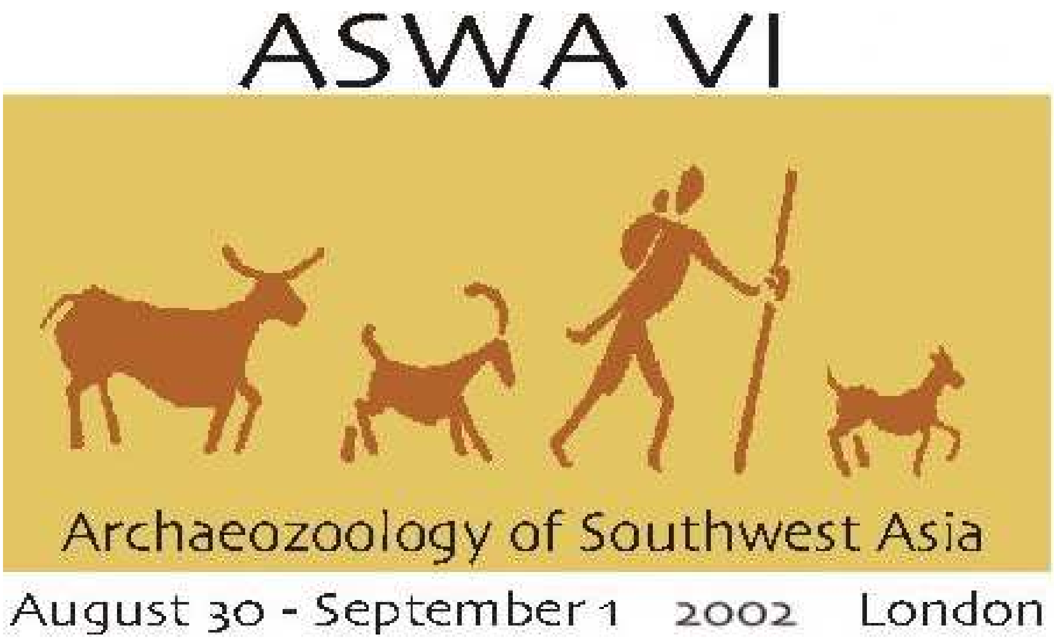
ARCHAEOZOOLOGY OF THE NEAR EAST VI

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

edited by

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



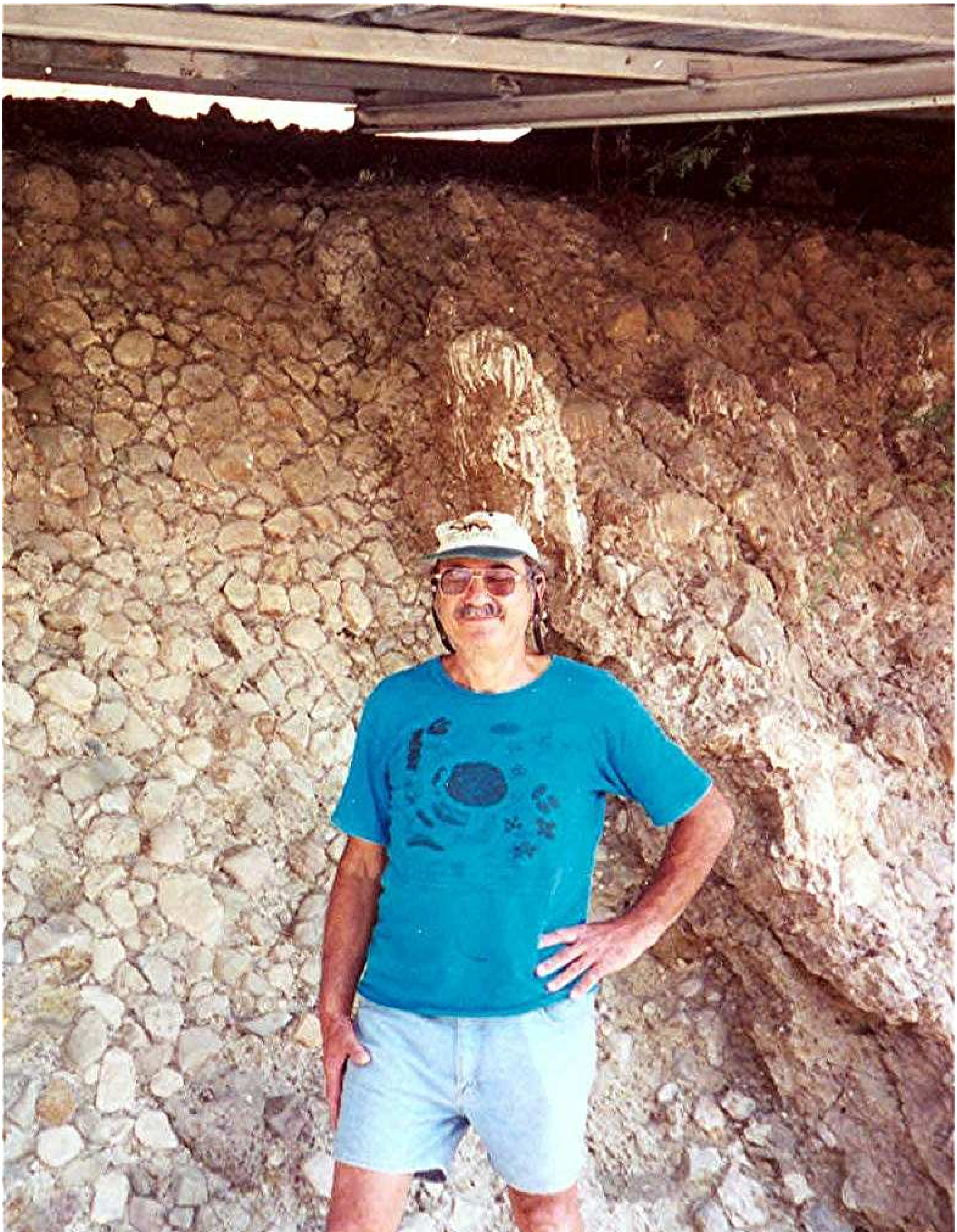
ARC-Publicaties 123
Groningen, The Netherlands, 2005

