ARCHAEOZOOLOGY OF THE NEAR EAST III

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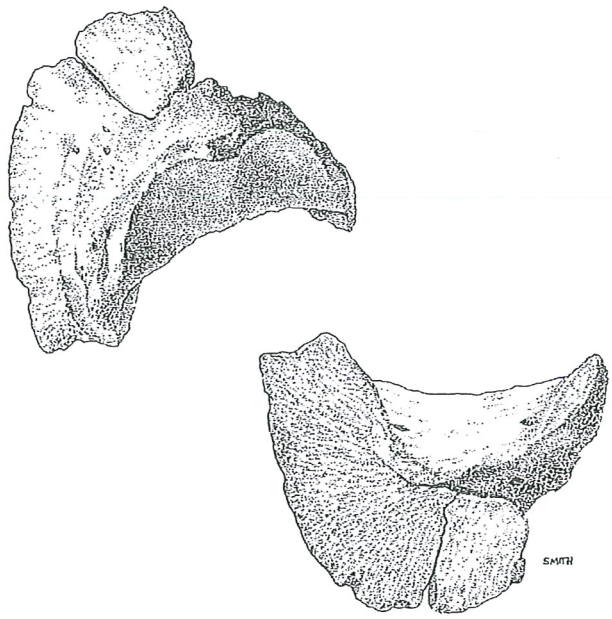
edited by

H. Buitenhuis, L. Bartosiewicz and A.M. Choyke



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Cover illustration: Dorsal and palmar aspects of a
Bronze Age horse phalanx from Arslantepe, Turkey,
identified by Sándor Bökönyi.
Courtesy by the artist, Patricia Smith (Reduction: 64%).

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Preface

This publication is the result of the third international symposium on archaeozoology of southwestern Asia and adjacent areas, held in Budapest, Hungary from 2 - 5 September 1996. The editors would like to thank all colleagues of the Working Group who helped with the translation of abstracts. Financial support for the publication was given by the Acker Stratingh Stichting, Groningen, The Netherlands.

Participants of the 3rd ASWA Conference, Budapest 1996
(Photo: Péter Komjáthy, Aquincum Museum)

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Participants not shown in picture: D. Carruthers (Great Britain), D. MacHugh (Ireland), S. Whitcher (Great Britain).

Contents

PATTERNS OF ANIMAL HUSBANDRY IN CENTRAL ANATOLIA IN THE SECOND AND FIRST MILLENNIA BC: FAUNAL REMAINS FROM KAMAN-KALEHÖYÜK, TURKEY

Hitomi Hongo[1]

Zusammenfassung

Der Aufsatz befaßt sich mit der Analyse der Tierreste von der Tellsiedlung Kaman-Kalehöyük in der Provinz Kirsehir (Türkei). Hier wurden bei archäologischen Ausgrabungen Schichten des 2. und 1. Jahrtausends v. Chr. sowie des Mittelalters (Ottomanische Periode) freigelegt. Dargestellt werden die Untersuchungsergebnisse an den Tierreste aus Befunden der vorchristlichen Zeit. Sie lassen vermuten, daß die beobachteten zeitlichen Veränderungen lediglich gradueller Art waren und sich im Rahmen der lokalen Pastoralwirtschaft vollzogen. Für den Platz wird eine Kontinuität der Bevölkerung angenommen, mit Ausnahme von Phase Iib. Jener Abschnitt scheint durch fremdartige Besiedlung gekennzeichnet zu sein.

Introduction

This paper is based on results of the analysis of faunal remains from Kaman-Kalehöyük in Central Anatolia. Kaman-Kalehöyük is a rather small tell, of about 280 meters diameter at the base and about 16 meters high. The excavation, sponsored by the Middle Eastern Culture Center in Japan, started in 1986 after a season of survey in 1985. Layers of the 2nd and 1st millennia BC have been identified beneath layers of the Ottoman period (ca 16th-17th century AD; Table 1). The excavation is under the direction of Dr. Sachihiro Omura (S. Omura, 1989; 1991a,b; 1992b,c; 1993a,b; 1994; 1995a,b; Mikami and S. Omura; 1987; 1988; 1991a,b; 1992; Mori and S. Omura, 1990; 1993).

This paper deals with the faunal remains from Phases III and II, dated to the 2nd and 1st millennia BC, and reports the patterns of animal exploitation and their changes through time. Relative proportions of taxa, kill-off patterns and body sizes of the major domesticates, and the frequency and nature of bone modification are examined by phase and also by subphase. How the timing and nature of changes in the faunal remains compare with the traditional cultural history of Central Anatolia, and also with other parts of the archaeological record at the site, is the focus of this study.

The importance of the material from Kaman is due to three features at the site. Firstly, the occupation covers time periods in which major cultural transformations took place in Anatolian history. Secondly, Kaman-Kalehöyük was located within the core area of Hittite culture. Later this area was the border between two Iron Age cultures, the Phrygian in the west and the Neo-Hittite in the southeast. Therefore, the site has the potential for providing us with evidence of interaction between various Early Iron Age cultures. Thirdly, the site can provide us with information about little known aspects of cultural, economic, and political history as documented by finds from a rural town, as opposed to what we know from previous research that has focused on the capitals and elites.

The analyzed faunal samples were collected from the deep trench in the north excavation area during six field seasons from 1987 to 1992. All the excavated soil was dry-screened using a one square centimeter mesh. Since the research questions are directly related to archaeological problems, faunal samples were taken from carefully selected areas of the site with good archaeological contexts.

A total of more than 25 thousands bone fragments (25.415) weighing more than 84 kg, excavated from Phases III and II layers have been analyzed. A total of 6.815 fragments, about 48.8 kg

[1] Primate Research Center, Kyoto University, Inuyama, Aichi 484, Japan.

Phase	Architectural levels	Date	
Phase I			
IA	I-1,2	16th-17th c. AD and later ?	
			Ottoman period
IB	I-3,4	16th-17th c. AD (or earlier?)	
			Hiatus
Phase II			
Iron Age			
IIA	II-1-7	mid. 7th-4th c. BC	Achaemenid ?
IIB	II-8,9	mid. 7th c. BC	
IIC	II-10,11	8th-mid. 7th c. BC	
		burning in upper levels of IID	
	(II-12-16)		
IID	II-12-19	12th-early 8th (?) c. BC	"Dark Ages"
Phase III			
Late Bronze Age			
IIIA	III-1,2	ca 1450-1180 BC	Hittite Empire ?
IIIB	III-3,4	ca 1650-1500 BC	Old Hittite
			burning (destruction ?)
Middle Bronze Age			
IIIC	III-5-12	ca 1950-1780 BC	Assyrian Colony
Early Bronze/Middle Bronze Age			
IIID	III-13	ca 2000 BC	

Table 1. Periodisation at Kaman-Kalehöyük.

(48.792 grams) have been identified to the species, genus or family level. Additional measurement data and data on tooth eruption and wear were taken at the site during the field seasons.

Range of identified taxa

Figures 1a and 1b summarize the relative abundance of identified animal taxa by the number of identified specimens and bone weight. The results of the identifications are grouped by subphase and type of archaeological context, such as pits, rooms, and outside areas. Bones of domestic animals are dominant throughout the occupation of the site and make up more than 90 % of the total number of identified fragments and bone weight. Cattle, sheep, goat, and pig are the most common taxa in the samples, with some dogs, donkeys, and horses. Of the wild animals, hare is relatively common, especially after the Late Iron Age. Red deer, wild pig, wild goat, and red fox are found occasionally. Present, but rarely found wild species include roe deer and large carnivores such as wolf, lion, and possibly lynx. Ducks are relatively common among the bird species (Table 2). Fish bones are almost absent. When different contexts within a subphase are compared, more large mammal bones seem to be found in pits or outside contexts than in the rooms, probably largely because of different depositional practices for large animals and medium or small size species (Meadow, 1978; 1983).

