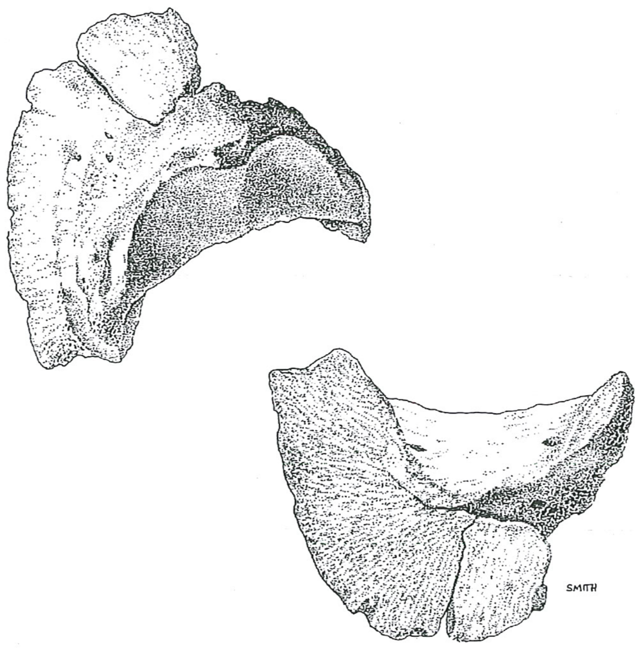
ARCHAEOZOOLOGY OF THE NEAR EAST III

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

edited by

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



ARC - Publicaties 18
Groningen, The Netherlands, 1998

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%).

Printing: RCG -Groningen

Information: Centre for Archeologicl Research and Consultancy
Poststraat 6, 9712 ER Groningen, The Netherlands

ISBN 903670791-9
NUGI 644/821/835

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).

Contents

THE MESOLITHIC-NEOLITHIC TRANSITION IN THE FAUNAL ASSEMBLAGE FROM KONISPOL CAVE, ALBANIA

Nerissa Russell[1]

Resumé

Cette contribution est un rapport préliminaire sur le premier étude zooarchéologique en Albanie. La grotte de Konispol, au sud dÁlbanie, était occupé du Paléolithique à l'Age de Fer. Ici, renseignements sur la transition du Mésolithique au Néolithique sont presentées. La faune de Konispol suggère que cette transition soit graduelle.

Introduction

Albanian prehistory has been relatively little studied, and, due to recent political history, is largely unknown outside Albania (Korkuti and Petruso, 1993). From 1992 to 1996, a joint Albanian-American project in southern Albania directed by Muzafer Korkuti of the Institute of Archaeology in Tirana and Karl Petruso of the University of Texas at Arlington has begun to fill this gap with the excavation and analysis of material from Konispol Cave, located near the Strait of Corfu at about 400 m above sea level (Fig. 1). This work has produced the first definite evidence of Mesolithic occupation in Albania (Harrold *et al*., in press). It is also the first time that faunal remains have been studied from an Albanian archaeological site. The report here is on one aspect of this work, the contribution of the faunal remains to the understanding of the Mesolithic-Neolithic transition at the cave.

The site

Konispol Cave has stratified deposits to a depth of ca. 4 meters that contain a sequence running from an ephemeral Upper Paleolithic use of the cave through a probably late Mesolithic occupation, a complete Neolithic and Eneolithic sequence, Bronze Age layers, and relatively scant Iron Age and later deposits. Some 18,000 fragments of bone from the site have been recorded, including 4000 identified specimens. At this point, the analysis is still in a preliminary stage, but intriguing patterns emerge even at this gross level. The fauna will be discussed from the four trenches that were excavated through the entire sequence: Trenches VIII, IX, X, and XXI (Fig. 2).

The Konispol Mesolithic is characterized by a microlithic chipped stone industry and the lack of ground stone and bone tools and pottery. It is dated to approximately 8000 BP by a combination of radiocarbon dating and magnetic susceptibility measurements (Ellwood *et al.,* 1996, Ellwood *et al.,* in press). The cave appears to have been occupied for several relatively short (i.e., not year-round) episodes, some of which occurred during the fall-winter (Trenches IX and XXI), others during the spring-summer (Trenches VIII, IX and X). Preliminary geomorphologic work suggests that occupation moved from the central part of the cave (Trenches VIII, IX and X) to the western periphery (Trench XXI) during the later part of the Mesolithic sequence, at which time the central area was wet (Schuldenrein, in press).

