THE PLANT HUSBANDRY OF ACERAMIC ÇAYÖNÜ, SE TURKEY

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ABSTRACT: The present paper deals with the results of the examination of plant remains recovered from aceramic Neolithic levels at Çayönü in southeastern Anatolia. The cultivated plants included einkorn and emmer wheat, field pea, lentil and bitter vetch. It is not clear whether grass pea and chickpea were crop plants of the aceramic farmers. Barley was neither cultivated nor gathered intentionally. Pulses predominate over cereals in the archaeobotanical record. A characteristic feature of Çayönü is the wild type emmer wheat grains in the lower occupation levels. Wild pistachio (*Pistacia atlantica/khinjuk*) fruits were collected intensively. The large numbers of wild vetch (*Vicia* sp.) seeds suggest that these were gathered purposely.

KEYWORDS: aceramic Neolithic, SE Anatolia, plant domestication, hulled wheats, pulse crops, bitter vetch, wild fruit collecting.

1. INTRODUCTION

1.1. Location and environmental conditions

The prehistoric mound of Çayönü Tepesi is located c. 7 km southwest of Ergani, in the Diyarbakir Province of southeastern Anatolia, at 38°16'N, 39°43'E (fig. 1). The site is situated on a small tributary of the upper Tigris (Dicle) River, in a rather broad valley at the foot of the East Taurus Mountains, at an elevation of c. 830 metres.

1.1.1. *Physical environment*

No long-term weather records are available for the Çayönü area (Ergani). In table 1, data for three stations which are closest to Çayönü are presented. Climatic (hydrothermic) diagrams for the stations concerned, Diyarbakir, Elaziğ and Malatya, are shown in Zohary (1973: fig. 8). For Ergani, which is about halfway between Diyarbakir and Elaziğ, mean annual precipitation may be estimated at about 450 mm. Winters are relatively mild (estimated mean January temperature somewhat above 0°C) and summers are fairly hot (estimated mean July temperature 28°C). The dry period lasts from June through September. The Çayönü area does not experience the continental climatic conditions of the interior of eastern Anatolia. Precipitation is brought in by prevailing southwesterly winds from the Eastern Mediterranean. The climate of the area is suitable for rain-fed agriculture.

To the authors'knowledge there are no specialist reports available on the soil conditions in the Çayönü area. As mentioned by Çambel & Braidwood (1983) and Stewart (1976) the valley bottom consists of calcareous, reddish, silty clay which provides good arable soil. To the south of the stream on which the site is located the landscape is dominated by weathered, bare limestone outcrops.

1.1.2. *The vegetation*

Under the present climatic conditions a considerable part of southeastern Turkey, including the Çayönü area, would naturally, that is to say without the interference of man, be covered by woodland: open forest with a tree cover of at most 50% (fig. 2). The woodland in this part of Turkey belongs to Walter's (1956) East-Anatolian oak-juniper region. Arboreal components include *Quercus brantii, Q. infectoria, Q. boissieri, Acer cinerascens (A. monspessulanum* ssp. *cinerascens), Pyrus syriaca, Crataegus azarolus, Pistacia atlantica, P. khinjuk* and *Juniperus oxycedrus*. Summer drought prevents a more dense tree growth. As a result of the destructive activities of man most of the woodland has degraded into shrub vegetation or has disappeared altogether. Holy places are often the last refuges of trees. The Çayönü area is an example of a landscape where only a few poor tree stands testify to the original woodland vegetation.

To the south, with decreasing precipitation, the woodland gives way to steppe, usually via a transitional (almond-pistachio) forest-steppe zone. At present most of the steppe vegetation is dominated by *Artemisia (herba-alba)*, but this may be due to intensive grazing which results in the replacement of the herb-rich grass steppe (with many palatable species) by *Artemisia* steppe rich in thorn-cushion species. The 'steppe island'in the Diyarbakir basin is somewhat puzzling,

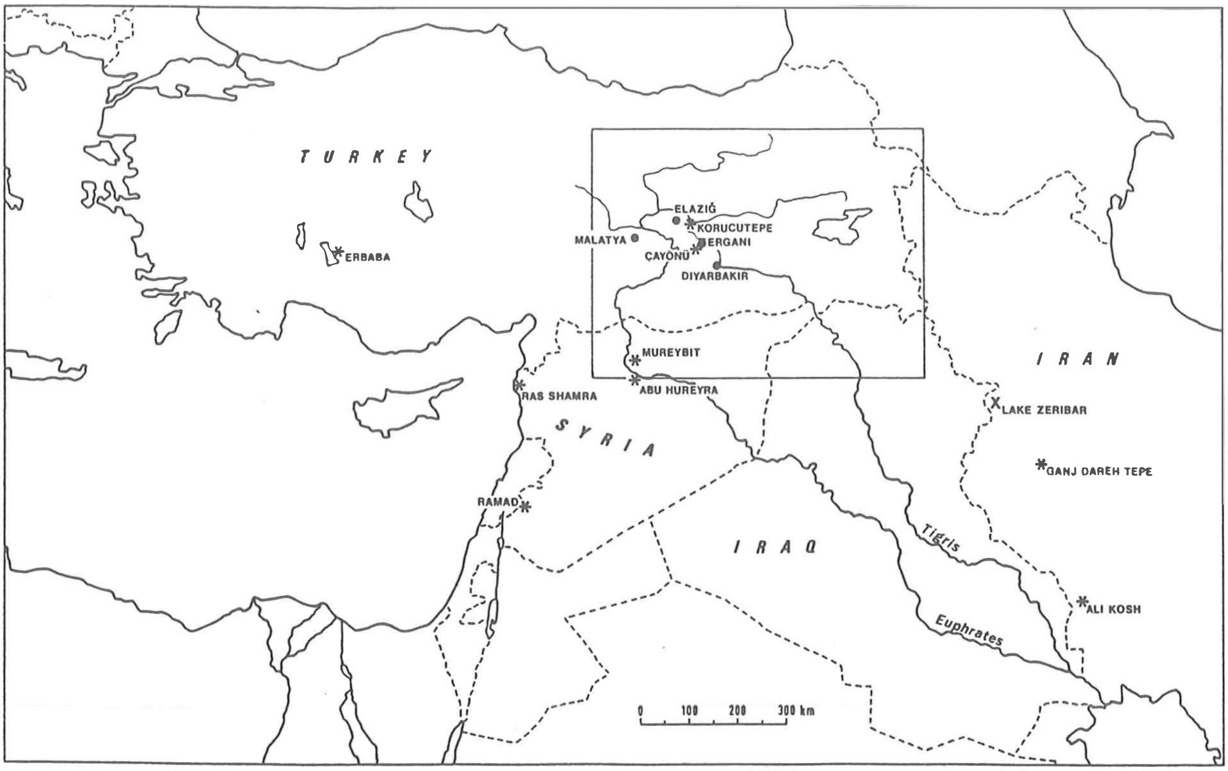

Fig. 1. Map of the Near East showing the location of sites mentioned in the present paper. For the framed area a vegetation map is shown in fig. 2.

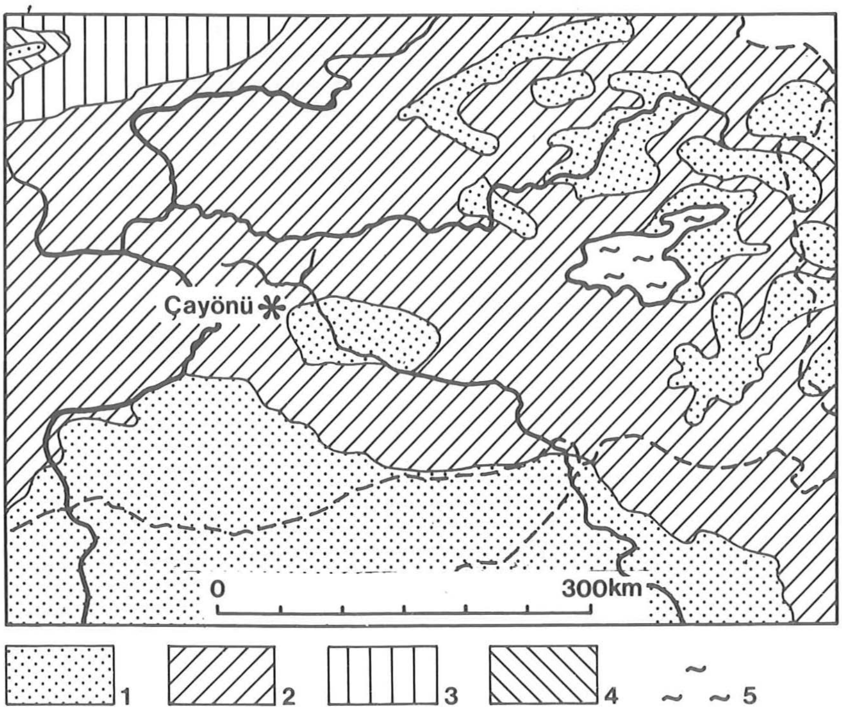

Fig. 2. Map of (assumed) natural vegetation. Section of map published by van Zeist & Bottema (1991: fig. 4), slightly simplified. 1. Steppe vegetation; 2. SE Anatolian mixed-oak woodland; 3. Montane Euxinian forest; 4. Xero-Euxinian woodland; 5. Lake Van.

Table 1. Climatic data for three stations in SE Turkey (after Alex, 1985).

	Diyarbakir	Elazığ	Malatya
Elevation (in m)	660	1105	998
Mean annual temperature (in °C)	16.0	13.2	13.6
Mean January temperature	2.5	−1.0	−0.1
Mean July temperature	30.2	26.8	26.7
Mean annual precipitation (in mm)	495	415	395.8
Month with maximum precipitation	Dec.	May	April
Mean precipitation in wettest month	79.0	62.2	61.8
Mean precipitation in driest month (July)	0.4	0.7	0.9
Dry summer period	June-Sept.	June-Sept.	June-Sept.

because climatically it cannot easily be understood. Mean annual precipitation at Diyarbakir (495 mm) is even higher than at Elazığ (415 mm) and Malatya (396 mm), which are both situated in naturally wooded areas. Mean summer temperatures are higher at Diyarbakir (table 1), implying a more intensive drought period, which could possibly account for the steppe vegetation. On the other hand, one wonders to what extent the predominantly volcanic soils there create unfavourable conditions for woodland vegetation. The dry limestone outcrops near Çayönü may originally have borne steppe vegetation.

1.2. The site

The information below on Çayönü Tepesi has been taken mainly from Braidwood et al. (1981), Schirmer (1990) and Özdoğan & Özdoğan (1989), supplemented by personal information from Professor Robert J. Braidwood and Dr. Mehmet Özdoğan. The site appears to measure about 150 by 250 m, with an overall inhabited area not yet well determined; it may have reached over three hectares. At its highest point it stands about 3 m above the level of the neighbouring fields. The core of the site is formed by the pre-pottery (aceramic) Neolithic mound (phase I), the surface area of which is not exactly known because it is partly covered by younger occupation deposits. Occupation phase II almost completely surrounds the pre-pottery mound and comprises mainly pre-Halafian (pottery Neolithic) layers. Minor and discontinuous deposits in various parts of the mound date from the Early Bronze Age (EBAII and III) to the Early Iron Age (phase III).

Excavations at Çayönü, which through 1988 were largely confined to the pre-pottery mound, started in 1964 as a joint project of the Prehistory Section of Istanbul University and the Oriental Institute of the University of Chicago, under the direction of Professors Halet Çambel and Robert J. Braidwood. Later, in 1978, the expedition was joined by a team from the Institut für Baugeschichte, University of Karlsruhe, headed by Professor Wolf Schirmer. In 1989 Dr. Mehmet Özdoğan from the Prehistory Section of Istanbul University succeeded Çambel and Braidwood as field director. Since 1964, thirteen campaigns of archaeological excavation have been undertaken, plus three more under Özdoğan.

Radiocarbon determinations date the pre-pottery occupation between 9200 and 8700 BP, which after calibration should approximately correspond with 8250-7750 BC in calendar years. In this main prehistoric phase (phase I), a number of so-called 'sub-phases' are

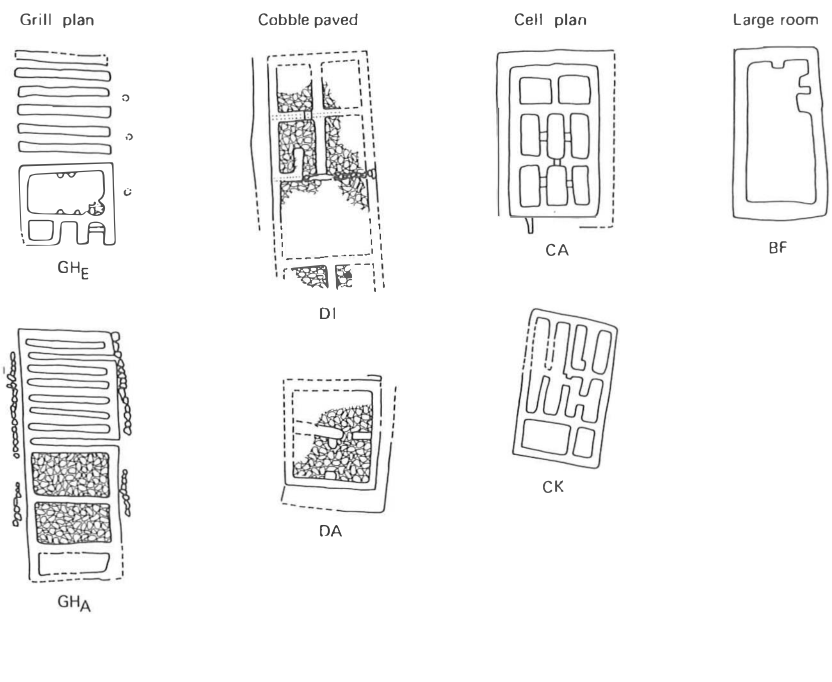

Fig. 3. Schematized plans of main domestic building types at aceramic Çayönü. Redrawn from Özdoğan & Özdoğan (1989: fig. 2).