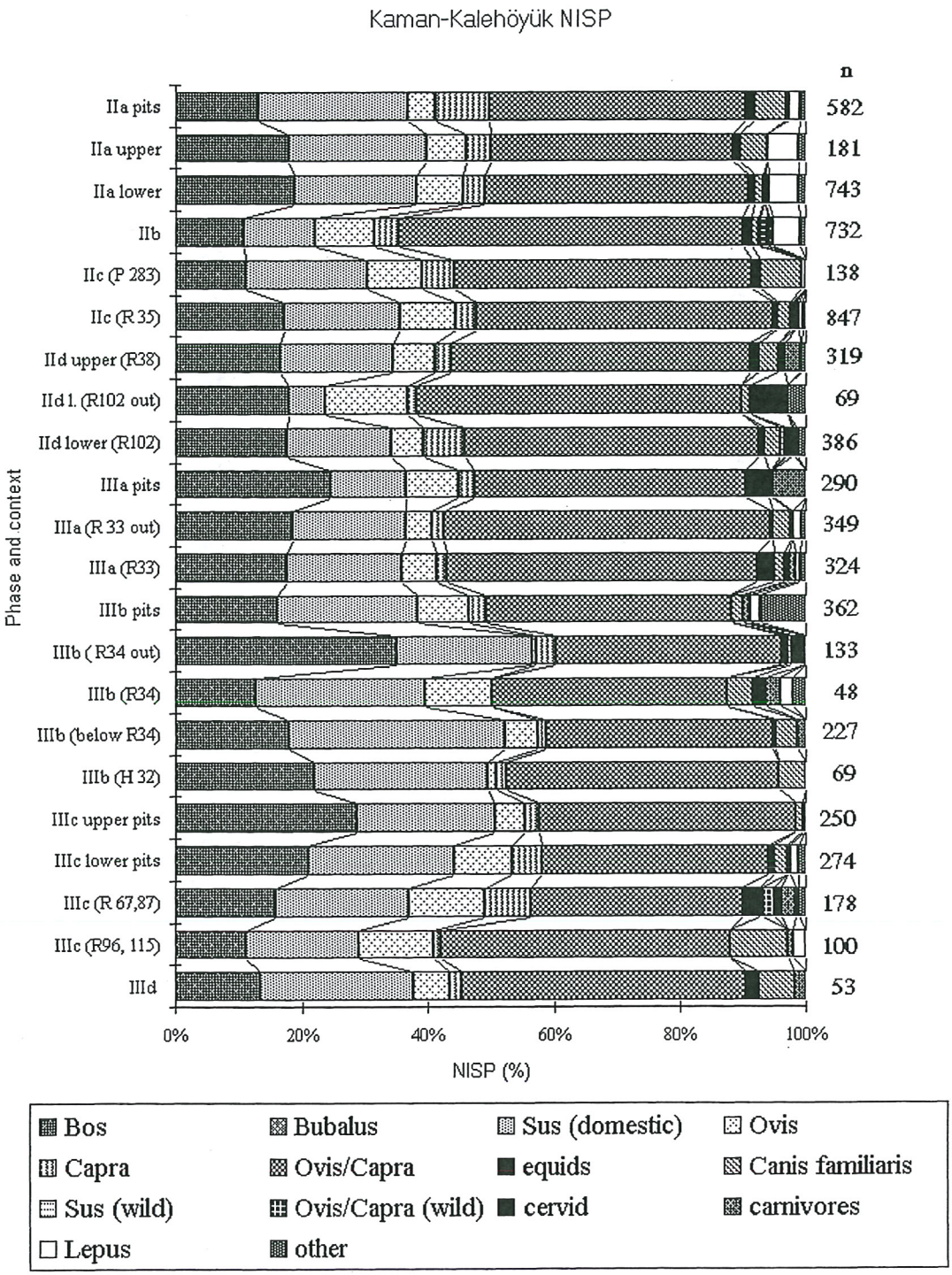

Figure 1a. Relative proportions of the identified remains from Kaman-Kalehöyük based on NISP.

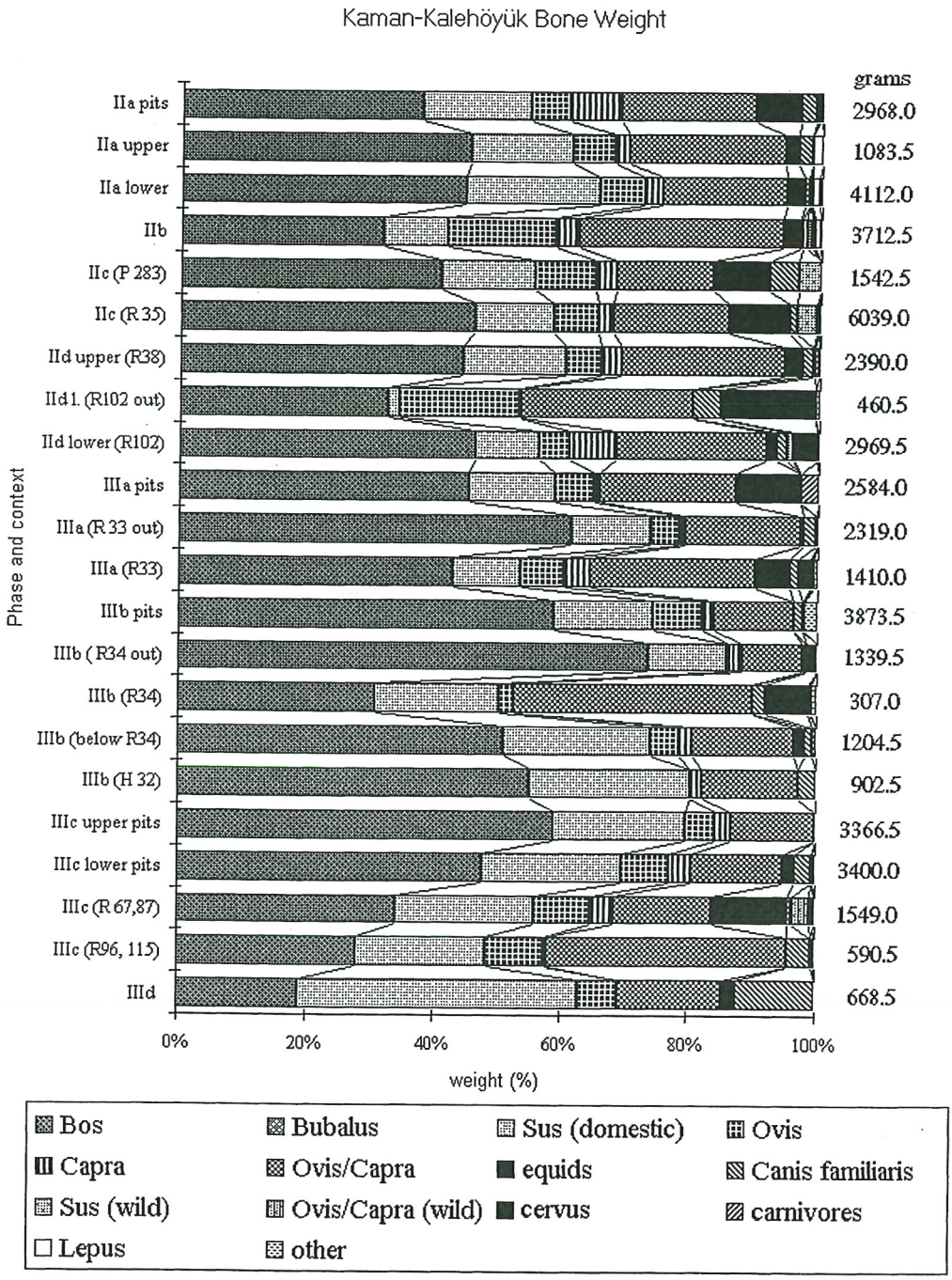

Figure 1b. Relative proportions of the identified remains from Kaman-Kalehöyük based on weight.

Domestic mammals		**phase**	**III d**	**III c**	**III b**	**III a**	**II d**	**II c**	**II b**	**II a**
Cattle	*Bos taurus*		x	x	x	x	x	x	x	x
Water buffalo	*Bubalus bubalis*									x?
Sheep	*Ovis aries*		x	x	x	x	x	x	x	x
Goat	*Capra hircus*		x	x	x	x	x	x	x	x
Pig	*Sus domesticus*		x	x	x	x	x	x	x	x
Horse	*Equus caballus*			x	x	x	x	x	x	x
Ass	*Equus asinus*		x	x	x?	x	x	x	x	x
Mule	*E .caballus x E. asinus*							x		
Camel	*Camelus bactrianus/dromedarius*									x?
Dog	*Canis familiaris*		x	x	x	x	x	x	x	x
Wild mammals										
Red deer	*Cervus elaphus*			x	x	x	x	x	x	x
Roe deer	*Capreolus capreolus*							x?		x?
Wild goat	*Capra aegagrus*			x			x	x	x	x
Wild sheep	*Ovis orientalis*							x		x?
Wild pig	*Sus scrofa*				x?		x	x	x	x
Wolf	*Canis lupus*					x?	x?			x
Red fox	*Vulpes vulpes*				x	x	x	x	x	x
Lion	*Panthera leo*						x			
Lynx	*Lynx lynx*						x?			
Weasel	*Mustela nivalis*			x	x?	x	x		x	
Ground squirrel	*Spermophilus citellus*			x?		x	x			
Hare	*Lepus capensis*			x	x	x	x	x	x	x
Blind mole rat	*Spalax leucodon*									x
Domestic birds										
chicken	*Gallus gallus*			x?		x?			x?	x
Wild birds										
Mallard	*Anas plathyrhynchos*				x	x		x		
European widgeon	*Anas penelope*			x	x					
Teal	*Anas crecca*			x	x?				x	x
Pochard	*Aythya ferina*				x?					
Shelduck	*Tadorna ferruginea*									x
Hazel grouse	*Bonasa bonasia*								x	x
Pheasant	*Phasianus colchicus*			x?		x			x?	x?
Partridge	*Perdix perdix*			x?		x?			x?	x?
Cukar	*Alectoris graeca*			x?		x?			x?	x?
White stork	*Ciconia ciconia*						x			
Egyptian vulture	*Neophron percnopterus*				x					
Pigeon	*Columba livia ?*									x
other unident. birds			x	x	x	x	x	x	x	x
Reptiles										
Tortoise	*Testudo graeca*			x	x	x	x	x	x	x
Amphibian					x	x		x	x	
Fish						x	x			
Molluscs										
Freshwater mollusc	*Unio spec.*			x	x	x	x	x	x	x

Table 2. List of taxa identified at Kaman-Kalehöyük (including taxa identified during survey)

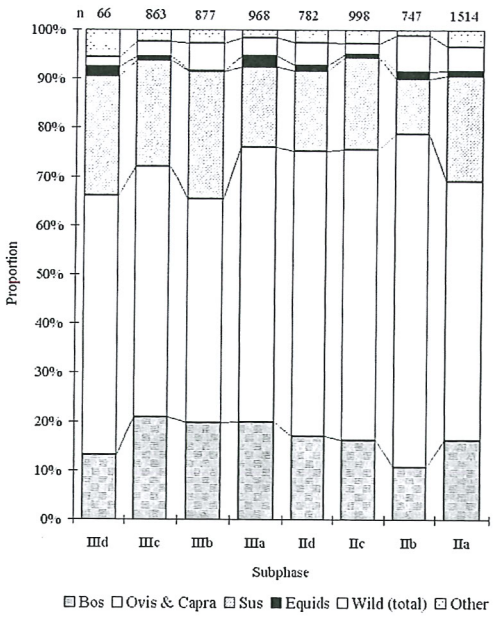

Figure 2. Relative proportions of the principal domesticates and total wild taxa by NISP.