1 Department of Sociology, Anthropology and Social Work, Mississippi State University, MS 39762, USA.

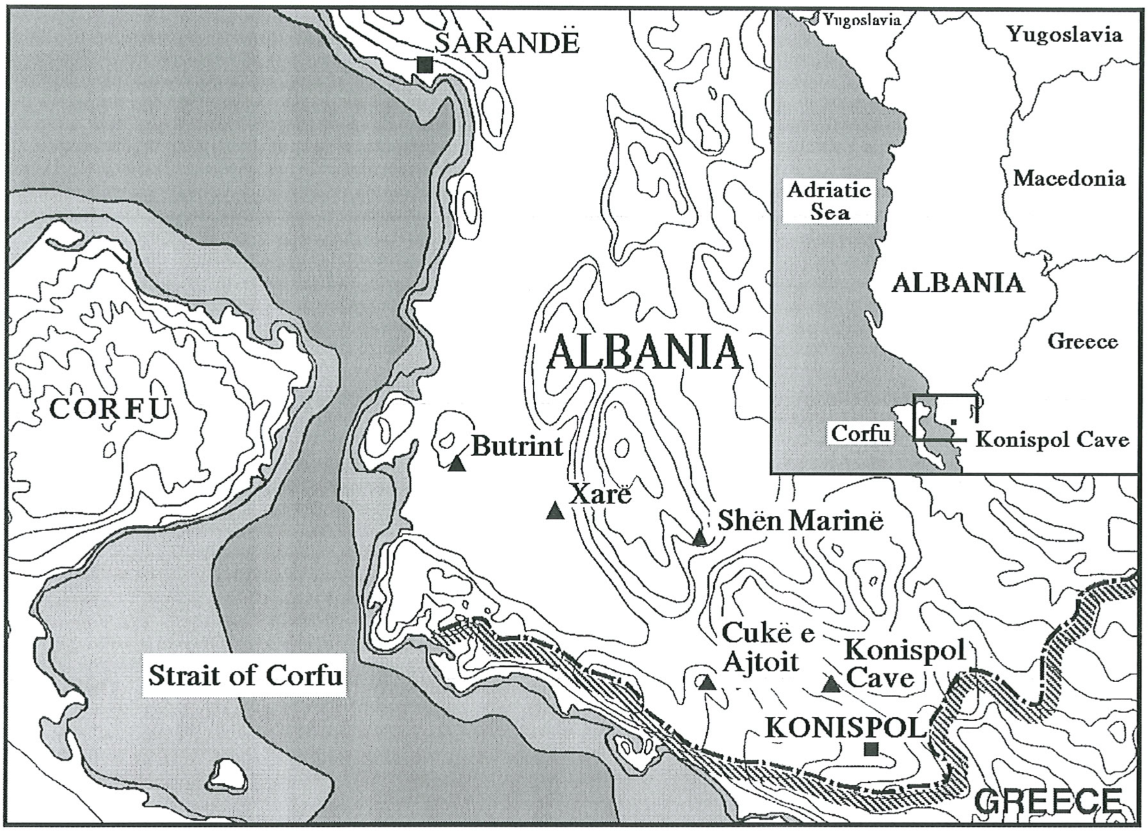


Figure 1. Map of the location of Konispol Cave. From Robert Cooke n.d.

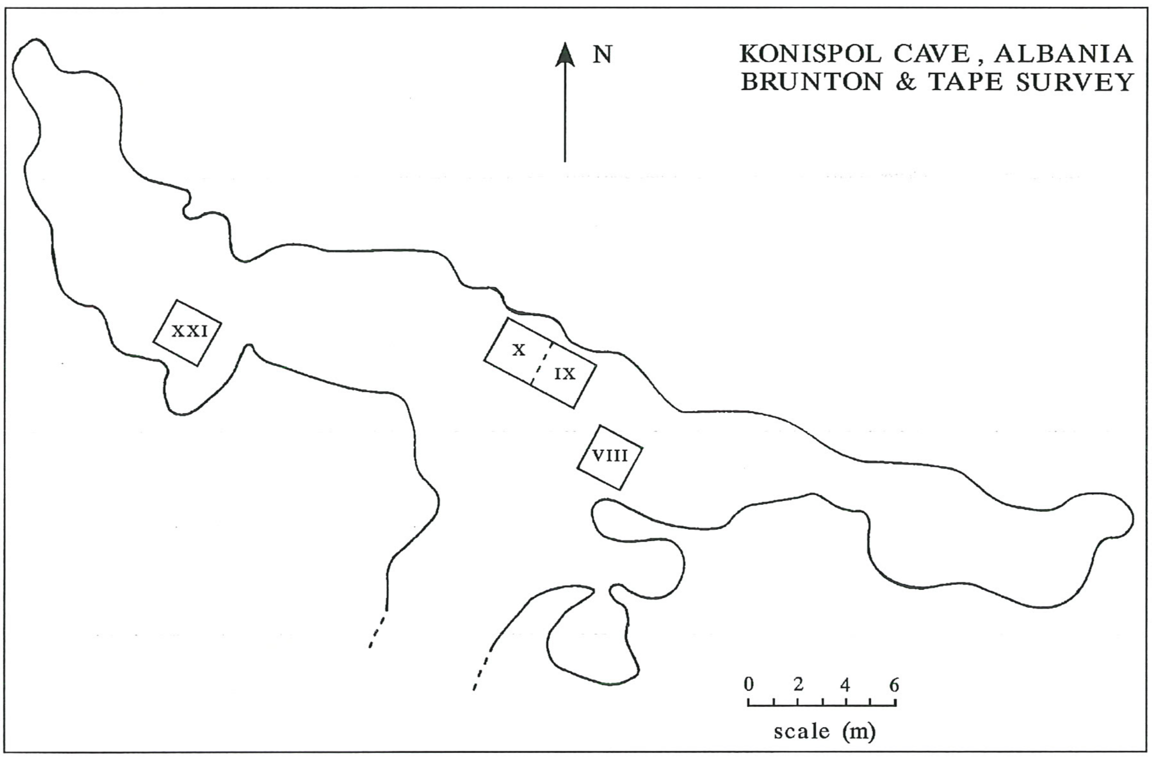


Figure 2. Plan of Konispol Cave. From Petruso *et al.*, 1994: 337.

Fauna

The Mesolithic fauna consists mainly of ibex, chamois, red deer, and wild pig (Tables 1-5). Red deer and wild pig predominate in Trenches VIII and IX, ibex in Trench XXI, and the three species are more evenly balanced in Trench X. Chamois is always a very minor component, and seems most abundant in the pre-Mesolithic layers of Trench XXI, which show little sign of human occupation. Chamois has been reported in Late Glacial contexts to the north, at Crvena Stijena (Montenegro) and Badanj (Herzegovina), where Miracle and Sturdy (1991) associate it with active karstic environments at this time.