Cover illustration by Chris Mosseri-Marlio

This publication is sponsored by: ARC-bv and Vledderhuizen Beheer bv

Information and sales: ARC-bv, Koningsweg 48, Postbus 41018, 9701CA Groningen, The Netherlands, Tel: +31 (0)50 3687100, fax: +31 (0)50 3687 199, email: info@arcbv.nl, internet: www.arcbv.nl

ISBN 90-77170-02-2



Prof.Dr. Eitan Tchernov

This volume is dedicated to the memory of Prof. Dr. Eitan Tchernov, in fond memory of his enthusiasm and support to many in the field of archaeozoology**.**

Preface

The ASWA VI meeting was held at the Institute of Archaeology, University College London, from 30th August-1st September 2002, timetabled to follow on the heels of the ICAZ meeting in Durham, UK. Over 55 participants attended the meeting, travelling from 13 countries, bringing the latest research results from our field. As usual, it was a pleasure to see so many doctoral students presenting their research – a sign for a very healthy future for zooarchaeology in south west Asia. It is still unfortunate, however, that colleagues from some Middle Eastern countries were unable to attend due to financial and political constraints.

Presentations were organized into the following six themes, which highlight the scope of the ASWA membership: Animals in Palaeolithic and Epipalaeolithic Levant; Neolithic Patterns of Animal Use; Animals in Neolithic Anatolia; Animals in the Chalcolithic and Bronze Ages; Iron Age, Nabatean and Roman Patterns of Animal Use; Animals in Ancient Egypt. There was also a poster session, and contributors were invited to submit papers to this volume.

As always with the ASWA forum, the meeting served to welcome new scholars to the group, but was also very much a reunion of old friends and colleagues who have been sharing new information and discussing issues of joint interest for many years now. In this vein, it is a great sadness that ASWA VI was the last international meeting attended by Prof. Eitan Tchernov, an original founder of the group and mentor and inspiration to so many. For many of us, it was the last time we saw Eitan, and experienced his usual incisive comment, unstoppable enthusiasm for the subject, and warm friendship. He will be greatly missed.

ASWA VI was supported by the Institute of Archaeology, UCL, who provided facilities and financial and administrative help. In particular, the organizing team was aided greatly by the administrative assistance of Jo Dullaghan at the Institute. ARC bv (Archaeological Research and Consultancy, Groningen, The Netherlands) once again shouldered the finances of the publication of the proceedings, and we are extremely grateful for their continuing support. Many thanks are also due to the post-graduate student helpers from the Institute of Archaeology who made the meeting run so smoothly: Banu Aydinoğlugil, Jenny Bredenberg, Chiori Kitagawa, Peter Popkin, and Chris Mosseri-Marlio (who also produced the logo reproduced on the frontispiece of this volume).

Many thanks to all the participants for making the meeting such a success!

Louise Martin
London 2005

Participants of the 6th ASWA Conference, held at the Institute of Archaeology, University College London.

List of Participants and Co-Authors:

Francesca Alhaique falhaiqu@artsci.wustl.edu
Benjamin Arbuckle arbuckle@fas.harvard.edu
Elizabeth Arnold earnold@shaw.ca
Levent Atici atici@fas.harvard.edu
Banu Aydinoglugil banuaydinoglugil@hotmail.com
Aubrey Baadsgaard --
Guy Bar-Oz guybar@research.haifa.ac.il
Ofer Bar-Yosef obaryos@fas.harvard.edu
László Bartosiewicz h10459bar@ella.hu
March Beech mark_beech@yahoo.co.uk
Miriam Belmaker Miriamb@vms.huji.ac.il
Jenny Bredenberg j.bredenberg@ucl.ac.uk
Hijlke Buitenhuis h.buitenhuis@arcbv.nl
Denise Carruthers denise@permedia.ca
Louis Chaix louis.chaix@mnh.ville-ge.ch
Alice Choyke choyke@ceu.hu
Thomas Cucchi cucci@mnhn.fr
Marion Cutting tcrnmvc@ucl.ac.uk
Simon Davis sdavis@ipa.min-cultura.pt
Tamar Dayan dayan@taunivm.tau.ac.il
Rebecca Dean rmd@email.arizona.edu
Keith Dobney k.m.dobney@durham.ac.uk
Yvonne Edwards y.edwards@ucl.ac.uk
Avi Gopher a.gopher@post.tau.ac.il
Haskel Greenfield greenf@cc.umanitoba.ca
Caroline Grigson cgrigson@compuserve.com
Hulya Halici h.halici@arcbv.nl
Robert Hedges --
Hitomi Hongo hitomi@pri.kyoto-u.ac.jp
Liora Kolska Horwitz lix100@excite.com
Salima Ikram salima@aucegypt.edu
Evangelia Ioannidou vioannidou@hotmail.com
Joel Janetski joel_janetski@byu.edu
Chiori Kitagawa --
Priscilla Lange plange999@aol.com
Cheryl Makarewicz makarew@fas.harvard.edu
Louise Martin louise.martin@ucl.ac.uk
Marjan Mashkour mashkour@cimrs1.mnhn.fr
Richard Meadow meadow@fas.harvard.edu
Chris Mosseri-Marlio chris@cwinkelb.demon.co.uk
Natalie Munroe munro.Natalie@nmnh.si.edu
Jessica Pearson --
Carl Phillips karp.phillips@virgin.net
Peter Popkin tcrnprp@ucl.ac.uk
Rivka Rabinovich rivka@vms.huji.ac.il
Richard Redding rredding@umich.edu
Stine Rossel rossel@fas.harvard.edu
Aharon Sasson sasson@post.tau.ac.il
Jaqueline Studer jaqueline.studer@mnh.ville-ge.ch
Robert Symmons r.symmons@nhm.ac.uk
Eitan Tchernov ---
Jill Weber jweber@sas.upenn.edu
Sarah Witcher-Kansa skansa@fas.harvard.edu
Lisa Yeomans lisayeomans350@hotmail.com

Contents

A PRELIMINARY STUDY OF THE ANIMAL HUSBANDRY FROM LATE NEOLITHIC DISPILIO, NORTHERN GREECE

Evangelia Ioannidou[1]

Abstract

A small bone assemblage recovered from the Late Neolithic layers of the lake settlement of Dispilio in Northern Greece was examined to define the degree that the animal economy of this site may diverse from other assemblages of the same date from Greece. Fish remains were very abundant. Otherwise the faunal sample appears similar to any other Neolithic, that is heavily dominated by the four domestic mammals, sheep, goat, pig and cattle. Ovicaprid flocks appear to contain more than usually adult/old animals hinting to the possibility of systematic exploitation of secondary products and/or higher herd replacement/increase. Despite the fact that secondary products may have been exploited in the site, deaths under the age of 6 months have not been recorded. This might be an indication for seasonal removal of the flocks from the site.

Resumé

Un petit assemblage faunique issu des niveaux du Néolithique final du site de Dispilio en Grèce du Nord a été examiné pour évaluer les différences de mode de subsistance avec d'autres sites contemporains en Grèce. Les restes de poissons sont très abondants. A part ce caractère, l'assemblage ressemble aux autres assemblages Néolithiques qui sont composés essentiellement par les restes d'artiodactyles domestiques, le mouton, la chèvre le porc et le bœuf. L'abattage des ovicaprinés plus accentués pour les classes d'âges d'adulte à vieux semble cependant plus tardif que d'habitude et reflète probablement une exploitation de produits secondaires et /ou une réforme plus importante. Bien que les produits secondaires aient été exploités sur le site, un abattage en dessous de six mois n'a pas été enregistré. Ceci peut-être une indication de déplacement saisonnier du troupeau.

Keywords: Late Neolithic, Greece, animal exploitation, ovicaprid management.

Mots Clés: Néolithique final, Grèce, exploitation animale, gestion des ovicaprinés.

Introduction

The site of Dispilio is located on the bank of the lake Orestiada in Kastoria, Northern Greece, and was excavated under the direction of Prof. G. Hourmouziadis from the Aristotle University of Thessaloniki. It was of interest, because of the location of the settlement on and by the lake, which is expected to have played an important role in forming the economy and dietary preferences of the site's inhabitants, to examine whether the faunal assemblage recovered at Dispilio exhibits the characteristics of a "Neolithic" type of animal exploitation, or it is targeted towards other sources.

The sample

The bone sample comes from two phases of the settlement, the phase B2 and B3 (later named B IV and V respectively**,** Hourmouziadı 2000). From the phase B2, 3904 bone fragments were examined. The sample from the phase B3 is considerably smaller; 1306 fragments. The difference in the sample size may have caused dissimilarities amongst the two assemblages concerning both the species diversity and the computation of species proportions.

The area sampled is small (3 excavation squares, 4m x 4m each) compared to the excavated total and even smaller compared to the size of the settlement. Taphonomic effects related to possibly differential rubbish deposition and/or differential use of space through time cannot be easily detected, thus the composition of each sub-assemblage may reflect localised phenomena which might be dissimilar from one phase to another.

[1] British Institute of Archaeology at Ankara, Tahran cad. 24, Kavaklidere, 06700, Ankara, Turkey, vioanndou@hotmail.com

Another consideration is whether or not there are important preservation differences amongst the two assemblages. A rough assessment of this problem was done by comparing the proportions of identified to unidentified fragments and complete to broken bones (Table 1). Both assemblages were found to be very similar in these two aspects: highly fragmented but with a good portion of identifiable bone.