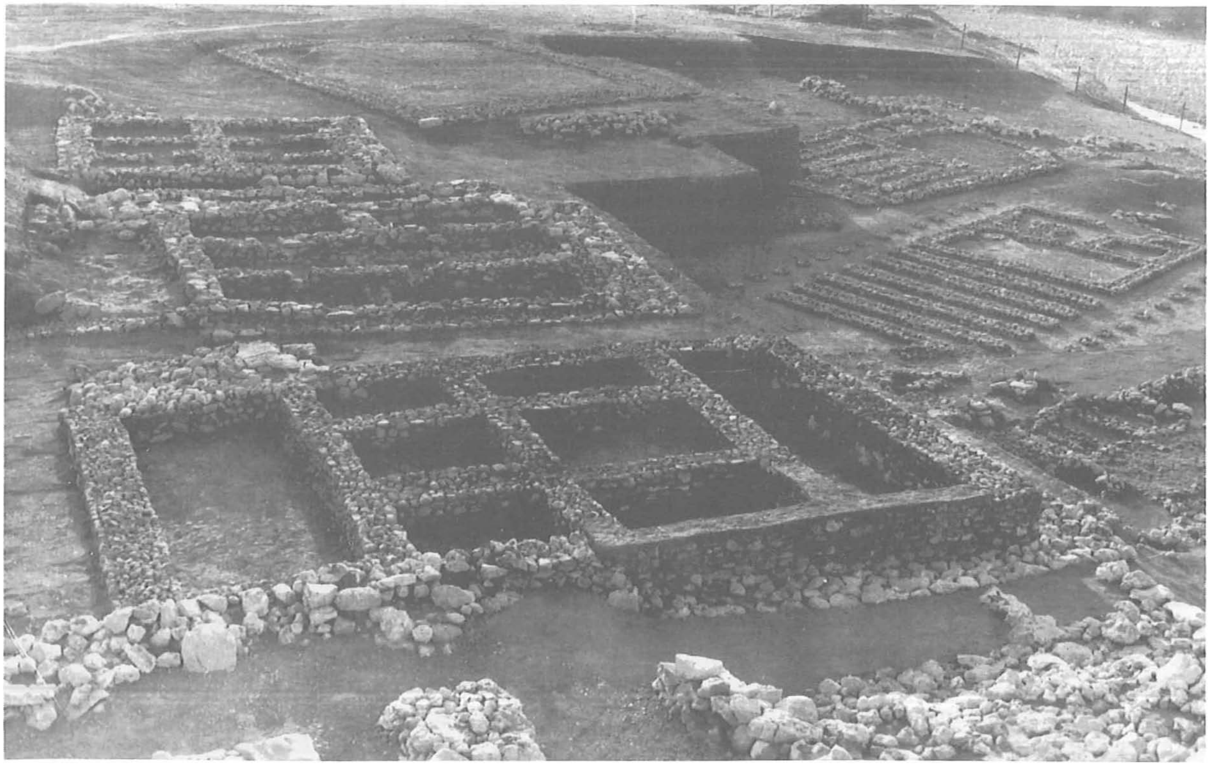

Fig. 4. To the left, at a higher stratigraphic level, three cell plan buildings; at a lower stratigraphic level, grill plan buildings (photo Çayönü archive, Istanbul).

Table 2. Periodization in sub-phases of the aceramic occupation (phase I) at Çayönü. Various sub-phases have been further subdivided, e.g. c1, c2, c3.

lr	Large room	
c/lr	Cell/Large room transition	
c	Cell House (Cell plan)	
cp	Cobble-paved house	Former
ch	Channelled house	Intermediate
cp	Basal pits	Sub-phase
g	Grill house (Grill plan)	
r	Rounded huts (Round plan)	

distinguished. The sub-phases are mainly characterized by houses of different plan types (see figs 3-5). In this paper, the botanical samples are attributed to eight sub-phases (cf. tables 3 and 4). Below there follows a brief description of the house plans, from deepest to uppermost in stratigraphic order, characteristic of the various sub-phases. In parentheses are the sub-phase letter indications (see also table 2).

Round or oval huts, with a sunken floor, were recovered from the bottom levels: the Rounded huts or Round plan (r) sub-phase. The walls were constructed in wattle and daub technique, sometimes on stone-laid foundations.

The second sub-phase is characterized by the so-called grill-plan buildings: the Grill plan or Grill house (g) sub-phase. The rectangular buildings of this sub-phase, measuring c. 5.5 by 11 m, are tripartite in ground plan and approximately north-south oriented. The northern part of the buildings has a substructure of parallel narrow wall strips built of small stones, the grills. The superstructure of these houses is believed to have been made of light organic material.

The succeeding Basal pits (bp) sub-phase is somewhat puzzling in that it suggests that the inhabitants of the site changed their fairly roomy houses for sunken huts of about 3-5 m in diameter[1].

In the Channelled house (ch) sub-phase, the grill substructure was replaced by a solid stone foundation, interrupted by parallel drainage channels.

In the Cobble-paved (cp) sub-phase houses, a paved floor covers the entire space of the room.

The ground floor plan of the Cell plan or Cell house (c) sub-phase is somewhat different from those of the preceding sub-phases. The term 'cell plan' derives from the very small dimensions of the individual chambers, whose walls support the overlying living floor. In addition, the stone foundations are known to have supported mud-brick walls.

The final two sub-phases, Cell/Large room (c/lr),

Fig. 5. The structure in front represents the remains of two buildings: the right part is made up of the front court yard and cellular section of a grill plan building (the grill structure itself is still covered by the clayey floor); the left part is a cobble paved building, partly running over the grill plan house. Behind this composite structure, a grill plan building. At the right end of the latter building, the remains of a rounded hut (Round plan sub-phase) (photo Çayönü archive, Istanbul).

and Large room (lr), (for which the terms Early Large room and Late Large room are preferable) have houses of the Large room plan type. They are distinguished from one another on the basis of stratigraphy and other recognizable differences.

Within most sub-phases, a number of main architectural layers can be observed, e.g. Cell plan c1, c2 and c3.

In addition to the domestic buildings, a few buildings of special function, different in plan and construction techniques, have been uncovered (e.g. Schirmer, 1983). One of them is the so-called 'skull building', so named when some 70 human skulls were uncovered in the first season of its excavation. Continued excavations revealed that in earlier aspects of this building (at least five major phases suggesting rebuilding are distinguished), skeletons and parts of skeletons had also been stored here. The skull building, in its various rebuilding aspects, largely corresponds with the Cobble-paved sub-phase.

The house plans and those of other non-domestic buildings are indicated by a two-letter code, e.g. GD, DI and BM (skull building).

One may wonder whether the different building types characterizing the sub-phases point to discontinuity in the habitation. However, the differences in house plan between sub-phases are less abrupt than they seem at first sight. Except for the earliest round houses and the so-called basal pits, a gradual development of architecture can be observed.

Two sectors of the aceramic mound have been excavated (eastern and western excavation areas) separated by a c. 30 m wide, largely unexcavated zone. The approximate extent of the excavated areas appears from figure 6 in which the distribution of botanical samples included in the present publication is shown. Of the Cell plan sub-phase, which has been excavated most extensively, an estimated 20-30% had been unearthed by 1987 (Özdoğan & Özdoğan, 1989).

1.3. Archaeobotanical research

In 1968, the first attempts were made to retrieve floral remains from the Çayönü site, with the aim of obtaining information on the exploitation of cultivated and wild plants by the aceramic inhabitants. Professor Robert B. Stewart (Houston State University, Huntsville, Texas) initiated the flotation of soil samples from the site. The results were disappointing in that Stewart did not succeed in recovering identifiable plant remains. In the next field campaign in 1970, the first author was more successful. Appreciable numbers of seeds, fruits and other plant remains could be brought to light (van Zeist, 1972; this paper is referred to below as '1972 publication'). Stewart's negative results can probably be ascribed to the fact that the material he had access to was only available from layers near the surface of the mound. As a consequence of alternate drying and moistening of the soil and of root action, the carbonized plant remains had disintegrated in the upper layers.

In 1972, Stewart returned to Çayönü (fourth season) and examined a large number of samples secured from 109 provenances (Stewart, 1976). This time the results were quite satisfactory; fair quantities of plant material were recovered, including a cache of more than 1500 emmer wheat grains. Stewart (1976) noted that the 1972 campaign had yielded only a few additions to the inventory of plant taxa demonstrated in 1970. Whether or not this made the excavators believe that little new information was to be expected from a continuation of archaeobotanical research on the site, the fact is that in following field seasons no botanist was scheduled as a member of the excavation team. It was not until the 1985 campaign that archaeobotanical fieldwork was taken up again, this time by the second author of this report. Sampling for archaeological plant remains was continued in 1986 and 1987.

2. THE SAMPLES

2.1. Field and laboratory procedures

The conditions at Çayönü are such that only carbonized vegetable material and possible mineralized (organic material replaced by calcium phosphate) plant remains will have been preserved. The plant remains were recovered in the field by means of manual water flotation of samples of occupational soil. The volume of soil floated varies considerably, but the majority of the samples measured between 15 and 40 litres.

The samples were taken partly by members of the excavation team and partly by the palaeobotanist during the periods the latter took part in the field work (WvZ in 1970, GJdR in 1985, 1986, 1987). The flotation was carried out by the botanist. Samples were secured from places which looked promising because of the presence of charcoal and ashes or because seeds were observed with the naked eye (so-called judgement samples). The presence of particular features was also occasion for botanical sampling. No systematic sampling in the sense of some kind of random sampling has been considered, irrespective of the question whether or not this may have been practicable.

The samples taken in 1970 during the stay of the palaeobotanist in the field were examined in the Çayönü excavation house. Of this material only part was taken to the laboratory in Groningen for checking identifications and for measuring and drawing seed and fruit types. In preparing the present report it was regretted that some of the 1970 material was not available for re-examination. Some of the samples floated in 1985, 1986 and 1987 were provisionally examined in the field, but all the material was taken to Groningen. In the laboratory the samples were examined according to standard procedures.

A considerable number of samples turned out to be disappointingly poor in seeds, fruits and chaff remains. Wood charcoal was examined whenever the pieces

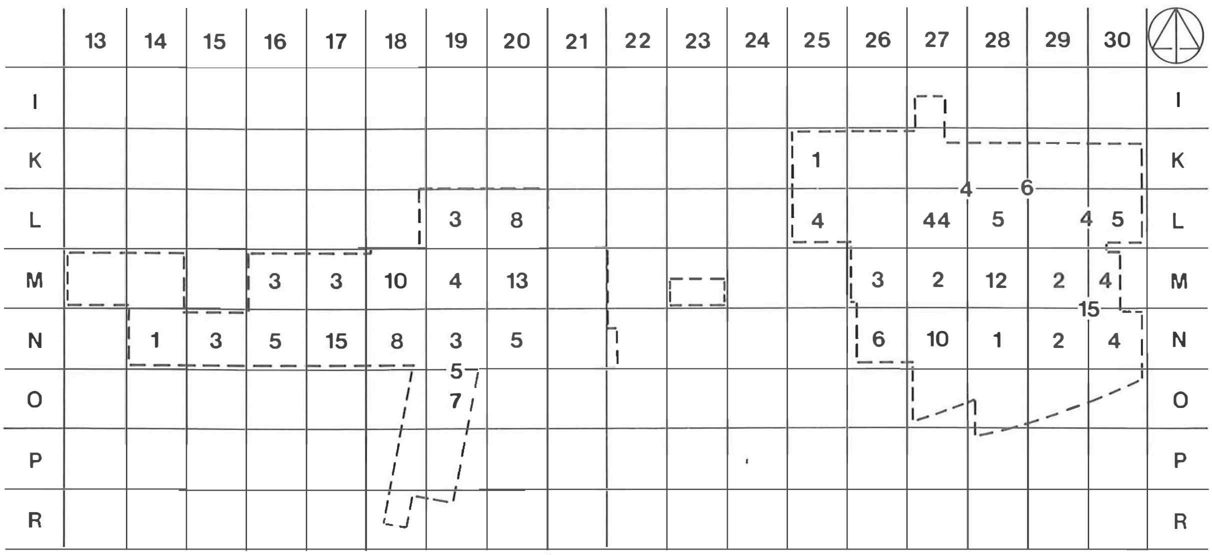

Fig. 6. Distribution of palaeobotanical samples. For discussion, see 2.1. The broken line is the approximate limit of the eastern and western excavation areas (end 1987 field season).

were large enough to be handled. Frequently the wood structure had suffered much from heat, which prevented identification.

The samples included in the present publication are mainly from the 1970, 1985, 1986 and 1987 field seasons. A few samples were secured by the excavators in 1979, 1981 and 1984. Where appropriate, the results of the 1972 field season (Stewart, 1976) will be included in the discussion, but the data of the latter campaign have not been published in such a way that they could be incorporated in those of the other years. The fact that only a few field seasons are reasonably well covered archaeobotanically inevitably leads to a very uneven distribution of the botanical samples over the areas excavated. This is clear from figure 6, in which the numbers of samples which yielded floral remains other than wood charcoal are given per square. For some of the 1970 samples the exact location within the present grid system, which was laid out in 1978, could not be established, hence the numbers between squares. It is true that the number of samples examined is greater than that shown in figure 6 because some of them yielded no seeds or chaff. However, the latter samples would not have changed the overall picture of the sample distribution. It goes without saying that this incomplete coverage has provided less detailed information on the Çayönü plant husbandry than one could obtain from a more thorough study of the deposits excavated.

A fairly large number of accidentally burned mudbrick samples had been secured by the excavators for botanical examination. Inspection of these samples showed that the imprints of vegetable matter could generally not be identified ('grass stems' and such like) and therefore the mudbricks would not essentially supplement the charred seed record. For that reason it was decided to discard the mudbrick samples.

Mr. Michael K. Davis, New York, a Çayönü expedition member of many years' standing, has expertly identified the sub-phase attributions of the botanical samples.

2.2. Presentation of the results

With a few exceptions no data of individual samples are presented, but in tables 3 and 4 (for the eastern and western areas respectively) the total numbers of seeds, fruits and other plant remains other than wood charcoal are shown per occupation sub-phase. In addition, the sample frequencies, expressed as percentages, are given. Seed types for which not even the family could be identified are not listed. As for the numbers of *Triticum* spikelet forks, two glume bases are counted as one spikelet fork. It was decided not to publish the full data as this would have led to long lists with predominantly zero scores[2]. A small number of individual samples are presented as examples of the botanical contents of certain types of contexts (tables 12, 21, 23-25).

As usual measurements are presented. In addition to descriptions and illustrations, measurements should document the archaeological plant remains. So far, little use has been made of measurements in evaluating the archaeobotanical data, particularly in comparing between sites. A complicating factor is the fact that we hardly know to what extent the dimensions have been affected by the carbonization.

In this paper the term 'seeds' has been used somewhat loosely and may also denote anatomically-defined fruits.

3. COMMENTS ON PLANT REMAINS

The comments on the seed and fruit types presented in this section are in part similar to those in the 1972 publication. As this final report aims at presenting all relevant information on the Çayönü floral record, some repetition of what has been written in an earlier paper is unavoidable. Moreover, the 1972 publication may not always readily be available to the reader. The illustrations in the 1972 publication are also shown again, in addition to new drawings of plant remains. Drawings have been prepared for only some of the seed and fruit types established for Çayönü. For various other types reference is made to illustrations in archaeobotanical literature: 'Korucutepe': van Zeist & Bakker-Heeres, 1975b; 'Ramad': van Zeist & Bakker-Heeres, 1982(1985); 'Ras Shamra': van Zeist & Bakker-Heeres, 1984(1986)a. 'Cf.' indicates that the Çayönü seed does not exactly conform to that illustrated.

Except for some crop-plant species, seed and fruit types recovered only from pottery Neolithic samples (table 3) are left out of consideration.

3.1. Cereals

By far the majority of the cereal remains are of hulled wheats. Particularly chaff, in the form of spikelet forks and glume bases (see figs 8:5,6 and 9:2,3), is well represented. As mentioned above, in the tables two glume bases are counted as one spikelet fork. No free-threshing wheat has been identified for aceramic levels, but some naked wheat grains (*Triticum durum/aestivum*) were recovered from pottery Neolithic samples.

3.1.1. *Emmer wheat*

In the 1972 publication attention is focussed on the occurrence of wild emmer wheat (*Triticum dicoccoides*) grains in addition to those of the domestic type, *Triticum dicoccum*. Wild emmer wheat kernels are characterized by an oblong shape and a longitudinally straight or only slightly curved dorsal side. The flat ventral side has a narrow furrow. *Triticum dicoccum*-type grains are spindle-shaped in outline, showing the greatest breadth in the middle of the kernel. The ventral side is longitudinally straight or somewhat concave. Examples

Table 3. Eastern excavation area. Total numbers of seeds, etc. (Σ) and sample frequencies expressed as percentages (% fr) per sub-phase. x Present; xx Frequent; xxx. Very frequent.

