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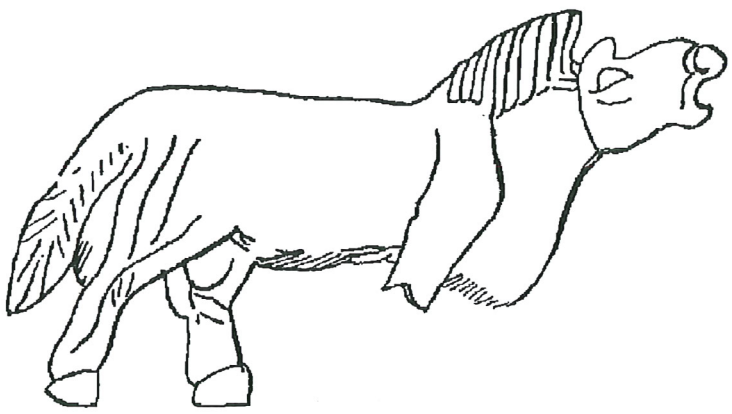

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FAUNAL REMAINS FROM PREPOTTERY NEOLITHIC LEVELS AT ÇAYÖNÜ, SOUTHEASTERN TURKEY: A PRELIMINARY REPORT FOCUSING ON PIGS (*SUS* SP.)

Hitomi Hongo[1] and Richard H. Meadow[2]

Abstract

Results of the analysis of faunal remains from Prepottery Neolithic levels at Çayönü Tepesi, southeastern Turkey, are presented in this paper. Portions of the total assemblages from the PPN levels at Çayönü have been analyzed in detail to investigate the relative frequency of different animal taxa. To supplement these data, additional pig, cattle, and red deer remains from the earliest four PPN levels, the Round Building, Grill Building, Channeled Building, and Cobble-paved Building subphases were recorded and measured. The paper focuses on pig, which is the most commonly encountered taxon during the Prepottery Neolithic at Çayönü. The proportion of pro-domestic taxa - pigs, sheep, goats, and cattle- increases through time, although hunting of wild animals continued to be important throughout the Prepottery Neolithic at Çayönü. Also noted is a gradual increase in the relative proportion of sheep and goats in the faunal assemblage through time. Progressively earlier kill-off and appearance of smaller animals suggest that at least some pigs were being kept in the community perhaps as early as the Grill Building subphase but certainly by the Channeled Building subphase.

Résumé

Les résultats de l'étude des vestiges faunes des niveaux du Néolithique précéramique (PPN) de Çayönü Tepesi dans le sud-est de la Turquie sont présentés ici. Des échantillons de l'assemblage faunique total ont fait l'objet d'une analyse détaillée afin d'évaluer la fréquence relative des différents taxons. En vue de compléter ces données, des restes supplémentaires de porc, du bœuf et du cerf appartenant aux quatre niveaux les plus récents du PPN - le bâtiment rond, le bâtiment en grille, le bâtiment aux canalisations, le bâtiment pavé aux galets - ont été enregistrés et mesurés. Dans cet article nous nous intéressons plus particulièrement aux restes de porc, l'espèce la plus représentée à Çayönü au PPN. Les proportions des espèces « proto-domestiques », porc, mouton, chèvre et bœuf, augmentent avec le temps même si la chasse continue a être importante durant le PPN à Çayönü. Nous pouvons aussi noter une augmentation progressive des pourcentages relatifs de mouton et de la chèvre dans l'assemblage faunique. En outre, l'évolution vers un abattage plus précoce et l'apparition d'animaux plus petits suggèrent qu'au moins quelques cochons étaient sans doute gardés dans la communauté dès la sous-phase correspondant au bâtiment en grille, mais aussi durant la sous-phase du bâtiment aux canalisations.

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

Mots Clés: Çayönü Tepesi, Sud Est de la Turquie, Néolithique Pré-poterie, Domestication, Cochon, Ages d'abattage, Analyses d'Indices de Taille

Introduction

In this report we present preliminary results of the on-going analysis of faunal remains from Prepottery Neolithic (PPN) levels at Çayönü Tepesi in southeastern Anatolia. The focus of our investigations is the nature of animal exploitation at the site and how it changed from the earliest settlement of the site in the PPNA through the PPNB and into the Pottery Neolithic. Evaluating the evidence at the site for animal domestication is of particular interest because of the long span of the occupation and the opportunity it provides to examine such indicators of domestication as size diminution as well as changes in kill-off and in skeletal part distributions. We are also examining how the nature of the fau-

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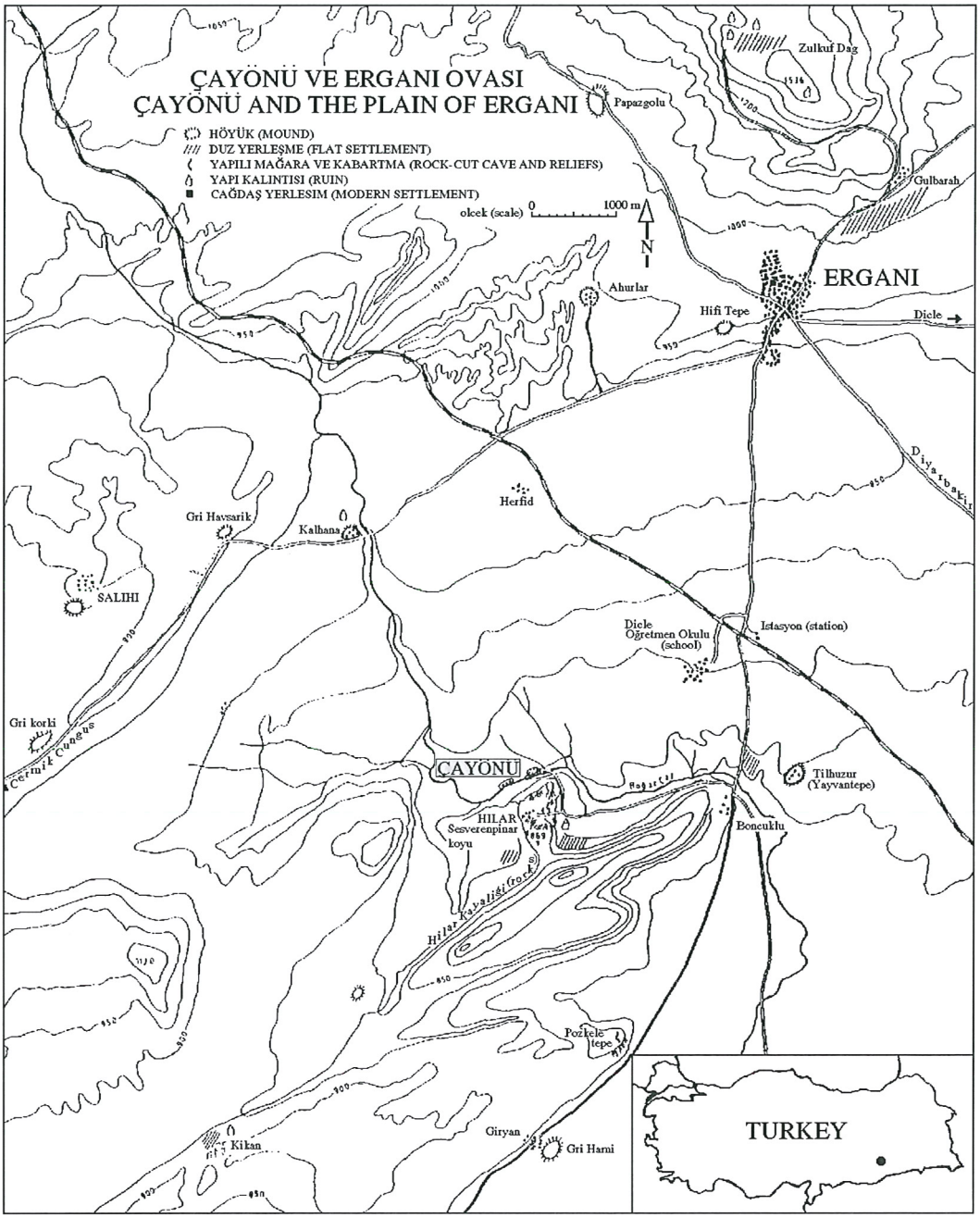


Fig. 1. Location of Çayönü Tepesi (modified from Plate 74 in A. Özdoğan 1994)

nal remains corresponds to other archaeological evidence at the site (architecture configurations and kinds of small finds and their distribution) in order to better understand the development of social differentiation and economic specialization.

During the first two years of study, we focused on change in animal exploitation practices through the Prepottery Neolithic levels at the site. We also focused initially on pigs (*Sus* sp.) because of the frequency of their remains and because of observations made by Stampfli (1983) and Kuşatman (1991) about the presence of the remains of domestic pigs at the site. In this report we review some results of analyses carried out from 1996 through 1998. This work was carried out at Istanbul University in the Prehistory Laboratory and was supported by grants from the Nissan Science Foundation (Japan) and the National Science Foundation (USA).

