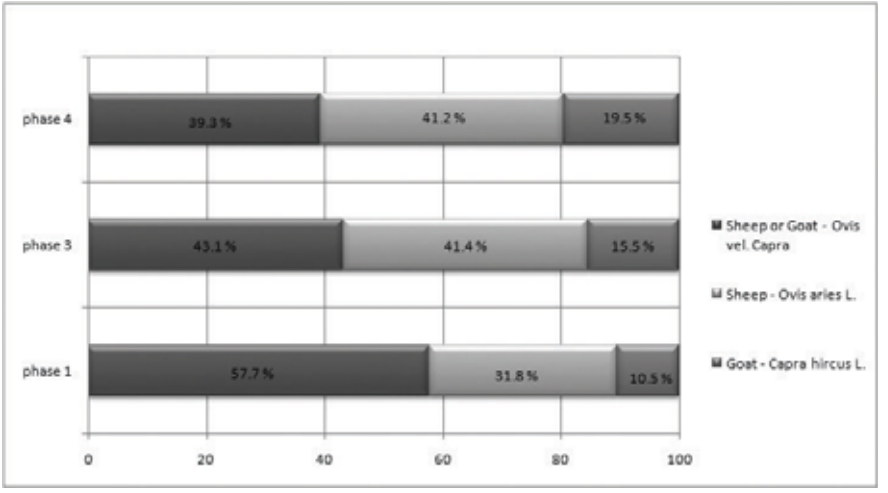

Fig. 4: Shahr-i Sokhta, Area 33. Ratio of sheep to goats for each phase.

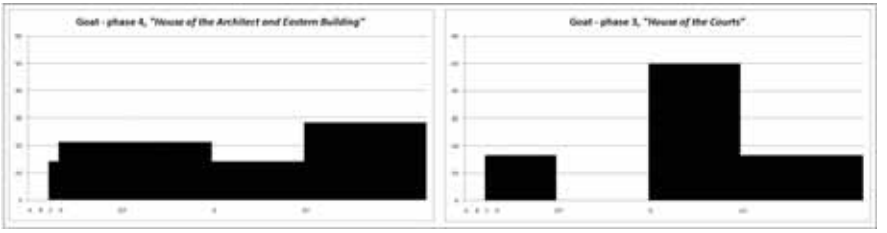

Fig. 5: Shahr-i Sokhta, Area 33. Mandibular teeth wear in goats, from Layer 4 ('Western Building' and 'Eastern Building') and Layer 3 ('House of the Courts'), following Helmer - Gourichon - Vila 2007.

Few data on goats are available. They show that in Layer 4 almost equal percentages of individuals were slaughtered between the first and the third years of age and between the fourth and the tenth years, whereas in Layer 3 one third of goats before reaching the second year but the majority after the fourth year. No data are available on goat mortality from Layer 1 (Tab. 8).

Data on sheep mortality show that in all phases most of them were slaughtered after the fourth year of life, while only 20-30% of animals were slaughtered between six months and the fourth year of age (Tab. 9).

These results and their relative correlation with categories of caprine management (Helmer - Gourichon - Vila 2007) suggest that goats were partly slaughtered for meat and partly after prolonged breeding before obtaining the hides (Fig. 5); sheep were mainly exploited for their fleeces and secondarily for mutton (Fig. 6). The low percentages of sheep and goats slaughtered at a young age may indicate that milk was not important in the inhabitants' diet. However, a certain interest in milk might be indirectly reflected by the slaughtering of individuals (in these cases females) between two and four years of age and, to a lesser degree, between four and six years, when milk production decreases.

Butchery marks are visible on a large number of caprine bones: half of the caprine samples bear traces of the dismemberment of carcasses and filleting (Fig. 7). Butchery marks are also present on medium-sized ribs that probably belonged to sheep and goats. Extensive burning was also noted, particularly on the epiphyseal extremities of long bones, suggesting that body parts were severed at the joints before being roasted.

Fig. 6: Shahr-i Sokhta, Area 33. Mandibular teeth wear in sheep, all phases, following Helmer - Gourichon - Vila 2007.