Sub-phase	r		g		bp		ch		cp	
Number of samples	16		17		23		21		24	
	Σ	%fr	Σ	%fr	Σ	%fr	Σ	%fr	Σ	%fr
Triticum boeoticum	-	-	-	-	4.3	17	0.6	5	1.5	8
Triticum boeoticum/monococcum	-	-	-	-	2.3	9	1	5	1	4
Triticum monococcum	-	-	1.1	12	2.6	9	1	5	1	4
Triticum dicoccoides	-	-	-	-	6.5	17	5	14	-	-
Triticum dicoccoides/dicoccum	-	-	0.9	12	5.5	13	5.3	19	-	-
Triticum monococcum/dicoccum	-	-	1	6	-	-	-	-	-	-
Triticum dicoccum	-	-	-	-	1.5	4	-	-	1	4
Triticum aestivum/durum	-	-	-	-	-	-	-	-	-	-
Triticum sp.	-	-	-	-	1	4	-	-	-	-
Triticum spikelet forks	9	56	116	59	249	56	128	71	254	71
Triticum rachis internodes	-	-	-	-	-	-	-	-	-	-
Hordeum (cf.) *spontaneum*	-	-	0.8	12	1.8	13	4	5	-	-
Hordeum rachis internodes	-	-	3	6	2	4	2	10	1	4
Unident. rachis internodes	-	-	-	-	-	-	-	-	-	-
Cereal grain fragments	xx	38	xx	24	x	27	x	19	x	42
Pisum	-	-	1	6	31	35	20.5	38	32.5	25
Lens	1	6	-	-	1.5	9	1.5	10	6	13
Vicia ervilia	-	-	-	-	49.5	48	31.5	24	48	54
Cicer	-	-	-	-	1	4	-	-	-	-
Lathyrus cicera/sativus	-	-	-	-	-	-	1	5	1	4
Pulse grain fragments	x	6	-	-	-	-	-	-	-	-
Linum cf. *bienne*	-	-	-	-	-	-	7	10	90	4
Vitis	-	-	3	6	3	4	-	-	1	4
Ficus	-	-	-	-	-	-	-	-	1	4
Celtis	-	-	-	-	-	-	1	5	-	-
Pistacia nutshell fragments	xx	94	xx	100	xx	96	xx	100	xx	92
Amygdalus nutshell fragments	x	6	x	24	x	35	x	10	x	25
Quercus acorn fragments	-	-	-	-	-	-	-	-	-	-
Lathyrus aphaca type	2	6	2	6	-	-	1	5	-	-
Vicia sp.	13.5	32	16.5	41	182.5	74	67.5	72	45.5	58
Vicia seed fragments	x	19	xx	41	x	17	x	10	xx	13
Astragalus	-	-	-	-	-	-	-	-	1	4
Medicago radiata	-	-	-	-	-	-	-	-	1	4
Trigonella astroites type	-	-	-	-	-	-	-	-	-	-
Unident. Leguminosae	-	-	-	-	2	9	-	-	3	4
Lolium rigidum/perenne	1	6	1.5	12	13.5	22	5	19	-	-
Bromus	-	-	-	-	1	4	-	-	-	-
Phalaris	-	-	-	-	-	-	-	-	-	-
Cynodon	-	-	-	-	-	-	-	-	-	-
Echinaria	-	-	-	-	1	4	2	10	6	4
Stipa grains	-	-	-	-	5	4	-	-	-	-
Stipa awn fragments	x	19	x	18	x	4	-	-	-	-
Agrostis type	-	-	-	-	-	-	-	-	-	-
Unident. Gramineae	2.5	12	2	6	4.5	13	0.5	5	5	13
Anagallis arvensis	-	-	-	-	-	-	-	-	-	-
Anchusa	-	-	-	-	-	-	-	-	-	-
Chrozophora	-	-	-	-	2.5	9	2	5	-	-
Rumex	-	-	-	-	-	-	-	-	-	-
Polygonum corrigioloides type	-	-	-	-	-	-	-	-	-	-
Scirpus maritimus	1	6	2	12	20	41	7	24	3	8
Vaccaria	-	-	-	-	-	-	0.5	5	-	-
Thymelaea	-	-	-	-	-	-	-	-	-	-
Verbena type	-	-	-	-	-	-	-	-	-	-
Ziziphora	-	-	-	-	-	-	-	-	1	4
Galium	-	-	-	-	3	9	-	-	-	-
Unident. Umbelliferae	-	-	-	-	-	-	-	-	-	-
Plantago lagopus type	-	-	-	-	-	-	-	-	-	-
'*Lycium* type'	1	6	-	-	22	4	-	-	-	-

Table 3 (Continued).

c		c/lr		lr		Pott.Neol.		Sub-phase
20		8		5		9		Number of samples
Σ	%fr	Σ	%fr	Σ	%fr	Σ	%fr	
1.3	10					3	11	*Triticum boeoticum*
								Triticum boeoticum/monococcum
2.6	25		13				11	*Triticum monococcum*
								Triticum dicoccoides
								Triticum dicoccoides/dicoccum
								Triticum monococcum/dicoccum
35	65	2	25			16	67	*Triticum dicoccum*
						3	11	*Triticum aestivum/durum*
						5	22	*Triticum* sp.
79	35	12	63			1679	89	*Triticum* spikelet forks
						1	11	*Triticum* rachis internodes
	5					1	11	*Hordeum* (cf.) *spontaneum*
	5					3	22	*Hordeum* rachis internodes
						5	22	Unident. rachis internodes
x	10	x	13			xx	89	Cereal grain fragments
27.5	15	3	13	37	80			*Pisum*
59	35		13	93	80	149.5	67	*Lens*
92.5	75		13	3.5	40	45	78	*Vicia ervilia*
3	15					6	33	*Cicer*
								Lathyrus cicera/sativus
								Pulse grain fragments
								Linum cf. *bienne*
								Vitis
						7	22	*Ficus*
	5							*Celtis*
xxx	80	xx	75	x	20	x	89	*Pistacia* nutshell fragments
xx	50	x	13			x	11	*Amygdalus* nutshell fragments
x	15							*Quercus* acorn fragments
								Lathyrus aphaca type
121	55	3	13			25.5	67	*Vicia* sp.
xx	10	xx	13	x	20	xx	89	*Vicia* seed fragments
								Astragalus
								Medicago radiata
							11	*Trigonella astroites* type
1.5	15	0.5	13					Unident. Leguminosae
4	10					3.5	33	*Lolium rigidum/perenne*
2	5					0.5	11	*Bromus*
						2	22	*Phalaris*
						3	11	*Cynodon*
						1	11	*Echinaria*
								Stipa grains
						x	22	*Stipa* awn fragments
1	5							*Agrostis* type
1.5	10		13			6.5	33	Unident. Gramineae
						2	11	*Anagallis arvensis*
1	5							*Anchusa*
4	5							*Chrozophora*
3	10							*Rumex*
			13					*Polygonum corrigioloides* type
5.5	20					6	56	*Scirpus maritimus*
								Vaccaria
						4	44	*Thymelaea*
							11	*Verbena* type
2	5							*Ziziphora*
6	20		13			1.5	22	*Galium*
1	5							Unident. Umbelliferae
	5							*Plantago lagopus* type
								'*Lycium* type

Table 4. Western excavation area. Total numbers of seeds, etc. (Σ) and sample frequencies expressed as percentages (%fr) per sub-phase. x Present; xx Frequent; xxx. Very frequent.

Sub-phase	g		ch		cp		c	
Number of samples	15		20		14		47	
	Σ	%fr	Σ	%fr	Σ	%fr	Σ	%fr
Triticum boeoticum	0.6	13	7	10	1	7	-	-
Triticum boeoticum/monococcum	0.3	7	-	-	1	7	1	2
Triticum monococcum	2.3	20	3	10	1.5	14	3.8	12
Triticum dicoccoides	2.5	13	5	10	-	-	-	-
Triticum dicoccoides/dicoccum	1.6	13	-	-	-	-	-	-
Triticum monococcum/dicoccum	-	-	-	-	2	7	-	-
Triticum dicoccum	-	-	7	35	2	7	1	4
Triticum sp.	-	-	-	-	-	-	1	2
Triticum spikelet forks	131	73	797	95	243	93	181	74
Hordeum (cf.) *spontaneum*	-	-	0.3	5	0.3	7	1.3	4
Hordeum rachis internodes	-	-	6	10	2	14	-	-
Unident. rachis internodes	-	-	3	5	-	-	-	-
Cereal grain fragments	xx	13	xx	80	xx	57	xx	47
Pisum	14.5	33	26	30	2	14	15.5	23
Lens	4	20	6.5	15	19.5	43	15.2	27
Vicia ervilia	13.5	40	42	70	55.5	43	3731	40
Cicer	-	-	2.5	10	-	-	4.5	10
Lathyrus cicera/sativus	-	-	1	5	-	-	-	-
Pulse grain fragments	x	7	x	25	x	7	x	4
Linum cf. *bienne*	-	-	-	-	-	-	0.3	2
Vitis	-	-	1	5	2	7	-	-
Celtis	-	-	-	-	-	-	1	2
Pistacia nutshell fragments	xx	87	xx	95	xx	93	xx	83
Amygdalus nutshell fragments	x	13	x	15	x	14	x	19
Lathyrus aphaca type	-	-	8	10	14	14	-	-
Lathyrus hirsutus	-	-	1	5	-	-	-	-
Vicia sp.	156	80	105	85	72.5	43	21	13
Vicia seed fragments	xx	13	x	20	xx	36	xx	28
Medicago radiata	-	-	-	-	1	7	-	-
Medicago	-	-	2	5	-	-	-	-
Melilotus	-	-	4	5	-	-	-	-
Unident. Leguminosae	2.8	20	1	5	1	7	1	2
Lolium rigidum/perenne	4.5	20	9.8	40	5	21	3.9	15
Bromus	-	-	2.5	10	-	-	1	2
Stipa awn fragments	x	13	x	10	x	7	-	-
Unident. Gramineae	8	13	7	20	2	7	2.5	9
Ranunculus arvensis type	-	-	-	-	-	-	1	2
Adonis	-	-	1	5	-	-	-	-
Unident. Compositae	-	-	1	5	1	7	-	-
Lithospermum tenuiflorum	-	-	2	10	-	-	-	-
Unident. Boraginaceae	-	-	-	-	1	7	-	-
Chrozophora	2	7	5	5	-	-	-	-
Unident. Cruciferae	-	-	1	5	-	-	1	2
Scirpus maritimus	3	13	2	10	3	21	-	-
Silene	-	-	1	5	-	-	-	-
Thymelaea	-	-	-	-	-	-	1	2
Unident. Labiatae	1	7	-	-	-	-	-	-
Ziziphora	2	13	58	10	-	-	-	-
Galium	2	13	1.5	10	2	14	0.5	2
Malva	-	-	1	5	-	-	-	-
Unident. Umbelliferae	-	-	1	5	-	-	-	-
Helianthemum	-	-	-	-	-	-	1	2
Fumaria	-	-	1	5	-	-	-	
Verbascum	1	7	-	-	-	-	-	-
'*Lycium* type'	-	-	1494	90	23	36	1.5	4

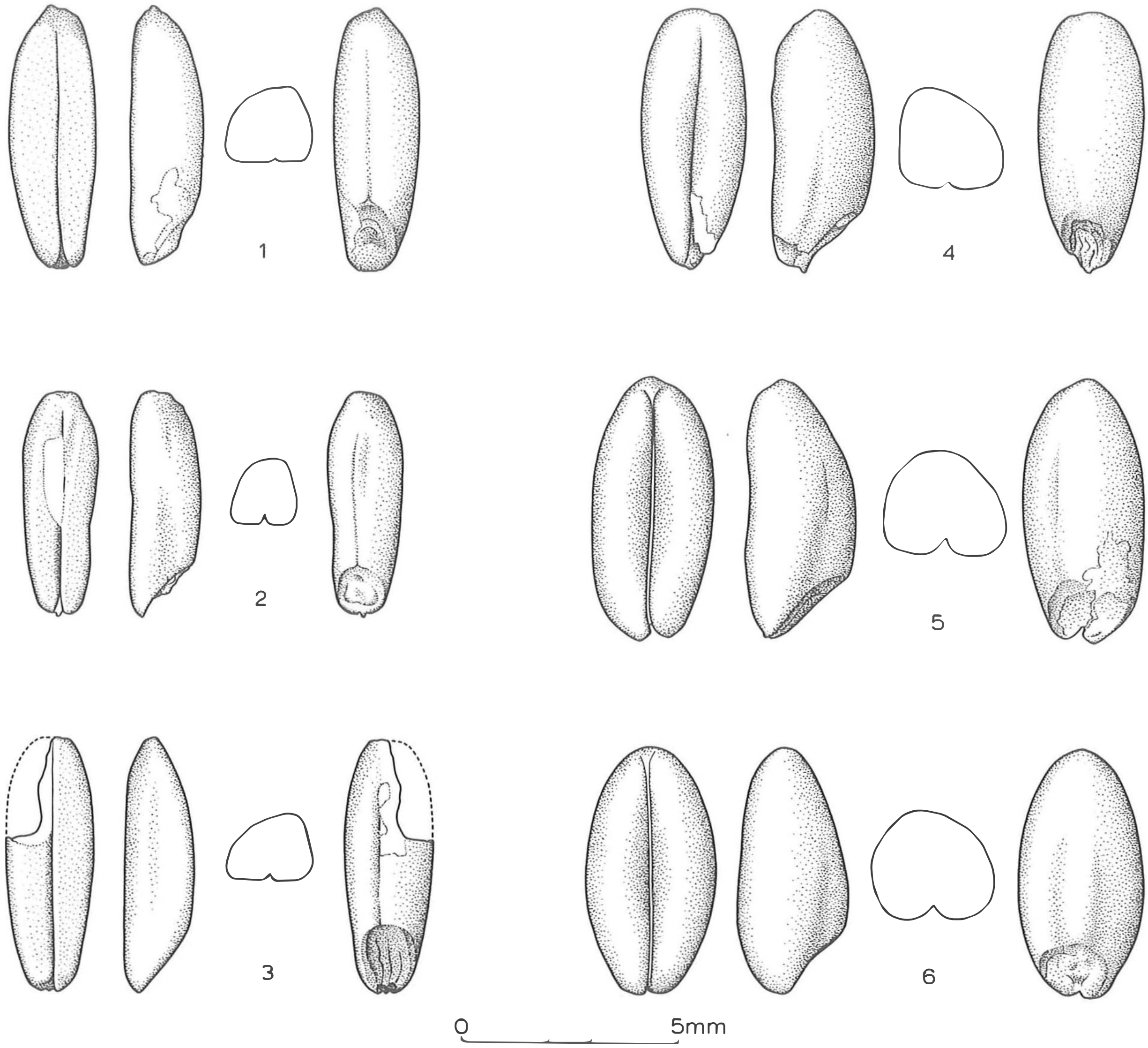

Fig. 7. 1. *Triticum dicoccoides* (70/R 14-0); 2,3. *T. dicoccoides* (70/R 15-2); 4. *T. dicoccum* (70/R 4-1); 5,6. *T. dicoccum* (70/R 5-8). After van Zeist (1972: fig. 4).

Table 5. Dimensions (in mm) and index values of *Triticum dicoccoides*(-type) grains.

