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ANIMAL EXPLOITATION AT EARLY BRONZE AGE ASHQELON, AFRIDAR: WHAT THE BONES TELL US—INITIAL ANALYSIS OF THE ANIMAL BONES FROM AREAS E, F AND G

SARAH WHITCHER KANSA

INTRODUCTION

A primary aim of zooarchaeological research traditionally has been to provide information on human subsistence. However, recognizing that the human-animal relationship involves a much broader spectrum of economic, social and ideological factors, recent zooarchaeological studies have moved beyond subsistence in order to investigate issues such as specialization, socioeconomic status, trade and ethnicity (Pohl 1985; Crabtree 1990; Redding 1991; Zeder 1991; Gumerman 1997). Understanding the nature and extent of animal products exploitation is especially important for the initial stages of the Early Bronze Age, when this region stood on the brink of urban development.

This paper presents a preliminary analysis of the animal bones from three areas (E, F and G)[1] in the Afridar neighborhood in Ashqelon, an EB I settlement on Israel's southern coastal plain. Area E lies adjacent to the modern seashore and was excavated by Amir Golani in 1994 and 1995 (Golani, this volume). On the basis of ceramic typology and other finds from the numerous pits, the excavator assigns the site to the earliest part of the EB I (EB IA), although radiocarbon dates clustering around the first half of the fourth millennium indicate a late Chalcolithic presence as well. Area F, the smallest of the areas, was excavated by Hamoudi Khalaily and Zvi Wallach (Khalaily, this volume). The earliest phase (Stratum II), in which conical and bell-shaped pits and V-shaped bowl fragments were found, dates either to the Late Chalcolithic or to the very early portion of EB I (Khalaily and Wallach 1998). Area G, excavated by Eliot Braun during the spring of 1993, produced the largest animal bone assemblage in this study. The curvilinear structures of the two main strata (1 and 2) are assigned by the excavator to an initial phase of EB I (Braun 2000; Braun and Gophna, this volume). Below these are traces of Chalcolithic and Pottery Neolithic remains (see Zbenovich, this volume).

There are few faunal assemblages that can be assigned to a specific sub-phase within the Early Bronze Age (Horwitz and Tchernov 1989:281), and most of them are very small. Areas E, F and G at Afridar produced a sample of over 4000 identified bones, ranking it among the largest EB animal bone assemblages in the southern Levant (see Table 1). Of particular interest is the assemblage's attribution to the early EB I, a specific phase of the EB from which faunal data are lacking. Afridar thus provides a large corpus of data with which to investigate the human-animal relationship during the EB I, specifically the exploitation of secondary products—such as milk, hair, wool, labor and transport—which can be taken from an animal while it is still alive (Sherratt 1983), as well as other benefits such as protection and companionship.

METHODS

Following the excavations, the animal bones recovered from Afridar Areas E, F and G were stored at Israel Antiquities Authority facilities in Jerusalem. In 1996 and 1997, I undertook analysis of the entire corpus of animal bones in the Zooarchaeology Laboratory of the Hebrew University of Jerusalem, under the auspices of

Table 1. Relative Frequencies of Taxa at EB and Chalcolithic Sites in the Southern Levant

	Sample Size	Sheep/ Goat	Cattle	Pig	Equid	Dog	Gazelle	Deer	Other	Reference
EB Sites										
Afridar E	527	30.6	19.7	15.4	20.9	1.7	2.7	0.2	8.8	
Afridar F	303	30.0	29.0	15.8	14.9	1.0	6.3	0.6	2.4	
Afridar G	3277	56.8	21.8	15.7	1.7	0.7	1.2	0.5	1.6	
Tel Yarmut	1184	88.0	11.0	-	-	-	0.3	0.3	0.2	Davis 1988
ʿArad	1820	87.3	7.4	0.3	1.9	1.9	1.0	-	2.0	Lernau 1978
Tel Dalit	1071	78.0	18.0	<1	1.0	<1	4.0	2.0	-	Horwitz 1996
Jericho	500	74.4	12.0	1.8	3.8	-	5.4	2.0	0.6	Clutton-Brock 1979
Meʿona	115	63.0	26.0	3.0	-	1.0	-	4.0	3.0	Horwitz 1996
Tel Nagila	484	58.4	29.3	2.5	1.2	0.8	4.6	-	3.0	Ducos 1968
Tel Kinrot	341	55.2	26.5	7.6	0.8	0.5	-	0.2	8.9	Hellwing 1988–89
Tel Dan	192	48.0	33.0	5.0	-	-	-	11.0	3.0	Wapnish and Hesse 1991
Tel ʿErani	787	50.4	20.1	9.0	7.4	0.4	7.7	0.4	4.5	Ducos 1968
ʿEn Shadud	97	29.0	22.0	24.0	25.0	-	-	-	1.0	Horwitz 1985
Chalcolithic Sites										
Meẓer	394	22.3	20.6	44.2	0.5	3.2	2.6	6.6	-	Ducos 1968
Wadi Gazzeh D	65	22.6	36.9	33.8	1.6	3.1	2.0	-	-	Ducos 1968
Tel Aviv	599	24.5	61.4	10.7	-	-	3.4	-	-	Ducos 1968
Munḥatta	358	30.7	31.2	25.5	0.3	0.6	11.7	-	-	Ducos 1968
Gat-Govrin	210	33.0	36.2	18.1	3.8	-	8.9	-	-	Ducos 1968
Abu Maṭar	971	69.0	19.0	-	3.0	6.0	-	-	-	Joisin 1955
Shiqmim 93	1558	85.0	11.5	-	0.2	0.3	1.0	-	2.0	Whitcher, Levy and Grigson 1996
Bir eṣ-Ṣafadi	513	89.9	3.7	-	-	0.8	5.3	-	-	Joisin 1955, Ducos 1968

the late Professor Eitan Tchernov (Department of Evolution, Systematics and Ecology). Identifications were facilitated by use of the extensive faunal reference collection housed at the Hebrew University. Over 13,000 bones and bone fragments were recovered from Areas E, F and G. The matrix in which occupational remains were found is a dark-brown, water-retentive soil. In all three areas of Afridar, animal bones were hand-collected and stored, unwashed, in paper bags according to excavation unit. Secure contexts such as pits and floors were dry-sieved in order to retrieve smaller remains. High salinity made it impossible to clean the bones in water, as they would quickly disintegrate. Instead, the material had to be cleaned off carefully with a wooden pick and a wet brush. Some bones, even after cleaning, were encrusted with patches of calcium carbonate, making the notation of butchery, gnawing, or other bone-processing marks difficult. An attempt was made to piece together some of the recently broken fragments.

Each identified bone or bone fragment was given an identification number and documented on a spreadsheet, along with other notes of identification such as taxon, element, a description of the part preserved, fragment size, side and age. Measurements were taken, where

possible, according to von den Driesch (1976). Bone fragments that could not be identified to taxon or element were grouped into size categories and counted.

Unless otherwise stated, the data presented are based on NISP (Number of Identified Specimens). However, to take into account the possibility that a single animal might be represented by more than one element, bones that obviously paired or articulated were noted. This method was used on a context-specific level: no attempt was made to pair or articulate bones from different loci.