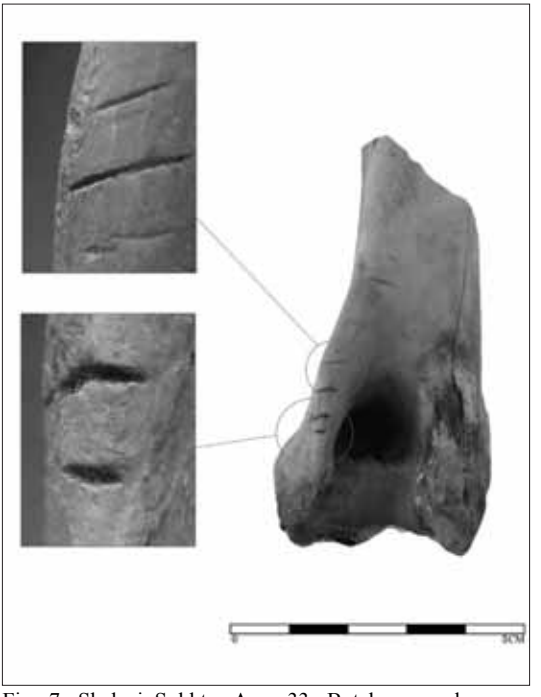

Fig. 7: Shahr-i Sokhta, Area 33. Butchery marks on a caprine distal humerus seen in dorsal view.

Withers height estimated for sheep using Teichert coefficients (1975) ranges from 50.5 to 71.5 cm (Tab. 10). Plots of bone measurements show a certain variability in sheep and goats, with both small and large individuals, probably due to the presence of both sexes and maybe also to different breeds.

Dogs

The dog is represented in all phases of occupation of Area 33, albeit to a limited extent. The specimens are generally adults, apart from a young dog aged less than 12 months from Layer 4. Biometric analysis suggests the presence of large individuals; one of them was 64.4 cm tall, based on Clark's coefficients (1985). Gnawing marks by carnivores were observed on a dog pelvis from Layer 1 (Fig. 8).

Wild species

Wild species are present in all phases, but in lower numbers than domesticates. The remains of wild mammals include gazelle, wild goat (Fig. 9) and urial, the last two identified on the basis of biometric parameters. Many rodent bones and a fish vertebra not identified to species level are also documented.

Bird remains are represented in all phases but there are more in Layer 3 than any other (Tab. 11). They belonged to several migratory bird species. The Eurasian coot and the pochard are documented in all phases and account for the majority of bird bones found at Area 33. The grey heron and the cormorant are documented only in Layer 4, and the wild goose only in Layer 3.

4. Discussion

This preliminary study of the animal remains found in Area 33 shows that in all three chronological phases domesticated animals accounted for 92% to 96% of remains. Caprines always dominated, followed by cattle, which increased over time from 7% to 22%. Intensive husbandry of domesticated ruminants is appropriate for an environment of open spaces with low vegetation, located near streams or lakes, such as the one that characterized the settlement. Pigs are completely absent in all phases.

Fig. 8: Shahr-i Sokhta, Area 33, Layer 1 (Building 33). Dog pelvis with carnivore bites.

Fig. 9: Shahr-i Sokhta, Area 33, Layer 4 ('Western Building' and 'Eastern Building'): distal humerus of Capra aegagrus (left) and Capra hircus (right).

These results are perfectly in line with those from previous studies carried out on other parts of the site (Caloi - Compagnoni 1977; Bökönyi - Bartosiewicz 2000; Minniti 2019).

Other sources suggest the presence of suids in Sistan, and the reasons for their apparent exclusion from the diet of the inhabitants of Shahr-i Sokhta still need to be clarified.

Cattle were always primarily used for the plough and only secondarily slaughtered for meat. The exploitation of cattle as draught animals seems to intensify in Layer 1. All the cattle remains are currently identified as belonging to domestic breeds and probably to the humped and humpless forms already documented at Shahr-i Sokhta. Their measurements generally match the data documented by previous studies (Bökönyi - Bartosiewicz 2000).