Sample no.	Sub-phase	Square	L	B	T	100 L/B	100 T/B
86/90	?	27L	6.4	1.6	1.5	400	94
86/130	ch	20M	5.3	2.0	1.3	265	65
86/130	ch	20M	5.9	2.4	2.1	246	88
70/R-15	ch	27L	c.6.2	2.2	c.1.6	282	73
70/R-15	ch	27L	6.0	2.4	1.9	250	79
70/R-15	ch	27L	6.0	2.0	1.6	300	80
70/R-15	ch	27L	5.2	1.8	1.6	289	89
70/R-14	ch	27L	6.2	2.0	1.8	310	90
87/36	bp	27L	6.0	2.3	1.9	261	83
70/R-19	bp	27L	6.6	2.2	c.1.6	300	73
70/R-18	bp	27L	c.5.8	1.7	1.5	341	88

Table 6. Dimensions (in mm) and index values of *Triticum dicoccum* grains from aceramic and pottery levels.

Sample no.	Sub-phase	Square	L	B	T	100 L/B	100 T/B
Aceramic:							
70/R-5	c	27L	6.0	3.0	2.7	200	90
70/R-5	c	27L	5.0	2.9	2.2	172	76
70/R-5	c	27L	6.2	2.8	2.6	221	93
70/R-4	c	27L	6.2	2.7	2.4	230	89
70/R-4	c	27L	5.3	2.4	c.2.2	221	92
70/R-4	c	27L	6.0	2.3	1.8	261	78
86/85	ch	20L	5.7	2.2	1.8	259	82
86/79	ch	20L	4.6	2.3	2.1	200	91
Pottery section:							
87/23		27K	5.9	3.0	2.6	197	87
87/23		27K	6.0	2.6	2.1	231	81
87/23		27K	5.6	2.8	2.3	200	82
87/27		27K	5.4	2.7	1.9	200	70
87/21		27K	5.8	2.8	2.3	207	82
87/21		27K	5.2	2.7	2.3	193	85

of both types of wheat grains are illustrated in figure 7. The greater slenderness of the wild emmer-type grains compared to those of the domestic type finds expression in the L/B index values, ranging from 246 to 400 (mean 295) in *T. dicoccoides* (table 5) and from 172 to 261 (mean 221) in *T. dicoccum* (table 6).

On second thought, doubt has arisen on the attribution of the slender emmer wheat grains to *T. dicoccoides*, because no spikelet forks with an intact articulation scar have been found. The Çayönü emmer wheat-type spikelet forks show the features of the semi-tough central rachis of *T. dicoccum*. There are no signs of natural disarticulation of the ear as one would expect in wild emmer wheat.

It is striking that in the lowermost layers which yielded emmer wheat kernels, in the Grill-house sub-phase, no typical *T. dicoccum*-type grains were found, whereas in the upper half of the aceramic occupation, in the Cobble-paved house and younger sub-phases, *T. dicoccoides*-type grains are absent. Thus, in the course of the occupation one type of emmer wheat was replaced by another. Should this be explained in terms of the gradual replacement of the wild type by the domestic type? In the 1972 publication it was suggested that the Çayönü farmers had started to grow wild emmer wheat which in the course of time developed into the domestic type. However, the spikelet remains suggest rather that from the beginning on, domestic, that is to say semi-tough rachised emmer wheat was cultivated. One could speculate that changes in the shape of the grain lagged behind the transition from the brittle to the semi-tough type of rachis. It was continued cultivation which eventually resulted in the development of kernels typical of domestic emmer wheat.

For comparison with the aceramic grains, the dimensions of emmer wheat grains from pottery Neolithic levels are available (table 6). There are no significant differences in the dimensions and index values between the aceramic and pottery Neolithic specimens. Unfortunately, only a few grains were suitable for measurement.

3.1.2. *Einkorn wheat*

Wild as well as domestic-type einkorn wheat remains have been established for Çayönü. The domestic einkorn (*Triticum monococcum*) grains are of the one-seeded type (one grain develops in a spikelet); the kernels are laterally compressed, with longitudinally curved ventral and dorsal sides (fig. 8:1,2). Of wild einkorn wheat (*Triticum boeoticum*) both the one-seeded and the two-seeded type are represented. The grains of one-seeded wild einkorn (*T. boeoticum* ssp. *aegilopoides*) show, as in those of the domestic form, a longitudinally curved ventral side, but the dorsal side is longitudinally straight or only slightly curved. One-seeded wild einkorn grains differ further from those of domestic einkorn by a yet greater lateral compression (fig. 8:3). The breadth does not exceed 1.2 mm. Because of damage and deformations it was not always possible to distinguish between wild-type and domestic-type one-seeded einkorn grains.

A few grains and grain fragments of two-seeded wild einkorn (*T. boeoticum* ssp. *thaoudar*) were recovered. In two-seeded wild einkorn the ventral side is flat, while the dorsal side is longitudinally straight or only slightly curved (fig. 8:4). The grains are not laterally compressed. In tables 3 and 4 no distinction is made between the two wild einkorn types. The dimensions of einkorn grains are shown in table 8.

No spikelet remains of the shattering (wild) type could be established. A rachis internode fragment which originally had been attributed to einkorn wheat (van Zeist, 1972: fig. 5:7) turned out to be of wild barley (see below). The distinction between spikelet forks of emmer wheat and einkorn wheat is to some extent arbitrary.

Table 7. Width of spikelet forks measured across the articulation scar (in mm). N = number of measurements.

Sample no.	Sub-phase	Square	N	Mean dimension
Triticum dicoccum type:				
85/89	c	27L	5	1.92
86/39	cp	29-30N	4	1.75
87/13	ch	20L	4	1.69
86/30	ch	20M	5	1.92
87/4	bp	27L	7	1.78
87/47	bp?	27M	6	1.86
Total (N = 31): min. 1.4 mm, mean 1.82 mm, max. 2.2 mm.				
Triticum monococcum type:				
Total (N = 14): min. 1.0 mm, mean 1.23 mm, max. 1.4 mm.				

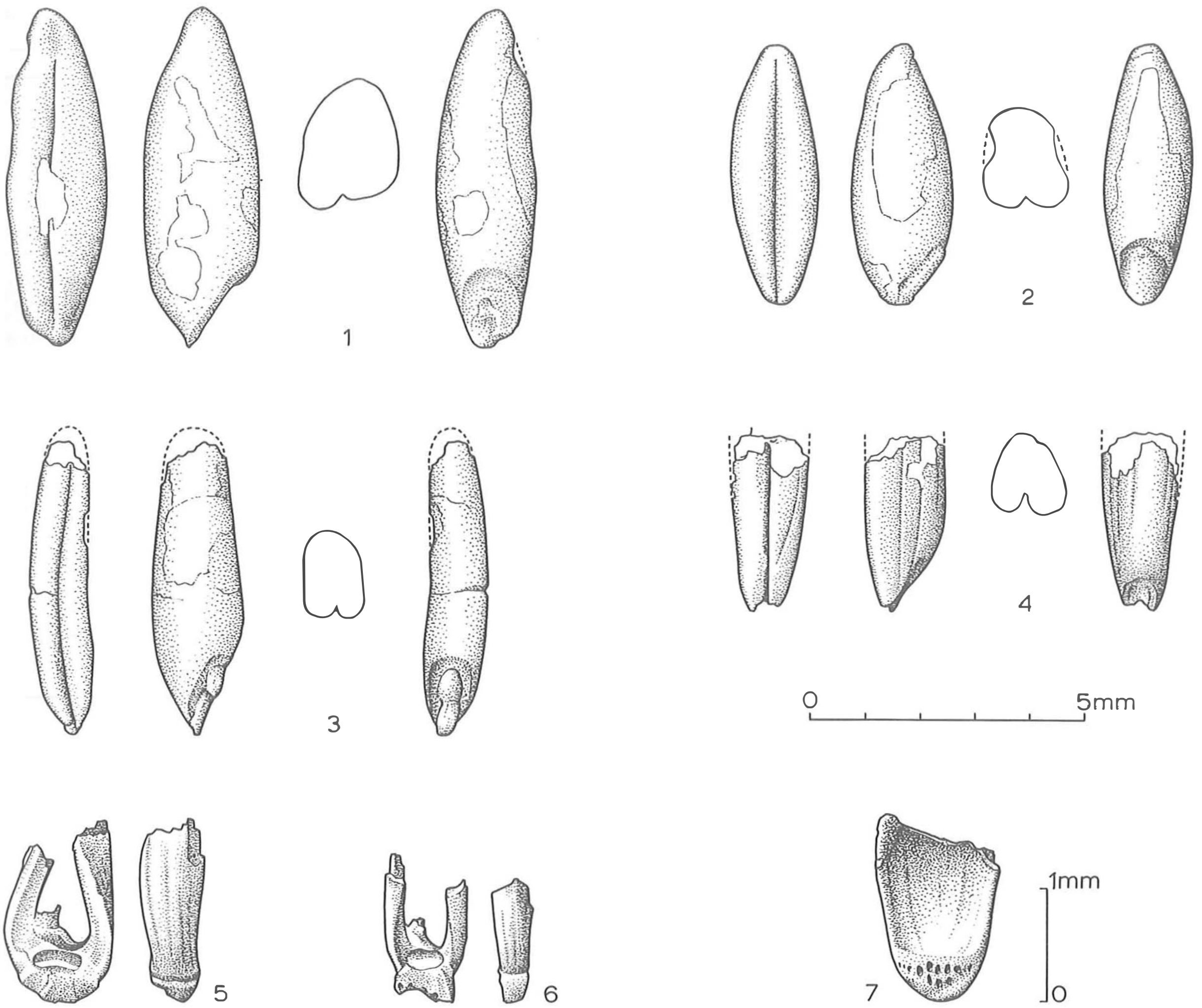

Fig. 8. 1. *Triticum monococcum* (70/R 19-3); 2. *T. monococcum* (70/R19-8); 3. *T. boeoticum* ssp. *aegilopoides* (70/R 18-0); 4. *T.* cf. *boeoticum* ssp. *thaoudar* (70/R 15-0); 5. Emmer wheat spikelet fork (70/R 15-0); 6. Einkorn wheat spikelet fork (70/R 15-0); 7. *Hordeum spontaneum* rachis internode fragment (70/R 15-0). After van Zeist (1972: fig. 5).

Table 8. Dimensions (in mm) and index values of wild and domestic einkorn grains.

Sample no.	Sub-phase	Square	L	B	T	100 L/B	100 T/B
Triticum monoccocum:							
70/X-5	c/lr	29-30L	6.2	2.0	c.2.4	310	120
86/77	cp?	19N	4.5	1.8	1.9	250	106
70/R-15	ch	27L	c.5.6	1.6	1.9	350	119
86/79	ch	20L	3.8	1.8	1.9	211	106
70/R-19	bp	27L	6.2	1.8	2.2	344	122
70/R-19	bp	27L	4.8	1.6	1.8	300	113
70/G-8	g	19N-O	c.5.6 .	1.8	2.1	311	117
Triticum boeoticum ssp. *aegilopoides*:							
70/R-5	c	27L	5.0	1.2	1.9	417	158
70/R-18	bp	27L	c.5.6	1.1	1.6	509	145
Triticum boeoticum ssp. *thaoudar*:							
87/45	cp	29-30N	4.1	1.3	1.4	315	108

Fairly narrow spikelet forks with the glumes at right angles on the base of the spikelet have been assigned to *T. monococcum* (figs 8:6 and 9:3). For characteristic einkorn and emmer wheat spikelet forks the width, measured across the articulation scar, has been determined (table 7).

In contrast to wild emmer wheat, wild einkorn wheat has weedy characters and consequently the species could have maintained itself as a weed in or near the Çayönü arable fields. Moreover, two-grained wild einkorn is found in massive stands on basaltic soils to the south of Çayönü. On the other hand, the absence of wild-type (shattering) spikelet remains and the large proportion of wild-type einkorn kernels with respect to that of the domestic type make one wonder whether, as is suggested for emmer wheat, einkorn wheat cultivation had also not yet resulted in the full replacement of the morphologically wild by the morphologically domestic grain type. Admittedly, this hypothesis is, to some extent, invalidated by the fact that wild einkorn-type grains do not disappear in the upper aceramic levels for which a satisfactory floral record has been obtained (and have been attested also for pottery Neolithic levels). Thus the relatively large proportion of wild einkorn wheat remains puzzling.

3.1.3. *Barley*

The paper on the 1970 season (van Zeist, 1972) mentions only two fragments of barley (*Hordeum*) grains. Samples from the 1985-1987 seasons yielded some more barley remains, grains as well as rachis internode fragments. One fairly well-preserved kernel was recovered from a 1970 sample that had been collected after the first author had departed from the site. However, compared to the number of *Triticum* remains, those of *Hordeum* are rather insignificant.

In the same 1972 paper it was assumed that the barley remains are of the wild type, *Hordeum spontaneum*, which occurs in massive stands in the Çayönü region (Harlan & Zohary, 1966). Moreover, wild barley has weedy characters and grows in segetal habitats, e.g.

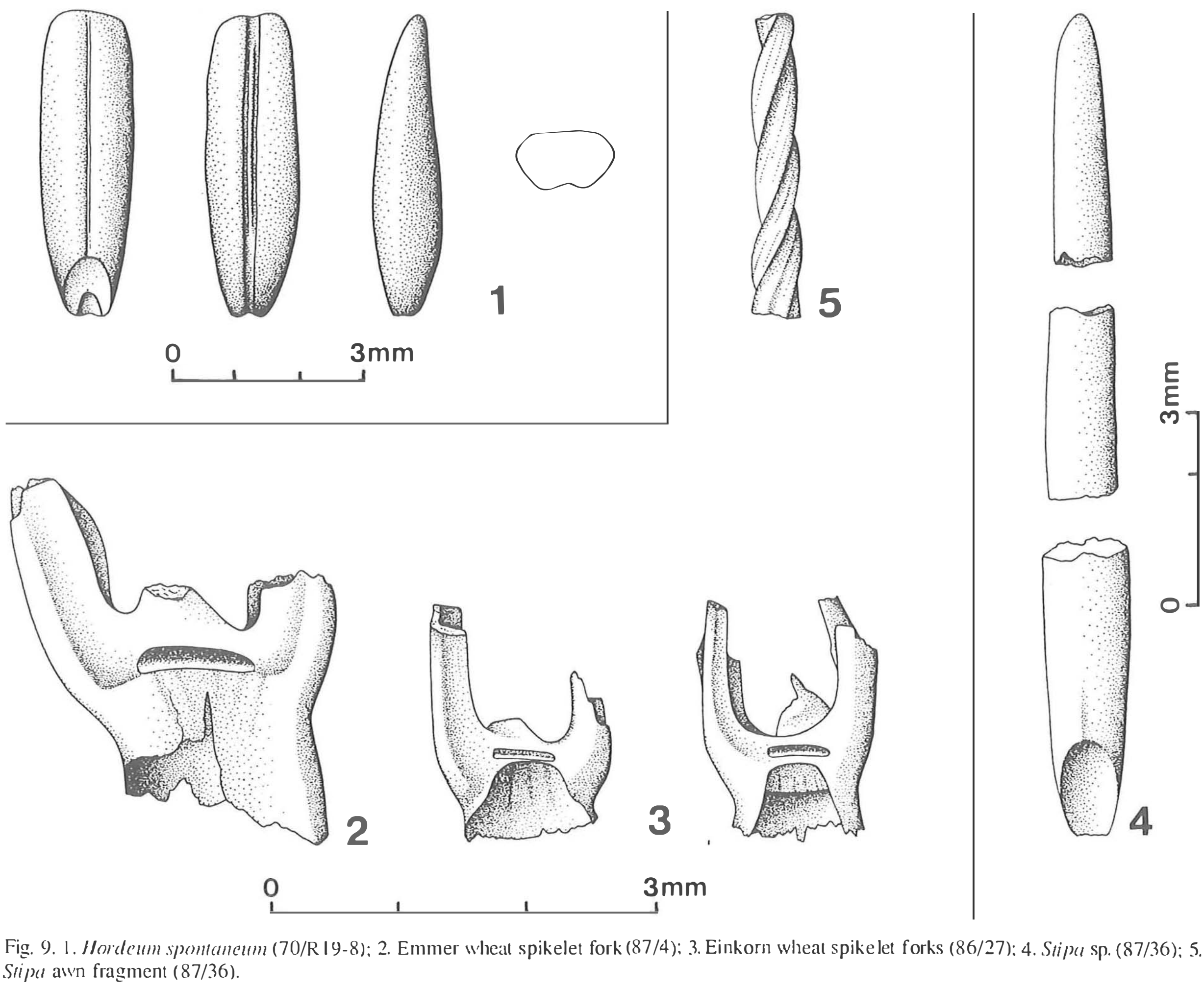

Fig. 9. 1. *Hordeum spontaneum* (70/R19-8); 2. Emmer wheat spikelet fork (87/4); 3. Einkorn wheat spikelet forks (86/27); 4. *Stipa* sp. (87/36); 5. *Stipa* awn fragment (87/36).