Ibex has been reported in Holocene contexts at Mesolithic and Neolithic Odmut in Montenegro (Srejovic, 1974, 1977) and Neolithic Achilleion in Thessaly (Bökönyi, 1989). While the Odmut and Achilleion ibex are of medium to large size (Bökönyi, 1989: 321), those at Konispol are quite small, with postcranial remains that, on the basis of robusticity, appear to be ibex falling largely within the range of domestic goats (see Appendix 1; this complicates the detection of domesticated small bovids at the site). Several unmistakable ibex horn cores definitely establish the presence of the species at the site, however. These horn cores all derive from pre-Mesolithic, Mesolithic, or transitional Mesolithic-Neolithic levels. A few postcranial remains are tentatively assigned to ibex from later in the sequence, but these cannot be considered secure attributions. In any case, ibex are at best quite rare at Konispol after the Mesolithic.

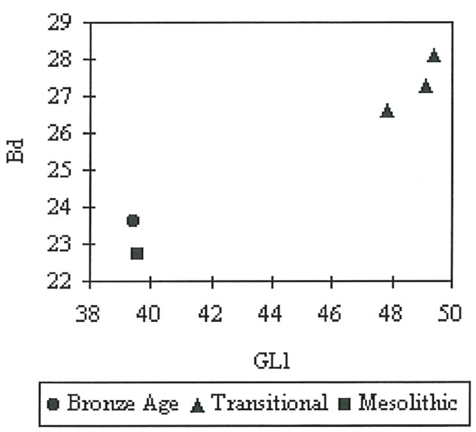


Figure 3. Konispol pig astragali, greatest lateral length (GLl) by distal breadth (Bd).

The pigs from Konispol separate quite clearly by size into wild and domestic groups, with little or no overlap (Fig. 3, Appendix 2). The size of both wild and domestic pigs is similar to those from Lerna (Gejvall, 1969), Achilleion (Bökönyi, 1989), Dimini, and Ayia Sofia (Halstead, 1992), while the domestic pigs are of similar size to those of Platia Magoula Zarkou and Pevkakia, but the Konispol wild pigs fall toward the low end of the range of the wild pigs at these two sites (Becker, 1991). For the most part, the pigs in the Mesolithic and transitional levels at Konispol are large and almost surely wild. However, a few specimens falling clearly in the domestic size range occur in the Mesolithic levels of Trench XXI in the context of otherwise wild fauna, suggesting that these should perhaps be considered transitional as well. As noted above, it is likely that this occupation is later than the Mesolithic levels in the central area of the cave.

Most of the rather scarce cattle at Konispol are clearly domestic and again fall in the same size range as the Neolithic cattle from the afore mentioned sites (Appendix 3). A few are somewhat larger and quite robust. Most of these are comparable in size to the smaller of the bones considered aurochs at Platia Magoula Zarkou (Becker, 1991). They would correspond to intermediate or large domestic cattle at Achilleion (Bökönyi, 1989), Dimini, and Argissa Magoula (Halstead, 1992). The small number of measurable cattle bones at Konispol, and the small number of measured specimens identified as aurochs in Greece makes it very difficult to make definitive determinations. Aurochs from farther north in the Balkans, like the pigs and red deer, are substantially larger, no doubt due to more favorable habitats. It is my judgment that small aurochs were probably present in small numbers throughout the sequence at Konispol, but they played only a very minor role in subsistence.

While there is some variability, the Neolithic and Bronze Age periods at Konispol are characterized by a faunal assemblage heavily dominated by sheep and goat (mostly sheep), with an age distribution dominated by very young, fetal/neonate individuals. The site appears to have been occupied seasonally during the spring/early summer, probably by a limited subset of the population.

There are some continuities that can be seen from the Mesolithic in butchering techniques and the lithic industry (Harrold *et al.*, in press).

Discussion

The fauna from Konispol provides a major source of information about the nature of the transition from Mesolithic to Neolithic in the region. Despite an extensive flotation program carried out by Julie Hansen of Boston University, very few seeds were recovered from the cave, so there is little that can be said about the adoption of domesticated plants. For this discussion, I will rely mainly on the sequence from Trench IX. The bones from the transitional period in Trench X are missing; Trench XXI was scarcely occupied after the Mesolithic; and there is a depositional hiatus at this point that obscures the sequence in Trench VIII, although some of the same patterning can also be seen there. Judging from the amount of bone, this transitional period was in fact the time of greatest occupational intensity in Trench IX.

Units 20-29 of Trench IX are considered to have a Mesolithic lithic industry (Harrold *et al.*, in press). Units 22-27 have a very few sherds of pottery, which may be intrusive. Units 20 and 21, however, have a certain amount of early Neolithic ceramics. This overlap raises the possibility of a gradual transition from hunting and gathering to a 'Neolithic' way of life, a scenario that is supported by the faunal evidence. Unfortunately, the bone from the lowest Mesolithic levels of Trench IX, units 28 and 29, is also missing, so that there remains no purely 'Mesolithic' fauna (i.e., without domesticates) from the trench. The fauna from units 27 and 26, which have by far the most bone in the trench, closely resembles that from units 20 and 21 in Trench VIII (Table 1, 2). Most of the fauna is wild, chiefly red deer and wild boar. However, some bones from domestic cattle, sheep, goat, and a few pigs do occur here. In Trench VIII, this assemblage is separated by a depositional hiatus from underlying units that contain purely wild taxa, again mostly red deer and wild boar. Mesolithic stone tools are found in units 21-31 (Harrold *et al.,* in press). There are only two, quite possibly intrusive, sherds below unit 18. The hiatus appears to be due to dampness and ponding in this part of the cave at this time. Schuldenrein (in press) suggests that occupation shifted at this point to the western end of the cave (Trench XXI). This would make the Mesolithic levels in Trench XXI later than those in Trench VIII and perhaps also IX and X. There was no significant occupation in Trench XXI before or after the Mesolithic.

Starting with unit 24 in Trench IX and unit 19 in Trench VIII, the faunal assemblage becomes more 'Neolithic' in character (in terms of later units in the cave): sheep and goat predominate, but in unit 24 of Trench IX and unit 19 of Trench VIII there are still some wild taxa and domestic cattle, and there is very little fetal/neonatal sheep/goat. This gradually alters so that by unit 22 of Trench IX the fauna seems quite Neolithic in character, while still retaining some cattle and wild taxa, and by units 20-18 of Trench IX and 16-18 of Trench VIII the fauna is completely consistent with most Neolithic units from the cave: predominantly sheep and goat, with a high proportion of fetal/neonatal individuals.