Sheep and goats provided meat, fleeces and hides in all phases. Their mortality profiles are consistent with those of other domestic areas previously studied (Bökönyi - Bartosiewicz 2000: 126-127). Given the absence of perinatal and very young caprines in the samples, milk production seems to have been negligible in Area 33. However, we should bear in mind that several young sheep and goat remains were found in tombs as funerary offerings (Sajjadi 2008a; 2008 b; 2010). This suggests that data from Area 33 may not reflect the general pattern of husbandry followed at the site. Further analyses conducted in other areas are expected to provide new information that will improve our understanding of caprine exploitation at Shahr-i Sokhta.

The measurements of sheep long bones generally lie within the range already documented in previous studies but they also highlight the presence of small individuals that were not previously documented (Bökönyi - Bartosiewicz 2000: tab. 4). They also show a slight decrease in the size of sheep over time.

In all phases, dogs are represented by a small number of remains, which are believed to belong to large animals, probably used in pastoral activities.

Wild animal remains are rare in all phases. Their scarcity confirms the marginal role of game in the inhabitants' diet that has already been seen in previous studies.

The main wild species in Area 33 (gazelle, wild goat and urial) are consistent with low vegetation that is conducive to pasture. Layers 4 and 3 yielded abundant rodent remains. These belonged to commensal animals, as shown by the numerous gnawing marks found on the other bones.

The discovery of a fish vertebra in a layer dated to Layer 1 suggests that fishing also played a role, albeit a marginal one.

The bird remains found in Area 33 belonged to migratory bird species; these data are consistent with the results of previous analyses of other samples (Bulgarelli 1977; Cassoli 1977).

Unsurprisingly, they are associated with marshes, small lakes and streams, which characterize the environment of the site.

All the bird species detected were edible, with the exception of the cormorant. Previous studies have shown that birds were hunted for food at this site (Gala - Tagliacozzo 2014), and the long bones of some species were secondarily used to make so-called 'pourers' (Potenza 2019). In the case of cormorants, their use in fishing activities has been suggested (Cassoli 1977).

5. Conclusion

Our paper presents preliminary results from the study of a new faunal sample found at Shahr-i Sokhta by the MAIPS project, specifically examining the data from Area 33, which are dated to Periods III and II. They generally confirm the animal economy shown by previous studies of the material carried out by the Italian Archaeological Mission between 1967 and 1978, but also reveal some small changes otherwise not detected until now. Despite the small size of the sample, the new data highlight the need to investigate the animal economy of the site in accordance with a more refined chronology.

The results discussed here are preliminary and future research in Area 33 will yield further material that will help to verify the scenario presented here.

Analyses of material from other areas of the site demonstrate the importance of comparing data from a range of buildings and areas, in order to obtain reliable knowledge of animal exploitation in Shahr-i Sokhta.

NISP					
Taxon	Layer 4	Layer 3	Layer1	Tot.	%
Cattle - *Bos indicus* L.	19.5	52.25	35	106.75	12.9
Sheep or Goat - *Ovis* vel. *Capra*	104.5	110.25	71.75	286.5	34.7
Sheep - *Ovis aries* L.	109.5	106	39.5	255	30.9
Goat - *Capra hircus* L.	52	39.5	13	104.5	12.7
Dog - *Canis familiaris* L.	1.5	1	2.5	5	0.6
Urial - *Ovis orientalis vignei* Blyth	3		2	5	0.6
Wild goat - *Capra aegagrus* L.	1	1		2	0.2
Gazelle - *Gazella* sp.	2	4	3	9	1.1
Rodents - *Rodentia* ind.	5	12	1	18	2.2
Birds - *Aves* ind.	18	9	6	33	4
Fish - *Pisces* ind.			1	1	0.1
TOTAL	316	335	174.75	825.75	100

Tab. 1: Shahr-i Sokhta, Area 33. Number of identified animal remains (NISP) per Layer.

MNI			
Taxon	Layer 4	Layer 3	Layer 1
Cattle - Bos indicus L.	2	3	4
Sheep or Goat - Ovis vel. Capra	16	13	11
Dog - Canis familiaris L.	1	1	1
Urial - Ovis orientalis vignei Blyth	1		1
Wild goat - Capra aegagrus L.	1	1	
Gazelle - Gazella sp.	1	1	1

Tab. 2: Shahr-i Sokhta, Area 33. Minimum Number of Individuals (MNI) for the main mammal species per Layer.

