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Rémi BERTHON and Marjan MASHKOUR*

ANIMAL REMAINS FROM TILBEŞAR EXCAVATIONS, SOUTHEAST ANATOLIA, TURKEY

INTRODUCTION

This paper presents a first synthesis of the zooarchaeological studies carried out at the archaeological site of Tilbeşar since 2001. The excavations are directed by Dr. Christine Kepinski (UMR 7041, CNRS, Nanterre). Tilbeşar is a large site located on the banks of the Sajur, one of the Euphrates' tributaries (Kepinski 2005: 145-146). Tilbeşar lies at 20 km north-west of Gaziantep. Here the environment is not excessively dry despite the proximity of the North-Mesopotamian steppe. Tilbeşar stands between the 600 mm and 400 mm isohyets (Zohary 1973: Map 5) and the geographical depression around the site is pretty well irrigated by springs, subterranean water courses and the Sajur itself. These favorable conditions are confirmed by the noteworthy presence of the water demanding free-threshing wheat, at least during the Bronze Age (Kepinski *et al.* 2006: 258; Herveux 2007: 552). There is evidence of a woodland in the vicinity of the Sajur Valley with the domination of the deciduous oak during the Bronze Age. At the same period, an exploitation of the riverine forest has been seen in the charcoal analysis (Pessin 2007: 561-564).

I. MATERIAL AND METHODS

A first analysis of the animal remains from Tilbeşar¹ was performed in the excavation house in

1999 and 2001 by M. Mashkour (2002). A small sample exported to Paris was reexamined by R. Berthon during his M.A. traineeship. During the 2007 season, M. Mashkour and R. Berthon proceeded with the study of animal remains from the post-Bronze Age levels in the excavation house. The remains from the Bronze Age levels were studied by R. Berthon in the laboratory of the UMR 5197 "Archéozoologie. Histoire des sociétés humaines et des peuplements animaux" at the Muséum national d'Histoire naturelle in Paris (Berthon 2007).

During the excavations the faunal remains were carefully collected by hand but no sieving was undertaken. The faunal remains were washed, weighed² and identified as a skeletal part and assigned to a genus or species level when possible. In total we registered more than 7500 animals remains of which 5750 were assigned to an identified, chronologically homogeneous, archaeological layer. The work on the archaeological contexts is still in progress. Thereby we decided to use only the 5750 remains with a defined chronological position to assure a suitable interpretation of our data. We consider that this sample is large enough to be representative but more remains could be included in the future in case of new chronological attributions. The analysis of the faunal remains will be presented in three chronological groups, the Chalcolithic and Bronze Age levels, the equid from a pre-medieval burial, and the Medieval levels. The

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1) We are pleased to thank here Christine Kepinski, the excavations director, for her invitation to study at Tilbeşar. The exportation of a part of the sample has been possible thanks to the kind permission of the Direction of the Gaziantep Museum. The research unit "Archéozoologie. Histoire des sociétés humaines et des peuplements animaux" (UMR 5197, CNRS/MNHN), directed by Jean-Denis Vigne, provided a financial support and osteological comparative collection for the study of the exported samples. We also thank Laszlo Bartosiewicz for sharing data from Horum Höyük and with whom we have had numerous pleasant and enhancing discussions. Krystyna Irvine kindly corrected our English expression.

2) We were not able to weigh the remains at all steps of the study, therefore weight will not be used in this paper.

methods used to determine the species and the age at death were applied to all the remains without regards to the levels where they were found, wherefore they are presented here by taxonomic groups³.

A. Leporidae

The only species naturally present in Anatolia from the leporidae family is the hare (*Lepus europaeus*) (Wilson and Reeder 1993 for the synonym issues; Demirsoy 2003: 109-110). All the bones found in our assemblage fit with this large-size European form.

B. Rodentia

Most of the rodent remains come from mixed layers or are considered as intrusive animals⁴. A jaw has been determined as a Muridae on dental morphology (Hillson 2005: Fig. 1.50), possibly a spiny mouse (*Acomys* spp.). Two species of this genus are currently present in Anatolia (Demirsoy 2003: 181); the often commensal common spiny mouse (*Acomys cahirinus*) and the Cilician spiny mouse (*Acomys cilicicus*). Further analysis will be carried out to solve this question.

C. Carnivora

a. Canidae

If the *dogs* (genus *Canis*) and the *foxes* (genus *Vulpes*) can be sorted easily, the different species of a same genus are difficult to discriminate. The jackal (*Canis aureus*), the domestic dog (*Canis familiaris*) and the wolf (*Canis lupus*) are pretty similar from a morphological point of view. Seeing that the measurable bones are in the range of the domestic dog and that no other bone attributed to the same genus is particularly larger or smaller, we determined all the dog-like bones as possibly domestic dog (*Canis cf familiaris*).

The genus *Vulpes* is less problematic as only the red fox (*Vulpes vulpes*) is attested in Anatolia (Demirsoy 2003: 213). Among the few bones of our sample, we didn't find any clue to attest the presence of another species, such as the Blandford's fox (*Vulpes cana*) or the sand fox (*Vulpes rueppelli*), which are smaller than the red fox.

b. Felidae

A medium size cat-like sacrum is the only bone recognized for this family. Several species of this

size are apt to be encountered in this region (Demirsoy 2003: 226-232), the European wild cat (*Felis silvestris silvestris*), the caracal (*Caracal caracal*), the jungle cat (*Felis chaus*), the Asian wild cat (*Felis silvestris ornata*) and the lynx (*Lynx lynx*). Each species provides a specific environmental indication but this bone has not yet been determined to this level.

D. Equidae

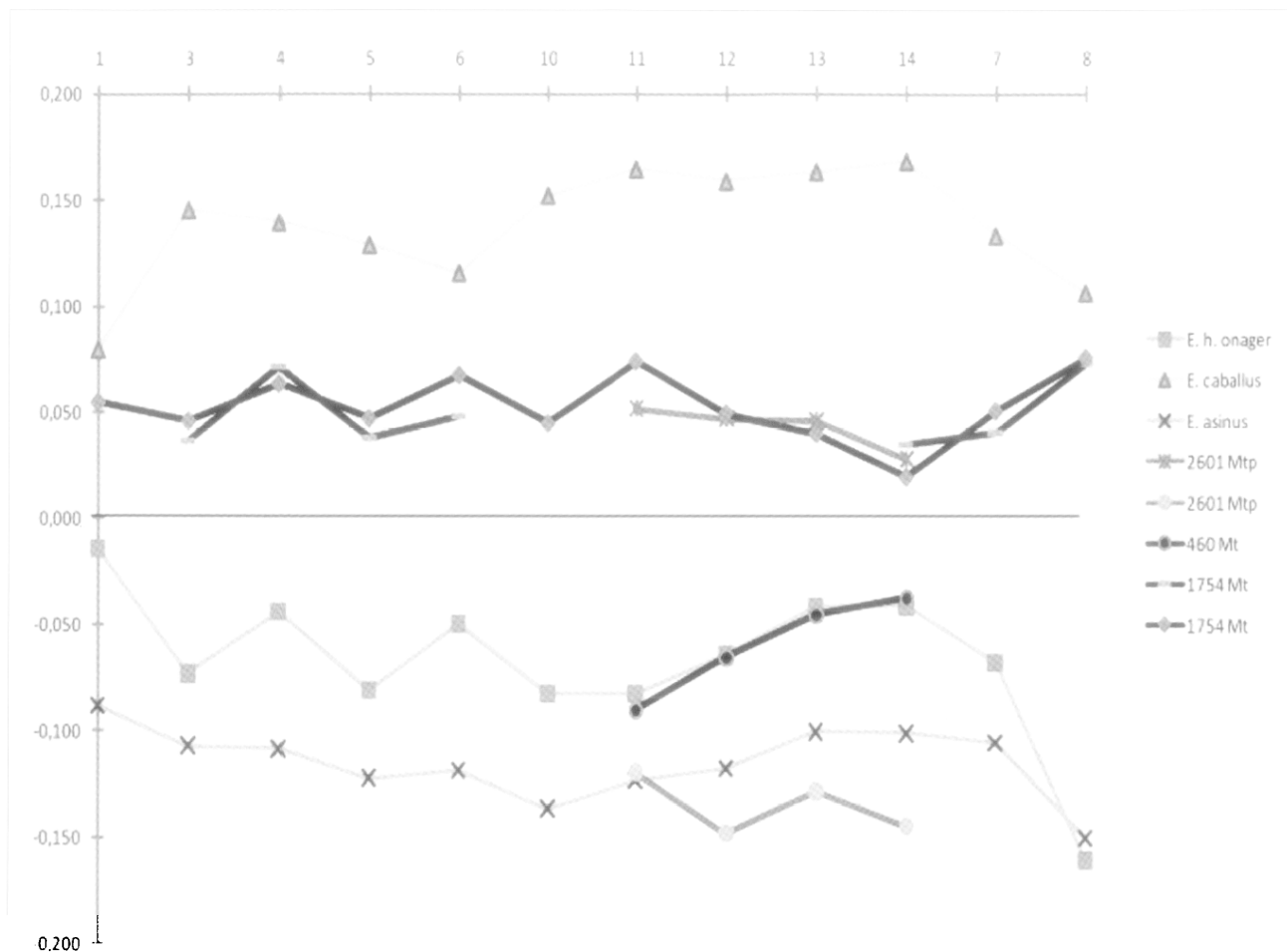
An accurate determination of the different species of equids require a large number of measurable or well preserved bones. Apart from the remains for which we could use one of the under-mentioned criteria, the other fragments were not assigned further than to the genus level. The teeth are, in absence of complete series, less discriminating than the bones. Nonetheless, we used the morphology of the inferior teeth as described by V. Eisenmann (1986) and metrical index for the maxillary rows (Eisenmann 1980). For the bones, with the exception of the metapodial and the proximal phalanx, we refer to the different morphological criteria already published (Uerpmann 1986; Boessneck 1987: 139, 142; Uerpmann 1991; Vila 1998: 59-65; Helmer 2000b: 235-237). The metacarpals, metatarsals and proximal phalanx were assigned to a species using the log ratios method (Simpson 1941: 23-25) with the commonly accepted reference data (Eisenmann and Beckouche 1986 for the metapodials; Dive and Eisenmann 1991 for the proximal phalanx). We draw attention to the onager (*Equus hemionus onager*) metatarsal from locus 460 (Fig. 1). The variability of the ratio for the bones above the horse reference and around the donkey signal is notably large and we cannot exclude the presence of mules or hinnies among the individuals assigned to the domestic horse (*Equus caballus*) or the domestic donkey (*Equus asinus*).

E. Suidae

The genus *Sus* can be represented by two forms, the wild (*Sus scrofa*) and the domestic (*Sus domesticus*) representatives. The difference between those two species is usually made on the size of the bones. We used a log ratio method to compare our bones with measurements of modern wild boar from Anatolia (Payne and Bull 1988). All the bones and teeth are noticeably smaller than the

3) Following the order proposed by A. Gilbert (2002).

4) Rodents could burrow deeply in the ground. Hence, it is difficult to assume the contemporaneity of the rodent remain and the layer where it was found.



**Fig. 1 : Log ratio of equid metatarsals. The reference (line 0) is the *Equus przewalski*.
Reference data from Eisenmann and Beckouche 1986.
The two signals “2601 Mtp” are metapodials not assigned to the hind or fore limb.**

wild boar reference. All the remains are considered as domestic pig, even if they were not measurable, as none of them seem to be larger than the average size of the assemblage. Nonetheless, some tusk fragments and a frontal bone are assigned to the wild boar.

Age is determined from the teeth with the occlusal wear stage for the mandibular teeth (Grant 1982; Horard-Herbin 1997: Tab. 25) and tooth eruption (as compiled by Bull and Payne 1982). For the epiphyseal age we follow the data given by R. Barone (1999: 76).

F. Camelidae

As no wild camel (*Camelus* spp.) lived in Anatolia (Uerpmann 1987: 48), the camel remains discovered could either be assigned to the Bactrian camel (*Camelus bactrianus*) or the dromedary (*Camelus dromedarius*), both domesticated and

used for transport. The assignment to a species level is delicate. We could measure a proximal phalanx and a distal part of a radius. Using the measurements given by C. Steiger (1990: 94, 103), the phalanx is clearly an anterior specimen but stands in the overlap zone of dromedaries and Bactrian camels (Fig. 2). The distal part of radius is in the middle range of the Bactrian camels when considering the ratio of the distal transverse diameter on the transverse diameter of one or the other distal facet. On the other hand, considering the ratio of the transverse diameter of the ulnar on the transverse diameter of the radial facets, the bone from Tilbeşar doesn't stand on the Bactrian camel linear regression line (Fig. 3). We know that interbreeding between dromedary and Bactrian camel has been used to product pack animals (Potts 2004), further analysis will be undertaken to consider this hypothesis.

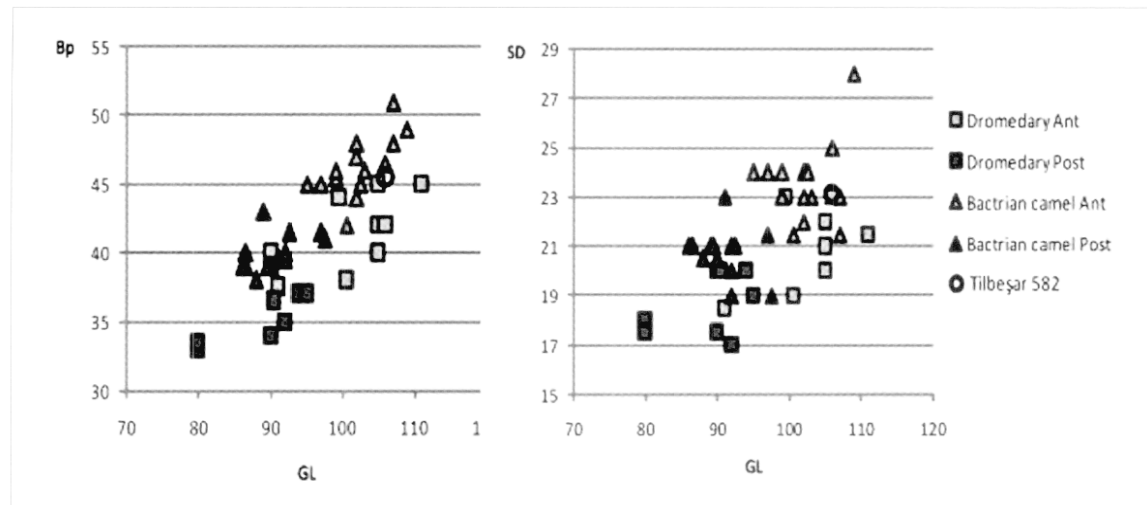


Fig. 2 : Comparison of the measurements from the camels proximal phalanx. Reference data from Steiger 1990.