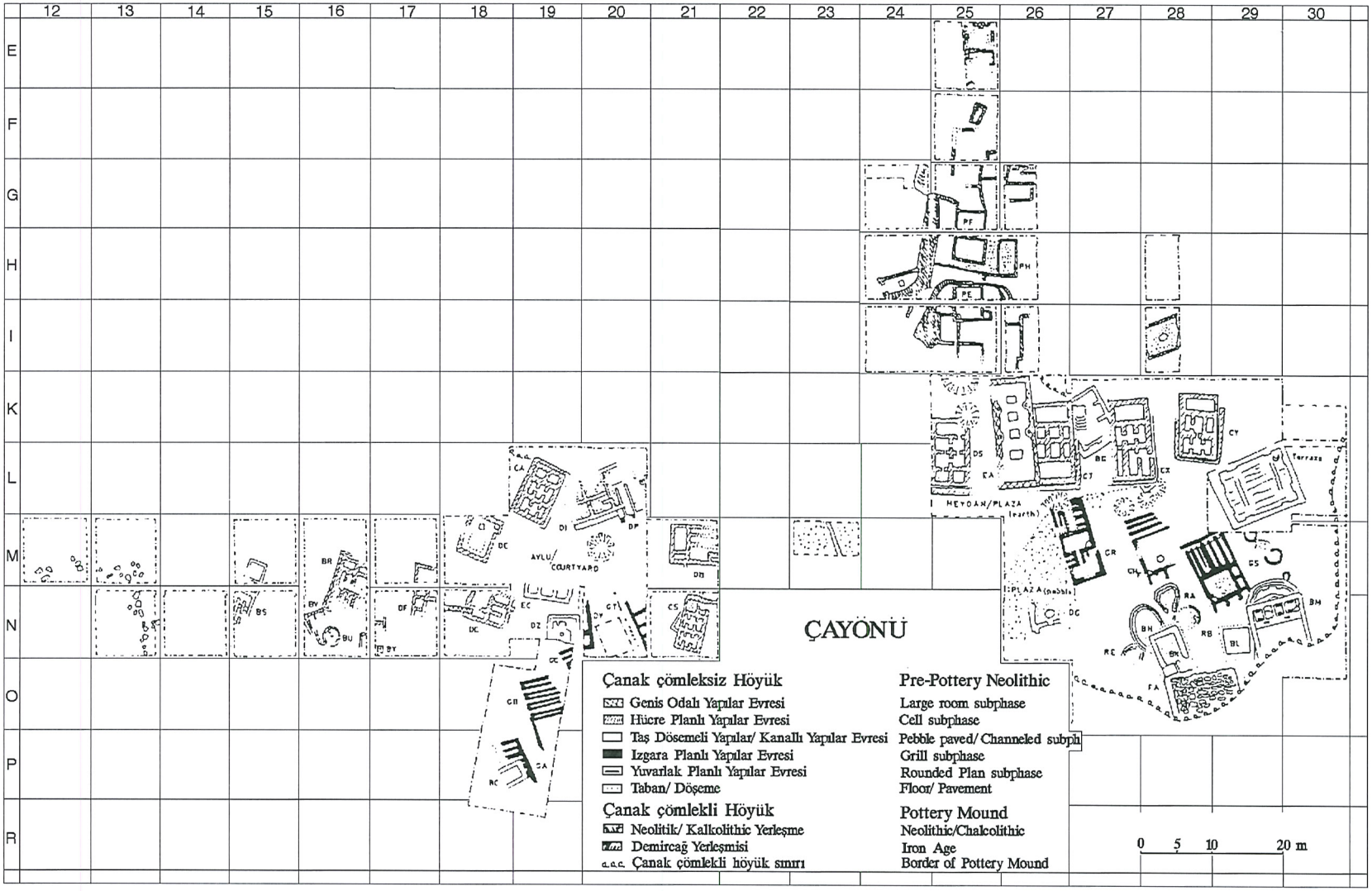


Fig.2. Plan of the excavation area at Çayönü (Plate 2 in A. Özdoğan 1995)

The Site and History of Research

Çayönü Tepesi is located about 40 km northwest of Diyarbakır in southeastern Turkey at an elevation of about 830 m above sea level (Fig. 1). The site is situated about 5 km from the foot of the Taurus Mountains on a small tributary of the Tigris called Boğazçay. At the time of its occupation, a second stream, possibly forming a pond, may have partially encircled the site on the north. Beyond the riverine zone, the area was probably covered with an open forest, consisting mainly of oak, pistachio, and almond. East of the site toward Diyarbakır, there was also an area covered with steppe vegetation. Such diverse environmental conditions would have provided the inhabitants of the site with a wide variety of plant and animal resources. This rich environment defined a mode of subsistence in the eastern Taurus zone that was different from the modes of northern Mesopotamia and the Levant. Fat-rich plants such as pistachio and almond were widely gathered and, together with wild barley, continued to play an important role in subsistence at Çayönü even after the beginning of the cultivation of einkorn, emmer, and pulses by at least the end of the Grill Building subphase (van Zeist 1972; Stewart 1976; van Zeist and De Roller 1994). In a similar fashion, the hunting of wild mammals continued throughout the Prepottery Neolithic.

Excavations at Çayönü were carried out between 1964 and 1991 by archaeological teams from the University of Chicago, Istanbul University, Karlsruhe University, and the University of Rome (H. Çambel and R.J. Braidwood 1980; L.S. Braidwood and R.J. Braidwood 1982; M. Özdoğan and A. Özdoğan 1990; see Fig. 2). This work at Çayönü has also resulted in one of the largest exposure of architectural remains from any PPN site in the Middle East - more than 7,000 sq.m. Thus, the material from the site provides archaeologists with a rare opportunity to examine intra-site variability during the whole of the Prepottery Neolithic into the Pottery Neolithic.

Each subphase of Çayönü is characterized by particular types of buildings. In chronological order, from earliest to latest, these are the Round Building, Grill Building, Channel(ed) Building, Cobble-paved Building, Cell Building, and Large Room subphases (Tables 1 and 2). This Prepottery sequence is followed by the Pottery Neolithic occupation at the site.

Faunal remains from Çayönü excavated between 1964 and 1978 were analyzed and published in part by Barbara Lawrence (1980, 1982). Berrin Kuşatman (1991) studied pig remains excavated between 1980 and 1985. After these reports, as excavation at the site continued, understanding of the stratigraphy of the site changed (A. Özdoğan 1994). Our analysis of the Çayönü faunal remains began in 1996. The faunal remains reported in this paper comprise materials excavated between 1985 and 1991 that were studied through the winter of 1998 (Table 3). All of the excavated faunal remains from the Round Building subphase as well as portions of the total assemblages from the rest of the PPN levels have been analyzed in detail to investigate the relative frequency of different animal taxa. To supplement these data, additional pig, cattle, and red deer remains from the Grill Building, Channeled Building, and Cobble-paved Building subphases were recorded and measured. (For the results of the analysis of the red deer and cattle bones from these subphases, see the papers by Gülçin İlgezdi and Banu Öksüz in this volume).

Analysis

Relative proportions of taxa

Figure 3 and Table 4 summarize the relative abundance of identified animal taxa by number of identified specimens. Pigs, sheep, goats, and cattle together make up about 60% of the identified faunal remains up to the Cobble-paved Building subphase. The proportion of these pro-domestic taxa increases in the Cell Building subphase to about 75% and then to about 82% in the Large Room Building subphase. Also of note is the gradual increase of sheep and goats through the Prepottery Neolithic, from about 5% in the Round Building subphase to about 20% in the Cell and Large Room Building subphases. Pigs are the most commonly encountered taxon throughout the Prepottery Neolithic at the site. Their bones and teeth make up about 35 to 40% of the total identified faunal remains, except in the Cobble-paved Building subphase where they account for only about 20% of identified specimens. Additional taxa include equids, cervids, gazelle, and small mammals.