Relative proportions by NISP of the main domesticates and the total amount of wild species including birds in the different subphases are summarized in Figure 2. The proportion of pigs is higher during the first half of the 2nd millennium BC. The assemblage from Subphase IId ("Dark Ages") is marked by a relatively high proportion and wide range of wild animals. Although subphase IIIb also shows a relatively high proportion of wild animals, this is largely due to a single pit that contained bird bones. Relatively high proportions of equids are attested in Subphase IIIa. The proportion of horse among equid remains increases from Subphase IIc. Faunal remains from Subphase IIb are characterized by a dramatic increase of sheep and goat remains in relation to those of cattle and pig. Heavy dependence on sheep and goat is indicated by a proportion close to 70% by NISP and more than 50% by bone weight. In addition, the presence of more bones of wild species, both in variety and in number, is attested.

Relative abundance of principal domestic animals

Ratios of sheep, goats, cattle, and pigs to each other by the number of identified fragments are shown in Figure 3. The general tendency at Kaman is for an increase in sheep and goats relative to cattle or pigs from Subphase IIIb through Subphase IIb.

The ratio of sheep to goat shows a steady increase from Subphase IIIc to IIIa (Middle and Late Bronze Age), then drops in Subphase IId to almost one to one. The ratio of sheep to goat again shows a gradual increase through the Iron Age until it drops again to 1 to 1 in Subphase IIa. The pattern of shifts in sheep to goat ratios at Kaman is very similar to that reported from Gordion (Zeder and Arter 1994), in spite of the differences in the size and function of the two sites. Also, the two sites seem to have belonged to different cultural traditions during the earlier part of the Iron Age. Therefore, the changes in the ratio of sheep to goat may have been a common phenomenon in Central Anatolia, and

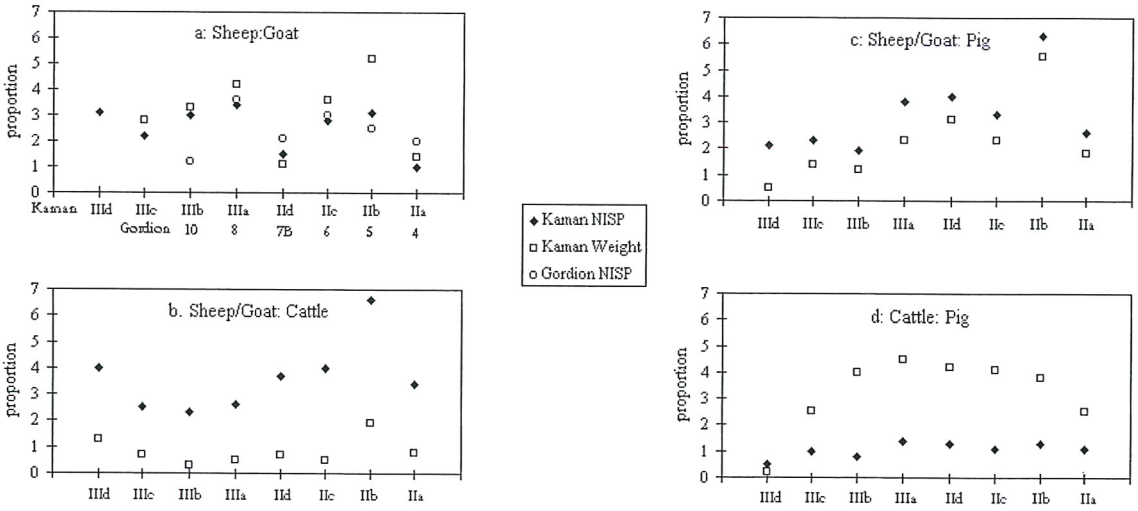

Figure 3. Ratios of the principal domestic animals (proportion y:1) (data for Gordion from Zeder and Arter, 1994).

have belonged to different cultural traditions during the earlier part of the Iron Age. Therefore, the changes in the ratio of sheep to goat may have been a common phenomenon in Central Anatolia, and influences other than social conditions or cultural preference, perhaps environmental factors, might have been a principal contributor to the changes.

The proportions of pig and cattle fluctuate in a parallel manner in relation to sheep and goat, which might suggest that cattle and pigs formed a unified complex in animal husbandry practices. Since sheep and especially goat can be pastured in the hills and mountains and tolerate lower quality pasture than cattle, they are less in competition with crop cultivation than cattle. Sheep and goat became increasingly important both for primary and secondary products, probably because it was more economical to limit the number of cattle just for use as an animal for traction and perhaps for milking, as well as keeping pigs as a source of protein in households.

Kill-off pattern for the principal domestic animals

Kill-off patterns for the major domestic animals are investigated based on the state of epiphyseal fusion and on the eruption and wear of teeth. Post-cranial parts are grouped according to the sequence of epiphyseal fusion based on the ages presented by Silver (1969), Bökönyi (1972), and Habermehl (1975; Table 3). Teeth are seriated according to the wear stage sequence based on the protocols presented by Grant (1975, 1982) for cattle and pigs, and by Payne (1973) as well as Deniz and Payne (1982) for sheep and goats (Table 4). The method based on tooth eruption and wear was more useful in the case of sheep and goat, because of the difficulty of distinguishing between unfused bones from sheep and goat skeletons. The results were interpreted with the assumption that the site had a closed economy.

Ovis & Capra			
I (6-12 months)	**II (12-28 months)**	**III (30-36 months)**	**IV (36-42 months)**
scapula (d),	1st phalanges (p)	ulna (p)	humerus (p)
humerus (d),	2nd phalanges (p)	femur (p)	radius (d)
radius (p)	metapodial (d)	calcaneum (p)	femur (d)
pelvis (acetabulum)	tibia (d)		tibia (p)
Sus			
I (c. 12 months)	**II (24-30 months)**	**III (36-42 months)**	
scapula (d)	1st phalanges (p)	humerus (p)	
humerus (d)	metapodial (d)	radius (d)	
radius (p)	tibia (d)	ulna (p&d)	
2nd phalanges (p)	fibula (d)	femur (p&d)	
pelvis (acetabulum)		tibia (p)	
		fibula (p)	
Bos			
I (6-12 months)	**II (12-18 months)**	**III (24-42 months)**	**IV (42-48 months)**
scapula (d)	humerus (d)	metapodial (d)	humerus (p)
radius (p)	1st phalanges (p)	tibia (d)	radius (d)
pelvis (acetabulum)	2nd phalanges (p)	calcaneum	ulna (p)
			femur (p&d)
			tibia (p)

Table 3. Stages of epiphyseal fusion and estimated age of fusion (after Silver, 1969; Habermehl, 1975; and Bökönyi, 1972; p=proximal epiphysis, d=distal epiphysis).