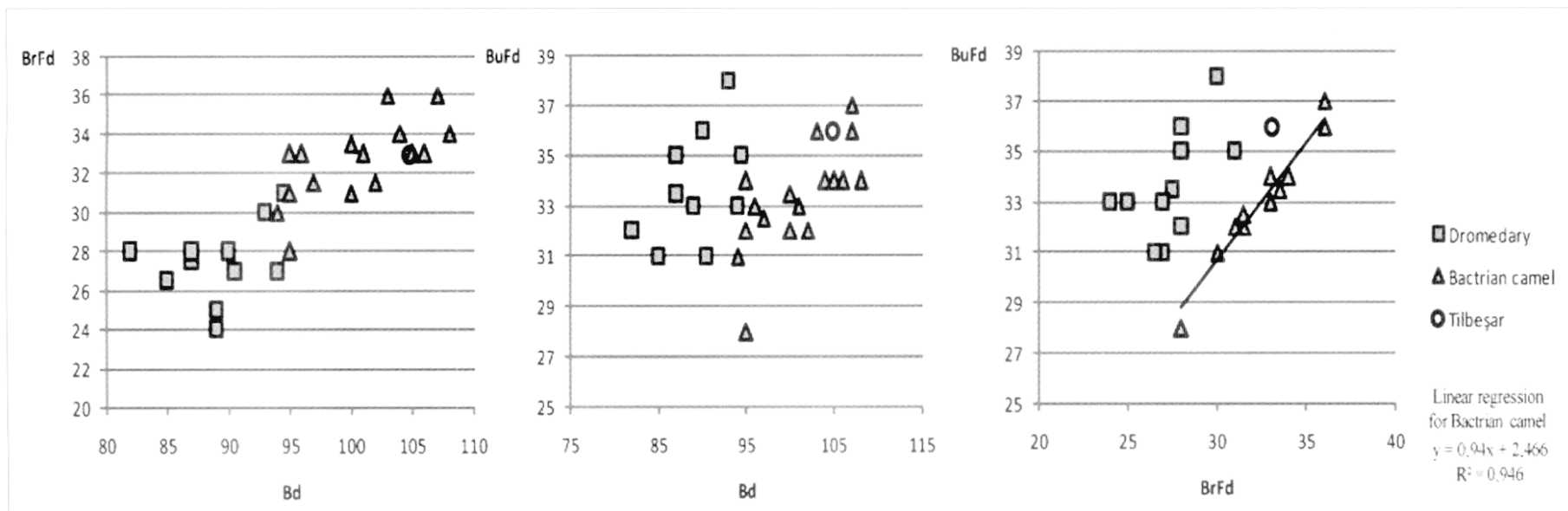


Fig. 3 : Comparison of the measurements from the camels distal part of radius. Reference data from Steiger 1990.

G. Cervidae

Four species can be found in Anatolia and North Mesopotamia (Uerpmann 1987: 57-70; Demirsoy 2003: 252-256). The roe deer (*Capreolus capreolus*) is more difficult to distinguish from the small ungulate (sheep, goat or gazelle) than from the other deer. We differentiate the fallow deer (*Dama* spp.) for the red deer (*Cervus elaphus*) on morphological aspects (Di Stefano 1996; Lister 1996). Those determinations are confirmed by the size of the bones following the measurements published by J. Boessneck and A. von den Driesch for the fallow deer (1995: Tab. 6.1) and the red deer (1975: Tab. 31-32). Occasionally the size of large red deer and small cattle overlap, thus the determination of the red deer on morphological basis was assured following W. Prummel's criteria (1988). Another issue lies in the determination of the fallow deer to a species level. Tilbeşar is located in a boundary zone between the poorly defined distribution areas of the European (*Dama dama*) and Mesopotamian (*Dama mesopotamica*) fallow deer (Uerpmann 1987: 57-63). The Mesopotamian fallow deer is assumed to be larger than the European one. We assigned the remains from Tilbeşar to this larger species in comparison with *Dama dama* measurements from Demirci Höyük in Western Anatolia (Boessneck and Driesch von den 1995: Tab. 6.1) and *Dama mesopotamica* measurements from Tell Hesban in Jordan (Boessneck and Driesch von den 1995: Tab. 6.1) and Shillourokambos in Cyprus⁵. Although we keep in mind that sexual dimorphism is important for the deer. Therefore male *Dama dama* and female *Dama mesopotamica* could have the same size. We assigned our fallow deer remains as *Dama* cf. *mesopotamica* awaiting further analysis.

H. Bovidae

a. Bovinae

The domestic cattle (*Bos taurus*) was distinguished from the aurochs (*Bos primigenius*) in relation to the size of the bones. We first compared our measurements with the large range, both gender and all periods included, published from Korucutepe (Boessneck and Driesch von den 1975: Tab. 9-10). A astragalus and a proximal phalanx are over those reference intervals. When those two remains are included with the data compiled by E. Vila (2001: Tab. 8-9), the determination as wild cattle (*Bos primigenius*) is confirmed. For the domestic cattle, the age at death is estimated on the teeth with the index Height (H)/Transversal Diameter (DT) of the upper and lower molars (Ducos 1968: 10-13), dental eruptions (as compiled by Hillson 2005: Tab. 3.3-3.4) and epiphyseal fusions (Barone 1999: 76).

b. Antilopinae

We recognized gazelle (*Gazella* spp.) from some teeth, an horn core and an humerus' distal part. As mentioned above, it could be difficult to distinguish the different small artiodactyla, especially on the post-cranial skeleton. The distal part of the humerus is one of the rare skeletal parts for which morphological and metrical criteria were published (Helmer and Rocheteau 1994). The index (100 x Maximal Height of the Trochlae / Transversal Diameter of the Trochlae) confirmed the assignation of this humerus as a gazelle (Fig. 4). The assignation of gazelle remains to a species level is still an issue. No criteria as been published for the limb bones and the horn core of this sample is not well enough preserved. Furthermore, there is

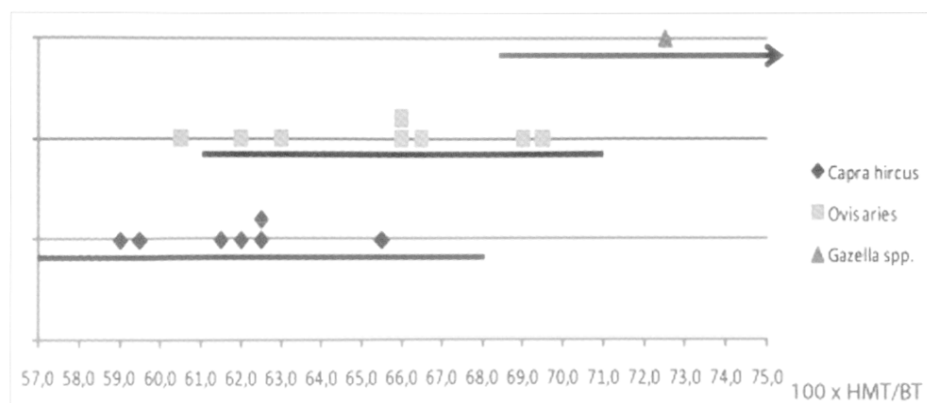


Fig. 4 : Comparison of the index 100X(Height Maximal of the Trochlea)/(Breath of the Trochlea) of humerus. Sheep, goat and gazelle from Tilbeşar's sample determinate from morphological criteria. The black lines are the range given in Helmer and Rocheteau 1994.

5) We thank Jean-Denis Vigne who communicated to us those unpublished measurements.

no general acceptance on the gazelle species which could have lived in South-Eastern Anatolia (Kasperek 1986; Uerpmann 1987: 90-107).

c. *Caprinae*

Goat, genus *Capra*, and sheep, genus *Ovis*, are very close both from a metrical and a morphological aspect. The post cranial elements are determined with morphological and osteometrical criteria (Boessneck *et al.* 1964; Boessneck 1969; Kratochvil 1969; Payne 1969; Prummel and Frisch 1986; Clutton-Brock *et al.* 1990; Helmer and Rocheteau 1994; Fernández 2001; 2002). However, the distinction is easier using the mandibular teeth⁶ morphology (Payne 1985; Helmer 2000a; Halstead *et al.* 2002; Balasse and Ambrose 2005).

To distinguish the wild goat (*Capra aegagrus*) from the domestic goat (*Capra hircus*) and the wild sheep (*Ovis orientalis*) from the domestic sheep (*Ovis orientalis*) we use the Log Size Ratio (LSI) method (Meadow 1999). As reference measurements, we use for the goat the means between a male and a female wild goat (*Capra aegagrus*) from the Turkish Taurus Mountains (Uerpmann M. and Uerpmann 1994: Tab. 14). The unimodal distribution fits between -0.08 and 0.2. Only three values are above the 2 σ interval and were assigned to *Capra aegagrus*⁷. The reference for the sheep is a female wild sheep (*Ovis orientalis*) from Western Iran (Uerpmann M. and Uerpmann 1994: Tab. 12). The distribution is also unimodal but overlap more closely the wild sheep range between -0.09 and 0.05. Two bones are widely above the 2 σ interval. Mandibular teeth is the most reliable skeletal part to give a precise enough age which will allow interpretation on the herding strategies (i.e. Payne 1973). For the Bronze Age layers sample from the 2005 and 2006 seasons (Berthon 2007), we use together the occlusal wear stage (Payne 1973) and the abrasion index (Ducos 1968: 10-13), following the method finalized by D. Helmer (1995: Fig. 12; 2000b: Tabl. 7; Helmer and Vigne 2004: Fig. 1).

I. Other taxa

a. *Avifauna*

We determined the bird bones thanks to the "Collections ostéologiques d'Anatomie Comparée du Muséum national d'Histoire naturelle". In a first view we recognized phasianidae (grouse, partridges, pheasant or quails) of which domestic fowl (*Gallus gallus*), gulls (*Larus* spp.) and anserini (swans or geese). The analysis of those remains is still undergoing.

b. *Reptilia*

A distal part of a femur is likely to correspond to a tortoise. The Mediterranean spur-thighed tortoise (*Testudo graeca*) is the most frequent tortoise in archaeological context in South-East Anatolia (Boessneck and Driesch von den 1975; Bökönyi 1983; Cavallo and Maliepaard 2002; Siracusano 2003) but this fragment is not complete enough to go so deeply in the determination level. A carapace remain is more like a freshwater turtle, the European pond terrapin (*Emys orbicularis*) or the Caspian terrapin (*Mauremys caspica*), although the exact determination is not yet done.

c. *Amphibia*

A complete skeletal of green toad (*Bufo viridis*) has been determinate on morphological basis (Bailon 1999).

d. *Ichtyofauna*

Those remains are still under analysis. However, a remain is assigned to a catfish (*Clarias* sp.)⁸.

e. *Crustacean*

A freshwater crab (*Potamon potamios* Olivier, 1804) was recognized with the help of Pierre Noël (UMR 5178, CNRS).

f. *Mollusks*

The analysis of those remains is carried out by Chloé Martin. Most of those shells belong to freshwater mollusk but it has not yet been attested that they were consumed.

6) Unfortunately, criteria for adult teeth were not published or widely known at the time of the first study at Tilbeşar and we were not able to reexamine those remains prior to this paper.

7) However two more remains, which could not have been included in the LSI analysis, were confidently assigned to the wild goat.

8) We thank Wim Van Neer for this identification.

II. THE CHALCOLITHIC AND BRONZE AGE LEVELS

A. Tilbeşar's chronology and archaeological contexts⁹

Ch. Kepinski recognized at least nine phases or sub-phases during the excavations. As the stratigraphical analysis is still undergoing, we pooled those levels into four more general periods. **Late Chalcolithic and Late Chalcolithic/Early Bronze Age transition (3300-2900 B.C.).** Those levels (thereafter LCh) are very rare and have been excavated only in the deep sounding of the citadel (E) and ever more scarcely in the south lower town (L). Considering the very small number of bones from those levels, we will rate them together.

Early Bronze Age (2900-2100 B.C.). The settlement extends rapidly to the south and north lower town to reach the size of 56 hectares even if a break seems to happen around 2300/2200 B.C. The Early Bronze Age (thereafter EBA) was found in most of the squares represented in our assemblage (D, E, H, J and L).

Early Bronze Age/Middle Bronze Age transition (2100-2000 B.C.). The question of a transition between the Early and Middle Bronze Age is not fully resolved yet (Kepinski 2007a; Kepinski, *et al.* 2007: 283). However, some floors and filling were observed between those two well-known levels in squares J, D and M.

Middle Bronze Age (2000-1600). The first part of this period shows a reduction of the settlement limited then to the citadel and north lower town. Starting from 1800 B.C., Tilbeşar seems to have reached again its maximal expansion with 56 hectares. The Middle Bronze Age (thereafter MBA) sample comes from the C, D, E, G and J squares.

B. The faunal remains

In total 4151 fragments dated from the Late Chalcolithic to the MBA were registered (Table 1). If the identifiable fragments represent only from 44 to 54% of the Number of Remains (NR), it is par-

ticularly on account of the heavy fragmentation. In a weighted sample, the identifiable remains represent 70% of the total weight of the assemblage and the non-identifiable fragments have an average weight of 2.3 g (Berthon 2007). Deer antler fragments are not included in the account because we consider them as raw material which could have been acquired outside the site's vicinity.

a. Stock breeding

Domestic mammals dominate the assemblage with an average of 95% of the number of identifiable specimens (NISP). We will look at the three main food providers, cattle, pig and caprine (Fig. 5). Looking at the herd management, we have representative data only for the EBA and MBA periods. The cattle show, with dental age, a bimodal distribution in the EBA (Fig. 6) with a slaughter focused first on young animals between 2 and 6.5 years old and then on more mature individuals older than 9 years. For the MBA, dental ages shows two main classes, before 2 years and between 4 and 6.5 years. The epiphysal fusions give less importance to the young class but confirms that less animals are killed after 4 years old.

The management of pigs seems to be unchanged between from the EBA to the MBA with a majority of animals killed before 3 years old (Fig. 7).

It is more difficult to discuss sheep and goat because no more than twenty percent of the remains could have been assigned to a species level. However, our study of the remains from the 2005 and 2006 seasons (Berthon 2007) provides some clues. For the EBA we could construct a kill-off pattern only for sheep and we showed an exploitation focused both on meat of young animals and on secondary products, presumably wool¹⁰ as attested by the noteworthy representation of individuals older than six years (Fig. 8). In the MBA period, goats seemed to have been reared for mass-production meat and to a smaller extent milk while sheep have a less specialized kill-off pattern where production of young meat dominates (Fig. 9).

