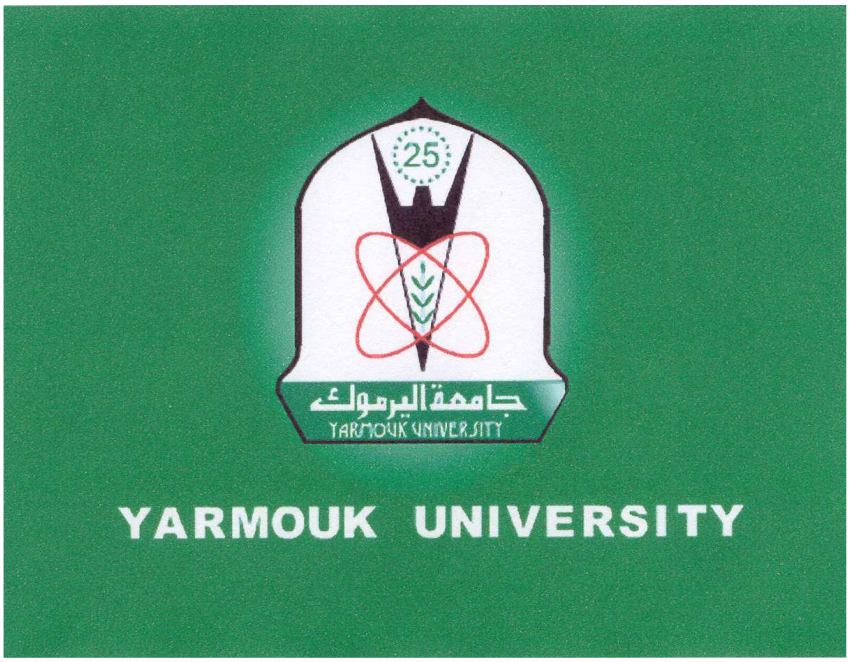
ARCHAEOZOOLOGY OF THE NEAR EAST V

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

edited by

H. Buitenhuis, A.M. Choyke, M. Mashkour and A.H. Al-Shiyab



ARC-Publicaties 62
Groningen, The Netherlands, 2002

Cover illustrations:
Logo of the Yarmouk University, Jordan

This publication is sponsored by: ARCbv and Vledderhuizen Beheer bv

Printing: RCG-Groningen

Information and sales: ARCbv, Kraneweg 13, Postbus 41018, 9701 CA, Groningen, The Netherlands
Tel: +31 (0)50 3687100, fax: +31 (0)50 3687199, email: info@arcbv.nl, internet: www.arcbv.nl

ISBN 90 – 77170 – 01– 4

NUGI 680 -430

Preface

When I participated in the IVth International Conference of ASWA, held in the summer of 1998 in Paris, I was gratified to learn that the Scientific committee had unanimously agreed to hold the next meeting in Jordan. Thus, on 2 April 2000, the Vth International Conference of the Archaeozoology of Southwest Asia and Adjacent Areas was held for the first time within the region at Yarmouk University in Irbid, Jordan after being held on the past four occasions in Europe.

The themes of this conference were divided into five areas including:

- Paleo-environment and biogeography
- Domestication and animal management
- Ancient subsistence economies
- Man/animal interactions in the past
- Ongoing research projects in the field and related areas

I wish to thank all those who helped make this conference such a success. In particular, I would like to express my appreciation to the Director of the Institute of Archaeology and anthropology at Yarmouk University Special thanks are due to his excellency, the President of Yarmouk University, Professor Khasawneh, who gave his full support and encouragement to the convening of this conference at Yarmouk University and to all those who contributed the working papers which made the conference possible.

I also wish to thank members of the organizing committee who worked very hard for many months in preparing the venue for this conference.

Abdel Halim Al-Shiyab
Yarmouk University
Irbid, Jordan

Note from the editors:
The editors wish to thank Dr. László Bartosiewicz for his excellent assistance in preparing and checking the contributions to this volume.

Participants at the 5th ASWA Conference, held at theYarmouk University in Irbid, Jordan, 2000

Contents

THE PROCESS OF UNGULATE DOMESTICATION IN PREPOTTERY NEOLITHIC ÇAYÖNÜ, SOUTHEASTERN TURKEY

Hitomi Hongo[1], Richard H. Meadow[2], Banu Öksuz[3] & Gülçin Ilgezdi[3]

Abstract

Results of the analysis of faunal remains from Prepottery Neolithic levels at Çayönü Tepesi are presented. Changes in size and kill-off patterns of pigs, sheep, goats, and cattle are examined. For pigs as well as for cattle, fewer animals survive into adulthood in later subphases. Marked size reduction is observed by the Cell Building subphase for pigs and goats, and by the Large-room Building Subphase for sheep and cattle. For all four species, however, smaller individuals start to appear as early as during the Grill Building Subphase for pigs and the Channeled Building Subphase for bovids. The timing of changes in the kill-off patterns and size in these four pro-domestic species is comparable to that at other sites in Southeastern Anatolia. Active hunting of wild pigs, sheep, goats, and cattle as well as hunting of red deer continued through the Prepottery Neolithic period.

Résumé

Les résultats des analyses de restes fauniques des niveaux du Néolithique Pré-poterie de Çayönü Tepesi sont présentés. Les modifications de taille et de profils d'abattage de porc, du mouton, de la chèvre et du bœuf sont examinés. Pour le porc et le bœuf un plus petit nombre d'animaux a survécu jusqu'à l'âge adulte dans les sous-phases plus tardifs. Une forte réduction de taille est observée à la sous-phase *Cell Building* chez le porc et la chèvre et à la sous-phase *Large-room Building* chez le mouton et le bœuf. Cependant pour les quatre espèces des individus plus petits commencent à apparaître déjà pendant la sous-phase *Grill Building* pour le porc et à la sous-phase *Channeled Building* pour le bœuf. La chronologie des modifications dans les profils d'abattage ainsi que la taille dans ces quatre espèces pro-domestiques est comparable à celle d'autres sites du Sud-Est d'Anatolie. La chasse du sanglier, du mouflon, de la chèvre égagre et de l'aurochs continua activement ainsi que celle du cerf durant la période du Néolithique Pré-poterie.

