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Proceedings of the third international symposium on the archaeozoology of southwestern Asia and adjacent areas

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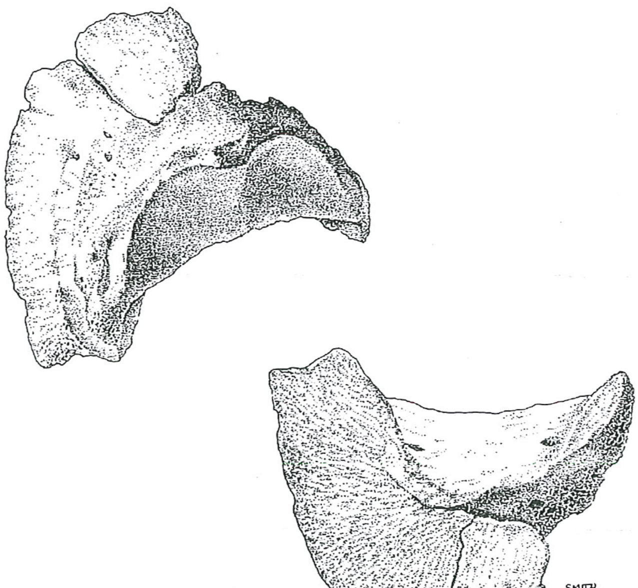
H. Buitenhuis, L. Bartosiewicz and A.M. Choyke



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

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Preface

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

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

Standing, left to right: B. De Cupere (Belgium), G. Bar Oz (Israel), H. Buitenhuis (The Netherlands), R. Rabinovich (Israel), L. Leblanc (New Zealand), N. Benecke (Germany), H. Hongo (Japan), N. Russell (USA), J. Speth (USA), A. Patel (India), E. Stephan (Germany), C. Cavallo (The Netherlands), W. Van Neer (Belgium), A.T. Clason (The Netherlands), T. Dayan (Israel), L. Van Es (The Netherlands), C. Becker (Germany), R. Meadow (USA), M. Mashkour (France), F. Poplin (France), E. Vila (France), Mrs. Poplin (France), L. Bartosiewicz (Hungary), E. Pellé (France), P. Ducos (France).
In front, left to right: E. Tchernov (Israel), L. Martin (Great Britain), A. Choyke (Hungary), I. Zohar (Israel).
Participants not shown in picture: D. Carruthers (Great Britain), D. MacHugh (Ireland), S. Whitcher (Great Britain).

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TAPHONOMIC ANALYSIS OF THE FAUNAL REMAINS FROM NEVE DAVID

Guy Bar Oz[1], Tamar Dayan[1], and Daniel Kaufman[2]

Résumé

Cette étude traite les pertubations taphonomiques qui ont affecté l'asemblage de faune de Neve David. La corrélation entre les vestiges osseux conservés, la densité d'ossements et une faible représentation de l'extrémité proximale de l'humérus témoigne de ces pertubations. L`analyse taphonomique montre que, parmi les différents processus qui ont pu intervenir sur les restes de faune, la plus grosse partie de la destruction, résultant de la fracturations des ossement pour la consommation de la moelle, s'est produite pendant l'occupations même du site par ses habitants.

Introduction

Taphonomic research deals with analyzing preservational processes and their influence on faunal remains from archaeological sites. During time, various factors interact in the fossilization process, bringing about the diminution of the bone assemblage. These taphonomic factors may cause a wide range of error which may intervene and influence our ability to interpret the findings (Lyman, 1984; 1994). Searching for markers of these processes, while analyzing faunal remains from archaeological sites, enables us to reconstruct the processes of material loss since the time hunted animals were brought to the site until their recovery in the present (Gifford, 1981; Bonnichsen, 1989; Lyman, 1994).

Two main types of taphonomic disturbances reduce our ability to interpret human subsistence patterns ("the death assemblage") and paleoecological conditions ("the life assemblage"): these are predepositional processes ("the deposit assemblage") and postdepositional processes ("the fossil assemblage");(Klein and Cruz-Uribe, 1984).

Predepositional processes include both biotic and abiotic factors. Among the biotic factors are human activities, such as bone marrow extraction (e.g., Enole, 1993), and animal activities, such as the effect of carnivores (Binford, 1981; Blumenschine, 1988) or rodents (Shipman and Rose, 1983; Rabinovich, 1990). The abiotic factors include the possible effect of fluvial transport (Shipman, 1981) and pre-deposition bone trampling (Fiorillo, 1989). Post-depositional processes occur because archaeological remains are buried in a dynamic environment in which various physical, chemical, and biological processes interact, bringing about change in the original information buried underground (Lyman, 1994).

