Who Let the Dogs Out?
Bone Destruction and Its Broader Implications in Interpreting the Bronze Age Pastoral Economies at Kaman-Kalehöyük

A. Levent ATICI
Cambridge, Mass.

ABSTRACT

Taphonomic analysis has shown that the Early Bronze Age faunal assemblage from Kaman-Kalehöyük was modified by the combined destructive effects of humans and dogs. Intensive human processing and consumption of bones and subsequent dog ravaging substantially decreased the number of specimens intact enough to be identified. This has resulted in significant distortions, seriously affecting our efforts to develop a picture of the consumption and redistribution of animal resources and modes of pastoral production as reflected in kill-off patterns and in skeletal part profiles derived from long bone epiphyseal fusion data. An evaluation of the scale of the taphonomic loss may enable the zooarchaeologist to seek alternative ways of approaching the same questions. Before attempting to interpret paleoeconomies and patterns of social organization, the zooarchaeologist should deal with taphonomic problems, thus gaining insights into assemblage formation and modification processes in order not to formulate misleading interpretations of past human behavior.

INTRODUCTION

Various cultural and natural agents can affect the quality, quantity, and condition of faunal remains, which are subject to postmortem, predepositional, and postdepositional processes. Humans, dogs, sediment weight, water transport, gravity, chemical leaching, trampling, burning, and/or a combination of nutritive and non-nutritive processes of destruction are some of the dynamic forces creating and/or altering archaeofaunal assemblages (Behrensmeyer 1993; Marean and Cleghorn 2003). Interpreting an assemblage based on the simple assumption that all excavated bone fragments are the products of past human behavior is apt to be largely erroneous and may generate rather biased interpretations with reference to past human behaviour and paleoeconomies. This may be particularly problematical when dealing with centralized and specialized Bronze Age pastoral economies, as many inferences with reference to paleoeconomies are drawn from age structure and skeletal part profiles, which are very susceptible to and can easily be distorted by taphonomic bone loss. In order to deal with this bias, the zooarchaeologist should employ a detailed taphonomic assessment in order to better understand bone accumulating, modifying and destroying factors. This will ultimately aid archaeologists in their efforts to retrieve data for developing a picture of past patterns of social organization and paleoeconomies.

Dogs have already been suggested as a major taphonomic filter at Kaman-Kalehöyük, and the lack of certain less mechanically durable elements has been explained by the heavy impact of dogs on the Early Bronze Age (EBA) assemblage (Atıcı 2003; 2005). This paper attempts to gain insights into the formation and modification of EBA Kaman-Kalehöyük faunal assemblages through a detailed taphonomic analysis. In so doing, we evaluate the degree of bone preservation and the extent of overall taphonomic bone loss as well as discuss some of the underlying mechanisms involved in these processes. Documentation of bone accumulating, modifying and destroying factors and their impacts on the EBA Kaman-Kalehöyük assemblage will help us to better interpret EBA and subsequent pastoral economies.

MATERIAL AND METHOD

The stratigraphy of the site comprises four major divisions with several distinct architectural phases in each (Omura 2000; 2001; 2002):
I- Islamic Period (the Ottoman Empire Period) from ca. AD 1500
II- Iron Age (the Phrygian Period) from the 9th century BC to 7th century and later
III- Middle and Late Bronze Age (the Assyrian Trade Colony, the Old Hittite, and the Hittite Empire periods) of the second millennium
IV- Early Bronze Age of the third millennium.

The material analyzed for this paper comes from sectors III and IV in the northern trench. Five building levels dating to the EBA have been unearthed in this part of the mound. The sampled units are from three rooms that have been identified as high priority contexts. Rooms R104, R240, and R287 represent three building levels (BL): BL1, BL4, and BL5 (Table 1).