Key words: Çayönü Tepesi, Southeastern Turkey, Prepottery Neolithic, Domestication, Pigs, Sheep, Goats, Cattle, Kill-off patterns, Size index analysis

Mots Clés: Çayönü Tepesi, Sud-Est Turquie, Néolithique Pré-poterie, Domestication, Porc, Mouton, Chèvre, Bœuf, Profils d'Abattage, Analyse de Size Index

Introduction

In this paper we discuss the changes in the exploitation of pigs, cattle, sheep and goats during the entire span of the Prepottery Neolithic period at Çayönü Tepesi in southeastern Anatolia. The long span of the occupation at the site provides us with the opportunity to examine and evaluate such indicators of domestication as size diminution as well as changes in kill-off patterns. Our previous reports focused on pigs, deer, and cattle, mostly from the earlier part of the Prepottery Neolithic (Hongo & Meadow 2000; Ilgezdi 2000; Öksüz 2000). Since then, we have collected additional data, especially on sheep and goats, from the later subphases of the Prepottery Neolithic. We are also examining how the changes in animal exploitation patterns correspond to other archaeological evidence at the site (archaeobotanical evidence, architecture configurations and kinds of small finds and their distribution) in order to better understand the development of social differentiation and economic specialization.

The site and history of research

Çayönü Tepesi is located northwest of Diyarbakır in southeastern Turkey, about 5 kilometers from the foot of the Taurus mountains on a small tributary of the Tigris (Figure 1 in Hongo & Meadow 2000). The vicinity of the site was probably covered with open forest, consisting mainly of oak, pistachio, and

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almond. To the east of the site, there was also an area covered with steppe vegetation. There was a small stream or a swamp on the northern side of the site that probably attracted wild animals, especially wild pigs. Thus, the environment surrounding the site was rich and diverse, which would have provided the inhabitants of the site with a wide variety of plant and animal resources. Sixteen seasons of excavation were carried out at Çayönü between 1964 and 1991 by archaeological teams from the University of Chicago, Istanbul University, Karlsruhe University, and the University of Rome (L.S. & R.J. Braidwood 1982; Çambel & Braidwood 1980). The faunal material analyzed in this study came mostly from various features excavated in the 1985 and later seasons.

Stratigraphy

Particular types of buildings (M. & A. Özdoğan 1990; Hongo & Meadow 2000: Table 2) characterize each subphase of Çayönü. In chronological order, from earliest to latest, these are the Round Building, Grill Building, Channeled Building, Cobble-paved Building, Cell Building, and Large Room subphases. The Round Building subphase and earlier Grill Building subphase correspond to the PPNA. The later Grill to most of the Cell Building subphases correspond to the PPNB, and the final Cell and the Large Room Subphase correspond to the final PPNB (or 'PPNC') (A. Özdoğan 1994, 1999). This aceramic sequence is followed by the Pottery Neolithic occupation at the site.

Analysis

Faunal remains from selected features of each PPN level have been analyzed in detail to investigate the relative frequency of different animal taxa. All the faunal remains from the earlier two subphases (Round and Grill Building) that were excavated in 1985 and later, as well as portions of the assemblages from the rest of the PPN, have been analyzed. Additional pig, cattle, sheep, goats, gazelle, and red deer remains from each subphase were recorded and measured. Measurements were taken following the criteria defined by von den Driesch (1976), with additional measurements defined by Kuşatman for the pigs as well as those defined by the authors.

Relative proportion of taxa

Although sample size, especially that from the Cell and Large Room Building subphases, has been increased since our previous report (see Table 3 & Figure 3 in Hongo & Meadow 2000), the general trend observed in the relative proportion of taxa is unchanged. Pigs are the most commonly encountered taxon and make up about 35 to 40 percent of the identified specimens. The most important trend is the gradual increase of 'pro-domestic' taxa, especially sheep and goats, through the aceramic Neolithic subphases. Pigs, sheep, goats, and cattle together make up about 60 percent of the faunal remains up to the Cobble-paved subphase. The proportions of these pro-domestic taxa increase in the Cell subphase to about 75 percent and then to about 82 percent in the Large-room subphase. Additional taxa include equids, cervids, gazelle, and small mammals.

Pigs

Pig remains have so far been studied in most detail. Whether there is any evidence for pig domestication at Çayönü is of particular interest in connection with the report from the nearby site of Hallan Çemi that pigs were at least “culturally controlled” during the Epipalaeolithic (Redding 1994, 1995; Rosenberg 1994, 1999; Rosenberg & Redding 1998; Rosenberg *et al.* 1998).

The presence of the domestic form of pigs at Prepottery Neolithic Çayönü was suggested by Stampfli (1983, in ms. from 1966) and Kuşatman (1991). These studies, however, treated material from all the aceramic levels together. Consequently, the timing of the appearance of domestic pigs at Çayönü remained unclear in these previous studies.

In our previous reports, we have observed general trends in the pig data through the Prepottery Neolithic period toward features that can be considered characteristic of domestic populations, namely presence of specimens from small animals and a slightly earlier kill-off in later subphases (Hongo &

Meadow 1998, 2000). Since then we have increased the sample size for the Cell and Large Room subphases, in order to see whether these trends are more clearly seen in these two latest subphases.

Size of *Sus*

Size reduction in teeth is one of the indicators used for identifying the presence of domestic pigs at a site (e.g., Flannery 1983; Stampfli 1983). Figure 1 shows occlusal lengths and greatest breadths of lower third molars from various subphases. Measurements of the lower third molars of modern male and female wild pigs from Turkey are shown as open squares. A series of length measurements taken by Flannery (1983) on modern wild specimens from different parts of the Middle East are shown at the bottom of the chart.

Almost all of the Çayönü specimens fall in the size range for modern wild pig, but there is a trend toward somewhat smaller teeth in later subphases. Specimens with length measurements smaller than 40 millimeters exist only in the Cobble-paved and later subphases as well as those from the Pottery Neolithic levels. In the Pottery Neolithic period, this trend becomes even clearer, with an overall shift towards smaller length measurements (Ervynck *et al.* 2002).