Table 1. Fragmentation and identifiability of the assemblages.

	Phase B2		**Phase B3**	
	n	**%**	**n**	**%**
Identified	1580	**40,5**	593	**45,4**
Unidentified	2324	**59,5**	713	**54,6**
Complete	20	**0,5**	13	**1,0**
Total	**3904**	**100**	**1306**	**100**

The methodology

The bone fragments were identified using a small private reference collection. In addition to that, for the separation of sheep/goat, the criteria established by Boessneck *et al* (1964), Kratochvil (1969) and Payne (1985), and for red deer/fallow deer by Lister (1996) were consulted. Because of the lack of suitable reference materials and the fragmentation of the sample, some of the identifications could not be verified. These are denoted with a question mark in the Table 3.
The species proportions were calculated by three methods:

1. NISP (number of identified specimens): all fragments were included save for ribs, premaxillae and maxillae without teeth. Skull fragments were calculated when part of the orbit or occipital condyle was present.
2. EO (epiphysis only): all bone fragments with part of an epiphysis/epiphyseal plate and jaws with teeth. Phalanges were included only when their proximal epiphyses was present; carpals and tarsals were included when complete or more than half; calcanea and ulnae when more than half of their articular surface was present; from the vertebrae only the atlas and axis were included.
3. MNI (Minimum number of individuals): For each species, the most abundant element was divided by the frequency it occurs in the skeleton.

The tooth eruption and wear follows Payne (1973, 1987). Apart from mandibles, loose but complete dP4 and M3 were included in the reconstruction of mortality profiles. For a dP4 to be included, its roots should not have been absorbed by more than half their length. The frequency of mandibles and loose teeth that were from the same side of the animal and exhibited the same wear were divided by two.

The economy

The assemblage composition

In Table 2, the bones are grouped in broad categories; birds, fish, reptiles/amphibians and mammals. The latter group is subdivided into three groups, the domestic mammals, the wild mammals and the canids (this includes canid bone fragments for which the status of the animal, domestic or wild could not be assessed). The reasons for this initial grouping are methodological and cultural. The quantification problems and the taphonomy of the bones of the species included in each group are different. Similarly, the strategies of exploitation/capture and the output in meat are more diverse amongst the four groups than amongst the species within each group.

The mammals make up the largest part of the assemblage (73,1% and 83,8%), from which the game animal bones are a small portion, showing that the settlement's economy was directed towards the exploitation of mammalian resources and in particular of the domestic animals – a typical trend of Neolithic economy. Bird bones are a fraction of the total assemblage. The high percentage of fish

Table 2. Assemblage composition.

Phases	Phase 2		Phase 3	
Method	**NISP**		**NISP**	
Species	**n**	**%**	**n**	**%**
Mammals	1155	**73,1**	497	**83,8**
Mammals - Domestic	*1075*	***68,0***	*441*	***74,4***
Mammals - Wild	*61*	***3,9***	*44*	***7,4***
Canids	*19*	***1,2***	*12*	***2,0***
Birds	16	**1,0**	11	**1,9**
Fish	365	**23,1**	69	**11,6**
Reptiles/Amphibians	44	**2,8**	16	**2,7**
Total	**1580**	**100**	**593**	**100**

remains is the one that really differentiates Dispilio from other sites excavated in Greece. Apparently, and expected, the lake has been intensively exploited. The reptile/amphibian group, which is comprised of tortoise carapace and bone fragments with a single frog bone representing the amphibians, makes up a small and unvarying proportionally part of the assemblage (2,8% for phase B2 and 2,7% for phase B3). This is taken as an indication that humans may not have introduced these bones into the assemblage. These remains may have originated from animals living in the settlement during the time of occupation or animals that burrowed in the site at a later time.

The overall picture appears to be of an economy whose backbone is the keeping of the domestic animals. Whether or not this does represent the true dietary preferences of the site's inhabitants is an open question. It is likely that the mammalian game proportion to the domestic mammals' proportion is more or less a reliable estimation since the mammalian bones have broadly similar taphonomy when referring to their destruction by natural factors. On the other hand, it is well known, that when fish and bird bones are to be compared with mammal bones the first two are more likely to be underestimated. It is hard to define how much this underestimation might be and it is even harder to examine whether or not the lake sources (fish and waterfowl), in fact, were the staple of the economy and diet rather the domestic animals. The overwhelming, when compared to other settlements, REF quantity of fish bone proves regular and intensive fishing. It is possible, that even though the long–term planning of the animal economy was clearly targeted towards the keeping of the four domesticates, the most commonly consumed flesh on everyday "family meals" was that of fish. It wouldn't be surprising if this was the first choice of the Neolithic people of Dispilio, not only because the location of the site favours it, but also because it seems an "economical" decision. Fish is an elusive source of nutrition since wild and uncontrollable but fishing, at a non-commercial level, is a rather "cheap" way to obtain food when all that is needed is suitable equipment, a few hours to spare and good luck. Invalid, old or perhaps very young members of the household could have been assigned such a job, saving valuable labour for other tasks. In contrast, domestic animals require long-term planning and intense effort to keep, making the slaughter of any domesticate an expensive choice. In this case, two separate and complementary strategies can be discerned: Domestic animal husbandry as the primary component of the systematic animal exploitation, signified by the overwhelming finds of domestic mammal bone, and fishing for the provision of the everyday food as often as possible.