Table 1 Archaeological contexts selected for the analysis

Kaman-Kalehöyük North Trench, Sector III			
Stratum	Building Level	Trench	Feature
IV a	1	XLI-55 G	R 104
IV a	4	XLI-55 G	R 240
IV b	5	XLI-54 G	R 287
IV b	5	XLI-55 G	R 287

The analysis was carried out at the excavation facilities near Kaman, Kırşehir. Four principle taxa – sheep (*Ovis aries*), goat (*Capra hircus*), cattle (*Bos taurus*), and pig (*Sus domesticus*) – dominate the EBA fauna of Kaman-Kalehöyük, their bones making up 97 percent of the total number of bones identified to taxon (Atıcı 2003; 2005). The bones from sheep, goat, sheep/goat, and medium mammal category were combined into an "O/C" ("caprine") category and treated as a single analytical unit so that a dependable sample size could be achieved for the specific purpose of this paper. The sampled assemblage consists of 3538 specimens, which were selected from 4717 specimens that were previously analyzed (Atıcı 2005). Of these, 1152 specimens that were not identified to any skeletal element were excluded from the analysis, reducing the sample size to 2386 specimens. This sample comprises 51 percent of the previously analyzed assemblage. All specimens were assigned a unique identification number, counted and weighed. Data on the context, skeletal element, body part, taxonomic affiliation, symmetry, epiphyseal fusion, sex, pathology, fragmentation, completeness of element, completeness of portion, fragment size group, origin and type of break, bone surface modifications (i.e., cut marks, carnivore gnawing, rodent gnawing, root etching, pitting) type and color of burning, type of cut mark, location of cut mark, erosion/rolling, and fracture platform angle were recorded into a FileMaker Pro database.

The taphonomic methodology adopted in this analysis is a multivariate one. Bone fragmentation and breakage patterns were approached by a combined use of different aspects of bone surface modifications such as platform angles of long limb bone shaft fragment breaks, tooth marks, cut marks, and the relationship between bone survival and bone density.

The frequency of breakage planes and the range of longitudinal and oblique fracture angles were recorded for 204 randomly selected shaft specimens (eliminating the specimens with modern breaks) in order to document the presence or absence of dynamic and/or static loading in the fragmentation process. This sub-sample makes up 15 percent of the total number of long bone shaft fragments. Dynamic loading (e.g., using a hammer stone) will fracture a bone along oblique and/or longitudinal planes and will preserve fracture angles that vary but usually are less than 85° or 95°. This is in contrast to a bone broken by static loading (i.e., carnivore tooth or sediment loading), which will typically break along transverse and/or longitudinal planes at a ~90° angle and with an irregular release surface (Outram 2001; Pickering *et al.* 2005). This methodology helped us determine whether or not bone fragmentation was a product of cultural processes (i.e., human activities) or natural processes such as dog gnawing.

Previously identified carnivore species at EBA Kaman-Kalehöyük include dog (*Canis familiaris*, NISP=32), fox (*Vulpes* sp., NISP=2), and cat (*Felis catus*, NISP=1) (Atıcı 2005: Table 3). Traces of carnivore ravaging on this assemblage were thus attributed to dogs based on the presence of their physical remains in the assemblage as well as the nature of the traces. We use tooth marks and evidence of static loading in order to determine the impact of the dogs on the assemblage formation and modification. Tooth marks were identified and examined with a 15x hand lens under a strong light following Blumenschine (1995).

Number of identified specimens (NISP) was used as the basic quantitative measure. Minimum number of individuals (MNI) was used to estimate the expected number of elements. Based on the sampled assemblage, an MNI count of 18 was derived from 10 right mandibular fourth premolars (P_4) and 8 right mandibular fourth deciduous premolars (dP_4). Minimum number of elements (MNE), a secondary level of abstraction of NISP, was used to derive minimum animal units (MAU) values. MNE values are calculated considering the completeness of the elements and portions. The state of completeness for each element and element portions was coded as "complete," "almost complete," ">3/4," ">1/2 but <3/4," "1/2," ">1/4 but <1/2," "<1/4," and "various/nonidentified." MAU values are used to test the correlation between %MAU and Lyman's (1994) bone density values for sheep.