Bos		*Ovis & Capra*		*Sus*	
Age stage	**Teeth & Wear stages**	**Age stage**	**Teeth & Wear stages**	**Age stage**	**Teeth & Wear stages**
I - Newborn	dp4 (a-c)	**I - Newborn**	dp4 (DU-D3) n.d. dp (er-sl) n.d. di (er-sl) M1 (ue)	**I - Newborn**	dp4 (a-c) dp (er-sl) n.d. I (er-sl)
II		**II**		**II**	
M1 erupting	dp4 (d-g)	**M1 erupting**	dp4 (D4-D5)	**M1 erupting**	dp4 (d)
(c. 6 months)	n.d. dp (mod) M1 (a-c) M2 (ue)	**(<= 6 months)**	n.d. dp (mod) M1 (er-S2/3)	**(<= 6 months)**	n.d.dp (mod) M1 (er, a-b) n.d. P1 (er)
III		**III**		**III**	
M2 erupting	dp4 (h-n)	**M2 erupting**	dp4 (D6-DV)	**M2 erupting**	dp4 (e-l)
(1 - 1.5 years)	n.d. dp (hv)	**(6 - 12 months)**	M1 (S3-S6)	**(6 -12 months)**	n.d.dp mod/hv
	mod/hv	M1 (d-g)		M2 (er-S2/3)	i
	M2 (a-c) M3 (ue) n.d. P (ue)		M3 (ue)		M1 (c-e) M2 (er,a-b) M3 (ue) n.d. I3,C er
IV		**IV**		**IV**	
M3,	M1 (h-k)	**M3,**	dp4 (DX)	**P4 erupting**	P4 (a-c)
P4 erupting	M2 (d-g)	**P4 erupting**	n.d. dp (hv)	**(1-1.5 years)**	P2,3 & unld
(2 - 3 years)	M3 (a-d) P4 (a-c) n.d. P (er-sl)	**(1 - 2 years)**	M1 (S8-M1) M2 (S5-S8) M3 (er-S3) P4 (er-S4) n.d. P (er-sl)		er/sl n.d. I1 er
V		**V**		**V**	
(>> 3 years)	M1 (l-n)	**(2 - 4 years)**	M1 (M2-H1)	**M3 erupting**	M1 (f-h)
	M2 (h-k) M3 (e-j) P4 (d-h) n.d. P mod		M2 (M1) M2 (S4-S8) P4 (M1-M2) n.d. P mod	**(1.5 - 2 years)**	M2 (c-e) M3 (a-b) P4 (d-e) n.d. P mod I2 er
VI		**VI**		**VI**	
(old)	M1 (o-p)	**(4 -7 years)**	M1 (H2-H3)	**(>> 2 years)**	M1 (f-h)
	M2 (l-p) M3 (k-n) P4 (j) n.d. P (hv)		M2 (M2-H1) M3 (M1-M3) P4 (H+) n.d. P (H,V)		M2 (c-e) M3 (a-b) P4 (d-e) n.d. P mod n.d. I hv
		VII		**VII**	
		(old)	M1 (V1) M2 (H2-V1) M3 (H1-V1) P4 (V+)	**(old)**	M1 (l-n) M2 (j-k) M3 (f-j) P4 (g-h)

Table 4. Tooth wear stages for *Bos*, *Ovis* and *Capra* and *Sus*. (di=deciduous incisor; dp= deciduous premolar, I= incisor, P= premolar, M= molar, n.d.= unidentified).

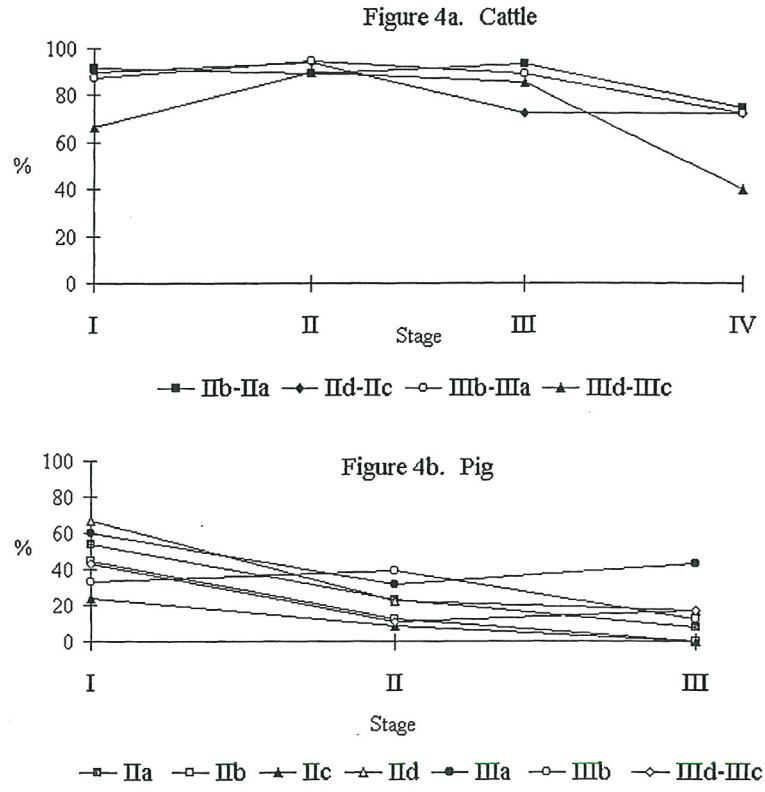

Figure 4. Survivorship curves for cattle (4a) and pig (4b) based on epiphyseal fusion.

The survivorship curves for cattle show that cattle were generally kept until adulthood in most of the periods of occupation at Kaman (Fig. 4a). Pigs were slaughtered at a young age throughout the 2nd and the 1st millennia BC (Fig.4b).

The kill-off patterns of cattle based on tooth eruption and wear, however, indicate an increase in younger age groups from Sub-phase IIb on, although the peak of the age distribution is still at an adult stage (Fig. 5). More younger cattle teeth were found also in samples from Subphase IIIb.

In pigs, teeth of Stages I, II, and III (M2 erupting) account for the majority of teeth, (up to 80% of the sample), in most subphases (Fig.6). Survivorship curves based on epiphyseal fusion and kill-off patterns based on teeth both suggest that in Subphase IIIa, for some reason, more pigs reached the subadult stage or older. Also, both analyses suggest that fewer infantile animals died or were killed in Subphase IIa compared to other sub-phases.

A mixed strategy is suggested by the kill-off patterns for sheep, with emphases on milk, meat, or wool shifting through time (Fig.7). In Subphases IIId and IIIc, relatively few old animals are found. In Subphases IIIb, IIIa, and also in IIa, there are clearly two peaks in the slaughter schedule. This pattern suggests optimization for milk production. In Subphases IId and IIc, higher proportions of the samples come from animals of Stage V, and relatively fewer from young animals, which suggest that production of wool became important in the Early Iron Age.

Goat teeth display a distribution with two peaks in all subphases, one at Stage III and another at Stage VI, although the sample size of some of the subphases are too small to observe clear patterns (Fig.8). These patterns suggest that goats were used for milk and also for meat, with almost all males being killed young, and most females being kept until they became old.

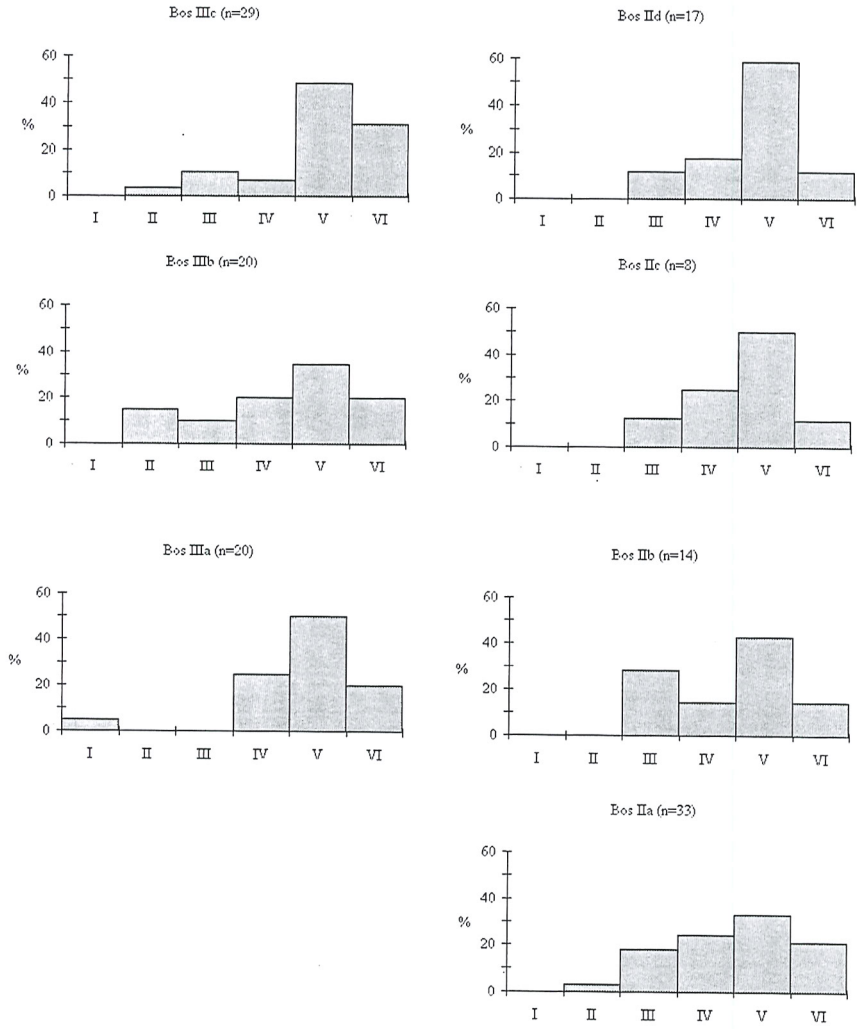

Figure 5. Kill-off patterns for cattle based on tooth eruption and wear.