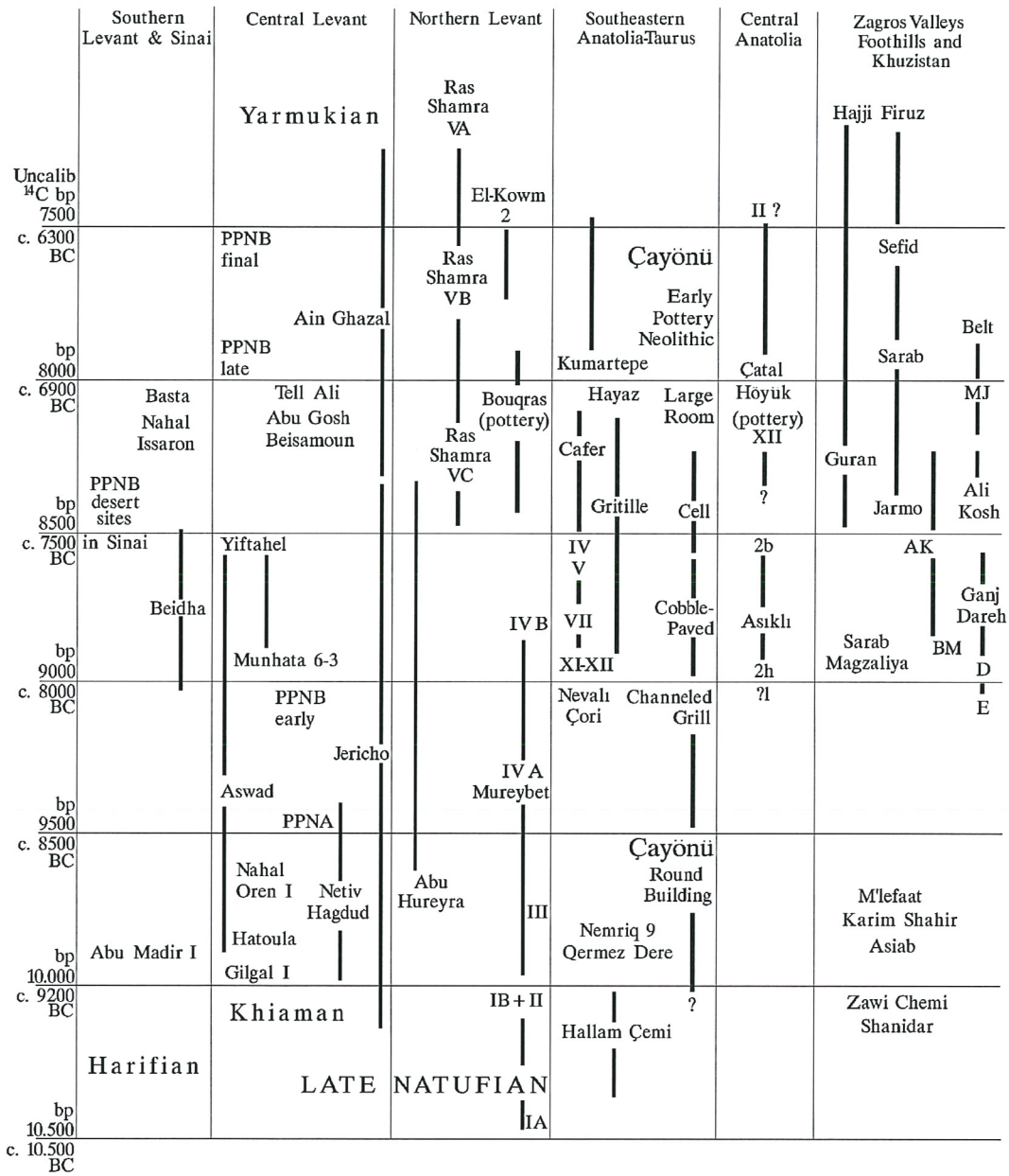


Table 1. Chronology of Neolithic sites in western Asia (modified from information compiled when developing Fig. 3.2 in Bar-Yosef and Meadow 1995)

Clearly, pigs played a very important part in the diets of the Prepottery Neolithic populations of Çayönü. The remainder of the paper focuses on the pig remains, which have so far been studied in the most detail.

Pigs

Analysis of all the pig remains from the Round, Grill, Channeled, and Cobble-paved Building subphases has been completed. Whether there is any evidence of pig domestication at Çayönü is of particular interest in connection with reports from the nearby site of Hallan Çemi that pigs were at

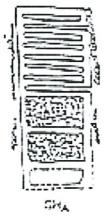
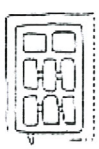
Subphases	N. arch. layers	Cultural affiliation	date (bp)	Architectural plan
Round Buildings	4	PPNA	10,200 - 9,200	
Grill Buildings			9,200 - 9,100	
proto-type	2	PPNA		
open type	2	PPNA/PPNB		
meandering type	1	PPNB		
closed type	2	PPNB		
Channeled Buildings	4	PPNB	9,100 - 9,000	
Cobble-paved Buildings	3	PPNB	9,000 - 8,600	
Cell Plan Buildings	3	PPNB	8,600 - 8,300	
Large Room Buildings	6	PPNC ?	? 8,300 - 8,000	
Pottery Neolithic	7	PN	8,000 - 7,500 ?	

Table 2. Building subphases at Çayönü. Dates provided by M. and A Özdoğan, Istanbul University (modified after İlgezdi 1999: Table 2)

least 'culturally controlled' if not domesticated during the Epipalaeolithic in a context without any evidence for plant cultivation (Redding 1994, 1995; Rosenberg 1994; Rosenberg *et al.* 1998).

The presence of the domestic form of pigs at Çayönü was first suggested by Stampfli (1983, in ms. from 1966). Based on the study of pig teeth from the 1964 season, he observed that the ratio of domestic to wild pigs at Çayönü seemed to be about one-to-one. Berrin Kuşatman (1991) also suggested that domestic pigs are present in the Prepottery Neolithic levels of Çayönü. These studies, however, treated material from all Prepottery levels together. Thus the timing and the nature of the appearance of domestic forms, if any, have not been evident. Therefore, our main questions are: Is there is any evidence for pig domestication at Çayönü? and, If so, when did it begin?

Table 3. Çayönü periodization, dating and quantity of specimens analyzed (through winter 1998)
The number of fragments is not corrected for multiple specimens from a single individual

Periodization of Çayönü			Analyzed Faunal Remains			
Building subphase	Abbrev.	Date (bp)	N Analyzed	W Analyzed (g)	NISP (%)	W NISP (g, %)
Round Building	r	10,200-9,200	3,543	18,435	713 (20.1)	9,327 (50.6)
Grill Building	g	9,200-9,100	2,631	11,862	486 (18.5)	5,770 (48.6)
Channeled Building	ch	9,100-9,000	1,817	3,964	272 (14.9)	1,879 (47.4)
Cobble-paved Building	cp	9,000-8,600?	1,236	8,356	238 (19.3)	4,287 (51.3)
Cell Building	c	8,600-8,300	1,793	10,886	298 (16.6)	5,757 (52.9)
Large Room	lr	?8,300-8,000	1,065	13,395	331 (31.1)	9,771 (72.9)
Early Pottery Neolithic	P	8,000-7,500?	0	0	0	0

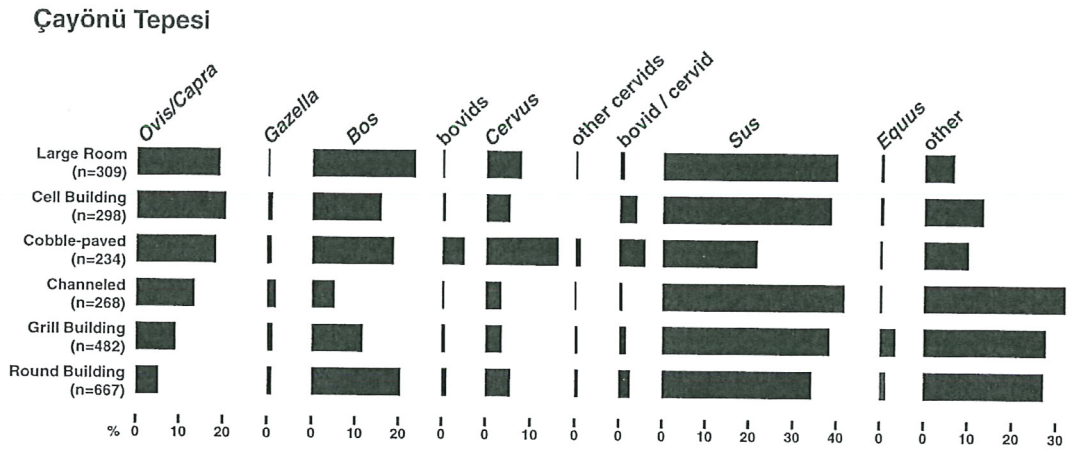


Fig. 3. Relative proportion of identified taxa based on the number of identified specimen. The number of fragments is corrected for multiple specimens from single individuals

Kill-off patterns

Kill-off patterns for pigs in each subphase were investigated by examining the 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 (1983). In general, Stage I epiphyses fuse before 12 months (infantile/juvenile), Stage II epiphyses between 24 and 30 months (subadult), and Stage III epiphyses between 36 and 42 months (adult; Table 5).