RESULTS

A total of 2386 caprine specimens was used to estimate MNE counts for skeletal elements and portions whose density values are known from modern specimens. Expected MNE counts were estimated for each skeletal element and portions given an MNI count of 18. Then, these counts were compared to the observed MNE counts that were derived from NISP counts (Fig.1). Observed MNE counts were used to derive MAU and percentage MAU (%MAU) counts for caprine skeletal elements and element portions. Table 2 presents

Table 2 Caprine MNE, MNI, MAU, and %MAU counts

Element	MNE	MNI	MAU	%MAU	Density***
Horn	5	3	2.5	50.0	NA
Skull	5	4	2.5	50.0	NA
Mandible	8	18*	4.0	80.0	0.55**
Atlas	2	2	2.0	40.0	0.11
Axis	1	1	1.0	20.0	0.14
Cervical	2	1	0.4	8.0	0.13
Thoracic	3	1	0.2	4.6	0.24
Lumbar	0	0	0.0	0.0	0.22
Rib	9	1	0.3	6.9	0.25**
Sternum	0	0	0.0	0.0	0.22**
Scapula	9	6	4.5	90.0	0.33
Humerus proximal	1	1	0.5	10.0	0.13
Humerus distal	8	4	4.0	80.0	0.34
Radius proximal	4	4	2.0	40.0	0.36
Radius distal	2	2	1.0	20.0	0.21
Carpals	4	2	0.3	6.7	0.48**
Metacarpus proximal	5	3	2.5	50.0	0.55
Metacarpus distal	3	2	1.5	30.0	0.44
Pelvis	10	7	5.0	100.0	0.26
Femur proximal	4	2	2.0	40.0	0.28
Femur distal	2	2	1.0	20.0	0.22
Tibia proximal	3	2	1.5	30.0	0.16
Tibia distal	7	5	3.5	70.0	0.36
Astragalus	7	7	3.5	70.0	0.63
Calcaneus	8	5	4.0	80.0	0.58
Metatarsus proximal	6	4	3.0	60.0	0.68
Metatarsus distal	0	0	0.0	0.0	0.39
Phalanx 1	16	7	2.0	40.0	0.55
Phalanx 2	9	2	1.1	22.5	0.4
Phalanx 3	5	1	0.6	12.5	0.3

* The highest MNI value was derived from the teeth.
**Deer density values used when sheep data not available.
***Bone density: Lyman, 1994: 246.