A detailed taphonomic analysis of the faunal remains may also provide new insight into ancient economies. The distribution and frequencies of cut marks provide information regarding butchering methods and processing techniques (Binford, 1981; Noe-Nygaard, 1989).

Taphonomic research has been applied in recent years to many zooarchaeological studies so as to identify specific factors which have influenced the faunal remains. Israel is a major center of archaeological research. However, the zooarchaeological research carried out in our region generally does not include detailed consideration of taphonomic issues (however see Rabinovich, 1990; Rabinovich and Tchernov, 1995). Here we present the results of a detailed taphonomic analysis, carried out on the faunal remains from Neve David, a Geometric Kebaran hunter-gatherer site on the coastal plain of Israel.

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The site

Neve David is situated at the foot of the western slope of Mount Carmel, on the northern bank of Nahal Siah, at its outlet to the coastal plain, 60 meters above sea level, and 1,000 meters from the present shoreline (Kaufman, 1986). The finds from the site include an exceptionally rich lithic collection, ground stone implements, and faunal remains. The lithic assemblage is typical of the Geometric-Kebaran culture and is dominated by Geometric microliths, principally trapeze/rectangles (Kaufman, 1986; 1987; 1989).

Neve-David was a rich and varied hunting site: fifteen species of mammals, two reptile species, and eight genera of gastropods and bivalves from the Mediterranean Sea were found. The faunal remains are dominated by gazelle (*Gazella gazella*: 60%) and fallow deer (*Dama mesopotamica*: 31%; Bar Oz, 1996).

The taphonomic analysis

We carried out a detailed taphonomic analysis of the faunal remains from Neve David along the following lines:

1. Quantifying the characteristics of the bone assemblage. Among the main variables studied are bone fragment density and distribution, ratio of identifiable to non-identifiable remains, and patterns of spatial distribution.
2. Analysis of skeletal part frequencies. The working hypothesis behind this analysis is that the probability that skeletal parts will survive the various taphonomic processes is at least partially a function of that part's structural density. This analysis enables us to quantify the completeness of the bone assemblage and therefore can serve as a baseline for comparison between bone assemblages from different archaeological sites (Lyman, 1984). Two methods were used:

a. Relationship between bone survivorship and bone density (Lyman, 1984, 1994). This method quantifies the degree of taphonomic bias that affects Neve David`s bone assemblage.

b. Relationship between proportional frequency of proximal humerus and distal humerus in Neve David in comparison with values from a series of control assemblages with known degrees of destruction. Among the causes of bone destruction in these sites are human activities and predator-scavenger activities (Binford, 1981).

3. Identifying specific attritional processes influencing the bone assemblage. These processes have a heterogenic influence on bone preservation and may cause differential loss. Of the various attritional processes which may influence bone preservation, the following variables were studied:

a. Bone frequencies were analyzed in relation to their surface-volume ratio (after Shipman, 1981). This ratio indicates the likelihood of bones having been transported in a stream, and depends largely on the shape, size, and density of the bone.

b. Signs of trampling that may have occurred before bone burial according to observed bone surface modification (Fiorillo, 1989). Trampling was also studied by looking at bone fragmentation (after Villa and Mahieu, 1991, see 4a).

c. Signs of carnivore or rodent activity: typical chewing, scratches or furrows that remain on the surface of bones (see Fisher, 1995 for description and references).

4. Identifying signs of human activity. We looked for the following signs:

a. Signs of marrow extraction from bones by studying the mode of bone fragmentation (after Villa and Mahieu, 1991). Mode of bone fragmentation was examined on all epiphyses and on a random sample of diaphyses. Two variables were checked: fracture angle and fracture outline. Fracture angle is the angle formed between the edge of the fracture and the cortical bone. The angle formed by the fractures can be oblique, right, or a fracture which includes both traits. The fracture outline is the outline formed between the surface of the fracture and the cortical bone. The outline can be transverse, curved or V-shaped, or intermediate (Villa and Mahieu, 1991).

b. Identification of cut marks and burned bones, which indicate stages of carcass preparation for consumption (Binford, 1981).

All the identifiable bones and a random sample of the non-identifiable fragments were immersed in 5% acetic acid in order to remove patina and to enable observation of cut and gnaw marks (by using a 2.5× magnifying lamp).