Post-cranial measurements of Çayönü pig specimens were compared to the corresponding dimensions

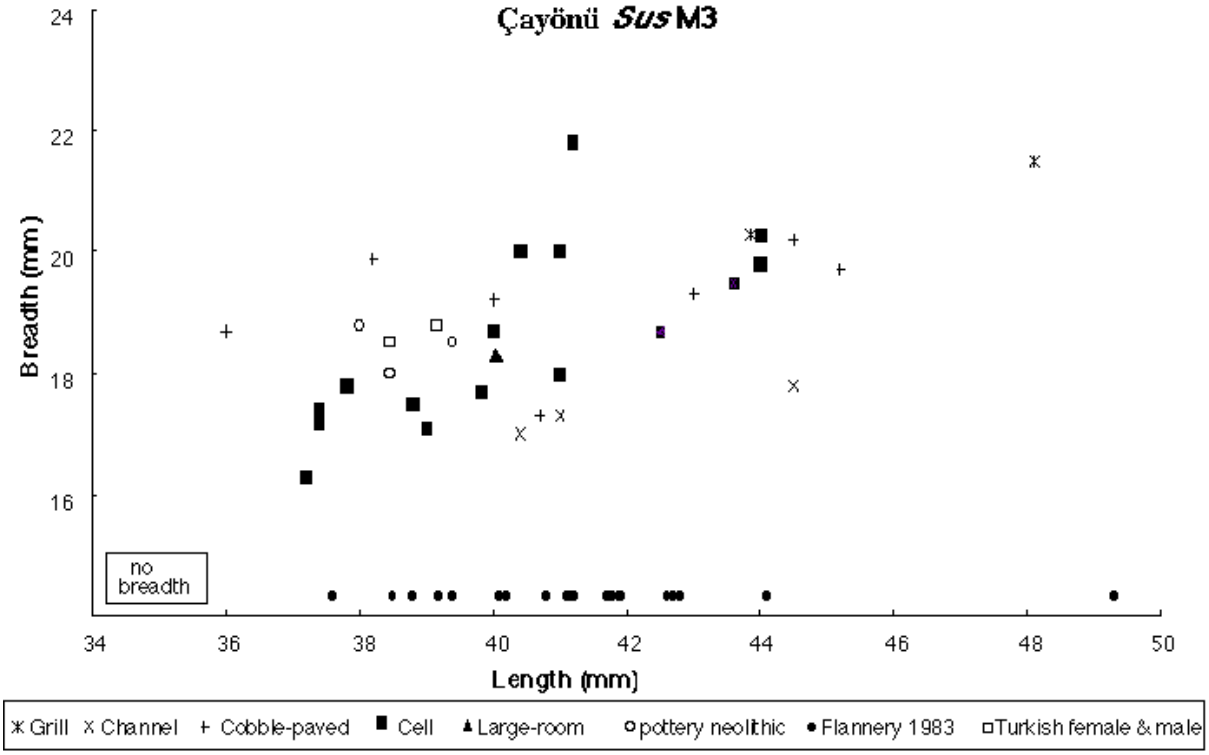

Fig. 1. Occlusal length and greatest breadth of *Sus* mandibular third molars from Çayönü, from a modern wild Turkish male (collection H. Hongo) and female (specimen #51621, Mammal Department, Museum of Comparative Zoology, Harvard University). Open circles at the bottom of figure are length measurements of modern specimens reported by Flannery (1983). The area of overlap between wild and domestic pig is considered to be between 36 and 40 mm (Flannery 1983, Stampfli 1983).

of a standard animal using the "difference of logs" method (Meadow 1981, 1983; Uerpmann 1979). Measurements of the female Turkish wild pig stored at the Museum of Comparative Zoology at Harvard University (specimen #51621) were used as the standard (see Hongo & Meadow 2000: Table 8 for the standard measurements). This standard animal is near the small end of the size range of modern Turkish wild pigs.

The log size indices of length measurements and breadth or depth measurements are dealt with separately (Fig. 2). The medians are also plotted on the chart. In order to compare the size of pigs from Çayönü with that of a domestic pig population, log size indices for pig bones from Kaman-Kalehöyük in the second and first millennium BC are also shown. Clearly, most of the pigs from Çayönü are much larger than domestic pigs in the Bronze and Iron Ages.

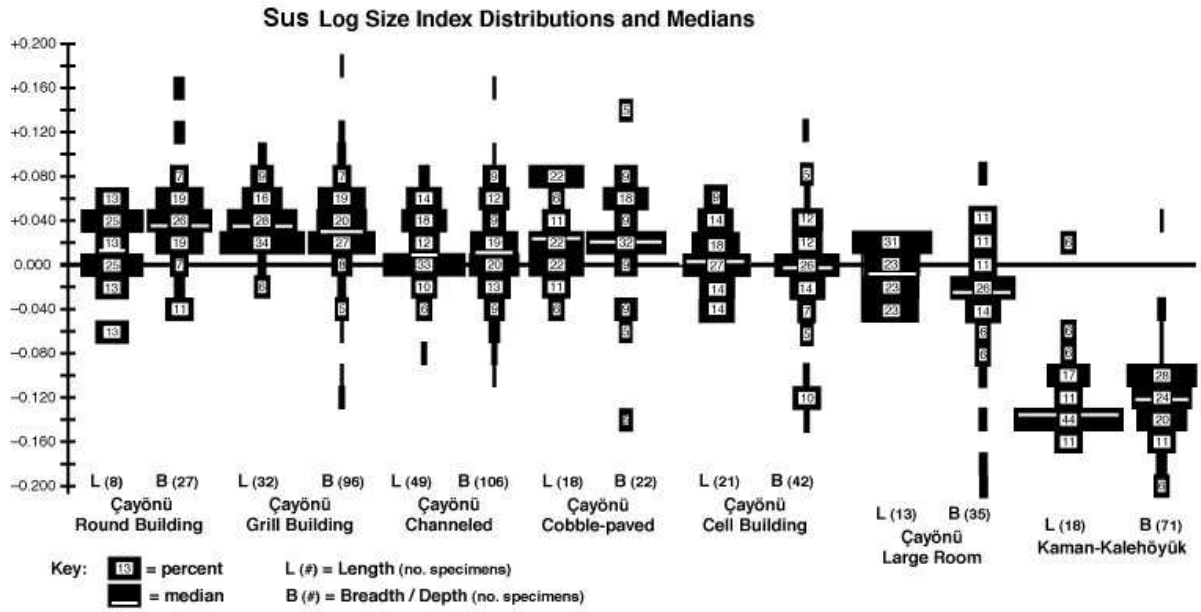

Fig. 2. Summary of *Sus* log size index data from Çayönü and Kaman-Kalehöyük. The 'battleship curves' show the percentages of indices falling into the various 0.020 intervals for Length and Breadth/Depth for each tem-poral division. The white lines indicate the median values. Measurements of a female Turkish wild pig (specimen #51621, the Museum of Comparative Zoology at Harvard University) were used as the standard (Hongo & Meadow 2000 Table 8).