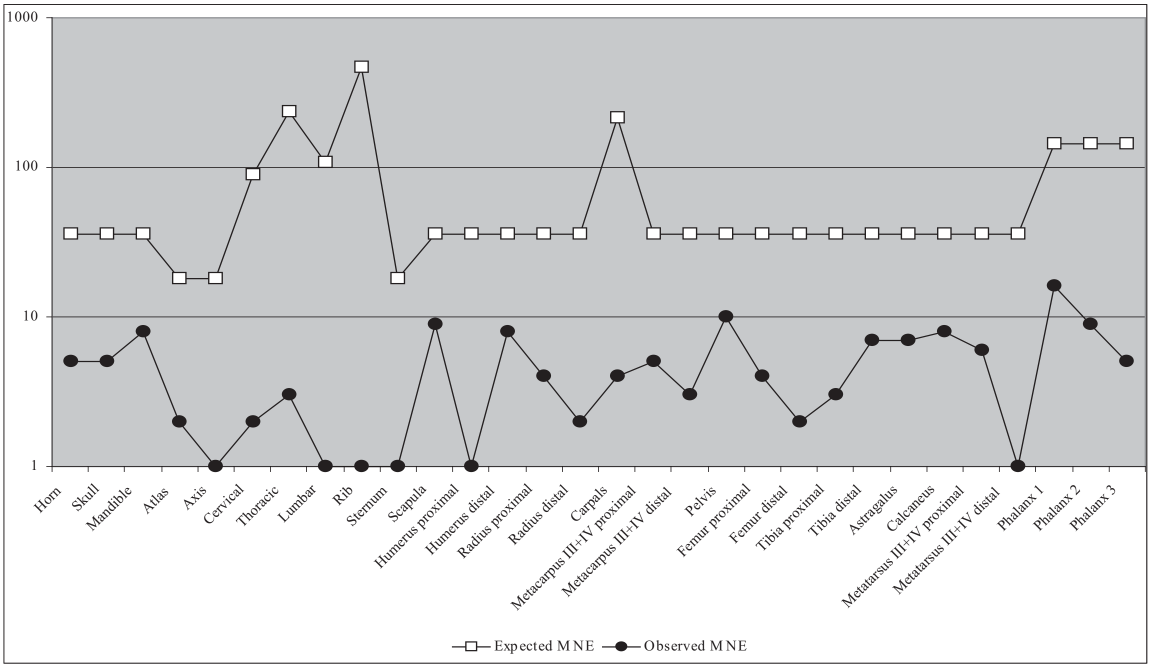


Fig.1 Expected vs. Observed MNE counts (Log scale used. MNE for the lumbar vertebra, sternum, and distal metatarsus is 0)

Table 3 %Survival of skeletal element and portions

Element*	Expected MNE	Observed MNE	% Survival	Element**	Expected MNE	Observed MNE	% Survival
Pelvis	36	10	27.8	Horn	36	5	13.9
Scapula	36	9	25.0	Skull	36	5	13.9
Mandible	36	8	22.2	Mandible	36	8	22.2
Calcaneus	36	8	22.2	Atlas	18	2	11.1
Humerus distal	36	8	22.2	Axis	18	1	5.6
Astragalus	36	7	19.4	Cervical	90	2	2.2
Tibia distal	36	7	19.4	Thoracic	234	3	1.3
Metatarsus III + IV proximal	36	6	16.7	Lumbar	108	0	0.0
Metacarpus III + IV proximal	36	5	13.9	Rib	468	0	0.0
Skull	36	5	13.9	Sternum	18	0	0.0
Horn	36	5	13.9	Scapula	36	9	25.0
Phalanx 1	144	16	11.1	Humerus proximal	36	1	2.8
Femur proximal	36	4	11.1	Humerus distal	36	8	22.2
Radius proximal	36	4	11.1	Radius proximal	36	4	11.1
Atlas	18	2	11.1	Radius distal	36	2	5.6
Tibia proximal	36	3	8.3	Carpals	216	4	1.9
Metacarpus III + IV distal	36	3	8.3	Metacarpus III + IV proximal	36	5	13.9
Phalanx 2	144	9	6.3	Metacarpus III + IV distal	36	3	8.3
Femur distal	36	2	5.6	Pelvis	36	10	27.8
Radius distal	36	2	5.6	Femur proximal	36	4	11.1
Axis	18	1	5.6	Femur distal	36	2	5.6
Phalanx 3	144	5	3.5	Tibia proximal	36	3	8.3
Humerus proximal	36	1	2.8	Tibia distal	36	7	19.4
Cervical	90	2	2.2	Astragalus	36	7	19.4
Carpals	216	4	1.9	Calcaneus	36	8	22.2
Thoracic	234	3	1.3	Metatarsus III + IV proximal	36	6	16.7
Metatarsus III + IV distal	36	0	0.0	Metatarsus III + IV distal	36	0	0.0
Sternum	18	0	0.0	Phalanx 1	144	16	11.1
Rib	468	0	0.0	Phalanx 2	144	9	6.3
Lumbar	108	0	0.0	Phalanx 3	144	5	3.5

*Ordered by percentage survival values ** Ordered anatomically these counts along with Lyman's (1994) sheep density values.