Bone fragment density and distribution

During 5 seasons of excavation, 25 m^3 were dug in an area of 30 m^2 (Kaufman, 1989). Over 21,000 bone fragments were found of which 2,496 were identified to species. Thus, the ratio of identifiable to non-identifiable elements is 1:9. Bone density at the site is 860 bone fragments per m^3.

Morisita's index of dispersion (Krebs, 1989) was used to determine the pattern of distribution of the identified bones within the excavated area, divided into a grid of square meters (Table 1).

Its results indicate random, clumped or uniform distribution, with 95% confidence limits. Values lower than (-0.5) indicate a uniform distribution and values higher than 0.5 indicate clumped distribution. All values in this range indicate a random distribution. The mode of bone distribution found in Neve David points to such a random distribution (Ip= 0.4994).

O	N	M	L	K	
33	**34**	**60**	**12**	**54**	16
43	**66**	**35**	**40**	**43**	17
42	**24**	**47**	**117**	**58**	18
70	**28**	**75**	**11**	**6**	19
44	**54**	**70**	**86**	**56**	20
28	**31**	**28**	**40**	**112**	21
	2	**33**	**146**	**166**	22
		95	**115**	**120**	23

Table 1. Bone densities in the excavated area. (grid size = 1x1 m).

The size of the bone sample and the bone density suggest that the excavated area was in the center of activity. This is also indicated by the analysis of the lithic findings (Kaufman, 1986; 1987; 1989). The random distribution of the identified bones suggests that the retrieved sample is representative of the faunal remains at this site. From here we proceeded to analyze the influence of fossilization on the osteological remains through time.

Bone preservation

The first step in analyzing bone preservation was examining the relationship, through regression analysis, between gazelle bone survivorship, based on the proportional frequency of elements observed at Neve David (%MNI) and bone density. Since no data were available for gazelle structural bone density, we used published values of domestic sheep (*Ovis aries*) bone densities (Lyman, 1984).

The resulting regression line, MNI = 0.8817×(bulk density)-0.0411 (R^2=0.4005; P<0.001) indicates a significant and meaningful relationship between bone survivorship and bone density, which explains 40% of the variance. This result indicates differential loss of bone fragments according to their density due to taphonomic disturbances.

The ratio of proximal to distal parts of gazelle humeri from Neve David shows a similar trend. The ratio of these bone parts provides an index of the degree of attrition suffered by the assemblage. This ratio can be compared to those obtained from various sites in which the taphonomic history is known (Binford, 1981).

Fig. 1 compares the ratio from Neve David to these sites. Closed circles represent sites without destruction and closed rectangles represent sites which suffered from destruction. Neve David (open rectangle) is found among the latter. The correlation between bone survivorship and bone density, and the low representation of proximal humeri, indicate differential loss of bones due to taphonomic disturbances.

