ANIMAL EXPLOITATION AT ÇAYÖNÜ TEPESİ, SOUTHEASTERN ANATOLIA

GÜNEYDOĞU ANADOLU, ÇAYÖNÜ TEPESİ'NDE HAYVANLARDAN YARARLANILMASI

Our work on faunal remains from Çayönü began in 1996 in Istanbul. Shortly after the plan for our investigation of Çayönü fauna was proposed, one of the authors (Hongo) visited the Braidwoods at the Oriental Institute, at the end of 1994 or beginning of 1995. We had a lunch in the basement of the Oriental Institute over a lunch box that Dr. Linda Braidwood had brought. It was a simple, unpretentious but pleasant and memorable lunch break. It was the first and only occasion that Hongo met the couple, and it still remains as a warm memory. Shortly before that another of us (Meadow) had a dinner with the Braidwoods at Halet Çambel's stately home on the Bosphorus. This one too, was the only time that he met this wonderful couple. Even these brief encounters made it easy to see how Linda and Robert Braidwood captured the hearts of everyone who worked with them. It was the will of late Dr. Barbara Lawrence, who carried out zooarchaeological studies at Çayönü in the 1970s, as well as of the Braidwood's that faunal remains from Çayönü be studied in details and Turkish zooarchaeologists being trained through the work. That mission was halted by the unexpected death of Dr. Berrin Kuşatman in 1995. Our work on Çayönü fauna has been carried out with the assistance of two students from Prhistory Section of University of Istanbul, Gülçin İlgezdi and Banu Öksüz who started learning zooarchaeology with Dr. Kuşatman. The spirits of all these people continue to accompany us in our investigation of the faunal remains from Çayönü

*Hitomi HONGO
** Richard H. MEADOW
*** Banu ÖKSÜZ
**** Gülçin İLGEZDİ

Key words: Çayönü Tepesi, southeastern Anatolia, Prepottery Neolithic, Pottery Neolithic, domestication, pigs, sheep, goats, cattle

Anahtar sözcükler: Çayönü Tepesi, güneydoğu Anadolu, Çanak Çömleksiz Neolitik, Çanak Çömlekli Neolitik, evcilleştirme, domuz, koyun, keçi, sığır

Bu yazıda Çayönü Tepesi'nin Çanak Çömleksiz Neolitik ve İlk Çanak Çömlekli Neolitik evreye ait tabakalardan elde edilen hayvan kemiklerinin incelenme sonuçları sunulmaktadır. Domuz, koyun, keçi ve sığır türü hayvanların boyutlarındaki ve öldürülme şekillerindeki değişiklikler araştırılmıştır. Koyun ve keçiye rastlanma sıklık oranı zaman içersinde, özellikle 'Geniş Odalı Yapılar' alt evresinde, gitgide artar. Hayvanların çok geniş dağılımlı kullanımından başlayarak, sadece koyun ve keçi kullanımı üzerinde yoğunlaşan, güneydoğu Anadolu'nun Son Çanak Çömleksiz Neolitik B evresinde sık görülen bir uygulamadır. Burada genç yaştaki hayvanlara rastlama oranı daha fazladır, bunlar; domuz için 'Izgara Planlı Evler' alt evresi gibi oldukça erken bir zamanda, sığır türleri için ise

* Primate Research Institute, Kyoto University, Kanrin, Inuyama, Aichi 484-8506, Japan
** Zooarchaeology Labaratory, Peabody Museum, Harvard University, 11 Divinity Avenue, Cambridge M.A., 02138, U.S.A.
*** Istanbul Üniversitesi, Edebiyat Fakültesi, Prehistorya Anabilim Dalı,34459 Beyazıt, Istanbul, Türkiye
**** Institut für Ur- und Frühgeschichte, Universität Tübingen, Eugenstr.40, 72072 Tübingen, Germany

'Kanallı Yapılar' alt evresinde ortaya çıkar. 'Hücreli Yapılar' yahut 'Geniş Odalı Yapılar' alt evrelerinden itibaren ise hayvan boyutlarında bir küçülme gözlemlenmektedir. Daha geç evrelerde domuz gibi sığır türünde de erişkin yaşa gelebilen çok az hayvan mevcuttur, fakat koyun ve keçi türlerinde daha yaşlı hayvanların öldürüldüğü saptanmaktadır. Yabani hayvanların yoğun olarak avlanması tüm Çanak Çömleksiz Neolitik süresince devam etmiştir.

1. Introduction

Çayönü Tepesi is located near Diyarbakır in southeastern Turkey, about five kilometers from the foot of Taurus Mountains on a small tributary of the Tigris (A. Özdoğan 1994, Plate 74; H. Hongo & Meadow 2000, Figure 1). After the first reports on the faunal remains from Çayönü by Barbara Lawrence (1980, 1982), new material was excavated during the campaigns of the 1980s and early 1990s. In addition, understandings of the stratigraphy of the site also underwent major revisions (Özdoğan & Özdoğan 1990; A. Özdoğan 1994, 1999). The foci of the present study are the changes in animal exploitation patterns that took place during the Prepottery Neolithic and early Pottery Neolithic periods at Çayönü based on study of the faunal remains recovered beginning with the 1985 season. Since the occupation at Çayönü covers the entire span of the Prepottery Neolithic, its faunal assemblage provides us with the opportunity to examine changes in animal exploitation patterns through time at a single site. Although analysis is ongoing, in this paper we can present some of the results obtained to date, focusing on the relative proportion of taxa in the faunal assemblages, on animal size, and on kill-off patterns for "pro-domestic" ungulates (sheep, goats, pigs, and cattle) for each occupation period at the site. In addition, we discuss patterns evident in these data in the context of contemporary developments occurring at Çayönü and throughout the region and also how changes in animal exploitation patterns at Çayönü correspond to changes in other archaeological evidence at the site, both in subsistence practices and in other aspects of ancient society. We do this in order to obtain a better understanding of the development of social differentiation and economic specialisation at Çayönü and in southeastern Anatolia in general.