Percent survival of elements reveals that destructive taphonomic processes differentially affected all skeletal elements (Table 3). In some cases, some skeletal elements or element portions are completely absent from the archaeological record, including lumbar vertebrae, ribs, sternums, and distal metatarsals and other elements or portions thereof such as thoracic and cervical vertebrae, carpals, proximal humeri, and distal phalanges are virtually absent (Fig.2). Among the best represented parts in the assemblage are pelves with a proportion of 27.8 percent, followed by scapulae (25 percent), calcanea, mandibulae, and distal humeri (each with a proportion of 22.2 percent). Thus, a high proportion of the skeletal elements and element portions in the assemblage seem to be significantly underrepresented with reference to expected MNE values.

Not-identified long bone shaft fragments comprise 55 percent of the assemblage, while long bone articular ends comprise 3 percent of the total number of bones (Table 4). There is thus a clear bias against mechanically less resistant or less dense element portions in general and the axial skeletal elements and long bone articular ends in particular. Bivariate analysis of anatomical units (%MAU) in relation to density values for sheep has revealed a positive and significant correlation (Spearman's rho= .456; P= .015 at .05 level) (Fig.3; Table 5). This also confirms the selective density-mediated destruction of the bones.

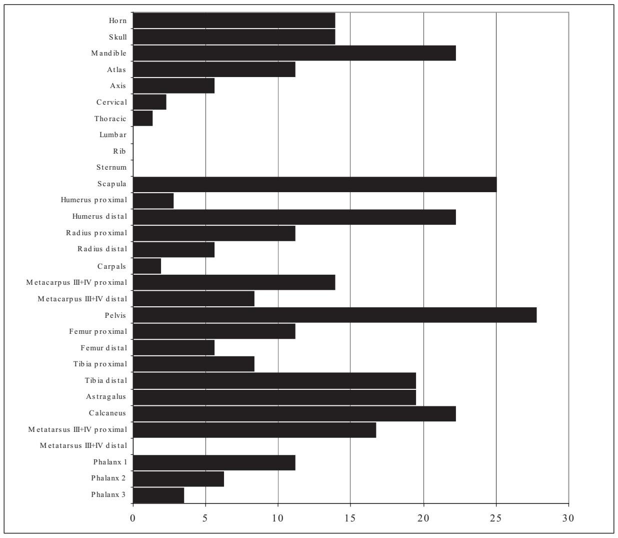


Fig. 2 Percentage survival of caprine skeletal elements and portions

Table 4 Long bone epiphyses and diaphyses

Element/portion	NISP	%NISP	MNE
Nonidentified long bone shafts	1313	55	NA
Long bone epiphyses	65	3	43
Humerus, proximal	1		1
Humerus, distal	8		6
Humerus shaft	8		4
Radius, proximal	9		4
Radius, distal	3		2
Radius shaft	8		4
Metacarpus III + IV, proximal	12		5
Metacarpus III + IV, distal	5		3
Metacarpus III + IV, shaft	5		4
Femur, proximal	4		4
Femur, distal	4		2
Femur, shaft	3		1
Tibia, proximal	3		3
Tibia, distal	9		7
Tibia, shaft	3		3
Metatarsus III + IV, proximal	7		6
Metatarsus III + IV, distal	0		0
Metatarsus III + IV, shaft	5		4

Bone surface modifications are of both biotic and non-biotic origin. Burned bones make up 70.3 percent of all the modified bones and 8.8 percent of the entire assemblage showing the strong effect of cultural transforms (Table 6). Traces of carnivore ravaging are also present. The marks that were identified in this assemblage are very conspicuous and damage is significant, supporting our previous assumption that all 57 carnivore tooth marks recorded for the EBA Kaman-Kalehöyük can be attributed to dogs (Fig.4). The number of bones with cut marks, another example of cultural transforms, is 27 (Fig.5). The number of diaphyses with complete circumferences – cylinders – and without both proximal and distal epiphyses is 31. These cylinders bear traces of dog ravaging,