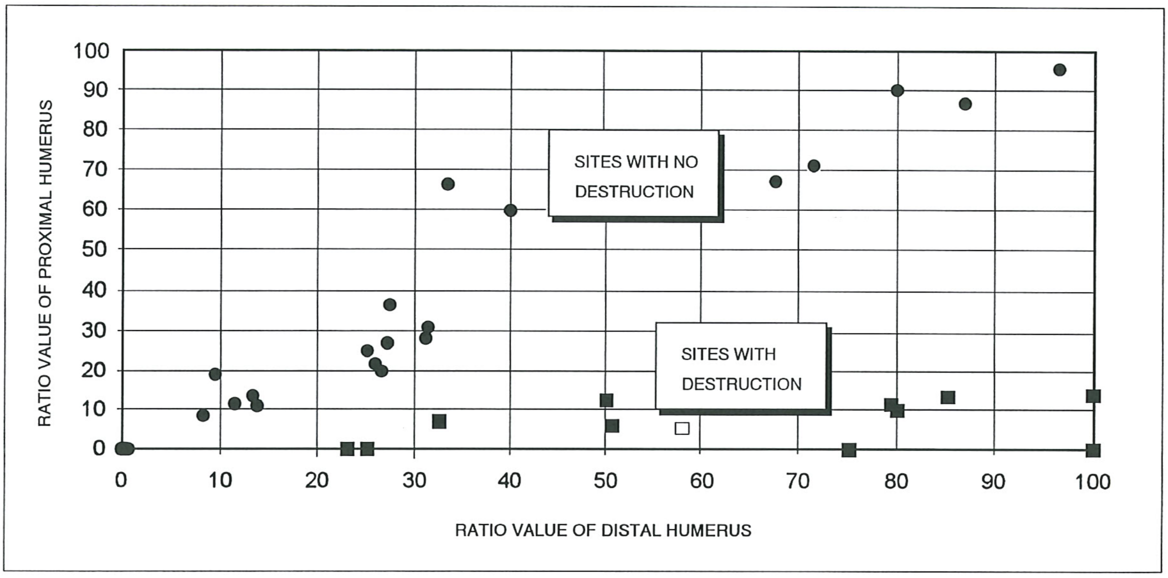

Figure 1. Relationship between proportional frequencies of proximal humerus and distal humerus at Neve David (open square) compared to values in a series of control assemblages with known degree of destruction (adapted from Binford, 1981).

Specific non-human attritional processes

Neve David is situated on the bank of Nahal Siah and floods could have carried bones out of the site. Therefore we examined the possible effect of fluvial interference on skeletal part representation. We checked gazelle skeletal part representation in three fluvial groups, based on their dispersal potentials in flowing water, according to their surface-volume ratio, as defined by Shipman (1981). The first fluvial group contains bones that flow in low stream (n=52 bones per individual). This group includes vertebrae and ribs. The second group contains bones that flow in intermediate stream (n=54 bones per individual). This group includes most of the long bones. The third group contains bones flowing in strong stream and includes the mandibles (n=2). There appears to be no differential bone loss that could indicate fluvial processes (Table 2). While this result is of a qualitative nature only, underrepresentation of group 1 elements, or overrepresentation of group 3 elements, would indicate that significant fluvial disturbances had occurred. This finding is in accord with a high frequency of small flattened bones (e.g. astragali) found at the site.

No signs of pre- or postdepositional bone trampling were found. This is in accord with the absence of typical surface modification as described by Fiorillo (1989). In addition, chewing and gnaw marks are totally absent, so it appears that destruction of bone elements by carnivores and rodents was insignificant at Neve David. Bunn (1993) suggests that the lack of carnivore activity may be due to inavailiability of the bones to carnivores at the time of the site's occupation. Ethnographic evidence from Hadza sites (Bunn, 1991; 1993) shows that in short term occupation sites (maintained

	Number of bones per individual	**Observed number of bones**	**% Expected (based on MNI of 45 individuals)**
Group 1	52	278	12.0 %
Group 2	54	620	25.5 %
Group 3	2	14	15.5 %

Table 2. Gazelle skeletal part representation from different fluvial groups, according to their surface-volume ratio (after Shipman, 1981).

	Oblique	Right	Oblique and Right
Neve David	46 (54 %)	11 (13 %)	28 (33 %)
Fontbregoua	114 (65 %)	47 (27 %)	13 (8 %)
Sarrians	22 (8 %)	176 (65 %)	74 (27 %)

Table 3. Fracture angle frequencies in Neve David in comparison to the sites of Fontbregoua and Sarrians (Villa and Mahieu, 1991).

only for a few days) bones are discarded while still fresh and are thus available to carnivores, which arrive at the site soon after its abandonment. In long term occupation sites (maintained for weeks to months) the rate of exposure to carnivores is low and insignificant. Thus, lack of carnivore activity may be a clue to the duration of occupancy of Neve David as a site inhabited for long periods of time during the year.

Signs of human activity

Mode of bone fragmentation can provide additional evidence. It enables us to discern between fresh bone breakage and dry bone breakage, due to predepositional or postdepositional trampling processes (Villa and Mahieu, 1991).

The mode of fracture angle and fracture outline of the Neve David bones were compared to two Neolithic sites in southern France, where the taphonomic history is known, based on other characteristics. Evidence of fresh bone fracture for marrow extraction was found at the site of Fontbregoua and evidence for dry bone fracture due to sediment compaction was found at the site of Sarrians (Villa and Mahieu, 1991). Tables 3 and 4 present the mode of fracture angle and fracture outline, respectively, and their relative frequencies, in comparison to these sites.

The mode of bone fractures found in Neve David, in comparison to the sites of Fontbregoua and Sarrians, shows low representation of bone trampling, as observed in Sarrians, and indicates that fractures were made on fresh bones, similar to the situation at Fontbregoua. The χ^2 distribution for each of the above variables confirms these results (χ^2= 194.2 and χ^2=39.2 for fracture angle and fracture outline, respectively; $p<0.0001$).