⁹ We present here a summary to enable a contextualized interpretation of the faunal remains analysis. More detailed excavation reports and synthesis articles have already been published (Kepinski-Lecomte *et al.* 1996 ; Kepinski-Lecomte and Ergeç 1997 ; 1998 ; 1999 ; 2000 ; Kepinski-Lecomte and Ahlan 2001 ; Kepinski 2005 ; Kepinski *et al.* 2006 ; Kepinski 2007b ; 2007a ; Kepinski *et al.* 2007).

¹⁰ The exploitation of wool could be confirmed by the discovery of object, considered as having been used for weaving, from a room of level IIC (*ca.* 2500-2300 B.C.) (Kepinski 2005 : 149).

	LCh/LCh-EBA		EBA		EBA/MBA		MBA		TOTAL	
	NR	%	NR	%	NR	%	NR	%	NR	%
<i>Canis cf. familiaris</i>	1	0,74	49	2,43	1	0,32	21	1,29	72	1,76
<i>Equus</i> spp. including <i>Equus caballus</i> including <i>Equus asinus</i>			10	0,50	13	4,21	40	2,46	63	1,54
					2	0,65	4	0,25	4	0,10
							6	0,37	8	0,20
<i>Sus domesticus</i>	7	5,19	81	4,01	18	5,83	94	5,79	200	4,90
<i>Camelus</i> spp.			2	0,10					2	0,05
<i>Bos taurus</i>	13	9,63	183	9,07	43	13,92	188	11,58	427	10,45
Caprinae	42	31,11	578	28,64	87	28,16	332	20,44	1039	25,43
including <i>Capra hircus</i>	1	0,74	35	1,73	7	2,27	24	1,48	67	1,64
including <i>Ovis aries</i>	3	2,22	76	3,77	10	3,24	47	2,89	136	3,33
Total domestic mammals	63	46,67	903	44,75	162	52,43	675	41,56	1803	44,14
<i>Lepus europaeus</i>			3	0,15			4	0,25	7	0,17
<i>Acomys</i> spp. ?			1	0,05					1	0,02
<i>Vulpes vulpes</i>			2	0,10			1	0,06	3	0,07
Felidae			1	0,05					1	0,02
<i>Equus hemionus onager</i>			1	0,05			1	0,06	2	0,05
<i>Sus scrofa</i>			3	0,15					3	0,07
<i>Capreolus capreolus</i>	1	0,74	9	0,45			2	0,12	12	0,29
Large Cervidae *			8	0,40			7	0,43	15	0,37
including <i>Cervus elaphus</i>			2	0,10			2	0,12	4	0,10
including <i>Dama cf. mesopotamica</i>							3	0,18	3	0,07
<i>Gazella</i> spp.	1	0,74	1	0,05			3	0,18	5	0,12
<i>Capra aegagrus</i>			1	0,05			1	0,06	2	0,05
<i>Ovis orientalis</i>	1	0,74	1	0,05					2	0,05
Total wild mammals	3	2,22	31	1,54			19	1,17	53	1,30
Avifauna			2	0,10			4	0,25	6	0,15
including Phasianidae							2	0,12	2	0,05
including <i>Larus</i> sp.							1	0,06	1	0,02
including Anserini							1	0,06	1	0,02
<i>Testudo</i> sp.							1	0,06	1	0,02
<i>Bufo viridis</i> **							1	0,06	1	0,02
<i>Clarias</i> sp.							1	0,06	1	0,02
<i>Potamon potamios</i>			1	0,05					1	0,02
Malacofauna	2	1,48	10	0,50	4	1,29	13	0,80	29	0,71
Total other taxa	2	1,48	13	0,64	4	1,29	20	1,23	39	0,95
Total identifiable	68	50,37	947	46,93	166	53,72	714	43,97	1895	46,39
Undeterminate	55	40,74	940	46,58	94	30,42	757	46,61	1846	45,19
Large mammals	6	4,44	62	3,07	20	6,47	61	3,76	149	3,65
Medium-size mammals	6	4,44	69	3,42	29	9,39	92	5,67	196	4,80
Total unidentifiable	67	49,63	1071	53,07	143	46,28	910	56,03	2190	53,61
TOTAL	135	100	2018	100	309	100	1624	100	4085	100
Antlers										
Cervidae	1		2				5		8	
<i>Dama cf. mesopotamica</i>			3						3	

* excluding antlers

** complete skeleton = 55 rests

Table 1 : The taxonomic and chronological distribution of animal remains from Chalcolithic and Bronze Age. Tilbeşar (LCh = Late Chalcolithic, EBA = Early Bronze Age, MBA = Middle Bronze Age) in Number of Remains (NR) and percent.

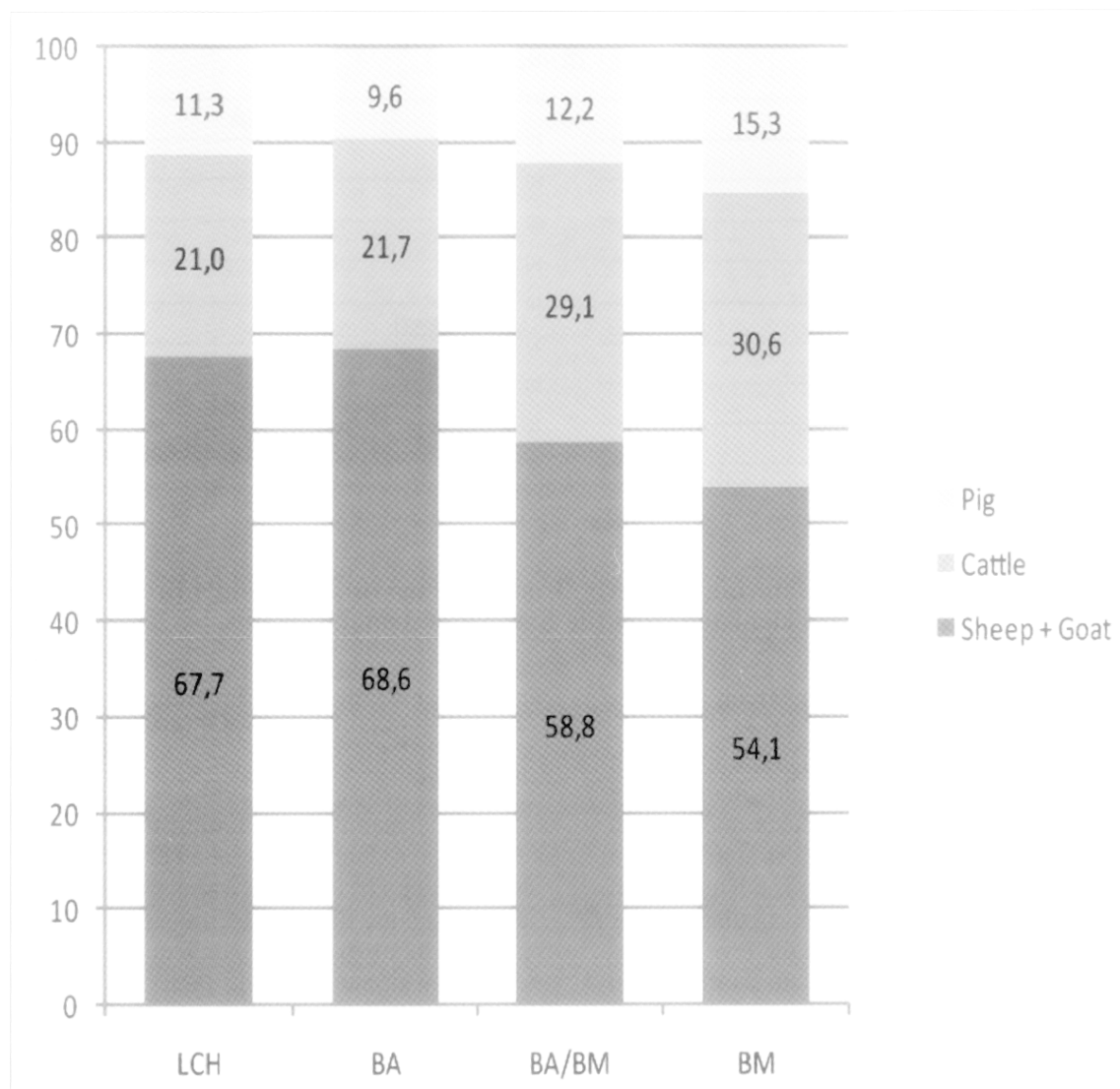


Fig. 5 : Percentages of the numbers of fragments of pigs, cattle, sheep and goats.

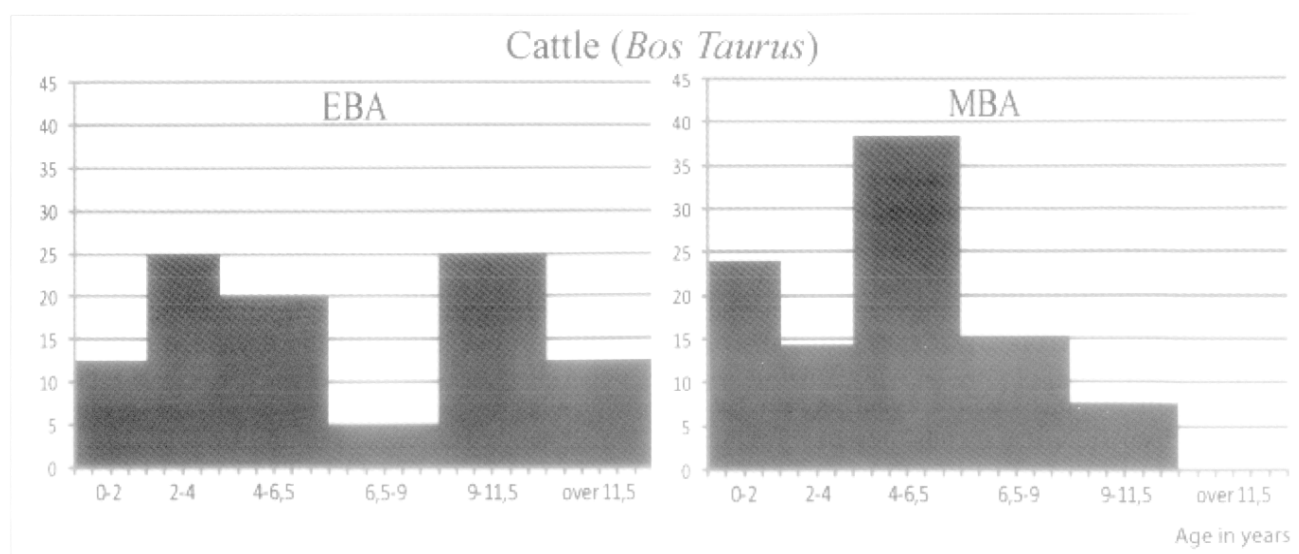


Fig. 6 : Kill-off pattern for cattle during the Early Bronze Age (n=9) and Middle Bronze Age (n=12) periods. Calculated from the number of dental remains.

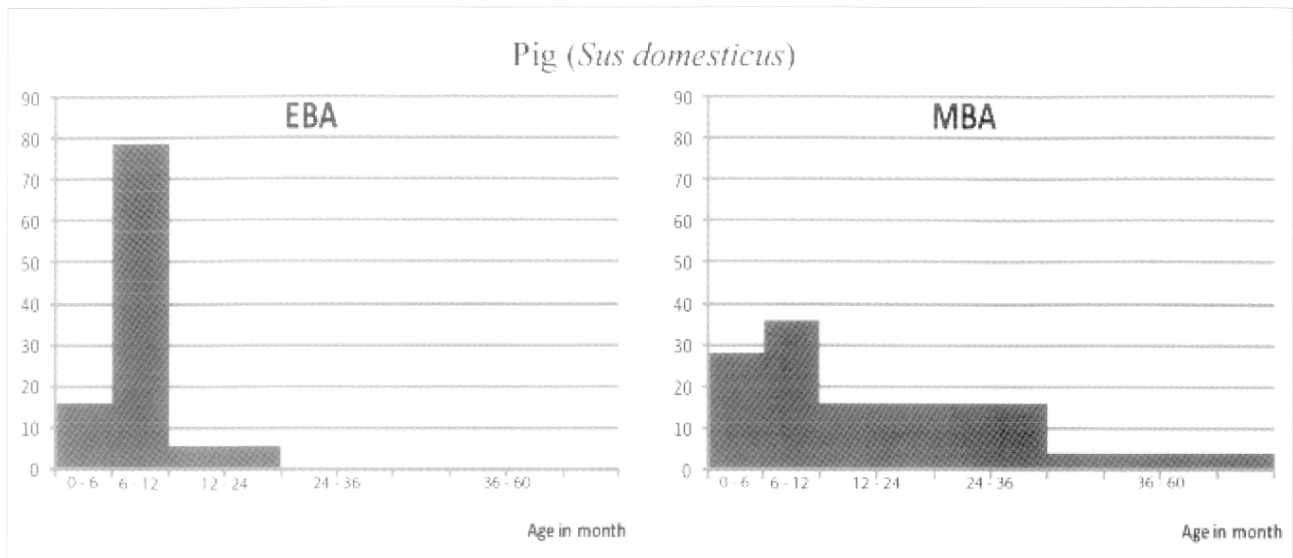


Fig. 7 : Kill-off pattern for pigs during the Early Bronze Age (n=10) and Middle Bronze Age (n=18) periods. Calculated from the Number of dental Remains.

We compared the size of sheep, which is affected by human and environmental factors, with data from other sites of South-East Anatolia and North Mesopotamia (Vila 2002). Due to our small sample we deal more with individual measurements than with the mean of a population but it appears that the EBA remains fit in size and in robustness with other South-East Anatolian sites, particularly Lidar Höyük. The only astragalus from LCh level is closer to the measurements of EBA sites rather than those from Uruk sites.