A shift in the exploitation of the wild sources is observed amongst the two phases. The frequency of fish bones has been halved in the phase B3 whilst the bird and mammalian game frequencies have been doubled. It is hard to say whether or not this is a real change in economy. Differential deposition may constitute what seems to be a "change". Or, it might be that the people who used the examined part of the settlement during the phase B3 had different skills (hunting versus fishing) or dietary preferences from the people of the phase B2.

The mammals

The mammalian bones were separated in three groups (Table 3):

1. The "domestic" animals that represent the part of the settlement's economy program concerning the animal husbandry.
2. The "game" animals that are believed to be the target of systematic hunting for the provision of meat and possibly by-products (hide, antlers).
3. The "others", a group that includes both domestic and wild animals for which the reason for keeping/hunting them is not absolutely clear, does not necessarily fall within a strictly utilitarian

purpose plan (i.e. dog) or does not represent systematic hunting (very few bones are thought to indicate that a species is not hunted regularly therefore a planned, specific purpose of exploitation is not attached to this species).

The bulk of the assemblage is made up of the four domestic animals, sheep, goat, pig and cattle whilst the two other groups together vary from 8.3% (Phase B2, NISP, Table 3) to 15,1 (Phase B3, EO, Table 3). The MNI percentages are much higher for both groups but because several species represented by one fragment are included in the MNI counts, the results of this method are inflated and misleading.

Hunting appears to be directed towards the three deer species, amongst which the roe deer is the most abundant. The game species frequency doubles in the phase B3 due to an increase of red and roe deer bones. Hare is also hunted. The stable proportion of it points towards a constancy in hare hunting which might have been a habitual activity aimed at a regular population of animals around the settlement. Aurochs and boar remains are very few. Maybe the systematic exploitation of their domesticated counterparts had made their hunting unnecessary. For the rarity of wild pig remains, it should be kept in mind that most of the pig bones found are of immature animals and the differentiation of wild – domestic within this age group is not easy.

Taking a closer look to the group named “others”, dog and canid bones make up the bulk of the finds. In fact, only four bones come from other than canid species. These are one bone fragment of each, fox, wild cat, a bear (?) and a beaver (?). Careful examination revealed that butchery marks were very rare on the dog-canid remains. From the 31 canid bones only 1 sacrum, and from the 18 dog bones only a distal humerus, have knife marks. Apparently, the species was eaten but very occasionally; dogs were, most likely, kept as working animals and/or pets. The proportions of this group, despite slightly reduced in the phase B3, is even indicating that this group originates from a steady animal population which should be the dogs kept at the site. If such is the case, it wouldn’t be unsound to contemplate that all, or most, of the canid bone fragments were indeed of dog.

Finally, the species diversity of the hunted animals, including both categories – game and others – is higher in the phase B2. Because the number of bones representing each additional species is very low, this diversity is considered to be rather a function of the much larger size of the assemblage studied for the phase B2 than a reflection of varied hunting strategies and/or richness - poorness of the environment.

Table 3. Species proportions.

Phases	**Phase B2**						**Phase B3**					
Method	**NISP**		**EO**		**MNI**		**NISP**		**EO**		**MNI**	
Species	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Cattle	107	*9,3*	*50*	*10,4*	4	8,3	24	*4,8*	*6*	*2,4*	3	10,3
Ovicaprids	743	*64,3*	*287*	*59,5*	17	35,4	351	*70,6*	*168*	*66,7*	11	37,9
Pig	209	18,1	83	17,2	12	25,0	64	12,9	40	15,9	4	13,8
Domestic total	**1059**	**91,7**	**420**	**87,1**	**33**	**68,8**	**439**	**88,3**	**214**	**84,9**	**18**	**62,1**
Aurochs	1	0,1	1	0,2	1	2,1	-	-	-	-	-	-
Boar	-	-	-	-	-	-	2	0,4	1	0,4	1	3,4
Red deer	7	**0,6**	3	0,6	1	2,1	13	**2,6**	7	2,8	2	6,9
Fallow deer?	10	***0,9***	*7*	*1,5*	1	2,1	4	**0,8**	4	1,6	1	3,4
Roe deer	29	***2,5***	*18*	*3,7*	2	4,2	21	**4,2**	11	4,4	2	6,9
Hare	10	0,9	9	1,9	2	4,2	4	0,8	4	1,6	2	6,9
Game total	**57**	**4,9**	**38**	**7,9**	**7**	**14,6**	**44**	**8,9**	**27**	**10,7**	**8**	**27,6**
Dog	16	1,4	5	1,0	2	4,2	2	0,4	1	0,4	1	3,4
Fox	1	0,1	1	0,2	1	2,1	-	-	-	-	-	-
Canid	19	*1,6*	*15*	*3,1*	2	4,2	12	*2,4*	*10*	*4,0*	2	6,9
Wild cat	1	0,1	1	0,2	1	2,1	-	-	-	-	-	-
Castor?	1	0,1	1	0,2	1	2,1	-	-	-	-	-	-
Ursus?	1	0,1	1	0,2	1	2,1	-	-	-	-	-	-
Others total	**39**	**3,4**	**24**	**5,0**	**8**	**16,7**	**14**	**2,8**	**11**	**4,4**	**3**	**10,3**
Grand total	**1155**	**100**	**482**	**100**	**48**	**100**	**497**	**100**	**252**	**100**	**29**	**100**

Table 4. Proportions of cattle, ovicaprids and pig.