Sheep and goat bones are notoriously difficult to distinguish. For this reason, the majority of the sheep and goat bones are included in the broader category 'sheep/goat'. When diagnostic parts were present, the distinction between sheep and goat was based upon the morphological and metrical criteria laid out by Boessneck (1969).

THE ASSEMBLAGE

Of the 13,000 bone and tooth fragments, 4107 were identified to element and taxon. Table 2 shows the relative frequencies of the 23 taxa of domestic and wild animals identified at Afridar Areas E, F and G. Although the faunal spectrum is fairly typical of a southern Levantine EB site (see Table 1), there are a few anomalies, such as the high number of equid bones in Areas E and F, and the lion, crocodile and sea turtle bones in Area G. Moreover, there appear to be a number of differences in relative frequencies of taxa between the three areas of Afridar (Fig. 1; Table 2). While it is unclear whether these differences are due to the small sample sizes of Areas E and F, these differences would be lost if the data from all three areas were aggregated. Thus, to avoid misleading results of aggregation, the assemblages from the three areas are considered separately where possible. In some cases, such as for aging, the data from Areas E and F are given less weight than the data from Area G, which provides the largest and thus the most reliable sample.

The predominant taxa at Afridar are domesticated sheep, goats, cattle, pigs and donkeys. Sheep and goats dominate the assemblage, ranging from 30% to almost 60% of the NISP totals in each area (see Fig. 1; Table 2). Cattle and pigs are represented in similar proportions, at an average of 25% and 15%, respectively, in all areas. In Area G, equid bones

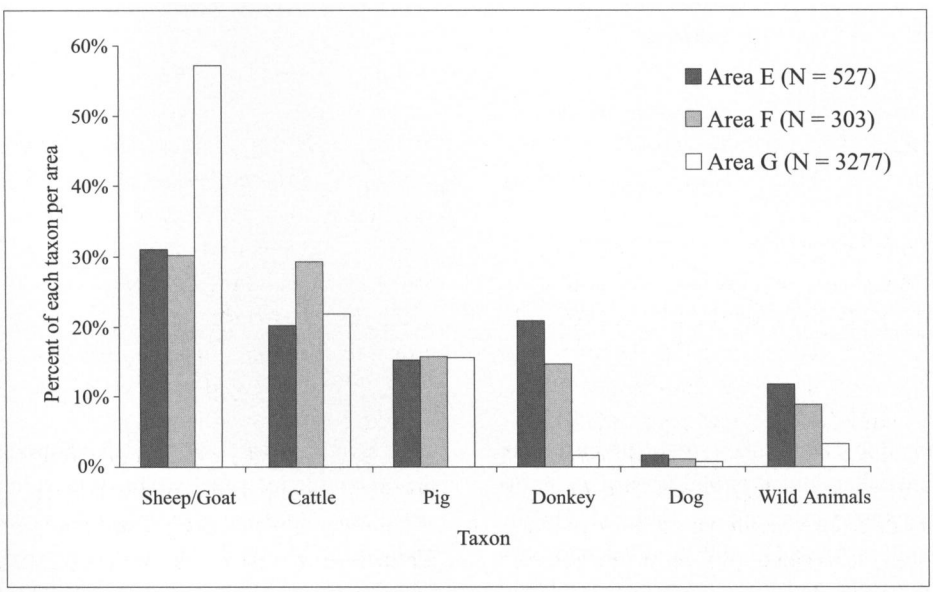

Fig. 1. Relative frequencies of taxa at Afridar.

Table 2. Relative Frequencies of Taxa at Afridar Areas E, F and G*

		Area E		Area F		Area G	
Common Name	Taxon	N	%	N	%	N	%
Domestic animals							
Sheep/Goat	*Ovis aries/Capra hircus*	161	30.6	91	30.0	1862	56.8
(Sheep)		(18)	-	(9)	-	(130)	-
(Goat)		(7)	-	(6)	-	(32)	-
(Sheep/Goat)		(136)	-	(76)	-	(1700)	-
Cattle	*Bos taurus*	104	19.7	88	29.0	714	21.8
Pig	*Sus scrofa*	81	15.4	48	15.8	515	15.7
Donkey	*Equus asinus*	110	20.9	44	14.9	55	1.7
Dog	*Canis familiaris*	9#	1.7	3	1.0	22	0.7
Total		*465*	*88.0*	*274*	*91.0*	*3168*	*97.0*
Wild Animals							
Gazelle	*Gazella* sp.	14	2.7	19	6.3	40	1.2
Hartebeest	*Alcelaphus buselaphus*	-	-	3	1.0	5	0.2
Wild cattle	*Bos primigenius*	-	-	-	-	1	<0.1
Fallow deer	*Dama dama*	-	-	-	-	14	0.4
Red deer	*Cervus elaphus*	-	-	1	0.3	7	0.2
Roe deer	*Capreolus capreolus*	1	0.2	1	0.3	3	0.1
Fallow deer/Red deer	*D.dama/C.elaphus*	-	-	-	-	5	0.2
Horse (wild?)	*Equus* cf. *ferus*	-	-	1	0.3	1	<0.1
Lion	*Panthera leo*	-	-	-	-	2	0.1
Cat (domestic?)	*Felis* sp.	-	-	-	-	2	0.1
Hyaena	*Hyaena hyaena*	1	0.2	-	-	-	-
Fox	*Vulpes vulpes*	1	0.2	-	-	-	-
Rodent	Rodentia	2	0.4	-	-	1	<0.1
Bird	Aves	1	0.2	1	0.3	3	0.1
Crocodile	*Crocodilius niloticus*	-	-	-	-	1	<0.1
Sea turtle	Testudines	-	-	-	-	1	<0.1
Fish	Osteichthyes	42	8.0	3	1.0	23	0.7
Total		*62*	*12.0*	*29*	*9.0*	*109*	*3.0*
Total		*527*		*303*		*3277*	

* This table does not include: (1) shells; (2) bones from intrusive loci

This number includes a partial dog burial from Area E, which is counted here as one individual

(probably domestic donkey) make up just under 2% of the collection, a normal presence at most Early Bronze Age sites (see Table 1). On the other hand, in Areas E and F, equids comprise a surprising 20% and 15%, respectively. There are also substantial numbers of fish bones, especially in Area E, where fish comprise 8% of the assemblage (see Lernau, this volume). A small portion of the assemblage in each area is made up of wild animals such as deer, hartebeest, gazelle and fox (1 bone). The remains of domestic dogs make up about 2% of

each assemblage, including a dog burial in Area E (Golani, this volume).

The faunal spectrum at Afridar is similar to other EB sites in the southern Levant, although the relative frequencies are distinctive (see Table 1). At most EB sites, sheep and goats dominate the assemblage and are at least twice as numerous as cattle (Horwitz and Tchernov 1989:283). This appears to be the case in Area G, where sheep/goat and cattle comprise 57% and 22% of the assemblage, respectively. However, in Area E sheep and goats are present in only slightly higher numbers than cattle, and in Area F their numbers are nearly equal.[2] These differences hold true even if we exclude the equid bones from Areas E and F. The relative percentage of pig remains at Afridar is also unusual, compared to other EB sites where pig bones usually comprise less than 10%. At Afridar pig bones comprise 15% of the assemblage, more closely resembling Chalcolithic assemblages from the coastal plain (see Table 1). Lastly, as mentioned above, the percentage of donkeys at the site is highly unusual. The only site presenting a similar proportion of donkey bones is 'En Shadud, whose faunal assemblage is too small (97 identified bones) to provide a reliable comparison.

