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ANIMAL HUSBANDRY AT THE EARLY NEOLITHIC TO EARLY BRONZE AGE SITE OF BADEMAĞACI (ANTALYA PROVINCE, SW TURKEY): EVIDENCE FROM THE FAUNAL REMAINS

Bea De Cupere[1], Refik Duru[2], Gülsün Umurtak[3]

ABSTRACT

Excavations at the mound of Bademağacı have yielded faunal assemblages that were retrieved from levels dated from the Early Neolithic up to the Early Bronze Age. These faunal remains have been used to obtain information on the subsistence of the site. Special attention has been paid to the wild or domestic status of pig, sheep, goat and cattle. Osteometry (using raw measurement data, size indices and mixture analysis), kill-off patterns and sex ratios evidence the domestic status of not only sheep and goat but also of cattle and pig from the beginning of the 7th millennium BC onwards. Diachronic size changes of cattle and sheep, changes in the relative abundance of the pig, sheep/goat and cattle remains, and slaughtering ages have been used to indicate changes in herd management through time. These management changes involved a shift from meat production to an emphasis on dairying practices, and the necessity of coping with environmental limitations.

Keywords: SW-Turkey, Early Neolithic/Early Bronze Age, domestication, pigs, sheep, goats, cattle, osteometry, kill-off patterns, herd management.

RÉSUMÉ

Les fouilles du site de Bademağacı ont livré des collections de restes fauniques qui proviennent des niveaux du Néolithique ancien jusqu'à l'âge du Bronze. Ces restes fauniques ont été analysés afin d'obtenir des informations sur la subsistance des occupants du site. Une attention particulière a été prêtée au statut sauvage ou domestique des cochons, des moutons, des chèvres et des bœufs. Plusieurs aspects, c'est-à-dire l'ostéométrie (en employant les données brutes des mesures, les indices de taille et l'analyse des mélanges), les profils d'abattage et les proportions des sexes, mettent en évidence le statut domestique non seulement du mouton et de la chèvre, mais aussi du bœuf et du porc à partir du début du VII^e^ millénaire av. J.-C. Les

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changements de la taille du bœuf et du mouton, les variations des proportions des ossements de cochon, de caprinés et de bœufs ainsi que les profils d'abattage ont été employés pour indiquer les modifications de la gestion des troupeaux au cours des différentes périodes. Ces modifications impliquent une conversion de la production de viande aux produits laitiers, et devaient faire face à des limitations environnementales.

Mots-clés : *Sud-Ouest de la Turquie, Néolithique ancien/âge du Bronze, domestication, porc, mouton, chèvre, bœuf, ostéométrie, profils d'abattage, gestion des troupeaux.*

INTRODUCTION

Bademağacı Höyük is situated in the south of the Lake District (South-Western Turkey), about 50 km north of Antalya, near the town of Bademağacı (*fig. 1*). The mound lies at an altitude of 780 m a.s.l. on a small plain surrounded on all sides by mountains (*fig. 2, 3*), and located about 5 km north of the Çubuk Beli natural gorge between the Taurus Mountains and the flat plain of Antalya. Bademağacı Höyük is an oval shaped mound of about 90 m by 200 m rising about 9 m above the level of the plain.

Fig. 1—Geographical location of Bademağacı Höyük.

Fig. 2—Aerial picture of the excavations at the mound of Bademağacı.

Fig. 3—View from the mound onto the plain of Bademağacı.

Excavations were started in 1993 by a research team from Istanbul University, under the directorship of Refik Duru and his colleague Gülsün Umurtak, and have continued every year since then (Duru 1997a, b, 1998, 2000, 2001, 2003, 2005). The fieldwork mainly took place in the centre and the northern part of the mound and revealed settlements and archaeological finds from various periods (*table 1*). The remnants of a "church" were uncovered at the highest point on the mound, but there is no evidence of a related settlement and associated pottery or small finds are lacking. The Middle Bronze Age (MB) is represented by a small number of stone foundations only. These have been found near the "church", very close to the surface, together with a limited number of artefacts. The architectural remains have recently been severely damaged by agricultural activities. The Early Bronze Age (EBA II), on the other hand, is evidenced by three architectural levels and a stone paved terrace, which could be followed along the slopes of the mound. The youngest EBA settlement level (EBA II-1) is represented at the centre of the mound, next to the MB foundations, by walls made of large stones. The second EBA settlement phase (EBA II-2 and 3) is represented by several houses with an identifiable plan, *i.e.* from the megaron-like and megaron-type. These ruins were found in the northern part of the mound and continued towards the south. All the houses are built side by side, with their opening facing towards the centre of the mound. The architectural remains of the EBA settlement in the central part of the höyük indicate multi-roomed building groups with different plans. It seems that the settlement at Bademağacı was an important town during the Early Bronze Age.

A large number of pottery fragments and complete vessels, found in the central and eastern sections of the mound, belong to the Late Neolithic period (LN) but possibly extend into the Early Chalcolithic period (ECh). Related architectural remains consist of the thick stone foundations of a house. Large amounts of pottery were collected from the debris accumulation under the EBA houses, which probably date to a later period than LN-ECh and are likely to belong to the Late Chalcolithic period (LCh).

The Early Neolithic levels were divided into two groups. The upper levels (EN II) mainly represent the remnants of houses made from sun-dried mud bricks. Level 3 (EN II-3) corresponds to 9 houses. These are, with the exception of house 8, all single-roomed houses that are almost square in plan. House 8 consists of two rooms and has obviously larger dimensions than the others. Nine human skeletons were found within this house, while another skeleton was found just outside the door. Level 4B (EN II-4B) and level 4A (EN II-4A) consist of one and two houses respectively, while level 4 (EN II-4) corresponds to a small room/structure which could not be identified with certainty.

Cultural period	Architectural stratigraphy	
Christian Period (CP)	"church"	
Middle Bronze Age (MBA)	Two architectural levels	MBA 1 MBA 2
Early Bronze Age (EBA II)	Three architectural levels	EBA II–1 EBA II–2 EBA II–3
Late Chalcolithic period (LCh)	?	
Early Chalcolithic period (ECh)	?	
Late Neolithic period (LN)		
Early Neolithic period (EN II)	Seven architectural levels	EN II–1 EN II–2 EN II–3 EN II–3A EN II–4 EN II–4A EN II–4B
Early Neolithic period (EN I)	Five architectural levels	EN I–5 EN I–6 EN I–7 EN I–8 EN I–9

Table 1—Cultural sequence and stratigraphy at Bademağacı.

The lower levels, belonging to the Early Neolithic period (EN I), consisted of five levels and were unearthed in two deep trenches in the centre of the mound. These oldest levels yielded no architectural remains, but were distinguished by the identification of floor levels and pottery finds. It is suggested that in these earlier levels walls were constructed using the wattle and daub technique. Level 8 (EN I-8) was characterised by a hard limestone plaster, covering level 9 (EN I-9) which was situated on top of the virgin soil. Levels from the Aceramic Neolithic seem to be absent on this site.

Several small finds, *e.g.* stamp seals, retrieved at Bademağacı from within the EN levels show close similarities with those found at Çatalhöyük and other sites near Izmir (Duru 2003, 2005). This indicates that there were close contacts between the western Anatolian, Neolithic, cultures, from the Konya plain to the region of Burdur, and from there to the Aegean coastal areas.

Radiocarbon dating has been carried out on several samples from the EN (*table 2*) and shows that the earliest occupation at Bademağacı dates back to around 7100 cal. BC. As already mentioned, there appears to be no Aceramic Neolithic phase at this site.

Laboratory nr	Level	Uncalibrated date	Calibrated (1 σ)	Calibrated (2 σ)
Hd 21046	EN II–1	7307 ± 41 B.P.	6220-6080 BC	6230-6060 BC
Hd 21058	EN II–3	7459 ± 51 B.P.	6390-6240 BC	6430-6220 BC
Hd 20910	EN II–3	7546 ± 41 B.P.	6450-6270 BC	6460-6250 BC
Hd 21015	EN II–4	7481 ± 40 B.P.	6400-6250 BC	6420-6230 BC
Hd 21016	EN II–4	7424 ± 37 B.P.	6380-6230 BC	6400-6110 BC
Hd 22279	EN II–4A	7465 ± 27 B.P.	6390-6250 BC	6405-6235 BC
Hd 22339	EN II–3A/4	7553 ± 31 B.P.	6440-6405 BC	6460-6275 BC
Hd 22340	EN I–8	7949 ± 31 B.P.	7035-6705 BC	7050-6690 BC

Table 2—Radiocarbon dates of Bademağacı (calibration following Stuiver et al. *1998).*

THE FAUNAL MATERIAL

The faunal remains were identified in the field by the first author during the campaigns of 1998, 1999 and 2005. The material was mainly hand-collected; no sieving was carried out during the excavation of the upper levels but in the deep trenches all sediment from the EN I levels (5 to 9) was screened using a 4 mm mesh. In general, the faunal remains were very well preserved and had a rather dark colour. Almost all show a similar good state of preservation and only a minority of the material has been burnt. Not all stratigraphic levels yielded animal remains, and certainly not in the same quantities. Most of the material was collected from the early Neolithic levels, especially from the EN II period. Many bone objects were found, including both tools and decorative elements, but these are not included in this report. Human remains are also omitted.

Non-mammalian remains were very low in number. Shells of molluscs were found in very small quantities and include both marine species and terrestrial gastropods. The marine species (n = 20), represented by *Cypraea*, *Glycymeris* and *Murex* among others species, were mainly retrieved from levels dated to the EN II period. Some of the *Glycymeris* shells have drilled holes at the umbo, indicating that these marine shells were used for adornment. Land snails were represented by large gastropods of the genus *Helix* (n = 34). The shells of the latter were not restricted to the EN, but also occurred in levels dated to the Late Neolithic/Early Chalcolithic and the Bronze Age period. These shells are considered to be the remains of intrusive animals that lived on the site during or after the human occupation. An almost complete skeleton of a toad or a frog (Anura) collected from the EN II (level 2) is similarly considered to be intrusive. Reptile remains are restricted to six finds of tortoise bones (*Testudo graeca*) in levels of the EN I and EN II. No anthropogenic traces were visible on these bones and it is assumed that these are also the remains of intrusive animals. Only six bird bones were recovered in total. The identification of these elements was problematic since no reference material was available in the field. One large clavicula was tentatively identified as be longing to a great bustard (*Otis tarda*). In addition, there was the shaft of a large humerus, probably from a swan (*Cygnus* sp.), an ulna of a duck (Anatinae) and a carpometacarpal of a passerine bird (Passeriformes). All six bird bones were dated to the EN II.

The taxonomic composition of the mammalian remains from Bademağacı is given in tables 3 to 5. Measurements taken from these finds are listed in appendix 1. Remains of small mammals were very rare: there was one skull of a lesser mole rat (*Spalax leucodon*) in an EBA II level and some postcranial bones of a small rodent (Rodentia) were recovered in a house dated to EN II (level 4B). Bones of European hare (*Lepus europaeus*) were more frequent (n = 39), although their relative number (0.5% of the total number of identified mammal remains) is still very low. This lagomorph was identified in almost all levels, but was most abundant in EN II levels. Three bones—two mandibles and a pelvis—have been identified as wild cat (*Felis silvestris*). A metacarpal and a metatarsal are most probably from the same species but could not be identified with certainty due to the lack of comparative material in the field. All these finds have been derived from levels dating to the EN II. Dated to the same period are two brown bear (*Ursus arctos*) bones, an ulna and a metapodial. Of the metapodial only the proximal part is preserved; this specimen shows exostoses all around the articular surfaces. The presence of the brown bear must be related to a landscape of wooded hills and mountains. In open steppe, bears occur in low numbers or may even be completely absent. The remaining carnivore represented at Bademağacı is the red fox (*Vulpes vulpes*). Like the hare, its remains (n = 24) were recovered in most levels. Remains of cervids were rather common and consisted mainly of fallow deer (*Dama dama*) and roe deer (*Capreolus capreolus*), although some bones could also be assigned to red deer (*Cervus elaphus*). The presence of the cervids indicates an open landscape around the site, with some woodland and shrubs. There were many antler fragments, from the EN II onwards, most of which showing signs of having been worked. It is clear that this material must have been collected deliberately because several of the antler fragments derived from shed specimens. Not all antler fragments could be identified to species, but it appears that all three deer species are represented by antler, with apparently a preponderance of fallow deer. Only a few pieces could be positively identified as roe deer and red deer. The antler fragments have been listed separately in tables 3 to 5.

Remains of domestic dog (*Canis lupus* f. *familiaris*) were mainly found in the uppermost level of the EN I and in all levels of the EN II period. Although only few bones were measurable (*appendix 1*), it is clear

that dogs of different sizes lived on the site, as remains of small, medium and large-sized individuals were retrieved from the excavations. The greatest length of a complete tibia from the EN II (level 1) indicates a small animal with a height at the shoulder of about 40.5 cm (using the multiplication factors by Koudelka 1885, summarised in von den Driesch and Boessneck 1974). The remains of a similar small-sized dog were collected from another level of the EN II (level IV) and from a level dated to the EBA. Most of the canine remains, however, seem to originate from medium-sized animals.

The majority of the mammalian fauna consists of the remains of pigs (17%), sheep and goats (51%) and cattle (23%). For all of these species, the possible occurrence of both the domestic and the wild forms had to be considered. The abundance of these four taxa, combined with the relative scarcity of cervids and other game already strongly suggests the presence of domestic animals at the site (cf. Lawrence 1980). However, since their wild ancestors also lived in the region, the wild and/or domestic status of these taxa needs to be established. Of the various criteria defined for the recognition of an early domestic status on the basis of skeletal remains (for an overview see Vigne *et al*. 2005), mortality curves, sex ratio and osteometry have been used here. Although size indices (LSI) are broadly applied in the literature, they are very sensitive to allometric variations, especially in the case of small samples (see Meadow 1999). It was decided, therefore, to use raw data as much as possible.

Pig

Osteometrical data were obtained from a number of elements and mainly included early fusing bones such as scapula (GLP), distal humerus (Bd), proximal radius (Bp) and distal tibia (Bd). Since these elements continue to grow for some time after epiphysial closure (Payne, Bull 1988; Albarella, Payne 2005), individuals that were not yet fully adult may explain the occurrence of small-sized specimens in the assemblage. Indeed, analysis of the dental eruption stages and of the epiphysial closure of the postcranial elements from Bademağacı shows that mainly young animals were butchered at the site (see below). Furthermore, sexual dimorphism is also responsible for differences in the size of bones (Payne, Bull 1988). Therefore, the measurements taken on the Bademağacı pigs were compared to measurements taken on the bones of Turkish wild boars of known age and sex (Payne, Bull *ibid.*; Hongo, Meadow 1998, 2000). The data on the pig remains from Höyücek, a Neolithic site about 50 km to the north of Bademağacı (see De Cupere, Duru 2003), were included within these plots (*fig. 4*). Even though the number of observations is rather limited, the dataset of Bademağacı indicates (at least) two groups, *i.e.* a group of larger animals and a group of smaller ones. A clear gap is visible between these two groups. The measurements of the recent wild boar, on the contrary, display a continuous plot of data with female animals on the left side and male animals on the right side. Although sexual dimorphism is present in wild boar, with females smaller than males, there is some size overlap between both groups and no clear gap occurs between the measurements of both groups. Indeed, pig remains cannot be easily discriminated on the basis of metric data (Albarella, Payne 2005). Moreover, the measurements taken on the long bones of the modern wild boars include those of young animals as well, with some of their articular ends still fusing. These data are also included in figure 4. The measurements from Bademağacı and Höyücek were exclusively taken from fully fused specimens. The bimodal distribution in the measurements of the Bademağacı material is therefore not related to sexual dimorphism or to age. The difference in size can only be interpreted in terms of two populations, *i.e.* wild and domestic. The absence of intermediate values indicates that (almost) no interbreeding between these two populations occurred and that the herded animals were kept well apart from wild boar. The modern wild boars used here are considered to be relatively small compared to the prehistoric Anatolian specimens (cf. Peters *et al*. 2005). Therefore, it is not surprising to see that the group of wild boars of Bademağacı includes values that are larger than those of the modern male wild boars. When the LSI values of all available breadth measurements taken on the post-cranial elements are calculated, using as a standard the female wild boar published by Hongo and Meadow (1998, 2000), the separation between the two groups is also prominent, the first group being smaller than the standard and the second being larger than the standard (*fig. 5*).