Table 9. Dimensions (in mm) and index values of two *Hordeum spontaneum* grains.

Sample no.	Sub-phase	Square	L	B	T	100 L/B	100 T/B
85/89	c	27L	5.9	1.5	0.9	393	60
70/R-19	bp	27L	4.8	1.4	1.0	343	71

alongside fields. The assumption of wild barley was mainly based upon the minimal representation. If the species had been cultivated, one would have expected more remains than two grain fragments. As the continuation of the botanical analyses resulted, among other things, in a slightly better representation of barley, the question arises whether the species could have been cultivated, if only as a minor crop. In principle the kernels as well as the rachis internode remains should allow a differentiation between *Hordeum spontaneum* and the domesticated two-rowed form *H. distichum*. Charred rachis internodes of the wild form should show an intact articulation scar. Not only the articulation scar but also the base of the internodes of brittle-rachised barley may be expected to be undamaged. In tough-rachised *Hordeum distichum* the ears stay intact until threshed, and in threshing, the rachis usually does not break up at the joints between the internodes. In charred archaeological material, two or more internodes may occur still adhering together or, what is more usual, internodes are found with the basal part of the next internode attached.

The kernels of both barley species are rather similar, but those of *Hordeum spontaneum* are characterized by their flatness; they are markedly thinner than those of *H. distichum*. Although modern grains of the two barley species can satisfactorily be separated, in charred archaeological specimens the distinction is often less clear, due to deformations through carbonization. Reasonably well-preserved barley grains from Çayönü remind one of those of *H. spontaneum* (fig. 9:1). The rachis internodes are strongly fragmented, but in various specimens an intact base can be observed (fig. 8:7). Thus, the grains as well as the rachis internode remains point to *H. spontaneum* and there is no convincing evidence of *H. distichum*. It goes without saying that various fragments did not allow a species determination. Two grains were suitable for measuring (table 9), but admittedly there is not much to compare with. The only other wild barley dimensions published so far are those for late-Palaeolithic Mureybit (van Zeist & Bakker-Heeres, 1984(1986)b: table 7).

One could hypothesize that morphologically defined wild barley had been cultivated. However, in that case one would have expected the domestic form in the upper aceramic occupation deposits, as it is assumed that the latter developed from the wild form as a result of cultivation. It is very unlikely that barley was cultivated at aceramic Çayönü. It is also doubtful whether it was gathered purposely, as in that case the remains should have been more numerous.

3.2. Pulses

3.2.1. *Field pea*

As usual, also the Çayönü peas show a fairly large variation in shape: more or less spherical seeds as well as those with one or two flat or indented sides occur. The seed coat has nearly always disappeared, but in a few specimens from Basal-pit samples (70/R-19 and R-20) a rough surface could be observed. A hand-picked mineralised pea from a Cell-house sub-phase context (70/U-9) has a smooth surface and it is the only specimen in which the oval hilum has been preserved. As a rough seedcoat is characteristic of wild pea, one wonders whether the peas that were initially cultivated were still of the wild type (*Pisum humile*), while peas with a smooth surface, characteristic of the domestic form (*Pisum sativum*), evolved only later. A similar development is suggested for the Çayönü emmer wheat (3.1.1). It cannot be ascertained whether the pods with the rough seed-walled (wild-type) peas were already of the non-dehiscent type (seed-retaining when mature).

The greatest dimension of peas from various levels is shown in table 10. As appears from this table, there are no significant differences in size between sub-phases. The mineralized specimen (not included in table 10), which measures 5.4 mm, is larger than any other measured Çayönü pea (maximum dimension 5.0 mm), suggesting that carbonization resulted in a decrease in size.

3.2.2. *Lentil*

As was to be expected, the Çayönü lentils are of the small-seeded type; only occasional seeds measure more than 3.0 mm in diameter. No increase in size is observed for the upper aceramic levels, and also the pottery Neolithic lentil seeds are very small on average (table 11). It cannot be ascertained whether lentil from the lower levels still had wild-type characters such as those recognized in emmer wheat and field pea.

3.2.3. *Bitter vetch*

The seeds of bitter vetch (*Vicia ervilia*) are obliquely pyramidal, with a triangular base on which the radicle

Table 10. Largest diameter of charred *Pisum* seeds. N is number of seeds measured.

Sample no.	Sub-phase	Square	N	Min.	Mean	Max.
70/U-5	lr	28-29/K-L	8	3.8	4.14	4.7
70/U-9	c	28-29/K-L	6	3.9	4.24	5.0
70/R-10	cp	27L	10	3.1	3.94	5.0
Various samples	ch	Various squares	11	2.8	4.04	4.6
70/R-19 R-20	bp	27L	9	3.8	4.16	4.6

Table 11. Diameter of *Lens (culinaris)* seeds. N is number of seeds measured.

Sample no.	Sub-phase	Square	N	Min.	Mean	Max.
Various samples	Pottery	27K	74	2.1	2.71	3.3
70/U-5	lr	28-29/K-L	22	2.1	2.59	3.0
70/S room	c	27-28/K-L	20	2.1	2.42	2.8
70/U-9	c	28-29/K-L	15	2.2	2.60	3.0
Various samples	cp	Various squares	8	2.4	2.90	3.4

Table 12. *Vicia ervilia* samples. Cell-plan sub-phase.

Square, feature	17N, house DF						17M
Sample number	85/40	85/24	85/46	85/51	85/56	85/57	85/58
Vicia ervilia	550	375	625	618	110	595	800
Lens	-	-	1	1	0.5	-	1
Pisum	4	1.5	1	-	0.5	1	1
Triticum boeoticum/monococcum	-	-	1	-	-	-	-
Triticum spikelet forks	-	3	2	4	5	8	40
Cereal grain fragments	-	-	x	x	-	-	xx
Pistacia fragments	-	x	x	x	x	x	x
Amygdalus fragments	-	-	-	x	-	-	-
Lolium	-	-	-	-	0.3	1	-

Table 13. Dimensions of *Vicia ervilia*. Cell-plan sub-phase. N = number of measurements.

		L	B	T
85/40	Min.	1.6	1.7	1.5
N = 35	Mean	2.06	1.95	1.93
	Max.	2.4	2.2	2.2
85/46	Min.	1.9	1.8	1.6
N = 35	Mean	2.19	2.07	2.00
	Max.	2.6	2.5	2.2
85/51	Min.	1.7	1.5	1.5
N = 40	Mean	2.19	2.09	2.01
	Max.	2.8	2.5	2.4
85/57	Min.	1.8	1.6	1.8
N = 25	Mean	2.14	2.01	1.99
	Max.	2.6	2.4	2.2
85/58	Min.	1.7	1.7	1.6
N = 40	Mean	2.21	2.07	2.04
	Max.	2.6	2.5	2.5

is located, and a round apex. As for the position of the measurements (table 13), length and breadth have been determined in the plane of the triangular base, while the thickness is the distance between the base and the apex. Bitter vetch seeds have been retrieved from a great number of samples.

Although in southeastern Turkey bitter vetch is found in the wild (Zohary & Hopf, 1973) and moreover weedy forms of this species occur, one may safely assume that bitter vetch formed part of the crop-plant assortment of the Çayönü farmers and that it was grown for human consumption. Convincing evidence of the intentional cultivation of bitter vetch and of its use as a human food plant is provided by the deposit of these seeds in the fill of house DF (square 17N) of the Cell-house sub-phase. The analyses of the samples from this deposit are presented in table 12. The contextual aspects of this find will be discussed in 5.3. In this section the following may be remarked.

The bitter vetch supply must have been conspicuously pure. The cereal remains and the nutshell fragments are probably of secondary origin, that is to say, that they had been mixed in during or after carbonization. The bitter vetch crop had been thoroughly cleaned of field-weed seeds and other contaminants. It is evident that this only makes sense if the bitter vetch was intended for human consumption. Before food preparation, the poisonous substance in the seeds had to be removed, which could simply be done by soaking in water. At present bitter vetch is grown only for stock feed.

The Çayönü bitter vetch seeds (table 13) are, on average, about 20% smaller than those from pottery Neolithic Erbaba, in southwestern Turkey (van Zeist & Buitenhuis, 1983: table 13).

3.2.4. *Other pulses*

Field pea, lentil and bitter vetch were commonly cultivated at aceramic Çayönü. Chickpea (*Cicer* sp.) and grass pea (*Lathyrus cicera/sativus*), on the other hand, must have played a much more modest role in the diet of the inhabitants of the site. The few wedge-shaped grass-pea seeds (fig. 10:6) are no evidence of intentional cultivation. The seeds may have been collected in the wild or the species may have occurred as a field weed. Dimensions of these seeds are: 3.6×4.5×3.4, 4.4×4.8×3.8 and 3.8×4.4×3.8 mm.

Chickpea (fig. 10:5) is slightly better represented. As with grass pea, it cannot be determined whether the seeds are of the domestic form, *Cicer arietinum*, or of a wild species, e.g. *Cicer reticulatum*, which is assumed to be the wild ancestor of cultivated chickpea and which is native to SE Anatolia (Ladizinsky & Adler, 1976). Chickpea is only scarcely recorded for the (early-) Neolithic of the Near East. Four fairly well-preserved seeds measure: 3.8×3.6×3.2, 5.4×4.1×3.2, 4.4×4.2×3.5 and 3.5×3.4×2.9 mm.

3.3. Linseed (flax)

Virtually all linseeds are from the 1970 campaign. Subsequent sampling for floral remains yielded only one linseed fragment. Moreover, by far the majority of the seeds (90 specimens) were retrieved from one sample attributed to the Cobble-paved house sub-phase (square 27L). The Çayönü linseeds are characterized by the beak (fig. 11:1). The dimensions of the seeds that were suitable for measurement (most seeds are damaged) are shown in table 14. As for the original size, it has been determined experimentally (Helbæk, 1959) and empirically (van Zeist & Boekschoten-van Helsdingen, 1991) that through carbonization linseeds shrink in length and breadth. Mean dimensions of 2.45×1.30 mm for the charred seeds point to an original size of at least 2.8×1.6 mm. The concentration in one of the samples suggests that the seeds in question had been collected purposely or perhaps had been cultivated. This brings us to the species identity of the linseeds. The earliest firm evidence of linseed cultivation is attested for Ramad in western Syria, dated to 7190-6700 BC (calibrated ^{14}C dates). On the basis of the size of the seeds it was concluded that domestic *Linum*

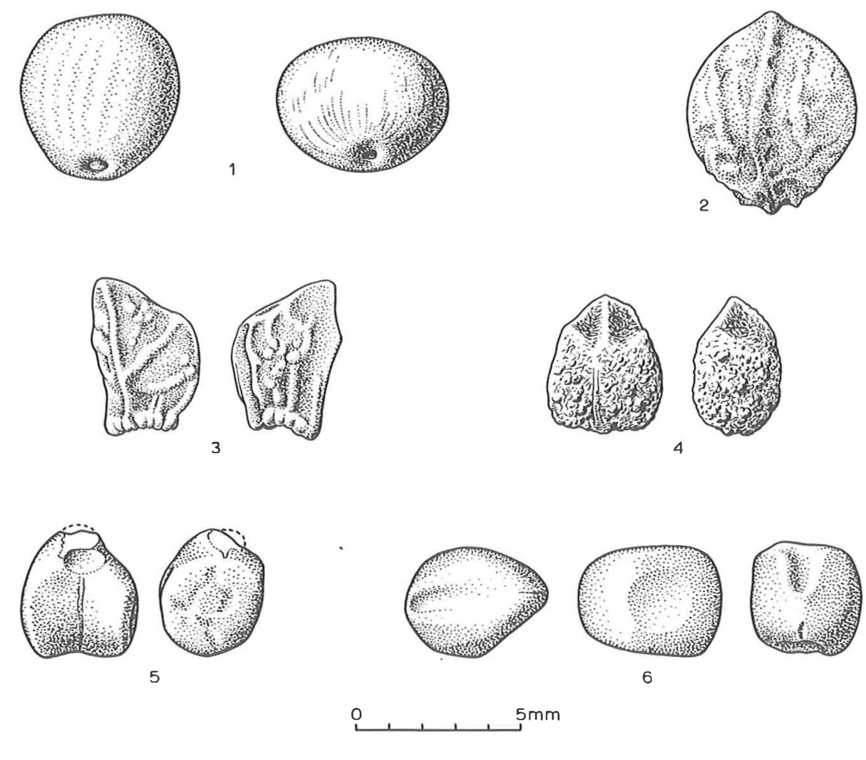

Fig. 10. 1. *Pistacia* sp. (70/R 4-1); 2. *Celtis* cf. *tournefortii* (70/S room); 3. *Anchusa* sp. (70/R 5-8); 4. *Chrozophora tinctoria* (70/R 14-2); 5. *Cicer* sp. (70/U 9-5); 6. *Lathyrus cicera/sativus* (70/R 10-3). After van Zeist (1972: fig. 7).

Table 14. Dimensions of linseeds. *Linum* cf. *bienne*, in mm (N = 12). Sample 70/R-10.

	L	B	100 L/B
Min.	2.2	1.1	172
Mean	2.45	1.30	189
Max.	2.6	1.5	207

Table 15. Dimensions of *Pistacia* nutshells in mm (N = 17). Sample 70/R-4.

	L	B	T	100 L/B
Min.	3.8	4.1	3.1	76
Mean	4.47	5.03	3.50	89
Max.	5.3	5.6	3.8	97

usitatissimum is concerned there. The length of the Ramad linseeds ranges from 2.8 to 3.6 mm, which after correction for shrinkage gives a measurement of 3.2 to 4.1 mm, with a mean value of 3.61 mm (van Zeist & Bakker-Heeres, 1975a, 1982(1985)). The size of the Ramad linseeds is typical of rain-fed agriculture. Under conditions of irrigation larger-sized seeds are obtained (Helbæk, 1959).

It is evident that the Çayönü linseeds cannot possibly be of *Linum usitatissimum*; they are much too small. An original mean size of 2.8×1.6 mm (see above) conforms to that reported for *Linum bienne* Mill. (syn. *L. angustifolium* Huds.): length 2-3 mm (Zohary, 1972), 2.4-2.7 mm (Helbæk, 1959), 2.6-2.7 mm (our own measurements). *L. bienne*, which is identified as the wild progenitor of *L. usitatissimum* (cf. Zohary & Hopf, 1988: p. 115), is widely distributed over the Mediterranean basin and the Near East. The species identification of the Çayönü linseed (*Linum* cf. *bienne*) remains uncertain as various other Near Eastern wild flax species have seeds which do not exceed 3 mm (cf. van Zeist & Bakker-Heeres, 1975). Flax remains (fragments of seeds and capsules) in samples from the earliest horizon of Ali Kosh, the Bush Mordeh phase, in southwestern Iran, are attributed by Helbæk (1969) to *Linum bienne*, on the basis of the dimensions.