Sheep and Goats

Sheep and goats serve as a mobile and convenient source of meat in the Near East. Cut marks on long bones and extremities from Afridar indicate that they were butchered for food (see also Greenfield, this volume). All body parts are found in similar frequencies in all areas of Afridar, indicating that the animals were present at the site and exploited in similar ways in all areas, that is, for food and other products. Other than meat, sheep and goats also provide other primary products such as sinews and hides, and secondary products such as milk, wool, hair, and dung. Extensive studies have been undertaken to determine when milk and wool were first intensively exploited in the Near East and how to detect these products using animal bones and teeth (see Payne 1973; Davis 1984; Grigson 1995). It is thought that secondary products exploitation was intensified in the Early Bronze Age (Horwitz and Tchernov 1989; Grigson 1995), making early EB I Afridar especially useful for investigating incipient milk and wool intensification. While the inhabitants of Afridar surely exploited their sheep and goats for milk and wool/hair, it is of interest to determine, if possible, the degree to which this exploitation occurred.

An effective zooarchaeological tool for establishing the use of animals for primary or secondary products is age of death. This study uses two common methods to determine the age at which animals were being killed: mandibular tooth eruption and wear, and bone fusion stages. The former method is widely used in Near Eastern zooarchaeological studies, usually according to guidelines laid out by Payne (1973), facilitating comparison between assemblages. It is often applicable because durable mandibles and mandibular teeth are often the most abundant elements recovered at a site. Like human teeth, sheep and goat teeth erupt at more or less predictable ages. Therefore, the teeth of immature animals reveal their general age at death. Teeth of mature animals wear down as the animals grow older. By noting the enamel patterns and amount of wear on a specimen, the age of the animal at death can be estimated. Certain caveats make inter-assemblage comparison of tooth eruption and wear difficult. For example, the amount of sand in the pasturage can affect tooth wear, making a sheep with a gritty diet appear older than a sheep of the same age with a less gritty diet. Thus, this method is most useful for assessing the relative ages of individuals within an assemblage, and caution must be taken when comparing tooth wear on an inter-site level.

Using mandibular eruption and wear patterns, Payne (1973) has postulated survivorship curves for sheep and goats that reflect different exploitation strategies. When meat production is the primary aim, the survivorship curve should reflect a high kill-off of both males and

females up to the age of maximum growth (about two years of age), with a smaller population of mostly mature females being kept as a breeding population. In a milk-focused economy, there would be a sharp decline in very young animals (mostly males under six months to one year of age), again with maintenance of the majority of the females for milking. Finally, in a wool-focused economy, a higher preservation of adult animals is predicted (Payne 1973).

Like teeth, bones also mature at more or less predictable rates. The articular ends (epiphyses) of each bone fuse to the shaft (diaphysis) at slightly different ages. By noting the state of fusion (unfused, fusing, fused) for each element, we can gain a general impression of the percent of the overall population that survived beyond each broad age category. While bone fusion stages encompass a larger body of data than tooth eruption, the disadvantage of this method is that the latest-fusing (long) bones in sheep and goats fuse before four years, rendering inaccessible the mortality profile for the population beyond that age. Thus, bone fusion is most useful for corroborating (or, in some cases, contradicting) tooth eruption and wear results, at least up to maturity.

The chart of mandibular eruption and wear for sheep/goat at Afridar (Fig. 2) shows the percentages of individuals in each age category, together with a curve reflecting the declining survivorship in each category. These results are based on a sample of 146 mandibles and mandibular teeth from Area G, a reliable sample size for the Early Bronze Age. The results indicate that there is a very low kill-off of animals under one year of age. This seems to rule out the likelihood that milk was the primary aim. The lack of juvenile bones might be due to poor preservation, but with a sample size of 146 we would expect at least some representation of young animals if milking was intensive. The chart indicates a high kill-off of sub-adult animals that have achieved maximum growth (about two years of age), indicating that the inhabitants of Afridar considered meat a primary aim. Only five of the 32 pelves for which sex could be determined were from females. This supports the theory that males were killed more frequently and females were kept to older ages for breeding and probably for non-intensive milk and wool production. Wool production is supported further by a predominance of sheep bones over goat in all three

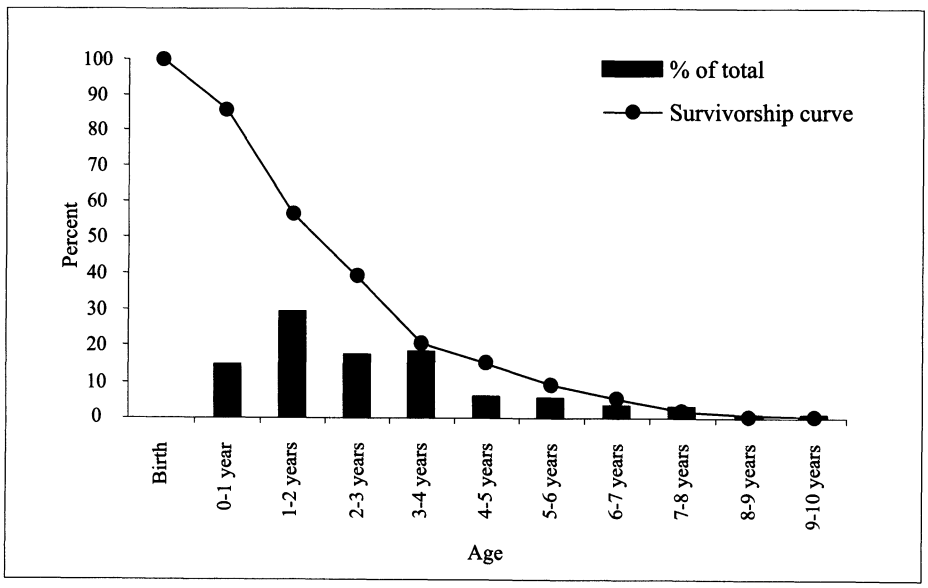

Fig. 2. Sheep/goat mortality at Afridar G, based on mandibular tooth eruption and wear (n = 146).

areas of Afridar as well as by spindle whorls found at the site.

These mandibular eruption and wear data are substantiated by an analysis of epiphyseal fusion for sheep and goat (Fig. 3). Fusion data are given for all areas; however, the sample from Area G is much larger than that of Areas E and F, making material from Area G the most reliable. The data from Area G indicates that the majority (up to 70%) of the individuals survived up to two years of age, after which there is a sharp decline around three years of age. Beyond that, about a third of the population was kept into older ages.