It is possible that postdepositional mixing or the cross-cutting of sloping deposits by the arbitrary spits used in Trenches VIII, IX and X could account for this apparent gradual transition. However, there is little sign of significant postdepositional disturbance in the cave. Small bones and artifacts do seem to have occasionally sifted down through loose deposits, but this does not appear to have affected larger pieces, and there are many large pieces of domesticates in some of the lithically Mesolithic levels. There is some sloping of sediments, but it is not pronounced and should not produce mixing across more than two or three excavation levels (Schuldenrein, in press). In Trench IX, this transition occurs over six arbitrary 10 cm levels of sediments that are believed to have accumulated at a steady rate of ca. 0.5 m/1000 years (Ellwood *et al.*, 1996; Ellwood, pers. comm.), thus representing about 1200 years. While the early stage of the analysis of the Konispol sediments renders any conclusion tentative, it seems likely that this is genuinely a gradual transition.

It would thus appear that local hunter-gatherers began acquiring small numbers of domestic animals perhaps before they adopted ceramics (certainly before very many were in use at the cave), and that herd sizes gradually increased while hunting continued but slowly lost importance. The evidence certainly does not support a model of population replacement with the advent of the Neolithic in this region. It is possible, however, that the Konispol inhabitants acquired their livestock from intrusive farming groups entering the area.

The question remains as to why the Konispol hunter-gatherers started keeping domestic animals. Several possibilities can be suggested, and await further analysis of the materials from Konispol and contemporary sites in the region that will, with luck, be excavated in the future. Some of my colleagues on the Konispol project (B. Ellwood and W. Balsam, University of Texas at Arlington) have detected a climatic change that occurs at this time (Ellwood *et al.,* in press; Harrold et al., in press). From 9000-7800 BP, the climate fluctuates between cool-dry and warm- wet periods, ending with a cold snap for a 200-year period from ca. 8000-7800 BP, just before the early Neolithic levels. At this point it becomes warmer (although still somewhat cooler than the present), but still dry. So it would be possible to see the cold climate as making life harder for the Konispol inhabitants, such that they were eager to adopt new food sources, or the improving climate as raising the productivity of domestic animals (or more likely plants) so that they would be more attractive as a food source. It remains to be determined what effect these fluctuations may have had on wild and domestic taxa and the humans who depended on them.

The sheep and goats, at least, were introduced into the region from elsewhere, ultimately from southwest Asia. Whether they spread with advancing farmers or by diffusion, they introduced a dramatically new element into hunter-gatherer economies. Perhaps the most important feature of domesticated animals is that they have owners. They are not simply a resource to be harvested by anyone who needs it, but a valued possession requiring care and creating wealth. Local hunter-gatherers may have been willing to take on the burden of caring for domestic animals because of their status or wealth value. In particular, the use of animals as bridewealth can draw hunter-gatherers into herding as they come into contact with herders (Cronk, 1989; Russell submitted; ten Raa, 1986).

It is also interesting to note that domestic cattle seem to play a more important role in the transitional period at Konispol than they do during the full-fledged Neolithic. It is possible, however, that this picture would change if we were able to examine the fauna from the village site with which Neolithic Konispol Cave must have been associated. It is clear that the cave was not a permanent settlement with the full range of domestic activities during the Neolithic and later periods. We may actually be seeing the increasingly specialized use of the cave by shepherds tending flocks of sheep and goats rather than an overall shift in taxonomic composition of herds. If the change is real, however, it may reflect an initial attempt to keep the more valuable cattle for purposes such as bridewealth, later abandoned in favor of the smaller bovids that are better adapted to the Mediterranean climate of the area.

The Mesolithic of the southern Balkans is very poorly known. The only other well-published sites with Mesolithic and Neolithic levels are Franchthi and Sidari (Demoule and Perlès, 1993: 364-365), but at Franchthi there is a break of several hundred years in the occupation at this point (Farrand, 1993). While many elements of the Neolithic at these sites were clearly introduced from elsewhere, including the domesticates, both Franchthi and Sidari show continuity in the lithic industries that suggest the Mesolithic inhabitants did not simply disappear. At Sidari, which lies on the island of Corfu across from Konispol, distinctive early Neolithic ceramics also suggest the possibility that pottery and domesticates were adopted by local hunter-gatherers (Andel and Runnels, 1995; Demoule and Perlès, 1993).

Conclusion

Thus Konispol adds to the evidence that the spread of farming in the southern Balkans involved a combination of immigration and interaction with local hunting and gathering populations, which may have been quite sparsely distributed. If my interpretation of the Konispol sequence is correct, this interaction would appear to be a long process of exchange and intermarriage rather than a rapid acculturation, at least in this instance.

Acknowledgments

The joint Albanian-American excavations at Konispol Cave are co-directed by Muzafer Korkuti (Instituti Arkeologjik, Tirana) and Karl M. Petruso (University of Texas at Arlington). Major funding for the project has been provided by the Institute for Aegean Prehistory and the National Endowment for the Humanities. I am deeply grateful to Léola LeBlanc of Trent University for her assistance in the faunal analysis during the 1995 and 1996 seasons. This paper has benefited from discussions with all of my Konispol colleagues, in particular Lorenc Bejko, Brooks Ellwood, Frank Harrold, Muzafer Korkuti, Karl Petruso, Joe Schuldenrein, and Jere Wickens. However, none of them should be held responsible for my errors or misinterpretations.

References

Andel, T.H. van and C.N. Runnels 1995. The earliest farmers in Europe. *Antiquity* 69 (264): 481-500.