About 55 to 70% of pigs in each of the Round, Grill, and Channeled Building subphases can be said to have survived Stage I, and about 45 to 55% to have survived Stage III (Fig. 4). A "rebound" during Stage II was observed for all the subphases except the Channel and Large Room Building subphases. This is caused primarily by large numbers of fused distal tibiae and metapodials. There are progressively fewer animals appearing to survive Stage III. This trend is especially marked in the Cobble-paved and Large Room Building subphases, with only 11% of the animals appearing to sur-

Table 4a. List of identified taxa and relative frequency in selected features at Çayönü, based on the number of identified specimens

	r	r (%)	g	g (%)	ch	ch (%)	cp	cp (%)	c	c (%)	lr	lr (%)
Sus	229	34.3%	185	38.4%	110	41.0%	51	21.8%	115	38.6%	124	40.1%
Bos	136	20.4%	57	11.8%	14	5.2%	44	18.8%	47	15.8%	73	23.6%
Ovis/Capra	35	5.2%	45	9.3%	36	13.4%	43	18.4%	61	20.5%	59	19.1%
Cervus	37	5.5%	22	4.6%	12	4.5%	38	16.2%	16	5.4%	24	7.8%
Dama	2	0.3%	2	0.4%	1	0.4%	1	0.4%	0	0.0%	0	0.0%
Capreolus	2	0.3%	0	0.0%	0	0.0%	1	0.4%	0	0.0%	0	0.0%
Gazella	7	1.0%	6	1.2%	5	1.9%	2	0.9%	3	1.0%	1	0.3%
Equids	9	1.3%	18	3.7%	1	0.4%	1	0.4%	2	0.7%	2	0.6%
Bovids	8	1.2%	4	0.8%	1	0.4%	12	5.1%	2	0.7%	1	0.3%
Cervids	2	0.3%	1	0.2%	0	0.0%	1	0.4%	0	0.0%	1	0.3%
Bovid/Cervid	18	2.7%	8	1.7%	2	0.7%	14	6.0%	12	4.0%	3	1.0%
others	182	27.3%	134	27.8%	86	32.1%	26	11.1%	40	13.4%	21	6.8%
Total identified fragments	667	100%	482	100%	268	100%	234	100%	298	100%	309	100%
small (fox, hare size)	162	5.7%	149	6.9%	97	6.3%	45	4.5%	49	3.3%	9	1.2%
small-medium (gazelle, roe deer size)	117	4.1%	32	1.5%	4	0.3%	40	4.0%	0	0.0%	30	4.1%
medium (dog, domestic O/C size)	1785	63.1%	1322	61.6%	1172	75.9%	711	71.3%	1125	75.3%	500	68.1%
medium-large (wild O/C, fallow deer size)	39	1.4%	6	0.3%	24	1.6%	0	0.0%	2	0.1%	29	4.0%
large (wild pig, dom. cattle, red deer)	5	0.2%	0	0.0%	0	0.0%	0	0.0%	3	0.2%	0	0.0%
very large (wild cattle)	675	23.8%	426	19.9%	73	4.7%	200	20.1%	313	20.9%	140	19.1%
fragments	48	1.7%	210	9.8%	175	11.3%	1	0.1%	3	0.2%	26	3.5%
Total unidentified fragments	2831	100%	2145	100%	1545	100%	997	100%	1495	100%	734	100%
Total fragments	3498		2627		1813		1231		1793		1043	

Notes: "Bovids" includes unidentified *Ovis/Capra/Gazella*, unidentified small, medium and large bovids; "Cervids" includes both small and medium unidentified cervids; "Bovid/Cervid" includes unidentified bovids/cervids in all sizes; "others" includes all other wild animals, dogs, unidentified fish, reptiles, amphibians, birds and shells; unidentified medium artiodactyl is added to medium unidentified

Table 4b. List of identified taxa and relative frequency in selected features at Çayönü, based on the weight of identified specimens

	r	r (%)	g	g (%)	ch	ch (%)	cp	cp (%)	c	c (%)	lr	Lr (%)
Sus	2773.5	29.7%	2652.6	46.0%	1055.0	56.1%	729.0	17.0%	1698.0	29.5%	1756.6	18.0%
Bos	4861.6	52.1%	1536.4	26.6%	359.8	19.1%	1871.4	43.7%	2518.5	43.7%	4299.6	44.0%
Ovis/Capra	263.4	2.8%	474.2	8.2%	172.8	9.2%	500.4	11.7%	506.8	8.8%	712.0	7.3%
Cervus	647.8	6.9%	363.2	6.3%	197.2	10.5%	807.6	18.8%	472.6	8.2%	2649.7	27.1%
Dama	18.0	0.2%	36.0	0.6%	11.4	0.6%	15.6	0.4%	0.0	0.0%	0.0	0.0%
Capreolus	4.8	0.1%	0.0	0.0%	0.0	0.0%	19.0	0.4%	0.0	0.0%	0.0	0.0%
Gazella	28.6	0.3%	38.8	0.7%	19.0	1.0%	4.0	0.1%	8.5	0.1%	2.6	0.0%
Equids	185.1	2.0%	394.6	6.8%	1.6	0.1%	4.6	0.1%	23.8	0.4%	103.2	1.1%
Bovids	12.4	0.1%	69.6	1.2%	1.8	0.1%	5.4	0.1%	4.2	0.1%	2.0	0.0%
Cervids	60.5	0.6%	5.4	0.1%	0.0	0.0%	5.0	0.1%	0.0	0.0%	20.6	0.2%
Bovid/Cervid	136.8	1.5%	23.4	0.4%	2.8	0.1%	139.6	3.3%	194.7	3.4%	104.8	1.1%
others	334.9	3.6%	175.7	3.0%	57.5	3.1%	184.9	4.3%	330.2	5.7%	120.0	1.2%
Total identified weight	9327.4	100%	5769.9	100%	1878.9	100%	4286.5	100%	5757.3	100%	9771.1	100%
small (fox, hare size)	77.1	0.8%	69.9	1.1%	39.8	1.9%	23.5	0.6%	31.5	0.6%	6.0	0.2%
small-medium (gazelle, roe deer size)	94.0	1.0%	21.0	0.3%	0.0	0.0%	20.0	0.5%	0.0	0.0%	39.2	1.1%
medium (dog, domestic O/C size)	3060.5	33.6%	2654.2	43.6%	1306.2	62.7%	1508.4	37.1%	1872.0	36.5%	1162.0	32.1%
medium-large (wild O/C, fallow deer size)	205.3	2.3%	110.4	1.8%	94.8	4.5%	0.0	0.0%	11.6	0.2%	144.1	4.0%
large (wild pig, domestic cattle, red deer)	61.0	0.7%	0.0	0.0%	0.0	0.0%	0.0	0.0%	87.6	1.7%	0.0	0.0%
very large (wild cattle)	5567.8	61.1%	3032.5	49.8%	522.0	25.0%	2503.0	61.5%	3099.1	60.4%	2047.0	56.5%
fragments	41.5	0.5%	204.2	3.4%	121.9	5.8%	14.2	0.3%	27.2	0.5%	226.0	6.2%
Total unidentified weight	9107.2	100%	6092.2	100%	2084.7	100%	4069.1	100%	5129.0	100%	3624.3	100%
Total fragment weight	18434.6		11862.1		3963.6		8355.6		10886.3		13395.4	

Table 5. Skeletal parts allocated to the different epiphyseal fusion stages for *Sus*; Allocations based on Silver (1969), Bökönyi (1972), Habermehl (1975), and Bull and Payne (1982)

Stage I	Stage II	Stage III
Acetabulum area	Distal Metapodials	Distal Radius
Distal Humerus	Distal Tibia	Proximal and Distal Ulna
Proximal Radius	Distal Fibula	Proximal and Distal Femur
Proximal Phalanx 2	Calcaneum	Proximal Tibia
		Proximal Fibula

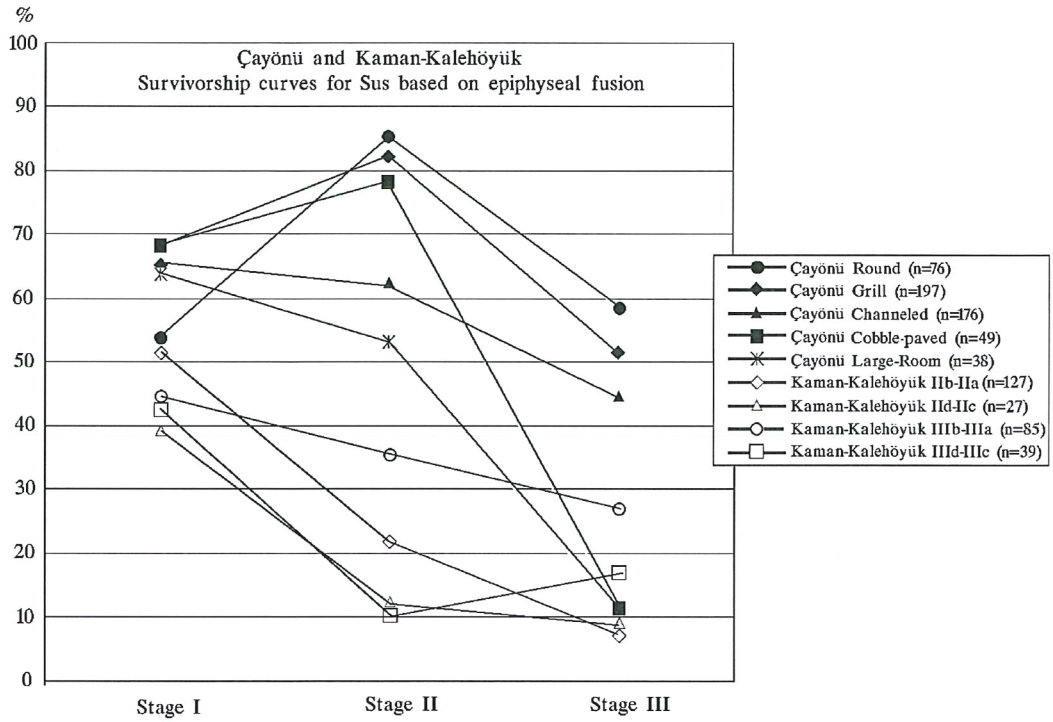


Fig. 4. Survivorship curves for *Sus* based on epiphyseal fusion for Aceramic Neolithic Çayönü and Bronze and Iron Age Kaman-Kalehöyük (IIId – IIIc is earliest; Hongo 1996)

vive Stage III. In the Channeled Building subphase, fewer animals survived Stage II. Although the situation in the Cobble-paved and Cell Building subphases is not clear due to the rebound, this trend of younger kill-offs seem to progress into the Large Room Building subphase.