Sheep/goat herd composition data provides more insight into the use of these animals at Afridar. The sample size of bones identified specifically as either sheep or goat is too small from Areas E and F. However, the more reliable sample from Area G (162 bones) provides a ratio of 4:1 sheep over goat. A predominance of sheep in the Afridar herds reflects an environment that was sufficiently temperate and wet to provide a suitable habitat for sheep, which are better adapted to wetter environ mental conditions. A high proportion of sheep also suggests that wool was an important product, although the age data from Afridar does not support any intensive focus on wool production.

In conclusion, the age data indicates that the people of Afridar were exploiting sheep and goats locally and that their primary aim was meat production. While the majority of their sheep and goats were killed by the point of maximum growth, it is likely that the remainder of the flock was used for other products such as milk and wool on a regular, albeit non-intensive, basis. Although the high proportion of sheep might point to wool exploitation, the kill-off patterns indicate that this was on a small scale only.

Cattle

In total, 906 bones and bone fragments were identified as domestic cattle, *Bos taurus*, making up an average of 23.5% of the entire assemblage in all three areas of Afridar. Since one cow can provide up to ten times the meat (or other products) of one sheep or goat (Grigson 1995), cattle at Afridar, if raised for meat, would have made a substantial contribution of beef to the Afridar diet. However, the data from Areas E, F, and G suggests that the majority of the cattle was not killed for meat (at the age of maturity). Bone

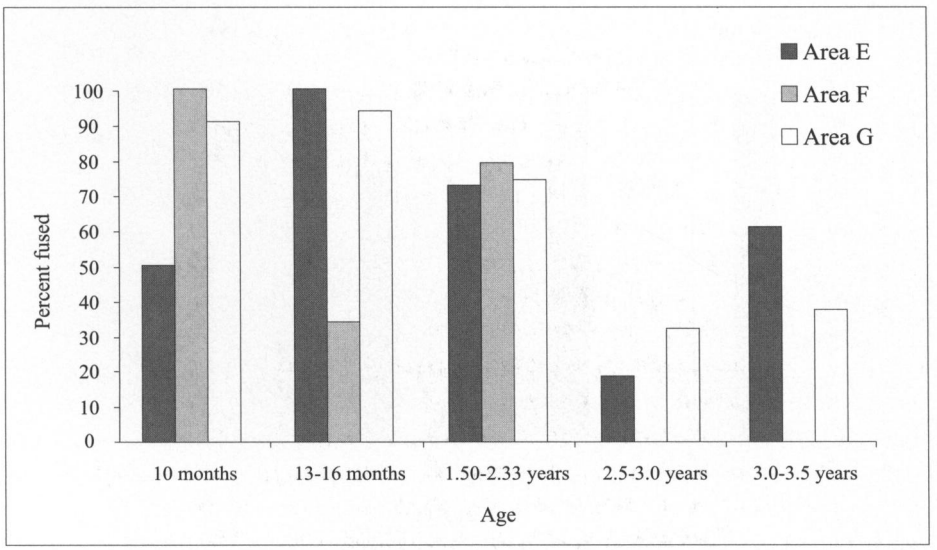

Fig. 3. Sheep/goat mortality at Afridar, based on bone fusion (data in Table 3).

fusion (Fig. 4; Table 3) shows that nearly 70% of the bones for which fusion data could be determined are from animals that survived beyond the age of two and a half years. Furthermore, 36% of the bones in the latest-fusing category (3.5–4.0 years) for all areas are fused, indicating that over a third of the cattle were kept beyond maturity, certainly females for breeding and perhaps for milking and/or labor. Considering the rather diverse spectrum of taxa exploited at Afridar, especially the high proportion of pigs (a major meat provider), it is likely that the role of cattle at Afridar was not primarily for meat. Chalcolithic and Early Bronze Age ceramic representations depicting cows carrying churns and yoked oxen provide evidence that cattle were used for labor and draft during this time (Ussishkin 1980; Amiran 1986; see Grigson 1995:267–268 for photos and a discussion of the use of cattle for labor). Certain anomalies on cow bones can be attributed to their use for heavy labor, transport, or draft. In fact, Grigson (1995) has taken these anomalies on cattle bones from Chalcolithic sites to suggest that this period provides the first evidence for the use of cattle for draft in this region. Among the cattle bones at EB I Afridar, 5% of the 108 first phalanges and 67 second phalanges show moderate to severe exostosis. While such chronic conditions can result from old age, the consistent occurrence of such pathologies can also be attributed to the use of cattle as draft animals (Bartosiewicz, Van Neer and Lentacker 1997:123). The relatively low proportion of pathologies at Afridar indicates that the inhabitants might have used a portion of the cattle population for draft on a non-intensive scale.

Some substantial size differences were noted among the cattle bones from Afridar. This can be accounted for in a number of ways: the difference between males and females; the hunting of the larger wild species of cattle, *Bos primigenius*; the presence of oxen (castrates) at the site; perhaps even the use of different breeds. These questions are being explored in continuing research on the Afridar animal bones.

Pigs

The 644 pig bones comprise a fairly high proportion (about 15.5%) of the entire assemblage in all three areas of Afridar. The pigs from Afridar were domestic, as the size of their mandibular third molars[3] falls well within

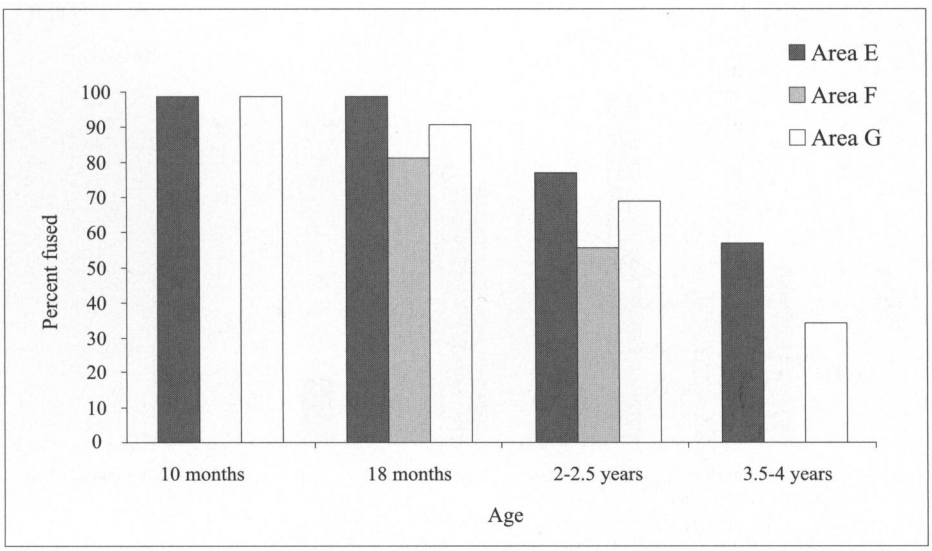

Fig. 4. Cattle mortality at Afridar, based on bone fusion (data in Table 3).