Phases	Phase B 2						Phase B 3					
Method	**NISP**		**EO**		**MNI**		**NISP**		**EO**		**MNI**	
Species	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Cattle	107	**10,1**	50	**11,9**	4	**12,1**	24	**5,5**	6	**2,8**	3	**16,7**
Ovicaprids	743	**70,2**	287	**68,3**	17	**51,5**	351	**80**	168	**78,5**	11	**61,1**
Pig	209	**19,7**	83	**19,8**	12	**36,4**	64	**14,6**	40	**18,7**	4	**22,2**
Total	1059		420		33		439		214		18	

The animal husbandry

Because the remains of these four animals are numerous enough to support statistics it deserves to take a look at the different methods used to calculate the species proportions. The NISP and EO method have given very similar results for all species in the phase B2 and for the ovicaprids in the phase B3 (Table 3 and 4). Discrepancies are observed in the phase B3 for the pig and cattle but there, the small number of bones recovered probably causes these fluctuations. In the Dispilio material when the sample is large enough there is no important difference between NISP and EO. MNI, on the other hand, gives a very different picture of the assemblages' composition. Obviously, this is due to the fact that there are numerous species represented by one or two individuals and since the samples are small (particular of the B3 phase) these single entries throw out of balance the overall picture. The MNI is considered to be unreliable for these assemblages but the figures are given for reasons of comparison with the results of other sites.

The majority of the bone fragments recovered belongs to ovicaprids, the backbone of the Neolithic economy. The two species seem to be more important in the Phase B3 whilst sheep are much commoner than goats in both phases (sheep: goat ratio 8:2). Cattle make up a small part of the assemblage in the Phase B2 (10-12%) and in the Phase B3 the importance of cattle has been diminished considerably. Pig is the second most abundant animal in both phases although in phase B3 it has also been reduced in numbers.

The reduction of cattle and pig and the increase of ovicaprids are parts of the "change" already traced through the increase of hunting and the reduced importance of fishing. The people of the phase B3 – either the Dispilio community as a whole or only the inhabitants of the area examined – appear less interested in the lake and more occupied with the herding of small ruminants and hunting. If this is a real change it may have been connected with more intensive agriculture for which pig might be harmful and cattle too demanding since it needs large pasture fields that may have been taken up for cultivation. In contrast, forests bordered by agricultural fields are favourable for deer populations and ovicaprids are good providers of manure that can be easily removed from the site in times when they may pose a danger for agriculture (for example, when the crops are mature and ready to be harvested). The results of the anthracology (Ntinou 2000) and palynology (Kouli 2000) do not indicate any sharp change in the floral environment, therefore any possible intensification of agriculture is not likely to have been done at too large a scale. On the other hand, the palaeobotanical analysis in Dispilio (Mangafa 2000) indicated an emphasis on the cultivation of the *Triticum monococcum* and *Triticum dicoccum* whilst there was a lack of evidence for the systematic cultivation of pulses and other cereals. This may well fit the argument for some expansion of agricultural fields due to the possible intensification in the production of a limited number of crops.

Taking a look at other Late Neolithic assemblages from Greece (Table 5, for source of data see Halstead, 1996 and references therein), the management of ovicaprids and cattle appears to be the driving force whilst the pig is a complementary species. Based on the cattle–ovicaprid husbandry three distinctive groups of settlements can be discerned:

1. Sites where cattle frequencies range from 12% to 19% and ovicaprid from 60% to 66%. The common parameter on this group is that all the sites with the exception of Dimitra, are located in Thessaly. Only one of the Thessalian sites, the Agia Sophia has a different pattern with less intense exploitation of ovicaprids and large numbers of pig.
2. Sites where a higher proportion of cattle (20-24%) is accompanied by reduction of ovicaprids (51-57%) All of these sites are located in Macedonia.

3. Sites with very low cattle frequency (1-6%) and overwhelming quantities of ovicaprid bone (76-94%). These sites are caves and settlements located mostly in islands. Exception is the site of Kastri but this might be due to the different quantification method (MNI).

The site of Dispilio in Phase B2 appears to be marginally similar to the group 1 with ovicaprid frequencies within the range of the Thessalian sites and cattle proportions lower (Table 4). In the phase B3 the animal husbandry is very close to the group 3 save for the rather high frequencies of the pig (Table 4). For this phase, the lake might have stimulated a type of economy similar to the one practiced in islands where other sources, related to water horizons (sea – lake) are available.

Table 5. Cattle, ovicaprid and pig proportions of Greek Late Neolithic sites. V = village, H = hamlet, C = cave, TH = sites in Thessaly, M = sites in Macedonia, I = sites in islands, sites in *Italics* = sieved assemblages, sites underlined = partially sieved assemblages. Data adopted after Halstead 1996.