In order to compare the kill-off patterns of pigs at Çayönü with those of a clearly domestic population, "survivorship curves" for pigs at Kaman-Kalehöyük, a mound site in Central Anatolia, are also plotted in Figure 4 (from Hongo 1996). The material of Kaman-Kalehöyük comes from levels of the second and first millennia BC. The kill-off patterns for pigs at Kaman-Kalehöyük stand in stark contrast to those at Çayönü. At Kaman, only 40 to 50% of pigs survived Stage I, and fewer than 30% survived Stage III. Thus, the kill-off patterns at Çayönü are not what we would expect for a fully domestic population. The low survivorship into adulthood in the Cobble-paved and especially the pattern in the Large Room Building subphases, however, might indicate a shift toward a kill-off pattern similar to that of a domestic population.

Table 6: Tooth wear stages for *Sus*; See Grant (1975, 1982), Bull and Payne (1982), and Hongo (1996)

Age Stage	Tooth	Wear Stages (after Grant 1982)
I	dp4	a, b, c
Newborn	dp other	erupting, slight
	di	erupting, slight
II	dp4	d
M1 erupting	dp other	moderate
(up to ca. 6 months)	M1	erupting, a, b
	P1	erupting
III	dp4	e, f, g, h, i, j, k, l
M2 erupting	dp other	moderate, heavy
(ca. 6-12 months)	di	moderate, heavy
	M1	c, d, e
	M2	erupting, a, b
	M3	unerupted
	I3, C	erupting
IV	P4	a, b, c
P4 erupting	P2, P3, n.d. P	erupting, slight
(ca. 12-18 months)	I1	erupting
V	M1	f, g, h
M3 erupting	M2	c, d, e
(ca. 18-24 months)	M3	a, b
	P4	d, e
	P other	moderate
	I2	erupting
VI	M1	j, k
(over 24 months	M2	f, g, h
but not old)	M3	c, d, e
	P4	f
	P	heavy
	I	heavy
VII	M1	l, m, n
(old)	M2	j, k
	M3	f, g, h, i, j
	P4	g, h

di: deciduous incisor — I: permanent Incisor
dp: deciduous premolar — P: permanent Premolar
n.d.: unidentified — M: Molar

Another way to investigate slaughter patterns is through analysis of tooth eruption and wear data. Loose teeth and tooth rows were classified into age stages based on wear patterns defined by Grant (1975, 1982) and Bull and Payne (1982; Table 6). The first three stages represent infantile and juvenile animals (up to ca. 12 months), Stage IV and V subadult (ca. 12 to 18 months and ca. 18 to 24 months, respectively), and Stage VI and VII full adult (ca. 24 to 36 months) and old animals (over ca. 36 months). Although we are aware of the problem of small sample sizes, we can make the following observations. Relatively early kill-off is indicated for the Round Building subphase, with about half of the teeth coming from infantile or juvenile animals and with another peak at Stage V which represents animals nearing adulthood. A different pattern is observed in the Grill Building subphase, with only about 23% of the animals being killed during the earliest three age stages (Fig. 5). A more reliable pattern (because of larger sample size) is that for the Channeled Building subphase, with about 37% of the teeth coming from young animals (Stages I to III), and another 58% from subadult animals. At first glance, the pattern for the Cobble-paved Building subphase looks somewhat similar to that of the Round Building subphase, with peaks at Stage III and V. Actually, the slightly higher proportion of teeth in Stage IV in the Cobble-paved Building subphase, in comparison to that in the Round Building subphase, might indicate that the kill-off pattern in the Cobble-paved Building subphase is more similar to the pattern observed in the Channeled Building subphase.

The pattern observed in the Channeled Building subphase resembles the type of kill-off that might be expected in a domestic population, with few very young animals and few very old animals. Kill-off patterns derived from the teeth of domestic pigs of Kaman-Kalehöyük (Hongo 1996), however, indicate an even earlier slaughter schedule (Fig. 6). At least 50% and up to 80% of pig teeth from the Bronze and Iron Age samples come from young animals killed in Stages I, II, and III. And, again unlike Çayönü, there are some old (Stage VII) animals represented at Kaman.

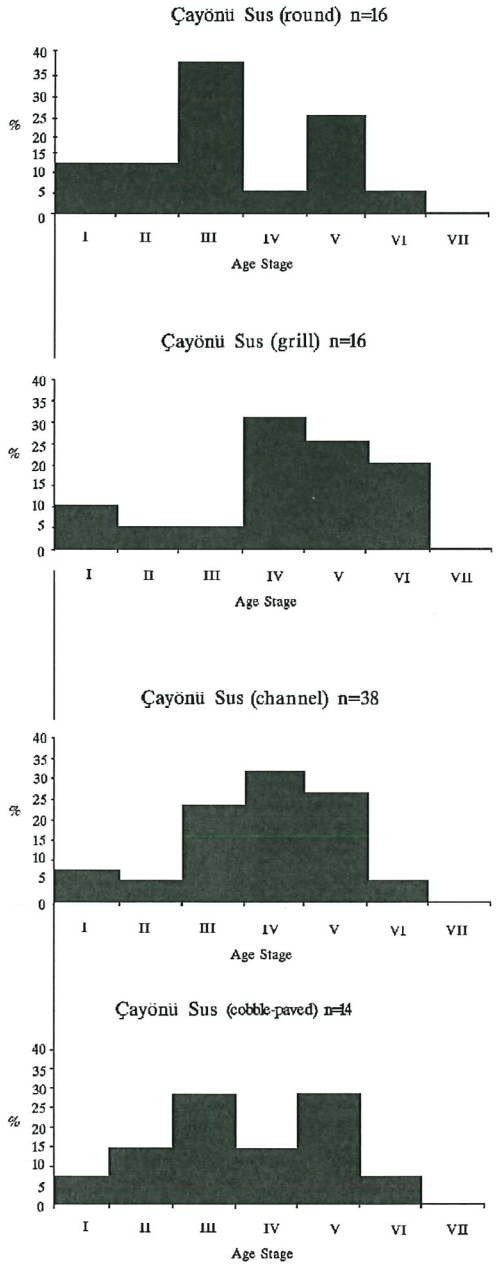


Fig. 5. Kill-off patterns for Sus from Aceramic Neolithic Cayonu based on tooth eruption and wear

Table 7. Measurements (in mm) of *Sus* mandibular third molars from Çayönü and from modern Turkish specimens

Subphase	Length	Breadth
Grill Building	48.1	21.5
Grill Building	44.0	20.2
Channeled Building	40.4	17.0
Channeled Building	41.0	17.3
Channeled Building	44.5	17.8
Cobble-paved Building*	45.2	19.7
Cobble-paved Building*	40.0	19.2
Cobble-paved Building*	38.2	19.9
Cobble-paved Building*	40.7	17.3
Cobble-paved Building*	36.0	18.7
Cobble-paved Building*	44.5	20.2
Cobble-paved Building*	43.0	19.3
Cell Building	40.0	18.7
Cell Building*	40.4	20.0
Cell Building*	37.8	17.8
Cell Building*	39.8	17.7
Cell Building*	41.0	18.0
Cell Building*	43.6	19.5
Cell Building*	41.2	21.8
Cell Building*	41.0	20.0
Cell Building*	42.5	18.7
Pottery Neolithic*	38.5	18.0
Pottery Neolithic*	39.4	18.5
Pottery Neolithic*	38.0	18.8
Modern Turkish female (MCZ #51621)	38.5	18.5
Modern Turkish male (H. H. collection)	39.2	18.8

* after Kuşatman (1991)

Size

Size reduction in teeth is one of the characteristics used for identifying the presence of domestic pigs at a site (e.g., Flannery 1983; Stampfli 1983). Occlusal lengths and greatest breadths of lower third molars from various subphases of Çayönü are plotted in Figure 7. Measurements of the lower third molars of two modern wild pigs from Turkey are shown as open squares in the chart. These are a female wild pig stored at the Museum of Comparative Zoology at Harvard University (specimen #51621) and a male wild pig in the first author's collection. 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.