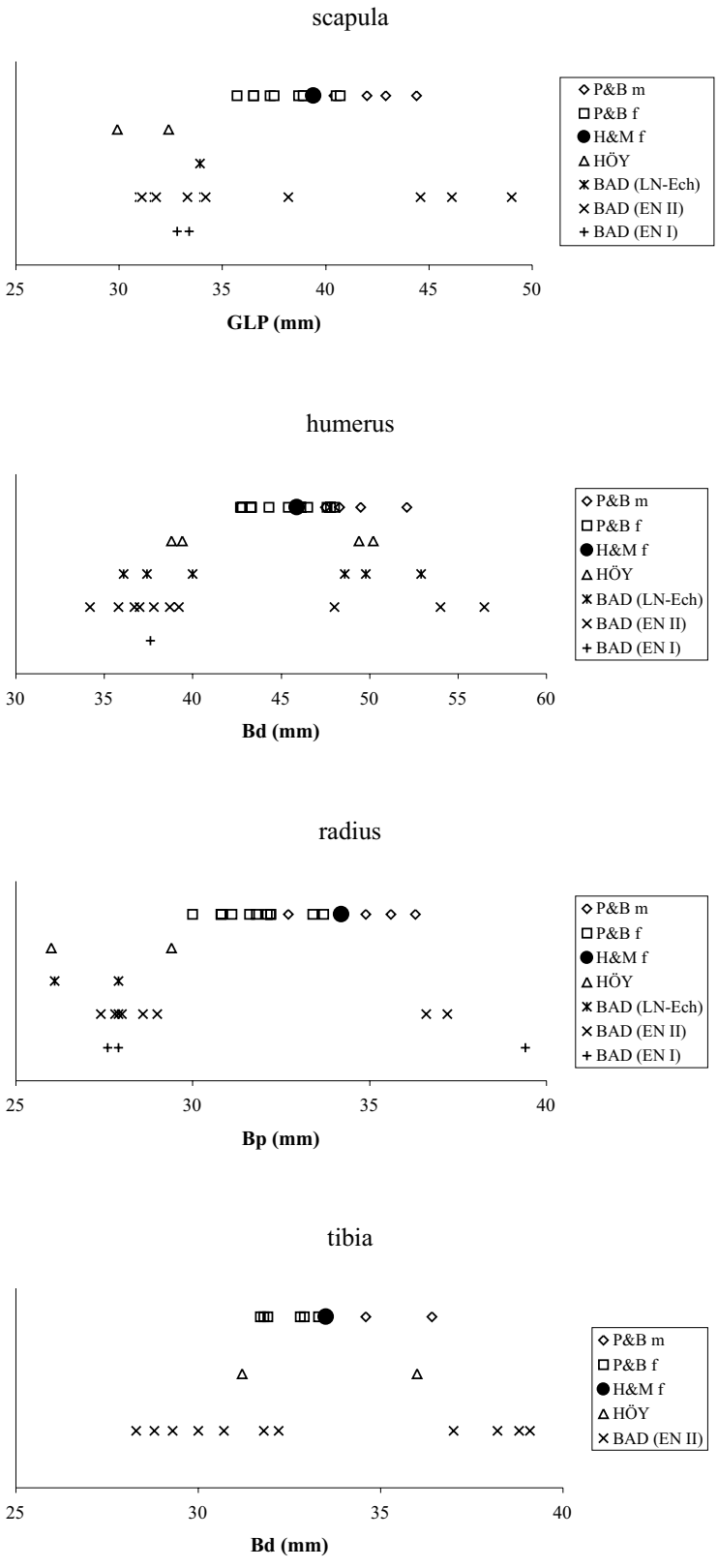

Fig. 4—Measurements of pig (P and B: modern wild boar after Payne and Bull (1988); H and M: modern female wild boar after Hongo and Meadow (2000); f: female; m: male; HÖY: Höyücek; BAD: Bademağacı).

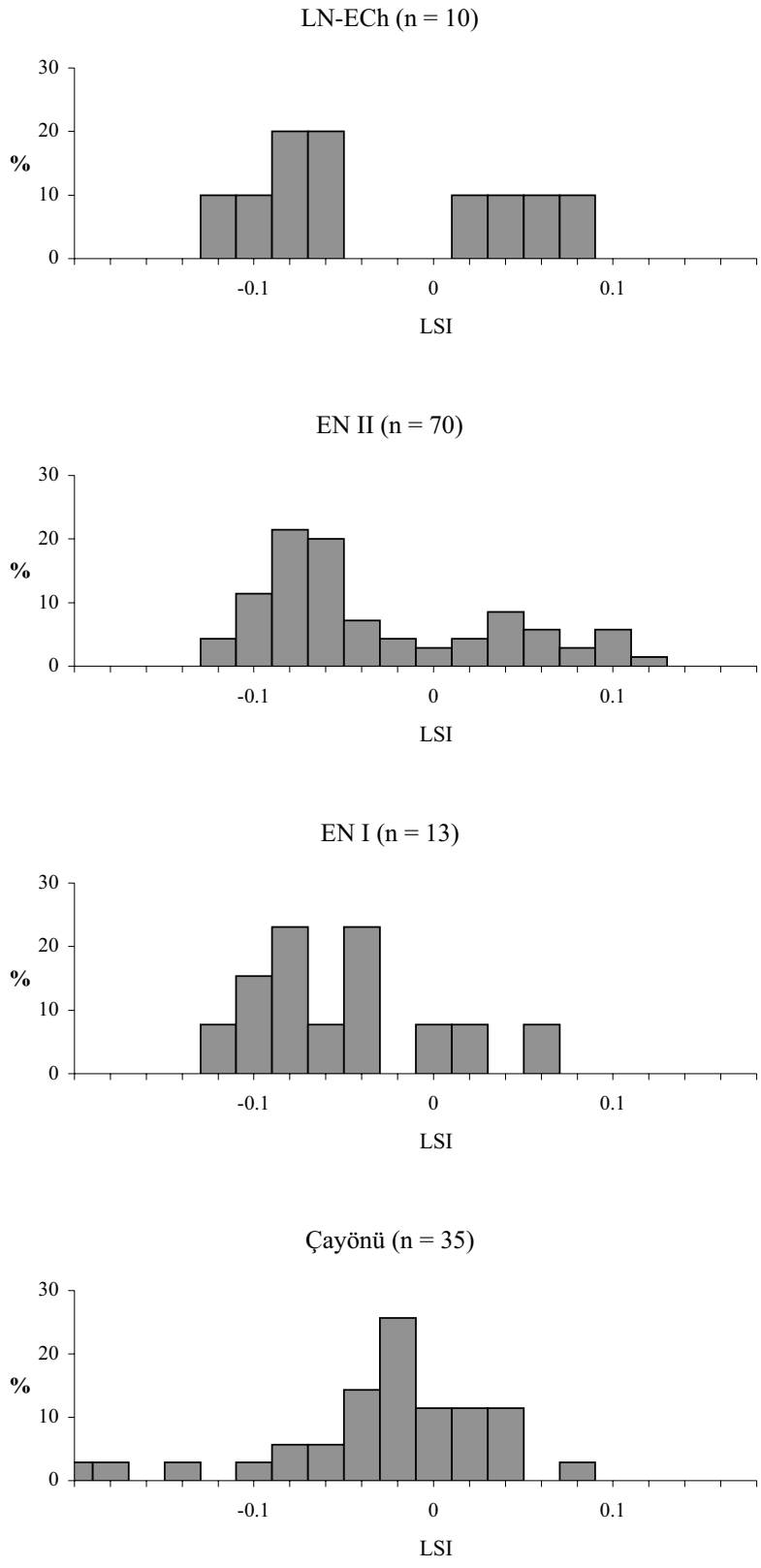

Fig. 5—Logarithmic size index (LSI) data for pig per phase at Bademağacı, compared to the "large-room building phase" of Çayönü (data after Ervynck et al. *2001).*

Using the eruption and wear of the mandibular teeth, an attempt was made to establish the age at slaughter of pigs during the successive periods of Bademağacı (*table 6*). In general, pigs were mainly slaughtered before 2 years of age. Mandibles with moderately and strongly worn third molars, *i.e.* from individuals older than 3 years of age, are almost completely absent from the collection. However, the number of observations is not equally distributed among the different periods; only the material dated to the EN II yielded a sufficiently high number of mandibles (n = 67) to allow firm conclusions. During the later Early Neolithic almost 40% of the pigs were slaughtered before 1 year of age, 34% died during the following, second, year. Less than a quarter of the pigs were slaughtered between 2 and 3 years of age, while only a few specimens (5%; n = 3) were older than 3 years.

Considering both the size differences and the kill-off pattern, it is hypothesised that the pigs of Bademağacı were domesticated. Both domestic and wild pigs are present in the assemblage, but establishing their exact ratio is difficult. However, it is obvious from the plots and the mortality curve that the domestic animals were more abundant than the wild boars. Because it is impossible to assign each individual bone to either the wild or domestic form, the Suidae remains are indicated in tables 3-5 as "wild boar/pig".

Sheep and goat

Caprines dominate the faunal collection, with sheep outnumbering goats (*table 3-5*). There is no doubt about the presence of domestic forms of both species, as shown by the small size of many postcranial bones and the morphology of some of the horn cores (for measurements see *appendix 1*). However, remains of wild goat and wild sheep are definitely present as well.

Among the sheep remains a few elements, including a distal humerus, two distal metacarpals and an unfused calcaneus, were clearly larger in size and could therefore be identified with certainty as wild sheep. It is not excluded that some additional remains of wild sheep may be present, but their number must be relatively low. The presence of complete long bones allowed estimation of the withers height of the sheep (using the factors of Teichert, summarised in von den Driesch, Boessneck 1974). These heights range between 52 cm and 60 cm during the EN I and EN II periods. Values are a little higher, *i.e.* between 58 and 62 cm, during the LN-ECh but the number of observations is low (n = 5). To verify a possible increase in size, the logarithmic size index (LSI) was calculated from all available sheep measurements (*fig. 6*). The measurements of a female wild sheep, published by Uerpmann and Uerpmann (1994) are used here as a standard. When the median is considered, a slight decrease in size is visible from the EN I up to LN-ECh, whereas values increase again during the EBA II. These data hence do not support the size trend indicated by the withers height values.

The number of wild goat remains is much higher. In several instances there was no doubt concerning their identification but in many cases it was not possible to classify goat finds as either domestic or wild due to the incompleteness and fragmentation of the material. Logarithmic size indices were calculated for goat, using as standard the measurement values published by Uerpmann and Uerpmann (1994) (these are given in *fig. 7*). The histograms show a large variation in the size of the goats, including small and large sized animals, and clearly indicate that a certain proportion of the remains belong to wild goat. But, as was the case with the pigs, it is impossible to establish the exact ratio of wild to domestic.

Identification of the caprine mandibles to species level was not attempted, although recently some suitable criteria have been published (Helmer 2000a; Halstead, Collins 2002). The study of the Bademağacı material was largely carried out before the publication of these criteria. Therefore, the caprine mandibles will have to be re-examined at a later stage. Nevertheless, the data on mandibular tooth eruption and wear are compiled in table 7. Assuming that goats and sheep were similarly managed, and that the number of mandibles of hunted wild goats is limited in our studied collection, caprines appear to have been slaughtered when relatively old. While it is generally assumed that caprines were still mainly exploited for their meat during the late PPN, as shown by a high proportion of immature animals (*e.g.* Gürcütepe, Peters *et al*. 2005), it is clear that the opposite is true at Bademağacı. During the EN II about 40% of the caprines were killed off at the age of 4 years or more, while only 30% were slaughtered at an age younger than 2 years. A similar pattern is observed for the Late Neolithic-Early Chalcolithic period.

	Level				
	9	8	7	6	5
European hare, *Lepus europaeus*	.	.	2	5	2
Red fox, *Vulpes vulpes*	.	.	.	2	1
Roe deer, *Capreolus capreolus*	.	2	.	3	7
Fallow deer, *Dama dama*	.	1	.	3	11
Red deer, *Cervus elaphus*	.	.	.	1	3
Cervidae indet.	.	.	.	.	5
Antler	.	1	1	.	3
Dog, *Canis lupus* f. familiaris	.	.	1	1	21
Canidae indet.	.	2	.	5	1
Wild boar/domestic pig, *Sus scrofa*/*Sus scrofa* f. domestica	3	11	20	156	126
Wild goat/domestic goat, *Capra aegagrus*/*Capra aegagrus* f. hircus	.	4	1	19	15
Wild sheep/domestic sheep, *Ovis ammon*/*Ovis ammon* f. aries	14	15	7	18	26
Goat/sheep, *Capra*/*Ovis*	46	26	70	279	311
Cattle, *Bos primigenius* f. taurus	.	14	28	200	99
Total identified	63	76	130	692	631
Unidentified mammals	148	105	120	906	673

Table 3—Taxonomic composition of the mammalian remains, dated to the EN I.

	Level						
	4B	4A	4	3A	3	2	1
European hare, *Lepus europaeus*	.	3	4	3	6	8	3
Rodentia indet.	4	.	.	.	.	.	.
Wild cat, *Felis silvestris*	.	.	.	1	2	1?	1?
Brown bear, *Ursus arctos*	.	.	1	.	.	1	.
Red fox, *Vulpes vulpes*	.	.	5	2	1	2	2
Roe deer, *Capreolus capreolus*	1	.	28	.	14	6	11
Fallow deer, *Dama dama*	.	2	26	7	20	35	26
Red deer, *Cervus elaphus*	.	2	4	.	3	5	3
Cervidae indet.	.	.	.	3	4	.	.
Antler	.	1	8	3	16	12	14
Dog, *Canis lupus* f. familiaris	1	3	6	6	15	6	10
Canidae indet.	.	.	5	.	.	3	.
Wild boar/domestic pig, *Sus scrofa*/*Sus scrofa* f. domestica	14	27	299	40	183	150	94
Wild goat/domestic goat, *Capra aegagrus*/*Capra aegagrus* f. hircus	2	3	44	13	53	39	32
Wild sheep/domestic sheep, *Ovis ammon*/*Ovis ammon* f. aries	2	9	83	35	54	55	45
Goat/sheep, *Capra*/*Ovis*	15	41	694	140	711	245	177
Cattle, *Bos primigenius* f. taurus	12	52	195	71	248	207	114
Total identified	51	143	1412	324	1330	774	531
Unidentified mammals	1	39	1015	??	1381	118	188

Table 4—Taxonomic composition of the mammalian remains, dated to the EN II.