The chronological units used in our study follow the periodization based on characteristic architectural types at Çayönü (Bıçakçı 1998; M. & A. Özdoğan 1990, 1998; A. Özdoğan 1994, 1999). Based on the comparison of radiocarbon dates from Çayönü and the Levant, the oldest Round Building subphase and the early part of the Grill Building subphase correspond to the later part of Prepottery Neolithic A (PPNA) period of the Levant (ca. 10,200/10,000-9600/9500 radiocarbon years bp). The remainder of the Grill subphase corresponds to the Early PPNB (ca. 9600/9500-9200 bp). The following Channelled Building subphase goes into the beginning of the Middle PPNB (ca. 9200-8500 bp), which continues with the Cobble-paved into the Cell Building subphases. The Late PPNB (ca. 8500-8000/7900 bp) includes most of the Cell and Large Room Building subphases, but with at least part of the latter continuing into the Final PPNB (or "PPNC": ca. 8000/7900-7500 bp). With an estimated date of 8000-7500 radiocarbon years BP, the following early Pottery Neolithic at Çayönü would also be contemporary with the Final PPNB in the Levant. (A.Özdoğan 1994, 1995, 1999; Hongo & Meadow 2000; Ervynck et al. 2001, but following the periodization of Cauvin & Cauvin 1993 for the northern Levant).

2. Analysis

2.1. Changes in the relative proportion of taxa

Table 1 shows the relative proportion of pigs, cattle, sheep, goats, and other taxa based on the number of identified specimens (NISP). The

wild and domestic forms of pigs, cattle, sheep, and goats are not differentiated in this table, and the wild varieties of these four taxa are excluded from the category of "other wild taxa." At Çayönü, pigs are the single most abundantly represented taxon through the Cell subphase. Pigs always comprise more than 30 percent of the identified specimens, and especially in early subphases (Round, Grill, and Channelled Building subphases), the proportion of pigs approaches 40 percent (Hongo & Meadow 1998, 2000; Ervynck et al. 2001). Cattle, sheep, goats, and a wide range of wild taxa were also exploited at the site. These last include red deer, gazelle, roe deer, onager, bear, leopard, red fox, hare, and a few other small mammal species as well as some birds, tortoise, and a few fish. The most important trend through time is the gradual increase in representation of the animal taxa that were to become domestic at some point in Neolithic. The bones of these "pro-domestic" forms -- pigs, sheep, goats, and cattle -- regardless of their domestic or wild status -- comprise about 60 percent of the faunal remains up to the Cobble-paved subphase and close to 90 percent by the Large Room subphase. The main contributors to this trend are the increasing numbers of goat and especially sheep bones in the assemblage. Sheep and goat bones together only comprise about 10 % of the identified specimens in the earliest Round and Grill Building subphases, but by the Cobble-paved Subphase, their proportion increases to more than 20 percent. The NISP of sheep and goats exceeds 50 percent of the assemblage in the Large Room subphase, increasing from about 25 percent in the immediately preceding Cell Building subphase and replacing pigs as the most abundantly represented taxon at the site. The relative numbers of bones of the total of miscellaneous wild taxa (excluding the four "pro-domestic" taxa) began to decrease in the Cobble-paved subphase and dropping to less than 10 percent in the Large Room subphase and early Pottery Neolithic.

2.2. Changes in the size of animals

Reduction in body size is one of the characteristics that can be used to provide information on the domestic or wild status of an animal (e.g. Zeuner 1963; Meadow 1989; Vigne 2000). Measurements of post-cranial elements of the four "pro-domestic" taxa from each subphase of Çayönü were compared using "difference of logs" technique (Meadow 1981, 1983, 1999; Uerpmann 1979). Size reduction of teeth is another commonly used feature for identifying the presence of domestic pigs in an assemblage (e.g., Flannery 1983; Stampfli 1983).

Both the body size and the length of mandibular third molars of pigs from Çayönü show a gradual diminution over time (Hongo & Meadow 2000, Figs. 1, 2; Ervynck et al. 2001, Figs. 6-19). Measurements of the greatest lengths of the lower third molars of pigs from Çayönü show that increasing numbers of smaller teeth appear in later subphases. As the upper range of the size distribution remains the same, however, it is clear that wild pigs continued to be hunted throughout the Prepottery Neolithic. Thus there is increasing variability in the size of teeth through time (Fig.1 -a~c, modified from Ervynck et al. 2001, Fig. 13). Although most of the pig mandibular third molars from PPN Çayönü fall in the size range for modern wild pigs (Fig.1e, data taken from Flannery 1983; Payne & Bull 1988; Hongo & Meadow 1998), teeth that fall in the range of overlap for wild and domestic pigs begin to appear in the Cell and Large Room subphases. Teeth that are smaller than the size range for modern wild pigs appear only in the Pottery Neolithic, and there is a clear shift in the size range of pig teeth toward smaller teeth, although a few large, presumably wild, pigs are still represented.

Comparison of post-cranial measurements of pigs from different subphases also shows that the size diminution of pigs progressed gradually until the Cobble-paved subphase, although some smaller individuals started to appear as early as in the Grill subphase (Hongo &

Meadow 1998, 2000). There was a shift in the range of size distribution toward smaller pigs in the Cell subphase, which progressed further in the Large Room subphase (Hongo et al. 2002). The size range of the pigs in the Large Room subphase of Çayönü is similar to that of later Bronze and Iron Age domestic population in central Anatolia, although the majority of pigs from Çayönü are still larger than those from the later periods. The upper range of the size distribution corroborates the tooth data that the hunting of wild pigs likely continued throughout the Prepottery Neolithic.

Changes in the size of bovids were more abrupt than those of pigs. Both sheep and goats in the Round and Grill subphases were relatively large and comparable in size to those of wild populations (Hongo et al. 2002, Fig. 4& 5). Measured bones of more small individuals appear in the following Channelled Building subphase, although both the distribution and the upper size range remain similar to those of the previous subphases.

The peak of the size distribution for sheep clearly shifts toward smaller animals in the Large Room subphase; this peak also suggests that the number of females included in the measured assemblage has increased. There is a further size diminution in the following early Pottery Neolithic period, accompanied by an overall shift in the size distribution range toward smaller animals, indicating a sharp increase in the number of measured elements from females. Bones from large animals still occur, however, suggesting that the hunting of wild sheep continued into the Pottery Neolithic.

For goats, post-cranial measurements indicate a gradual decrease in animal size through the Cobble-paved subphase. More variability in the size of goats is indicated by the increase in the range of the size distribution in the Cobble-paved subphase. A clear shift toward smaller animals (at least partly due to an increase in the number of females) occurs in the following Cell subphase, although the overall range of measured bone sizes remains the same. A clear shift in the range of size distribution toward smaller animals took place in the following Large Room subphase, and this pattern continues into the Pottery Neolithic. Very few, if any, wild goats seem to have been hunted in the Large Room subphase and Pottery Neolithic.