The question of whether flax was gathered in the wild or cultivated must remain unanswered. It is tempting to hypothesize that the Çayönü farmers had pioneered with flax cultivation, but this is sheer speculation. We don't even know whether linseeds played a more than marginal role in the Çayönü plant husbandry. The find of 90 seeds in one of the samples may have been of an accidental nature.

3.4. Nuts and fruits

3.4.1. *Pistacia*

Pistacia nutshell fragments show the highest sample frequencies of all plant remains (tables 3 and 4). The 1970 campaign yielded intact nutshells (fig. 10:1); in some of them remains of the fruit flesh and fruit wall are still present. Intact nutshells were found only in Cell-house sub-phase samples from square 27L. Here large quantities of, mainly broken, pistachio nutshells (and almond fruit-stone remains, see 3.4.2.) must have been dumped in a large ash pit (see discussion in 5.3).

The nutshells are more or less laterally flattened and broader than long, which finds expression in L/B index values of less than 100 (table 15). In the 1972 publication it is stated that the remains are of *Pistacia atlantica* and not of *P. khinjuk*. However, it may be better not to specifically attribute the nutshells to one species or the other. Both *Pistacia* species are constituents of the present natural forest cover of southeastern Anatolia (see 1.1.2).

Appreciable quantities of *Pistacia* nutshell remains are reported for late-Palaeolithic (Abu Hureyra, Mureybit) and early-Neolithic sites in the Near East. The highly nutritive fruits (the fruit flesh is rich in fats) must have contributed essentially to man's diet. Fruits of wild *Pistacia* species are at present still sold in the markets (Zohary, 1972: p. 298).

3.4.2. *Amygdalus*

Only fragmented almond fruit-stones have been recovered. This is in itself no surprise, as the stones have to be broken to obtain the kernels which are rich in fats. Fresh wild almonds have a bitter taste and, moreover, are poisonous because in crushing and chewing the seed, prussic acid (hydrogen cyanide) is formed (cf. Zohary & Hopf, 1988: p. 161). The thick-walled fragments have a pitted and grooved surface and in some of them the lateral keel can be observed (fig. 12). The shape of some large fragments indicates that the stones must have had a length of about 2 to 2.5 cm.

The majority of the almond fruit-stone fragments derive from Cell-house sub-phase levels in square 27L, the same area which yielded the greatest quantities of *Pistacia* nutshell remains (see 3.4.1). Post-1970 field-work campaigns produced only modest numbers of almond remains. Was almond for one reason or another not much appreciated or did it not commonly occur in the area? Various *Amygdalus* species are reported for SE Anatolia (Davis, 1972: vol. 4).

3.4.3. *Vitis vinifera*

From various levels one or a few grape pips were recovered, some of them in a rather battered state. The shape of the better preserved pips conforms to that of the wild type, viz. fairly squat with a short stalk. Wild grape

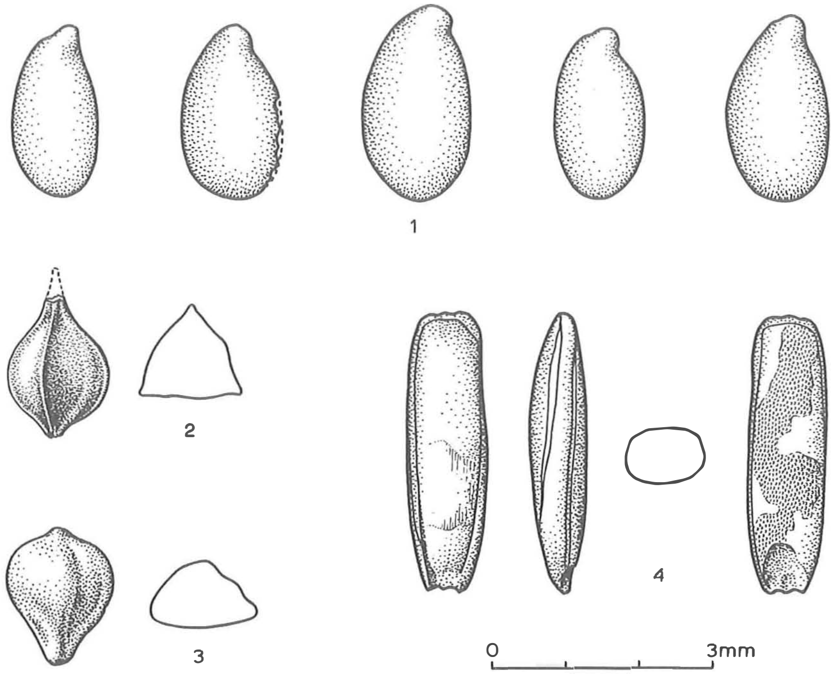

Fig. 11. 1. *Linum* cf. *bienne* (70/R 10-3); 2. *Rumex* sp. (70/S room); 3. *Scirpus maritimus* (70/R 20-9); 4. *Lolium perenne/rigidum* (70/R 15-0). After van Zeist (1972: fig. 6).

vines may have been found in thickets along streams. The berries are small and have an acid taste. Wild-type grape pips are reported for Chalcolithic Korucutepe, c. 50 km NNW of Çayönü (van Zeist & Bakker-Heeres, 1975b: fig. 7).

3.4.4. *Other fruits and nuts*

Only one *Ficus* (fig) pip was recovered from aceramic Çayönü; pottery Neolithic levels yielded a few more seeds (for illustration, see Ramad, fig. 30:1). It is likely that wild fig was hardly collected by the aceramic inhabitants, as otherwise more seeds might have been expected, seeing that each fruit contains a considerable number of pips. The distribution area of wild fig, *Ficus carica* s.l., includes SE Anatolia (Davis, 1982: vol. 7).

Two hackberry (*Celtis*) fruit stones were suitable for measurement: 6.3×5.3×5.0 and 6.2×5.6×5.4 mm. The stones are characterized by four longitudinal ridges and a rugose (coarsely wrinkled) surface structure (fig. 10:2). Most likely the Çayönü stones are of *Celtis tournefortii* Lam. (Davis, 1982: vol. 7). One wonders whether the scarce representation of this edible fruit could indicate that hackberry was not common in the area.

A few acorn (*Quercus* sp.) fragments suggest that these fruits were gathered by the inhabitants of the site, probably for human consumption. There is convincing evidence that in prehistoric Europe acorns played a part in man's diet. The tannin which causes the bitter taste can be removed by roasting the peeled acorns.

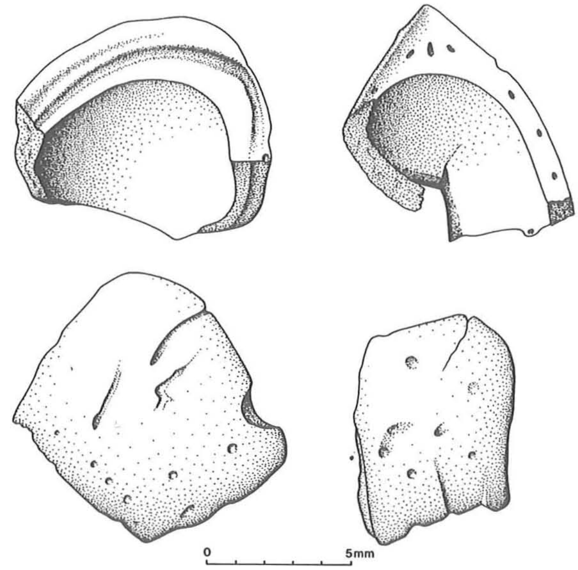

Fig. 12. *Amygdalus* nutshell fragments (70/R 4-1).

3.5. Gramineae

3.5.1.` *Lolium*

The *Lolium* grains are dorso-ventrally compressed, and oblong in outline (fig. 11:4). In some *Lolium* grains parts of the finely papillose enveloping bracts are still preserved. Most of the caryopses are broken; a few almost intact grains measure 4.0x1.4, 3.6x1.3 and 3.4x1.2

mm. *Lolium perenne* L. as well as *L. rigidum* Gaudin come into consideration. The latter is at present a common arable field weed (e.g. Jansen, 1986).

3.5.2. *Stipa*

One sample (87/36) yielded broken caryopses of *Stipa*, amounting to about five complete specimens. Figure 9:4 shows a reconstructed linear-cylindrical fruit. In addition, twisted *Stipa* awn fragments (fig. 9:5) were retrieved from a few samples. *Stipa* caryopses are reported for late-Palaeolithic Abu Hureyra (Hillman et al., 1989) and early-Neolithic Ganj Dareh Tepe (van Zeist et al., 1984(1986)). Körber-Grohne (1987) describes and illustrates *Stipa* awn remains from a Middle-Neolithic site in Germany.

Feathergrass species are typical of steppe vegetation.

3.5.3. *Echinaria*

Small, squat fruits, tapering at the embryo end and rounded-truncated at the apical end (fig. 13:1). *Echinaria capitata* (L.)Desf. is reported for SE Anatolia (Davis, 1985; vol. 9). This grass is only scarcely represented at Çayönü.

3.5.4. *Other Gramineae*

Agrostis-type: small (1.2 mm long), slender caryopsis.
Bromus: only broken grains.

3.6. Leguminosae

3.6.1. *Vicia sp. (vetch)*

Vetch seeds are among the most abundant plant remains at Çayönü (tables 3 and 4). The shape of the seeds is variable. Where (part of) the seed coat is preserved it shows a finely granular surface pattern. The dimensions of seeds in various samples are shown in table 16. The majority of the vetch seeds measure between 2.0 and 2.5 mm. Only occasional seeds are bigger than 3 mm. More

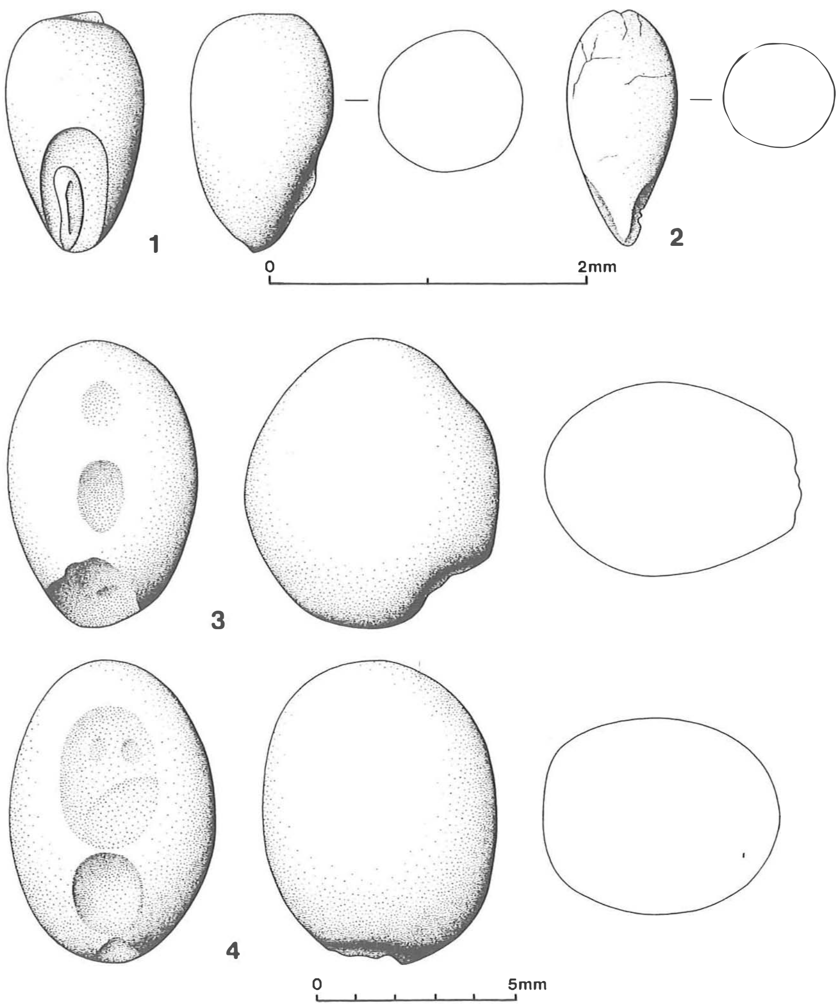

Fig. 13. 1. *Echinaria capitata* (87/45); 2. *Ziziphora* sp. (87/14); 3,4. *Lathyrus aphaca* type (86/6).

Table 16. Largest dimension (in mm) of *Vicia* sp. seeds. N is number of seeds measured.

Sample no.	Sub-phase	Square	N	Min.	Mean	Max.
86/6	cp	19L	14	1.7	2.27	3.3
70/R-15	ch	27L	13	1.8	2.25	2.5
70/R-19	bp	27L	15	1.8	2.10	2.5
70/R-20	bp	27L	25	1.4	1.96	2.4
87/36	bp	27L	11	1.3	1.94	2.3
70/G-8	g	27L	40	1.5	2.05	2.4

than one *Vicia* species may be represented. Vetch species may have expanded as weeds of cultivation. One wonders whether the great numbers of vetch seeds could be interpreted as evidence of the intentional collecting of these seeds for human consumption.

3.6.2. *Lathyrus aphaca type*

The seeds are elliptic in outline (fig. 13:3,4). Hilum and radicle are not preserved. Five seeds from sample 86/6 (Cobble-paved house sub-phase) measure 3.65(3.4-4.0)x3.09(3.0-3.2)x2.64(2.4-3.0) mm. At first we wondered whether a small, somewhat aberrant form of *Pisum* or perhaps a large-seeded *Vicia* was concerned. *Lathyrus aphaca* is a common weed of arable fields.

3.6.3. *Lathyrus hirsutus type*

One *Lathyrus hirsutus*-type seed, largest diameter 3.0 mm, was recovered. Characteristic of this type is the rugulose (wrinkled) seed coat.

3.6.4. *Other Leguminosae*

Astragalus: Ramad, fig. 28:7,8.
Medicago sp.: Ramad, fig. 28:4.
Medicago radiata: Ramad, fig. 28:1.
Melilotus: Ramad, fig. 28:9,10.

3.7. Other wild plant taxa

3.7.1. *Chrozophora*

This type is listed as cf. Boraginaceae in the 1972 publication. The squat, angular seeds are pointed at the upper end and have a warty surface (fig. 10:4). The dimensions of 6 specimens are 4.2(3.9-4.4)×3.5(3.4-3.6)×2.8(2.7-3.0) mm. *Chrozophora tinctoria* (L.)A.Juss (Euphorbiaceae family) occurs as a field weed.

3.7.2. *Galium*

Hemispherical fruits, with a round concavity on the ventral side. The size of 12 specimens varies from 1.1 to 2.9 mm. Probably more than one species is represented.

Table 17. Dimensions in mm and index values of '*Lycium* type''s seeds.

		L	B	T	100 L/B	100 T/B
87/14	Min.	2.4	1.9	0.8	68	23
N=50	Mean	3.35	2.79	1.16	122	43
	Max.	4.2	3.8	1.7	154	72
87/13	Min.	2.3	1.8	0.6	94	21
N=20	Mean	3.06	2.55	1.04	121	43

3.7.3. *'Lycium type'*

Well-preserved specimens of this enigmatic seed type are flat, broadly obovate in outline, and obliquely pointed at the base (fig. 14). Due to carbonization the seeds are often misshapen. In a few specimens parts of a pitted seed wall have been preserved (fig. 14:4). The dimensions of this seed type are presented in table 17. The wide range in the L/B and T/B index values illustrates the variation in the shape of the seeds.