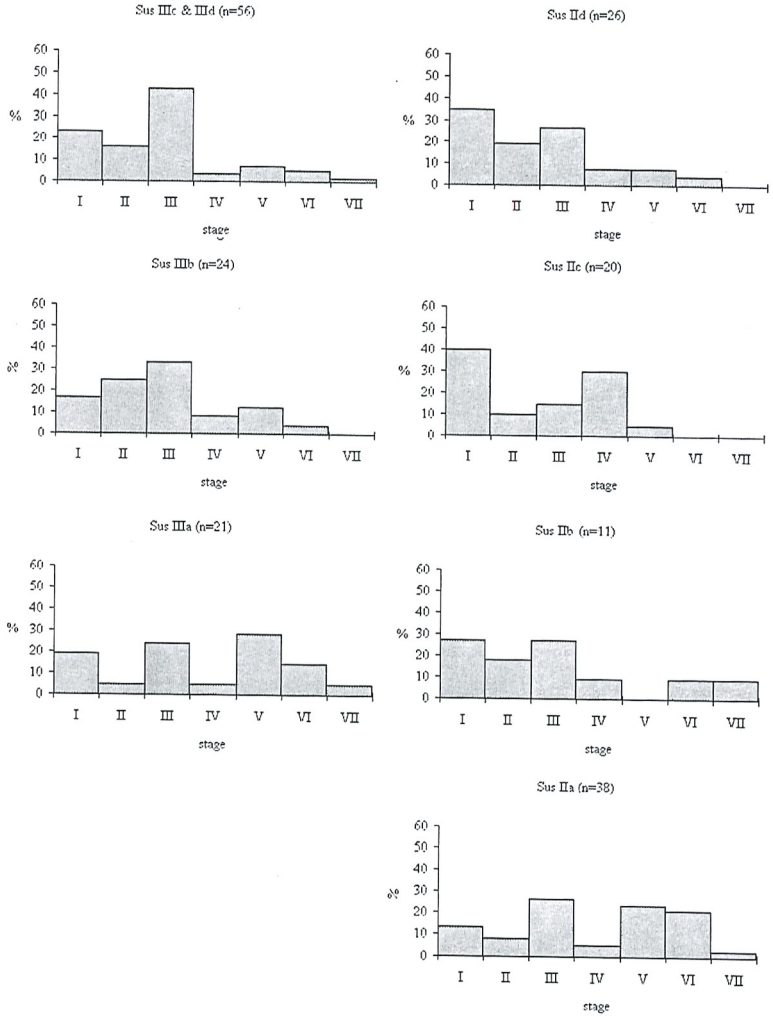

Figure 6. Kill-off patterns for pig based on tooth eruption and wear.

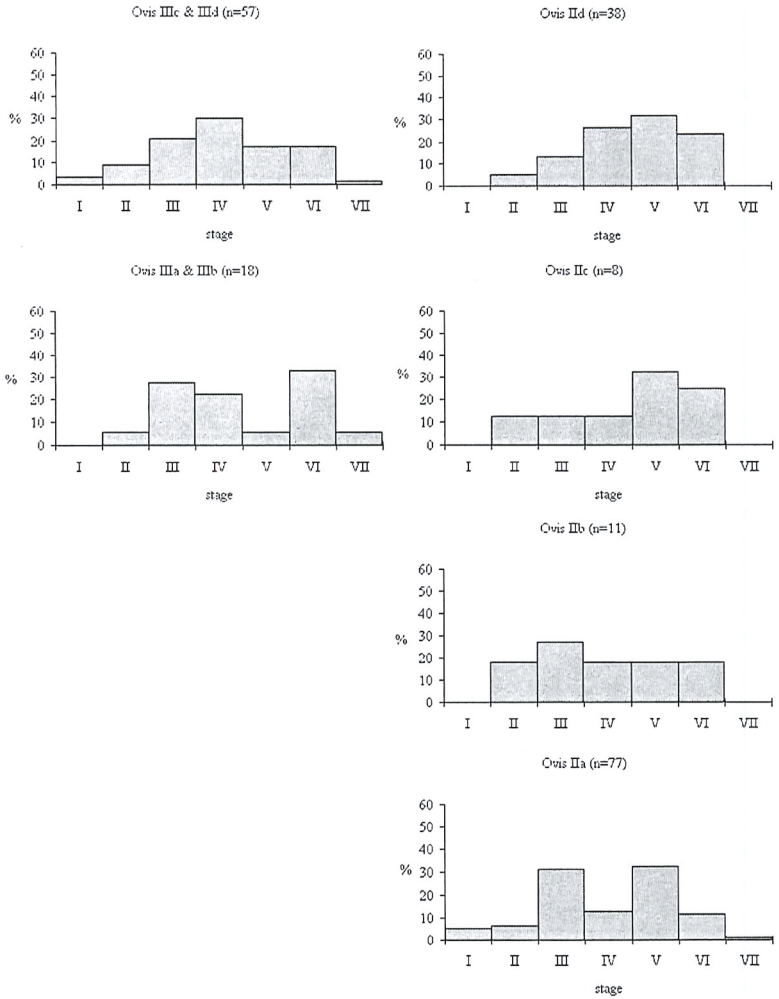

Figure 7. Kill-off pattern for sheep based on tooth eruption and wear.

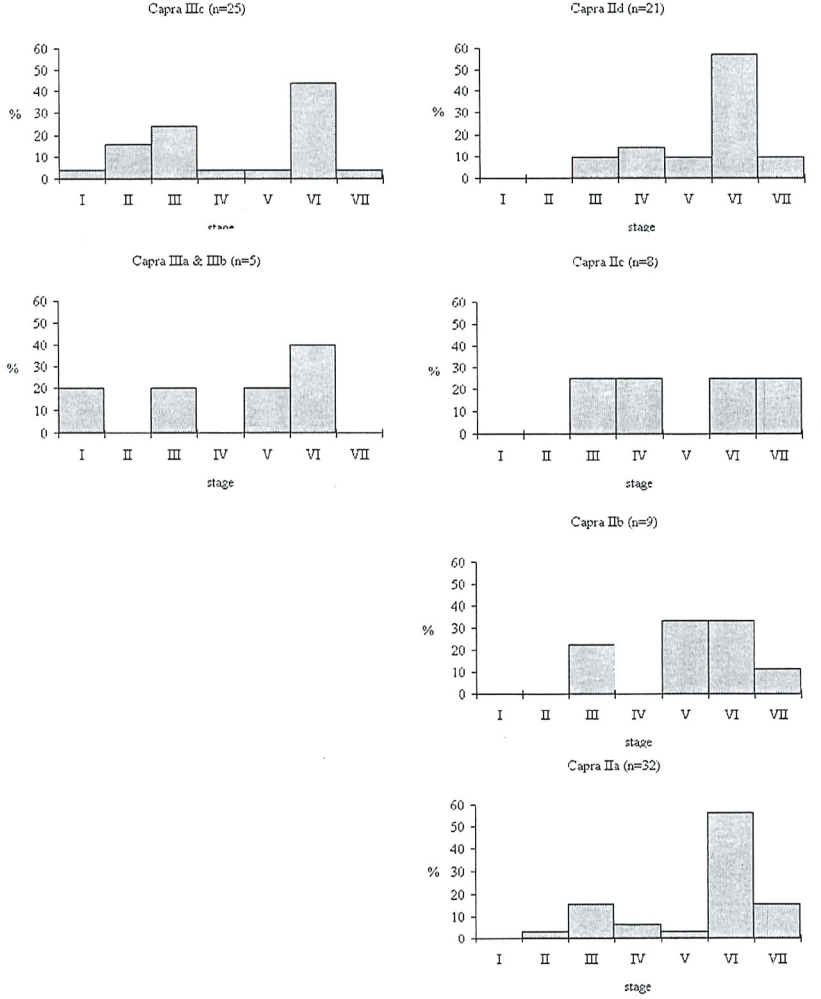

Figure 8. Kill-off pattern for goat based on tooth eruption and wear.

Sizes of principal domestic animals

In order to compare the sizes of animals in different periods at the site, each measurement of limb bones was compared to the corresponding dimensions of a "standard" animal using the "Index Method" developed by Uerpmann (1979) or the "difference of logs" method developed by Meadow (1981, 1983). Lengths and breadth measurements are dealt with separately, because the length of a bone is related to the height of the animal whereas the breadth is related to weight (Meadow, 1991: 90). For cattle, measurements from Lidar Höyük in Eastern Anatolia dating from the Early Bronze Age to the Middle Ages were used as the standard (Kussinger, 1988; Appendix 1). An equation presented by Uerpmann (1982: 18) was used to calculate size indices for cattle from Kaman. Size-indices of sheep and goats from Kaman were calculated in the same way as described by Uerpmann (1979; Appendix 2). For pigs, the "Difference of Logarithms Method" (Simpson, 1941; Meadow, 1983) was employed to compare the size of pigs from Kaman-Kalehöyük to a modern female European wild pig skeleton at the University of Tübingen (catalogue number Su 12 of the Archaeozoology Laboratory, Institut für Vor-und-Frühgeschichte; Appendix 2). There was a considerable increase in the size of cattle from Subphase IIIc-d to Subphase IIIb. This change is indicated both by an increase in median value and by an overall shift of the size index distribution towards the larger size side of the graph. Then, there is a decrease in the size of cattle starting in Subphase IIIa which continues through Phase II (Fig. 9).