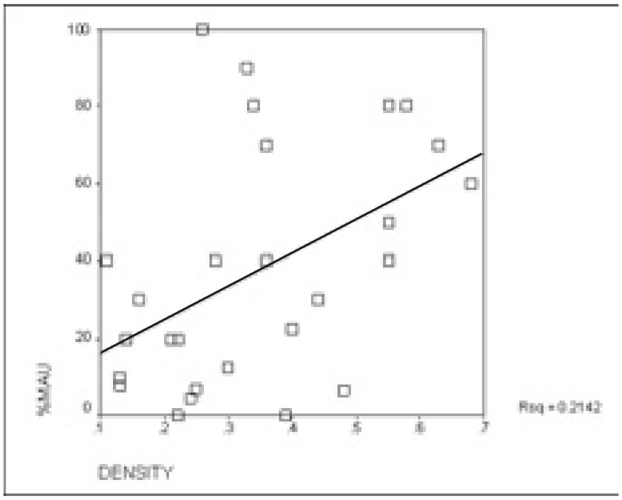
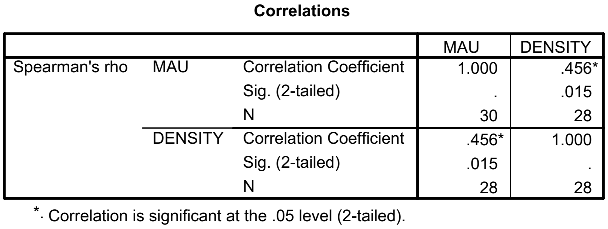


Fig. 3 Bivariate scattogram of %MAU vs. sheep bone density values

Fig. 4 A dog-gnawed pelvis fragment. Arrows show tooth scars

Fig. 5 A long bone diaphysis with cut marks

Table 5 Bivariate correlation of %MAU vs. sheep bone density values



Correlations

			MAU	DENSITY
Spearman's rho	MAU	Correlation Coefficient	1.000	.456*
		Sig. (2-tailed)	.	.015
		N	30	28
	DENSITY	Correlation Coefficient	.456*	1.000
		Sig. (2-tailed)	.015	.
		N	28	28

*. Correlation is significant at the .05 level (2-tailed).

Table 6 Bone surface modifications

Type of Modification	Total N	% N
Bones with cut marks	27	9.0
Bones with carnivore gnawing	57	19.0
Digested bones	4	1.3
Bones with rodent gnawing	1	0.3
Burned bones	211	70.3
Total Modified	300	100

Fig. 6 A chewed-over long bone cylinder

Table 7 Distribution of cut marks and carnivore (dog) tooth marks

Element	MNE	Cut marks	Dog gnawing
Mandible	21	1	0
Atlas	2	1	0
Thoracic	3	2	0
Rib	9	4	2
Scapula	9	2	6
Humerus distal	8	1	2
Humerus cylinder	4	3	2
Radius proximal	4	2	3
Radius cylinder	4	0	3
Carpals	4	0	1
Metacarpus III + IV proximal	5	1	1
Metacarpus III + IV distal	3	0	1
Metacarpus III + IV cylinder	4	0	1
Pelvis	10	2	5
Femur proximal	4	1	1
Tibia distal	7	0	1
Tibia cylinder	3	0	1
Astragalus	7	1	0
Calcaneus	8	0	2
Metatarsus III + IV proximal	6	0	1
Metatarsus III + IV cylinder	4	0	2
Nonidentified shaft	0	5	17
Nonidentified cylinder	12	1	3
Phalanx 1	16	0	2

the observed number of tooth mark occurrences on these specimens being 12, the number of tooth mark occurrences on nonidentified long bone shafts is 17 (Table 7; Fig.6).