Becker, C. 1991. Die Tierknochenfunde von der Platia Magoula Zarkou—Neue Untersuchungen zu Haustierhaltung, Jagd und Rohstoffverwendung im neolitisch-bronzezeitlichen Thessalien. *Prähistorische Zeitschrift* 66(1): 14-78.

Bökönyi, S. 1989 Animal Remains. In: M. Gimbutas, S. Winn and D. Shumabuku (eds.), *Achilleion: A Neolithic Settlement in Thessaly, Greece, 6400-5600 BC*. Monumenta Archaeologica, No. 14: 315-332.

Cronk, L. 1989 From hunters to herders: Subsistence change as a reproductive strategy among the Mukogodo. *Current Anthropology* 30(2): 224-234.

Demoule, J.-P. and C. Perlès 1993. The Greek Neolithic: A new review. *Journal of World Prehistory* 7(4): 355-416.

Driesch, A. von den 1976. *A Guide to the Measurement of Animal Bones from Archaeological Sites*. Peabody Museum Bulletins, No. 1.

Ellwood, B. B., K. M. Petruso, F.B. Harrold and M. Korkuti 1996. Paleoclimate characterization and intra-site correlation using magnetic susceptibility measurements: An example from Konispol Cave, Albania. *Journal of Field Archaeology* 23(3): 263-271.

Ellwood, B.B., K.M. Petruso, F.B. Harrold and J. Schuldenrein in press. High-resolution paleoclimatic trends for the Holocene identified using magnetic susceptibility data from archaeological excavations in caves. *Journal of Archaeological Science*.

Farrand, W.R. 1993. Discontinuity in the stratigraphic record: Snapshots from Franchthi Cave. In: P. Goldberg, D. T. Nash and M. D. Petraglia (eds.), *Formation Processes in Archaeological Context*. Monographs in World Archaeology, No. 17: 85-96.

Gejvall, N.-G. 1969. *Lerna: The Fauna*. Princeton, American School of Classical Studies.

Halstead, P. 1992. Dimini and the 'DMP': Faunal remains and animal exploitation in Late Neolithic Thessaly. *Annual of the British School at Athens* 87: 29-59.

Harrold, F., N. Russell and J. Wickens in press. The Mesolithic of Konispol Cave, Albania. In: P. Rowley-Conwy and A. Matsui (eds.), *From the Jomon to Star Carr: Hunter-Gatherers of East and West Temperate Eurasia*.

Korkuti, M. and K. Petruso 1993. Archaeology in Albania. *American Journal of Archaeology* 97: 703-743.

Miracle, P.T. and D. Sturdy 1991. Chamois and the karst of Herzegovina. *Journal of Archaeological Science* 18: 89-108.

Russell, N. submitted. Cattle as wealth in Neolithic Europe. In: D. W. Bailey (ed.), *The Archaeology of Prestige and Wealth*. London, Routledge.

Schuldenrein, J. in press. Konispol Cave, southern Albania, and correlations with other Aegean caves occupied in the Late Quaternary. In: B. Gladfelter (ed.), *Supplement to Festschrift in Honor of Professor Karl W. Butzer*.

Srejovic, D. 1974. The Odmut Cave — A new facet of the Mesolithic culture of the Balkan peninsula. *Archaeologia Iugoslavica* 15: 3-6.

Srejovic, D. 1977. Pecina Odmut. In: B. Gavela (ed.), *Velika Arheoloska Nalazista u Crnoj Gori*. Beograd, Kolarçev Narodni Univerzitet: 7-13.

ten Raa, E. 1986. The acquisition of cattle by hunter-gatherers: A traumatic experience in cultural change. *Sprache und Geschichte in Afrika* 7(2): 361-374.

Uerpmann, H.-P. 1978. The "KNOCOD" system for processing data on animal bones from archaeological sites. In: R. H. Meadow and M. A. Zeder (eds.), *Approaches to Faunal Analysis in the Middle East*. Peabody Museum Bulletins, No. 2: 149-167.

Watson, J.P.N. 1979. The estimation of the relative frequencies of mammalian species: Khirokitia 1972. *Journal of Archaeological Science* 6: 127-137.

No./% Unit	Sheep/ Goat	Cattle	Aur-ochs	Pig	Red Deer	Roe Deer	? Fallow Deer	Ibex	Cha-mois	Hare	Dog	Wild Carni-vores
1	18/62.1	3/10.3		3/10.3	1/3.4	1/3.4					2/6.9	1/3.4
2	16/47.1	9/26.5		6/17.6	P	1/2.9					2/5.9	
3	23/60.5	3/7.9		9/23.7	2/5.3	P					P	1/2.6
5	7/50.0	1/7.1		2/14.3	1/7.1	1/7.1					2/14.3	P
7	24/63.2	1/2.6		6/15.8	5/13.2	2/5.3					P	
8	17/63.0	1/3.7		4/14.8	1/3.7	2/7.4					1/3.7	1/3.7
9	43/82.7	1/1.9		4/7.7	1/1.9						1/1.9	2/3.8
10	18/58.1	1/3.2		4/12.9	7/22.6	P						1/3.2
11	15/62.5	P		5/20.8	2/8.3	1/4.2					1/4.2	
12	14/93.3			P	P	P				1/6.7		
13	21/87.5				P	1/4.2			1/4.2	1/4.2		
14	26/78.8	4/12.1		1/3.0	1/3.0	1/3.0						
15	2/66.7			P		1/33.3						
16	16/72.7	P		1/4.5		4/18.2	1/4.5				P	
18	11/91.7			1/8.3	P							
19	13/81.3	1/6.3		1/6.3	1/6.3							
20	11/68.8	1/6.3		1/6.3	P	3/18.8		P				
21	30/85.7	1/2.9		2/5.7	1/2.9	1/2.9						
22	3/12.0	1/4.0		2/8.0	14/56.0	5/20.0		P				
23	6/20.0	1/3.3		6/20.0	9/30.0	2/6.7		5/16.7	1/3.3			
24	1/8.3	P	P	7/58.3	2/16.7				1/8.3		1/8.3	
25	P			2/22.2	3/33.3	1/11.1		2/22.2			1/11.1	
26					1/50.0	1/50.0	P					P
27	1/20.0	P		P	P	1/20.0		1/20.0	2/40.0			
28				P	P							
29	P			3/100	P							
30				1/100								
31					P							
32	1/50.0			1/50.0								
36	no identified fauna											
37						P			P			
38	no identified fauna											
39						P						