A significant overlap in the range of sizes is expected for domestic and wild cattle in the Middle East (Grigson 1989:Fig. 5A-B). Post-cranial measurements of cattle from Çayönü indicate that most of the specimens fall into the range of overlap between domestic and wild cattle. The cattle in the Round and Grill subphases were all relatively large, and the post-cranial measurements fall within the size range for wild cattle (including the area of overlap). A few small specimens, the measurements of which fall below the size range for wild cattle, appear as early as in the Channelled Building subphase (Öksüz 1998, 2000). In spite of the presence of a few small individuals, however, a clear shift in the size distribution toward bones from smaller animals does not take place until the Large Room subphase (Hongo et al. 2002, Fig.8). This overall shift might also reflect an increase in the number of females in the measured assemblage. None of the measurements of cattle bones from the Large Room subphase is larger than the range of overlap for domestic and wild cattle in the Middle East (Grigson 1989), although it is possible that a small number of wild cattle might also have been hunted during the Large Room subphase.

2.3. Kill-off patterns

Since humans are able to control the timing of slaughter of domestic animals so that the resources provided by any individual animal can be exploited at its optimum point, the kill-off pattern for a domestic population is generally expected to be different from that for a hunted population, although the degree of difference will vary according to the hunting and herding strategies. Kill-off patterns for sheep, goats, cat-

tle, and pigs in each subphase at Çayönü were investigated using the state of epiphyseal fusion of limb bones.

The survival rates for Çayönü pigs through the infantile and juvenile age stages were found to be much higher than those of domestic pig populations. In all subphases at Çayönü, about 50 to 65 percent of pigs in the assemblage survived the juvenile age stage while only 10 to 35 percent survived the same age stage in a domestic pig population in the Middle and Late Bronze Age in Central Anatolia (Hongo et al. 2002, Fig.3). Kill-off patterns for pigs at Çayönü, however, show a trend in which progressively fewer individuals survive into adulthood in later subphases (Hongo & Meadow 1998, 2000; Hongo et al. 2002; Ervynck et al. 2001). Survival rates for pigs at the subadult-adult age stages range from 45 to 60 percent in the earlier subphases, but drop to less than 30 percent in the Cobble-paved subphase and later. Such low survival rates into adulthood are comparable to those for a domestic pig population (Hongo & Meadow 2000; Hongo et al. 2002; Ervynck et al. 2001).

The trend of an earlier kill-off in later subphases is also evident for cattle. In the Cobble-paved and Large Room subphases, only about 50 percent of the cattle survived beyond the subadult age stage (Hongo et al. 2002, Fig.9), while 80 to 90 percent survived the same age stage in the Round and Grill subphases. The shift toward earlier kill-off took place either in the Channel or Cobble-paved subphase. Relatively high survival rates for the Cell subphase, however, make any trend through time unclear, although assemblage sizes are small.

In contrast to pigs and cattle, results of the investigation of kill-off patterns for sheep and goats at Çayönü suggest a delay in slaughter schedule in later subphases. Because of small assemblage sizes, kill-off patterns for sheep and goats (combined) can be compared only up to the subadult age stage. During the Prepottery Neolithic, about 50 to 65 percent of sheep and goats survived the juvenile age stage (approximately corresponding to 12-30 months, Hongo 1998, Table 3). Survival rates at the juvenile age stage are lower, at about 50 percent, especially in some of the earlier subphases (Round and Channel), while survival rates increase to more than 80 percent in the early Pottery Neolithic. Between 25 and 50 percent of sheep and goats survived the subadult age stage in the Round, Grill, and Channelled subphases. Survival rates at the subadult stage in later subphases are somewhat higher, up to 60 percent.

When sheep and goats are examined separately, the results are problematic due to the small sample sizes of the late-fusing skeletal parts. In addition, the specimens clearly able to be identified as either sheep or goat are more likely to have fused epiphyses. These biases, combined with small sample sizes in the earlier subphases, limit meaningful comparisons to the infantile and juvenile age stages. Survival rates at the juvenile age stage are about 50 to 60 percent in the earlier subphases (Round, Grill, and Channelled) for both sheep and goats. Higher survival rates for juvenile sheep, at 70 to 85 percent, are observed in the later subphases (Cobble-paved to Pottery Neolithic). Survival rates for juvenile goats in the Large Room subphase and Pottery Neolithic are even higher. The survivorship curve for sheep in the Large Room subphase, which should be the most reliable because of the large sample size, indicates that only about one third of animals survived the adult age stage, suggesting that much sheep kill-off took place during the subadult stage.

3. Comparison of the Çayönü fauna with that from other Prepottery Neolithic sites in southeastern Anatolia

Çayönü is the only site in southeastern Anatolia where faunal assemblages from the entire span of the Prepottery Neolithic and early Pottery Neolithic periods have been recovered. Below, we compare the results of the analyses of faunal

remains from other PPN sites in the region with those from contemporary subphases at Çayönü. The proportions of sheep and goat remains among the identified specimens at other PPN sites in southeastern Turkey show that the gradual increase of sheep and goats through the Prepottery Neolithic was a universal trend in southeastern Anatolia. The sites in Figure 2 are arranged in roughly chronological order, with the earliest site at the bottom of the chart. Faunal data from more than one phase are available from Nevali Çori and Çayönü. Proportions of sheep and goat bones at most of the sites in southeastern Anatolia are only about 10 percent of the identified specimens (NISP) into the Middle PPNB (through Nevali Çori III). This proportion shows a gradual increase, but still remains at less than 25 percent into the Late PPNB (through the Cell Plan Building subphase at Çayönü). The exceptions to this generalisation are two earlier sites, Hallan Çemi (Rosenberg et al 1995; Rosenberg & Redding 1998) and Cafer Höyük (Cauvin 1985), where faunal assemblages are dominated by the remains of wild sheep and wild goats, respectively.

In the Large Room Building subphase, the NISP of sheep and goats exceeded 50 percent of the assemblages, increasing from about 25 percent in the immediately preceding Cell Building subphase (Fig. 2). Sheep and goat bones comprise 60 to 70 percent of the faunal remains also at other Late or Final PPNB sites in the region, such as Gritille, Hayaz Höyük, and Gürcütepe II (Table 2 and Fig. 2). Most sheep and goats from these sites are considered as domestic based on bone size and kill-off patterns (Stein 1986; Buitenhuis 1985; Driesch & Peters 1999; Peters et. al 2000).