The size index distributions for sheep show little change except during Subphase IIIb when there was an increase and during Subphase IIb when there was an overall decrease in size (Fig. 10). It should be noted that a few specimens from young animals bring the median values down for Subphases IIIa and IId. When these are excluded, the median values for Subphase IIIa and IId become 44.7 and 43.2 respectively, showing that there was actually very little fluctuation in the size of sheep through time. The size of goats decreased after Phase III and increased again in Subphase IIa (Fig. 11). The size of pigs remained more or less the same throughout the occupation of the site except for an increase in Subphase IIIa (Fig. 12).

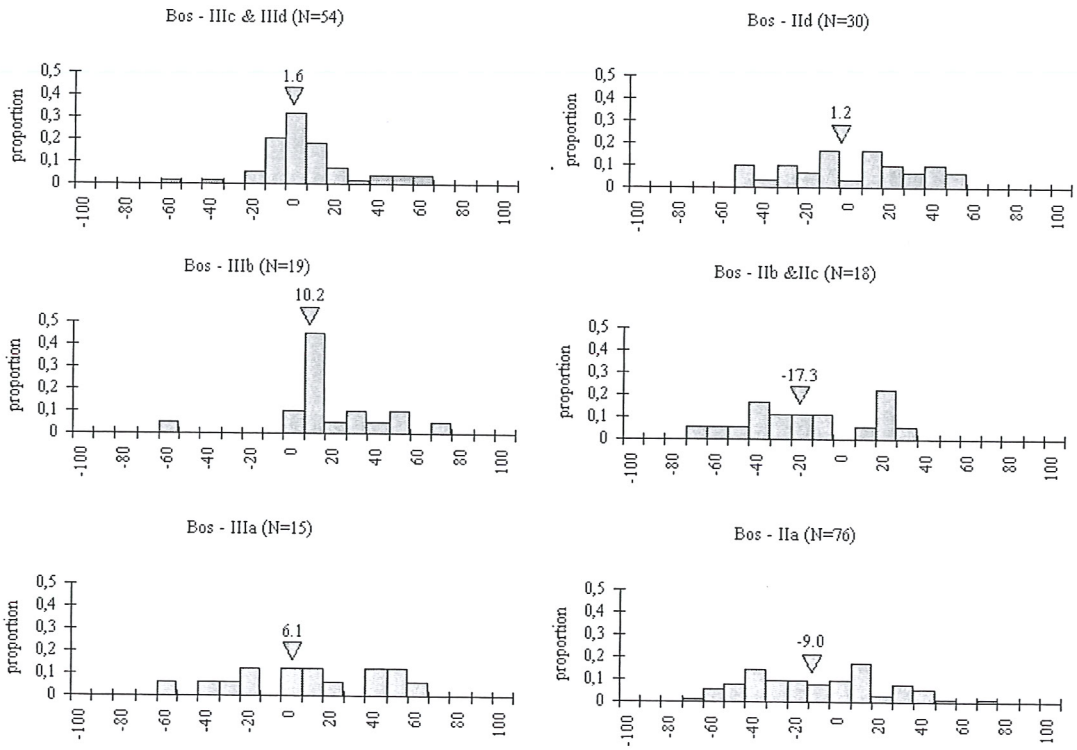

Figure 9. Size Index distributions for *Bos* (breadth).

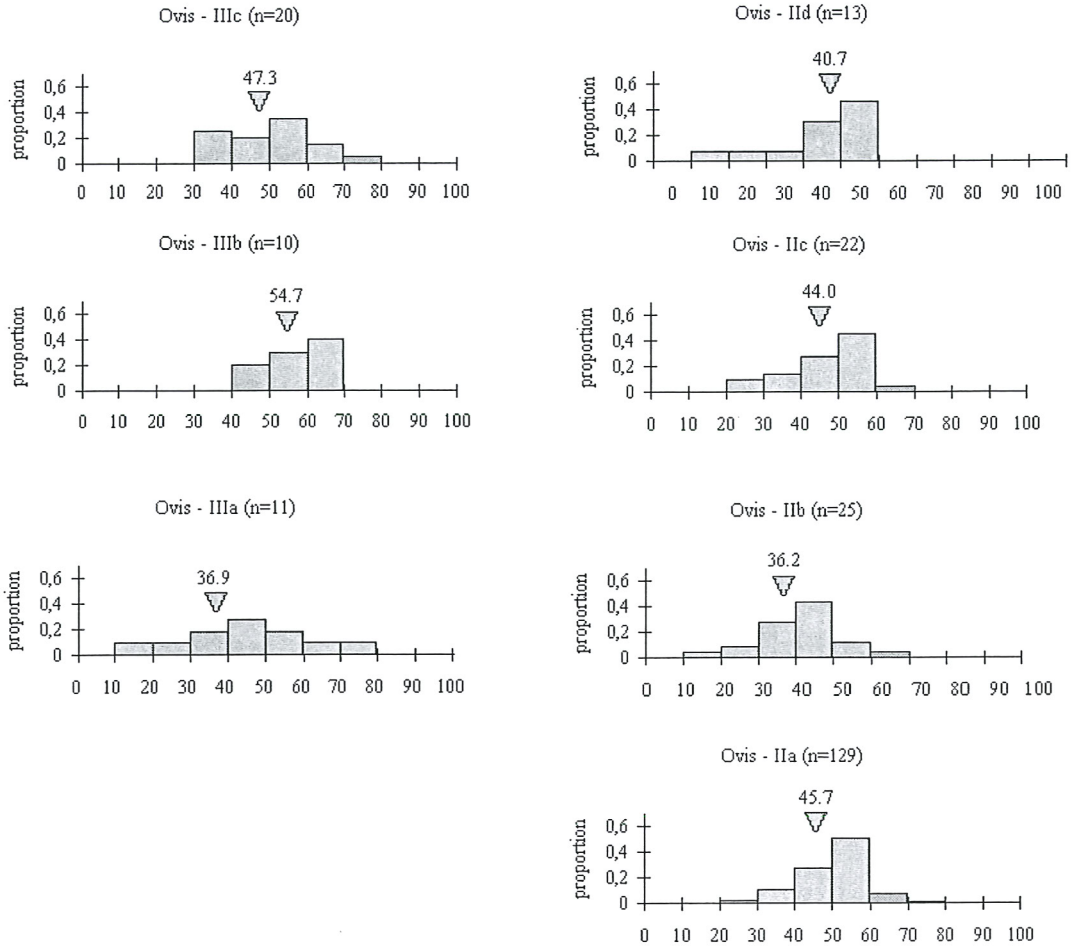

Figure 10. Size Index distributions for *Ovis* (breadth).

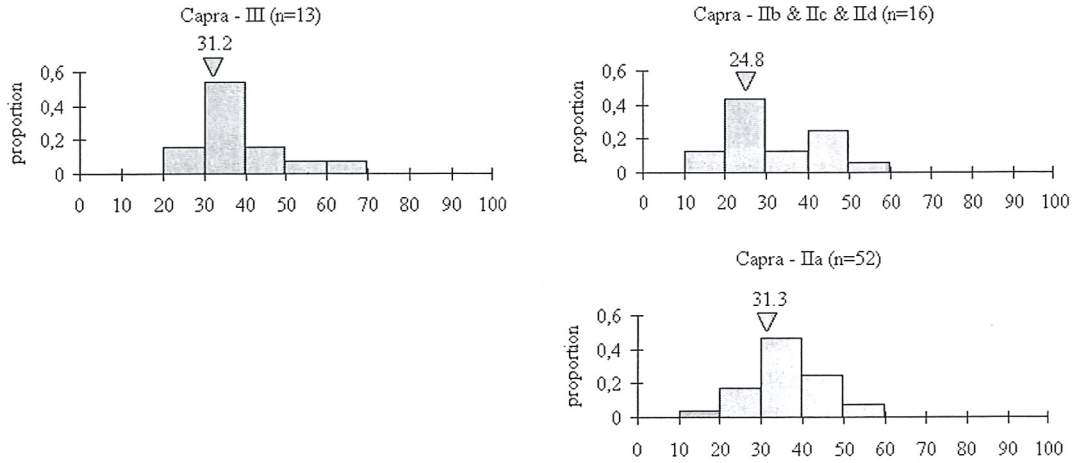

Figure 11. Size Index distributions for *Capra* (breadth).