Table 3. Numbers of Fused and Unfused Sheep/Goat, Cattle and Pig Bones from Afridar Areas E, F and G (Bone Fusion Stages are Adapted from Silver 1969)

		Area E		Area F		Area G	
Fusion Stage		Fused	Unfused	Fused	Unfused	Fused	Unfused
Sheep/Goat							
10 months	Distal humerus, proximal radius, distal scapula	7	7	8	0	176	17
13–16 months	Proximal phalanx, middle phalanx	7	0	1	2	91	7
1.5–2.33 years	Distal tibia, distal metacarpus, distal metatarsus	13	5	7	2	103	39
2.5–3 years	Calcaneum, distal radius, proximal femur	1	5	0	1	28	62
3–3.5 years	Proximal humerus, distal femur, proximal tibia	3	2	0	1	10	18
Total		*31*	*19*	*16*	*6*	*408*	*143*
Cattle							
10 months	Distal scapula	2	0	0	0	6	0
18 months	Distal humerus, proximal radius, proximal phalanx, middle phalanx	18	0	9	2	139	12
2–2.5 years	Distal tibia, distal metacarpus, distal metatarsus	7	2	5	4	29	13
3.5–4 years	Calcaneum, proximal femur, distal radius, proximal humerus, distal femur, proximal tibia	4	3	0	1	18	35
Total		*31*	*5*	*14*	*7*	*192*	*60*
Pig							
1 year	Distal scapula, distal humerus, proximal radius, middle phalanx	11	0	3	0	29	14
2–2.5 years	Proximal phalanx, distal tibia, distal metacarpus, distal metatarsus, calcaneum	5	3	5	0	39	22
3.5 years	Proximal humerus, distal radius, proximal ulna, proximal femur, distal femur, proximal tibia	0	5	1	2	7	35
Total		*16*	*8*	*9*	*2*	*75*	*71*

the range for domestic pigs around the East Mediterranean (Davis 1987:138). Since pigs cannot be herded long distances, the high proportion of pigs at Afridar implies a more or less sedentary community (Grigson 1995).

While pigs provide no secondary products, their reproductive capacity and their fat content make them remarkable meat-producers: they reproduce more often than other animals and they have multiple offspring in a litter. Kill-off patterns based on bone fusion indicate that most animals survived their first year, and about 70% survived beyond two years of age (Fig. 5). However, nearly all of the pigs were killed before maturity, with an average of less than 20% of the individuals in all areas being maintained past maturity (probably for breeding). The lack of newborns and pigs killed under one year suggests that pigs were not penned at the site (at least not within the excavated portion of the site). As pigs are not herd animals, they may have been left to roam the environs of the site, while remaining closely monitored, perhaps through daily feeding.

The similarity of the kill-off pattern for pigs in all three areas of Afridar indicates that the inhabitants had control over the selection of individuals for butchery. This is in keeping with the non-specialized nature of pig husbandry, which allows for pigs to be kept in small numbers in or near households, resulting in relatively equal numbers of pig bones in all areas. In contrast, the fluctuations in the relative proportions of sheep/goat, cattle and equids between Areas E, F and G might result from specialized animal husbandry activities in different areas pertaining to pasturage or secondary products exploitation strategies.

There is a high consistency in the representation of body parts of pig bones between all areas of Afridar, suggesting that pigs were a common, non-specialized, and possibly individually owned resource. Pigs in ancient Egypt are thought to have been maintained by individuals and not subjected to the same degree of state control as were cattle, sheep and goats, largely because pigs produce little in the way of secondary products, and thus do not yield a surplus (Redding 1991:23). It has been suggested that at Tel Ḥalif, pigs composed a larger component in the economy of the autonomous Late Chalcolithic/EB I settlement than in later periods when the site was incorporated into a well-integrated regional

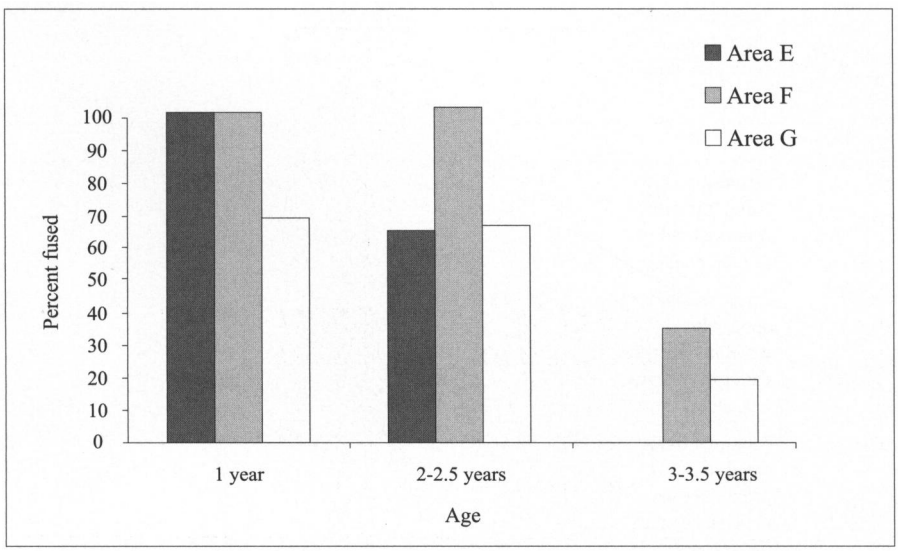

Fig. 5. Pig mortality at Afridar, based on bone fusion (data in Table 3).

economy (Zeder 1996). Along the same lines, Redding (1991) has suggested that agricultural intensification is inversely related to the abundance of pigs on sites in Egypt; that is, pigs are more difficult to keep in a society focused on grain agriculture since they compete with humans for food.

In summary, the higher number of pig bones at Afridar, in relation to other Early Bronze Age sites in the region, likely reflects a favorable environment for pig keeping and breeding. Their presence also suggests a number of social and economic conditions discussed above, including: a more or less sedentary population, since pigs cannot be driven over long distances; the keeping of pigs as individual household items; and a low degree of grain agriculture.

Equids

Equid and dog bones are less fragmented than those of sheep/goat and pig (and to a certain extent, cattle) at Afridar, indicating that for the most part they served the inhabitants for purposes other than food (Fig. 6). Furthermore, the excavations recovered more articulating bones of equids and dogs than other domesticates (Table 4). These facts provide intriguing insight into the human treatment of the animals at this site.