A small overall shift toward less heavy animals throughout the Prepottery Neolithic is indicated by smaller median values in later subphases. The shift towards smaller animals is more clearly observed in the later subphases, in the Cell and especially Large Room subphases. Starting from the Grill subphase, some smaller specimens are observed, especially in breadth/depth dimensions. Until the Cobble-paved subphase, however, in no case does the median fall below 0.00. More animals with a log index smaller than -0.075 appear in the last two subphases. The range of size distribution in the Large Room subphase is comparable to that of a domestic population, although the battleship curve suggests that active hunting of wild pigs continued. Again, the shift in size is more visible in the breadth/depth dimensions, suggesting that animals were less heavy but not necessarily shorter in size.

Kill-off patterns for *Sus*

Kill-off patterns for pigs in each subphase were investigated by examining state of epiphyseal fusion and tooth eruption and wear. Post-cranial parts were grouped according to the sequence of fusion presented by Silver (1969), Bökönyi (1972), Habermehl (1975), and Bull and Payne (1982). In general, Stage I epiphyses fuse during infantile and juvenile stage (before 12 months), Stage II epiphyses during subadult stage (between 24 and 30 months), and Stage III epiphyses fuse when the animals become fully adult (between 36 and 42 months) (Hongo & Meadow 2000: Table 5).

In all subphases at Çayönü, about 55 to 70 percent of pigs can be said to have survived Stage I (Fig. 3). The survival rate at Stage II is probably around 50 to 65 percent, although there is a "rebound" caused primarily by large numbers of fused distal tibiae and metapodials.

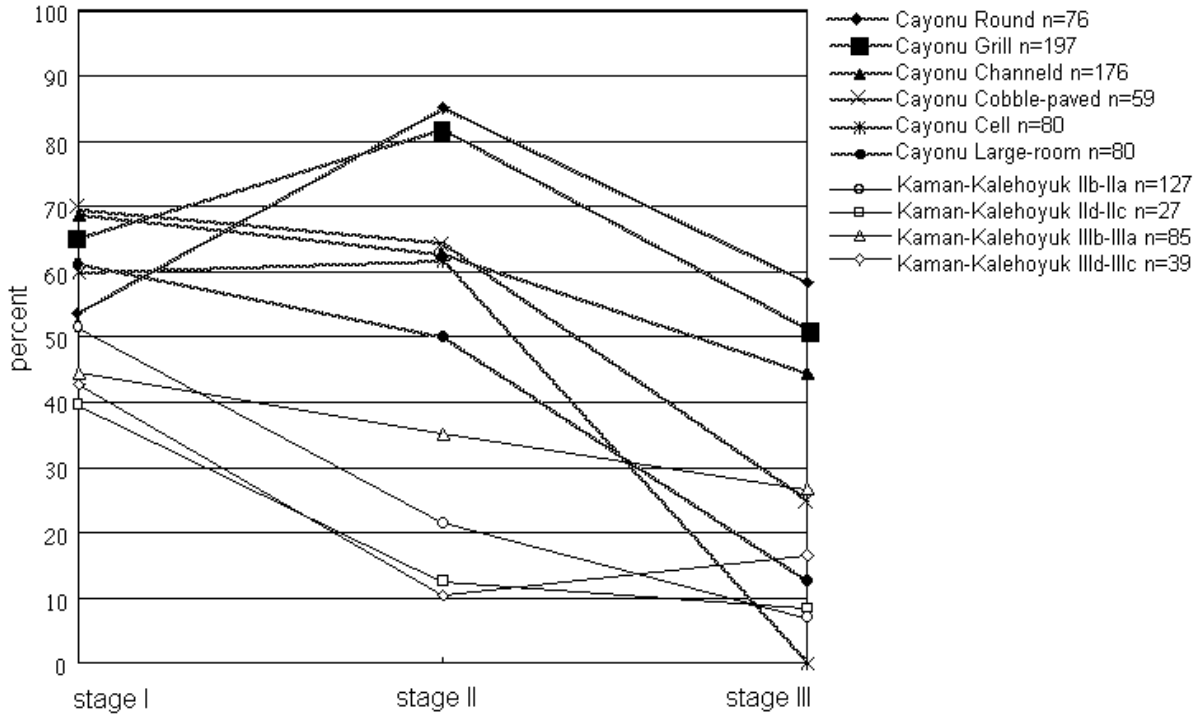

Fig. 3. Survivorship curves for *Sus* based on epiphyseal fusion for Prepottery Neolithic Çayönü and Bronze and Iron Age Kaman-Kalehöyük (IIId-IIIc is the earliest subphase; Hongo 1996).

In order to compare the kill-off patterns of pigs at Çayönü with those of a clearly domestic population, "survivorship curves" for pigs from the second and first millennium BC levels at Kaman-Kalehöyük are also shown on Figure 3 (after Hongo 1996). In general, the survival rate of pigs at Çayönü in Stage I and II are higher than those of the domestic population at Kaman. There are, however, progressively fewer animals appearing to survive Stage III. This trend is especially marked in the later Cobble-paved, Cell, and Large-room subphases. The survival rates at Stage III in these subphases are 10 to 25%, comparable to that in the domestic pig population.

Thus, the low survivorship into adulthood in the later Prepottery phases might indicate a shift toward a kill-off pattern similar to that of a domestic population.