	Level				
	EN I	EN II	EN	LN-ECh	EBA II
European hare, *Lepus europaeus*	9	27	.	1	2
Lesser mole rat, *Spalax leucodon*	.	.	.	.	1
Rodentia indet.	.	4	.	.	.
Wild cat, *Felis silvestris*	.	3+2?	.	.	.
Brown bear, *Ursus arctos*	.	2	.	.	.
Red fox, *Vulpes vulpes*	3	12	.	7	2
Roe deer, *Capreolus capreolus*	12	60	.	.	5
Fallow deer, *Dama dama*	15	116	3	15	9
Red deer, *Cervus elaphus*	4	17	1	2	6
Cervidae indet.	5	7	.	3	2
Antler	5	54	4	9	33
Dog, *Canis lupus* f. familiaris	23	47	.	1	6
Canidae indet.	8	8	.	.	.
Wild boar/domestic pig, *Sus scrofa*/*Sus scrofa* f. domestica	316	807	18	91	27
Wild goat/domestic goat, *Capra aegagrus*/*Capra aegagrus* f. hircus	39	186	9	26	18
Wild sheep/domestic sheep, *Ovis ammon*/*Ovis ammon* f. aries	80	283	9	24	18
Goat/sheep, *Capra*/*Ovis*	732	2023	28	193	70
Cattle, *Bos primigenius* f. taurus	341	899	58	278	135
Total identified	1600	4552	130	671	334
Unidentified mammals	1954	2742	14	82	61

Table 5—Taxonomic composition of the mammalian remains from all periods.

		EN I (n = 12)	EN II (n = 67)	LN-ECh (n = 17)	EBA II (n = 6)
M_1 absent, Pd_4 present M_1 erupting M_1 worn, M_2 absent M_2 erupting	< 1 year	6	26/39%	4	2
M_3 erupting	1-2 years	4	23/34%	6	2
M_3 little worn (a-d)	2-3 years	2	15/22%	7	2
M_3 medium worn (e-g) M_3 strongly worn (h-k)	> 3 years	.	3/5%	.	.

Tabl. 6—Slaughter age of pigs per phase, based on eruption and wear of mandibular teeth; wear stages according to Grant (1982) are given between brackets for the third molars.

		EN I (n = 9)	EN II (n = 121)	LN–ECh (n = 53)	EBA II (n = 17)
M_1 absent, Pd_4 present M_1 erupting M_1 worn, M_2 absent M_2 erupting	< 1 year	.	23/19%	7/13%	.
M_3 erupting	1-2 years	2	15/12%	10/19%	2
M_3 little worn (a-e)	2-4 years	2	35/29%	15/28%	7
M_3 medium worn (f-h) M_3 strongly worn (j-m)	> 4 years	5	48/40%	21/40%	8

Table 7—Slaughter age of sheep/goats per phase, based on eruption and wear of mandibular teeth; wear stages according to Grant (1982) are given between brackets for the third molars.

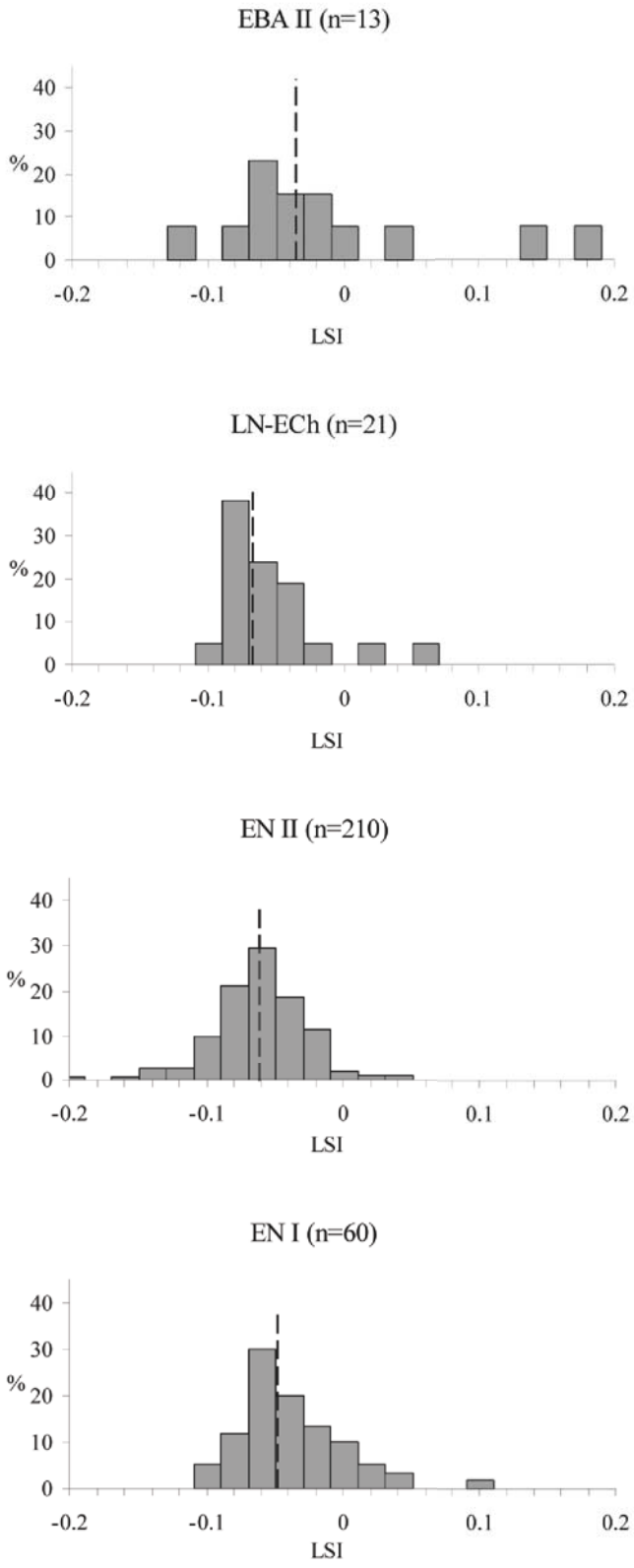

Fig. 6—Logarithmic size index (LSI) data for sheep phase at Bademağacı; median is indicated by dashed line.

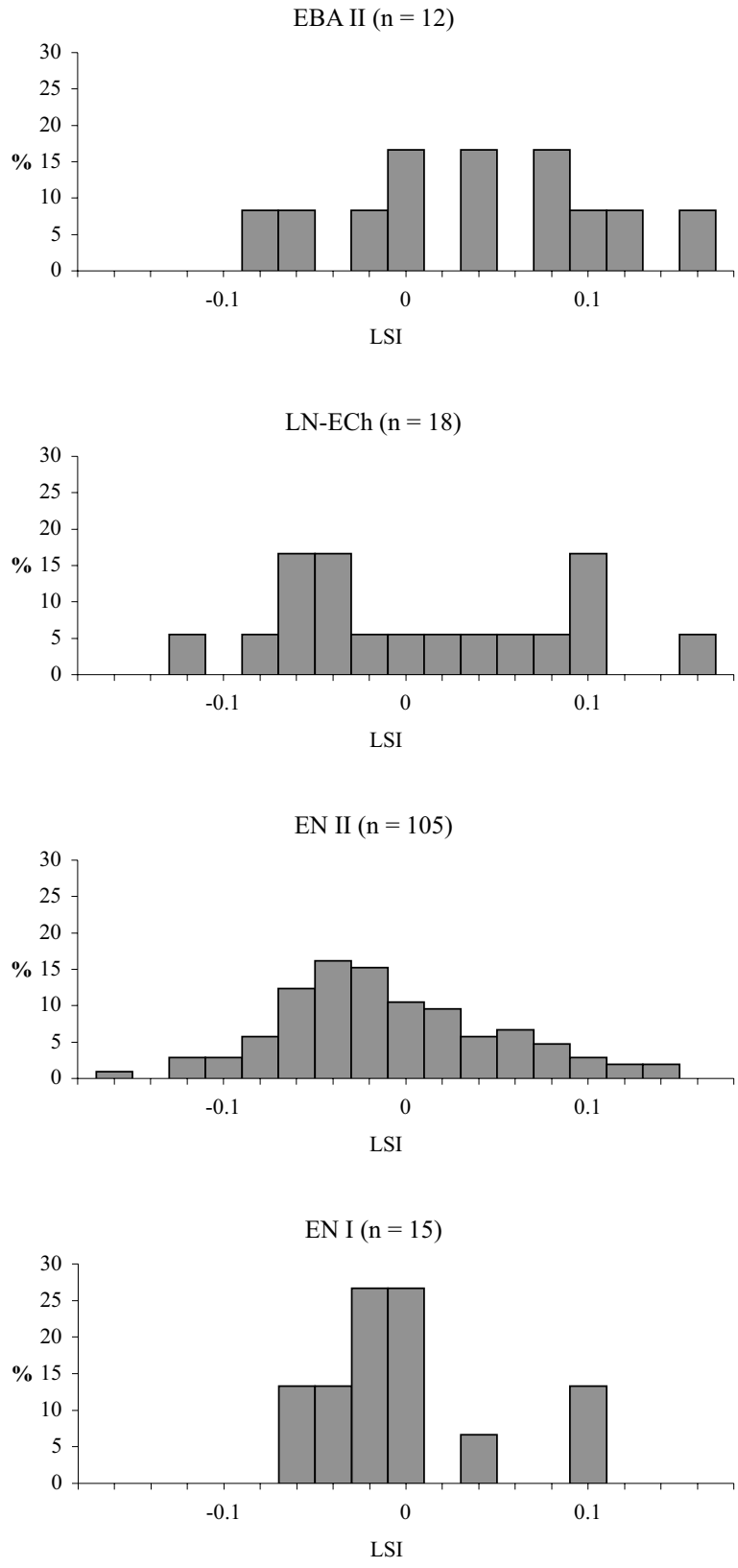

Fig. 7—Logarithmic size index (LSI) data for goat per phase at Bademağacı.

Cattle

Possible indications for the domestic status of cattle at an Early Neolithic site are: a reduction in size, a sex ratio with a high proportion of females, and a younger kill-off pattern (cf. Peters *et al*. 2005). These three criteria were used to establish the wild or domestic status of cattle at Bademağacı.

The osteometric analysis of the cattle remains given here first considers the raw measurements of the astragalus (GLl). Most faunal assemblages taken into account here provided numerous measurements of this skeletal element, since it is generally well preserved due to its compact structure. Range and mean of the greatest lateral length (GLl) of the astragali from different sites are given in figure 8. Data from the following prehistoric sites were used: Mureybet (Ducos 1978), Demircihüyük (Rauh 1981), Göbekli Tepe (von den Driesch, Peters 1999), Çayönü (Cobble-paved building phase, Öksüz 2000), Gürcütepe, Mersin-Yumuktepe (Buitenhuis, Caneva 1998), Höyücek (De Cupere, Duru 2003) and Fikirtepe (Boessneck, von den Driesch 1979). With the exception of Mureybet, all sites considered for the metrical analyses are located in Anatolia. Although from a more distant region, the site of Mureybet (10th millennium BP) was included here, as it provides metrical data on aurochs bones, which are generally rare in Anatolia. At Bronze Age Demircihüyük, domestic cattle were considerably smaller than the wild, ancestral, aurochs and, therefore, easy to distinguish. For the purpose of our osteometric comparisons, only the aurochs measurements from Demircihüyük are used. Excavations at Göbekli Tepe yielded a faunal assemblage with wild mammals only, while at Gürcütepe bovid remains are from animals that were at the beginning of the domestication process (von den Driesch, Peters 2001; Peters *et al*. 2005). The material from Fikirtepe, dated to around 5000 BC, is used as a sample for early domestic cattle. It is clear that the cattle from Bademağacı, like those from Höyücek, were considerably smaller than the aurochs at Mureybet, Göbekli Tepe and Demircihüyük (cf. *fig. 8*). They are also smaller in comparison to the presumed domestic cattle of Gürcütepe, but about equal in size to the domestic cattle of Fikirtepe. The log-ratio method was also used to reveal the small size of the cattle remains of Bademağacı. For the calculation of the LSI, a female aurochs from Ullerslev (Denmark) from the Boreal Period (7000-6000 BC) (Degerbøl 1970) was used as a standard (histograms of the log differences are presented in *fig. 9*). From the beginning of the occupation at Bademağacı cattle remains were relatively small compared to those of female aurochs. The osteometric data indicate that the cattle from Bademağacı were small-sized, suggesting their domestic status. Remains of large animals, *i.e*. aurochs, seem to be absent.

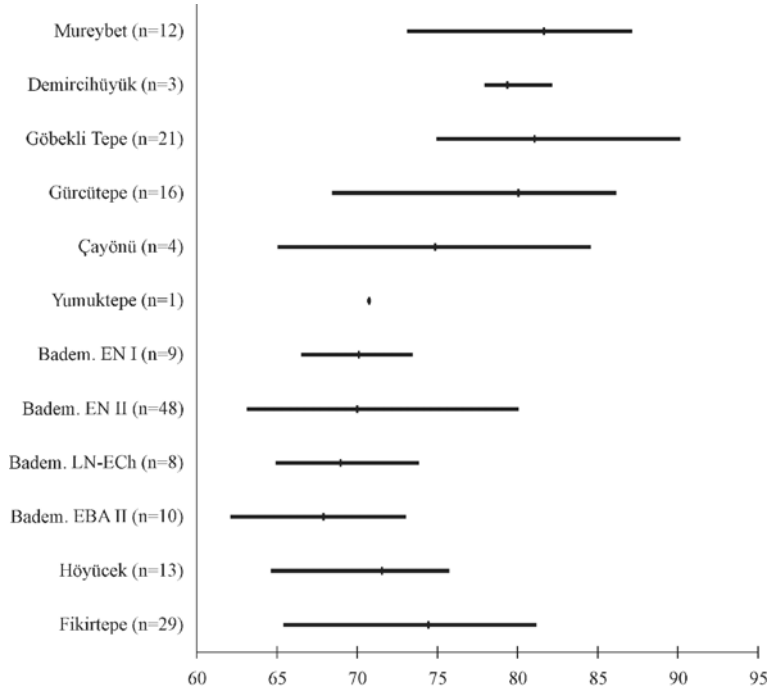

Fig. 8—Minimum, maximum and mean of the greatest lateral length (GLl) of the cattle astragali from different sites.