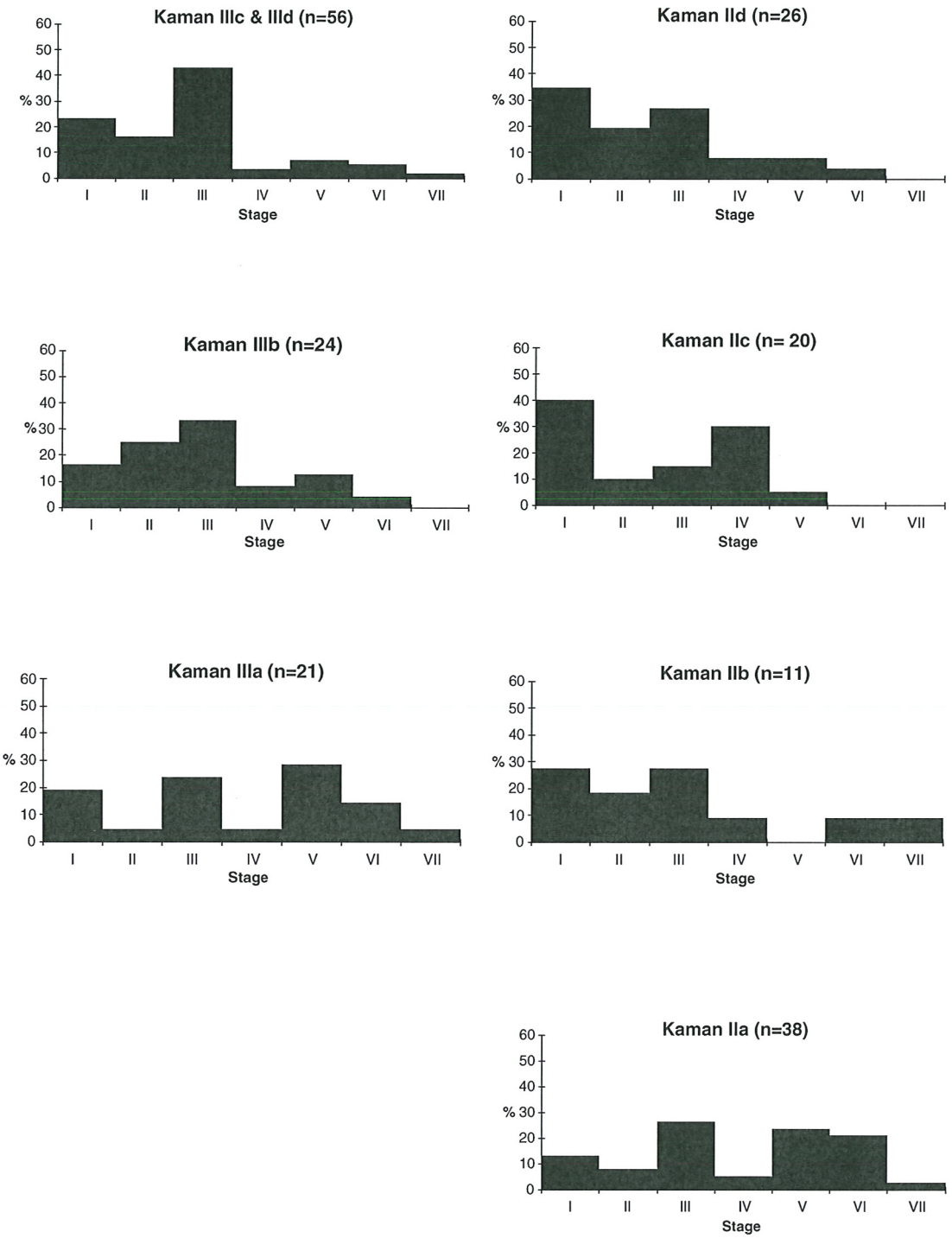


Fig. 6. Kill-off patterns for *Sus* from Bronze and Iron Age Kaman-Kalehöyük based on tooth eruption and wear (from Hongo 1996)

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. All the specimens from the Grill and Channeled Building subphases have length measurements greater than 40 millimeters (Table 7). Some teeth from the Cobble-paved and Cell Building subphases as well as those from the Pottery Neolithic levels fall in the range of overlap for wild and domestic pigs between 36 and 40 millimeters. Third molars, however, come from subadult or adult animals, which are expected to be better represented in a collection resulting from hunting. Therefore, future analysis will need to evaluate teeth that are represented in younger individuals.

Turning to the postcranial skeleton, measurements of Çayönü specimens were compared to the corresponding dimensions of a standard animal using the 'difference of logs' or 'log size index' method developed by Meadow (1981, 1983) and Uerpmann (1979; Fig. 8). Measurements of the female Turkish wild pig stored at the Museum of Comparative Zoology at Harvard University (specimen #51621) were used as the standard (Table 8). This 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. If more than one length or breadth/depth measurement was obtained from a specimen, the average value for the log size indices was used. The medians are also plotted on the chart.

There is considerably more overall variability in the breadth/depth dimensions than there is in the length dimensions. Nevertheless, a small overall shift toward less heavy animals from the Round Building through the Grill Building to the Channeled Building subphase is indicated by smaller median values. While there are also few quite small specimens in the Grill and Channeled Building subphases, in no case does the median fall below 0.00. Indeed, there is even something of a rebound in the Cobble-paved Building subphase toward overall larger animals - although the smallest specimens (in breadth/depth) also occurs in this subphase. There seems to be a continuing shift toward smaller animals in the following Cell and Large Room Building subphases, although the analysis of material from these subphases is still in progress, and the sample sizes analyzed to date are small. Log size indices for pig bones from Kaman-Kalehöyük in the second and first millennium BC using the same

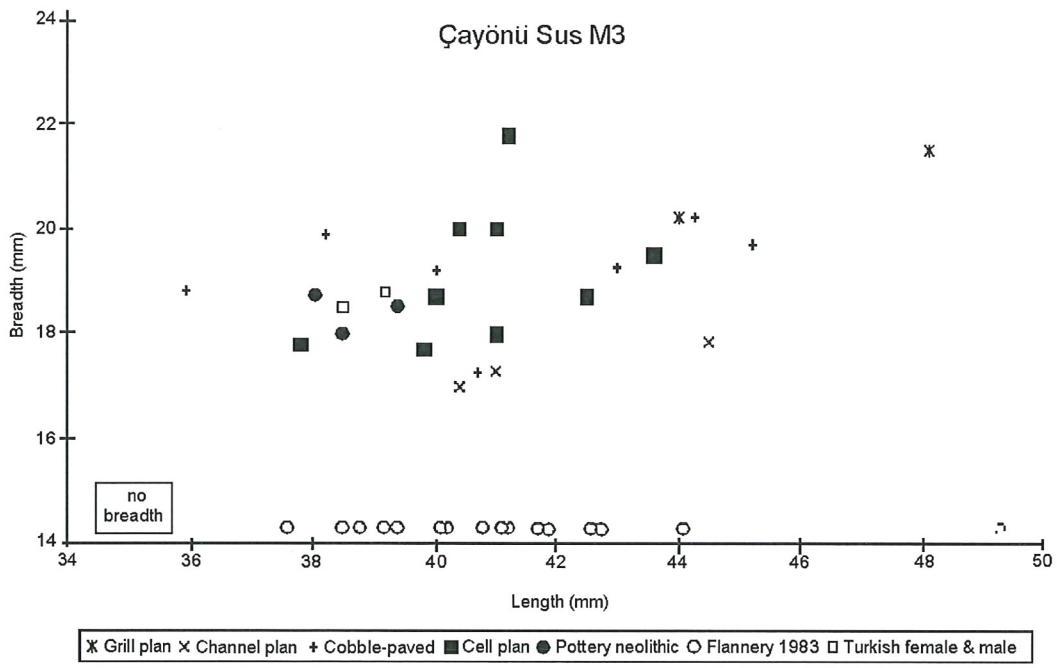


Fig. 7. Occlusal length and greatest breadth (where available) of *Sus* mandibular third molars from Çayönü, from a modern wild Turkish male (collection H. Hongo) and female (specimen # 51621, Mammal Department, Museum of comparative Zoology, Harvard University), and from modern specimens reported by Flannery (1983). The area of overlap between wild and domestic pig is considered to be between 36 and 40 mm (Flannery 1983; Stampfli 1983)

standard animal (MCZ #51621) are also shown in Figure 8 (Hongo 1996). There are marked differences between the Çayönü and Kaman-Kalehöyük assemblages. This contrast shows the degree to which pigs were to change in size over the next millennia. The smallest specimens in the Round Building subphase at Çayönü are almost all larger than the domestic pigs from the second and first millennia BC.

If we postulate an area of overlap between wild boar and domestic pigs to be from log index 0.00 to -0.075, then starting from the Grill Building subphase, some smaller specimens are observed, especially in breadth/depth dimensions. However, while there are certainly a few small animals represented, the picture is not a clear-cut one. Overall lower centers of gravity in the battleship curves for the Cell and Large Room Building subphases indicate a continuous shift towards smaller individuals even though there are no individuals with a log index smaller than -0.075 in these last two subphases, at least among the small samples being analyzed.

Summary and conclusion for pigs

High proportions of pig bones in the earlier Prepottery Neolithic levels at Çayönü suggest that pigs were exploited intensively. These pigs may have been attracted by crops around the site and by the chance to scavenge on wastes from the village. Thus a mutualistic relationship between humans and pigs may have already existed from the very beginning of occupation at the site. However, based on the samples analyzed to date, we cannot characterize the Çayönü pig material in any simple fashion. Both epiphyseal fusion and tooth eruption and wear data indicate that about 50% or more of the pigs at Çayönü survived into the subadult or adult stages. None of the third molars from Çayönü are smaller than the range of overlap of wild and domestic pigs. The vast majority of log size indices are larger than those for a relatively small modern wild female, although a few smaller animals are also represented. Thus, neither the kill-off patterns nor the size of pigs at Çayönü show the unequivocal characteristics of a fully domestic population.