The sub-sample of the assemblage that was analyzed for breakage planes shows a dominance of acute and obtuse angles (84.1 percent: Table 8; Fig.7). This is an indication of fragmentation of long bones primarily through dynamic loading, which is usually associated with human involvement in the bone fragmentation, most probably when the bones were in a fresh state green-stick fractures).

Table 8 Distribution of breakage platform angle types

Platform Angle	N	%
Acute--< 85	116	65.9
Right--90	28	15.9
Obtuse> 95	32	18.2
Total	176	100

Fig. 7 Long bone shaft fragments with acute and/or obtuse breakage plane angles

DISCUSSION

This paper has attempted to elaborate the assemblage formation and modification, and responsible modifier agents for the EBA Kaman-Kalehöyük. The basic aim was to demonstrate the degree of completeness of the assemblage through documenting which elements or element portions are missing and why.

The EBA Kaman-Kalehöyük faunal assemblage was affected by two major taphonomic factors: human processing and consumption and dog ravaging. It is clear that many skeletal elements and portions did not survive these two destructive forces and thus are missing from the assemblage. The relationship between our expected and observed MNE counts shows the biased representation of many element groups and the substantial degree of taphonomic bone loss. Actualistic studies show that there can be considerable difference in pre-carnivore ravaged and post-carnivore ravaged assemblages. NISP counts for epiphyses in post-ravaged assemblages are dramatically lower than in pre-ravaged ones, and post-ravaged shaft NISP counts are significantly higher than pre-ravaged ones (Pickering *et al*. 2003: 1473). This is because carnivores attack first the more cancellous or spongy, less resistant, and greasier axial elements and long bone articular ends (Payne and Munson 1985).

It is very common for zooarchaeologists to deal with extremely fragmented assemblages, because cancellous axial elements and articular ends contain tissues rich in fat and lipids and thus calories, which makes them the most likely targets for marrow and grease rendering processes that result in the smashing up of these elements (Speth 1991). Defleshing meat from bones, cracking open long bones to extract marrow, and pounding and boiling axial bones and cancellous articular ends to render grease result in the loss of these skeletal elements and/or portions. Depending upon the degree of processing and consumption imposed by cultural preferences and customs and subsistence stress levels (Marean and Cleghorn 2003; Outram 2001), animal carcasses may be exploited exhaustively and acquired nutrients may be transported to other locations creating a wide array of faunal patterns in the archaeological record.

The complete lack of certain bones such as lumbar vertebrae, ribs and sternums, and the under-representation of thoracic and cervical vertebrae and proximal humeri in our assemblage may be related to the high grease contents of these elements and portions, thus increasing their attractiveness to both humans and dogs. Yet, it is not a straightforward task to accurately identify grease rendering because both destructive agents may have been in action.

The analysis of bone surface modifications confirms that EBA Kaman-Kalehöyük residents butchered the caprine carcasses, defleshed the bones, and extracted the marrow from the long bones. Cut marks on both the articular ends and shafts attest to the practice of disarticulation and meat removal, and the preponderance of acute and obtuse fracture angles on the breakage planes of long bone shafts attests to the dynamic loading and thus human fragmentation of fresh bones for marrow (Table 7). This suggests that primarily humans destroyed long bones and generated most of the long bone shaft fragments. This also fits Pickering's (2002) assessment that carnivore generated assemblages have high ratios of intact cylinders without epiphyses, unlike human generated assemblages with a high degree of shaft fragmentation.

The EBA Kaman-Kalehöyük residents may have rendered grease by smashing the cancellous articular ends and axial bones into smaller pieces and boiling them in a pot (Outram 2001: 402). Thus, a part of the assemblage passed through the first taphonomic filter, humans, and many bones were removed from the potential depositional assemblage.