To sum up, in the EBA period animal products for alimentation came mostly from sheep or goat. Cattle has also an important role even if a part of the herd was kept as draught animals¹¹. In the MBA period, the importance of sheep and goat reduce slightly while cattle should have become of first importance for food production. The kill-off pattern indicates that most of the herd was used to produce meat and milk and even if sheep and goat remains are twice more numerous, cattle produce four or five times more than a sheep or a goat per individual. Pigs stay in third position in both EBA and MBA periods but increase noticeably in the MBA. Its exclusive meat-producer status maybe allowed a focus on secondary products from sheep, goat and cattle. The proportional representation of food-providers mammals is so similar between the LCh and EBA periods that it could be a clue for the

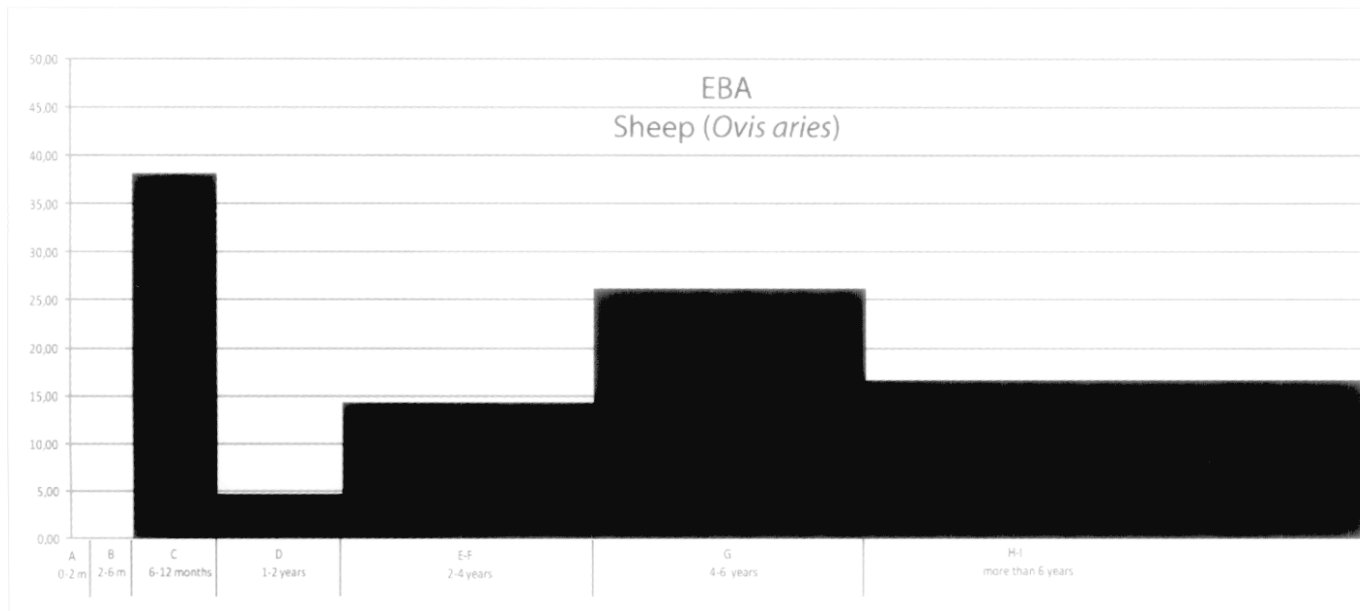
attribution of the Late Chalcolithic contexts to the very beginning of EBA (Kepinski 2005: 147-148).

b. Hunting

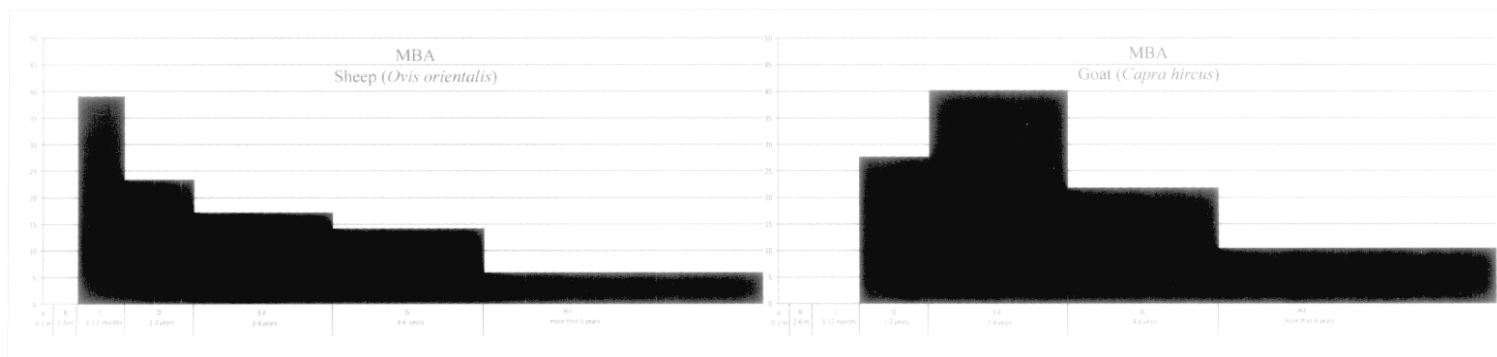
Game mammals (meaning the wild mammals except the rodent) represent a very small part of the assemblage. It is noteworthy that none of them come from the EBA/MBA transition. As those taxa are commonly rarer in Ancient Near East urban sites than domestic ones, their absence could be due to the very small size of the sample from these level. It is known that the probability for a rare species to appear in a small sample is low. However, the relation between the number of species and the size of the sample can be better seen when looking at the distribution of two variables, LOG (Number of species) and LOG (Number of Identifiable Specimens) (Grayson 1984: 137-140). The EBA, MBA and even the smallest LCh assemblages are on or above the linear regression line but the EBA/MBA Transition sample is far under it (Fig. 10). That means it is not only the fact of the size but maybe an intrinsic nature of this assemblage.

In EBA and MBA samples, the game mammals sample is outclassed by the deer (Fig. 11). Then come the hare and the other species. The absence of wild boar in MBA contexts is surprising but the small number of remains inhibit from any environ-

¹¹) In this matter pathologies are not very helpful as only one proximal phalanx in EBA and one proximal phalanx in MBA show pathologies linked with draught activities such as lipping.



**Fig. 8 : Kill of pattern for sheep during the Early Bronze Age (n=9).
Calculated from the Minimal Number of Individuals from the lower dental remains.**



**Fig. 9 Kill of pattern for sheep (n=11) and goats (n=7) during the Middle Bronze Age.
Calculated from the Minimal Number of Individuals from the lower dental remains.**

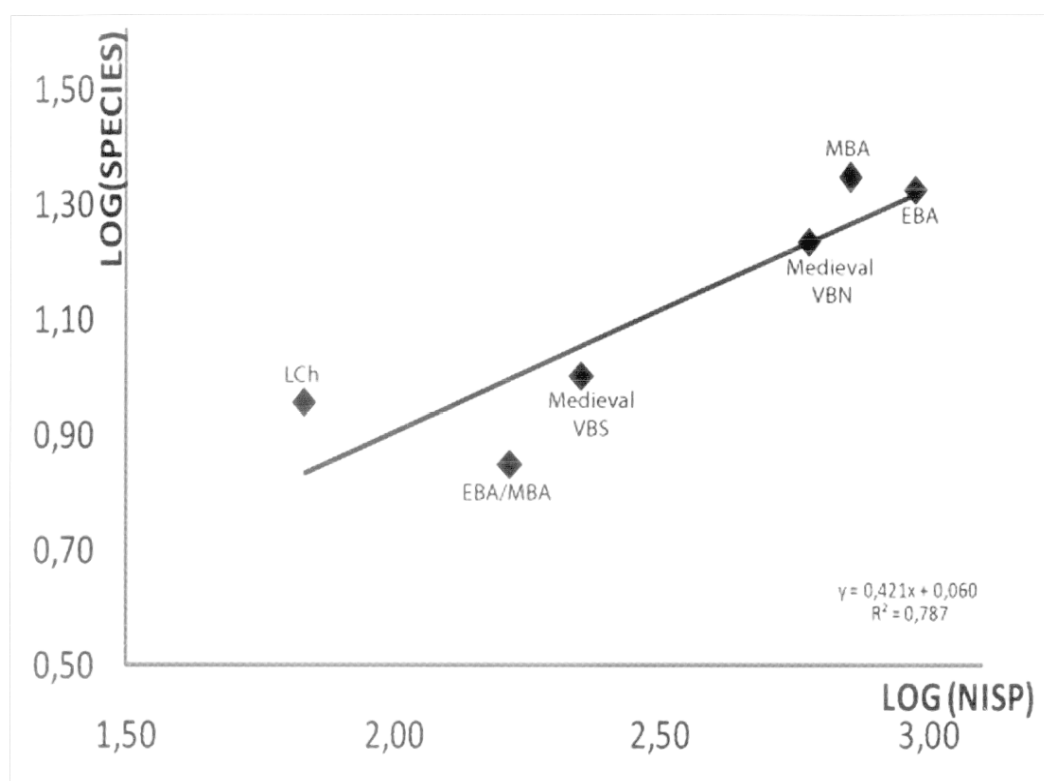


Fig. 10 : Relationship between sample size and taxonomic richness.

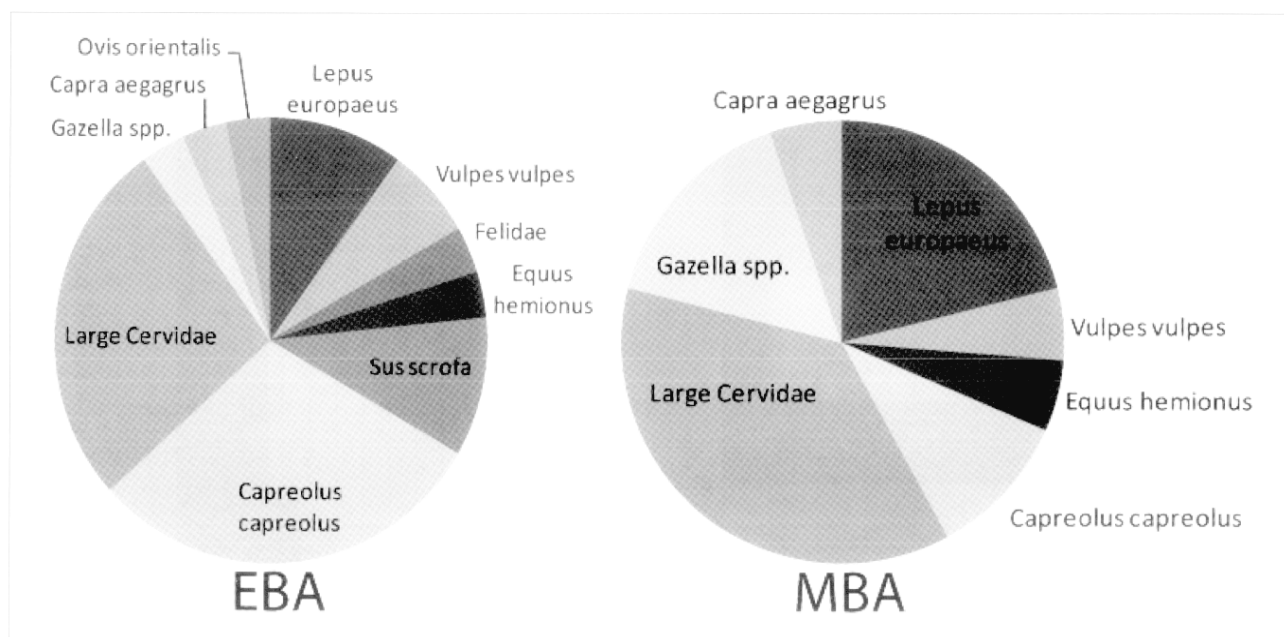


Fig. 11 : Relative distribution of wild mammals in the Early Bronze Age and Middle Bronze Age periods.

mental interpretation. The diversity of species recalls the environmental mosaic described above. The importance of deer could stress an exploitation of the riverine forest or the hilly woodland but those species are less linked with this environment than it is usually thought. The aim of this hunting (meat, antlers, fur, leisure, cultural, social) is still to be investigated. The birds could have been included within the hunted animals but we are waiting for further analysis in order to attest an accurate determination and eventually deduce seasonal implications.

c. Other species

Dogs are quite numerous, especially in the EBA period, and their presence is also visible in the gnawing marks, meaning they were in liberty in the site and interfering with the bones deposits. The dogs were not consumed as we didn't remark any cut marks on the bones. It is not obvious that the equids were commonly consumed even if we saw cut marks on a horse metapodial and a donkey scapula and tibia, all from the MBA period. The presence of camel bones in the EBA sample is extremely surprising as it is far earlier than the first mention in Anatolia. Two proximal phalanx come from contexts assigned to the EBA. One of them, from locus 740, is unfused and thus cannot be determinate to a species level. The second proximal phalanx, from locus 582, is in the overlap of dromedaries and Bactrian camels data. In Lidar Höyük (Kussinger 1988) and Hadidi (Clason and Buitenhuis 1978) the earliest camel remains are dated from the Late Bronze Age. The attribution of some contexts is still subject to change after the completion of several studies in progress. Consequently we highly recommend to our colleagues to quote with precaution Tilbeşar's camels before a definitive publication of the contexts¹². The green toad is accustomed to a dry environment and is a common inhabitant of cultivated steppes (Gasc *et al.* 1997: 122-123). This complete skeleton was in a narrow-necked vase from a MBA tomb but we cannot provide any explanation for its presence there. Finally, the catfish and river crab remains show an exploitation of the near Sajur. Nonetheless those aquatic remains are very scarce and we can wonder about the effect of the no-sieving in the recovery of fish and crustacean remains.

d. Social and Cultural markers

We consider worked bones as markers of social and cultural practices. Bone tools are rare in our assemblage. Two awls or pointed tools come from EBA contexts and one is dated from the LCh period. All are made from medium size mammals, likely sheep or goat, metapodials. In the EBA level we found a polished tool made from an equid II or IV metapodial.

A fallow deer cut and polished astragalus comes from a MBA tomb. As comparanda two worked fallow deer astragalii were found in a MBA infant tomb at Ebla (Minniti and Peyronel 2005). A sheep and a goat astragalii were found in another tomb of the same period, they are not worked but their deposit is enlightening a cultural practice.

The most impressive worked bones from our assemblage are three incised scapulas (Fig. 12, 13, 14). One from a sheep comes from the EBA period, a goat one is dated from the MBA and a pig one from the EBA/MBA transition. Incised scapulas become frequent in the Ancient East Mediterranean and Near East (for a first inventory see Reese 2002). The use of such bones is still subject to discussion. The different kinds of incisions in our three examples don't support the musical scrapper theory (for an Anatolian example of this theory see Driesch von den and Boessneck 1981). The recent interpretation of incised scapula as possible weaving tool (Zukerman *et al.* 2007) is interesting considering the possible exploitation of sheep wool in Tilbeşar as described above. However a specific research will be undertaken on those objects¹³.

The gull ulna presents fine incisions all around its distal part. It could be the sign that the feather was taken away¹⁴ (Fig. 15).

Antlers were also a common raw material. Eleven fragments, of which five from the EBA and five from the MBA, were recovered. We didn't see any evidence for roe deer antler but it was not always possible to distinguish between the red deer and fallow deer antler fragments. A complete antler (Fig. 16) and two other fragments from the EBA period were assigned to the fallow deer. This complete antler and three other remains of all levels are shed antlers, meaning that they were collected for themselves and are not a product from hunting. Five of the eleven antlers fragments present manu-

12) If the stratigraphic attribution to EBA levels is confirmed, we will carry out a ¹⁴C datation of these phalanx.