Equid remains are found at many sites dating to the Chalcolithic and Early Bronze Age, usually in small numbers. There is always a question as to their taxonomic status: horse (*Equus caballus*), onager (*Equus hemionus*), wild ass (*Equus africanus*), or domestic donkey

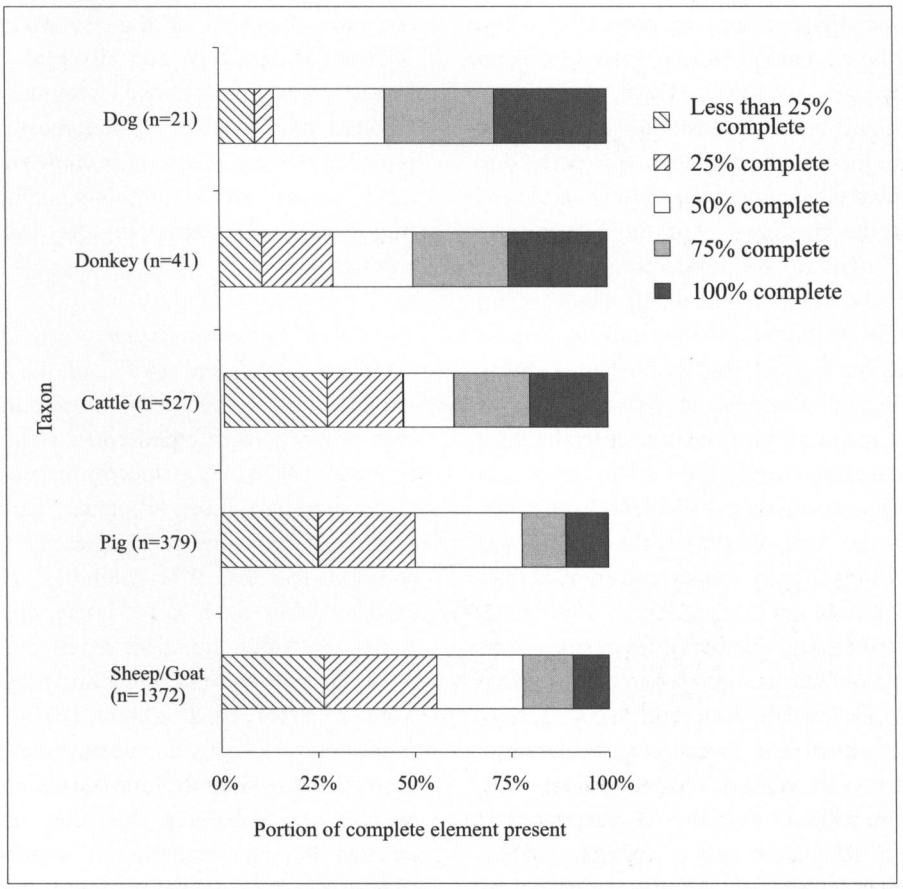

Fig. 6. Fragment sizes for the bones of the primary taxa at Afridar G.

Table 4. Number of Articulations Per Taxon: Areas E, F and G Compiled

Taxon	No. of Articulations	Total No. of Bones	Ratio
Donkey	40	211	1:5
Dog	30	56	1:2
Sheep/Goat	18	2110	1:117
Cattle	29	896	1: 31
Pig	5	643	1:129

(*Equus asinus*). It is thought that the domestic donkey became widespread as an animal for transport all over the Near East and Egypt during the Early Bronze Age (Grigson 1993). However, given that Afridar dates to the earliest part of the EB I, the possibilty that the equid bones found here are wild onager, ass, or horse must be considered.

Although the presence of horses has been noted at both Chalcolithic (Grigson 1993) and Early Bronze Age sites (Davis 1976), the Afridar equid bones are generally smaller than horse and their teeth have enamel patterns that indicate that they come from another species of equid. In the maxillary teeth, the anterior and posterior sides of the protocone are of equal size. In the mandibular teeth, there is no penetration of the buccal fold into the lingual fold, and the lingual fold is V-shaped rather than U-shaped. These are all characteristics of ass (wild and domestic) and onager teeth rather than horse teeth (Davis 1980). The bones and teeth of these species are difficult to distinguish, although the long bones of the onager are thought to be slightly longer and thinner than those of the ass and donkey (Davis 1980:308). However, the small number of long bones from Afridar prohibits comparisons with known archaeological and modern equid specimens.

Since metrical and morphological determinations between wild ass, onager and domestic donkey are difficult with the Afridar material, we turn to the nature and composition of the equid population at Afridar. The high percentage of equid remains is indicative, for a number of reasons, of domestic donkey (*Equus asinus*). Firstly, there appears to have been an increase in the number of equid remains at sites from the Chalcolithic to the Early Bronze Age (Ovadia 1992; see Table 1), most likely reflecting the arrival of the domestic donkey in the area. In addition, it appears that wild animals played a minor role in Late Chalcolithic and EB economies in general in the southern Levant. Sites of this period typically produce remains of gazelle, deer, and hartebeest, although in very small numbers (see Table 1). At Afridar there are very few wild animals (an average of 8%), but an average of 18% equid remains in Areas E and F. If the equids were wild, their presence would indicate a focus on equid hunting at Afridar, which is highly unlikely given the overall predominance of domestic animals at the site (each of the hunted species at Afridar, with the exception of gazelle and fish, make up no more than 1% of the assemblage). The differential butchery and disposal of equid bones mentioned above provides further evidence that the bones are of domestic donkey: if the bones were from equids hunted and eaten, they would show similar butchery and fragmentation patterns to the other food animals.

The Role of Equids at Afridar.— Equid remains make up 20.9% and 14.9% of the bones in Areas E and F, respectively. These surprisingly high proportions of equid bones stand in stark contrast to most of the Chalcolithic and EB sites in the area (see Table 1)[4], and in particular to Area G of the same site, where equid remains comprise less than 2%. The bones of animals used for labor, such as the horse, donkey and camel, are often found in small numbers as fewer animals were kept for this purpose than were kept for food (Davis 1987). A high frequency of a particular taxon usually occurs when that taxon contributes to the diet of the people who inhabited the site, the bones representing the remains of butchery and discard for primary animal products such as meat, hides, blood, marrow and sinews, to name

a few. Thus, the possibility that the equids at Afridar E were eaten cannot be ruled out. However, only five of the 27 equid bones for which fusion information could be noted are unfused. This indicates that the majority of the equids at Afridar E survived to adulthood, a pattern that suggests that these animals were not an important part of the diet or provided another product more valued than meat. Cut marks were noted on just one equid bone, a metacarpus from Area E. Cut marks on lower limb bones are often attributed to skinning (Greenfield, this volume). Furthermore, the equid remains are not highly fragmented (see Fig. 6) and are often found articulated (see Table 4), attesting to a differential treatment and disposal, as opposed to common food animals.

It is therefore most likely that the equids at Afridar were used for a purpose other than meat, such as labor and transport. Their high numbers in Areas E and F suggest an intensive exploitation of these secondary products. The facilitation of movement by donkeys has important economic and social implications, and we can imagine scenarios such as movement of people over longer distances, or transport of copper and other materials from distant regions previously difficult to access, such as the Wadi Feinan area in Jordan (Levy 1995). The inhabitants of the site may have been involved in some kind of industry requiring large amounts of raw materials, or involving a greater transportation or trade network. In light of the increasing contacts with Egypt during the Early Bronze Age, the significance of the donkey in the facilitation of overland routes of contact is brought to the forefront (Gophna 1995:278–279).

A Concentration of Equid Bones.— Equid bones are found in small numbers in most loci in all areas of Afridar. However, Locus 331 in Area E (the debris above a pit in the metal-working area) produced almost exclusively equid remains. Of the 34 bones recovered, 32 are equid (mostly donkey). The other two bones are a fragment of a cow skull and a fragment of a sheep/goat scapula. Proportions of mandibles and maxillae comprise 27 of the 32 equid bones (including fragments of a nearly complete skull) representing a minimum number of four individuals—one horse and three donkeys. Also interesting, apart from the almost exclusive presence of equid in this locus, is the relative paucity of skeletal parts other than the head. No other context at the site shows a similar concentration of one particular taxon or skeletal area.