At least up to the end of the Middle PPNB, each settlement in southeastern Anatolia specialised in the exploitation of one particular animal species that was probably the most accessible taxon in the vicinity of that site. The most abundantly represented taxon at each site and its proportion of NISP are listed in Table 2. At Çayönü, wild pigs were the most abundant. Wild sheep were dominant at Hallan Çemi. At sites located close to the Urfa Plains, such as Göbekli Tepe and Nevali Çori, gazelle dominated the faunal assemblages (Peters et al. 2000). At Cafer Höyük on the northern side of the Taurus Mountains, wild goats were actively hunted (Cauvin 1985; Helmer 1988). These dominant species comprise more than one third and up to as much as 60 percent of NISP at each site. At Çayönü, while concentrating on pigs, a wide variety of wild animals, including cervids, gazelle, onager, bear, fox, hare, and other small wild taxa, were also hunted, which was the case for contemporary sites as well. These wild taxa together comprise more or less one third of the NISP at Çayönü until the Channelled subphase (Table 1). Thus the pattern of animal exploitation at early Neolithic sites in southeastern Anatolia, up through the Middle PPNB, can be defined as a broad-spectrum strategy combined with the intensive exploitation of one dominant taxon.

In the Late PPNB, however, there was a shift to a subsistence strategy concentrating on sheep and goats, and especially on sheep. At Çayönü, the proportion of miscellaneous wild taxa steadily decreased from the Cobble-paved subphase, reaching a level of less than 10% by the final PPNB and even less in the early Pottery Neolithic (Table 1). The shift from a broad-spectrum animal exploitation strategy to a strategy concentrating on sheep and goats was a universal trend in southeastern Anatolia that took place *circa* 8,500 bp (uncalibrated) in the Late Prepottery Neolithic B.

Measurements of post-cranial bones of pigs, sheep, goats, and cattle at Çayönü are largely in conformity with the measurement data from contemporary sites in southeastern Turkey and northern Syria (Peters et al. 2000, figs 7-10). The post-cranial measurements of pigs, sheep, and cattle in the Round and Grill subphases at Çayönü show similar distributions to those from Göbekli Tepe, and of goats to the wild population at Cafer Höyük. The size distributions of

these four taxa in the Channelled subphase are similar to those at Early PPNB Nevali Çori, except that a few smaller cattle, sheep, and pigs exist in the Çayönü assemblage. The size distributions for these animals, except for pigs, in the Cell subphase at Çayönü are similar to those at Late PPNB Gürcütepe II. The range of size distribution for pigs in the Cell subphase at Çayönü shows more variability than that at Gürcütepe II, although the peak of the size distribution is similar at the two sites. Further size diminution occurred for all four taxa at Çayönü in the following Large Room subphase.

Thus, frequency of animal taxa and animal size data for the major ungulate species in each subphase at Çayönü are all in accordance with those observed at contemporary sites in the region. Inter-site comparison of kill-off patterns is difficult with the data at hand, but at least the kill-off patterns for pigs at Gürcütepe II (Driesch & Peters 1999) is similar to those at Çayönü for the Cobble-paved and later subphases.

4. Discussion and conclusion

Based on his research at Çayönü and at other Neolithic sites in Southwest Asia, Robert Braidwood proposed a developmental model for Neolithic cultures from "Incipient Food Producing" to "Effective Food Producing" to "Developed Village Communities"(Braidwood et al. 1974). As our knowledge of the Prepottery Neolithic in southeastern Anatolia has increased during the last decade, it has become clear that a linear scenario based on subsistence changes accompanied by increasing social complexity is not an adequate model for the development of the Neolithic in the region.

Although the Flagstone and Terrazzo Buildings were excavated at Çayönü in the 1960s and 1970s, they were not recognized as special types of buildings until the 1980s (M. & A. Özdoğan 1990). And until similar evidence accumulated from other sites in the region, the presence of non-domestic buildings at Çayönü was considered as being an unusual case. Recent archaeological finds from other PPN sites, however, suggests that a certain degree of social stratification probably already existed from a very early period in the region, and that elaborate community rituals played an important role in the organization and integration of the settlements. Now it is widely recognized that many PPN sites in southeastern Anatolia have "cult buildings" (Hauptmann 1999; Rosenberg et al. 1995, 1998; Rosenberg 1999; M. & A. Özdoğan 1998; M. Özdoğan 1999) that were clearly different from domestic buildings in their location, plan, size, and material finds. At Çayönü, the settlement was maintained according to strict protocols of spatial planning, and the buildings were periodically rebuilt (M. & A. Özdoğan 1998). Some form of community organization is suggested by such orderly operations. In addition, non-utilitarian objects are abundant at PPN sites in southeast Anatolia, some of which reflect long-distance trade in raw materials or finished artifacts. The presence of this archaeological evidence and its distribution suggest that societies were not egalitarian in nature.

Based on zooarchaeological evidence, three phases can be recognised in animal exploitation patterns at Çayönü. The first phase includes the Round and Grill subphases, when the subsistence was based on the hunting of wild animals and foraging for wild plant resources. The second phase includes the Channelled, Cobble-paved, and Cell subphases. Smaller sheep and goats, as well as smaller pigs and cattle, start to be represented as early as in the Channelled subphase. Kill-off patterns for these four taxa began to change possibly as early as in the Channelled subphase, but certainly by the Cobble-paved subphase. A tendency for earlier kill-off is observed for pigs and cattle, while a delay in the kill-off schedule is observed for sheep and goats, although the resulting patterns are still very different from those for domestic populations in later time periods.

Until before the Cell Building subphase, subsis-

tence patterns as well as community organisation at Çayönü were relatively stable, founded on a long tradition of sedentary hunting and gathering in the region. By the Cell subphase, domestic sheep and goats played an increasingly important role in the economy of the site, although pigs were still the most abundant taxon in the assemblage. Clay figurines depicting sheep or goats are found only from the end of Cell and Large Room subphases (A. Özdoğan 1995, 1999), which also suggests a change in the relationship between these animals and humans. Domestic pigs probably also became increasingly important at the site. The definitive shift in the body size distribution toward smaller animals for both goats and pigs occurred in the Cell subphase. Size diminution for sheep may have occurred earlier, during the Cobble-paved subphase. Even though cultivated cereals and pulses and the exploitation of 'pro-domestic' or domestic animals became increasingly important by the Cell Building subphase (A. Özdoğan 1995, 1999, 52), wild plants and animals continued to play an important role at Çayönü (van Zeist 1972, 1988; Stewart 1976; van Zeist & de Roller 1994).