13) We are indebted to François Poplin who attracted our attention to these bones. He enlightens the discussion with his great knowledge.

14) As suggested to us by A. Bournery (UMR 5197 CNRS/MNH).

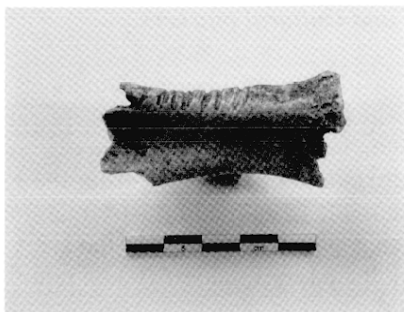


Fig. 12 : Incised caprine scapula.



Fig. 13 : Incised pig scapula.



Fig. 14 : Incised caprine scapula.

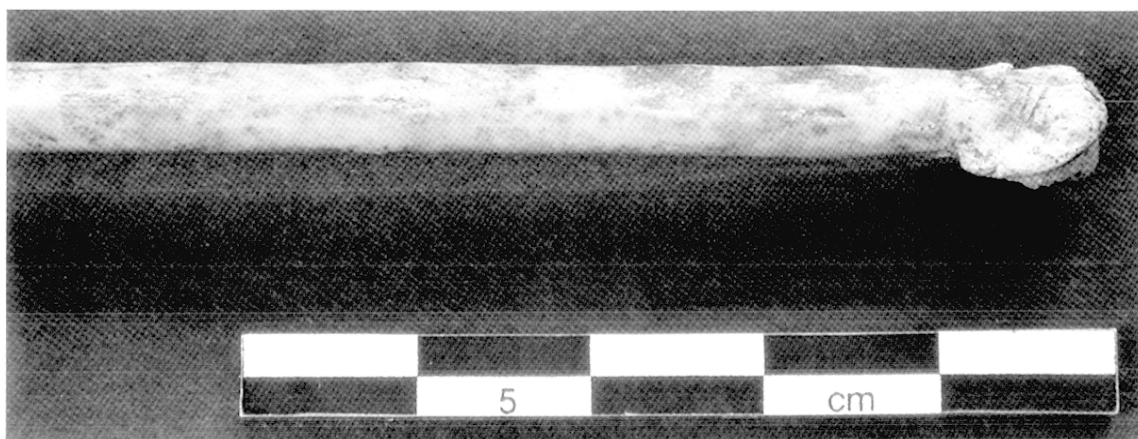


Fig. 15 : Distal part of gull ulna presenting incisions.



Fig. 16 : Complete fallow deer antler *in situ* in locus 2043.

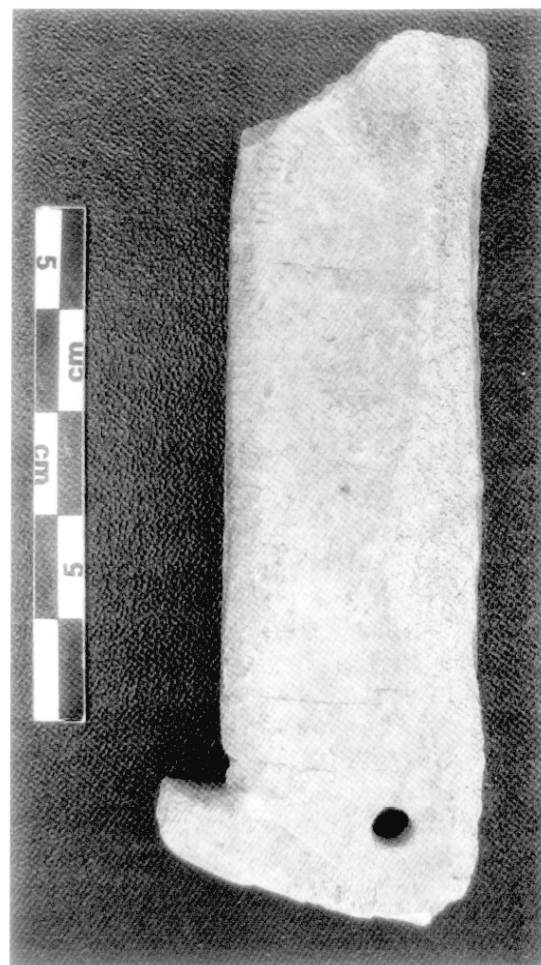


Fig. 17 : Worked piece of antler.

facturing traces more or less close to the finished object (Fig. 17). This comforts us in the idea to see antler as raw material and to not include it in the NR and NISP counts.

III. THE PRE-MEDIEVAL EQUID

An almost complete equid skeletal was excavated in square D (Kepinski *et al.* 2006: 253). The animal was in a large circular pit, overlaying the body of a man, so-called horseman, laid on his side. A bronze arrow head was also in this pit. This burial, locus 1754, is dated from the long abandonment of the site period between the mid-second millennium B.C. and the eleventh century A.D.¹⁵. As it can be seen on the excavation picture (Fig. 18),

all the bones of each member stayed in connection but the animal was clearly dismembered. The parts were layed down in four groups. The group constituted by the skull and the cervical vertebrae lays parallel to the second part of the backbones from the pelvis to the thoracic vertebrae. The two forelimbs were disposed together but close to the pelvis whereas the hind limbs are next to the thoracic vertebrae. The two scapulas were not recovered. Scapulas are known to have a symbolic value in some communities¹⁶. This equid was therefore disposed following an anthropic choice after having separated the limb from the trunk and removed the scapulas. This equid is obviously a male horse. We notice a pathology which consists in the absence of the left mandibular canine. The average height at

¹⁵ A more accurate date is waited from the ¹⁴C analysis.

¹⁶ See a modern example on caprine from North-Africa (Chaix and Sidi Maamar 1992: 9) or the numerous inscribed Arabic cattle scapulas.

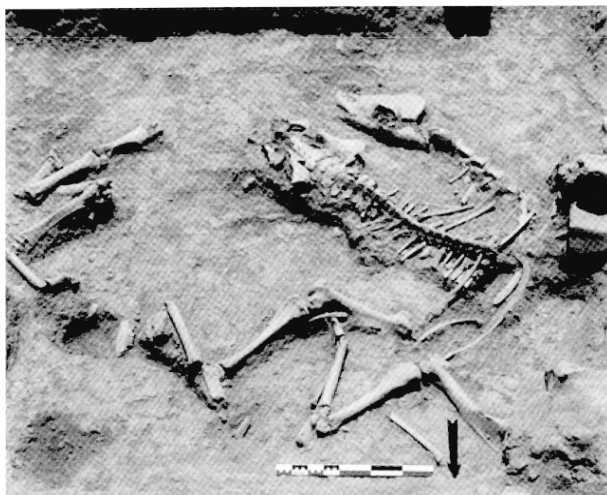


Fig. 18 : The pre-medieval equid (locus 1754) *in situ*.

withers¹⁷ of this horse is 159 cm which is relatively large. This is, for example, larger than the horses from EBA Selenkahiye (Ijzereef 2001: Tab. 15.2) but in the range of an Arab mare (Clutton-Brock and Burleigh 1979: Tab. 1). To compare, a modern male horse skeleton found close to the site and determinate as an Arab horse¹⁸ has an average height at withers of 152 cm. Finally we can mention that the two tibia of the horse from the burial are longer than expected as they give a height at withers of 175 cm.

IV. THE MEDIEVAL LEVELS

A. Archaeological contexts¹⁹

The medieval city, Tell Bašir or Turbessel, is cited since 1095 A.D. by the crusades' historians and said inhabited by Christian communities. The city is taken by Baudoin in 1097 A.D. and stay under Frankish domination until 1151 A.D. Tilbeşar is then ruled by Nur al-Din of the Zengid dynasty and since 1176 transferred to Ayyubid governors. The city was probably destroyed in 1265 by the Mameluk sultan Baybars²⁰.

Except some layers in square D which could date from the XIth century A.D., most of the

medieval remains come from XII-XIIIth centuries A.D. contexts.

Our sample was recovered from domestic areas in the north lower town (squares C, D and G) and in the south lower town (squares H and L).

B. The faunal remains

Among the 1617 remains registered, 835 were identifiable, which means 52% (Table 2). Although we don't have the weight for the whole assemblage, in the sample from the 2005 and 2006 seasons identifiable bones represent only 30,7% of the Number of Remains but 64,5% of the sample's weight.

a. Stock breeding

Domestic mammals represent 95% of the identifiable remains (NISP) and the mains food providers, cattle, sheep and goat, pig count for 88% in NISP.

For cattle, dental remains are too scarce to give an accurate idea of the kill-off pattern but we can notice that four remains are younger than two years. The data from the epiphysial fusions indicate that if there is indeed some individuals killed before two years old, a important part of the herd was slaughtered after three years but probably before four years old (Fig. 19).

We don't have enough dental remains of pig. According to the few epiphysial fusions, only one individual was older than one year.

Sheep and goat will be considered together. Considering the dental age, 60% of the individuals were killed between six months and 2 years. This is confirmed by the epiphysial age as more than 90% of the bones which fuse between three and three and an half years old were unfused or fusing (Fig. 20). To sum up, sheep and goat represent over 70% of the main food-providers (Fig. 21). Slaughter age suggests a focus on meat production but it is difficult to estimate exactly what was the part of the milk in this herding strategy. Cattle also seem to be raised mainly for meat. As cattle remains are four times less numerous than those of sheep and goat it

17) Calculated by the average of the height obtained from the different bones using the Kiesewalter factor cited by G. Ijzereef (2001: Tab. 15.2).

18) We thank Véra Eisenmann who provided numerous reference measurements and proceeded the determination of this equid.

19) More complete informations about Tilbeşar's medieval history and excavated medieval layers have been already published (Kepinski-Lecomte, *et al.* 1996; Kepinski-Lecomte and Ergeç 1997; Rousset and Ergeç 1997; Kepinski-Lecomte and Ergeç 1998; Rousset-Issa and Ergeç 1998; Kepinski-Lecomte and Ergeç 1999; Rousset-Issa and Ergeç 1999; Kepinski *et al.* 2006).

20) Other historical sources can be founded in Houtsma, M. H. – 1902, *Histoire des Seldjoucides d'Asie Mineure, d'après l'Abrégé du Seldjouknameh d'Ibn-Bibi, Textes Persans, publié d'après le Ms. de Paris*, Leiden: Brill (cited in Mashkour M. J. 1971: 44, 74).

	Medieval	
	NR	%
<i>Canis cf. familiaris</i>	13	0,80
<i>Equus</i> spp.	36	2,23
including <i>Equus caballus</i>	6	0,37
including <i>Equus asinus</i>	2	0,12
<i>Sus domesticus</i>	73	4,51
<i>Camelus</i> spp.	10	0,62
<i>Bos taurus</i>	124	7,67
Caprinae	539	33,33
including <i>Capra hircus</i>	33	2,04
including <i>Ovis aries</i>	45	2,78
Total domestic mammals	795	49,17
<i>Capreolus capreolus</i>	1	0,06
<i>Cervus elaphus</i>	3	0,19
<i>Dama cf. mesopotamica</i>	2	0,12
<i>Gazella</i> spp.	2	0,12
<i>Bos primigenius</i>	2	0,12
<i>Capra aegagrus</i>	3	0,19
Total wild mammals	13	0,80
Avifauna	15	0,93
including Phasianidae	5	0,31
including <i>Gallus gallus</i>	1	0,06
Emydidae	1	0,06
Ichthyofauna	6	0,37
Malacofauna	5	0,31
Total other taxa	27	1,67
Total identifiable	835	51,64
Undeterminate	582	35,99
Large mammals	119	7,36
Medium-size mammals	81	5,01
Total unidentifiable	782	48,36
TOTAL	1617	100

Table 2. : The taxonomic distribution of animal remains from Medieval Tilbeşar in Number of Remains (NR) and percent.

is possible to estimate that the part of cattle meat in the alimentation was equivalent to one of sheep and goat. Pigs count for a small but noteworthy part of the main food-providers. They seemed to have been selected for a tender meat. We don't know if the pig remains come from Frankish, Islamic or both layers. The part of Christians in the population is not either estimated. However, the presence of pigs is not so surprising when looking at other near sites. In Ta'as, a VIIth to XIth centuries A.D. city in North-West Syria, pig represents 3% of the sum of cattle, sheep, goat and pig number of rests. The

consumption of pig is imparted to Christians (Clason 1995). At Gritille, a site North-West of Tilbeşar in the Euphrates bank, the medieval chronology is very similar to that of Tilbeşar. It is assumed that most of the inhabitants remained Christian from the XIth to the XIIIth centuries A.D. All subphases counted in, the pig represent 48% of the sum of cattle, sheep, goat and pig number of rests (Stein 1988: 236-239). Even in the small assemblage from the XIIth and XIIIth centuries A.D. at Horum Höyük, pigs count for 13% of the cattle, sheep, goat and pig's sum (Bartosiewicz 2005: Tab. 1).

b. Hunting

Wild mammals count for a tiny part of the NISP but attest to the hunting activity. Half of the remains belongs to the deer (Fig. 22), almost a quarter to the rocky wild goat and the others to the steppe inhabitant gazelle and to the more ubiquitous aurochs. Even in small number, those wild mammals make clear that all the different landscapes around Tilbeşar were exploited. Considering the domination of domestic mammals in the assemblage, it is difficult to assume that meat was the main reason for hunting in the medieval period. Due to the presence of an upper class in Tilbeşar, it is more likely that those hunting could have been associated to leisure or prestige activities.

c. Other species

Dogs are not numerous in the medieval assemblage but their presence is also attested by gnawing marks. None of the bones wear cut marks.

In the same way there is no clue for consumption of horse, donkey and camel. Concerning camel only one remain could be determined to a species level and was assigned to a Bactrian camel or an hybrid. If it is an hybrid, this would indicate that at least a part of the camels were specifically used as pack animal.

We assigned one bird remain to domestic fowl. The status of the other bird bones is still to be investigated.

The exploitation of aquatic species is lower than expressed by the count given in the Table 2 as the six fish remains seem to belong to the same individual.

d. Social and cultural markers

A caprine metatarsal presents several sawing and work marks but we cannot presume which kind of objet was expected from this bone.