This large concentration of equid bones was created in a different way than the other food preparation or normal discard contexts from Afridar. Numerous clay figurines of donkeys carrying loads from this period (Ovadia 1992) emphasize the value of equids for transport during the Early Bronze Age. The potential for long-distance transport of people and goods had far-reaching implications on the economy and foreign relations, and may have led to a special perception of domestic donkeys in the early stages of their spread across the Near East. The early date of Afridar indicates that this might be one of the first sites to exploit domesticated donkeys to such an extent. In this context, one might speculate that the Afridar Area E equid bone concentration may represent a special association of equids with the metal industry at Afridar, the skulls having been placed on top of the pit, perhaps as a type of affirmation of their importance to the economy. On the other hand, the location might simply have been a convenient place to dispose of unwanted refuse: the fact that the bones were above the pit suggests that they were put there after it was no longer in use.

Dogs

Canid bones are found on many Early Bronze Age sites (see Table 1) and are generally thought to come from domestic dog, *Canis familiaris*. At Afridar, a small number of animal bones with gnaw marks on them suggest the presence of dogs. Among the mere 2% of canid bones found at the site is a complete dog burial in Area E. The animal was

found lying on its left side with its head resting on a juvenile donkey tibia that showed signs of having been gnawed (see Golani, this volume). The dog's permanent teeth and fully-fused bones indicate a mature animal. The articulation of the dog skeleton and the absence of gnaw-marks on its bones, despite the presence of carnivores at the site (dog and fox), indicate that the animal was intentionally buried.

Table 5 lists the measurements of some of the dog remains from all areas at Afridar, along with mandibular and maxillary teeth measurements taken by Lernau (1978) on domestic dog remains from an EB II deposit at 'Arad. The measurements of the teeth from 'Arad are very similar to those from the dog burial in Area E, suggesting that the animals were of a similar size. However, long bone measurements are needed to more accurately assess the size of the Afridar dog. Dog burials, though rare in earlier periods, have been found as early as the Natufian period (Davis and Valla 1978). A dog burial with ceramic vessels was found at the Chalcolithic sanctuary of Gilat (Levy 1995:237). The Afridar Area E burial, with a possible offering of a complete donkey tibia, indicates a special human-dog relationship, probably involving companionship and protection, which certainly had its roots thousands of years earlier.

Wild Animals

Less than 8% of the Afridar assemblage consists of wild animals, suggesting that hunting made up a very small part of the economy. In spite of this, there are a number of interesting components in the wild animal assemblage (including a rather large proportion of fish bones, see below, and Lernau, this volume).

The majority of the 73 gazelle (*Gazella gazella*) bones and bone fragments are from the lower limb areas and the head, indicating they were discard from butchery at the site or were present at the site in the form of skins. One aurochs bone (*Bos primigenius*) was identified in the Area G assemblage. This is a calcaneum with a maximum length of 163.7 mm. While this measurement falls within the range for domestic cattle, the corpus calcanei of the bone had recently fused (the fusion line is visible), suggesting a young individual of a substantial size.

Three species of deer (red deer—*Cervus elaphus*, fallow deer—*Dama dama*, and roe deer—*Capreolus capreolus*) are represented in 32 bones. Eight bones belong to hartebeest (*Alcelaphus buselaphus*), a wild herd animal which is present in small numbers at many Early Bronze Age sites in this area, but which has since been confined to North Africa. The small percentage of hartebeest in the collection includes a complete astragalus with the following measurements: GLl:46 mm; GLm: 44.2 mm; Bd:29.5 mm; Dl:27.1 mm; Dm:26.4 mm (following von den Driesch 1976).

Two equid bones from Afridar were identified as horse (*Equus ferus*): a distal radius (Bd:66.4 mm) from Area F, and a distal tibia (Bd:74.5 mm) from Area G. Horse bones have been found at a few Chalcolithic and Early Bronze Age sites (such as Shiqmim, Bir Abu Maṭar and 'Arad). These bones were originally thought to come from domestic horse, *Equus caballus*, due to their large size and their discovery outside the ancient range of the wild horse, *Equus ferus*. However, recent research demonstrates that the range of the wild horse extended farther than previously thought (Levine 1999). This suggests that the small numbers of identified horse bones from sites of this period may come from the occasional hunted wild horse, rather than domestic horse. If the horses were domestic and used in a similar way to other equids, they would probably be represented in more substantial numbers, similar to the percentage of donkey bones. Furthermore, domestic horses did not become widespread in this area until over 1000 years later, making it unlikely that these bones represent the earliest domestic horses in the region. While there is a possibility that these might be tame horses that reached this area

Table 5. Measurements of *Canis familiaris* Bones from Afridar Areas E, F and G*
(See von den Driesch 1976 for a Key to the Measurements)

Bone No.	Bone	Side	Measurements (mm)				
AM729, a-v	**Astragalus**	L	GL=27				
AM525	Atlas	NA	GB=76	GL=36.5	H=24	Bfcr=37	Bfcd=29.5
AF293	Calcaneum	L	GL=42	GB=16	Bp=11.9		
AM729, a-v	**Calcaneum**	L	GL=40.7		Bp=11		
MM225	Femur	L	GL=165	Bp=33.2	DC=16	Bd=26.4	SD=11.3
AM121	Humerus	L		Bp=24.3	Dp=25.1		
AF1028	Humerus	L	SD=12.8	Bp=27	Dp=39		
AF1511	Humerus	R	SD=11.1				
AM729, a-v	**Humerus**	R	SD=11.8	Bd=28			
MM126	mandibular M2	R	length=9				
AM729, a-v	**mandibular P2**	R	length=8.8				
Arad dog	*mandibular P2*	*L/R*	*length=7.8, 7.7*				
AM729, a-v	**mandibular P3**	R	length=9.4				
Arad dog	*mandibular P3*	*L/R*	*length=9.7, 10*				
AM729, a-v	**maxillary Canine**	R	length=9.3				
Arad dog	*maxillary Canine*	*NA*	*length=9.3*				
AM729, a-v	**maxillary P2**	R	length=9.6				
Arad dog	*maxillary P2*	*NA*	*length=9.6*				
AM729, a-v	**maxillary P3**	R	length=11				
Arad dog	*maxillary P3*	*NA*	*length=10*				
AF1248	metacarpus II	L	GL=69.5				
AM729, a-v	**metacarpus II**	L	GL=55.2				
AM729, a-v	**metacarpus III**	L	GL=64.2				
AM729, a-v	**metacarpus IV**	L	GL=62.7				
AM729, a-v	**metacarpus V**	L	GL=52.3				
AM729, a-v	**metatarsus III**	L		Bp=8			
AM299	metatarsus IV	L		Bp=5.6	Dp=10.8		
AM729, a-v	**metatarsus IV**	L		Bp=5.8			
AF3228	Radius	R	SD=11.5	DD=6.4	Bp=18		
AF1031	Radius	L	SD=13.2	DD=7.9		Bd=22.5	
AF1251	Radius	R				Bd=27.2	BFd=23
AF1527	Radius	L	SD=11.8	DD=6.6	Bp=17.7	Bd=22.5	BFd=19
AM729, a-v	**Radius**	R	SD=12		Bp=16.3		
AM227	Scapula	L	SLC=20.3	GLP=24.7	LG=21.7	BG=15	
AF2091	Scapula	L	SLC=24.4	GLP=29.8	LG=24.7	BG=18.1	
AF2981	Scapula	L		GLP=23.8	LG=19.8	BG=13.6	
AF1030	Tibia	R	GL=201.2	Bp=31.5	Bd=20.3	Dd=15.4	SD=12
AF3181	Tibia	R		Bp=25.4			
AM729, a-v	**Tibia**	L					SD=11.4
MM253	Ulna	R	GL=122	SDO=20.1	DPA=25.4		
AM729, a-v	**Ulna**	R		SDO=18.3	DPA=22.6	LO=29.8	