Sheep and Goats

Size of *Ovis* and *Capra*

Size indices for sheep and goats from Çayönü were calculated as described in Uerpmann (1979). Figure 4 shows size index distributions for sheep based on the breadth/depth dimensions because of the small number of length measurements. Size index distributions for sheep remain similar from the Round through Cobble-paved subphases, although some small animals start to appear in the Channel subphase (Fig. 4). There is a marked shift in the size distribution of sheep toward smaller animals in the Large-room subphase. Although some wild sheep continued to be hunted, the size distribution of sheep in the Large-room subphase is comparable to that of a domestic population.

Size index distributions for goats show a different pattern from those for sheep (Fig. 5). Again, the comparison is based on the breadth/depth dimensions. A gradual decrease in size through the Prepottery Neolithic period is observed. Because of the small sample size, it is difficult to evaluate the size data of goats from the Round and Grill subphase. As with sheep, some small animals start to appear in the Channel subphase. A shift in the distribution toward smaller animals, which is marked by the shift in the median value, might be earlier for goats than for sheep and took place during the Cobble-paved or Cell subphase.

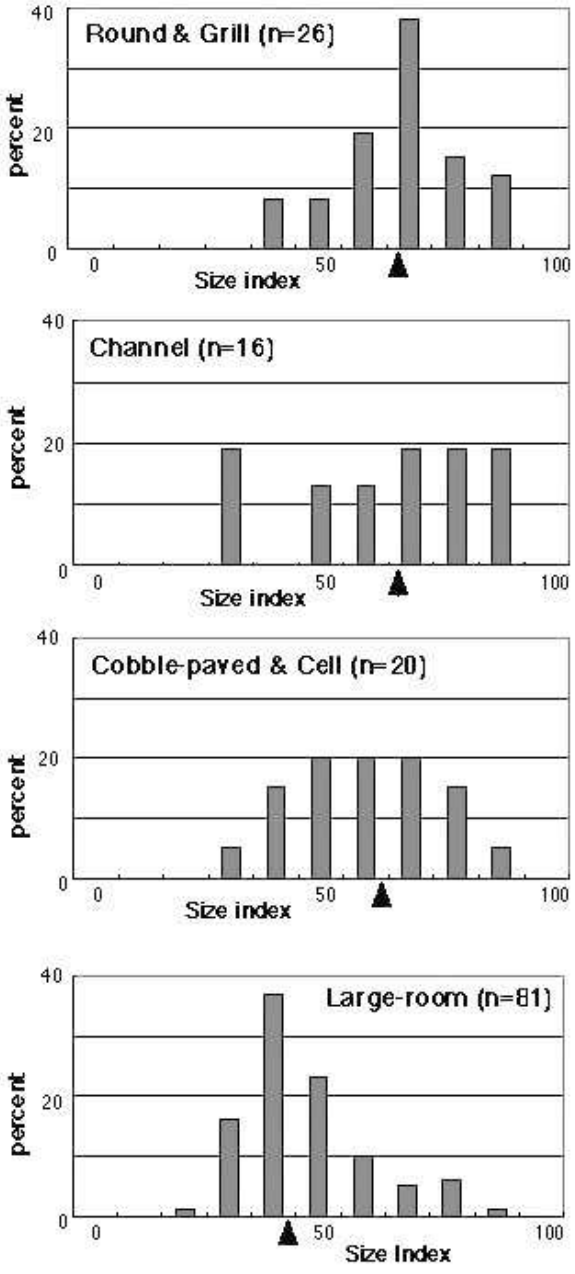

Fig. 4. Size index distributions of Breadth/ Depth dimensions for *Ovis* from Çayönü. The median value for each subphase is indicated by arrow at the bottom of the chart. See Uerpmann (1979) for the standard measurements.

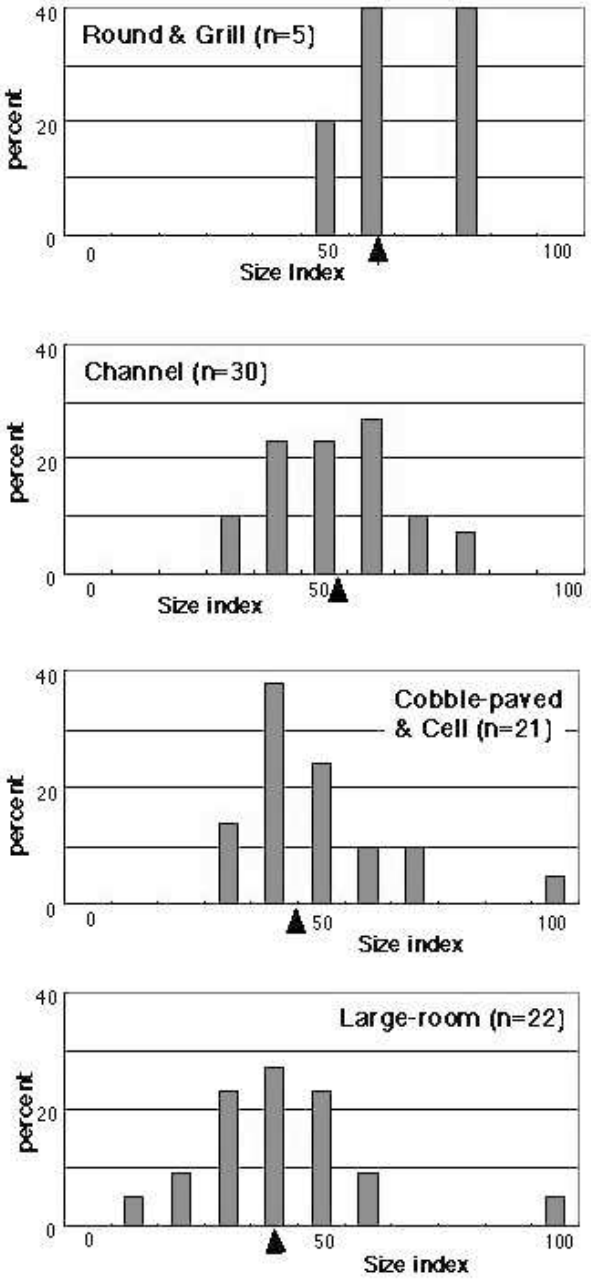

Fig. 5. Size index distributions of Breadth/Depth dimensions for *Capra* from Çayönü. The median value for each subphase is indicated by arrow at the bottom of the chart. See Uerpmann (1979) for the standard measurements.