Table 1. Trench VIII Fauna, diagnostic zones according to Watson, 1979.
(P= present, no diagnostic zones)

No./% Unit	Sheep/ Goat	Cattle	Pig	Aurochs	Red Deer	Roe Deer	Ibex	Chamois	Dog	Wild Carni-vores
1	15/53.6	10/35.7	3/10.7							
2	8/36.4	8/36.4	4/18.2		P	P		1/4.5		1/4.5
18	2/100	P								
19	P									
20	14/70.0	3/15.0	3/15.0							
21	4/36.4	1/9.1	4/36.4		2/18.2					
22	8/72.7	P	1/9.1		1/9.1					1/9.1
23	8/47.1	4/23.5	3/17.6		2/11.8		P			
24	11/61.1	1/5.6	6/33.3		P		P			
26	20/25.0	13/16.3	20/25.0	1/1.3	22/27.5	2/2.5	1/1.3	P		1/1.3
27	3/10.3	2/6.9	12/41.4		8/27.6	2/6.9	P		1/3.4	1/3.4
33			p							
34	no identified fauna									

Table 2. Trench IX Fauna, diagnostic zones according to Watson, 1979.
(P= present, no diagnostic zones).

No./% Unit	Sheep/ Goat	Cattle	Pig	Aur-ochs	Red Deer	Roe Deer	Ibex	Cha-mois	Hare	Dog	Wild Carni-vores
1-2	10/58.8		2/11.8		2/11.8		1/5.9			1/5.9	1/5.9
3-4	14/66.7	5/23.8	P		1/4.8		1/4.8				
5-6	2/100	P	P		P	P					P
7-8	5/38.5	2/15.4	2/15.4		3/23.1		1/7.7		P		
9-10	11/50.0	3/13.6	1/4.5		2/9.1	1/4.5				3/13.6	1/4.5
11-12	20/66.7	2/6.7	1/3.3	1*/3.3	P	3/10.0	1/3.3			2/6.7	P
21	1/9.1	P	2/18.2	P	1/9.1		3/27.3	4/36.4			
22	1/5.3	1/5.3	5/26.3	1/5.3	4/21.1		5/26.3	2/10.5			P
23			5/62.5		2/25.0						1/12.5
24			1/12.5		4/50.0		P		1/12.5	1/12.5	1/12.5
25			P		1/100						

Table 3. Trench X Fauna, diagnostic zones according to Watson, 1979.
(P= present, no diagnostic zones);(*Actually 19 DZ, but all from 1 individual).

No./% Unit	Sheep/ Goat	Cattle	Pig	Aur-ochs	Red Deer	Roe Deer	Ibex	Cha-mois	Hare	Dog	Wild Carni-vores
1	1/33.3	1/33.3	P						1/33.3		
2	P		P						1/100		
3	2/40.0	1/20.0	P						2/40.0		
4	P		P						1/100		
5	9/90.0		P						1/10.0		
6	2/100		P		P						P
7	2/18.2		9/81.8								
8	1/33.3	P	2/66.7								
9	1/100		P								
10	P		P								
11	2/40.0		P		2/40.0					1/20.0	
12			1/50.0		1/50.0						
13	P	P	4/80.0								1/20.0
14	3/100	P	P								
15	P		2/66.7								1/3.3
16	1/11.1	1/11.1	4/44.4		2/22.2			1/11.1			P
17	1/12.5	1/12.5	5/62.5		P						1/12.5
18	4/25.0	2/12.5	6/37.5		1/6.3					1/6.3	2/12.5
19	1/12.5	1/12.5	3/37.5		2/25.0					1/12.5	
20	1/100				P						
21	P		P		P				P		
22	8/44.4	P	6/33.3		2/11.1				2/11.1	P	
23	1/14.3	1/14.3	P		1/14.3	P			4/57.1	P	
24			P		P				1/50.0		1/50.0
25	5/55.5		1/11.1						2/22.2		1/11.1
26	5/83.3	1/16.7	P						P		
27	4/80.0		P								1/20.0
28	6/85.7		P						1/14.3		
29	5/62.5	1/12.5	2/25.0								
30	5/83.3	1/16.7									
31	6/85.7							1/14.3			P
32	8/88.8		P								1/11.1
33	5/71.4		1/14.3				1/14.3				
34	2/50.0		2/50.0								
35	6/75.0		1/12.5		P			1/12.5			
36			1/100								
37			P					2/100			
38	P		P	P	1/100						
39	1/7.7	1/7.7	4/30.8		1/7.7		5/38.5				1/7.7
39SW	3/42.9	P	1/14.3		1/14.3		2/28.6				
41	1/7.1	P	4/28.6	1/7.1	2/14.3		6/42.9				
42	1/4.8	1/4.8	4/19.0	1/4.8	1/4.8		13/61.9				
43	P		1/14.3		P		6/85.7				
44		P	2/40.0		P		P	3/60.0			
45			1/20.0		P			4/80.0			
46					P			1/100			
47		P									
48	no identified fauna										
49								1/100			

Table 4. Trench XXI Fauna, diagnostic zones according to Watson, 1979.
(P= present, no diagnostic zones)