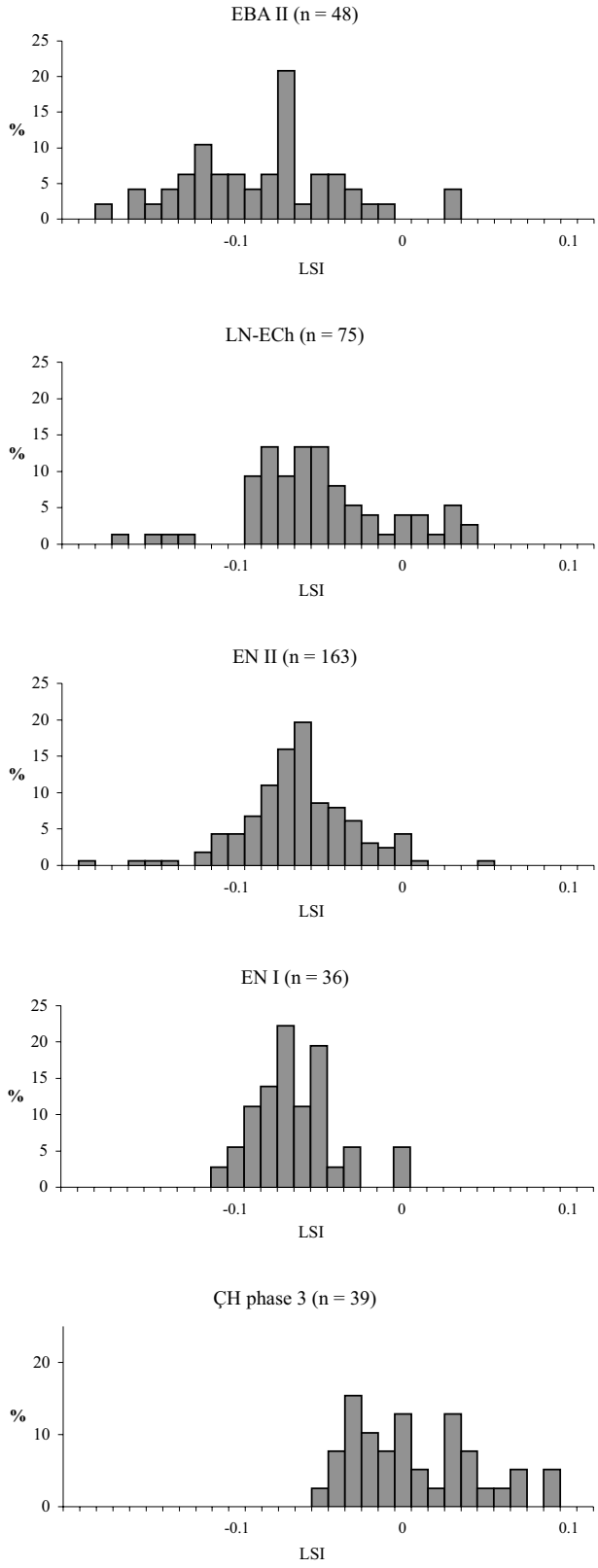

Fig. 9—Logarithmic size index (LSI) data for cattle per phase at Bademağacı, compared with the data of phase 3 of Çatalhöyük (after Russell et al. *2005,* fig. 4*) (interval -0.10 includes values from -0.109 to -0.100, interval -0.09 includes values from -0.099 to -0.090, etc.).*

To investigate the sex ratio at Bademağacı, the cattle measurements were subjected to mixture analysis (as described by Monchot 1999; Monchot, Léchelle 2002; Monchot *et al*. 2005). The distal metacarpal was used here since sexual dimorphism is well expressed in this body part (Higham 1969). However, the number of observations for this element being rather low, it was decided to analyse the astragalus measurements as well. The material dated to the EN I and EN II was amalgamated for this purpose in order to obtain a sufficiently high number of observations. In the case of the distal metacarpal only one group was retained for the EN (mean: 64.300; number: 12; SD: 4.144). The number of measurements dating to the LN-ECh and to the EBA was too low—respectively n = 4 and n = 6—to be examined in this way. When the raw data of the distal metacarpal are plotted (*fig. 10*), a separation between two groups can, however, be observed for each period with high values representing males and low values representing females. The high value indicated in this plot for the EN was not included in the mixture analysis, since it is an approximate value taken on an incomplete bone. Figure 10 (top panel) shows the predominance of females within the EN and the EBA assemblages at a ratio of 11:1 and 6:1 respectively. This ratio is very different for the LN-ECh period with 1:1, but the sample size of this assemblage is small (n = 4). Mixture analysis on the distal breadth of the astragalus shows the presence of two groups for each period (*table 9*). When the raw data of the astragali from each period are plotted (*fig. 10*, lower panel), males and females can be visually separated. From this plot it is also clear that female cattle were predominant in the assemblage from the Early Neolithic up to the Early Bronze Age. In addition, both the plots and the results of the mixture analysis clearly illustrate a diachronic size decrease.

The eruption and wear of the mandibular molar teeth are summarised in table 8. No observations were available for the oldest levels of the Early Neolithic (EN I), and for each of the other periods the number of observations is very low. It seems that both young and adult animals were slaughtered during the EN II, although very old individuals (with M_3 strongly worn) are rare. A completely different pattern is obtained for the LN-ECh, with an emphasis on killing very young animals (M_1 erupting). This pattern stands again in sharp contrast to the EBA II period, during which animals were apparently kept to a very old age.

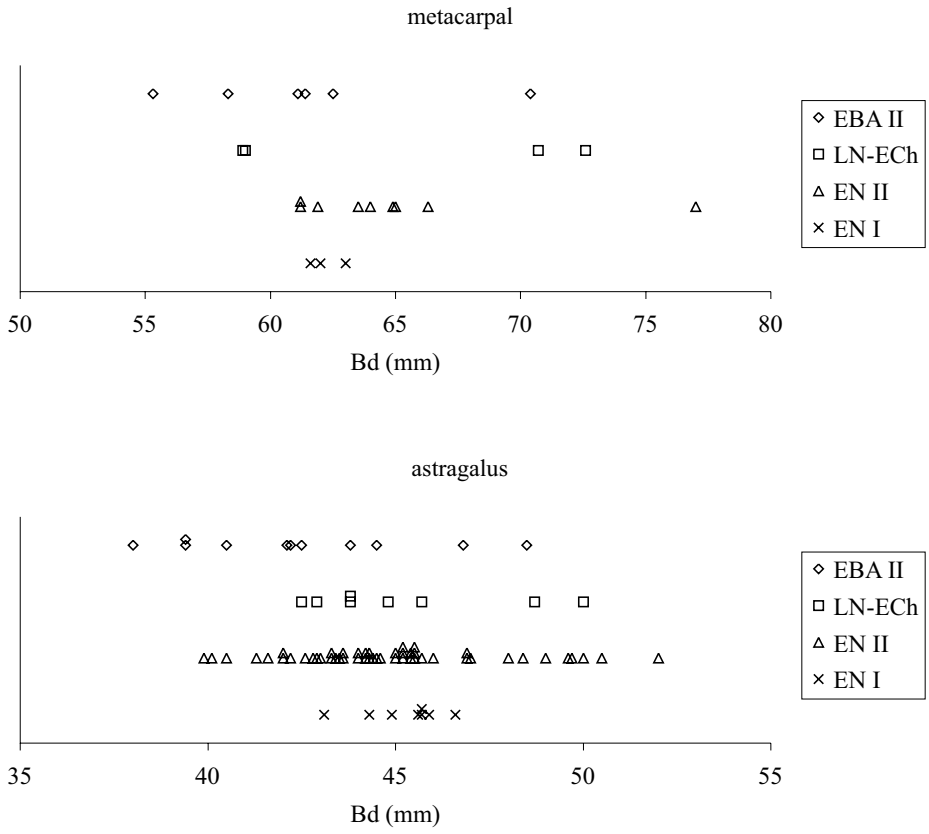

Fig. 10—Distal breadth (Bd) of the metacarpal and astragalus of cattle per phase at Bademağacı.

		EN II (n = 8)	LN–ECh (n = 14)	EBA II (n = 4)
M_1 erupting	6 m	1	9	1
M_1 worn, M_2 absent	6-18 m	1	1	.
M_2 erupting	18 m	1	1	.
M_3 little worn (a-e)	> 30 m	1	.	.
M_3 medium worn (f-h)	> 30 m	3	2	.
M_3 strongly worn (j-m)	> 30 m	1	1	3

Table 8—Slaughter age of cattle per phase, based on eruption and wear of mandibular teeth; wear stages according to Grant (1982) are given between brackets for the third molars.

Metacarpal (Bd)	EN		LN-ECh		EBA	
	Group 1	*Group 2*	*Group 1*	*Group 2*	*Group 1*	*Group 2*
Mean	64.300		58.950	71.650	56.810	61.250
SD	4.144		0.050	0.950	1.513	0.150
Prior probability	1.000		0.500	0.500	0.668	0.332
n	12		4		6	
Cut-off point			59.596		60.774	
Misclassification error			0.000		0.003	

(Unequal variances assumed; confidence level: 0.95)

Astragalus (Bd)	EN		LN-ECh		EBA	
	Group 1	*Group 2*	*Group 1*	*Group 2*	*Group 1*	*Group 2*
Mean	44.283	49.932	43.917	49.350	41.475	47.707
SD	1.850	1.124	1.083	0.650	2.167	0.851
Prior probability	0.890	0.110	0.750	0.250	0.833	0.167
n	58		8		11	
Cut-off point	48.418		47.389		46.155	
Misclassification error	0.021		0.001		0.019	

(Unequal variances assumed; confidence level: 0.95)

Table 9—Results of the mixture analysis of the distal breadth of the metacarpal and astragalus of cattle per phase at Bademağacı.

Hunting and herding through time

The relative importance of herding and hunting can be evaluated through the relative abundance of the major animal taxa, *i.e.* Cervidae versus *Capra*, *Ovis*, *Sus*, and *Bos*. Their proportions were calculated from the data in table 3 to 5 (*fig. 11*). Cervids were hunted, most probably on the plain surrounding the mound, although their proportion is never above 8%. Part of the goat and Suidae remains originate from wild animals. In the case of goats this may be a substantial part, while it seems to be considerably less in the case of pigs (see above), although precise numbers cannot be given. Wild goats and boars must have been common in the mountains that surround the plain around the mound. Even today, wild boars are still present in the Taurus Mountains. The proportion of cattle and sheep remains should be (almost) entirely originate from domestic animals. Domestic mammals were the major exploited animals at Bademağacı from the Early Neolithic onwards and hunting played, from the very beginning, only a minor role in the subsistence of the inhabitants of the site.

Similar proportions of cattle, pig and caprine remains are noted for the EN I and EN II: cattle and pigs are more or less equally represented (20% each), the proportion of sheep and goat being about 55%. When these proportions are compared to those from the LN-ECh and EBA II, the relative amount of cattle bones is almost doubled at the expense of sheep and goats. The share of pig bones also decreases through time, and in the EBA II they do not even represent 10% of the assemblage. When the ratio of sheep to goat is considered, sheep are predominant during the EN with about 65% and this value was probably even a little higher since wild goat remains are included in the number of goat finds. The proportion of goat increases during the Late Neolithic up to 50% and this ratio is maintained in the EBA II.

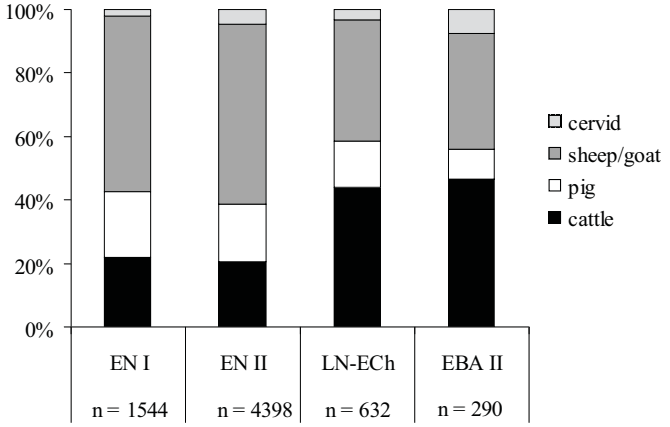

Fig. 11—Relative abundance of cervid (Capreolus capreolus, Dama dama *and* Cervus elaphus), *sheep/goat, pig and cattle per phase at Bademağacı.*

DISCUSSION

The importance of the Bademağacı material can only be evaluated when compared to that from some earlier sites, *i.e*. Gürcütepe (von den Driesch, Peters 2001; Peters *et al*. 2005) and the "large-room building phase" of Çayönü (Ervynck *et al*. 2001; Hongo *et al.* 2002) in south-eastern Turkey. Both are contemporaneous and are dated to the final Pre-Pottery Neolithic, while the oldest phase of Bademağacı (EN I) should be placed just at the beginning of the Pottery Neolithic.

As already mentioned above, the difference in size between the domestic pigs and wild boars strongly suggests that the pigs at Bademağacı were fully domesticated and that there was no genetic exchange between the domestic and the wild animals. This is different from the situation at Gürcütepe and the "large-room building phase" of Çayönü. At both sites pigs are smaller-sized and considered to be, depending on the authors' judgement, either domestic or at least under human control. Since no raw data on the pig measurements from either site were available in the literature, LSI values were calculated for the material of Bademağacı, using as a standard the female wild boar published by Hongo and Meadow 2000, and compared to those from Çayönü (data taken from Ervynck *et al* 2001) (*fig. 5*). Unlike Bademağacı, no bimodal distribution is seen at Çayönü. Moreover, the median of the latter site is still much higher than the one calculated for the EN of Bademağacı. Data from Gürcütepe could not be included in this graph since LSI values have been published as box plots (Peters *et al*. 2005). These are inconvenient to use for comparison with the material of Bademağacı since the data from the latter site show a bimodal distribution. The median value of Gürcütepe is, however, comparable to, or even a little higher than that from Çayönü. Thus, at both sites, measurements of pig remains still show overlap with those from wild boar, a pattern that is no longer present at Bademağacı. On the other hand, the shift in the age at death distribution is similar at all three sites, with proportionally more young animals being slaughtered.

At Gürcütepe, the bovids have a smaller average body size compared to the aurochs from near-by Göbekli Tepe and there is a preponderance of females among the mature animals. In addition, there is a shift towards a younger kill-off pattern (Peters *et al*. 2005). Also at Çayönü there is evidence that somewhat smaller animals occur during the later phases (Öksüz 2000; Hongo *et al.* 2002). These observations have been interpreted as evidence for "an advanced stage of cultural control and possibly a domestic status for part of the animals" (Peters *et al*. 2005). This is unlike the situation at Çatalhöyük: although there is a shift towards smaller (female) cattle at this site during phase 3 (roughly 6500-6300 cal. BC, levels VI-IV), the size range does not change and no indication is present to indicate local domestication (Russell, Martin 2005; Russell *et al*. 2005). When considering the cattle remains of Bademağacı the preponderance of females is clear (*fig. 10*), and measurements taken on the cattle remains of this site are smaller than the values given for Gürcütepe and Çayönü (*fig. 8*). In order to ascertain that the size diminution is not solely an effect of the dominance of females, the LSI data of Bademağacı were compared to those of Çatalhöyük (*fig. 9*). The sites differ in the fact that the size range of Bademağacı shows a lower minimum value than Çatalhöyük. Also the range of the raw data of the metacarpal, where both sexes can be easily differentiated, and of the astragalus shows smaller minimum values for Bademağacı than for Çatalhöyük (for raw data on the measurements see Russell, Martin 2005). There is therefore no doubt that like pigs, cattle were also already fully domestic at Bademağacı from the beginning of the occupation. Thus, while there may still be some discussion about the status of cattle and pigs in central and eastern Anatolia at the end of the Pre-Pottery Neolithic, it is clear that by the beginning of the 7th millennium BC herds of cattle, pig, sheep and goat were established.