Site	Method	Site type	Location	% Cattle	% Ovicaprids	% Pig
Ag. Sophia	NISP	V	TH	14	43	44
Dimini	NISP	V	TH	12	66	22
Peukakia	NISP	H/V	TH	14	61	25
Zarko	NISP	V	TH	19	64	17
Dimitra	NISP	V	M	12	60	28
Paradeisos	NISP	H	M	24	56	21
Sitagroi	NISP	V	M	20	52	27
Thermi	NISP	V?	M	22	51	28
Vasilika	NISP	V?	M	24	57	19
Skoteini	NISP	C	M	6	76	18
Kalythies	NISP	C	I	6	88	6
Zas	NISP	C	I	1	94	5
Kastri	MNI	V	I	10	78	12

The ovicaprid mortality profiles

Thirtyone mandibles and loose teeth from 20 mandibles and 26 loose teeth in the Phase 2, and 20 from 16 mandibles and 16 loose teeth from the phase B3, are used to reconstruct the mortality profiles, the rest are eliminated for methodological reasons (see methodology). Several fragmentary mandibles, fragmentary and single teeth could not be aged within a narrow time span. To circumvent the problem of having too many and vague categories, the mandibles were firstly separated to as narrow intervals of age as possible, usually one year (Table 6). Then, the fragmentary mandibles were grouped into broader categories that were representing “young” and “old” animals for which the age at death could not be established within one year (Table 7).

No mandible securely aged at less than 6 months has been found. This is not an unusual situation (Trantalidou 1990: 339) and there are obvious reasons for not killing animals that young, before having obtained a sufficient weight to justify their slaughter for meat but the complete lack of such specimens might be considered strange, since it is rather expected to have ill, weak or inferior animals that would be better slaughtered early and/or may have died natural deaths. The failure to record infant mortality has been interpreted as a result of recovery bias, poor preservation and possible differential deposition of such carcasses (Halstead 1992: 37) but the numerous loose dP4 and mandibles with milk teeth found make this hypothesis not totally persuasive. Because the area sampled was small, the lack of these age classes might be due to pure chance but if further study of the Dispilio materials fails to recover such mandibles then the possibility of animal mobility, perhaps seasonal, should be considered as an option.

The first peak in mortality occurs in the age class of 6 to 12 months. These animals are considered to have been slaughtered not young enough to save their mother’s milk if milking was the reason for killing them. On the other hand, they are rather young if meat was desired. Their slaughter is more likely driven by the need to bring the flock population down to a number that could have been sustainable over the winter with the quantities of fodder and labour available (Payne 1973).

Table 6. Ovicaprid tooth wear data.

Ovicaprids	Age	0-2M	2-6M	6-12M	1-2Y	2-3Y	3-4Y	4+	Total
Phase B 2	**n**	0	0	4	2	2	4	8	20
	%	0	0	20	10	10	20	40	100
Phase B 3	**n**	0	0	4	1	1	1	9	16
	%	0	0	25	6,25	6,25	6,25	56,25	100

Table 7. OC = ovicaprids, m = months, y = years, Y T = young total to include the seven first categories, O T = old total to include the last two categories.

OC	Age	6-12m	2-12m	6m-2y	1-2 y	2-3 y	3-4 y	1-4 y	Y T	3-6 y	4+ y	O T	Total
B 2	n	4	2	4	2	2	4	4	**22**	1	8	**9**	31
	%	**13**	**6**	**13**	**6**	**6**	**13**	**13**	**71**	**3**	**26**	**29**	**100**
B 3	n	4	0	2	1	1	1	1	**10**	1	9	**10**	20
	%	**20**	**0**	**10**	**5**	**5**	**5**	**5**	**50**	**5**	**45**	**50**	**100**

An effort has been spent to keep the majority of the animals over their first winter to various ages. The ages 1 – 2 years, 2 – 3 years and 3 – 4 years have equal proportions at the phase B3. This holds true for the phase B2 too, save for the age 3 – 4 years, when more deaths have been recorded indicating that animals are kept alive for longer than in phase B3. These groups represent animals that have been obviously kept for meat only (1 – 2 years) and meat, reproduction and perhaps secondary products (2 – 4 years). Their numbers are relatively small when considering that Neolithic farmers are usually thought to have kept ovicaprids for meat mainly (Halstead 1987).

The last peak includes animals over 4 years of age (amongst them, one senile sheep of 8-10 years). The group of these older animals is interesting since ovicaprid mortality profiles from Neolithic Greece, as already said, usually agree well with Payne's meat model or "unproductive meat strategy" (Halstead 1999: 77). Nevertheless, a similar mortality profile with almost half the animals killed after their 4th year has been reported from Late Neolithic Thermi (Giannouli 1992) and an economy that aims to exploit secondary products (milk) has been suggested for cattle in Makriyalos (Collins and Halstead 1999).

Apparently, meat only, is not the aim of keeping ovicaprids at such an old age. These animals are clearly good providers of secondary products, milk and possibly wool. Milking has not been verified according to Payne's criteria (1973) since the very young deaths required by his "milk" model are missing. Nevertheless, the lack of such animals does not necessarily means that milk has not been exploited. Clutton-Brock (1981) has argued that unimproved sheep breeds may require the keeping of the lamb for the ewe to continue letting down milk. Alternatively, the lack of these young age class might be due to possible seasonal mobility of the flocks, a possibility that will explain well both, the complete lack of deaths under 6 months and the required removal of the offspring in order to take the ewe's milk. In addition to that, populations of animals including a large number of adults have higher potential for herd growth, another diversion from the typical "small unproductive meat herd".