<table>
<tr><th>Period</th><th>Trench VIII Units</th><th>Trench IX Units</th><th>Trench X Units</th><th>Trench XXI Units</th></tr>
<tr><td>Upper Paleolithic</td><td>32-42</td><td>30-42</td><td>26-31</td><td>(47-49)</td></tr>
<tr><td>Mesolithic</td><td>23-31</td><td>28-29</td><td>20-25</td><td>38-46</td></tr>
<tr><td>Transitional</td><td>19-21</td><td>21-27</td><td></td><td>36-37</td></tr>
<tr><td>Early Neolithic</td><td>16-18</td><td>17-20</td><td rowspan="3">16-19</td><td>32-35</td></tr>
<tr><td>Middle Neolithic</td><td>11-14</td><td>14-16</td><td>27-31, 33-34</td></tr>
<tr><td>Late Neolithic</td><td>8-9</td><td>11-13</td><td>19-22</td></tr>
<tr><td>Eneolithic</td><td>6</td><td>6-8</td><td>15</td><td>13-17</td></tr>
<tr><td>Bronze Age</td><td>1-3</td><td>1-5</td><td>13</td><td>8-12</td></tr>
<tr><td>Iron Age/Antique</td><td></td><td></td><td>1-12</td><td>1-7</td></tr>
</table>

Table 5. Tentative period assignments, trenches VIII, IX, X and XXI.

Appendix 1: *Capra ibex* Measurements.
Measurements are in millimeters and follow von den Driesch, 1976, except as noted.
Estimated measurements are bracketed.

Bone	Trench/ Unit	Specimen					
Horncore			**Preserved Length**	**Greatest Diameter Base**	**Least Diameter Base**	**Circum-ference Base**	**Notes**
	VIII/20	17-109	64.6	32.0	24.4	(87.0)	young
	IX/26	116-550			(33.0)		
	IX/27	115-172		36.4	26.1	(97.0)	
	XXI/39	98-75		(38.5)	(27.5)	(107.0)	
	XXI/39	98-76	(150.0)	40.1	28.8	(108.0)	
	XXI/44	103-80		34.0	25.1	(93.0)	
Atlas			**GLF**				
	XXI/42	101-83	48.4				
Axis			**BFcr**	**Breadth Dens near Base[2]**			
	XXI/42	101-84	44.4	24.3			
Scapula			**SLC**	**GLP**	**LG**	**BG**	
	VIII/25	22-30	20.8	37.0	27.8	22.4	
	XXI/42	101-90	(19.0)	34.3	26.1	21.6	
	XXI/42	101-91	19.0	35.2	27.4		
	XXI/42	101-92	19.0	32.5	25.3	21.1	
Humerus			**Bd**	**BT**			
	Xxi/41	100-57	31.0	28.3			
Radius			**Bp**	**BFp**			
	XXI/43	102-61	30.2	28.9			
Ulna			**BPC**	**DPA**			
	VIII/23	20-144	(20.5)				
	X/22	110-160	19.4	28.0			
Metacarpal			**Bd**	**Dd**			
	IX/1-3	49-83					
	X/11-2	55-126	28.5	(18.5)			
Pelvis			**LA**	**Breadth Acetabulum**			
	X/7-8	51-42	31.8	29.7			
	XXI/42	101-103	28.2	27.1			
Tibia			**Bd**	**Dd**			
	VIII/27	23-23	30.0	(23.0)			
Astragalus			**GLl**	**Dl**	**Bd**	**Notes**	
	XXI/42	101-118	28.0	15.3	16.7	young	
	XXI/42	101-120	29.0	16.1	18.2		
Metatarsal			**Bp**	**Dp**	**Dd**		
	VIII/23	20-180			(17.0)		
	X/22	110-180	21.7	19.6			
Phalanx I			**A/P[3]**	**GLpe**	**Bd**	**SD**	**Bd**
	VIII/23	20-196	A	38.2	13.5	11.5	13.0
	XXI/39	99-108	P	36.3	11.4	9.1	11.3
	XXI/41	100-78	P		(14.5)		
Phalanx II			**A/P**	**GL**	**Bp**	**SD**	**Bd**
	X/22	110-97	P	24.0	12.9	9.6	10.2
	XXI/39	99-109	P	23.2	13.0	8.9	10.0
	XXI/41	100-79	P	20.8	11.2	8.3	(9.0)
Phalanx III				**HP**	**MBS**		
	VIII/23	20-202		20.2	6.0		
	X/21	109-195		(18.5)	(6.0)		

[2] Uerpmann, 1978
[3] A= anterior, P= posterior.

Appendix 2: *Sus* Measurements.
Measurements are in millimeters and follow von den Driesch, 1976, except as noted.
Estimated measurements are bracketed.

Bone	Trench/Unit	Specimen					
Atlas			**GL**	**GLF**	**BFcr**	**H**	**notes**
	VIII/23	20-92	46.3	44.9	51.3	(55.0)	
	IX/2	57-76		43.9			burnt
Scapula			**SLC**	**GLP**	**LG**	**BG**	
	VIII/2	2-71	21.2	(33.0)	(28.0)	22.2	
	VIII/8	6-60	28.5	44.7	37.0	31.4	
	VIII/20	17-44	22.1				
Humerus			**Bp**	**Dp**	**Bd**	**BT**	
	VIII/23	20-138				35.6	
	IX/1	32-33	41.9	58.3			
	IX/26	116-266			45.5	33.1	
	IX/27	115-92			50.3	36.7	
	XXXI/42	101-94			49.8	37.5	
Radius			**Bp**	**BFp**	**SD**		
	VIII/19	16-45	29.2	29.2	17.8		
	IX/27	115-99	37.3	37.3			
Ulna			**BPC**				
	IX/26	116-287	27.4				
Pelvis			**LAR**	**Breadth Acetabulum**			
	VIII/29	26-8	37.5	34.4			
	IX/27	115-113	34.8	36.2			
	X/7-8	51-44	32.5	30.6			
	XXI/8	65-12	28.1	28.1			
	XXI/39	99-88	(38.5)	35.9			
Femur			**Bd**				
	XXI/44	103-53	(53.0)				
Patella			**GL**	**GB**	**Greatest Depth**[4]		
	VIII/10	8-100	47.0	29.9	29.9		
	IX/2	57-119	35.3	19.3	20.1		
	IX/26	116-350	42.4	25.1	27.1		
Astragalus			**GLl**	**GLm**	**Dl**	**Dm**	**Bd**
	VIIIA/3	39-266	42.3		21.4		
	IX-1/1	33-44	39.4	35.8			23.6
	IX/20	121-117					
	IX/26	116-345	49.4	43.1	25.3		26.1
	IX/27	115-134	47.8	40.9		25.3	26.6
	IX/27	115-135	49.1	42.2		26.6	27.3
	XXI/39	99-95	39.6	35.4	20.3	21.3	22.7