In the course of the investigation various possible identifications have been considered, such as *Sorbus*, *Pyrus*, a member of the Solanaceae family, *Ranunculus* and *Lonicera*. However, none of them fits. This type was found in a fair number of samples, particularly in those from the Channelled-house sub-phase (table 4). In one sample (87/14, table 23) more than a thousand specimens were counted, which makes one suspect that the seeds, or the fruits which may have contained the seeds, were collected purposely.

3.7.4. *Scirpus maritimus L.*

Nutlets obovate in outline, tapering towards the base. The ventral side is more or less flat, while the dorsal side is roof-shaped (fig. 11:3). Surface is smooth. Dimensions of 8 fruits are 1.8(1.6-2.0)×1.4(1.3-1.6) mm. Although the scientific and colloquial names of this species suggest that it is confined to more or less saline habitats, Near Eastern *Scirpus maritimus* (sea club-rush) occurs also in fresh-water swamps.

Due to an incorrect identification of modern cyperaceous fruits from a Turkish provenience, in the 1972 publication this fruit is indicated as *Cyperus* sp. Near Eastern *Scirpus maritimus* nutlets are markedly smaller than those from western Europe.

3.7.5. *Ziziphora*

Fruits obovate in outline, apical end rounded, pointed at the base, with conspicuous basal depressions (fig. 13:2). One sample (87/14, table 23) yielded a comparatively great number of *Ziziphora* fruits. Dimensions of 8 specimens: 1.4(1.3-1.5)×0.6(0.5-0.7) mm.

A few *Ziziphora* species are reported for Turkey (Davis, 1982: vol. 7).

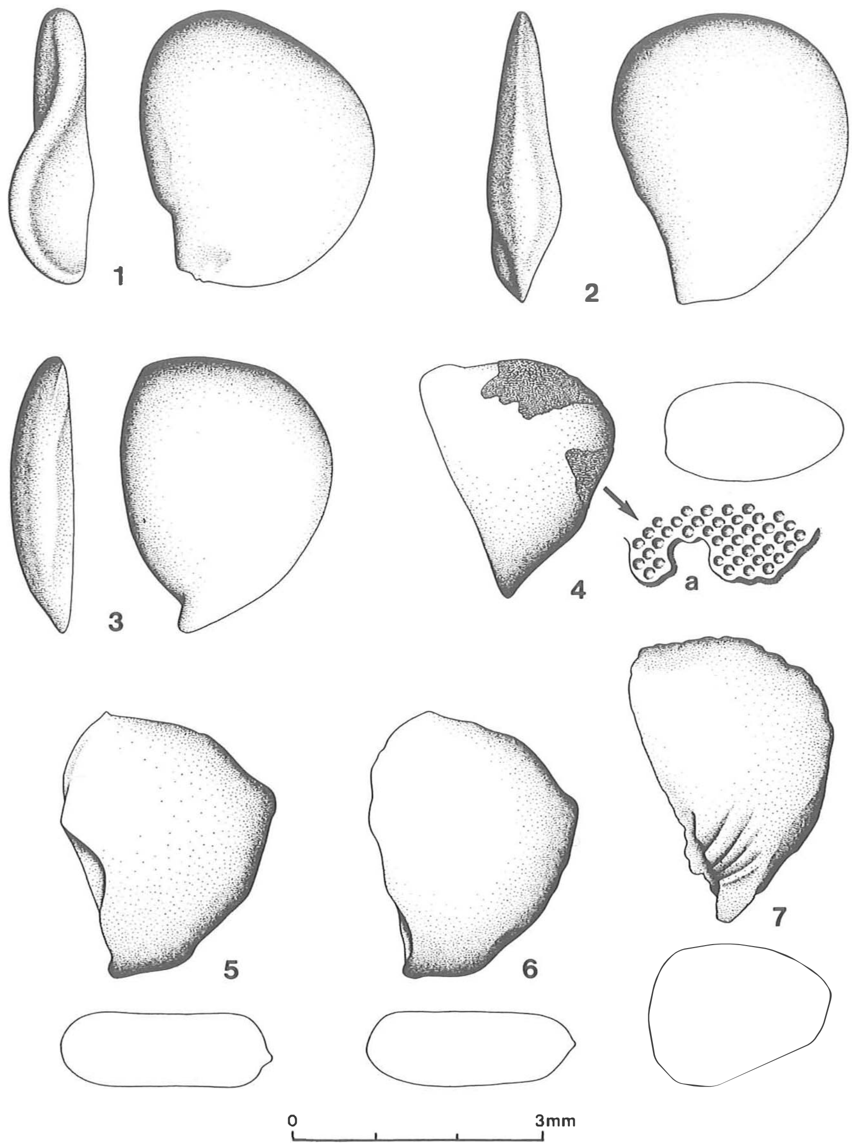

Fig. 14. '*Lycium* type'. 1-4,7. (87/14); 5,6. (86/71). Detail of wall surface structure is shown in 4a.

3.7.6. *Rarely occurring types*

Adonis: Ramad, fig. 30:9,10.
Anchusa: this publication, fig. 10:3, 5.0×3.3×2.6 mm.
Fumaria: Korucutepe, fig. 8:6; Ramad, fig. 30:2.
Helianthemum: cf. Ramad, fig. 23:6.
Lithospermum tenuiflorum: Ramad, fig. 22:6,7.
Malva: Ramad, fig. 24:11.
Plantago lagopus type: Ramad, fig. 30:5.
Polygonum corrigioloides type: Ramad, fig. 30:7.
Ranunculus arvensis type: cf. Korucutepe, fig. 8:8.
Rumex: this publication, fig. 11:2, c. 2.0×1.4×1.4 mm.
Silene: Ramad, fig. 23:4.
Thymelaea: Ras Shamra, fig. 7:12.
Vaccaria: half a seed; Ramad, fig. 24:3.
Verbascum: seed, 0.8x0.6 mm; van Zeist & Waterbolk-van Rooijen, 1985: fig. 4:4.

4. CHARCOAL ANALYSIS

No systematic charcoal identifications have been carried out. The majority of the identifications of material of the 1970 campaign are for hand-picked samples, partly destined for radiocarbon dating. In most of the flotation samples the wood charcoal pieces are too small or of too poor quality to allow an identification. The structure of the wood had often seriously been affected by carbonization. The sample frequencies of the wood types demonstrated are shown in table 18; unidentified charcoal is not included. Almost all samples which yielded identifiable charcoal are from the eastern excavation area.

The *Tamarix* identifications reported in the 1972 publication turned out to be incorrect. In preparing the present publication some doubt arose whether the

Table 18. Charcoal analysis. Numbers of samples in which the wood types identified were found.

Sub-phase	*Quercus*	*Pistacia*	Rosaceae	*Fraxinus*	*Lycium*
Cell house	1	1	-	2	-
Cobble-paved house	2	-	1	6	-
Channelled house	8	4	-	2	1
Basal pits	2	2	4	-	-
Grill house	1	1	1	-	-

Fraxinus identifications made in the field in 1970 are all correct, but this could not be checked any more. On the other hand, in one of the samples examined later, within the framework of the present study, *Fraxinus* could be established. The Rosaceous wood could be of *Amygdalus*, but other taxa, e.g. *Crataegus*, come also into consideration.

From table 18 it is clear that the data are altogether insufficient for a quantitative evaluation. They show us only which kinds of timber were used by the occupants of the site, either for building purposes or for fuel. *Pistacia atlantica* as well as *P. khinjuk* are to be expected in the surroundings of aceramic (early-Holocene) Çayönü. Apparently the fact that *Pistacia* yielded much appreciated fruits did not prevent people from cutting down trees. May we assume that there were enough? *Quercus brantii* is a deciduous oak species which very likely was found in the Çayönü area, but more oak species come into consideration, e.g. *Quercus boissieri* and *Q. infectoria*. *Fraxinus rotundifolia* is a constituent of the mixed-oak woodland which under the present climatic conditions would be the natural vegetation of the Çayönü area (1.1.2). It may be too far-fetched to see in the *Lycium* wood charcoal identification an indication that the enigmatic '*Lycium*-type' seed (see 3.7.3) is indeed of *Lycium*.

No coniferous wood has been demonstrated for Çayönü; *Juniperus oxycedrus* forms part of the SE Anatolian mixed-oak woodland.

5. THE INTERPRETATION OF THE DATA

5.1. Introduction

From the discussion of the plant remains in section 3 it will be clear that emmer wheat and einkorn were the predominant if not the only cereals of aceramic Çayönü, while lentil, field pea and bitter vetch were the main pulse crops. Wild vetch seeds (*Vicia* sp.) could have been an additional source of vegetable proteins. Wild pistachio (*Pistacia atlantica/khinjuk*) must have been a major source of vegetable fat, supplemented by wild almond and perhaps by linseed (*Linum* cf. *bienne*). Shifts in the frequencies of food-plant remains could have been the result of dietary changes, e.g. the (partial) replacement of one crop plant by another or changes in meat consumption, implying an increased or decreased proportion of animal protein and fat in the diet. Changes in plant husbandry should find expression in changes in the archaeological plant record through time (the chronological distribution). In addition, the spatial (horizontal) distribution of plant remains could in principle inform us about the occurrence and location of crop-processing/food-preparation areas (so-called activity areas), whether or not associated with archaeological features.

It is evident that for determining possible differences in the spatial and chronological distribution of plant remains, a fairly equal representation of the various occupation phases and areas excavated in the archaeological plant record is desirable. Unfortunately, as appears from figure 6, in which the numbers of samples which yielded plant remains other than wood charcoal are shown per square, this condition cannot in any sense be met. Only for a few squares is an appreciably great number of samples available. Moreover, as has already been mentioned, many of the samples yielded only insignificant numbers of plant remains. The above implies a considerable limitation to the degree of detail to be obtained from the Çayönü plant record. In general only some broad generalizations can be made.

5.2. The chronological and spatial distribution of plant remains

For a discussion of the chronological and spatial distribution of plant remains only species and groups of species which are more than occasionally represented in the archaeological record are of importance. Seed and fruit types which occur in one or a few samples with one or two specimens are not of relevance for speculations of this kind. This means that many of the taxa demonstrated for Çayönü can be left out of consideration here. As a matter of fact, food plants are by far the best represented taxa.

The chronological distribution of plant remains will be discussed at the level of the occupation sub-phase. Thus, the samples attributed to a particular sub-phase are taken together. This procedure generally results in satisfactorily greater numbers of samples and quantities of plant remains, although the upper aceramic occupation sub-phases remain poorly represented. To facilitate the comparison between sub-phases, in table 19 the mean numbers of seeds and fruits per 10 samples are shown. Moreover, morphologically wild and domestic forms of both einkorn wheat and emmer wheat have been lumped (tables 3 and 4 provide the more detailed information). As for the spatial distribution, the western and eastern areas will be compared with each other, again at the level of the occupation phase (table 20). The highly uneven distribution of the samples examined prevents the establishment of possible plant distribution

Table 19. Densities of seeds etc. in occupation sub-phases, expressed as mean numbers per 10 samples.

Sub-phase	r	g	b	ch	cp	c	c/lr	lr
Excavation area	E	E+W	E	E+W	E+W	E+W	E	E
Number of samples	16	32	23	41	38	67	8	5[6]
Triticum boeoticum + *monococcum*	-	1.3	4.0	3.1	1.8	1.3	1.3	-
Triticum dicoccoides + *dicoccum*	-	1.6	5.9	5.4	0.8	5.4	2.5	-
Triticum spikelet forks	5.6	77.2	108.3	225.6	130.8	38.8	15.0	-
Hordeum grains	-	0.3	0.8	1.0	0.1	0.3	-	-
Hordeum rachis internodes	-	0.9	0.9	2.0	0.8	0.1	-	-
Σ Cereal grains	x	3.5	11.1	9.6	3.2	7.2	3.8	-
Pisum	-	4.8	13.5	11.3	9.1	6.4	3.8	74.0
Lens	0.6	1.3	0.7	2.0	6.7	11.1	1.3	186.0
Vicia ervilia	-	4.2	21.5	17.9	27.2	25.0[4]	1.3	7.0
Σ Pulses	0.6	10.3	36.1	32.3	43.3	43.7[5]	6.3	267.0
Pistacia[1]	xx	xx	xx	xx	xx	xxx	xx	x
Amygdalus[1]	x	x	x	x	x	xx	x	-
Vicia sp.	8.4	53.9	78.5	42.1	31.1	21.2	3.8	x
Other Leguminosae	1.3	1.5	0.9	4.1	5.5	0.4	0.6	-
Lolium	0.6	1.9	5.9	3.6	1.3	1.2	-	-
Other Gramineae	1.6	3.1	5.0	2.9	3.4	1.2	1.3	-
Scirpus maritimus	0.6	1.6	8.7	2.2	1.6	0.8	-	-
Chrozophora	-	0.6	1.1	1.7	-	0.6	-	-
Galium	-	0.6	1.3	0.4	0.5	1.0	1.3	-
Ziziphora	-	0.6	-	14.1[2]	0.3	0.3	-	-
'*Lycium* type'	0.6	-	9.6	81.0[3]	6.1	0.2	-	-

[1]Estimates based upon quantities of nutshell remains and sample frequencies: x present; xx fairly common; xxx common
[2]Almost all seeds in one sample (see table 23)
[3]Sample with 1170 seeds (see table 23) not included (N = 40)
[4]*Vicia ervilia* deposit samples (see table 12) not included (N = 60)
[5]Corrected for *Vicia ervilia* deposit samples
[6]Four samples from inside same house (see table 24)

patterns, apart from a few concentrations of plant remains to be discussed below (5.3).

The volumes of soil floated have not always been recorded, but an overall average of 25 litres of soil per sample should be a fair estimate. This would imply that the numbers shown in tables 19 and 20 are those per 250 litres of soil, on average.

Our initial intention was to discuss the chronological and spatial distribution of the floral remains separately, but this turned out to be unpractical.

From the lowermost occupation levels, the Rounded-hut sub-phase, conspicuously few cereal- and pulse-crop remains were recovered: some chaff and cereal grain fragments and one lentil. These numbers are so low that one could question whether wheat and lentil had been food plants of the earliest occupants of the site. Could the few remains of these plants have originated from the overlying Grill-house sub-phase levels, in which, as is shown in table 19, cereals and pulses are, on average, better represented? This suggestion is invalidated by the fact that Grill-house sub-phase samples from the eastern area, to which the rounded huts are confined, yielded relatively few cereal remains and only one pulse-crop seed (table 20). Thus, these levels were not a particularly rich source of charred plant remains to be carried downwards (through the activity of man and burrowing animals). By far the most numerous plant remains in the rounded hut samples are *Pistacia* nutshell fragments, suggesting that pistachio fruits were gathered intensively. Admittedly, the tough nutshells may have had better chances of being preserved than cereal grains and pulse seeds, but if the latter had played a substantial role in the food economy, a better representation in the archaeological plant record might be expected. Thus, it is tempting to speculate that cereals and pulses, wild or cultivated, were at most of minor importance in the earliest stages of occupation. Be this as it may, the floral record of the Rounded-huts sub-phase is clearly distinct from that of the succeeding sub-phases.

The Grill-house sub-phase plant record, taken as a whole, provides a picture comparable to that of most other occupation sub-phases in that pulse-seed frequencies are higher than those of cereal grains. There are two differences: distinct *Triticum dicoccum*-type grains are lacking and the seed densities (numbers of plant remains per volume of soil) are still comparatively low. The low mean seed density is mainly accounted for by the eastern area (table 20). Pulse-crop and wild vetch (*Vicia* sp.) frequencies show the most conspicuous

Table 20. Densities of seeds etc. in occupation sub-phases itemized per excavation area, expressed as mean numbers per 10 samples.