Summing it all up, the ovicaprid flocks appear to contain a large number of older animals (40 to 56%). The deaths of young for meat or meat and reproduction is rather low and another also small part of the animal population has been killed prematurely because they couldn't have been kept over the winter. This picture is not very accurate.

Despite the fact that broadly aged mandibles cannot give sufficient detail about husbandry practises since slaughter could have taken place at any point of the time-span covered, these data can add some important information about the composition of the flock. In Table 7, more young deaths are evident which would have been missed if these broad categories were not taken into account, thus toppling the balance of recorded deaths over the older age classes. In fact, it appears that the majority of the flock has been kept for meat (2 – 12 months and 6 months – 2 years) and short–time provision of secondary products and reproduction (1- 4 years). The group 3 - 6 years may have included animals that were kept for secondary products as was the case for the 4+ group. The proportions of meat, and, meat plus reproduction/short term provision of secondary products animals are now 71% for the B2 phase and 50% for the phase B3 (Table 7) as compared to the 60% and 44% shown in the Table 6.

Conclusions

The economy of Late Neolithic Dispilio appears to differ from other settlements of the same period in terms of the large amount of fish bones recovered. Nevertheless, when it comes to animal husbandry it appears that the model is a typical Neolithic one with ovicaprids, pig and cattle making up the bulk of the assemblage. The most interesting point of the analysis is the ovicaprid mortality profiles that appear to differ from the usual Late Neolithic data with high juvenile/subadult death rates. In Dispilio, a larger than usual proportion of ovicaprids has survived beyond their 4th year indicating perhaps a systematic exploitation of secondary products and/or a potential for greater herd growth. Signs that hint at seasonal mobility of the ovicaprid flocks are also implied by the mortality data.

Acknowledgements

I am indebted to Prof. G. Hourmouziadis for offering me the opportunity to study the materials of Dispilio. Many thanks are also owned to Dr. Annie Grant for commenting on earlier drafts of this paper.

References

Boessneck J., H.-H. Müller and M. Teichert, 1964. *Osteologische Unterscheidungsmerkmale zwischen Schaf (Ovis aries, Linné) und Ziege (Capra hircus Linné).* Kühn-Archiv 78(1/2).

Clutton-Brock J., 1981. Contribution to discussion. In: J. Mercer (ed.), *Farming Practice in British Prehistory.* Edinburgh, Edinburgh University Press, pp. 218–220.

Collins P. and P. Halstead, 1999. Faunal remains and animal exploitation at Late Neolithic Makriyalos: preliminary results. In: P. Halstead (ed.), *Neolithic Society in Greece.* Sheffield Studies in Aegean Archaeology, Sheffield, Sheffield Academic Press, pp.139–141.

Giannouli E., 1992. I Neolithiki Thermi B: Ta dedomena apo ta osta zoon (Anaskafiki periodos 1989). *Makedonika* 18: 413–426.

Halstead P., 1987. Man and other animals in Later Greek Prehistory. *Annual of the British School at Athens* 82: 71–83.

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.

Halstead P., 1996. Pastoralism or household herding? Problems of scale and specialisation in early Greek animal husbandry. *World Archaeology* 28 (1): 20–42.

Halstead P., 1999. Neighbours from Hell? The household in Neolithic Greece. In: P. Halstead (ed.), *Neolithic Society in Greece.* Sheffield Studies in Aegean Archaeology, Sheffield Academic Press, Sheffield. pp. 77-95.

Hourmouziadı N., 2000. Provlimata kai methodoi proseggisis tou horou. *Eptakyklos* 15: 105–126.

Kouli K., 2000. Dispilio kai palynologia: Prosegizontas to palaioperivallon. *Eptakyklos* 15: 87–93.

Kratochvil Z., 1969. Species criteria on the distal section of the tibia in *Ovis ammon* F. *aries* L. and *Capra aegagrus* F. *hircus* L. *Acta Veterinaria (Brno)* 38: 483-490.

Lister A., 1996. The morphological distinction between bones and teeth of fallow deer (*Dama dama*) and red deer (*Cervus elaphus*). *International Journal of Osteoarchaeology* 6(2): 119-143.

Mangafa M., 2000. Arheobotaniki meleti tou limnaiou oikismou tou Dispiliou Kastorias. *Eptakyklos* 15: 189–199.

Ntinou M., 2000. I palaiovlastisi giro apo to limnaio Neolithiko oikismo tou Dispiliou kai I hrisi tis. Ta dedomena tis anthrakologikis meletis. *Eptakyklos* 15: 98–104

Payne S., 1973. Kill-off patterns in sheep and goats: the mandibles from Aşvan Kale. *Anatolian Studies* 23: 281-303.

Payne S., 1985. Morphological distinctions between the mandibular cheek teeth of young sheep, *Ovis* and goats, *Capra*. *Journal of Archaeological Science* 12: 139-147.

Payne S., 1987. Reference codes for wear stages in the mandibular cheek teeth of sheep and goats. *Journal of Archaeological Science* 14: 609-614.

Trantalidou K., 1990. Animal and human diet in the prehistoric Aegean. In: D.A. Hardy (ed.), *Thera and the Aegean World.* London, The Thera Foundation. pp. 392–405.