There are, however, general trends in the analyzed pig data toward features that can be considered as characteristic of domestic populations. Thus, the presence of a few specimens from small animals and a slightly earlier kill-off in later subphases might be significant. We also might be able to say that at least some pigs were being kept in the community perhaps as early as the Grill Building subphase but certainly by the Channeled Building subphase. However, it also appears that free-ranging populations of pigs continued to be exploited at Çayönü throughout the Prepottery Neolithic period. We believe that at least some individual animals were kept but that the exploited pig population was managed in such a way that breeding stock was not isolated from the wild population.

Future research on pigs will involve increasing the sample size for the Cell and Large Room Building subphases. It will also involve analyzing specimens from the Pottery Neolithic contexts to investigate whether trends observed in the early subphases continue into later levels.

Other animals than pigs

Turning briefly to other animal remains, interestingly, kill-off patterns and size indices for cattle show similar trends to those for pigs (Öksüz 1998; for details, see the paper by Banu Öksüz in this volume). Progressively earlier kill-off is observed starting from the Channeled Building subphase. Although we have the problem of especially small assemblage sizes, size diminution in cattle is suggested both by progressively smaller median values through time and the appearance in the Channeled and Cobble-paved Building subphases of animals smaller than the range of wild cattle documented by Grigson (1989). Certainly, however, the hunting of wild cattle continued at least through the Cobble-paved Building subphase. In contrast to cattle, it should be noted that no changes are observed in the size or kill-off patterns of red deer through time (İlgezdi 1999; also see the paper by Gülçin İlgezdi in this volume).

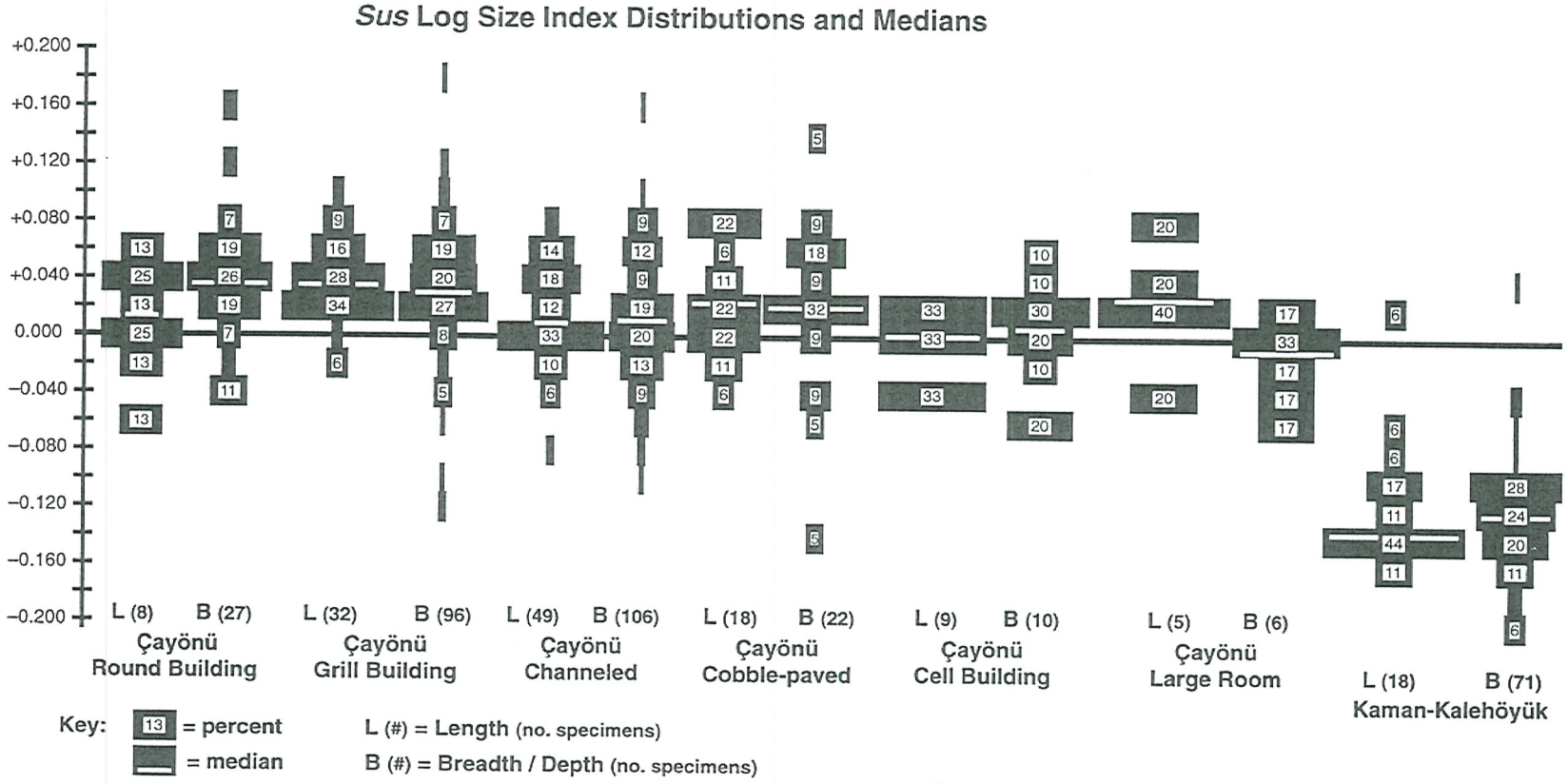


Fig. 8. Summary of *Sus* log size index data from Çayönü and Kaman-Kalehöyük. The 'battleship curves' show the percentages of indices falling into the various 0.020 intervals for Length and Breadth/Depths for each temporal division. The median values are also plotted

Although some work on the subject has been completed, the situation for sheep and goats is not yet clear. Lawrence (1980, 1982) reported that domestic sheep were kept in the 'uppermost level' at the site, 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. While already in the Round Building subphase there seem to be relatively small individuals, wild sheep and goats seem to have been actively hunted at least through the Large Room subphase.

Conclusion

Based on the data at hand, we feel that an overall change in the animal exploitation pattern at Çayönü had started as early as the end of the Grill Building subphase and certainly by the Channeled Building subphase. Cultivation of einkorn and emmer also seems to have begun in this period. The changes, however, were gradual ones, and it took nearly one thousand years for the mode of subsistence at the site to be transformed into that of a fully domestic economy. Hunting of wild animals and collecting of wild plants continued to be important throughout the Prepottery Neolithic. Indeed, the hunting of red deer seems to have even intensified during the Cobble-paved Building subphase.

The observation regarding the late Grill Building subphase or the Channeled Building subphase as the key period of change fits nicely the overall archaeological picture at Çayönü. The late phase of the Grill Building subphase corresponds to the beginning of PPNB at the site when various changes in chipped stone industry and other small finds are observed. Of particular note are changes in the construction techniques of buildings and in community patterns in the following Channeled Building subphase. Growing social differentiation at the site is suggested by a spatial arrangement of residential and specialized workshop areas as well as the growing importance given to the open courtyards as communal space (A. Özdoğan 1995). The Channeled Building and the following Cobble-paved Building subphases were periods of transition in terms of animal exploitation at the site. There was increasing reliance on domestic animals, with the growing importance of sheep and goats by the Cell Building subphase.

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References

Bar-Yosef, O. and R.H. Meadow, 1995. The origins of agriculture in the Near East. In: T.D. Price and A.B. Gebauer (eds.), *Last Hunters First Farmers*. Santa Fe, School of American Research Press: 39-94.

Bökönyi, S., 1972. Zoological evidence for seasonal or permanent occupation of prehistoric settlements. In: P.J. Ucko, R. Tringham and G.W. Dimbleby (eds.), *Man, Settlement and Urbanism*. London, Duckworth: 121-126.

Braidwood, L.S and R.J. Braidwood (eds.), 1982. *Prehistoric Village Archeology in South-Eastern Turkey*. Oxford, BAR International Series 138.

Bull, G. and S. Payne, 1982. Tooth eruption and epiphysial fusion in pigs and wild boar. In: B. Wilson, C. Grigson, and S. Payne (eds.), *Ageing and Sexing Animal Bones from Archaeological Sites*. Oxford, BAR British Series 109: 55-71.

Çambel, H. and R.J. Braidwood, 1980. The Joint Istanbul-Chicago Universities' Prehistoric Research Project in Southeastern Anatolia. Comprehensive View: The Work to Date, 1963-1972. In: H. Çambel and R.J. Braidwood (eds.), *İstanbul ve Chicago Üniversiteleri Karma Projesi Güneydoğu Anadolu Tarihöncesi Araştırmaları (The Joint Istanbul-Chicago Universities' Prehistoric Research in Southeastern Anatolia).* Istanbul, Istanbul Üniversitesi, Edebiyat Fakültesi Basımevi: 33-72.

von den Driesch, A., 1976. *A Guide to the Measurement of Animal Bones from Archaeological Sites.* Peabody Museum Bulletin 1. Cambridge, Peabody Museum, Harvard University.