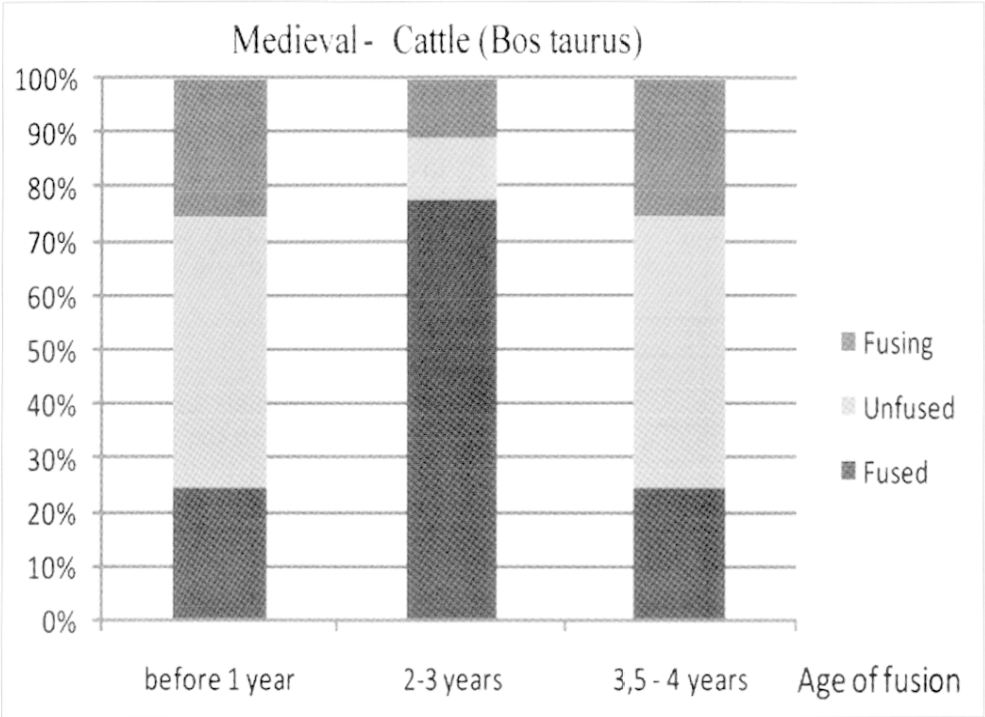


Fig. 19 : Slaughter age for cattle during the Medieval period from epiphyseal fusions in Number of Remains (n=17).

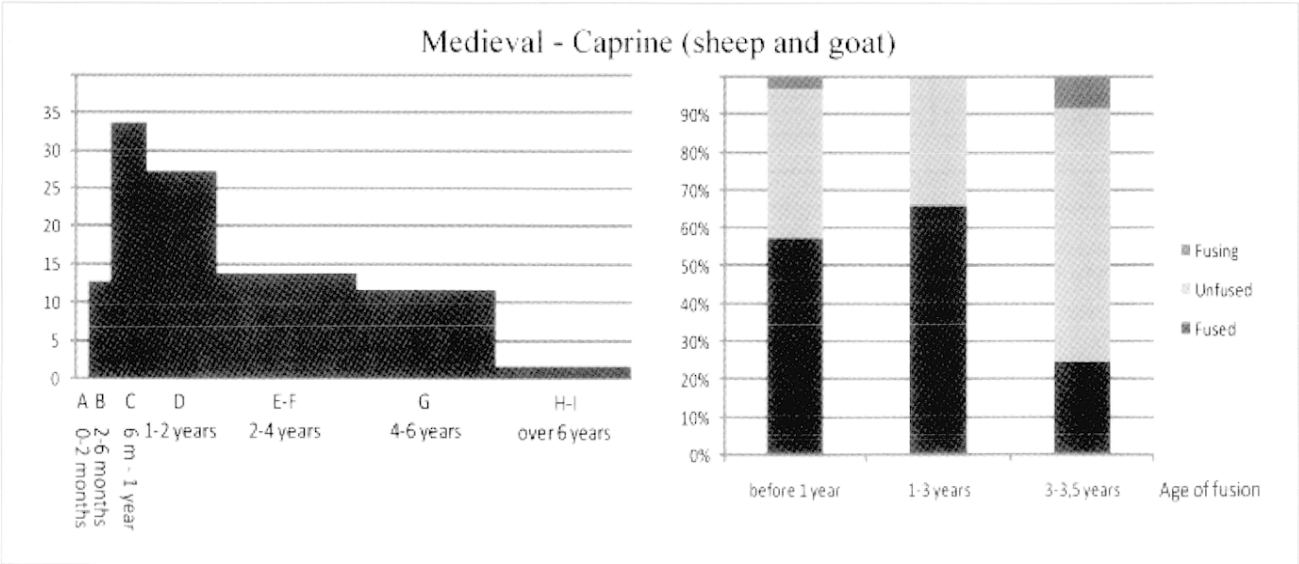


Fig. 20 : Kill of pattern for caprine during the Medieval period. Calculated from the dental remains in Number of Remains (n=25) and the epiphyseal fusions (n=95).

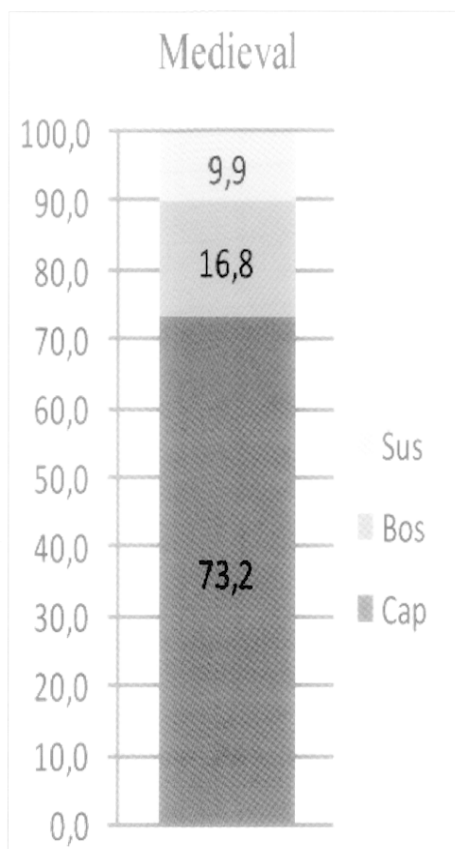


Fig. 21 : Percentages of the numbers of fragments of pigs, cattle, sheep and goats for the Medieval period.

All the other bones showing work marks are caprine astragalus, one holed and another one with a polished face. Eight astragali were found in the same pit, it reminds the knucklebones game but we have to keep in mind that astragalus has specific symbolic values (discussion on astragali uses can be found in Holmgren 2004).

The species distribution can also be used as a social marker. Due to the differences in architectural features and the presence of distinct city walls, M.-O. Rousset suggests that the south (VBS²¹) and north (VBN) lower towns could have been inhabited by different communities.

Indeed, noteworthy dissimilarities appear between the VBN and VBS assemblages (Fig. 23). As the stratigraphical assignation is still undergoing, we have to suppose that all those remains come from a same cultural period. The first difference is that the VBS sample is composed only of domestic

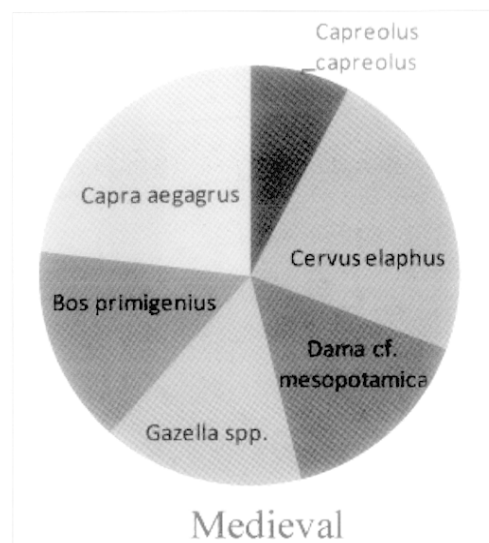


Fig. 22 : Relative distribution of wild mammals in the Medieval period.

mammals with the exception of birds and one fallow deer remain. The absence of game mammals could be an effect of the smaller sample but, when considering the relation between the number of species and the NISP, the VBS sample is slightly below the expected number of species for a sample of this size. Even if we don't know how to interpret this, all the camel remains come from the VBS sample. For the main food providers, the proportion of pigs is almost the same in the two samples. It would suggest that the difference between the two communities is not due to a religious taboo. Contrary to pig, cattle are three times more numerous in the VBN than in the VBS. We have already remarked that cattle are young in the medieval sample. We can wonder if it was not a pricey tender meat. Caprine are a little bit more important in the VBS than in the VBN but the real interest would be to know if the caprine eaten in the VBN were not younger than those consumed in the VBS. Unfortunately, our row of data is too small to expect reliable interpretations from a parting.

CONCLUSION

Animal exploitation at pre-medieval Tilbeşar is focused on the three main food-producers : caprine, cattle and pig. The relative proportion of those taxa is close to Hayaz Höyük for the EBA period and to Lidar Höyük in the MBA. The percentage of wild

21) Ville Basse Sud and Ville Basse Nord.

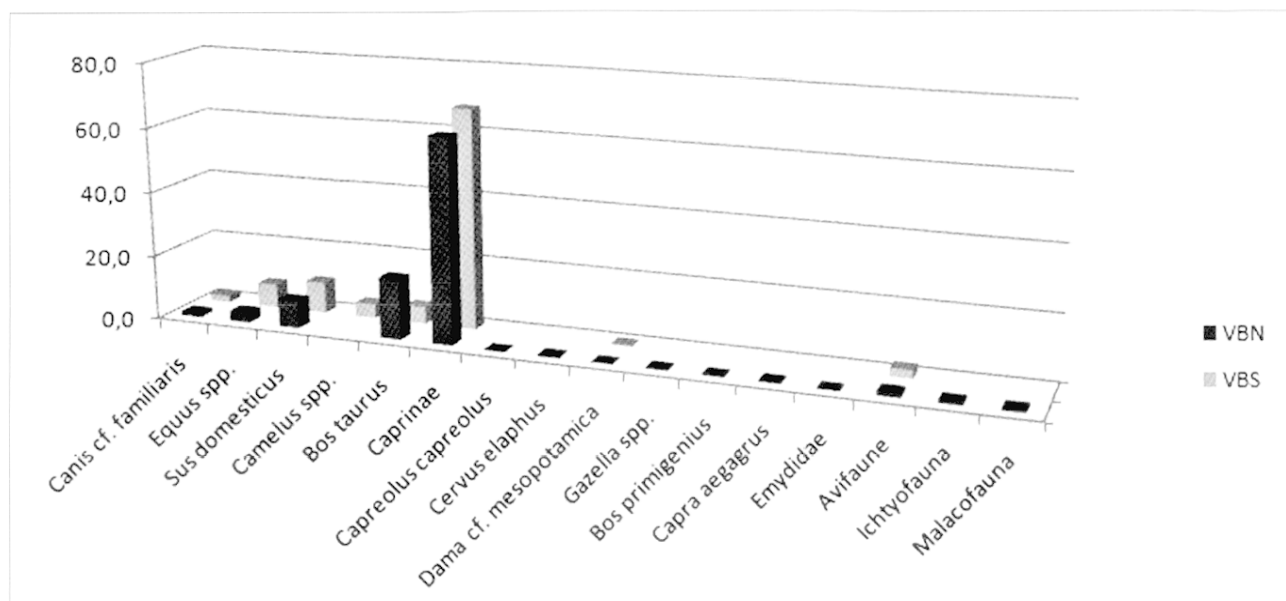


Fig. 23 : Relative Representation in NISP of species and taxonomic groups during the Medieval period in the “Ville Basse Nord” and “Ville Basse Sud”.

mammals is, at all periods, among the smallest of South-East Anatolia and Northern Mesopotamia. However, the number of species of wild mammals in the highest, with Hassek Höyük, for the EBA period but slightly lower than the ones at Lidar Höyük and Horum Höyük for the MBA (Clason and Buitenhuis 1997; 2000).

For the medieval period an inventory of the faunal remains from Near East sites is not yet available. Even so, Tilbeşar faunal assemblage seems to

be closer to the neighboring site of Horum Höyük than to Gritille.

Little can be said about the environment around Tilbeşar. Nonetheless, it is noteworthy that the three species of deer, gazelle and wild goat have been encountered in both protohistoric and medieval assemblages in roughly the same proportions, which means that no drastic landscape deterioration occurred before the medieval times.

R.B. and M.M.

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Lepus europaeus

		min	\bar{x}	max	σ	n
Metatarsus III						
GL	MBA		52,3			1
Bd	MBA		5,6			1

		min	\bar{x}	max	σ	n
Metatarsus V						
GL	MBA		45,0			1
Bd	MBA		5,1			1

Canis cf. familiaris

		min	\bar{x}	max	σ	n
Ulna						
DPA	EBA		24,6			1
SDO	EBA		21,5			1
BPC	EBA		14,0			1

		min	\bar{x}	max	σ	n
Metacarpus IV						
GL	Medieval		72,8			1
Bp	Medieval		7,4			1
Bd	Medieval		7,8			1
SD	Medieval		6,1			1
Dp	Medieval		12,4			1

		min	\bar{x}	max	σ	n
Femur						
Bd	MBA		29,0			1

		min	\bar{x}	max	σ	n
Tibia						
Bd	EBA		25,6			1
Dd	EBA		17,7			1

		min	\bar{x}	max	σ	n
Calcaneum						
GL	EBA		47,1			1
GB	EBA		14,0			1

		min	\bar{x}	max	σ	n
Phalanx 1						
GL	EBA	28,1	28,2	28,3	0,14	2
	MBA		22,0			1
Bp	EBA	9,0	9,3	10	0,35	2
	MBA		8,5			1
Dp	EBA	8,5	8,8	7,5	0,21	2
	MBA		8,0			1
SD	EBA	5,0	5,6	6	0,42	2
	MBA		5,0			1
Bd	EBA	7,3	7,4	7,5	0,14	2
	MBA		7,5			1
Dd	EBA	5,7	5,6	5,4	0,21	2
	MBA		6,0			1

Vulpes vulpes

		min	\bar{x}	max	σ	n
Femur						
Bp	EBA		23,3			1
DC	EBA		11,3			1

		min	\bar{x}	max	σ	n
Phalanx 1						
GL	MBA		21,0			1
Bp	MBA		5,6			1
SD	MBA		3,4			1
Bd	MBA		4,3			1

Equus hemionus

		min	\bar{x}	max	σ	n
Metatarsal						
11	MBA		36,7			1
12	MBA		30,0			1
13	MBA		23,5			1
14	MBA		26,4			1

Equus asinus

		min	\bar{x}	max	σ	n
Metapodial						
11	MBA		34,3			1
12	MBA		24,8			1
13	MBA		19,4			1
14	MBA		21,0			1

Equus asinus

		min	\bar{x}	max	σ	n
Metacarpal						
1	MBA		179,5			1
3	MBA		25,2			1
	Medieval		23,0			1
4	MBA		19,2			1
5	MBA		38,6			1
6	MBA		22,7			1
7	MBA		30,0			1
8	MBA		10,0			1
10	Medieval		30,8			1
11	Medieval		30,9			1
12	Medieval		24,5			1
13	Medieval		19,6			1
14	MBA		23,4			1
	Medieval		21,7			1
15	Medieval		19,0			1
16	Medieval		19,5			1