CATTLE

Elements	Layer 4			Layer 3			Layer 1		
	NISP	MNI	%	NISP	MNI	%	NISP	MNI	%
horncorn	-	-	-	2	1	-	-	-	-
cranium	-	-	-	1	1	-	-	-	-
upper deciduous/ permanent premolars	-	-	-	-	-	-	1	1	-
upper M1/2	-	-	-	3	1	-	3	2	-
upper M3	-	-	-	-	-	-	1	1	-
incisors	-	-	-	2	1	-	-	-	-
lower deciduous/permanent premolars	2	1	-	4	2	-	-	-	-
lower M1/2	2	1	-	3	2	-	2	1	-
lower M3	1	1	-	-	-	-	-	-	-
unidentified teeth	-	-	-	-	-	-	1	1	-
atlas	-	-	-	2	2	-	-	-	-
axis	-	-	-	1	1	-	1	1	-
scapula	-	-	-	4	2	-	-	-	-
humerus	3	2	100	3	2	-	3	2	-
radius	1	1	-	5	3	100	3	2	-
ulna	1	1	-	3	2	-	1	1	-
carpal	-	-	-	3	2	-	-	-	-
metacarpal	3	2	-	2.5	2	-	1.5	1	-
pelvis	2	1	-	2	1	-	7	4	100
femur	-	-	-	2	1	-	2	1	-
rotula	-	-	-	3	2	-	-	-	-
tibia	-	-	-	5	3	100	4	2	-
tarsal	4	2	-	6	3	100	2	1	-
astragalus	1	1	-	-	-	-	1	1	-
calcaneum	1	1	-	3	2	-	7	4	100
metatarsal	-	-	-	3.5	2	-	0.5	1	-
1st phalanx	4	1	-	13	2	-	5	1	-
2nd phalanx	2	1	-	5	1	-	2	1	-
3rd phalanx	3	1	-	1	1	-	1	1	-

Tab. 3: Shahr-i Sokhta, Area 33. Body parts of cattle by Number of Identified Specimens (NISP) and Minimum Number of Individuals (MNI) for each phase. The MNI was calculated as follows: deciduous and premolars were divided by 6; first/second molars by 4; third molars by 2; phalanges by 8 and all other elements except metapodials and vertebrae by 2. Metacarpal = (MC1+MC2/2+MP1/2+MP2/4)/2; metatarsal = (MT1+MT2/2 +MP1/2+MP2/4)/2. % = frequency of an element expressed in relation to the most common (by MNI).

CATTLE							
		Layer 4		Layer 3		Layer 1	
Element	**age of fusion**	**U**	**F**	**U**	**F**	**U**	**F**
scapula dist.	7-10 months	-	-	0	4	-	-
pelvis acet.	7-10 months	-	-	0	2	0	5
humerus dist.	12-18 months	1	2	0	3	0	2
radius prox.	12-18 months	0	1	1	3	0	2
1st prox. phalanx	18 months	2	2	0	13	0	5
2nd prox. phalanx	18 months	0	2	1	4	0	2
metacarpal dist.	24-30 months	1	1	0	2	0	1
tibia dist.	24-30 months	-	-	1	1	0	1
metatarsal dist.	24-36 months	-	-	0	3	-	-
metapodial dist.	30-36 months	-	-	0	1	0	2
calcaneum prox.	36 months	1	0	1	1	1	4
femur prox.	42 months	-	-	1	0	-	-
humerus prox.	42-48 months	-	-	-	-	0	1
radius dist.	42-48 months	-	-	1	0	0	1
ulna prox.	42-48 months	0	1	2	0	-	-
femur dist.	42-48 months	-	-	0	1	0	1
tibia prox.	42-48 months	-	-	1	2	0	2

Tab. 4: Shahr-i Sokhta, Area 33. Frequencies of unfused (U) and fusing/fused (F) bones of cattle; age of fusion following Silver (1969). Prox.= proximal; dist.= distal; acet.= acetabulum.