The third phase of animal exploitation is the Large Room subphase, when the more or less stable socio-economic system based on the long regional tradition of sedentary hunter-gatherers completely collapsed. The zooarchaeological data from Çayönü as well as from other sites in southeastern Anatolia suggest that a shift from a broad-spectrum exploitation strategy to a heavy reliance on sheep and goats took place in the Late PPNB. In addition, further shifts in body size distributions for 'pro-domestic' taxa, combined with an increase in females are observed at Çayönü. Sheep and goats came to outnumber pigs in the assemblage, and the proportion of miscellaneous wild taxa decreased to less than 10 percent of NISP. The relative proportions of animal taxa, as well as the size and kill-off patterns, for the Large Room subphase are very similar to those for the early Pottery Neolithic.

It should be emphasised that, although the three phases described above can be recognised based on animal exploitation patterns at Çayönü, the changes observed at the site up through the Cell Building subphase were gradual. This is especially the case for pigs. The gradual diminution in size and increasingly earlier kill-off for pigs through time makes it impossible to pinpoint any specific timing for the domestication of these animals (Hongo & Meadow 1998, 2000; Ervynck et al. 2001). Rather, what we can observe is the intensification of trends toward various features that came to be characteristic of domestic pig populations. Therefore we think that while individual pigs may have been kept in the community as early as in the Grill subphase and certainly by the Channelled subphase (i.e., early PPNB), the breeding stock was not completely isolated from the free-ranging wild population. Also, active hunting of wild pigs certainly continued throughout the PPN periods. The changes observed in the size of bovids are more abrupt, suggesting a rather different process for the appearance of domestic animals of these taxa. It should be noted that changes in the body size and kill-off patterns are observed only for the pro-domestic taxa (sheep, goats, pigs, and cattle) and not for other frequently hunted large and medium artiodactyls (red deer and gazelle) (İlgezdi 1999, 2000; Öksüz 1998, 2000; Hongo et al. 2002). This suggests that body size diminution and changes in kill-off for pigs, cattle, sheep, and goats were not caused primarily by environmental factors but were largely due to human interference in the subsistence and reproductive behaviors of these animals.

The zooarchaeological data confirm previous observations that key periods of change at Çayönü were in the Channelled Building and Large Room subphases from the point of view of archaeozoological and archaeobotanical data, as well as of the chipped stone industry and architectural configurations (Bıçakçı 1998; Caneva et al. 1998; Hongo & Meadow 2000; Hongo et. al. 2002).

Zooarchaeological data at Çayönü suggest that wild pigs, cattle, sheep, goats, and other wild taxa were actively hunted throughout the Prepottery Neolithic. At a site like Çayönü where rich wild animal resources were available, domestic animals (and probably also cultivated crops) were initially exploited only as additional subsistence options in a broad-spectrum subsistence strategy, although they became increasingly important through time. Small numbers of domestic animals may as well have been possessed by elites as status objects.

Continuous and increasingly intensive exploitation of wild resources by sedentary villagers, however, gradually exhausted the resources around the site. This process is evident in the steady decrease of the relative proportion of miscellaneous wild animals starting in the Cobble-paved subphase that accompanies an increasing reliance on domestic animals, particularly sheep and goats.

The traditional subsistence pattern started to collapse during the Cell Building subphase, and finally by the time of the Large Room subphase (Late to Final PPNB), the socio-economic basis of the site was drastically transformed. Heavy reliance on domestic animals, and especially on sheep and goats is characteristic of the Large Room subphase and of the Pottery Neolithic. This shift in subsistence took place together with marked changes in the social system. During these periods, community space and cult buildings were no longer maintained, which suggests that a fundamental change had taken place in the social and even psychological structure of the population, perhaps with a move toward more limited ("private") control over both productive and social resources. Overall, the process of "Neolithization" at Çayönü was a gradual one, perhaps starting by the end of early PPNB and intensifying over a thousand years or more, and culminating in a major shift both in subsistence and in the social system during the Late to Final PPNB, which laid the foundation for the Pottery Neolithic tradition at the site.

Acknowledgement

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

Our work has been supported by the Nissan Science Foundation in Japan (1996-97), the United States National Science Foundation (Grant No. 9601408), and Japan Society for Promotion of Sciences (B(1) 12571041, B(1) 15405017).

REFERENCES

BIÇAKÇI, E., 1998
"An essay on the chronology of the PrePottery Neolithic settlements of the Taurus Region (Turkey) with the building remains and 14C dates", *Light on Top of the Black Hill*, G. ARSEBÜK, M.J. MELLINK, W. SCHIRMER (eds.) Istanbul, Ege Yayınları, 137-150.

BRAIDWOOD, R.J., H.ÇAMBEL, B. LAWRENCE, C.L. REDMAN, R.B. STEWART, 1974
"Beginnings of village-farming communities in southeastern Turkey - 1972", *Proceedings of National Academy of Science*, U.S.A., 71/2, 568-572.

BUITENHUIS, H., 1985
"Preliminary report on the faunal remains of Hayaz Höyük from the 1979-1983 seasons", *Anatolica* 12, 62-74.

CANEVA, I., C. LEMORINI, D. ZAMPETTI, 1998
"Chipped stones at aceramic Çayönü: technology, activities, traditions, innovations", *Light on Top of the Black Hill*, G. ARSEBÜK, M.J. MELLINK, W. SCHIRMER (eds.), Istanbul, Ege Yayınları, 199-206.

CAUVIN, J., 1985
"Le Néolithique de Cafer Höyük (Turquie). Bilan provisoire après quatre campagnes (1979-1983)", *Cahiers de l'Euphrate* 4, 123-133.

CAUVIN, M.-CL., J. CAUVIN, 1993
"La sequence néolithique PPNB au Levant nord", *Paléorient* 19/1, 23-28.

DRIESCH, A. VON DEN, J. PETERS, 1999
"Vorläufiger bericht über die archäozoologischen Untersuchungen am Göbekli Tepe und am Gürcütepe bei Urfa, Turkei", *Istanbuler Mitteilungen* 49, 23-39.

ERVYNCK, A., K. DOBNEY, H. HONGO, R. MEADOW, 2001
"Born Free? New evidence for the Status of Sus scrofa at Neolithic Çayönü Tepesi (Southeastern Anatolia, Turkey)", *Paléorient* 27/2, 47-73.