A comment should still be made regarding the oldest levels of Bademağacı (EN II-9 and EN II-8), dated to about 7000 BC. Only sheep were positively identified in level 9, together with a few (domestic?) pigs, while remains of goat and cattle are completely absent (*table 3*). From level 8 onwards, cattle and goat remains are present as well. As level 9 represents the initial occupation of the site, the excavated remains most probably reflect the situation when the first inhabitants arrived at this place: possibly a group of people came with a small herd of sheep and perhaps some pigs. Most probably, only after they had settled down (perhaps after a relatively short period of time), they added cattle and goats as well as (more) pigs to their herds.

It should also be mentioned that there is until now no clear evidence within the Lake District for settlements dating to the Pre-Pottery Neolithic (Duru 1999). Such early sites are clustered in the central part of central Anatolia (*e.g.* Aşıklı Höyük, Musular, Can Hasan and Çatalhöyük) and in south-eastern Anatolia (*e.g.* Çayönü, Hallan Çemi, Nevalı Çori, Göbekli Tepe and Gürcütepe). These regions are characterised at the end of the Pre-Pottery Neolithic by a general collapse of the cultural system, with settlements being abandoned or decreasing in size. At the same time, there is a sudden increase in the number of settlements in central and western Anatolia (Özdoğan 1998). This colonisation also involved the introduction of domestic animals within the Lake District by the beginning of the 7th millennium BC.

The mortality curves from the EN at Bademağacı indicate that herding strategies for cattle and pigs were, at the beginning of this stage, directed towards meat production. At the same time, however, the survival of a large proportion of mature animals among the sheep and goat seems to indicate that, already during the 7th millennium BC in Anatolia, these species may well have been kept for reasons other than meat production only. The survival of animals into maturity is generally supposed to be indicative of subsistence with a heavy reliance on secondary products, in particular dairy products. It is suggested that milking was introduced shortly after domestication and evidence for dairying has already been found in the Near East as early as the end of the Pre-Pottery Neolithic (Helmer 2000b).

The marked increase of the relative abundance of cattle remains during the LN-ECh suggests that there was an intensification of beef production but at the same time a large proportion of these animals seem to have been slaughtered at a young age, *i.e.* around 6 months (*table 8*). It is possible that cattle management involved early weaning of calves, thus making cow's milk available for human consumption. Isotopic analyses on cattle teeth from a Neolithic site in Western Europe, where calves were slaughtered at an age of 6 months, seem to confirm that this slaughtering pattern is indicative of early weaning (Balasse, Tresset 2002). As the growing cattle herd required more grazing area in the plain around the settlement, there must have been competition with the flocks of sheep and goat, especially with the sheep (Redding 1992).

Small livestock may therefore have been forced to move to the mountains. Such a rough environment is more favourable for goat herding and this can explain why, from the Late Neolithic onwards, the sheep lost importance and relatively more goats were kept. The slight decrease in size that is observed among the sheep from the EN to the LN-ECh (*fig. 6*) also possibly reflects the environmental pressure from which the sheep flocks suffered.

Finally, while similar herding strategies of sheep and goats were maintained during the EBA II period, the mortality curves of cattle shifted at that time towards the kill-off of mature animals. This suggests that herd management was, again, adjusted to changing economies and that milk production favoured during the LN-ECh, now lost its importance. The demand for meat, other secondary products, or animal power, may have been more important. The observed size decrease of cattle through time was possibly caused by the changing environmental conditions. Indeed, the vegetation on the plain may have suffered from the impact of people and their herds (overgrazing, trampling), resulting in a general ecological deterioration. However, palynological data are needed to corroborate this hypothesis.

CONCLUSION

Bademağacı Höyük developed as a Pottery Neolithic site in the south of the Lake District at the beginning of the 7th millennium cal. BC and was occupied throughout the entire period up to the Early Bronze Age. The subsistence of the inhabitants was mainly based on sheep, goats, cattle and pigs. Several criteria, *i.e.* osteometric evidence, kill-off patterns and the preponderance of females, evidence the domestic status of not only sheep and goat but also of cattle and pig. Herding and breeding of domestic flocks were introduced to the region with the first settlers on the site. Hunting in the surrounding plain and nearby mountain range played only a minor role in the meat provisioning of the site throughout the entire period of occupation. The Early Neolithic was characterised by a dominance of sheep and goats, with the former outnumbering the latter. Unlike pig and cattle, which must have been kept for their meat, the kill-off patterns of the small livestock show they were presumably herded, not only for their meat, but also for their secondary products, during this period. Changes in herd management took place during the Late Neolithic and involved an increase in the relative importance of cattle herding, with a shift from meat production to an emphasis on dairying practices, and less interest in sheep. Indeed, the sheep flocks had to compete with these growing cattle herds for grazing ground and herders were probably forced to move them to the mountains, a more favourable environment for goats. The increasing pressure on the environment possibly brought about a reduction in size of cattle and sheep from the Early Neolithic to the Early Bronze age.

Acknowledgements

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Appendix—Measurements taken on the mammalian animal bones from Bademağacı, according to von den Driesc (1978).

(nf: non-fused; fg: fusing; bl: black; gr: grey; br: brown; op: other preservation; other abbreviations following von de Driesch (1978))

Vulpes vulpes

mandible	EN II-3A		**M_1**	EN II-3A			
{8}	58.6		**B**	6.6			
{9}	54.6						
{13}	17.0						
{19}	13.2						
{20}	12.3		**tibia**	EN II-3A	EN II-3	EN II-4	EN II-1
			Bp				20.3
femur	EN I-6		**SD**	7.4		6.9	7.8
Bd	20.4		**Bd**	14.3	14.1	13.6	

Felis silvestris

mandible	EN II-3A	EN II-3		**pelvis**	EN II-3
{1}	62.8			**LA**	12.2
{2}	60.7				
{3}	54.6				
{4}	53.5				
{5}	22.6	23			
{7}	9.2	9.1			
{9}	11.3				
{10}	9.8	10.5			

Capreolus capreolus

scapula	EN II-4B	EN II-4	EN II-4				**humerus**	EN II-4	
GLP	28.8	29.1	28.2				**Bd**	28.1	
LG	23.2	24.3	21.7				**BT**	23.3	
BG	18.3	19.1	19.0						
SLC	17.3	17.0	18.1						
radius	EN I-8	EN II-4	EN II-4	EN II-4	EN II-2		**mc**	EN I-5	EBA II-3
GL		145.5			143.2		**Bp**	21.5	20.6
Bp		27.9	29.1	26.2	{29}		**SD**	12.6	12.5
BFp		24.6	26.7	24.2					
SD		14.8			15.8				
Bd	24.4	25.6			27.6				
tibia	EN II-4	EN II-4	EN II-2	EN II-1	EN II-1	EBA			
SD	15.6	13.2	16.0	16.1	15.1	15.5			
Bd		24.0	26.5	27.4	24.6				
astragalus	EN I-6	EN II-4	EN II-1		**ph1**	EN II-2			
GLl	27.8	25.8	24.8		**Glpe**	38.4			
GLm	26.0	25.4	23.8		**Bp**	14.5			
DL	15.5	14.7	13.7		**SD**	10.0			
Bd	18.3	17.9	15.5		**Bd**	12.4			

Dama dama

scapula	EN II-4	EN II-2	EN II-1	EN II-1	EN II-1	EBA II				
GLP	38.0	45.6	41.5	41.4		44.1				
LG	30.6	36.3	32.2	33.2						
BG	26.4	31.9	25.6	29.1	29.1	32.7				
SLC	19.6	25.3		23.8	20.9	27.4				
humerus	EN II-3A	EN II-3	EN II-3	EN II-2	EN II-2	EN II-1	LN-ECh	LN-ECh		
Bd	47.2	42.7	34.8	45.3	40.1	39.3	43.1	38.2		
BT	38.2	35.0		37.1	32.8	32.6	37.7	33.6		
radius	EN II-4	EN II-4	EN II-3	EN II-2		**radius**	EN I-8	EN II-4		
Bp	42.9		41.0	40.0		**SD**	24.2	19.9		
BFp	39.3	21.9	36.5	36.7		**Bd**	36.3			
mc	EN II-2	EN II-3	LN-ECh	LN-ECh	EBA	EN I-5	EN II-4	EN II-4	EN II-3	EBA II-1
GL	208.5									
Bp	32.7	33.0	28.1	27.5	30.5					
SD	19.9				19.7	18.4				
Bd	31.7					30.3	32.3	29.8	29.9	30.0
remark							dist nf			
tibia	EN I-6	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2				
Bp		{52}								
SD	22.2		24.4	22.8						
Bd			35.2	36.6	36.0	34.7				
remark						burnt bl				
calcaneus	EN II-3A	EN II-3	EN II-2	EN II-2	EN II-2	EN II-1	EBA II			
GL	91.1	88.9	88.3	78.3	70.4	79.8	89.4			
GB		29.1	27.8	24.6	26.3	25.2				
astragalus	EN I-5	EN II-3A	EN II-3A	EN II-1	EN II-1	EN II-1	EN	EN	LN-ECh	LN-ECh
GLl	38.8	40.6	35.5	49.8	41.3	41.2	40.7	37.0	43.5	41.7
GLm	36.4	38.0	33.3		39.6	39.1	38.1	36.2	40.5	40.1
DL	21.7	22.9	20.1		23.3	23.0	23.3	20.5	24.2	22.0
Bd	25.3	26.5	22.9		26.6	27.0	26.1	22.9	27.4	25.4
talus	LN-ECh		**ph1**	EN I-5	LN-ECh					
GLl	40.8		**GLpe**	41.9	45.7					
GLm	38.3		**Bp**	12.5	16.0					
DL	23.2		**SD**	9.5	12.0					
Bd	25.4		**Bd**	12.3	14.4					
ph2	EN I-5	EN I-5	EN II-3	EN II-3		**ph3**	EBA II-3	EN I-6		
GL	32.2	33.4	28.1	32.8		**DLS**		38.1		
Bp	14.1		12.6	15.5		**Ld**	34.9	34.0		
SD	11.0		8.8	11.5						
Bd	12.0		10.0	12.5						

Cervus elaphus

humerus	EN II-4	EN II-2	**femur**	EN I-5		**tibia**	EN II-3
SD	23.8		**Bd**	75.0		**Bp**	{53}
Bd		66.4					
BT		57.2					
			ph1	EN II-2	EBA II-1		
ph2	LN-ECh		**Glpe**	57.4	62.3		
GL	42.5		**Bp**	23.5	24.6		
Bp	23.4		**SD**	18.1	19.0		
SD	19.1		**Bd**	22.2	24.4		
Bd	19.8		**remark**	prox fg			

***Canis lupus* f. familiaris** (#x: bone elements from the same individual)

mandible	EN I-5	EN II-3A	EN II-3A	EN II-3	EN II-2	EBA		**maxilla**	EN II-4	
{1}		105.1						**{17}**	47	
{2}		106.5								
{3}		101.8								
{4}	94.5	91.3		85	97.2	100.5		**axis**	EN II-3	
{5}	89.6	90		82.4	92	94.9		**BFcr**	25.5	
{6}	93.6				96.5	98		**Bpacd**	23.5	
{7}	63.5		64.6	58.4	64.9	65.6				
{8}	60.3		59.9		61.7	61.4				
{9}	55.6		56.5		56.4	57.6		**scapula**	EN I-5	EN II-3
{10}	31.2		30.3	28.7	28.4	29.8		**GLP**	24.7	24.5
{11}	31.1	28.1	21			32.6		**BG**	15.5	14.2
{12}	26.7		27.3			28.3		**SLC**		20.4
{13}	19.3									
{14}	18.2	14.3	18.3	17	17.5					
{19}	19	19.4	19.7	17.8		19				
{20}	16.5	15.4	16.2	15	15.2	14.9				

mandible	EN II-4	EN II-2	EN II-1	EN II-1	EBA II	EN II-4B	EN II-2	EN II-1	
{10}	33.3	29.6	27.8	27					
{11}									
{12}	31.8		30.2						
{13}	20	18.6	19.4	17					
{14}		18.2							
{19}	21.7		21.1	15.4	18.5	18	17.2	17.5	
{20}	18.1			14.7	15.1				
remark	#1				#2				

M_1	EN II-3	EBA II	EBA II	EN II-4	EN II-2	EN II-1	EN II-4B	EN II-3	EN II-3	EBA II
L	20.2	20.3	17.5	18.8	12	12.1	21.2	19.8	20	22.3
B	8.2	8.1	6.3				8.8	7.6	8.1	9.8
remark										#2

humerus	EN I-5	EN II-4	EBA II	**radius**	EN I-6	EN II-4	EN II-4	EBA II	
GL			125	**GL**		133		115.6	
Dp		33.2	32.3	**Bp**	17.1	14.6	14.3	14.9	
SD			10.2	**SD**		10.1		9.9	
Bd	26.5	26.1	25.4	**Bd**		19.7		19.3	
remark		#1	#2	**remark**		#1		#2	

ulna	EN II-4	EN II-2	EN II-2	EBA II		**mc III**	EN II-2		**pelvis**	EN II-3
BPC	14.6					**GL**	45.8		**LA**	23
DPA	21.1	20	20.6	20.2						
SDO	15.8	16.6	17.6	17						
remark	#1		burnt bl	#2						

femur	EN II-4		**tibia**	EN II-4	EN II-4	EN II-3A	EN II-3	EN II-3	EN II-1
Bp	31.3		**GL**	150	150	137.1			137.1
DC	15.3		**Bp**		28.1	26.8		28	26.8
remark	#1		**SD**	9.1	9.5	10.3	11		11.6
			Bd	18	18		18.7	17.8	18.3
			remark	#1	#1				

calcaneus	EN II-4	EN II-4	EBA II-3		**astragal.**	EN I-5	EBA II-3		**mt II**	EN II-1
GL	36.5	35.6	44.1		**GL**	21.4	26.2		**GL**	42.5
remark	#1	#1								

***Sus scrofa*/*Sus scrofa* f. domestica**

	EBA II	EN II-4A	EN I-7	EN I-5	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-1
molar	M_1	M_2	M_3	M_3	M_3	M_3	M_3	M_3	M_3	M_3
L	45.4	24.8	33.5	33.3	42.8	35.6	35.5	35.0	30.8	46.0