Cattle. phase 4 - 'Western Building' and 'Eastern Building'																					
	C	V	E	H	U	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
dP4																					
P4							1														
M1																				1	
M2																1					
M3																1					
M1/2																					

Cattle. phase 3 - 'House of the Courts'																					
	C	V	E	H	U	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
dP4																					
P4											1										
M1									1								1				
M2		1																			
M3																					
M1/2																					

Tab. 5: Shahr-i Sokhta, Area 33. Wear stages of individual cattle teeth from phase 4 ('Western Building' and 'Eastern Building') and phase 3 ('House of the Courts') following Grant (1982). Both mandibular and isolated teeth are included.

CAPRINES																
Elements	**Layer 4 Western and Eastern Building**					**Layer 3 House of the Courts**					**Layer 1 Building 33**				
	goat	**sheep**	**S/G**			**goat**	**sheep**	**S/G**			**goat**	**sheep**	**S/G**		
	NISP	**NISP**	**NISP**	**MNI**	**%**	**NISP**	**NISP**	**NISP**	**MNI**	**%**	**NISP**	**NISP**	**NISP**	**MNI**	**%**
horncorn	1			-	-	2	2		-	-	3		1	-	-
cranium	3	3	4	-	-	5	6	1	-	-		1	4	-	-
up. decid/perm P			20	4	25			16	3	23.08			1	1	9.09
upper M1/2			38	10	62.5			30	8	61.54			8	2	18.18
upper M3			12	6	37.5			6	3	23.08			2	1	9.09
incisors					-		1	1	1	7.69					-
low. decid/perm P	11	28	3	7	43.75	9	27	5	7	53.85	2	11	3	3	27.27
lower M1/2	9	36	2	12	75	9	27	7	11	84.62	2	10	4	4	36.36
lower M3	3	14	3	10	62.5	3	8	3	7	53.85	1	4	3	4	36.36
unidentified teeth					-					-					-
atlas	2	2	2	6	37.5			1	1	7.69			3	3	27.27
axis	2	3		5	31.25		4	4	8	61.54			4	4	36.36
scapula	1	1	3	3	18.75	4	4	6	7	53.85			5	3	27.27
humerus	4	18	9	16	**100**	3	14	9	13	**100**	5	5	12	11	**100**
radius	9	8	6	12	75	5	8	18	12	92.31		5	1	3	27.27
ulna	2	1	7	5	31.25		1	10	6	46.15		2	2	2	18.18
carpal					-					-			1	1	9.09
metacarpal	1	5	2.5	4	25	1	5	3.5	5	38.46	2		2.5	3	27.27
pelvis	6	7	13	13	81.25	1	5	9	8	61.54	1	2	10	7	63.64
femur	4	10	5	10	62.5	2	7	12	11	84.62		2	4	3	27.27
rotula			2	1	6.25			1	1	7.69					-
tibia	4	12	2	9	56.25	7	14	9	10	76.92	2	7	5	7	63.64
tarsal			4	2	12.5			5	3	23.08					-
astragalus	6	11	2	10	62.5	3	10	1	7	53.85	1	6	7	7	63.64
calcaneum	2	4	3	5	31.25	5	7	4	8	61.54		4	1	3	27.27
metatarsal	2	6	1.5	5	31.25		3	5.5	5	38.46		1	2.5	2	18.18
phalanx 1st	5	18	5	4	25	8	18	4	4	30.77	2	7	3	2	18.18
phalanx 2nd	3	2	1	2	12.5	4	4		2	15.38			1	1	9.09
phalanx 3rd	1	1		2	12.5	3			1	7.69					-

Tab. 6: Shahr-i Sokhta, Area 33. Body parts of sheep/goat by Number of Identified Specimens (NISP) and Minimum Number of Individuals (MNI) for each phase. Non-countable elements are not included. The MNI was calculated as follows: deciduous and premolars were divided by 6; first/second molars by 4; third molars by 2; phalanges by 8 and all other elements except metapodials and vertebrae by 2. Metacarpal = (MC1+MC2/2+MP1/2+MP2/4)/2; metatarsal = (MT1+MT2/2+MP1/2+MP2/4)/2. % = frequency of an element expressed in relation to the most common (by MNI).