After Kaman-Kalehöyük residents modified and discarded the caprine bones, dogs played their part, further ravaging the discarded assemblage –– destroying many spongy and soft articular ends of long bones and cancellous vertebrae, ribs, and even compact bones such as astragali through gnawing and/or swallowing and exposing them to digestive acids (Fig. 8). Dog-chewed bone cylinders indicate that humans were not exclusively responsible for the long bone shaft fragmentation. The occurrence of traces of dog gnawing on long bone epiphyses suggests destruction of greasy bone portions by dogs as well as by humans. As bones may retain their grease content for over a year (Marean 1998: 128), dogs may have been attracted to the remaining greasy articular ends and axial elements if humans only cared for meat and marrow and discarded the defleshed and cracked bones in or around the site. Capaldo (1995) reports that carnivores generally attack the greasy axial elements before the limb epiphyses. This may help explain the disappearance of the axial elements from the Kaman-Kalehöyük assemblage.

Fig. 8 A partially digested astragalus

CONCLUSIONS

It is clear that EBA Kaman-Kalehöyük faunal remains were modified by the combined destructive effects of humans and dogs. This paper demonstrates that intensive human processing and consumption of bones and subsequent dog ravaging substantially decrease the number of identified bones leaving many specimens as either not-identified skeletal elements or not-identified long bone shafts. Our taphonomic analysis underlines this situation as 55 percent of the assemblage consists of nonidentified long bone shafts and 1152 nonidentified specimens had already been excluded from the analysis because they were not identified to any skeletal category. This clearly has a negative effect on our efforts to construct a picture of kill-off patterns and the nature of the pastoral economy derived from epiphyseal fusion states of long bones. In a situation where density mediated attrition has destroyed most of the epiphyses, one cannot expect reliable results from small and biased samples. Even when sample sizes are large enough to obtain statistically meaningful results, the data generated are likely to be distorted by taphonomic processes, since young animals may be significantly underrepresented as their softer and more spongy bones are more prone to destruction and deletion from the archaeological record. An evaluation of the scale of such taphonomic loss may enable the zooarchaeologist to seek alternative ways of approaching these questions. For instance, when it is clear that the scale of taphonomic loss is large, the zooarchaeologist may choose to use tooth wear and eruption —since teeth are one of the densest skeletal structures and more likely to survive in the archaeological record —data to investigate kill-off patterns and make subsequent economic inferences. The zooarchaeologist studying social complexity and centralized and specialized economies seeks to gain insights into the production, consumption, and redistribution of animal resources using data pertaining to age structure and skeletal part profiles of the animals slaughtered (i.e., Redding 1994; Stein 1992; 1998; Zeder 1991; 1994). Thus, it is crucial to be able to distinguish between patterns resulted from past human behavior and taphonomic processes.

I must emphasize the significance and value of integrating data derived from taphonomic analyses into analyses of site formation processes or vice versa. It is well known that mound sites develop from complex and combined actions of natural and cultural phenomena both during the occupation and after the final abandonment of the site. Mudbrick, stone, ceramics, limestone, and organic remains comprise the major and primary components of mound sediments or the matrix. Such natural agents as water, humidity, ground water, and wind erosion along with bioturbation and mechanical effects of root action, burrowing rodents and insects, and nesting birds alter the matrix and thus lead to the formation of secondary matrix or sediments (Rosen 1986). Cultural practices such as construction, maintenance, destruction, and abandonment of different buildings or structures along with accumulation of ecofacts (i.e., ash, food refuse, and dung) and artifacts (i.e., pottery sherds, stone and/or metal tools and material associated with their production) contribute to the site formation processes, as well. Thus, the zooarchaeologist should also gain insights into site formation processes in order to prioritize different context types and to assess their stratigraphic integrity. In conclusion, before attempting to discuss paleoeconomies and social organizational patterns, the zooarchaeologist should evaluate taphonomic problems and gain insight into assemblage formation and modification processes in the broader context of site formation processes. This will help avoiding obscured and misleading interpretations with regard to past human behavior.

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A. Levent Atıcı
Department of Anthropology
Harvard University
11 Divinity Avenue
Cambridge, MA 02138
USA
atici@fas.harvard.edu