By negating destruction caused by other taphonomic agents it is possible to explain the absence of low density bones as a result of human behavior. We can conclude that bone fractures reflect human activities, principally marrow extraction, an action which produced the large number of fragments found at the site.

Among the 15 species of mammals, cut marks and burned bones indicate use for consumption of at least 9 species (Table 5). The diversity of each taxon and it's relative abundance were quantified using the NISP assigned to each taxon together with the MNI from which the faunal remains must have come. These values were calculated by using the assumptions described in Klein and Cruz-Uribe (1984). Cut marks were observed on the remains of 6 species: gazelle (*Gazella gazella*), fallow deer (Dama mesopotamica), hartebeest (*Alcelaphus* sp.), wolf (*Canis lupus*), fox (*Vulpes vulpes*) and hare (*Lepus capensis*). Cut marks on skeletal parts of the wolf and fox, as well as the disarticulation of the skeletal elements of these species, suggest that the carnivores were also consumed for their meat and not just for their fur.

	Curved/V shaped	Transverse	Intermediate
Neve David	36 (52 %)	19 (28 %)	14 (20 %)
Fontbregoua	134 (51 %)	92 (35 %)	35 (14 %)
Sarrians	106 (30 %)	193 (54 %)	59 (16 %)

Table 4. Fracture outline frequencies in Neve David in comparison to the sites of Fontbregoua and Sarrians (Villa and Mahieu, 1991).

	MNI/NISP	Cut marks	Burned bones
Gazella gazella	45/1296	+	+
Dama mesopotamica	21/675	+	+
Lepus capensis	7/39	+	+
Testudo graeca	4/13		+
Vulpes vulpes	3/41	+	
Capreolus capreolus	2/26		+
Sus scrofa	2/9		+
Sciurus anomalus	2/3		
Bos primigenius	1/13		
Canis lupus	1/10	+	
Cervus elaphus	1/8		
***Alcelaphus* sp.**	1/6	+	
Herpestes ichneumon	1/3		
***Ophiosaurus* sp.**	1/2		
Hystrix indica	1/1		
Martes foina	1/1		
Erinacaeus europaeus	1/1		
Total	95/2449		

Table 5. The Minimum Number of Individuals/Number of Identified Specimens, by which each taxon is represented at Neve David. (+) indicate signs of cut marks and presence of burned bones.

The gazelle and fallow deer remains bore marks from all stages of preparation: skinning, dismemberment, and filleting (Table 6 for gazelle and fallow deer, respectively). The hartebeest, wolf, fox and hare, all of which are represented by a small sample, bore a single cut mark related to dismemberment. The scarcity of cut marks on these species is probably due to small sample size. In general, cut marks on all species appear on various anatomical parts without any clear patterns that shows specific selection, possibly also due to small sample size.

Summary

The taphonomic analysis from Neve David reveals the attritional processes which played a role on the faunal assemblage through time. This analysis enables us to reconstruct the taphonomic history of the bone assemblage. It reveals that most of the destruction was caused during the time of the site's occupation as a result of exploiting bones for marrow consumption, an action which produced large numbers of fragments and accounts for their high density within the site.

Gazelle						**Fallow deer**			
dismemberment	**n**	**filleting**	**n**	**skinning**	**n**	**dismemberment**	**n**	**filleting**	**n**
Astragalus	9	Thoracic vertebra	2	Metacarpus	2	Tibia	9	Thoracic vertebra	2
Scapula	8	Vertebrae	1	Horn	1	Scapula	4	Tibia	1
Humerus	4	Calcaneum	1			Femur	2	Calcaneum	1
Cervical vertebra	2	Metacarpus	1			Humerus	2	Metacarpus	1
Metapodium	1					Rib	2		
						Astragalus	1		
						Mandibula	1		

Table 6. Sum of cut marks and related activities on gazelle and fallow deer bones at Neve David (Binford, 1981).

This taphonomic analysis is among the first carried out in our region. Unfortunately, because of the absence of similar information from other archaeological sites, comparative studies can not yet be carried out. It is recommended that future faunal analyses include taphonomic research. Such studies provide controls for biases resulting from destructive processes. In this way we can make more reliable comparisons between sites and assemblages and reach more meaningful conclusions concerning human subsistence patterns.

References

Bar Oz, G. 1996. *The Fauna of the Geometric-Kebaran Site, Neve David: Taphonomic, Economic and Ecological Implications*. Unpublished M.Sc. thesis, Tel Aviv, Tel Aviv University (in Hebrew).