CAPRINES

		Layer 4		Layer 3		Layer 1	
Element	age of fusion	U	F	U	F	U	F
humerus dist.	-12 months	2	23	3	22	1	20
radius prox.	-12 months	1	13	1	16	0	6
pelvis acet.	-12 months	0	9	0	6	0	9
scapula dist.	12 months	3	2	2	8	1	4
1st prox. phalanx	14-35 months	3	24	4	26	0	9
2nd prox. phalanx	14-35 months	0	6	0	8	0	1
tibia dist.	35 months	0	13	3	19	3	10
femur prox.	35 months	2	7	6	5	0	2
femur dist.	48 months	2	8	8	2	2	0
metacarpal dist.	48 months	1	6	8	5	1	3
metatarsal dist.	48 months	0	7	4	3	1	2
metapodial dist.	48 months	2	0	1	0	1	4
tibia prox.	48 months	0	5	4	7	0	1
humerus prox.	48-60 months	3	1	0	2	-	-
radius dist.	48-60 months	1	7	9	6	-	-
ulna prox.	48-60 months	2	6	4	6	1	3
calcaneum prox.	48-60 months	3	6	4	10	2	3

Tab. 7: Shahr-i Sokhta, Area 33. Frequencies of unfused (U) and fusing/fused (F) caprine bones; age of fusion following Bullock - Rackham (1982). Prox. = proximal; dist. = distal; acet. = acetabulum.

Capra hircus		Layer 4 Western Building and Eastern Building		Layer 3 House of the Courts	
Payne categ.	age	NISP	%	NISP	%
A	0-2 m.	0	0	0	0
B	2-6 m.	0	0	0	0
C	6-12 m.	1	14.3	1	16.7
D	1-2 years	1.5	21.4	1	16.7
E	2-3 years	1.5	21.4	0	0
F	3-4 years	0	0	0	0
G	4-6 years	1	14.3	3	50
H	6-8 years	1	14.3	0	0
I	8-10 years	1	14.3	1	16.7
Total		**7**	**100**	**6**	**100**

Tab. 8: Shahr-i Sokhta, Area 33. Goat mandibular teeth wear stage from phase 4 ('Western Building' and 'Eastern Building') and phase 3 ('House of the Courts'), following Payne (1973).

Ovis aries		Layer 4 Western Building and Eastern Building		Layer 3 House of the Courts		Layer 1 Building 33	
Payne categ.	age	NISP	%	NISP	%	NISP	%
A	0-2 m.	0	0	0	0	0	0
B	2-6 m.	0	0	0	0	0	0
C	6-12 m.	1	3.8	1	4.8	1	14.3
D	1-2 years	1.17	4.5	1	4.8	0	0
E	2-3 years	3.64	14	1.88	9	1.25	17.9
F	3-4 years	3.45	13.3	1.88	9	1.25	17.9
G	4-6 years	11.54	44.4	7.36	35	2.5	35.7
H	6-8 years	1.2	4.6	5.76	27.4	1	14.3
I	8-10 years	4	15.4	2.12	10.1	0	0
Total		26	100	21	100	7	100

Tab. 9: Shahr-i Sokhta, Area 33. Sheep mandibular teeth wear stage per phase, following Payne (1973).

Ovis aries	Layer 4				Layer 3			
	n.	min.	mean	max.	n.	min.	mean	max.
radius	1		65.1		1		67.7	
metacarpus	4	60.3	65.2	70.0	2	50.5	58.0	65.6
metatarsus	1		62.3		1		71.5	

Tab. 10: Shahr-i Sokhta, Area 33. Sheep withers heights, estimated in accordance with Teichert (1975).

NISP			
Birds	Layer 4	Layer 3	Layer 1
Gray heron - Ardea cinerea L.	1		
Pochard - Aythia ferina L.	7	4	2
Aythia sp.		1	
Wild goose - Anser anser L.		1	
Anser sp.		1	
Coot - Fulica atra L.	9	2	2
Cormorant - Phalacrocorax carbo L.	1		
Aves ind.			2
TOTAL	18	9	**6**

Tab. 11: Shahr-i Sokhta, Area 33, number of identified bird remains (NISP) per Layer.

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