*Elements in bold are from the partial dog burial in Area E. Elements in *italics* are measurements from 'Arad (Lernau 1978)
L=left; R=right; NA=not applicable

during the Early Bronze Age, there is no evidence to date that successful controlled breeding of domestic horses occurred until much later.

Two lion (*Panthera leo*) bones were found in Area G: a calcaneum and a complete half-mandible. The mandible was found in a secure Early Bronze Age deposit, just above a circular structure in Stratum I. Given the small amount of hunting practiced at Afridar and the scarcity of lion bones at Early Bronze Age sites, it is possible that both bones were brought to the site in a lion skin.

There are very few bird remains at Afridar, possibly a result of poor preservation, the bones of birds being quite thin-walled and fragile. However, there are numerous fish remains, particularly in Area E (see Lernau, this volume). Fish make up 8% of the entire assemblage in Area E, while comprising just 1% percent or less in the other areas. Whether the difference between the areas is due to preservation conditions or retrieval strategies is difficult to say. Area E appeared to have poorer preservation conditions than Area G, so we would expect to find more fish bones from Area G. Also, Area E is located only slightly closer to the water than Area G. It is possible that Area E had a special fish smoking area, possibly related to the smelting activities which seem to have been carried out in that area. A tentative parallel is found in smelting activities associated with deposits of fish bones from Giza in Lower Egypt (Lehner and Wilkinson 1997:236–237).

A maxilla fragment from a Nile crocodile and a plastron segment from a sea turtle add two rare and intriguing items to the bone assemblage. While their presence at Afridar is unusual, they are thought to represent infrequent resources available in the coastal region at this time. However, together with a Nile perch bone found among the fish remains (see Lernau, this volume), the Nile crocodile might represent early EB I ties with Egypt (contact that would have been greatly facilitated by the domestic donkey).

CONCLUSIONS

The inhabitants of Afridar enjoyed a varied subsistence economy of sheep/goat, cattle, pig, fish, and a number of wild taxa. The diversity of the surrounding landscape is reflected in a high proportion of pigs and three types of deer (indicating a somewhat wet environment with forest or brush nearby), together with small numbers of gazelle and hartebeest (suggesting dry, open grasslands and seasonal drainages). In this diverse and fruitful environment, the inhabitants of the site relied almost solely on domesticates, spending little time hunting wild animals. They also exploited local marine resources, including fish, shells, and the occasional sea turtle.

The highly fluctuating proportions of different taxa at Afridar and other Early Bronze Age sites probably reflect both environmental differences due to location as well as socioeconomic differences during this period. In particular, the early part of the Early Bronze Age I was a time of decentralized, autonomous sites, and variation between settlements is reflected in the faunal spectrum. Each site probably functioned more or less independently (in terms of subsistence activities), responding to their local economic and environmental needs, so we see a variation in animal proportions depending on the needs and activities of the specific site. A lack of broad regional husbandry practices during the early EB I is supported by the high proportions of pig and equid, at the expense of sheep and goat at Afridar, as well as by the evidence for non-specialized use of animals.

In all three areas of Afridar, sheep and goats were primarily meat animals. Only about 20% of the animals were kept past maturity, and these were probably mainly females for breeding and perhaps for some non-intensive milking and wool-production. Thus, it appears that sheep/goat exploitation at Afridar did not involve any intensified milk or wool production. This conclusion is not surprising

given the picture of highly site-specific husbandry practices painted by the relative faunal spectrum comparisons during the EB I. Most cattle were maintained to adulthood, possibly for draft and milking; however, some individuals were killed at a younger age indicating that the people of Afridar also used cattle for meat. The variation in the size of the cattle bones at Afridar probably reflects sexual dimorphism or perhaps the presence of castrates for labor.

Pigs were plentiful in the subsistence economy of Afridar, indicating a favorable environment in which pig-keeping was possible along with some degree of agriculture and the maintenance of other domestic animals. A rather high proportion of pigs (an average of about 70% in all three areas) survived past two years of age, followed by a kill-off of all but an average of 16% of the pigs by age three. The lack of juvenile pigs suggests that pigs were not kept in pens at the site, but perhaps were allowed to range in the area around the site under controlled conditions for breeding and butchery.

An abundance of mature equid bones and their differential discard and fragmentation patterns indicate that the equids of Afridar were most likely domestic donkeys and were used for labor, rather than for meat. Given the location of the site and the copper industry thought to have been associated with it, it is likely that the people of Afridar used equids for transport and labor. Domestic dogs appear to have had a certain sentimental value to the society (or to an individual).

Analysis of the faunal assemblage at Afridar indicates a broad spectrum of animal-related human behavior in addition to the provisioning of meat. It raises a number of issues concerning animal exploitation at Afridar, including the implications of pig-keeping, the sentimental relationship between people and dogs, and the use of donkeys and their corresponding iconography. The present study of the Afridar fauna emphasizes the ways in which humans related to animals and exploited them for non-subsistence products, and how this may convey information about human social organization. Further analysis of the assemblage will shed more light on human behavior and motivations related to the control and use of animals during the initial stages of the Early Bronze Age in the southern Levant.

NOTES

[1] The animal bones from Afridar constitute a portion of the material used by the author in her Ph.D. research at the University of Edinburgh. Further results are forthcoming.

[2] The relatively low numbers of sheep/goat remains as compared to other Early Bronze Age sites could be due to poor preservation at the site. Smaller bones might have been less well-preserved or more easily overlooked. When we consider the body part representation for the major taxa at the site, sheep/goat and pig feet bones are represented in smaller numbers than the larger cattle feet bones. Thus, we must keep in mind that the numbers of sheep/goat in the assemblage might be deflated due to preservation or excavation techniques.

[3] The lengths of the M3s from Afridar are: 32, 32, 32.4, 33.5, 34.4, 37 (an average of 33.5 mm).

[4] One taphonomic consideration is that many of these remains are teeth, so caution must be taken in the interpretation of the representation, as teeth tend to survive better than bones, and large teeth (those of equids and cattle) are more frequently spotted by the excavator than small teeth (those of sheep/goat or pig). In any case, the proportions are exceptionally high.

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