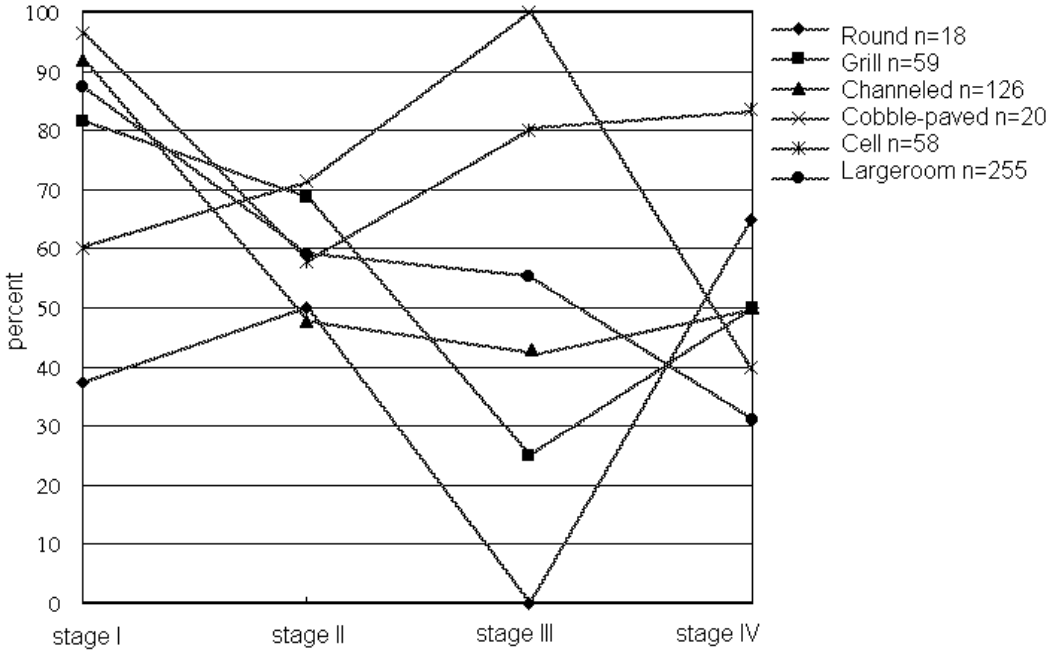

Fig. 6. Survivorship curves for *Ovis* and *Capra* from Çayönü based on epiphyseal fusion.

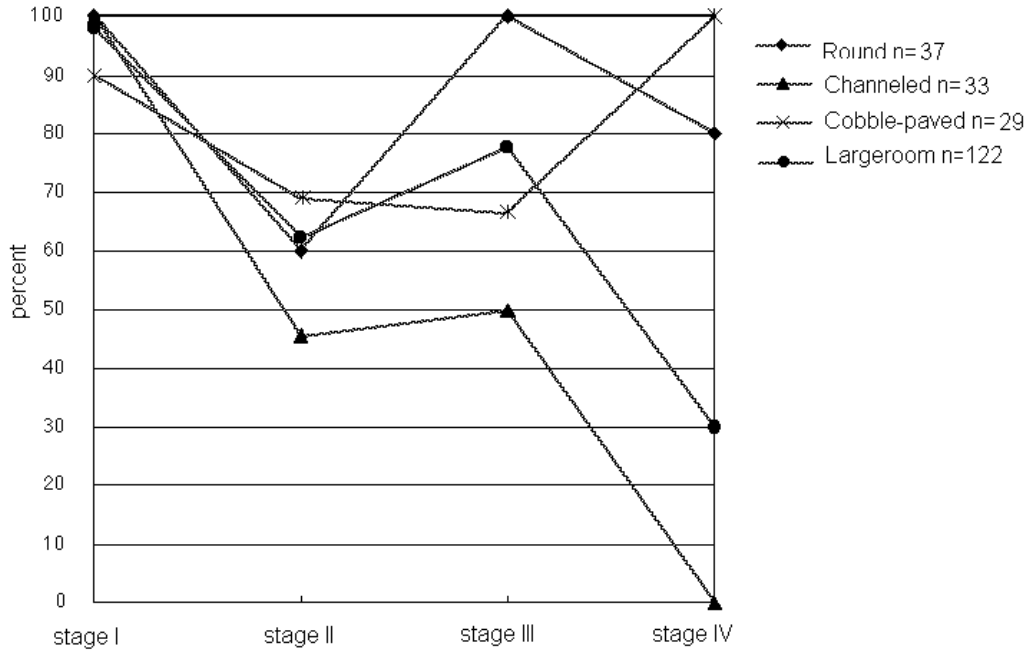

Fig. 7. Survivorship curves for *Ovis* from Çayönü based on epiphyseal fusion.

Kill-off patterns for *Ovis* and *Capra*

Kill-off patterns for sheep and goats were investigated based on the epiphyseal fusion of long bones. In general, Stage I corresponds to infantile (6-12 months), Stage II to juvenile (12-30 months), Stage III to subadult (30-36 months), and Stage IV (36-42 months) to adult (Hongo 1998: Table 3). Survivorship curves for the total of sheep and goats suggests that 50 to 70 % of animals survived Stage II in all subphases, but it is difficult to see a trend through time (Fig. 6). This kill-off pattern might have been established as early as in the Grill Building subphase. The patterns for the Channeled and Large-room subphases are more reliable because of larger sample size, which suggest that between 30 to 50 percent of animals survived until they were fully adult.

When sheep and goats are examined separately, the results are very problematic due to small numbers of identified specimens in Stages III and IV, especially for goats. Because of small sample size, specimens from the Round and Grill and also Cobble-paved and Cell subphases had to be combined. It seems that 50 to 70 percent of sheep survived Stage II (Fig. 7). Goats might have been kept longer than sheep, with a survival rate of between 70 and 90 % at Stage II, except for the Channeled Building subphase.