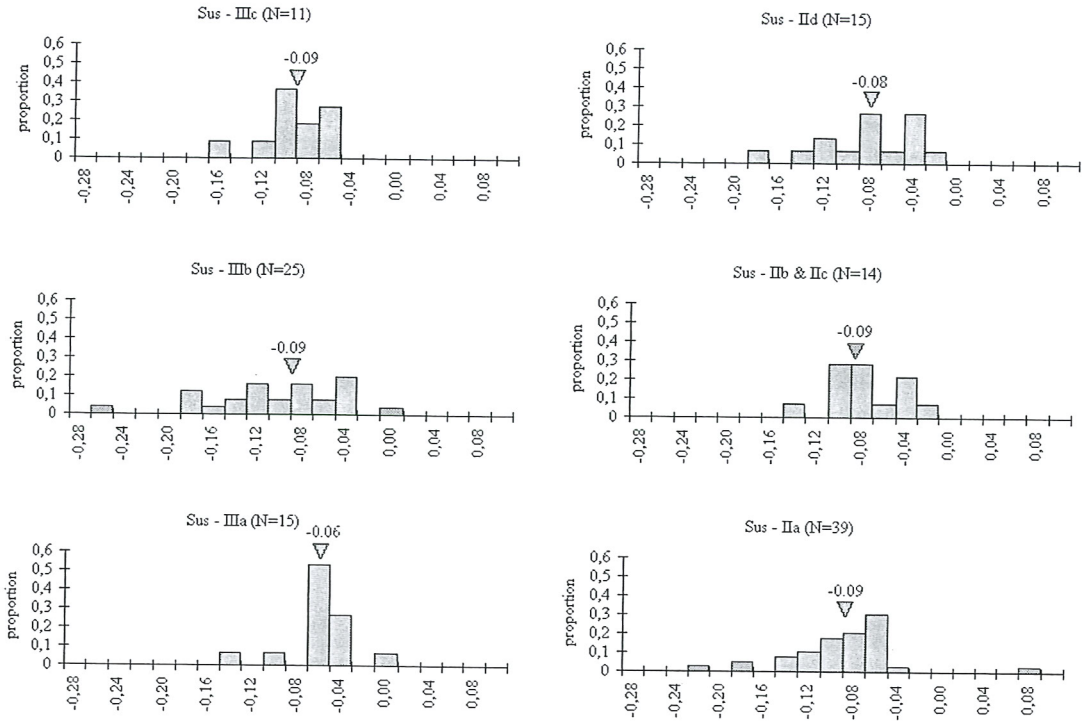

Figure 12. Log Size Index distributions for *Sus* (breadth).

Butchery patterns

A relatively high frequency of cut marks is observed in Subphase IIIc, especially on cattle (Table 5). The proportion of bones with cut marks increases from the Middle Iron Age, probably due to the availability of sharp iron tools. A very different butchery practice is observed in Subphase IIb. The frequency of cut marks is high in sheep, goat, and pigs in relation to the total number of fragments of those taxa, but low in cattle, which is a pattern opposite from that found in the other subphases. In addition, many cut marks in Subphase IIb are heavy chopping marks made by tools with sharp edges, and bones are often split. In Subphase IIb, cut marks are abundant on bones of the axial skeleton, especially on the neck and the skull of sheep and goat.

Status of Kaman-Kalehöyük and its population

The chronology, the status of Kaman-Kalehöyük as indicated by artifacts and architecture, and the nature of the faunal remains are briefly summarized in Table 6.

According to the established chronology of Central Anatolia, major archaeological changes might be expected between Subphases IIIc and IIIb (transition from the Assyrian Colony Period to the Hittite Old Kingdom), and also between Subphases IIIa and IId (the collapse of the Hittite Empire). The archaeological sequence at Kaman, however, exhibits changes of a more gradual nature than those observed at large centers in the region. In spite of the evidence of violence and large scale fires at the end of Subphase IIIc (S. Omura, 1995b), and burnt architectural levels in the later part of Subphase IId (S. Omura, 1992a), continuity in population between Subphases IIIc and IIIb, and also between Subphases IIIa and IId is suggested by the archaeological remains.

Phase			General Nature	*Bos*			*Ovis & Capra*			*Sus*		
				% within total cut bones	% within species	comment	% within total cut bones	% within species	comment	% within total cut bones	% within species	comment
IIa	n of fragments	6837	increase in IIb & IIa from	42.4	15.3	rel. high	38.8	4.3	rel. low	12.9	3.4	low
	n of cut bones	172	prev. periods. heavy marks/			increase			decrease			decrease
	% cut	2.5	chopping on art. area increase									
IIb	n of fragments	2836	IIb: chop marks w/ sharp edges	8.2	5.1	low	75.5	7.1	high	14.3	8.2	high in
	n of cut bones	74	on axial skeleton			decrease			increase			total pigs
	% of cut bones	2.6										increase
IIc	n of fragments	3125	(IId& IIc)	44.7	10.6	rel. high	36.8	2.4	low	10.5	2.1	low
	n of cut bones	56	heavy cuts increase			increase			decrease			decrease
	% of cut bones	1.5										
IId	n of fragments	2313		29.4	7.5		44.1	3.3	rel. low	17.6	4.6	
	n of cut bones	53				slow increase						(unchanged)
	% of cut bones	2.3										
IIIa	n of fragments	4159	(IIIb & IIIa)	32.5	6.8		45.0	3.3	rel. low	17.5	4.4	
	n of cut bones	60	majority of cutmarks are fine			decrease			increase			slow increase
	% of cut bones	1.4	cuts									
IIIb	n of fragments	3535		41.0	9.5	rel. high	30.8	3.1	rel. low	23.1	3.7	rel. low
	n of cut bones	56				decrease			decrease			decrease
	% of cut bones	1.6										
IIIc	n of fragments	2423	rel. high frequency of heavy	36.6	19.4	high in	37.6	9.0	high in total	21.8	10.8	high in total
	n of cut bones	120	cuts			total cattle			sheep & goat			pigs
	% of cut bones	5.0										
IIId	n of fragments	187										
	n of cut bones	3	(small sample size)									
	% of cut bones	1.6										

Table 5. Patterns in changes of cutmarks in Kaman-Kalehöyük.

Phase	Date		Cultural/Political Affiliation	Evidence of Destruction/ Conflict	Status of the Site	Faunal Remains	Population (suggested by archaeological & faunal evidence)
IIa	mid. 7th- 4th c. BC	**Iron Age**	**Phrygian/Persian?**		Important town/ local center	Change (similar to IId-c)	Continuity from IIc Increased Phrygian influence some new population
IIb	mid. 7th c. BC		**?**	Sudden change (no trace of violence)	Rural?	Change	Change-intrusive (origin unknown)
IIc	8th-mid. 7th c. BC		**?**		Rural/small town	Continuity	More influx of new population
IId	12th- early 8th (?) c. BC		**? "Dark Ages" (Some Neo-Hittite influence?)**	Burnt levels in upper IId	Rural/small town	Continuity	Gradual change, continuity in lower levels , increased influx of new population
IIIa	ca 1450-1180 BC	**Late Bronze Age**	**Hittite**		(no architecture) Important town?	Some Change	Continuity
IIIb	ca 1650-1500 BC		**Hittite**		Important town/ Local center?	Continuity	Continuity with some influx of new population
IIIc	ca 1950-1780 BC	**Middle Bronze Age (Early/Middle Bronze)**	**Anatolian (Influence of Assyrian Colony)**	"destruction" level at the end of IIIc	Local center	Continuity	"Anatolian"
IIId	ca 2000 BC		**Anatolian**		?		"Anatolian"

Table 6. Summary of archaeological evidence and faunal remains at Kaman-Kalehöyük.

A high frequency of cut marks especially on cattle in Subphase IIIc suggests either technical or cultural shifts manifested as differences in butchery between Subphases IIIc and IIIb. Generally however, the analysis of faunal remains from Kaman-Kalehöyük suggests, that the changes observed through time are gradual, resulting from developments within the framework of a local pastoral economy. A relatively high proportion of cattle, a relatively low frequency of wild species and the increase in the sizes of cattle and sheep suggests, that the site was politically secure and economically well-off in the middle of the 2nd millennium BC, with a subsistence regime based on agro-pastoralism. The scale of buildings and the nature of the artifacts found in Subphases IIIc and IIIb also support the view that the site was economically secure and was probably an important local center in the region.

Some change in the faunal remains was observed in Subphase IIIa. The characteristics observed in Phase II, such as an increase in sheep and goat remains, a decrease in pig bones, and a decrease in the size of cattle and goat, are trends that had already begun taking place in Subphase IIIa, and simply progressed further in Subphase IId. Thus, continuous occupation at the site by the same population in Subphases IIIa and IId is suggested on the basis of the faunal remains. Political instability and the site's diminished prosperity are indicated by smaller structures, burnt buildings, and the city wall in the upper levels of Subphase IId. Remains of a wide range of taxa of wild animals also suggest that the economic basis at the site became more unstable.

Faunal remains from Subphase IIb show different characteristics than those from other subphases at Kaman in almost every aspect, such as a high proportion of sheep and goat, a relatively high proportion of horse, smaller sizes of sheep and cattle, a dramatic increase of hare bones, and a relatively high proportion of wild animals. Faunal remains in the following Subphase IIa generally resume the same patterns as those of Subphase IIc.

Drastic changes in both faunal remains and the architecture suggest that Subphase IIb represents the intrusive occupation of the site by a population with a culture different from the ones in the previous or following periods.

The high proportion of sheep and goat, together with the short-lasting occupation, suggests that the inhabitants might have been a highly mobile population, largely dependent on sheep herding. It is tempting to speculate whether the occupation of Subphase IIb is related to an incursion by the Cimmerians, who are said to have migrated to Anatolia and destroyed the Phrygian capital at about this time (ca 700 BC; Eusebios "Chronicle"; Young, 1951: 12; DeVries, 1990: 388-9). However, neither the origin nor the affiliation of this postulated immigrant population can be identified from artifacts or architectural remains.