Binford, L. R. 1981. *Bones: Ancient Men and Modern Myths*. New York, Academic Press.

Blumenschine, R. J. 1988. An experimental model of the timing of hominid and carnivore influence on archaeological bone assemblages. *Journal of Archaeological Science*, 15: 483-502.

Bonnichsen, R. 1989. An introduction to taphonomy with an archaeological focus. In: R. Bonnichsen and M. H. Sorg (eds.), *Bone Modification* Orono, University of Maine Centre for the Study of the First Americans: 1-5.

Bunn, H. T. 1991. A taphonomic perspective on the archaeology of human origins. *Annual Review of Anthropology*: 20: 433-467.

Bunn, H. T. 1993. Bone assemblages at base camps: A further consideration of carcass transport and bone destruction by the Hadza. In: J. Hudson (ed.), *From Bones to Behavior: Ethnoarchaeological and Experimental Contributions to the Interpretation of Faunal Remains*. Center for archaeological investigations Occasional paper No. 21. Southern Illinois University: 156-168.

Enole, J. G. 1993. Ethnoarchaeology of marrow cracking: implications for the recognition of prehistoric subsistence organisation. In: J. Hudson (ed.), *From Bones to Behavior: Ethnoarchaeological and Experimental Contributions to the Interpretation of Faunal Remains*. Center for archaeological investigations Occasional paper No. 21. Southern Illinois University: 92-97.

Fiorillo, A. R. 1989. An experimental study of trampling: implication for the fossil record. In: R. Bonnichsen and M. H. Sorg (eds.), *Bone Modification* Orono, University of Maine Center for the Study of the First Americans: 61-71.

Fisher, J. W. 1995. Bone surface modifications in zooarchaeology. *Journal of Archaeological Method and Theory* 2/1: 7-68.

Gifford, D. P. 1981. Taphonomy and paleoecology: a critical review of archaeologist sister disciplines. In: M. B. Schiffer (ed.), *Advances in Archaeological Method and Theory* vol. 4. New York, Academic Press: 365-438.

Kaufman, D. 1986. A reconsideration of adaptive changes in the Levantine Epipaleolithic. In: L. G. Strauss (ed.), *The End of the Paleolithic in the Old World*. BAR International Series 284. Oxford, British Archaeological Reports: 117-128.

Kaufman, D. 1987. Excavations at the Geometric Kebaran site of Neve David, Israel: a preliminary report. *Quartar* 37-38: 189-199.

Kaufman, D., 1989. Observations on the Geometric Kebaran: a view from Neve David. In: O. Bar-Yosef and B. Vandermeersch (eds.), *Investigations in South Levantine Prehistory*. BAR International Series 497. Oxford, British Archaeological Reports: 275-285.

Klein, R. G. and K. Cruz-Uribe 1984. *The Analysis of Animal Bones from Archaeological Sites*. Chicago, University Chicago Press.

Krebs, C. J. 1989. *Ecological Methodology*. New York, Harper Collins Publishers.

Lyman, R. L. 1984. Bone density and differential survivorship of fossil classes. *Journal of Anthropological Archaeology* 3: 259-299.

Lyman, R. L. 1994. *Vertebrate Taphonomy*. Cambridge, Cambridge University Press.

Noe-Nygaard, N. 1989. Man made trace fossil on bones. *Journal of Human Evolution* 4: 461-491.

Rabinovich, R. 1990. Taphonomic research on the faunal assemblage from the Quneitra site. In: N. Goren-Inbar (ed.), *Quneitra: a Mousterian Site on the Golan Heights*. Qedem 31: 189-219.

Rabinovich R. and E. Tchernov 1995. Chronological, paleoecological and taphonomical aspects of the middle Paleolithic site of Qafzeh, Israel. In: H. Buitenhuis and H-P. Uerpmann (eds.), *Archaeozoology of the Near East II.* Proceeding of the second international symposium on the archaeozoology of Southwestern Asia and adjacent areas. Leiden, Backhuys Publishers: 5-43.

Shipman, P. 1981. *Life History of a Fossil: an Introduction to Taphonomy and Paleoecology*. Cambridge, Harvard University Press.

Shipman, P. and J. Rose 1983. Early hominid hunting, butchering and carcass-processing behaviors: approaches to the fossil record. *Journal of Anthropological Archaeology* 2: 57-98.

Villa, P. and E. Mahieu 1991. Breakage patterns of human long bones. *Journal of Human Evolution* 21: 27-48.