	EN II-1	EN II-1	EN II-1	ECh			EN II-4A	EN II-4	EN II-3	
molar	M_3	M_3	M_3	M_3		**molar**	M^3	M^3	M^2	
L	43.2	40.6	27.9	34.6		**L**	32.7	24.0	22.7	

atlas	EN I-8	EN II-1	EN II-1	EN II-3	EN II-4	EN II-4	EN II-4			
BFcr	55.3	50.8	52.6	55.7	59.3	64.2	69.8			
H		40.6			48.8	51.2				
BFcd	50.0	54.4	52.2	{49}	51.0	64.0				

scapula	EN I-8	EN I-8	EN II-4	EN II-4	EN II-4	EN II-3A	EN II-3A	EN II-3A	EN II-3	EN II-3
GLP	33.4	32.8	46.1	44.6		34.2	31.8	31.8	38.2	31.1
BG	23.4	24.7	31.3	29.9	23.9	24.0	22.4	20.7	23.7	22.4
SLC	20.7	22.7	33.0	30.2	21.5	23.2	20.8	19.4		20.8

scapula	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-1	LN-ECh		
GLP	49.0	34.1	33.3	31.7	31.0		49.0	33.9		
BG	33.7	22.4	23.0	{21}	21.9		40.1	23.5		
SLC	33.8		19.6		19.0	27.6	33.3	21.2		

humerus	LN-ECh		**humerus**	EN I-6	EN II-4	EN II-4	EN II-4	EN II-3	EN II-3	EN II-3
Bp	69.0		**Bd**	37.6	56.5	54.0	39.2	36.7	35.8	34.2

humerus	EN II-2	EN II-2	EN II-2	EN II-1	EN	LN-ECh	LN-ECh	LN-ECh	LN-ECh	LN-ECh
Bd	38.7	37.8	37.0	48.0	58.8	52.9	49.8	48.6	40.0	37.4
BT				39.7	42.3					
remark	burnt bl									

humerus	LN-ECh		**radius**	EN I-7	EN I-6	EN I-5	EN II-4	EN II-4	EN II-4	EN II-4
Bd	36.1		**Bp**	27.9	27.6	39.4	37.2	28.6	27.9	27.4
BT			**SD**							18.4

radius	EN II-3A	EN II-3	EN II-3	EN II-2	LN-ECh	LN-ECh				
Bp	36.6	29.0	28.0	27.8	27.9	26.1				
SD	21.1		17.5							
ulna	EN I-5	EN I-5	EN I-5	EN II-4A	EN II-4A	EN II-4A	EN II-4A	EN II-4	EN II-3A	EN II-3A
BPC	23.1	23.1	20.0	40.0	28.0	22.3	21.2	21.2	20.9	20.8
DPA						37.5				
SDO				40.0		31.0				
ulna	EN II-3A	EN II-3	EN II-2							
BPC	20.1	20.0	19.0							
pelvis	EN II-4	EN II-4	EN II-3	EN II-1	EN II-1	EN	EN			
LA	32.5	30.7	32.9	32.9	28.3	42.2	31.9			
femur	EN II-4	EN II-4	EN II-2	EN II-1		**calcan.**	EN I-7	EN II-3	EN II-2	
Bp	60.8					**GL**	103.7	98.5	102.8	
DC	28.3	25.4		26.2						
Bd			46.9							
tibia	EN II-4A	EN II-4	EN II-4	EN II-4	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN II-1
SD	28.7						21.5			
Bd	39.1	38.8	37.0	30.0	38.2	29.3	32.2	31.8	30.7	28.8
tibia	EN II-1	EBA		**astragal.**	EN I-6	EN I-6	EN I-5	EN I-5	EN II-4A	EN II-4
SD		23.3		**GLl**	50.8	44.0	47.0	36.2	49.7	51.6
Bd	28.3			**GLm**	45.1	39.1	42.8	34.1	44.5	46.5
				Bd					29.6	
astragalus	EN II-4	EN II-4	EN II-4	EN II-3	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2
GLl	47.4	40.9	38.3	41.5	45.6	42.7	42.4	41.7	39.8	
GLm	41.9	37.4	34.0	38.3		38.5	39.0	37.8	35.7	
Bd						23.0		23.3	23.4	31.5
astragalus	EN II-1	EN	EBA II-3		**mp**	EN II-2	EN II-1	EN II-2	EN II-2	EN II-2
GLl	52.1	50.3	48.7			mcIV	mcIV	mcV	mtII	mtIV
GLm	46.8	45.7	43.8		**GL**	75.8	74.0	69.1	58.1	113.2
ph1	EN I-6	EN I-6	EN II-4		**ph2**	EN I-5				
GL	49.0	45.8	39.8		**GL**	32.6				

***Ovis ammon*/*Ovis ammo*n f. aries**

horn core	EN II-1	EBA II
l. diam	55.3	54.6
sm. diam	37.3	39.0

scapula	EN I-8	EN I-6	EN I-5	EN I-5	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4
GLp		32.0	41.5	32.2	32.3	32.1	31.4	31.3	30.5	29.5
LG		25.0		25.4	23.8	24.5	24.5	23.8	23.2	23.8
BG	22.6	19.8	27.6	20.0	19.7	21.0	20.3	19.3	19.0	19.2
SLC	22.2	19.9		19.6	19.4	19.8	18.4	18.9	18.9	18.8

scapula	EN II-4	EN II-4	EN II-3A	EN II-3A	EN II-3A	EN II-3A	EN II-3A	EN II-3	EN II-3	EN II-3
GLp			31.1	29.6	27.2			29.3	29.2	29.0
LG				23.7	21.9			22.4	22.9	23.2
BG		19.3	20.8	19.0	17.7	18.1	19.2	18.5	18.2	18.6
SLC	17.3	18.6	19.1	18.3	17.2	17.6	18.2	18.4	17.7	17.4
remark			burnt bl							

scapula	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-1	EN II-1
GLp			33.3	33.3	31.3	31.1	30.3		35.6	31.9
LG	23.7		27.3	26.1	24.9	24.6	25.0		29.5	
BG	20.0	19.0	23.0	20.9	17.5	19.6	20.2	18.7	23.8	19.9
SLC	20.4	18.5	20.4	19.4	17.1	17.7	17.3	18.8	22.3	
remark	burnt bl									

scapula	EN II-1	EN II-1	EN	LN-ECh	EBA II		**ulna**	EN II-4	EN II-3	
GLp			31.7	31.0	31.2		**BPC**	20.2	17.6	
LG			24.8							
BG	18.4		19.8	19.2	19.9					
SLC	18.5	17.4	18.1	18.3	19.2					

humerus	EN I-9	EN I-9	EN I-9	EN I-9	EN I-6	EN I-6	EN I-6	EN I-6	EN I-5	EN II-4B
Bd	31.5	30.7	29.8	29.5	25.9	30.2	28.3	28.2	27.4	28.5
BT	29.8	27.9	28.3	27.4		28.6	26.3			26.8

humerus	EN II-4A	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4
SD	12.9	10.5								
Bd	26.6	25.6	28.2	28.7	28.6	27.2	27.5	27.7	28.3	27.3
BT	25.3		27.0	27.0	26.6	26.0	25.9	25.8	25.7	25.6
remark		prox nf								

humerus	EN II-4	EN II-3A	EN II-3A	EN II-3A	EN II-3A	EN II-3A	EN II-3A	EN II-3A	EN II-3	EN II-3
SD			12.6		13.2					15.0
Bd	27.0	29.1	28.7	27.5	27.4	26.8	26.7	25.8	32.3	30.4
BT	23.9	27.4	26.7	25.3	25.9	25.0	24.4	24.4	28.0	27.3

humerus	EN II-3	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2
SD				16.6		14.6	13.8		13.2	11.6
Bd	29.0	28.5	28.2	31.0	30.4	29.3	29.3	29.1	28.4	27.9
BT	27.5	25.7	26.4	29.0	28.4	26.0	25.7	26.6	26.5	25.2
remark										fg

humerus	EN II-2	EN II-2	EN II-1	LN-ECh	LN-ECh	EBA II	EBA	EBA
SD		12.1				25.2	17.1	12.5
Bd	27.4	26.9	31.0	29.0	25.7	45.8	34.9	26.6
BT	25.2	25.5	28.6		26.1	43.0	31.9	24.9

humerus	EN II-2	**radius**	EN I-5	EN II-4	EN II-2	EN II-1	EN I-8	EN I-6	EN I-6
GL	133.2	**GL**	135.8	127.8	143.8	135.7			
Bp	{37}	**Bp**		26.5	29.2	27.2	33.6	34.7	29.4
SD	13.4	**BFp**		24.2	27.5	25.2	30.8	30.6	
Bd	29.1	**SD**	14.5	15.4	15.7	14.3			
BT	26.5	**Bd**	24.6	24.9	27.6	24.9			

radius	EN I-6	EN I-5	EN I-5	EN I-5	EN II-4	EN II-4	EN II-4	EN II-3A	EN II-2	EN II-2
Bp	27.8	31.3	28.0	27.5	31.5	31.2	30.7	30.1	35.5	29.2
BFp	26.1	28.0	26.0	25.0	28.3	28.2	26.9	26.8	33.1	28.2
SD	13.3			15.2		16.0	18.9		18.4	17.2
radius	EN II-2	EN II-2	EN II-2	EN II-2	EN II-1	EN II-1	LN-ECh	EBA II-3	EBA II	EBA
Bp	27.6	27.6	27.2	27.1	31.0	28.6	28.6	33.2	25.9	26.2
BFp	25.9	24.9	24.5	25.2	28.0	25.8	26.5	30.9		24.5
SD	15.2			13.9		15.7	15.6	17.0		14.3
remark				dist nf						
radius	EN I-5	EN II-4	EN II-3A	EN II-3	EN II-3	EN II-2	EN II-2	EBA		
SD		14.6		14.7		16.5	15.4	15.8		
Bd	29.8	24.4	28.5	26.4	26.6	28.7	27.5	26.9		
mc	EN I-6	EN I-5	EN II-4A	EN II-4	EN II-3A	EN II-3	EN II-2	EN II-1	EN II-1	LN-ECh
GL	122.5	118.1	120.0	122.7	119.9	113.2	115.5	117.8	114.0	120.2
Bp	20.3	20.3	19.9	19.7	21.2	19.0	19.7	21.0	20.5	20.1
SD	13.0	11.4	11.5	11.8	12.6	12.5	11.3	12.0	12.8	11.9
Bd	22.5	25.1	22.2	22.5	23.6	21.1	23.2	22.9	23.4	22.6
remark				burnt bl					dist fg	
mc	LN-ECh	LN-ECh	EN I-9	EN I-6	EN I-5	EN II-4B	EN II-4	EN II-4	EN II-4	EN II-4
GL	120.0	120.0								
Bp	20.1	19.2	19.6	20.1	22.6	19.3	21.7	20.0	19.5	19.1
SD	13.3	11.9	12.7	11.3	13.2	11.6		12.2	11.6	11.5
Bd		21.4								
remark									dist nf	
mc	EN II-3A	EN II-3A	EN II-3	EN II-3	EN II-3	EN II-3	EN II-3	EN II-3	EN II-3	EN II-3
Bp	20.6	19.6	21.8	21.4	21.3	21.1	21.1	20.3	20.0	19.0
SD	12.6	11.1	14.7	11.4	11.7	11.6	11.7		12.6	10.2
remark		dist nf	dist nf			dist nf			dist nf	
mc	EN II-3	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-1
Bp	18.9	24.0	21.0	20.9	20.7	19.0	18.4	18.3	17.5	22.7
SD	11.8		13.0						11.5	12.8
remark	dist nf									
mc	EN	LN-ECh	LN-ECh		**mc**	EN I-8	EN I-7	EN I-5	EN I-5	EN II-4
Bp	19.2	26.0	21.4		**SD**		14.1			
SD	12.0		13.6		**Bd**	23.2	25.7	23.1	22.9	23.0
remark	dist nf									
mc	EN II-3	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN	EN	LN-ECh	LN-ECh
SD										13.7
Bd	26.7	24.1	23.5	24.2	23.1	22.1	30.9	43.2	22.3	22.1
remark						burnt bl				
mc	LN-ECh	EBA II	EBA	EBA		**tibia**	EN I-8	EN		
Bd	21.9	23.2	36.5	23.6		**Bp**	37.1	51.0		
						SD		22.0		
femur	EN II-4	EN II-3A	EN II-2	EN II-2						
Bp		43.8	42.2			**tibia**	EN I-6	EN I-6	EN II-4	
DC		21.7	19.4	18.3		**SD**	12.7		12.3	
Bd	35.6					**Bd**	24.3	22.7	23.0	

calcaneus	EN I-9	EN I-5	EN II-4A	EN II-4	EN II-4	EN II-3	EN II-3	EN II-3	EN II-1	EN II-1
GL	60.0	52.2	50.5	59.5	53.9	54.8	52.4	50.0	57.3	52.3
Bp		18.9	16.9	18.5	17.6	19.7	18.0		20.8	16.6

calcaneus	EN	EBA II-3	**astragal.**	EN I-8	EN I-8	EN I-8	EN I-7	EN I-6	EN I-6
GL	>78	56.2	**GLl**	32.0	29.2	28.6	28.1	29.4	27.9
remark	nf	fg	**GLm**	29.1	27.4	27.8	26.5	27.5	25.1
			Dl	16.7	16.5	16.3	15.8	16.5	15.3
			Bd		18.4	17.9	18.4	19.0	17.4

astragalus	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-3A	EN II-3A	EN II-3A
GLl	29.9	27.1	26.8	26.0	25.4	24.8		27.9	27.6	26.5
GLm	27.9	25.4	25.9	25.0	25.0	23.3	26.3	25.8	26.3	25.9
Dl	16.4	15.5	15.0	14.9	15.0	14.1		15.6	15.4	14.6
Bd	19.1	17.1	17.4	17.2	16.4	16.4	17.4	18.0	17.7	16.0

astragalus	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN	LN-ECh	LN-ECh
GLl	27.7	26.6	29.0	27.1	26.2	27.7	27.6	26.3
GLm	26.0	25.5	26.6	25.8	25.1	26.6	24.9	25.5
Dl	15.0	14.9	16.5	15.0	14.7	16.2	15.2	14.7
Bd	16.4	17.1	17.1	17.9	15.9	18.0	16.7	17.6

mt	EN I-6	EN I-5	EN II-4B	EN II-3	EN II-2	EN II-2	EN	EN	LN-ECh	LN-ECh
GL	132.7	126.0	130.0	129.2	121.2	120.7	134.5	123.4	136.4	128.2
Bp	17.2		18.6	19.9	18.0	17.3	18.4	18.2	18.3	18.6
SD	10.0	10.8	11.5	11.1	10.1	10.4	10.6	10.7	10.9	10.5
Bd	21.4	21.7	22.4	22.9	21.5	19.6	21.7	20.8	21.4	22.8

mt	EN I-8	EN I-8	EN I-8	EN I-6	EN I-6	EN I-6	EN II-4B	EN II-4	EN II-3A	EN II-3A
Bp	21.8	19.9	18.3	19.0	18.5	18.4	19.1	18.4	18.4	18.0
SD	13.0	11.7	11.2		11.7	10.8	10.7	9.1	11.2	10.3
remark		dist nf	dist nf							

mt	EN II-3A	EN II-3A	EN II-3	EN II-3	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN II-2
Bp	17.1	16.7	19.1	19.1	18.1	17.5	19.7	18.8	18.0	18.0
SD	9.4	8.6	10.8		10.0	9.0	10.3		10.2	9.7
remark	dist nf	dist nf			dist nf		dist nf		burnt bl	

mt	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-1	EN II-1	LN-ECh
Bp	17.8	17.8	17.5	17.4	17.4	17.0	16.8	19.2	15.7	18.7
SD		11.3	10.0	9.4	9.7	9.8				9.8
remark				dist nf	dist nf					

mt	LN-ECh	EBA II-3	**mt**	EN I-8	EN I-7	EN II-4	EN II-4	EN II-4	EN II-4
Bp	17.5	21.6	**SD**	13.3	11.9		11.6		
SD	11.0	10.4	**Bd**	26.3	23.8	26.7	23.0	22.7	21.4

mt	EN II-3A	EN II-3A	EN II-3	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2
SD	10.3	10.9	11.8	10.8	10.2			12.3		11.2
Bd	22.0	21.7	23.3	21.5	20.8	23.9	23.4	22.6	21.6	21.3
remark					burnt bl					