FLANNERY, K.V., 1983
"Early pig domestication in the fertile crescent: A retrospective look", *The Hilly Flanks and Beyond: Essays on the Prehistory of Southwestern Asia*, T.C. YOUNG, Jr., P.E.L. SMITH, P.

MORTENSEN (eds.), Studies in Ancient Oriental Civilization, vol. 36. Chicago, The Oriental Institute of the University of Chicago, 163-188

GRIGSON, C., 1989

"Size and Sex: Evidence for the Domestication of Cattle in the Near East", *The Beginnings of Agriculture*, A. MILLES, D. WILLIAMS, N. GARDNER (eds.), BAR International Series 496, Oxford, British Archaeological Reports, 77-109.

HAUPTMANN, H., 1999

"The Urfa Region", *Neolithic in Turkey*, M.ÖZDOĞAN, N. BAŞGELEN (eds.), Istanbul, Arkeoloji ve Sanat Yayınları, 65-86,

HELMER, D.,1988

"Les animaux de Cafer et des sites précéramiques due Sud-Est de la Turquie: Essai de Synthèse", *Anatolica* 15, 37-48.

HONGO, H., 1998

"Patterns of animal husbandry in central Anatolia in the second and first Millennia BC: Faunal remains from Kaman-Kalehöyük, Turkey", *Archaeozoology of the Near East* III, H. BUITENHUIS, L.BARTOSIEWICZ, A.M. CHOYKE (eds), ARC-Publicatie 18, Groningen, ARC Publications, 255-275,

HONGO, H., R.H. MEADOW,

1998 "Pig Exploitation at Neolithic Çayönü Tepesi (Southeastern Anatolia)", *Ancestors for the Pigs: Pigs in Prehistory* S.M. NELSON (ed.), MASCA Research Papers in Science and Archaeology 15, Philadelphia, MASCA at the University of Pennsylvania Museum, 77-98.

2000 "Faunal remains from Prepottery Neolithic levels at Çayönü, southeastern Turkey: A Preliminary Report Focusing on Pigs (*Sus sp.*)", *Archaeozoology of the Near East* IVA, H. BUITENHUIS, M. MASHKOUR, A.L. CHOYKE (eds.), Groningen, ARC-Publications, 121-140.

HONGO, H., R. H. MEADOW, B. ÖKSÜZ, G. İLGEZDİ, 2002

"The process of ungulate domestication in Prepottery Neolithic Çayönü, southeastern Turkey", *Archaeozoology of the Near East* V A.H. AL-SHIYAB, A.M. CHOYKE, H. BUITENHUIS (eds.), Groningen, ARC-Publication, 153-165.

İLGEZDİ, G.

1999 *Çayönü Çanak Çömleksiz Neolitik Yerleşmesinde Kızıl Geyik (Cervus elaphus) Kemiklerinin İncelenmesi, (Analysis of Red Deer Bones from the Prepottery Neolithic Settlement at Çayönü), Istanbul*, Institute of Social Sciences, University of Istanbul. Unpublished MA thesis.

2000 *Zooarchaeology at Çayönü: A Preliminary Assessment of the Red Deer Bones. Archaeozoology of the Near East* IVA, H. BUITENHUIS, M. MASHKOUR, A.L. CHOYKE (eds.), Groningen, ARC-Publications. 141-153,

LAWRENCE, B.,

1980 "Evidences of animal domestication at Çayönü". *Istanbul ve Chicago Üniversiteleri Karma Projesi Güneydoğu Anadolu Tarihöncesi Araştırmaları (The Joint Istanbul-Chicago Universities Prehistoric Research in Southeastern Anatolia)*, H. ÇAMBEL, R. J. BRAIDWOOD (eds), Istanbul, Istanbul Üniversitesi, Edebiyat Fakültesi Basımevi. 285-308,

1982 "Principal food animals at Çayönü", *Prehistoric Village Archaeology in South-Eastern Turkey*, L.S. BRAIDWOOD, R.J. BRAIDWOOD (eds.), BAR International Series 138, Oxford, British Archaeological Reports, 175-199.

MEADOW, R.H.

1981 "Early animal domestication in South Asia: a first report of the faunal remains from Mehrgarh, Pakistan", *South Asian Archaeology* , H. HÄRTEL (ed.) 1979, Berlin, Dietrich Reimer Verlag, 143-179.

1983 "The vertebrate faunal remains from Hasanlu period X at Hajji Firuz. Appendix G", *Hajji Firuz Tepe, Iran: The Neolithic Settlement (Hasanlu Excavation Reports I)*, M.M. VOIGT (ed.) Philadelphia, The University Museum of University of Pennsylvania, 369-422.

1989 "Osteological evidence for the process of animal domestication", *The Walking Larder: Patterns of Domestication, Pastoralism and Predation*, J. CLUTTOM-BROCK, (ed.). London,Unwin Hyman. 80-90.

1999 "The use of size index scaling techniques for research on archaeozoological collections from the Middle East.", *Historia Animalium ex Ossibus: Beiträge aur Paläoanatomie, Archäologie, Ägyptologie, Ethnologie und Geschichte der Tiermedizin*. C. BECKER, H. MANHART, J. PETERS, J. SCHIBLER, (eds.), Rahden/Westf, Verlag Marie Leidorf, 285-300.

ÖKSÜZ, B.

1998 *Çayönü Çanak Çömleksiz Neolitik Yerleşmesinde Yabani Sığır Kemiklerinin İncelenmesi (Analysis of the cattle bones of the Prepottery Neolithic settlement of Çayönü)*, Istanbul, University of Istanbul, Institute of Social Sciences, Unpublished MA thesis

2000 "Analysis of the cattle bones of the Prepottery Neolithic settlement of Çayönü", *Archaeozoology of the Near East* IVA. H. BUITENHUIS, M. MASHKOUR, A.L. CHOYKE (eds), Groningen, ARC-Publications, 154-163

ÖZDOĞAN, A.

1994 *Çayönü Yerleşmesinin Çanak Çömleksiz Neolitikteki Yeri (Küçük Buluntuların Yardımıyla)*, Istanbul University, Institute of Social Sciences, Unpublished Ph.D. dissertation

1995 "Life at Çayönü during the Pre-Pottery Neolithic period", *Readings in Prehistory, Studies Presented to Halet Çambel*, Istanbul, Graphis Yayınları. 79-100.