Cattle

Size of *Bos*

Measurements of the Çayönü cattle specimens were compared to the corresponding dimensions of a standard animal using the "difference of logs" method. The measurements of a wild cow from the Danish site of Ullerslev were used as the standard (Degerbøl 1970; Grigson 1989). Figure 8 shows size index distributions for cattle based on the breadth/depth dimensions. Although we again have the problem of small samples, size of cattle at Çayönü seems to have been unchanged from the Round through Cell Building subphase. However, relatively small animals, which are below the size range of wild cattle indicated by Grigson (1989), appear as early as in the Channeled Building subphase (Öksüz 1998, 2000). A clearer shift toward smaller animals is observed only in the end of the Prepottery Neolithic, during the Large-room subphase. This overall shift in size distribution of cattle might also reflect the presence of more females in the sample. The size index distribution in the Large-room subphase is similar to that of a domestic population in the Middle East, although a small number of wild cattle might also have been hunted.

Kill-off patterns for *Bos*

Post-cranial parts of cattle were grouped according to the sequence of fusion presented by Silver (1969), Bökönyi (1972), and Habermehl (1975). Stage I epiphyses fuse during the infantile stage (generally, 6-12 months), Stage II epiphyses during the juvenile stage (12-18 months), Stage III epiphyses during the subadult stage (24-42 months), and Stage IV epiphyses when the animals are fully adult (42-48 months); (Hongo 1998: Table 4).

Progressively earlier kill-off of cattle is observed through the Prepottery Neolithic period, except in the Cell Building subphase (Fig. 9). In the Cobble-paved and Large-room subphases, only about 50 percent of cattle survived Stage III and about 30 percent survived until they were fully adult (Öksüz 1998, 2000).

In contrast to cattle, there is no change in the size of red deer through the Prepottery Neolithic (İlgezdi 1999, 2000). The red deer sample is also dominated by fully adult animals. During the Round and Grill subphases, only adult animals were hunted. The slightly lower survival rates into adulthood (Stage IV), in the Channeled and Cobble-paved subphases might suggest increasing hunting pressure.

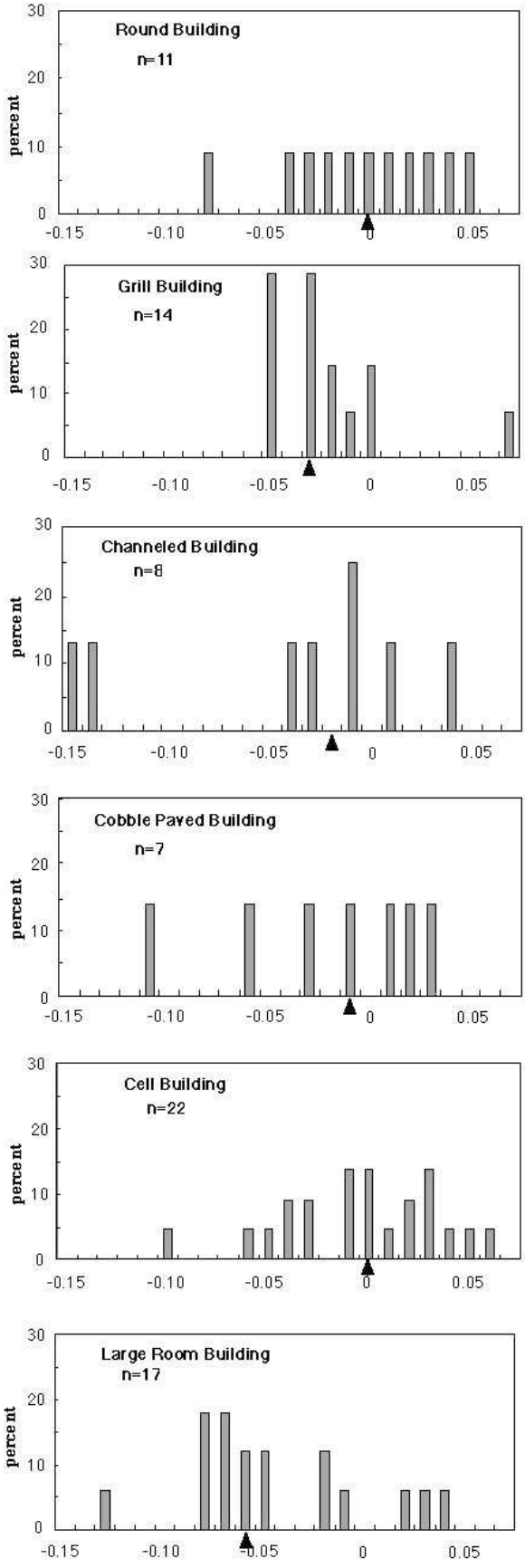

Fig. 8. Size index distributions of Breadth/Depth dimensions for *Bos* from Çayönü. The median value for each subphase is indicated by arrow at the bottom of the chart. The measurements of a wild cow from the Danish site of Ullerslev are used as the standard (Degerbøl 1970; Grigson 1989).