The architectural and artifactual evidence in Subphase IIa suggest that the site might have been the seat of a Persian vassal and functioned as a local center (M. Omura, 1994; S. Omura, 1992a). The characteristics of the faunal remains, however, do not suggest a particularly rich or elite status for the site, except that cattle, sheep, and goats became larger. There might be a bias caused by the area chosen for sampling, which was probably a dump about 50 meters away from the large public architecture. The picture presented by the faunal remains from subphase IIa is of a fairly stable and mature agro-pastoral economy, based on sheep and goat herding and cultivation using cattle, supplemented by keeping pigs in the household and hunting fowl and hare. This is already largely the same village economy as that of the Middle Ages and of Central Anatolia today (except for the disappearance of pigs in modern Turkey). It can be said that the basic pattern of the agro-pastoral economy in Central Anatolia was already firmly established as early as the Late Iron Age.

As a small site located within the hegemony of powerful empires such as the Hittite and the Phrygian, it was expected that the archaeological sequence at Kaman-Kalehöyük in the 2nd and 1st millennia BC would not exactly fit the existing chronology of Central Anatolia, especially because the major historical events probably affected only the political centers and the upper tier of society. It was also expected that the timing of changes in animal husbandry practices might not have taken place in accordance with changes observed in other archaeological aspects at the site. Information obtained from faunal remains can help us understanding the economic or political status of the population that occupied the site, how major historical events affected the general population, and

whether or not there was continuity in the population. Although far from answering the question of "who lived at the site", this study is intended to be another version of the cultural history of Anatolia where so much of the archaeology has been based on objects from the public architecture at capital sites.

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Appendix I. Standard measurements for *Bos*.

Scapula	Measurement	**SLC**	**GLP**	**LG**	**BG**	
	n	49	54	57	58	
	Mean	48 .7	65 .3	55 .1	45 .2	
	SD	6 .6	6 .7	5 .8	4 .9	
Humerus (n=84)	Measurement	**BT**				
	Mean	68 .6				
	SD	5 .4				
Radius	Measurement	**Bp**	**SD**	**Bd**	**GL**	**BFp**
	n	65	4	59	4	69
	Mean	75 .0	33 .1	67 .2	264 .1	69 .2
	SD	7 .3	3 .3	5 .7	19 .4	6 .5
Metacarpal	Measurement	**Bp**	**Bd**			
	n	135	115			
	Mean	55 .2	56 .9			
	SD	4 .7	5 .2			
Pelvis (n=28)	Measurement	**LA**				
	Mean	63 .0				
	SD	5 .7				
Femur (n=1)	Measurement	**Bd**				
	Mean	72 .0				
	SD	2 .9				
Tibia	Measurement	**Bp**	**Bd**			
	n	4	143			
	Mean	94 .1	58 .0			
	SD	5 .0	4 .9			
Astragalus	Measurement	**GLl**	**GLm**	**Dl**	**Bd**	
	n	188	183	184	180	
	Mean	62 .1	57 .5	34 .3	40 .1	
	SD	4 .0	4 .0	2 .1	3 .5	
Calcaneum (n=64)	Measurement	**GB**				
	Mean	42 .2				
	SD	4 .1				
Metatarsal	Measurement	**Bp**	**Bd**			
	n	113	124			
	Mean	45 .2	52 .8			
	SD	4 .0	4 .9			
Ph1 (anterior)	Measurement	**Bp**	**SD**	**Bd**	**GL**	
	n	215	219	216	222	
	Mean	29 .1	24 .3	27 .5	55 .6	
	SD	2 .8	2 .8	2 .8	3 .7	
Ph1 (posterior)	Measurement	**Bp**	**SD**	**Bd**	**GL**	
	n	199	201	198	203	
	Mean	26 .6	22 .5	25 .6	57 .6	
	SD	3 .1	2 .9	2 .7	4 .3	
Ph2 (anterior)	Measurement	**Bp**	**SD**	**Bd**	**GL**	
	n	173	173	168	175	
	Mean	28 .9	23 .2	25 .2	36 .9	
	SD	2 .7	2 .8	2 .5	2 .9	
Ph2 (posterior)	Measurement	**Bp**	**SD**	**Bd**	**GL**	
	n	155	153	149	158	
	Mean	26 .8	21 .6	22 .8	38 .0	
	SD	2 .3	2 .0	2 .0	2 .8	
Ph3 (n=14)	Measurement	**GL**	**Ld**			
	Mean	65 .8	51 .3			
	SD	8 .1	4 .3			

Based on measurement data from Lidar Höyük (Kussinger 1988).
Means and standard deviations (SD) calculated based on measurement data.
Published mean and SD were used for scapula, metacarpal, femur, astragalus, metatarsal, ph1 and ph2.

Appendix 2. Standard measurement for *Sus.*
Measurements of 'SU 12' at the Archaeozoology Laboratory, University of Tübingen.

Scapula	meas.	**SLC** 26 .0	**GLP** 36 .5	**LG** 32 .5	**BG** 25 .5	**HS** 217 .0	**DHA** 205 .0	**Ld** 122 .0			
	Log	1 .415	1 .562	1 .512	1 .407	2 .336	2 .312	2 .086			
Humerus	meas.	**Bd** 42 .5	**BT** 30 .5	**SD** 18 .0	**Bp** 65 .0	**GLC** 182 .5	**GL** 209 .5	**Dd** 40 .5	**GLT** 29 .0	**LT(mid)** 20 .0	**LT(lat)** 23 .0
	Log	1 .628	1 .484	1 .255	1 .813	2 .261	2 .321	1 .607	1 .462	1 .301	1 .362
Radius	meas.	**Bp** 29 .0	**SD** 18 .0	**Bd** 34 .0	**GL** 157 .0	**BFd** 31 .0	**Dp** 22 .0	**DFd** 17 .0			
	Log	1 .462	1 .255	1 .531	2 .196	1 .491	1 .342	1 .230			
Ulna	meas.	**BPC** 23 .5	**DPA** 39 .0	**SDO** 30 .5	**GL** 209 .0	**LO** 62 .5					
	Log	1 .371	1 .591	1 .484	2 .320	1 .796					
Metacarpal III	meas.	**Bp** 20 .0	**Dp** 19 .5	**SD** 14 .0	**Bd** 17 .0	**Dd** 18 .0	**GL** 74 .5				
	Log	1 .301	1 .290	1 .146	1 .230	1 .255	1 .872				
Metacarpal IV	meas.	**Bp** 16 .5	**Dp** 16 .5	**SD** 12 .0	**Bd** 17 .5	**Dd** 17 .5	**GL** 76 .0				
	Log	1 .217	1 .217	1 .079	1 .243	1 .243	1 .881				
Pelvis	meas.	**LA** 37 .5	**GL** 235 .0	**LFo** 45 .0	**BFo** 32 .0	**SC** 24 .5	**SH** 31 .5	**LAR** 13 .5			
	Log	1 .574	2 .371	1 .653	1 .505	1 .389	1 .498	1 .130			
Femur	meas.	**Bp** 58 .0	**DC** 26 .0	**SD** 20 .5	**Bd** 50 .0	**B.troch.** 23 .0	**GLC** 221 .0	**Dd** 60 .5			
	Log	1 .763	1 .415	1 .312	1 .699	1 .362	2 .344	1 .782			
Tibia	meas.	**Bp** 54 .0	**SD** 21 .0	**Bd** 30 .5	**Dd** 26 .5	**GL** 205 .0					
	Log	1 .732	1 .322	1 .484	1 .423	2 .312					
Astragalus	meas.	**GLl** 40 .5	**GLm** 39 .0	**Dl** 21 .0	**Dm** 24 .5	**Bd** 26 .5	**Bp** 21 .0				
	Log	1 .607	1 .591	1 .322	1 .389	1 .423	1 .322				
Calcaneum	meas.	**GL** 82 .5	**GB** 23 .5	**GDl** 31 .0	**sm.D.T** 20 .5	**L.Tub.** 52 .0					
	Log	1 .916	1 .371	1 .491	1 .312	1 .716					
Metatarsal III	meas.	**Bp** 15 .5	**Dp** 22 .5	**SD** 12 .5	**Bd** 16 .5	**Dd** 17 .5	**GL** 82 .5				
	Log	1 .190	1 .352	1 .097	1 .217	1 .243	1 .916				
Metatarsal IV	meas.	**Bp** 16 .0	**Dp** 24 .5	**SD** 12 .5	**Bd** 16 .0	**Dd** 18 .5	**GL** 91 .5				
	Log	1 .204	1 .389	1 .097	1 .204	1 .267	1 .961				
Phalanx1	meas.	**Bp** 16 .8	**SD** 13 .5	**Bd** 15 .2	**GL** 36 .5	**Dp** 16 .7	**min.D.** 9 .5	**Dd** 10 .7			
	Log	1 .225	1 .130	1 .182	1 .562	1 .223	0 .978	1 .029			
Phalanx 2	meas.	**Bp** 16 .3	**SD** 13 .5	**Bd** 14 .5	**GL** 24 .3	**Dp** 16 .5	**min.D.** 10 .5	**Dd** 13 .8			
	Log	1 .211	1 .130	1 .161	1 .385	1 .217	1 .021	1 .140			
Phalanx 3	meas.	**GL** 32 .5	**Ld** 31 .5	**MBS** 13 .0							
	Log	1 .512	1 .498	1 .114							

Note: Standards for Ph1, Ph2, and Ph3 are the average of anterior and posterior III and IV