1999 "Çayönü", *Neolithic in Turkey*, M. ÖZDOĞAN, N. BAŞGELEN (eds.), Istanbul, Arkeoloji ve Sanat Yayınları, 35-63.

ÖZDOĞAN, M.

1999 "Concluding remarks", *Neolithic in Turkey* ,M. ÖZDOĞAN, N. BAŞGELEN (eds.), Istanbul, Arkeoloji ve Sanat Yayınları, 225-236.

ÖZDOĞAN, M., A. ÖZDOĞAN

1990 "Çayönü: a conspectus of recent work", *Préhistoire de Levant* II, O. AURENCHE, M.C. CAUVIN (eds.), Lyon, Editions du CNRS, 387-396.

1998 "Buildings of cult and cult of the buildings", *Light on Top of the Black Hill*, G. ARSEBÜK, M.J. MELLINK, W. SCHIRMER (eds.), Istanbul, Ege Yayınları, 199-206.

PAYNE, S., G. BULL, 1988

"Components of variation in measurements of pig bones and teeth, and the use of measurements to distinguish wild from domestic pig remains", *ArchaeoZoologia* 2, 1/2, 27-66.

PETERS, J., D. HELMER, A. VON DEN DRIESCH,
M. SAÑA SEGUI ,2000

"Early animal husbandry in the northern Levant", *Paléorient* 25/2 (1999), 27-47.

ROSENBERG, M., 1999

"Hallan Çemi", *Neolithic in Turkey*, M. ÖZDOĞAN, N. BAŞGELEN (eds.) Istanbul, Arkeoloji ve Sanat Yayınları, 25-33.

ROSENBERG, M., R. W. REDDING, 1998

"Early Pig husbandry in southwestern Asia and its implications for modeling the origins of food production", *Ancestors for the Pigs: Pigs in Prehistory*. S.M. NELSON (ed.), MASCA Research Papers in Science and Archaeology 15. Philadelphia, MASCA at the University of Pennsylvania Museum, 55-64.

ROSENBERG, M., R.M.A. NESBITT, R.W. REDDING,
T.F. STRASSER, 1995

"Hallan Çemi Tepesi: some preliminary observations concerning early Neolithic subsistence behaviors in eastern Anatolia", *Anatolica* 21, 1-12.

ROSENBERG, M., R.M.A. NESBITT, R.W. REDDING,
B.L. PEASNALL, 1998

"Hallan Çemi, pig husbandry, and Post-Pleistocene adaptations along the Taurus-Zagros arc (Turkey)", *Paléorient* 24/1, 25-41.

STAMPFLI, H.-R. 1983

"The fauna of Jarmo with notes on animal bones from Matarrah, the 'Amuq, and Karim Shahir". *Prehistoric Archaeology along the Zagros Flanks*, L.S. BRAIDWOOD, R.J. BRAIDWOOD, B. HOWE, C.A. REED, P.J. WATSON (eds.), Oriental Institute Publications 105. Chicago, The Oriental Institute of the University of Chicago, 431-483.

STEIN, G.J., 1986
"Village level pastoral production: faunal remains from Gritille Höyük, southeast Turkey", *MASCA Journal* 4/1, 2-11.
STEWART, R., 1976
"Paleoethnobotanical report- Çayönü 1972", *Economic Botany* 30, 219-225.
UERPMANN, H.-P. 1979
Probleme der Neolithisierung des Mittelmeerraums, (Tübinger Atlas des Vorderen Orients, Reihe B, Nr. 28), Wiesbaden, Dr. Ludwig Reichert.
VAN ZEIST, W.
1972 "Palaeobotanical results of the 1970 season at Çayönü, Turkey", *Helinium* 12, 3-19.
1988 "Some Aspects of early Neolithic plant husbandry in the Near East", *Anatolica* 15, 49-68
VAN ZEIST, W., G.D. DE ROLLER , 1994
"The plant husbandry of aceramic Çayönü, SE Turkey", *Palaeohistoria acta et Communicationes Instituti Bio-archaeologici Universitatis Groninganae*, 33/34 (1991/1992), 65-96.
VIGNE, J.-D., G. DOLLFUS, J. PETERS, 2000
"Editorial note. The beginning of herding in the Near East: new data and new ideas", *Paléorient* 25/2 (1999), 9-10.
ZEUNER, F.S., 1963
A History of Domesticated Animals. London, Hutchinson.