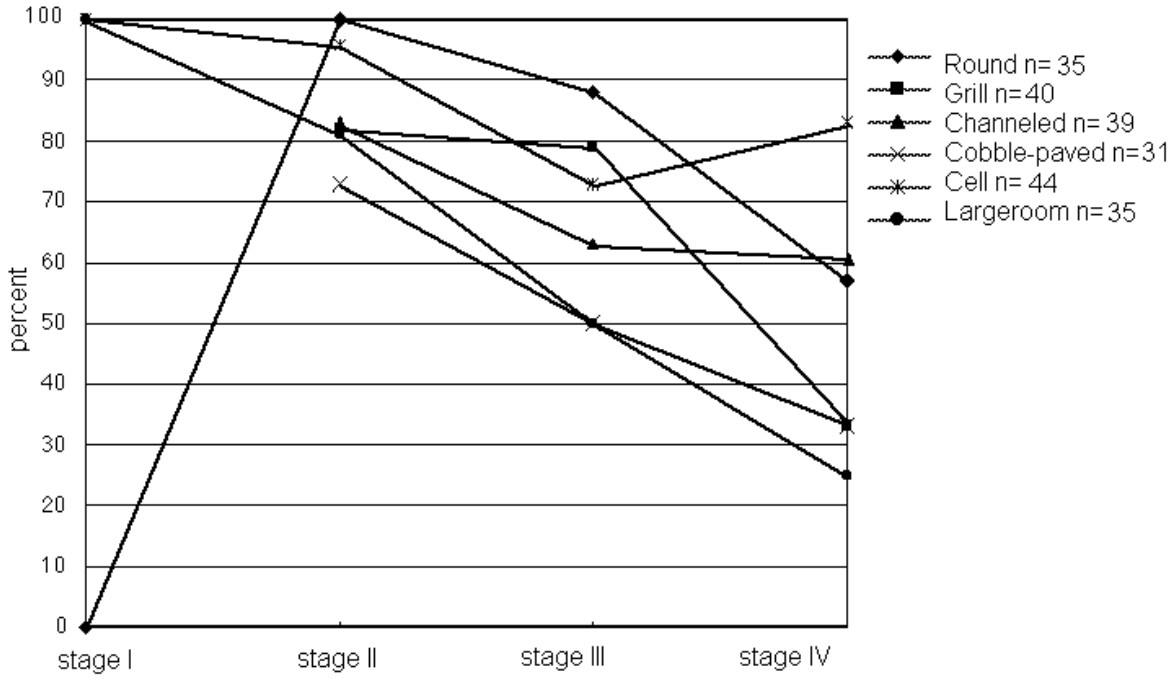

Fig. 9. Survivorship curves for *Bos* from Çayönü based on epiphyseal fusion.

Conclusion

Based on the data at hand, we feel that an overall change in the exploitation patterns of "pro-domestic" animals at Çayönü started by the Channeled subphase. As for pigs, a few specimens from small animals were present as early as in the Grill subphase. A shift in the log size index distributions, marked both by the lower median values and increase of smaller animals, becomes clearer in the Cell Building and Large Room subphases. Although neither the kill-off patterns nor the size of pigs at Çayönü show the unequivocal characteristics of a fully domestic population, earlier kill-off patterns and size diminution in the later subphases suggest the presence of some pigs under human control. The log size index distributions of post-cranial skeletons in later subphases (Cell, and Large Room) are comparable to those in roughly contemporary assemblages from (Late - Final PPNB) Gürcütepe II, where the presence of domestic pigs is reported (Hauptmann 1999; Peters *et al*. 2000, Fig.10; von den Driesch & Peters 1999: Fig.5). The kill-off patterns based on epiphyseal fusion of pigs at Çayönü in the Cobble-paved, Cell, and Large Room subphases, showing a survival rate of c. 55-60% at Stage I (c.1 year old) and c. 0-30 % survival rate into full adulthood, are also comparable to those at Gürcütepe II.

Although smaller cattle start to appear as early as in the Channeled Building subphase, a clear shift both in the size and kill-off patterns of cattle took place only by the end of the Prepottery Neolithic period, during the Large Room subphase.

Size index distributions of goats suggest a shift toward smaller animals as early as in the Channeled subphase, and certainly by the Cobble-paved subphase. The shift in the size index distributions of sheep might be later, during the Large Room subphase, although smaller animals start to appear as early as the Channeled Building subphase. Thus, the observation made by Lawrence (1980, 1982) that domestic sheep were kept in the “uppermost level” (which is now known to correspond to the late Cell Building and Large Room Building subphases, and perhaps also to some features now included in the Cobble-paved Building subphase) still holds.

Clearly, active hunting of wild pigs, sheep, goats, and cattle as well as the hunting of red deer continued throughout the Prepottery Neolithic period. Thus, even with the changes in animal exploitation patterns that brought at least some animals under human control in the latter half of the Prepottery Neolithic, wild animals constituted a significant portion of animals exploited at Çayönü. This picture

began to change only in the final PPN, in the Large Room subphase, when a clear shift is observed in both size and kill-off patterns in all pro-domestic taxa.

Although archaeobotanical data are rather scarce at Çayönü, wild pulses were predominant in the earliest subphase, and wild einkorn and emmer were intensively collected by the end of the Grill subphase. Emmer wheat, although morphologically still wild, was probably cultivated as early as the Channeled Building subphase (van Zeist 1972; Stewart 1976; van Zeist & de Roller 1994: 95). The abundance of grinding tools and sickles suggest that cereals became increasingly important in the Cell Building subphase (A. Özdoğan 1995, 1999: 52). Fat-rich plants such as pistachio and almond were, however, widely gathered and, together with wild barley, continued to play an important role in the subsistence at Çayönü even after the beginning of the cultivation of einkorn, emmer, and pulses (van Zeist 1972; Stewart 1976; van Zeist & de Roller 1994).

Concerning the architecture and settlement patterns, the Channeled Building subphase is the key period of change (Bıçakçı 1998; A. Özdoğan 1999: 46-7). Growing social differentiation at the site is suggested by the clear spatial division of residential and specialized workshop areas as well as the growing importance given to open courtyards as communal space.

Thus, the beginning of the changes in the animal exploitation at Çayönü probably coincides with overall changes in subsistence and social organization at the site, namely the beginning of cereal cultivation and growing social differentiation. The changes in animal exploitation patterns were, however, gradual. Both in pigs and bovids, marked size diminution and a shift to earlier kill-off are observed only in the Cell and Large Room subphase. By the Large-room subphase, there was increasing reliance on domestic animals, with a growing importance of sheep and goats. Even then, hunting continued to constitute a significant part of animal exploitation activities. This suggests that the "Neolithization" at Çayönü, which is located in a resource-rich environment, was a gradual process. It took at least a thousand years for the mode of subsistence at the site to be transformed into a fully Neolithic economy.

Acknowledgements

This project was supported by grants from the Nissan Science Foundation in Japan (1996-97), the National Science Foundation of the United States (1997-2000: SBR9601408), and the Japan Society for Promotion of Sciences (2000-2002: B(1) 12571041).

We would like to thank Professors Ufuk Esin, Mehmet Özdoğan, Dr. Aslı Özdoğan, and other members of the Prehistory Section of Istanbul University for their support. We would also like to thank Drs. Linda Braidwood, Robert J. Braidwood, and Halet Çambel. We wish to acknowledge help provided by Professor Hans-Peter Uerpmann in the identification of sheep and goats, and analytical help by Tomoko Anezaki (Keio University) and Benjamin Arbuckle (Harvard University).

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