Equus asinus

		min	\bar{x}	max	σ	n
Phalanx 1 anterior						
1	MBA		69,0			1
2	MBA		61,8			1
3	EBA/MBA		24,4			1
	MBA		23,0			1
4	EBA/MBA		39,1			1
	MBA		37,8			1
5	EBA/MBA		26,8			1
	MBA		27,5			1
6	MBA		33,2			1
7	EBA/MBA		46,0			1
	MBA		43,2			1
10	MBA		52,0			1
12	10,5		10,5			1
14	32		32,0			1

Equus asinus

		min	\bar{x}	max	σ	n
Radius						
8	MBA		45,0			1
11	MBA		9,5			1

Equus caballus

		min	\bar{x}	max	σ	n
Phalanx 1 anterior						
1	MBA		83,3			1
2	MBA		76,9			1
3	MBA		34,5			1
4	MBA		56,5			1
5	MBA		36,0			1
6	MBA		48,3			1
7	MBA		56,5			1
9	MBA		77,3			1
10	MBA		64,3			1
11	MBA		64,4			1
12	MBA		10,3			1
13	MBA		10,6			1
14	MBA		44,2			1

Equus caballus

		min	\bar{x}	max	σ	n
Metatarsal						
3	Medieval		30,0			1
4			30,0			1
5			45,7			1
6			37,0			1
7			42,0			1
8			10,9			1
9			3,9			1

Equus caballus

		min	\bar{x}	max	σ	n
Metapodial						
11	MBA		51,0			1
12	MBA		38,9			1
13	MBA		29,0			1
14	MBA		30,7			1

All measurements in mm. Abbreviations and measurement directions from von den Driesch 1976 except
All equid measurements from Eisenmann and Mashkour 2000

* Payne and Bull 1982

** Steiger 1990

*** Fernandez 2001 see also Boessneck and al. 1964. HMT=c HT=a

Sus domesticus

dp4 lower		min	\bar{x}	max	σ	n
*L	LCh		17.5			1
	EBA		15.6			1
	MBA	16	16.4	16.7	0.495	2
*WP	LCh		6.3			1
	EBA		7.6			1
	MBA	7.8	7.9	8	0.141	2

M2 lower		min	\bar{x}	max	σ	n
*L	LCh		16.8			1
	EBA		19.0			1
	EBA/MBA	18.2	18.5	18.7	0.4	2
	MBA	16.7	17.3	18.1	0.6	4
*WP	LCh		12.5			1
	EBA		13.2			1
	EBA/MBA	12.6	12.8	12.9	0.2	2
	MBA	12	12.4	13.2	0.5	4

Scapula		min	\bar{x}	max	σ	n
SLC	LCh		16.2			1
	MBA	19	21.0	23	2.83	2
GLP	LCh		24.6			1
	MBA		29.6			1
BG	MBA		21.0			1

Pelvis		min	\bar{x}	max	σ	n
LAR	MBA		27.0			1

Calcaneum		min	\bar{x}	max	σ	n
GL	EBA/MBA		59.0			1
	MBA		30.1			1
GB	EBA/MBA		19.0			1

M1 lower		min	\bar{x}	max	σ	n
*L	LCh		13.3			1
	EBA/MBA	13.8	13.9	13.9	0.1	2
	MBA	13.5	13.8	14	0.4	2
*WP	LCh		9.1			1
	EBA/MBA	10.1	10.5	10.9	0.6	2
	MBA	9.5	10.0	10.5	0.7	2

M3 lower		min	\bar{x}	max	σ	n
*L	EBA/MBA		34.1			1
	MBA	29.3	30.1	30.9	0.8	3
*WA	EBA/MBA		14.8			1
	MBA	12.9	13.8	14.4	0.6	4

Humerus		min	\bar{x}	max	σ	n
Bp	EBA		39.8			1
Dp	EBA		45.3			1
SD	EBA		17.4			1
Bd	EBA		39.0			1
	EBA/MBA		34.0			1
	MBA		29.0			1
	Medieval	31.0	32.0	33.0	1.27	2
BT	EBA/MBA	26.5	28.0	29.5	2.12	2
	MBA		26.5			1
	Medieval	26	27.0	27.9	1.3	2
Dd	EBA		44.7			1
	Medieval		30.5			1
*HTC	EBA/MBA		16.4			1

dp4 upper		min	\bar{x}	max	σ	n
*L	MBA		11.3			1
*WP	MBA		7.9			1

M1 upper		min	\bar{x}	max	σ	n
*L	MBA	12.6	13.1	13.5	0.6	2
*WP	MBA	12.3	13.0	13.6	0.9	2

M2 upper		min	\bar{x}	max	σ	n
*L			17.2			1
*WP			15.3			1

M3 upper		min	\bar{x}	max	σ	n
*L	Medieval		34.5			1
*WA	Medieval		15.6			1

Ulna		min	\bar{x}	max	σ	n
DPA	EBA	32.5	35.5	38.5	4.24	2
	MBA		29.0			1
BPC	EBA	21.7	21.9	22	0.21	2
	MBA		17.3			1

Femur		min	\bar{x}	max	σ	n
Bd	MBA		37.9			1
Dd	MBA		46.1			1

Tibia		min	\bar{x}	max	σ	n
SD	EBA		20.4			1
	MBA		18.9			1
Bd	EBA		28.1			1
	MBA		27.3			1
Dd	EBA		24.0			1
	MBA	22.4	22.7	23	0.45	2
*BdP	MBA		28.6			1

Camelus spp.

Phalanx 1		min	\bar{x}	max	σ	n
GL	EBA		105.8			1
Bp	EBA		45.6			1
Dp	EBA		35.9			1
Bd	EBA		39.0			1

Radius		min	\bar{x}	max	σ	n
Bd	Medieval		104.7			1
**BrFd	Medieval		32.9			1
**BuFd	Medieval		36.0			1

Capreolus caucasicus

Humerus		min	\bar{x}	max	σ	n
Bd	EBA		24.6			1
***HMT	EBA		18.1			1
Dd	EBA		22.8			1

Radius		min	\bar{x}	max	σ	n
Bd	EBA		28.4			1
SD	EBA		14.9			1
Bd	EBA		18.4			1

Cervus elaphus

Humerus		min	\bar{x}	max	σ	n
Bd	MBA		62.1			1
***HMT	MBA		32.2			1
Dd	MBA		61.1			1

Radius		min	\bar{x}	max	σ	n
Bp	EBA		69.3			1
SD	EBA		35.1			1
Dp	EBA		31.3			1

Metatarsus		min	\bar{x}	max	σ	n
Bp	Medieval		43.3			1
Dp	Medieval		39.4			1
SD	Medieval	22.7	22.8	22.9	0.14	2
Bd	Medieval		47.6			1
Dd	Medieval	23.5	25.5	27.4	2.76	2

Cervus elaphus

Phalanx 3		min	\bar{x}	max	σ	n
DLS	EBA		50.8			1
Ld	EBA		52.6			1
MBS	EBA		17.5			1

Dama cf. mesopotamica

Calcaneum		min	\bar{x}	max	σ	n
GL	Medieval		83.4			1
GB	Medieval		28.8			1

All measurements in mm. Abbreviations and measurement directions from von den Driesch 1976 except

All equid measurements from Esenmann and Mashkour 2000

* Payne and Bull 1982

** Steiger 1990

*** Fernandez 2001, see also Boessneck and al. 1964. HMT=c HT=a

Bos taurus

Humerus		min	\bar{x}	max	σ	n
Bd	MBA		62,9			1
	Medieval		68,2			1
Dd	MBA		63,7			1
	Medieval		78,6			1

Radius		min	\bar{x}	max	σ	n
Bd	Medieval		63,0			1
Dd	Medieval		40,1			1

Metacarpus		min	\bar{x}	max	σ	n
Bd	Medieval		49,0			1
Dd	Medieval		26,3			1

Astragalus		min	\bar{x}	max	σ	n
GLI	LCh		60,0			1
	EBA		56,7			1
	Medieval	56	59,4	61,2	2,95	3
GLm	LCh		56,1			1
	EBA		50,7			1
	Medieval	52,9	55,7	57,6	2,48	3
DI	EBA		30,5			1
	Medieval	30,3	33,3	36,8	3,28	3
Dm	LCh		36,2			1
	EBA		31,3			1
	Medieval	31,4	33,4	35,9	2,29	3
Bd	LCh		37,6			1
	EBA		40,2			1
	Medieval	35,8	39,1	41,8	3,05	3

Phalanx 1		min	\bar{x}	max	σ	n
GL	LCh		50,0			1
	EBA	47,4	50,5	54,9	3,49	4
	EBA/MBA	56,8	57,9	57,9	0,74	2
	MBA	58,8	60,9	63	2,97	2
	Medieval	51	52,7	54	1,55	3
Bp	LCh		39,2			1
	EBA	24,3	25,1	26,5	0,95	4
	EBA/MBA		30,8			1
	MBA	28,5	29,9	31,2	1,91	2
	Medieval	24,9	26,0	27	1,48	2
Dp	LCh		37,5			1
	EBA	23,8	27,7	30,2	3,38	3
	EBA/MBA		31,0			1
	MBA	31,4	31,9	32,4	0,71	2
	Medieval	26,6	27,6	29,3	1,49	3
SD	LCh		32,4			1
	EBA	21,4	22,4	23,5	0,87	5
	EBA/MBA	25,1	27,4	29,8	3,34	2
	MBA	22,8	24,7	26,6	2,69	2
	Medieval	20,4	21,6	23	1,32	3
Bd	EBA	23,3	24,0	25,2	0,84	4
	EBA/MBA	27,5	28,4	29,2	1,2	2
	MBA	25,9	26,6	27,3	0,99	2
	Medieval	23,5	24,0	24,3	0,46	3
Dd	EBA	16,5	18,4	19,6	1,41	4
	EBA/MBA	20,6	21,7	22,8	1,56	2
	MBA	21,7	21,9	22	0,21	2
	Medieval	18,6	19,1	19,7	0,55	3

Phalanx 2		min	\bar{x}	max	σ	n
GL	LCh		35,6			1
	EBA	40,0	42,3	47	4	3
	EBA/MBA	38,8	39,1	39,5	0,56	2
	MBA		41,0			1
	Medieval		42,4			1
Bp	LCh		26,2			1
	EBA	26,0	28,6	32,8	3,7	3
	EBA/MBA	24,1	25,3	26,6	1,82	2
	MBA		28,4			1
	Medieval		26,9			1
Dp	LCh		27,6			1
	EBA	28,3	30,8	34	2,9	3
	EBA/MBA	25,7	27,3	28,9	2,28	2
	MBA		29,3			1
	Medieval		31,8			1
SD	LCh		22,9			1
	EBA	21,5	23,6	27,7	3,5	3
	EBA/MBA	19,9	20,7	21,4	1,07	2
	MBA		23,7			1
	Medieval		21,8			1
Bd	LCh		22,5			1
	EBA	20,8	21,1	21,3	0,4	2
	EBA/MBA	20,8	22,1	23,3	1,8	2
	MBA		24,1			1
	Medieval		23,7			1
Dd	LCh		24,9			1
	EBA	25,0	27,0	30,6	3,1	3
	EBA/MBA	22,0	24,3	26,5	3,17	2
	MBA		26,5			1
	Medieval		26,5			1

Cubo-Nav		min	\bar{x}	max	σ	n
GB	EBA		55,8			1

Metatarsus		min	\bar{x}	max	σ	n
Bp	Medieval	42,9	45,3	47,6	3,32	2
Dp	Medieval	41,5	43,3	45,1	2,55	2
SD	Medieval	29,1	29,6	30	0,64	2
Bd	MBA		57,8			1
	Medieval	52,8	57,1	60,1	3,81	3
Dd	MBA		31,9			1
	Medieval	27,5	30,5	33	2,78	3

Phalanx 3		min	\bar{x}	max	σ	n
DLS	EBA	61,1	63,9	66,7	3,90	2
Ld	EBA	48,8	50,5	52,2	2,40	2
MBS	EBA	21,0	22,4	23,8	2,00	2

Bos primigenius

Astragalus		min	\bar{x}	max	σ	n
GLI	Medieval		80,6			1
GLm	Medieval		74,0			1
DI	Medieval		47,7			1
Dm	Medieval		48,0			1
Bd	Medieval		53,6			1

Bos primigenius

Phalanx 1		min	\bar{x}	max	σ	n
GL	Medieval		66,8			1
Bp	Medieval		36,1			1
Dp	Medieval		35,0			1
SD	Medieval		29,7			1
Bd	Medieval		31,2			1

Gazella spp.