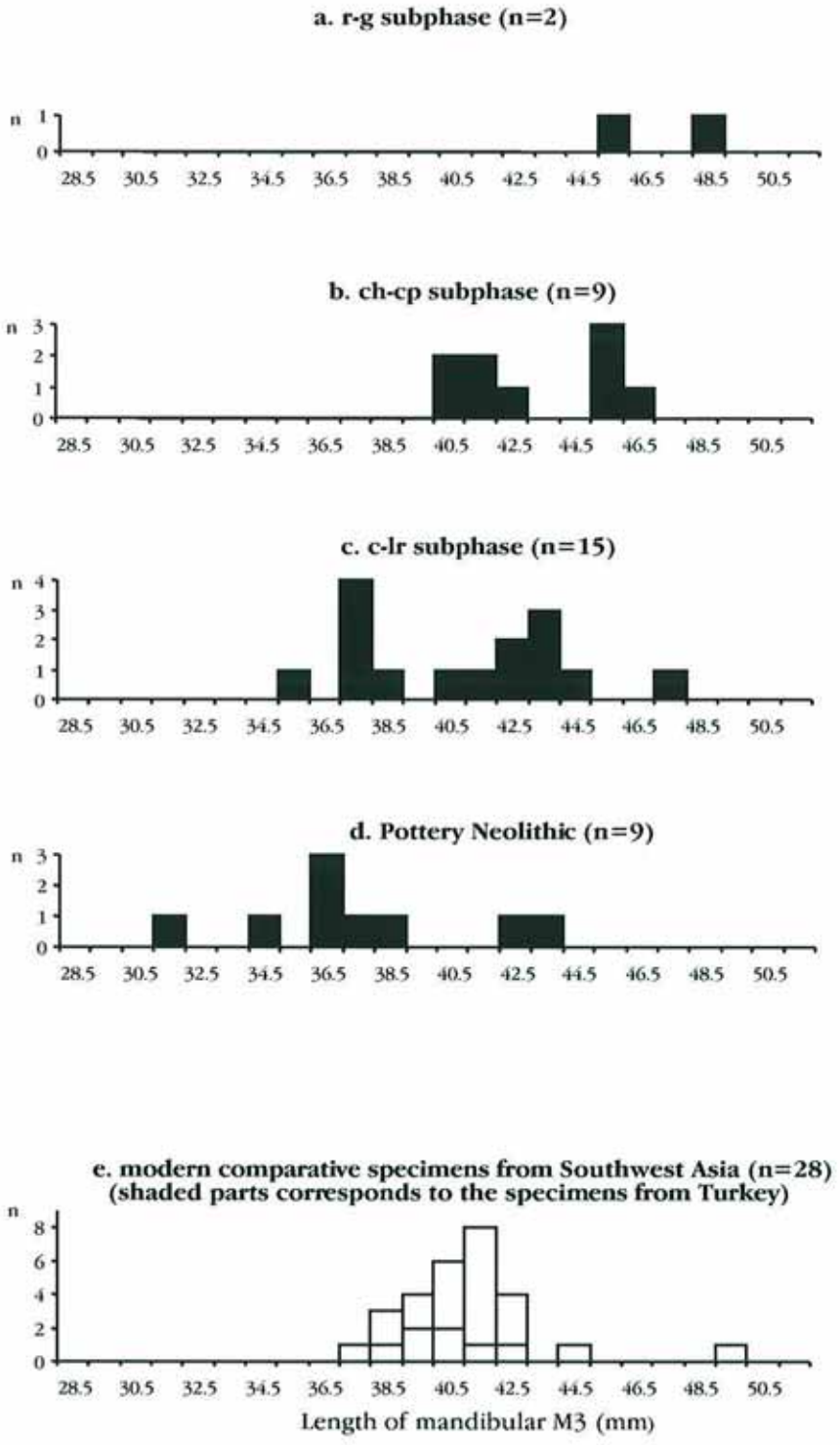

Fig. 1: Length of the M3 of Sus from Çayönü and recent compartive specimens (modified from Ervynck et al. 2002, Fig.13)

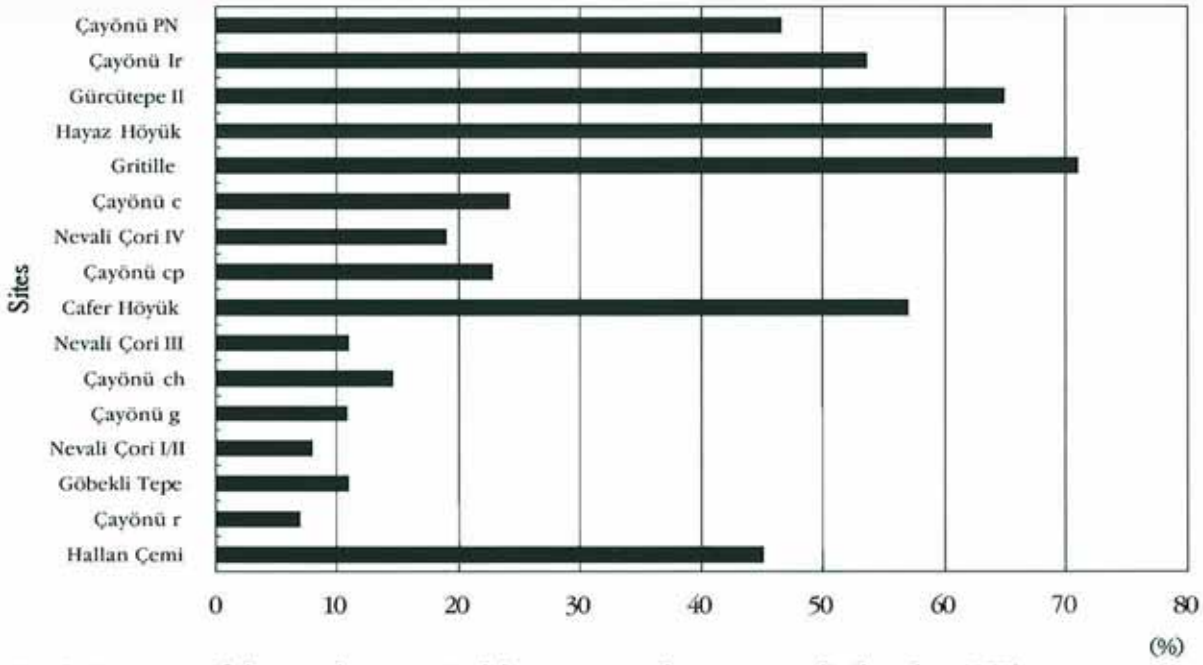

Fig. 2: Proportion of sheep and goats at Neolithic sites in southeastern Anatolia (based on NISP)

Building subphase	Pigs	Sheep and Goats	Cattle	Total of the four "pro-domestic" taxa	Other wild taxa
Round	35.9	6.9	17.9	60.7	35.9
Grill	44.6	10.8	9.4	64.8	31.9
Channelled	37.9	14.7	5.9	58.5	37.9
Cobble-paved	31.3	22.9	13.9	68.2	26.4
Cell	31.9	24.2	17.9	74.1	19.2
Large Room	21.9	53.6	13.1	88.7	9.4
early PN	35.4	46.6	11.3	93.3	6.2

NOTES

"Other wild taxa" include gazelle, cervids, equids, bear, fox, hare, and miscellaneous small mammals, birds, and amphibia.
Wild and domestic forms of pigs, sheep, goats, and cattle are not differentiated.
Animal taxa not reflected in this table are domestic dogs and unidentified medium and large bovids or cervids.

Table 1. Relative proportion of "pro-domestic" taxa and miscellaneous wild tax in each subphase at Çayönü (based on NISP)

site	Dominant Species	%
Hallan Çemi	wild sheep	43.0
Çayönü r	pig	36.5
Göbekli Tepe	gazelle	43.0
Nevali Çori I/II	gazelle	63.0
Çayönü g	pig	44.7
Çayönü cp	pig	37.9
Nevali Çori III	gazelle	59.0
Cafer Höyük	wild goat	42.9
Çayönü cp	pig	31.3
Nevali Çori IV	gazelle	42.0
Çayönü c	pig	31.9
Gritille	sheep and goat	71.0
Hayaz Höyük	sheep and goat	64.0
Gürcütepe II	sheep (and goat)	65.0
Çayönü lr	sheep and goat	53.6
Çayönü PN	sheep and goat	46.6

Table 2: Dominant Species at Neolithic Sites in southeastern Anatolia