Flannery, K.V., 1983. Early pig domestication in the fertile crescent: A retrospective look. In: T.C. Young, Jr., P.E.L. Smith, and P. Mortensen (eds), *The Hilly Flanks and Beyond: Essays on the Prehistory of Southwestern Asia.* Studies in Ancient Oriental Civilization, vol. 36. Chicago, The Oriental Institute of the University of Chicago: 163-188

Grant, A., 1975.The animal bones. In: B.W. Cunliffe (ed.), *Excavations at Portchester Castle. I: Roman.* London, Society of Antiquaries: 378-408.

Grant, A., 1982. The use of tooth wear as a guide to the age of domestic ungulates. In: B. Wilson, C. Grigson, and S. Payne (eds.), *Ageing and sexing animal bones from archaeological sites.* Oxford,. BAR British Series 109: 91-108.

Grigson, C., 1989. Size and Sex: Evidence for the Domestication of Cattle in the Near East. In: A. Milles, D. Williams, and N. Gardner (eds.), *The Beginnings of Agriculture.* Oxford, BAR International Series 496: 77-109.

Habermehl, K.-H., 1975. *Die Altersbestimmung bei Haus- und Labortieren.* 2 Auflage. Berlin, Verlag Paul Parey.

Hongo, H.,1996. *Patterns of animal husbandry in Central Anatolia from the second millennium BC through the Middle Ages: Faunal remains from Kaman-Kalehöyük, Turkey.* Ph.D. dissertation, Department of Anthropology, Harvard University, Cambridge.

İlgezdi, G., 1999. *Çayönü Çanak Çömleksiz Neolitik Yerleşmesinde Kızıl Geyik (*Cervus elaphus*) Kemiklerinin Incelenmesi. (Analysis of red deer bones from the Prepottery Neolithic settlement at Çayönü).* Unpublished MA thesis. Istanbul University, Institute of Social Sciences.

Kuşatman, B., 1991. *The origins of pig domestication with particular reference to the Near East.* Ph.D. Dissertation, Institute of Archaeology, University College London, London.

Lawrence, B., 1980. Evidences of animal domestication at Çayönü. In: H. Çambel and R.J. Braidwood (eds.), *Istanbul ve Chicago Üniversiteleri Karma Projesi Güneydoğu Anadolu Tarihöncesi Araştırmaları (The Joint Istanbul-Chicago Universities Prehistoric Research in Southeastern Anatolia.* Istanbul, Istanbul Üniversitesi, Edebıyat Fakültesi yayınları. 2589: 285-308.

Lawrence, B., 1982. Principal food animals at Çayönü. In: L.S. Braidwood and R.J. Braidwood (eds.), *Prehistoric village archeology in South-Eastern Turkey.* Oxford, BAR International Series 138: 175-199.

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

Meadow, R.H., 1983. The vertebrate faunal remains from Hasanlu Period X at Hajji Firuz. Appendix G. In: M.M. Voigt (ed.), *Hajji Firuz Tepe, Iran: The Neolithic Settlement.* Hasanlu Excavation Reports, Volume I., Philadelphia, The University Museum: 369-422.

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

Özdoğan, A., 1994. *Çayönü Yerleşmesinin Çanak Çömleksiz Neolitikteki Yeri (Küçük Buluntularin Yardimiyla*) (Prepottery Neolithic occupation at Çayönü with the study of small finds). Unpublished Ph.D. dissertation. Istanbul University, Institute of Social Sciences.

Özdoğan, A., 1995. Life of Çayönü during the Prepottery Neolithic period according to the artifactual assemblage. In: *Halet Çambel için Prehistorya Yazıları (Readings in Prehistory: Studies presented to Halet Çambel*). Istanbul, Graphis Yayınları: 79-100.

Özdoğan, M. and A. Özdoğan, 1990. Çayönü: a conspectus of recent work. In: O. Aurenche and M.C. Cauvin (eds.),, *Préhistoire de Levant II* . Lyon, CNRS: 387-396.

Redding, R.W., 1994. *The evolution of human subsistence behavior and food production in southern*

Anatolia. Paper presented at the Society for American Archaeology meeting in Anaheim, California.

Redding, R.W.,1995. *A piece of the flock: early domestic animals as insurance*. Paper presented at the Society for American Archaeology meeting in Minneapolis, Minnesota

Rosenberg, M., 1994. Hallan Çemi Tepesi: Some further observations concerning stratigraphy and material culture. *Anatolica* 20: 121-140.

Rosenberg, M., R. Nesbitt, R.W. Redding, and B.L. Peasnall, 1998. Hallan Çemi, Pig Husbandry, and Post-Pleistocene Adaptations along the Taurus-Zagros Arc (Turkey). *Paléorient* 24(1): 25-41.

Silver, I.A.,1969. The ageing of domestic animals. In: D. Brothwell and E.S. Higgs (eds.), *Science in Archaeology*, 2nd edition. London, Thames and Hudson: 283-302.

Stampfli, H.R., 1983. The fauna of Jarmo with notes on animal bones from Matarrah, the 'Amuq, and Karim Shahir. In: L.S. Braidwood, R.J. Braidwood, B. Howe, C.A. Reed, and P.J. Watson (eds.), *Prehistoric Archeology along the Zagros Flanks*. Oriental Institute Publications 105. Chicago, The Oriental Institute of the University of Chicago: 431-483.

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.

van Zeist, W. and G.D. de Roller, 1994. The Plant husbandry of Aceramic Çayönü, SE Turkey. *Palaeohistoria acta et Communicationes*. Groningen, Instituti Bio-archaeologici Universitatis Groningenae 91/1992: 65-96.

Table 8: Standard Measurements for *Sus*
Averaged left and right measurements (in millimeters) of a female wild boar from near Elazığ, Turkey
Museum of Comparative Zoology, Harvard University, specimen #51621
(Def. = measurement definition; Meas.= measurement)

Scapula	Def.	SLC	GLP	LG	BG	HS	DHA	Ld	SBC				
	Meas.	26.5	39.4	32.5	27.5	228.1	229.6	127.9	12.7				
Humerus	Def.	Bd	BT	BFT	SD	Bp	Dp	GLC	GL	Dd	GLT	LT (mid)	LT (lat)
	Meas.	45.9	37.5	34.6	17.8	58.5	74.9	207.2	232.3	46.2	32.4	21.3	23.7
Radius	Def.	BFp	DFp	SD	Bd	BFd	DFd	GL					
	Meas.	34.2	22.7	19.0	39.2	33.0	21.0	177.0					
Ulna	Def.	BPC	DPA	SBO	SDO	GL	LPA	LO	SLFp				
	Meas.	25.3	42.4	11.5	32.2	240.9	29.9	72.4	21.5				
Metacarpal II	Def.			BFd	DFd	GL							
	Meas.			12.5	16.5	64.5							
Metacarpal III	Def.	Bp	SD	BFd	DFd	GL							
	Meas.	20.7	14.6	19.1	19.7	86.8							
Metacarpal IV	Def.	Bp	SD	BFd	DFd	GL							
	Meas.	19.1	14.6	17.7	19.4	87.8							
Metacarpal V	Def.			BFd	DFd	GL							
	Meas.			13.7	17.6	63.8							
Femur	Def.	GL	GLC	SD	Bp	Dp	DC	Bd	B.tr. pat.	Dd			
	Meas.	251.4	250.2	21.0	66.8	37.8	29.8	53.2	26.7	64.4			
Tibia	Def.	GL	SD	Bp	Dp	Bd	Dd	BFd					
	Meas.	231.3	20.6	56.7	57.4	33.5	30.6	25.4					
Astragalus	Def.	GLl	GLm	LA	Dl	Bd	Bp						
	Meas.	47.5	43.6	38.7	25.0	27.6	24.0						
Calcaneum	Def.	GL	GB	GDl	SDTc	LTc	Ld	LFOM					
	Meas.	95.4	26.8	34.1	22.0	63.5	37.6	13.1					
Metatarsal II	Def.			BFd	DFd	GL							
	Meas.			11.4	16.2	69.0							
Metatarsal III	Def.	Bp	SD	BFd	DFd	GL							
	Meas.	17.9	13.3	18.4	20.3	97.2							
Metatarsal IV	Def.	Bp	SD	BFd	DFd	GL							
	Meas.	17.5	14.3	18.5	21.3	105.4							
Metatarsal V	Def.			BFd	DFd	GL							
	Meas.			11.7	17.0	73.6							

Abbreviations as in von den Driesch (1976) with additions as noted below.
Definitions follow Kuşatman (1992) based on von den Driesch (1976) with the following additions/clarifications:
Humerus BFT: as with BT but includes only articular surface;
Humerus GLT, LT(mid), LT (lat): greatest length of trochlea (medially) & least length in the middle & laterally;
Ulna SLFp (smallest length of *facies articularis proximalis*): least length (diameter) of art. surface for humerus;
Femur B.tr.pat. (Breadth of the *trochlear patellaris*): breadth of the articular surface for the patella;
Astragalus LA: smallest length taken between the condyles;
Calcaneum SDTc & LTc: least depth of *Tuber calcaneum* and length of *Tuber calcaneum* on dorsal side;
Calcaneum Ld: length of the distal portion from process for *Os malleolare* to the distal end;
Calcaneum LFOM: length of articular process for *Os malleolare*.