Humerus		min	\bar{x}	max	σ	n
Bd			26,4			1
BT			22,3			1
***HMT			16,2			1
***HT			12,9			1

Capra hircus

Scapula		min	\bar{x}	max	σ	n
GLP	EBA		35,1			1
LG	EBA		26,4			1
BG	EBA		22,3			1

Humerus		min	\bar{x}	max	σ	n
Bd	EBA	27	27,7	29	2	2
	EBA/MBA	29,4	31,5	33,6	2,96	2
	MBA	31,7	34,1	38,6	3,9	3
	Medieval	31	32,6	34,5	1,77	3
Dd	Medieval	25,8	27,3	30,2	2,51	3
BT	EBA		29,6			1
	EBA/MBA		30,7			1
	MBA	29,3	30,8	33,6	2,4	3
	Medieval	29,3	30,2	31	1,2	2
***HMT	EBA	16	17,0	17,6	0,85	3
	EBA/MBA	17,4	18,2	18,9	1,04	2
	MBA	18,3	19,6	22	2,1	3
	Medieval	18,3	20,5	25	3,87	3
***HT	EBA		13,3			1
	EBA/MBA		14,9			1
	MBA	13,8	14,6	15,6	0,9	3

Radius		min	\bar{x}	max	σ	n
Bp	EBA	29,9	31,6	33,3	2,44	2
	Medieval	29,9	32,9	37,2	3,8	3
Dp	EBA	15,4	16,1	16,8	0,96	2
	Medieval	15,0	16,4	18,60	1,90	3

Metacarpus		min	\bar{x}	max	σ	n
GL	MBA		122,7			1
	Medieval	107,1	113,4	120,5	6,74	3
Bp	MBA	21,9	23,2	24,5	1,84	2
	Medieval	24,2	24,8	25,6	0,74	3
Dp	MBA	15,2	16,1	17	1,27	2
	Medieval	16,5	17,2	18,2	0,87	3
SD	MBA	11,6	15,1	18	3,25	3
	Medieval	15	15,5	16,3	0,58	4
SDap	MBA	8,6	9,0	9,4	0,57	2
	Medieval	10	10,4	11	0,51	3
Bd	EBA	26,7	27,1	27,5	0,57	2
	MBA		30,2			1
	Medieval	26,2	26,8	27,5	0,54	4
Dd	EBA	16,6	16,7	16,8	0,14	2
	MBA		18,4			1
	Medieval	16,5	16,9	17,2	0,35	4

Astragalus		min	\bar{x}	max	σ	n
GLI	EBA		28,2			1
GLm	EBA		27,7			1
DI	EBA		14,6			1
Dm	EBA		15,4			1
Bd	EBA		18,1			1

Phalanx 1		min	\bar{x}	max	σ	n
GL	EBA	34,7	37,9	39,2	1,67	6
	EBA/MBA		38,8			1
	Medieval	34,9	39,5	41,5	3,24	4
Bp	EBA	12,7	13,5	14,4	0,56	6
	EBA/MBA		12,4			1
	Medieval	12,3	13,5	14,3	0,85	5
Dp	EBA	13,8	14,8	16,5	0,94	6
	EBA/MBA		13,8			1
	Medieval	15,5	16,0	16,6	0,49	4
SD	EBA	10,4	11,2	12	0,56	6
	EBA/MBA		11,4			1
	Medieval	9,9	11,5	12,9	1,08	5
Bd	EBA	12,2	12,8	13,3	0,38	6
	EBA/MBA		12,1			1
	Medieval	11,1	12,6	14	1,18	5
Dd	EBA	10,1	11,4	12,2	0,75	6
	EBA/MBA		10,8			1
	Medieval	9,8	11,5	12,8	1,34	4

Phalanx 2		min	\bar{x}	max	σ	n
GL	EBA	22,5	24	25,8	1,14	6
	EBA/MBA		26,1			1
Bp	EBA	11,8	13,1	13,8	0,85	6
	EBA/MBA		14,4			1
Dp	EBA	12	13,1	13,8	0,63	6
	EBA/MBA		12,8			1
SD	EBA	8,4	9,3	9,7	0,47	6
	EBA/MBA		10,3			1
Bd	EBA	9	9,8	10,5	0,57	6
	EBA/MBA		10,8			1
Dd	EBA	11,1	11,9	12,8	0,61	6
	EBA/MBA		12,2			1

Phalanx 3		min	\bar{x}	max	σ	n
DLS	EBA	31,5	32,3	32,9	0,6	4
Ld	EBA	20,3	21,0	22,5	1,04	4
MBS	EBA	5,1	5,3	5,4	0,15	4

Metatarsus		min	\bar{x}	max	σ	n
GL	EBA		121,0			1
Bp	EBA		21,1			1
Dp	EBA		18,7			1
	EBA		14,0			1
SD	Medieval		17,0			1
Bd	EBA	24,5	24,6	25	0,07	2
	Medieval		28,3			1
Dd	EBA	16,1	16,5	16,8	0,5	2
	Medieval		17,8			1

All measurements in mm. Abbreviations and measurement directions from von den Driesch 1976 except
All equid measurements from Eisenmann and Mashkour 2000
* Payne and Bull 1982
** Steiger 1990
*** Fernandez 2001. see also Boessneck and al. 1964, HMT=c HT=a

Capra aegagrus

Radius		min	\bar{x}	max	σ	n
Bp	EBA		39,0			1
Dp	EBA		19,8			1

Phalanx 1		min	\bar{x}	max	σ	n
GL	Medieval	47	47,7	48,3	0,92	2
Bp	Medieval	15	15,0	15	0	2
Dp	Medieval	16,6	17,0	17,3	0,49	2
SD	Medieval	11,1	12,0	12,9	1,27	2
Bd	Medieval	16,6	17,2	17,7	0,78	2
Dd	Medieval	12	13,8	15,5	2,47	2

Phalanx 3		min	\bar{x}	max	σ	n
DLS	Medieval		43,6			1
Ld	Medieval		27,8			1
MBS	Medieval		7,4			1

Ovis aries

Scapula		min	\bar{x}	max	σ	n
SLC	LCh		20,8			1
	EBA/MBA		18,7			1
	MBA		21,8			1
GLP	LCh		35			1
	MBA		36,6			1
LG	LCh		26,7			1
	MBA		24,8			1
BG	LCh		21,8			1
	EBA/MBA		20,8			1
	MBA		24,4			1

Humerus		min	\bar{x}	max	σ	n
Bd	EBA	29,1	30,7	34,4	2,9	5
	MBA		32			1
	Medieval	29	30,6	32,9	1,82	6
Dd	EBA	25,4	28,8	33,2	3,35	4
	MBA	29,1	31,6	34,5	2,04	5,0
	Medieval	24,2	26,5	28,8	1,91	4,0
Bt	EBA	28,6	29,8	30,9	1,63	2
	MBA	28	29,7	32,7	2,17	4
	Medieval	26,5	28,2	29,8	2,33	2
***HMT	EBA	17,1	19,7	23,3	2,11	7
	MBA	18,5	19,3	20,3	0,8	5
***HT	EBA	17,67	18,9	19,4	0,68	6
	MBA	14,8	15,2	15,6	0,57	2
	MBA	13,9	15,1	16,8	1,35	4

Radius		min	\bar{x}	max	σ	n
Bp	EBA	30,1	31,2	34,4	2,43	4
	MBA		36			1
	Medieval	32,2	32,8	34	0,74	5
Dp	EBA	14,2	16,2	17,5	1,39	4
	MBA		18,8			1
	Medieval	16,3	17,3	19,1	1,11	5
SD	Medieval	17,3	18,1	19,1	0,91	3

Metacarpus		min	\bar{x}	max	σ	n
GL	Medieval	113,4	117,5	123,4	5,25	3
Bp	EBA		23,8			1
	EBA/MBA		13			1
	Medieval	23	24,0	24,7	0,91	3
Dp	EBA		16,6			1
	EBA/MBA		17,5			1
	Medieval	16,3	17	17,5	0,62	3
SD	EBA		13,0			1
	EBA/MBA	12,8	13,1	13,4	0,4	2
	Medieval	13,7	15,5	17,3	1,5	4
DD	EBA		10,0			1
	EBA/MBA	8,7	9,3	9,8	0,78	2
	Medieval	10	10,5	10,9	0,64	2
Bd	EBA		24,6			1
	EBA/MBA		24,7			1
	Medieval	25,6	27,3	28,5	1,4	5
Dd	EBA		16,2			1
	EBA/MBA		16,8			2
	Medieval	15,4	16,7	18,2	1,1	5

Tibia		min	\bar{x}	max	σ	n
Bp	MBA		36,2			1
Bd	MBA	26	20,8	29	1,5	3
Dd	MBA	18,6	15,3	22	1,7	3

Metatarsus		min	\bar{x}	max	σ	n
GL	EBA		155			1
	MBA		117,9			1
	Medieval	121,1	126,7	132,2	7,85	2
Bp	EBA		20,3			1
	Medieval	22,3	22,7	23	0,49	2
Dp	EBA		21			1
	Medieval	20	20,9	21,7	1,2	2,0
SD	EBA	10,7	11,6	12,3	0,8	3
	EBA/MBA		13,7			1
	MBA		13,7			1
	Medieval	11,6	12,9	14,2	1,3	3
Bd	EBA	22,8	23,4	23,9	0,8	2
	EBA/MBA		26,0			1
	MBA		26,0			2
	Medieval	25,9	26,4	27,3	0,76	3
Dd	EBA	14,1	15,5	17,4	1,7	3
	EBA/MBA		16,7			1
	MBA		17,0			1
	Medieval	16	16,7	17,6	0,81	3

Astragalus		min	\bar{x}	max	σ	n
GLI	LCh		30,3			1
	EBA	29,7	30,6	31,5	0,87	3
	EBA/MBA		33,4			1
GLm	LCh		29,1			1
	EBA	28,1	28,9	30,2	1,19	3
	EBA/MBA		32			1
DI	LCh		17,2			1
	EBA	16,6	16,7	16,8	0,11	2
	EBA/MBA		18,6			1
Dm	LCh		18,7			1
	EBA	17,2	17,3	17,4	0,15	2
	EBA/MBA		19,1			1
Bd	LCh		19,2			1
	EBA	19,2	19,6	20,4	0,69	3

Phalanx 2		min	\bar{x}	max	σ	n
GL	EBA	21,8	23,0	24,5	1,39	3
	EBA/MBA		21,0			1
Bp	EBA	11,4	11,7	11,9	0,26	3
	EBA/MBA		12,1			1
Dp	EBA	12,1	12,4	12,7	0,31	3
	EBA/MBA		10,8			1
SD	EBA	8,4	8,7	9	0,31	3
	EBA/MBA		8,0			1
Bd	EBA	8,8	9,1	9,2	0,23	3
	EBA/MBA		8,7			1
Dd	EBA	10,1	10,8	11,3	0,62	3
	EBA/MBA		10,7			1

Phalanx 3		min	\bar{x}	max	σ	n
DLS	EBA		31,5			1
	Medieval		27,6			1
Ld	EBA		21,2			1
	Medieval		19,9			1
MBS	EBA		6,4			1
	Medieval		6,4			1

Phalanx 1		min	\bar{x}	max	σ	n
GL	EBA	32	38,4	44	3,56	14
	MBA	38,5	38,9	39,3	0,60	2
	Medieval	37,2	38,5	39,9	1,36	3
Bp	EBA	10,9	12,5	14,0	0,95	14
	MBA	12,1	12,4	12,8	0,50	2
	Medieval	12,5	12,9	13,3	0,40	3
Dp	EBA	13,3	14,7	17,2	1,12	14
	MBA	13,7	13,9	14,1	0,30	2
	Medieval	14,5	15,5	16,2	0,89	3
SD	EBA	8,5	10,2	11,9	1,03	14
	MBA		9,1			1
	Medieval	10,3	10,8	11,6	0,72	3
Bd	EBA	10,1	11,8	13,2	0,88	14
	MBA	10,7	11,5	12,3	1,10	2
	Medieval	11,4	12,0	12,9	0,79	3
Dd	EBA	9,2	10,5	12,1	0,75	14
	MBA	9,7	10,3	10,9	0,90	2
	Medieval	11,4	11,8	11,7	0,40	3

Ovis orientalis

Radius		min	\bar{x}	max	σ	n
Bd	LCh		39,5			1
Dd	LCh		28,3			1

Tibia		min	\bar{x}	max	σ	n
Bd	EBA		31,5			1
Dd	EBA		27,5			1

Gallus gallus

Femur		min	\bar{x}	max	σ	n
GL	Medieval		74,0			1
Lm	Medieval		69,7			1
Bp	Medieval		13,9			1
Dp	Medieval		13,0			1
SD	Medieval		5,6			1

All measurements in mm. Abbreviations and measurement directions from von den Driesch 1976 except
All equid measurements from Eisenmann and Mashkour 2000

* Payne and Bull 1982

** Steiger 1990

*** Fernandez 2001. see also Boessneck and al. 1964. HMT=c HT=a

Pre-Medieval male horse from locus 1754																	
	Side	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Hm	L	315,0		39,9	93,8	108,0	81,2	85,5	51,8	38,2	45,6	36,9					
Hm	R	312,0		35,6	96,3	107,0	76,3	79,2		38,1	46,3	36,7					
Rd	L	363,0		41,9	86,5	78,8	40,4	81,4	68,0	42,0	32,2	13,5					
Rd	R	365,0		41,2	85,5	78,1	40,7	79,7	65,1	38,4	29,5	14,9					
MC III	L	248,0		36,2	28,1	52,2	34,6	43,0	15,3		48,6	52,0	36,6	29,0	29,1	27,6	26,8
MC III	R	247,0		35,6	27,3	52,7	33,3	43,6	14,7		47,9	53,4	37,2	29,5	28,6	28,0	26,6
Fm	L	430,0		43,1	125,9	81,9	57,0										
Fm	R	430,0		42,3	126,3	81,8	56,8	98,8	93,1	124,3							
Tb	L	401,0		44,1	40,4	97,5	92,9	77,0	47,8	44,9	18,8						
Tb	R	403,0		43,6	40,0	97,3	88,5	74,1	49,4	47,2	18,9						
Talus		64,3	63,3	65,1	32,3	53,5	37,7	55,4									
Talus		63,5	63,3	61,9	30,6	53,9	37,4	60,4									
MT III	L			32,3	33,0	53,3	43,8	46,4	14,9						31,2		
MT III	R	290,0		33,0	32,4	54,4	45,8	47,3	15,0		51,2	53,6	39,1	28,6	30,1	27,8	27,9
Ph1	Ant	93,7	83,0	37,3	58,0	36,9	48,8	62,3	56,7	80,9	70,7	73,2	14,2	13,9	45,4		
Ph1	Post	90,0	81,3	36,5	59,1	41,2	47,4	54,7	49,0	77,3	62,5	65,5	13,9	13,2	45,0		
Ph2		50,8	36,3	44,4	55,1	34,5	47,9										
Ph2		51,1	35,5	46,9	53,9	33,6	50,8										
Ph3		53,6	58,5	48,1	77,2	29,0	43,9	174,0									
Ph3		56,1	64,9	50,0	74,9	27,6	46,3	174,0									

		Inf	L	B	LPF	LDK	H				Sup	L	B	LP	H	
Th	R	PM2	33,0	16,4	15,2	14,0				Th	R	PM2	38,0	26,4	9,0	
Th	R	PM3	28,7	18,2	13,5	16,7				Th	R	PM3	29,6	28,0	12,8	
Th	R	PM4	27,7	19,4	13,5	15,0				Th	R	PM4	27,7	27,5	12,8	
Th	R	M1	26,1	17,7	7,5	13,6	43,1			Th	R	M1	25,7	26,9	14,3	51,0
Th	R	M2	26,4	16,7	8,2	13,6	51,8			Th	R	M2	25,0	26,2	14,1	58,7
Th	R	M3	34,0	15,6	9,5	13,6	61,6			Th	R	M3	27,7	23,5	13,8	
Th	L	PM2	33,6	16,4	16,3	16,7	44,3			Th	L	PM2	37,4	25,5	9,4	46,3
Th	L	PM3	28,9	18,7	13,7	16,7	48,8			Th	L	PM3	29,3	28,3	13,0	56,3
Th	L	PM4	27,8	19,0	12,1	15,2	62,1			Th	L	PM4	28,8	27,6	13,9	60,7
Th	L	M1	25,0	17,7	7,9	13,5	46,9			Th	L	M1	25,8	26,8	12,9	51,4
Th	L	M2	26,7	16,4	7,9	13,0	57,0			Th	L	M2	26,2	25,9	14,2	58,6
Th	L	M3	34,6	14,9	9,3	13,2				Th	L	M3	28,7	23,8	14,5	57,8