mt	EN II-1	EN II-1	LN-ECh	ECh
SD	11.9	10.4	12.0	12.2
Bd	22.9	22.8	18.5	22.4

ph1	EN I-9	EN I-9	EN I-9	EN I-8	EN I-8	EN I-7	EN I-7	EN I-6	EN I-6	EN I-5
GLpe	38.7	37.0		35.1		37.2	36.0	36.1	35.8	33.5
Bp	13.6	12.8		11.2		11.7	12.0	10.9	12.1	11.0
SD	11.2	9.2	10.3	8.3	8.8	9.0	8.6	8.7	8.5	8.5
Bd	13.0	11.7	12.3	10.2		10.5	10.4	10.2	10.3	11.0
ph1	EN II-4A	EN II-4A	EN II-4A	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4
GLpe	35.9	34.9	34.7	36.6	35.0	34.9	34.8	34.6	34.6	34.5
Bp	11.7	10.8	11.4	11.8	11.2	11.3	11.5	{10.8}	11.2	11.6
SD	9.0	7.6	8.6	9.1	9.3	8.0	8.1	8.2	8.4	8.7
Bd	11.1	10.3	10.5	11.1	11.3	10.5	10.4	10.3	9.7	10.3
remark				burnt gr						
ph1	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-3	EN II-3	EN II-3	EN II-3	EN II-3
GLpe	33.6	32.9	32.7	32.3		{30}	36.9	34.6	33.6	
Bp	11.6	11.3	9.7	11.6		10.0	12.9	11.2	10.7	11.4
SD	9.7	7.9	7.5	9.4	8.4	7.6	8.5	8.7	8.3	8.3
Bd	11.5	10.7	9.7	11.4	9.7	10.2	11.5	9.9	10.0	
remark			prox fg							
ph1	EN II-2	EN II-2	EN II-1	LN-ECh		**ph2**	EN I-5	EN II-4	EN II-4	EN II-4
GLpe	{37.9}	35.0	34.1	41.6		**GL**	19.6	27.0	23.1	21.7
Bp	11.6	10.9	11.1	14.7		**Bp**	15.8	13.6	12.0	10.6
SD	9.3	7.8	8.6	12.1		**SD**	8.1	9.2	8.8	7.8
Bd	10.5	10.3	10.0	12.4		**Bd**	8.7	10.5	9.7	8.8
ph2	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-1	EBA II-3			
GL	21.5	21.3	20.1	19.6		18.3	22.1			
Bp	10.6	11.3	11.0	11.2		8.9	11.3			
SD	7.9	8.7	8.7	8.7	8.7	5.8	8.9			
Bd	8.6	9.3	9.0	9.3	9.4	7.0	9.0			
ph3	EN I-8	EN II-3								
DLS	30.6	30.0								
Ld	24.5	25.0								

***Capra aegagrus*/*Capra aegagrus* f. hircus**

horn core	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-2	EN	EN	EBA II-3	
l. diam	35.1	34.4	32.3	28.2	25.0	34.8	67.4	34.4	34.0	
sm. diam	25.0	25.7	22.1	20.2	17.5	25.3		25.7	27.4	
scapula	EN II-4B	EN II-4	EN II-4	EN II-4	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN II-1
GLP	35.0	34.0	30.8	30.1	33.2	31.2	40.3	27.8		36.6
LG	30.4	27.6	25.3	24.6	25.6	24.8	28.8	21.4	{34}	30.5
BG	24.7	22.9	21.5	21.9	20.2	19.0	27.2	17.6	{30}	23.3
SLC		21.0	18.4		20.2	18.5	25.2		26.8	13.1
scapula	EN II-4	EN II-3		**humerus**	EN I-8	EN I-7	EN I-6	EN II-4	EN II-3	EN II-2
BG	22.0			**SD**					14.6	19.7
SLC	18.3	19.0		**Bd**		29.3	33.7	35.7	32.3	
				BT	41.0	27.8		34.4	31.1	{39}
humerus	EN II-2	EN II-2	LN-ECh	LN-ECh	EBA II-1	EBA II	EBA II	EBA		
SD						25.2				
Bd	32.4	30.0	41.1	27.7	29.3	45.8	42.2	29.9		
BT	29.6	27.9	39.4	26.6	25.0	43.0		27.6		

radius	EN II-4	EN II-4	EN I-5	EN II-4A	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4
GL	139.8	139.5								
Bp	30.6	26.5	30.2	30.1	40.0	36.9	33.1	31.1	30.5	30.4
BFp	30.0	25.2	28.6	28.1	38.5	34.6	30.5	29.8	29.0	27.8
SD	18.7	16.3							18.8	16.3
Bd	29.0	25.3								
remark							op		dist nf	

radius	EN II-3A	EN II-3	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2
Bp	33.0	{33.5}	39.5	31.3	45.7	42.7	39.8	37.5	34.9	33.5
BFp	31.1		37.4	29.1	41.0	39.4	37.1	35.0	33.0	32.2

radius	EN II-2	EN II-2	EN II-1	EN	ECh	EBA II	EBA
Bp	30.6	28.6	30.0	42.4	36.2	36.6	34.8
BFp	28.2	27.0	28.2	39.5	33.6	35.2	32.3
SD	19.3						

radius	EN II-4A	EN II-4	EN II-4	EN II-4	EN II-4	EN II-3A	EN II-3	EN II-3	EN II-2	EN II-1
SD		18.2			15.2			24.5		17.9
Bd	33.3	30.3	26.8	26.6	25.2	43.6	30.3		33.2	26.9
remark		op								

ulna	EN II-4	EN II-4	EN II-3
BPC	16.0	15.7	20.1
DPA		23.1	
SDO		19.5	

mc	EN I-6	EN I-5	EN II-4	EN II-4	EN II-2	EN II-2	EN	EBA II-3
GL	112.7	106.5	96.6	96.3	103.0	99.4	99.6	126.1
Bp	26.9		24.1	24.3		22.4	23.3	28.7
SD	17.4	16.6	15.7	15.5	15.1	15.4	15.8	19.7
Bd	29.2	28.0	26.0		26.5	26.1	26.9	31.6
remark			op	op				

mc	EN II-4	EN II-3	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN
Bp	28.2	27.0	24.5	21.9	{31}	28.1	26.4	19.9	18.2	23.0
SD		17.9	15.1			17.8				15.8
remark		dist nf								

mc	EN I-6	EN I-5	EN II-4	EN II-4	EN II-3	EN II-3	EN II-2	EN II-2	EN	LN-ECh
SD			18.8		16.5		23.4			
Bd	27.9	29.4	32.8	27.9		24.4	37.0	27.8	38.9	41.2

mc	LN-ECh	LN-ECh	LN-ECh	LN-ECh	ECh
Bd	37.5	32.6	28.7	25.6	27.5

tibia	EN II-4B	EN II-4	EN II-4	EN II-3A	EN II-1	EN
BP		41.4	41.0			
SD	22.7		16.4	22.6	13.7	13.1
Bd	35.5			35.5	24.5	24.6
remark		op	op			

calcaneus	EN I-6	EN I-6	EN I-5	EN II-4	EN II-3A	EN II-3	EN II-3	EN II-3	EN II-2
GL	57.5	56.3	56.2	62.5	57.1	54.2	53.7	52.6	54.4
Bd	19.5		20.7	20.7	21.5	18.7	18.4	18.7	18.5

astragalus	EN I-6	EN II-4	EN II-4	EN II-4	EN II-4	EN II-3A	EN II-3A	EN II-3A	EN II-3	EN II-3
GLl	29.5	37.0	27.8	27.3	25.1	38.8	30.4	29.4	36.7	30.5
GLm	27.6	35.7	25.5	25.9	24.4	37.8	29.0	28.6	34.9	29.4
Dl	15.5	20.7	15.2	15.2	14.6	21.3	17.5	16.2	20.1	16.8
Bd	19.2	21.9	18.2	16.7	16.7	23.5	19.6	18.4	26.1	20.1

astragalus	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN II-2	EN II-1	LN-ECh	LN-ECh	EBA II-1
GLl	28.2	25.7	34.2	32.7	31.9	28.1	27.9	27.1	27.0	29.0
GLm	25.7	25.2	32.3	30.1	29.7	26.9	26.1	25.1	25.2	26.0
Dl	15.6	14.4	19.3	17.9	16.6	16.5	15.1	14.9	14.9	15.1
Bd	17.6	16.0	23.6	21.2	19.4	18.1	18.4	16.0	18.6	18.3
remark	burnt bl									

astragalus	EBA II	**mt**	LN-ECh	LN-ECh	EN II-4	EN II-4	EN II-3A	ECh	EBA II
GLl	36.4	**GL**	155.2	106.4	103.8	102.5	106.2	126.8	135.4
GLm	34.9	**Bp**	26.4	19.2	19.5	19.5	19.0	17.3	22.1
Dl	20.3	**SD**	18.1	13.1	12.0	12.4	12.6	10.6	13.3
Bd	23.0	**Bd**	33.0	23.8	23.2	23.6	26.1	20.3	29.0
		remark			op	op			dist fg

mt	EN II-2	EN II-2	EN II-2	EN II-2	EN I-6	**mt**	LN-ECh	LN-ECh	EN II-4
Bp	20.0	19.6	19.0	18.7	20.7	**SD**	16.7		
SD	12.9	12.3		11.4		**Bd**	29.0	24.4	20.9
remark		dist nf		dist nf					

mt	EN II-4	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN I-6	EN I-6	EN I-5	ECh
SD		13.7	14.0	15.2					13.1	
Bd	27.2	25.7	24.6	29.0	21.7	33.2	29.3	25.7	24.0	23.6

ph1	EN I-8	EN I-5	EN II-3	EN II-3	EN II-3	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2
GLpe	46.5	38.6	42.7	41.7	40.6	36.1		{43}	43.9	41.2
Bp	17.8	13.4	15.3	13.3	14.2	13.7	12.7	16.1	15.3	14.6
SD	14.2	11.2	10.2	10.5	14.0	11.1		12.6	13.8	12.3
Bd	15.8	13.3	12.1	12.2	14.9	12.7		15.4	15.5	13.9

ph1	EN II-2	EN II-2	LN-ECh	EBA II-3	EBA II-3		**ph2**	EN II-4	EN II-4	EN II-1
GLpe	37.7		46.9	50.4	43.3		**GL**	25.4	23.8	26.7
Bp	13.8	12.7	17.0	18.0	15.5		**Bp**	14.5	11.5	15.5
SD	10.7		13.9	14.7	13.8		**SD**	10.0	8.7	11.0
Bd	13.0		16.9	17.5	15.9		**Bd**	12.3	9.8	12.7

ph3	EN I-6	EN II-3	EN II-3
DLS	39.5	44.3	31.5
Ld	32.3	37.7	24.8

Bos primigenius f. taurus

horn core	EN II-1
l. diam	55.5
sm. diam	44.7

scapula	EN II-3	EN II-3	EN II-3	EN II-3A	EN II-3	EN II-1	EN II-1	EN	EN	EN
GLP	74.9	74.4	71.0	67.8		81.1		76.0	71.4	66.7
LG	61.9	61.4	59.0	56.1		67.3	54.9	62.9		57.9
BG	49.6	46.8	53.3	45.7		55.8	43.7	48.3	48.3	
SLC	60.6	53.8		46.9	56.8	56.4		55.0	53.6	51.1

scapula	LN-ECh	LN-ECh	ECh	EBA II		**humerus**	EN II-2	EBA II		
GLP	71.6	59.2	67.7			**Bp**	{101}	100.0		
LG						**humerus**	EN I-8	EN I-6	EN I-6	EN I-5
BG	48.0		49.7	55.6		**Bd**	87.4			86.4
SLC			55.4	63.4		**BT**	77.2	{95}	80.1	78.0

humerus	EN II-4	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN	LN-ECh
SD		48.6	34.0							
Bd		110.8	{92}			85.6	{83}	{66}		80.0
BT	69.2	93.8	83.0	{79}	79.4	76.2			72.7	
remark	burnt bl									

humerus	LN-ECh	LN-ECh	ECh	ECh	ECh	EBA II	EBA II-3	EBA II-1		
Bd			100.0		80.3	73.9	91.5	64.9		
BT	79.1	77.9	82.7	88.4	80.0	70.4	80.1	57.2		

radius	EN I-6	EN I-5	EN II-4	EN II-2	EN II-2	EN II-2	EN II-2	LN-ECh	LN-ECh	ECh
Bp	84.3	80.6	61.6	90.0	88.4	88.1		86.0		84.5
BFp	75.4	74.7	75.1	87.0	80.5	78.7	74.0	79.6	63.8	77.5

radius	EBA II-3	EBA II-3	EBA		**radius**	EN I-5	EN II-3	EN	LN-ECh	LN-ECh
Bp	83.9	74.7	74.2		**Bd**	78.0	63.4	76.2	87.0	78.0
BFp	76.3	65.4	67.8		**remark**	dist nf				

radius	LN-ECh	EBA II		**ulna**	EN II-4	EN II-4	EN II-4	EN II-4	LN-ECh	
Bd	61.6	68.0		**BPC**	52.6	51.7	48.3		45.3	
remark		dist fg		**SDO**				64.3		

mc	EN II-3	EN II-2	EN	LN-ECh	EBA II	EN I-6	EN I-6	EN II-4B	EN II-4	EN II-3
GL	218.0	{202}	{205}	208.8	214.4					
BP	60.6	64.4		71.1	63.6	60.1	59.9	65.2	69.7	63.5
SD	32.7		34.1	41.5	36.7			35.0	43.1	32.4
Bd		65.0	64.3	72.6	62.5					
remark	dist fg	path								

mc	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN	EN	LN-ECh	LN-ECh	EBA II-3
BP	65.7	64.2	62.6	59.2	51.2	65.7	63.2	60.2	59.0	62.2
SD	37.3	35.3				35.6	35.0			
remark				burnt gr						

mc	EBA II-3		**mc**	EN I-6	EN I-6	EN I-5	EN II-4A	EN II-4A	EN II-4	EN II-3
BP	55.2		**SD**					34.6		
SD			**Bd**	62.0	61.6	63.0	66.3	63.5	64.9	>76,6

mc	EN II-3	EN II-3	EN II-2	EN II-1	EN	EN	EN	LN-ECh	LN-ECh	LN-ECh
SD	31.6	33.0								
Bd	61.2		61.2	61.9	66.0	62.7	61.7	70.7	59.0	58.9

mc	EBA II-3	EBA II	EBA II	EBA II	EBA II					
Bd	70.4	61.4	61.1	58.3	55.3					

femur	LN-ECh	LN-ECh	LN-ECh	LN-ECh	LN-ECh	ECh	EBA II	EBA II	EBA II	EBA II
DC	52.0	51.8	47.1	43.7	42.4	47.3	46.7	42.8		
Bd									84.5	81.5

tibia	EN II-2		**tibia**	EN I-7	EN I-5	EN I-5	EN I-5	EN I-5	EN II-4	EN II-4
GL	342.0		**SD**						37.6	
Bp	{101}		**Bd**	64.0	{62}	{62}	60.9	59.8	67.0	62.2
SD	39.5									
Bd	64.4									

tibia	EN II-3A	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN II-2	EN II-1	EN II-1	LN-ECh
SD						42.4	40.0			
Bd	66.0	65.7	65.3	72.3	67.2	65.3		65.0	63.5	69.1