[4] Uerpmann, 1978

Appendix 3: *Bos* Measurements.
Measurements are in millimeters and follow von den Driesch, 1976, except as noted.
Estimated measurements are bracketed.

Bone	Trench/Unit	Specimen						
Horn Core			**Greatest Diameter Base**					
	IX/26	116-528	(66.5)					
Atlas			**GL**	**GLF**	**GB**	**BFcd**	**BFcr**	**H**
	X/11-2	55-77	104.9	85.2	(159.0)	102.3	107.6	85.2
Axis			**BFcr**	**Breadth Dens near Base[5]**	**SBV**	**notes**		
	X/11-2	55-78	100.7	45.2	54.5	young		
Scapula			**SLC**					
	VIIIA/3	39-208	44.3					
Humerus			**Bd**	**BT**				
	IX-1/3	35-36	67.5	58.1				
	X/11-12	55-101	89.6	(86.0)				
Ulna			**BPC**					
	VIII/23	20-145	52.6					
	IX/26	116-293	(52.5)					
Metacarpal			**Bp**	**Dp**	**SD**	**Bd**	**BT**	**GL**
	VIII/1	1-117	(60.0)	(36.0)				
	IX-1/3	49-84	60.1	37.6	(34.5)	63.2	(33.5)	184.4
	X/11-12	55-123				68.3	36.1	
	XXI/48	101-101	62.4	36.8				
Tibia			**Bd**	**Dd**				
	X/22	110-173	67.3	48.8				
Astragalus			**GLl**	**GLm**	**Dl**	**Dm**	**Bd**	
	VIII/10	8-109		61.2	(37.5	36.8	(41.0)	
	IX/26	116-343		64.3		38.8	46.3	
	X/11-12	55-144			38.2	38.9	47.1	
	X/11-12	55-150	71.5	(67.0)	38.8	39.1	46.7	
	XXI/29	86-52	64.6	59.1	34.6	33.4	37.6	
Calcaneus			**GL**	**GB**				
	X/11-12	55-145	140.8	(49.0)				
	X/11-12	55-151	144.5	(51.0)				
Metatarsal			**Bp**	**Dp**	**Bd**	**Bd**		
	IX/20	121-128			(56.5)	(33.5)		
	X/11-12	55-149			62.7	(35.0)		
	X/11-12	55-153	53.4	50.1				
	X/11-12	55-155			64.2	35.4		
Phalanx I			**A/P**	**I/E[6]**	**GLpe**	**Bp**	**SD**	**Bd**
	VIIIA/5	42-319	A	I	55.0			29.4
	VIIIA/8	48-118	A	I	54.5	29.1	23.9	26.6
	IX/27	115-141	A	I		34.3		
	IX-1/1	33-45	A	I	47.7	26.0	20.8	24.6
	X/7-8	51-53	A	I	59.8	31.3	26.5	29.7
	XXI/23	80-90	A	I	55.8	28.8	24.7	27.3
	IX/2	57-134	P	I	56.0	26.2	22.4	23.0
	IX/26	116-390	P	E	67.3	34.6	28.8	30.6
	VIII/11	9-152			55.5			

5 Uerpmann, 1978
6 I= internal, E= external

continuation appendix 3.

Phalanx II			A/P	I/E	GL	Bp	SD	Bd
	VIIIA/3	39-290	A	I	(39.0)	31.9	25.7	(28.0)
	VIIIA/8	48-119	A	I	35.5	28.1	22.6	24.7
	IX/2	57-133	A	I	37.8	34.1	27.2	29.7
	IX/26	116-395	A	I		34.6	27.8	
	VIII/2	2-113	A	E	38.6	31.6	25.2	29.4
	VIIIA/8	48-122	A	E	35.4	28.1	22.4	24.1
	X/9-10	54-69	A	E	36.8	29.4	23.2	26.5
	XXXI/18	75-184	A		(37.0)	27.3	(22.0)	
	VIIIA/1	37-136	P	I	40.4	26.5	20.9	22.3
	XXI/16	73-49	P	I	38.4	26.8	20.8	21.7
	IX/26	116-391	P	E		33.8		
	IX/23	118-110	P					26.3
Phalanx III			**A/P**	**I/E**	**DLS**	**Ld**	**HP**	**MBS**
	VIIIA/8	48-120	A	I	77.7	55.4	(39.0)	24.2
	VIIIA/8	48-121	A	E	(72.0)	(53.0)	(39.0)	21.6
	VIII/2	2-115	A		81.9	58.1	(41.5)	26.3
	IX/21	120-100	A		74.1	60.5	43.0	23.7
	IX/26	116-400	A		79.0	64.7	(46.5)	24.6
	XXI/23	80-91	A		68.5	54.2	(37.0)	21.7
	VIII/22	19-196	P		75.1	62.8	(41.5)	24.9
	IX/26	116-401	P		84.5			26.9
	XXI/19	76-101			55.9	50.2	33.3	16.5
	XXI/41	100-80			91.4	69.4	43.5	27.1