tibia		LN-ECh	LN-ECh	ECh	EBA II-1	EBA		**tibia**	EN I-5	EN II-4
Bd	66.7	63.5	63.5	66.2	56.5	65.9		**Bp**	101.9	{113,1}

tibia	EN II-2	EN II-2	EN II-1	LN-ECh	ECh		**calcan.**	EN I-7	EN I-6	EN II-4
Bp	101.7	95.6	100.5	93.0	89.0		**GL**	141.0	134.2	132.8

calcaneus	EN II-3	EN II-2	EN II-2	EN II-2	EN II-1	EN	EN	EN	EN	LN-ECh
GL	135.4	155.0	132.3	130.6	135.0	135.4	133.9	133.7	131.9	141.7

calcaneus	LN-ECh	LN-ECh	LN-ECh	LN-ECh	ECh	EBA II	EBA II-1
GL	141.3	137.5	132.4	125.5	142.5	{145}	137.5

astragalus	EN I-8	EN I-8	EN I-8	EN I-7	EN I-7	EN I-7	EN I-7	EN I-6	EN I-6	EN I-5
GLl	73.2	70.2		73.3	72.7	72.6	67.3	67.3	66.6	67.3
GLm	67.7	64.9	64.0	68.5	69.4	67.9	62.5	62.0	61.9	63.5
Dl	41.3	38.2		41.0	40.0	40.7	38.1	39.6	39.5	37.4
Bd	45.9			44.3	45.7	45.7	44.9	46.6	45.6	43.1
remark										

astragalus	EN II-4A	EN II-4A	EN II-4A	EN II-4A	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4
GLl	79.9	72.2	69.2		74.7	73.4	71.9	71.6	69.8	69.2
GLm	75.4	66.2	65.1	68.0	70.0	68.4	68.7		65.3	62.2
Dl	45.4	40.0	39.6			41.4	38.0	40.0	38.3	
Bd	52.0	48.0	46.0		49.6	48.4	42.6	45.5	44.0	45.7
remark										

astragalus	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-4	EN II-3A	EN II-3A
GLl	69.0	68.3	67.3	67.2	64.1				77.7	74.3
GLm	65.3	62.8	63.6	61.2	58.9	63.4	63.5		72.1	68.7
Dl	40.0	38.7	39.0	36.8	34.2				45.0	40.7
Bd	45.0	43.3	44.0	40.1	39.9		42.0	44.4	50.0	46.9
remark						burnt bl			burnt br	burnt gr

astragalus	EN II-3A	EN II-3A	EN II-3A	EN II-3	EN II-3	EN II-3	EN II-3	EN II-3	EN II-3	EN II-3
GLl	70.4	70.0	67.0	70.7	69.5	69.3	68.8	67.3	65.8	65.4
GLm	66.4	64.2	62.9	65.6	64.4	64.2	63.5	60.8	63.7	60.6
Dl	40.0	39.3	38.0	41.1	39.6	38.5	39.6	39.0	38.7	36.9
Bd	45.4	45.2	43.3	44.3	47.0	42.9	44.2	44.6	45.0	43.5
remark				burnt bl						

astragalus	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2
GLl	64.0		78.3	76.3	72.2	71.2	71.0	70.8	70.5	70.0
GLm	59.0	62.2	71.3	71.5	68.4	66.8		65.8	64.8	63.8
Dl	36.6		43.5	43.3	38.5	40.0	39.9	38.7	39.6	37.7
Bd	40.5	44.2	49.0	49.7	45.4	44.5	45.5	43.0	45.2	44.3

astragalus	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-2	EN II-1	EN II-1
GLl	70.0	69.6	69.2	68.1	67.8	65.6	63.2		75.1	72.4
GLm	64.4	65.1		64.0		62.0	58.7		69.1	67.1
Dl	38.5	38.1	38.2	39.3	38.4	37.4	35.0		42.5	40.2
Bd	43.6	43.6		42.8		42.0	41.3	50.5	45.5	45.2
remark				burnt bl						

astragalus	EN II-1	EN II-1	EN II-1	EN II-1	EN	EN	EN	LN-ECh	LN-ECh	LN-ECh
GLl	68.7	68.1	67.3	64.3	70.2	69.0	68.8	69.5	69.0	67.8
GLm	63.7	65.5	61.1	62.1	65.6	64.8	63.5	64.1	65.0	62.0
Dl	39.6	40.7	37.7	36.9	38.4	38.1	39.0	40.0	38.4	38.0
Bd	43.4	46.9	42.2	41.6	44.9	42.2	45.4	43.8	44.8	42.9

astragalus	LN-ECh	LN-ECh	LN-ECh	ECh	ECh	EBA II-1	EBA II-1	EBA II-1	EBA II-1	EBA II
GLl	67.4	67.0	65.0	73.7	72.0	69.8	67.7	67.0	64.4	72.9
GLm	60.6	62.6	60.2	68.5	66.5	63.3	61.6	64.2	62.4	66.8
Dl	37.5	37.2	38.0	41.7	39.5	38.9	36.8	28.2	36.3	40.0
Bd	45.7	42.5	43.8	50.0	48.7	42.1	38.0	42.2	39.4	48.5

astragalus	EBA II	EBA II	EBA II	EBA II	EBA II	EBA II	EBA
GLl	70.7	69.9	69.3	64.6	62.2		
GLm	64.8	66.8	62.1	58.8	57.6	63.2	
Dl	40.4	38.8	38.8	36.1	34.2	37.0	38.8
Bd	46.8	42.5	44.5	40.5	39.4		43.8

navic.	EN I-6	EN I-6	EN I-5		**patella**	EN II-1
GB	60.2	56.2	58.0		**GH**	64.4

mt	EN II-3A	EN II-3A	EN II-3	EBA II-1		**mt**	EN I-5	EN I-5	EN II-4B	EN II-3A
GL	248.3	242.8	{202}	224.0		**Bp**	52.3	30.6	49.3	50.8
Bp		50.0	46.3	44.0		**SD**		59.9		
SD	28.4	28.2		23.6						
Bd	64.4	57.4								
remark			dist nf							

mt	EN II-3	EN	EBA II		**mt**	EN II-3A	EN II-2	EN II-1	LN-ECh	EBA II
Bp	53.0	50.7	44.4		**Bd**	62.6	61.4	58.7	59.0	52.7
SD	30.0	27.0								
remark		dist nf								

ph1 AE	EN II-4	EN II-4	EN II-4	EN II-3	EN II-2	EN II-2	EN	EN	LN-ECh	LN-ECh
GLpe	66.3	62.4	60.8	76.2	65.3	58.6	61.3	57.7	67.4	55.8
Bp	31.7	33.5	31.8	35.8		38.5	34.5	32.2	35.3	32.7
SD	26.6	28.4	25.4	30.4	28.3	25.0	28.4	27.0	31.6	28.2
Bd	30.5	30.4	28.9	32.8	31.9	28.5	31.4	30.1	31.9	30.0

ph1 AE	LN-ECh	EBA II		**ph1 AI**	EN I-6	EN II-4	EN II-4	EN II-4	EN II-2	EN II-2
GLpe	55.8	62.8		**GLpe**	61.7	58.4	56.7	56.4	{66}	67.5
Bp	32.0	29.0		**Bp**	32.9	33.5	32.8	33.4	37.8	36.9
SD	27.3	25.5		**SD**	26.3	27.4	27.8	27.9	30.7	31.6
Bd	29.2	28.9		**Bd**	30.5	30.8	31.2	30.5	36.8	36.0

ph1 AI	EN II-2	EN	LN-ECh	LN-ECh	LN-ECh	EBA II		**ph1 A**	EN I-6	EN I-6
GLpe	59.9	66.3	61.6	61.2	59.2	51.9		**GLpe**		42.1
Bp	30.3	34.2	32.0	32.3	32.5	25.9		**Bp**	39.0	31.8
SD	24.0	29.7	28.1	28.5	28.4	22.5		**SD**		25.7
Bd	28.1	33.4		30.2	29.7	24.7		**Bd**		29.0

ph1 A	EN I-6	EN II-4B	EN II-3	EN II-3	EN II-2	EN II-2	LN-ECh	LN-ECh
GLpe	42.0		59.3		63.5	56.2	65.8	60.2
Bp	31.6		32.0	31.9	33.5	30.5	35.3	32.2
SD	25.6	30.0	26.7			25.7		
Bd	29.3	35.7						

ph1 PE	EN I-5	EN I-5	EN II-4	EN II-2	EN II-2	EN II-2	EN II-2	LN-ECh	LN-ECh	LN-ECh
GLpe	70.2	61.0	61.5	65.2	63.7	57.0		65.8	63.3	60.1
Bp	35.9	29.4	30.7	31.7	31.8	27.5		31.0	29.9	29.7
SD	28.5	23.7	24.8	25.0	24.2	22.2	26.6	27.0	25.0	24.7
Bd	34.0	26.3	28.2	27.0	29.5	26.5	30.6	28.5	27.4	26.9

ph1 PE	ECh	EBA II
GLpe	63.8	65.7
Bp	33.0	30.9
SD	26.6	
Bd	27.4	27.3

ph1 PI	EN II-4A	EN II-4	EN II-2	EN II-1	EN II-1	EN II-1
GLpe	65.1	61.2	67.1	64.2	62.6	59.2
Bp	31.0	31.9	33.0	30.5	29.3	28.4
SD	26.6	26.6	26.3	24.4	26.6	23.5
Bd	31.0	31.3	31.6	30.3	28.8	27.4

ph1 PI	LN-ECh	LN-ECh	LN-ECh	LN-ECh	LN-ECh	LN-ECh	ECh	ECh	EBA II-1	EBA II-1
GLpe	68.6	66.4	65.8	65.4	61.4	60.1	66.1	64.2	60.4	58.4
Bp	31.7	31.3	30.6	31.1	30.2	30.8	35.3	35.8	27.1	30.4
SD	28.0	28.3	27.4	28.4	26.8	27.3	27.1	29.9	22.0	24.3
Bd	31.2	30.2	29.4	30.0	28.6	29.0	31.1	33.8	26.3	29.1

ph1 PI	EBA
GLpe	62.3
Bp	32.9
SD	28.2
Bd	31.8

ph1 P	EN I-6	EN I-6	EN I-6	EN II-2	EN II-2	EN II-2	EN
GLpe	62.3	62.1		66.6			59.9
Bp	31.0	31.4	28.9		35.5	31.9	29.5
SD			23.7	29.4			23.6
Bd			24.9	34.1			27.9

ph1 P	ECh	EBA II
GLpe	71.6	65.7
Bp	36.5	30.5
SD	31.0	27.0
Bd	33.9	

ph1	EN I-8	EN II-4
Bd	28.5	26.5

ph2 A	EN I-6	EN II-4	EN II-3	EN II-3	EN II-3	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2
GL	40.1	44.2	44.9	42.5	41.2	40.8	39.9	43.3	42.7	42.5
Bp	32.1	34.7	32.5	33.3	31.0	33.9	30.6	30.6	33.8	32.3
SD	26.2	28.3	26.3	26.9	24.5	25.5	25.3	25.6	26.8	26.0
Bd	28.4	31.7	29.4	30.3	26.3	27.5	28.0	26.9	29.8	29.0

ph2 A	EN II-2	EN II-2	EN	EN	LN-ECh	LN-ECh	LN-ECh	LN-ECh	LN-ECh	EBA II
GL	41.2	40.0	43.2	41.4	41.2	40.4	39.9	38.9	37.5	37.6
Bp		30.9	33.9	31.4	32.8	31.8	32.2	30.8	29.4	30.5
SD	25.2	25.0	25.9	24.9	26.0	26.4	25.5	25.8	23.4	24.5
Bd	27.9	27.7	28.6	27.2	27.8	29.2	27.0		24.4	25.4

ph2 A	EBA
GL	40.0
Bp	31.6
SD	24.0
Bd	26.1

ph2 P	EN II-4B	EN II-4A	EN II-4	EN II-4	EN II-4	EN II-3A	EN II-3A
GL		43.8	41.6	40.8		43.4	41.3
Bp	29.0	30.7	32.2	29.7		32.0	
SD	23.4	24.7	26.0	23.2		24.5	22.9
Bd	25.4	26.0	28.2	24.0	24.8	25.9	25.3

ph2 P	EN II-3	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN II-1	EN II-1	EN	LN-ECh
GL	42.0	41.7	39.5	{38}	45.2	39.1	40.3		45.9	44.7
Bp	29.2	29.3	29.0	25.3		26.9	28.8	32.5	31.4	30.6
SD	24.3	23.8	23.1	21.0		23.4	22.6	26.3	25.6	24.3
Bd		25.7	24.5	22.2	28.8	25.4	24.0	27.6	27.4	24.7

ph2 P	LN-ECh	LN-ECh	LN-ECh	LN-ECh	ECh	ECh	EBA II	EBA II	EBA	
GL	40.2	39.9	38.8		44.1	44.0	41.7	39.9	41.1	
Bp	29.7	28.8	29.2	27.3	34.6	35.3	29.4	29.1	31.2	
SD	25.2	23.4	23.0		27.4	29.2	24.3	23.9	24.5	
Bd		25.1	24.5		29.2	29.1	24.9	23.6	26.0	

ph2	EN II-2	EN II-2	EN I-8	EN I-6	EN I-5	LN-ECh	LN-ECh	LN-ECh	LN-ECh	LN-ECh
GL	42.0	37.2	39.5	42.3	43.6	42.9	42.8	42.1	41.9	36.7
Bp	30.2	27.9	30.8	31.1	30.1	32.2	31.1	31.3	31.1	24.7
SD	22.8	22.7	24.8	24.9	24.0	26.5	26.0	25.5	25.0	19.4
Bd	25.3	24.3	26.8	29.4	25.5	27.2	26.8	26.0	26.8	23.0

ph2	LN-ECh		**ph3**	EN I-7	EN I-6	EN I-6	EN I-6	EN I-5	EN I-5	EN I-5
Bp	32.2		**DLS**	69.2	89.9	87.5	85.0	86.5	74.8	70.4
SD	26.6		**Ld**	57.2	72.2	63.2	63.0	64.5	58.9	56.8
Bd	27.0									

ph3	EN I-5	EN I-5	EN II-4B	EN II-4A	EN II-4	EN II-4	EN II-4	EN II-4	EN II-3A	EN II-3
DLS	64.8	60.0	76.6	72.4	92.2	79.5	79.2	76.7	61.8	87.4
Ld	54.5	50.0	59.9	55.4	69.1	58.4	57.0	57.0	51.1	66.3

ph3	EN II-3	EN II-3	EN II-2	EN II-2	EN II-2	EN II-1	EN II-1	EN II-1	EN II-1	EN II-1
DLS	78.8	59.3	74.9	73.2	58.1	97.5	86.2	79.4	70.0	66.4
Ld	63.9	49.2		59.5	43.3	73.0	63.1	56.7	54.7	53.6

ph3	EN	EN	LN-ECh	LN-ECh	LN-ECh	LN-ECh	LN-ECh	LN-ECh	LN-ECh	LN-ECh
DLS	80.9	69.4	88.7	84.6	82.0	79.2	79.1	76.6	75.5	74.7
Ld	61.5	57.2	66.9	62.0	63.8	61.4	62.4	61.8	60.5	59.8

ph3	LN-ECh	LN-ECh	ECh	ECh
DLS	74.0	73.6	83.4	
Ld	53.0	62.6	63.0	55.7