Sub-phase	g		ch		cp		c	
Excavation area	E	W	E	W	E	W	E	W
Number of samples	17	15	21	20	24	14	20	47
Triticum boeoticum + *monococcum*	0.6	2.1	1.2	5.0	1.5	2.5	2.0	1.0
Triticum dicoccoides + *dicoccum*	0.5	2.7	4.9	6.0	0.4	1.4	17.5	0.2
Triticum spikelet forks	68.2	87.3	61.0	398.5	105.8	173.6	39.5	38.5
Hordeum grains	0.5	-	1.9	0.2	-	0.2	0.5	0.3
Hordeum rachis internodes	1.8	-	1.0	3.0	0.4	1.4	0.5	-
Σ Cereal grains	2.2	4.9	8.0	11.2	1.9	5.6	20.0	1.7
Pisum	0.6	9.7	9.8	13.0	13.5	1.4	13.8	3.3
Lens	-	2.7	0.7	3.3	2.5	13.9	29.5	3.2
Vicia ervilia	-	9.0	15.0	21.0	20.0	39.6	46.3	14.5[4]
Σ Pulses	0.6	21.3	26.0	39.0	36.5	55.0	91.0	22.0[5]
Pistacia[1]	xx	xx	xx	xx	xx	xx	xxx	xx
Amygdalus[1]	x	x	x	x	x	x	xx	x
Vicia sp.	9.7	104.0	32.1	52.5	19.0	51.8	60.5	4.5
Other Leguminosae	1.2	1.9	0.5	8.0	2.1	11.4	0.8	0.2
Lolium	0.9	3.0	2.4	4.9	-	3.6	2.0	0.8
Other Gramineae	1.2	5.3	1.2	4.8	4.6	1.4	2.3	0.7
Scirpus maritimus	1.2	2.0	3.3	1.0	1.3	2.1	2.8	-
Chrozophora	-	1.3	1.0	2.5	-	-	2.0	-
Galium	-	1.3	-	0.8	-	1.4	3.0	0.1
Ziziphora	-	1.3	-	29.0[2]	0.4	-	1.0	-
'*Lycium* type'	-	-	-	170.5[3]	-	16.4	-	0.3

[1]Estimates based upon quantities of nutshell remains and sample frequencies: x present; xx fairly common; xxx common
[2]Almost all seeds in one sample (see table 23)
[3]Sample with 1170 seeds (see table 23) not included (N = 19)
[4]*Vicia ervilia* deposit samples (see table 12) not included (N = 40)
[5]Corrected for *Vicia ervilia* deposit samples

differences between the eastern and western areas. Low seed densities are sometimes explained as the result of open and/or short-lasting occupation. There is a relation between the density of the botanical record and the number of people who lived in a certain area during a certain period of time: the more people there are, the more refuse is produced. Such an explanation does not apply to the Çayönü Grill-house sub-phase. Judging from the numbers of houses uncovered so far, the eastern area must have been inhabited at least as densely as the western one (see Schirmer, 1990: fig. 2). As a matter of fact, the question of what may have caused marked differences in quantity and quality of floral remains between sites and within a site has not yet really been tackled. We are still in the dark about the taphonomic processes which ultimately resulted in the incorporation and preservation of seeds, fruits, charcoal and other plant particles in occupation deposits.

Most curious is the near absence of pulses in the eastern area. Should one believe that during the Grill-house sub-phase there were marked differences in consumption pattern between the two areas? The comparatively high vetch seed densities from the Grill-house sub-phase onwards make one wonder whether these wild leguminous seeds were gathered for human consumption.

Botanical information on the Basal-pits sub-phase is available only for the eastern area. The densities of almost all categories of plant remains are significantly higher than those of the Grill-house sub-phase, which is even more pronounced if the comparison is confined to the eastern area. Morphologically defined *Triticum dicoccum* could be established with certainty for this sub-phase. Should there be a final attribution of the basal pits to the Channelled-house sub-phase, this would be supported by the botanical evidence: there is a fair resemblance between the floral records of the Basal-pit and Channelled-house samples. On the other hand, from a botanical point of view there is no serious objection to the idea of a separate Basal-pits sub-phase, with the understanding that a return to housing in subterranean huts did not result in a more primitive type of subsistence economy, i.e. with a reduced reliance on plant cultivation.

A characteristic feature of the Çayönü plant husbandry is the predominant role of pulses. In almost all occupation sub-phases, pulse-seed frequencies are much higher than those of cereal grains. It is true that wheat chaff remains are very numerous, but these represent crop-processing waste not destined for human consumption. In prehistoric and early-historical sites cereal grains are usually much more numerous than pulse seeds. This has raised the question whether cereals have better chances of being preserved in a carbonized condition than pulses. Be this as it may, one may safely assume that leguminous plants played a prominent part in the diet of the aceramic inhabitants of the site. It is striking that this tradition persisted for a very long time. Also in the pottery Neolithic samples, pulse-crop seeds outnumber cereal grains by far.

As has already been mentioned, the archaeobotanical record of the Channelled-house sub-phase shows considerable resemblance to that obtained for the Basal-pits levels. The greater density of chaff remains is wholly accounted for by the western area, with a five times higher density than in the eastern area. Could this indicate that during the Channelled-house occupation sub-phase the western area witnessed more crop-processing (dehusking) activities than the eastern one, for instance, because the former area had more the function of a living quarter than the latter one with the skull building? '*Lycium*-type'shows a concentration in house DI, square 20L (see table 23 and discussion in 5.3), which accounts for the high mean density, also after correction for the sample in which more than 1000 specimens were counted. The distribution of '*Lycium*-type' seeds is almost as enigmatic as the species identity of this type itself. Large numbers of seeds and a high sample frequency are characteristic of the Channelled-house sub-phase levels in the western area (table 20) and not a single specimen in contemporary levels in the eastern area.

The floral record of the Cobble-paved house sub-phase suggests a shift in the cereal-grain and pulse-seed proportions. In the previous occupation sub-phases the ratio between cereals and pulses is about 1 to 3, but in this sub-phase the density of pulse seeds is more than ten times higher than that of cereal grains, although this ratio may be somewhat exaggerated due to the abnormally low emmer-wheat density. This shift in favour of pulses is manifest in both the eastern and western areas, so that one may assume that there was a real reduction in the contribution of cereals to the diet of the Çayönü inhabitants. The reason for this change is puzzling, particularly because it is not clear which other food sources could have substituted for the carbohydrates of the cereals. In the Cobble-paved house sub-phase wild emmer-type grains have disappeared, but admittedly it is not clear how this should be interpreted (see 3.1.1). The increased lentil density is largely accounted for by the lentil seeds in the western area. The western area has a significantly higher chaff density than the eastern one, but the difference is not so large as in the preceding sub-phase.

In the Cell-house sub-phase the ratio between total cereal-grain and pulse-seed densities (about 1 to 6) is again distinctly higher than in the early stages of occupation, suggesting that the shift to a greater reliance on pulse crops established for the Cobble-paved house sub-phase was not of a temporary nature, but that it persisted. The determination of the *Vicia ervilia* densities is somewhat complicated by the bitter vetch deposit in and near house DF, in the western area (see discussion in 5.3). The almost pure bitter vetch samples from this deposit are not included in the calculation of the densities of this seed type. In determining the total pulse-seed densities a correction is made for these bitter vetch samples. The mean density for emmer-wheat grains is much higher than in the previous sub-phase and again at the level of the Channelled-house and Basal-pit samples. One should perhaps be wary of concluding that there was a temporary decline in the economic importance of emmer wheat in the Cobble-paved house sub-phase. It cannot be excluded that the scarce representation of emmer-wheat grains in the latter sub-phase is due to accidental factors. Moreover, in this sub-phase wheat-chaff frequencies are certainly not low. Curiously, the eastern and western areas of the Cell-house sub-phase show greater difference in mean emmer-wheat densities (table 20) than there is between the Cobble-paved and Cell-house sub-phases (table 19). One wonders what explanation there could be for the striking differences in seed densities between the eastern and western areas of the Cell-house sub-phase. The usually low numbers of plant remains coupled with an unequal sample distribution may, in some instances, have resulted in inaccurate quantitative information. Only changes in food-plant proportions which embrace more than one occupation sub-phase should be considered as indicative of changes in plant husbandry.

It is evident that the botanical information available for the upper two occupation sub-phases is altogether insufficient for drawing conclusions. From deposits attributed to the Cell/Large-room transition sub-phase only 3 cereal grains and 5 pulse seeds were recovered in addition to a few seeds of wild plants. It is unlikely that during the final aceramic occupation sub-phase only pulse crops and no cereals would have been cultivated. Four of the five samples are from the fill of the same house (see 5.3) and the fifth sample is almost devoid of plant remains.

The scarcity of botanical information for the youngest aceramic sub-phases must, to a large extent, be due to the fact that in the upper levels of the site usually few plant remains are preserved. As a result of alternating wetting and drying of the upper layers during hundreds and thousands of years the charred plant remains have disintegrated.

In conclusion it can be remarked that the Çayönü archaeobotanical record provides evidence of some changes in the food-plant exploitation in the course of the aceramic occupation. Differences in floral remains between the eastern and western excavation areas may reflect intra-site differences in plant use and/or food-processing activities, but speculations of this kind should be considered with due reservation.

5.3. The plant record in relation to context

One of the questions that are put to the archaeobotanist is whether a relation between archaeological features and the composition of plant remains recovered from these features can be established and if so, what such a relation may mean. In other words, do the plant remains provide further information on the function of the feature or, alternatively, do they correspond to what was expected by the archaeologist (and botanist) on the basis of the kind of feature? Obvious archaeological features on the function of which the archaeobotanist is expected to provide information include jars, storage pits and ovens (what has been stored or prepared?). Unfortunately, the interpretation of possible plant remains obtained from such features in terms of the function of the latter is less clear-cut than one would wish. Moreover, features of this kind are either not to be expected in aceramic Çayönü (jars) or have not been unearthed or sampled for botanical examination (only two samples are reported to derive from a bin, see below). As a matter of fact, the roasting pits from the lower occupation levels are distinct features, which, as it were, call for a botanical evaluation. This topic will be discussed in the next section (5.4).

The most obvious features at Çayönü are the house plans. In a first attempt to get some hold on possible correlations between the composition of plant remains and archaeological context, it was considered whether a comparison between houses makes sense. Are there archaeobotanical differences between houses which could be explained in terms of socio-economic differentiation within the site or, for instance, between the 'public' ritual skull building and the other, domestic buildings? This approach turned out to be unpromising. One of the reasons why this approach failed may have been that in general the samples from inside house plans have no direct bearing on the occupation of the house concerned. Inspection of the field data showed that many samples are from contexts which very likely date from before or after the occupation. The remains of a bitter vetch supply in house DF is a notable exception. It will be discussed below.

In the majority of the samples that yielded more than a few plant remains, typical refuse, such as chaff (glume bases, spikelet forks, rachis internodes) and *Pistacia* nutshell fragments, is most common, with occasionally a fair number of seeds of cultivated species or wild plants. The botanical contents are usually of mixed origin, that is to say, the plant remains derive from various household activities. Specific activity areas with respect to food plants, such as areas for storage and processing, are only seldom indicated by the archaeobotanical record. As a case in point, table 21 shows the contents of an 'ash deposit' in square 20M, attributed to the Channelled-house sub-phase (ch3). This example is illustrative of many of the Çayönü samples, with the understanding that the actual botanical composition varies considerably.

The botanical contents of an ash pit from square 27L, attributed to the Cell-house sub-phase (c3), differs from other refuse deposits in that chaff is almost absent (table 22). Apparently the dehusking of einkorn and emmer wheat was not carried out in the direct vicinity of this ash pit. *Pistacia* and *Amygdalus* nutshell remains are predominant by far. Even complete pistachio nutshells were recovered from the fill of this pit (fig. 10:1). Estimates of the numbers of whole pistachio and almond nutshells are presented in table 22. What is the explanation for the extraordinarily large quantities of nutshell remains? As for almond, one could imagine that the stones were cracked to retrieve the edible contents, after which the shells were thrown in the refuse pit which was periodically set afire. In wild pistachio, it is the fruit flesh that was consumed or from which the oil was extracted. Could it be that the fruits,

Table 21. Samples from ash deposit in square 20M, sub-phase ch3.

Sample number 1986/	30	38	29	23
Triticum monococcum	-	2	-	-
Triticum dicoccum	-	2	0.5	-
Triticum spikelet forks	87	89	66	4
Hordeum rachis internodes	-	4	-	-
Cereal grain fragments	xx	xx	-	x
Lens	-	1.5	-	-
Vicia ervilia	1	17	2	1
Pulse grain fragments	-	-	-	x
Vitis	-	-	1	-
Pistacia	x	xx	x	x
Vicia sp.	-	5	3	1
Vicia fragments	-	xx	-	-
Lolium	-	-	1	-
Unident. Gramineae	1	-	-	-
Unident. Compositae	-	1	-	-
Unident. Umbelliferae	-	1	-	-
'*Lycium* type'	1	9	27	1

Table 22. Numbers of seeds and fruits retrieved from five samples from 'ash pit' 70/R 5-8 (square 27L, sub-phase c3). In brackets numbers of samples in which taxon is represented. Of *Pistacia* and *Amygdalus*, numbers of whole nutshells are estimated (on the basis of weight).

Triticum monococcum	1	(2)
Triticum dicoccum	c. 18	(4)
Triticum spikelet forks	1	(1)
Pisum	2.5	(2)
Lens	2	(1)
Vicia ervilia	c. 27	(4)
Vicia sp.	6	(2)
Unident. Leguminosae	2	(1)
Pistacia	c. 256	(5)
Amygdalus	c. 16	(5)
Quercus	c. 0.5	(2)
Lolium	1	(1)
Galium	3	(2)
Anchusa	1	(1)
Unidentified	1	(1)

Table 23. Samples from ash deposits in Channelled-house (ch3) DI. square 20L.

Sample number	1987/ 6	13	14	29	1986 / 71	79	86
Triticum boeoticum	-	-	-	6	-	1	-
Triticum monococcum	-	-	-	-	-	1	-
Triticum dicoccum	-	-	-	-	-	1	-
Triticum spikelet forks	49	88	111	127	10	85	6
Unident. rachis internodes	-	-	-	-	-	3	-
Cereal grain fragments	xx	xx	xx	xx	-	xx	x
Pisum	-	-	16	-	-	2	3
Vicia ervilia	2	-	2.5	4	0.5	-	-
Lathyrus cicera/sativus	-	1	-	-	-	-	-
Pulse grain fragments	x	x	-	x	-	-	-
Pistacia fragments	xx	xx	-	xx	x	xx	xx
Amygdalus fragments	x	x	x	-	-	-	-
Vicia sp.	2	5	24	21	2	-	0.5
Vicia fragments	-	xx	xxx	-	-	xx	-
Lolium	-	0.5	1.5	1.3	-	4	-
Bromus	0.5	-	-	2	-	-	-
Stipa awn fragments	-	x	x	-	-	-	-
Unident. Gramineae	-	x	-	x	-	-	-
Adonis	-	-	1	-	-	-	-
Lithospermum tenuiflorum	1	-	1	-	-	-	-
Chrozophora tinctoria	-	5	-	-	-	-	-
Scirpus maritimus	-	-	-	1	-	-	1
Ziziphora	-	5	53	-	-	-	-
'*Lycium* type'	10	184	1170	6	43	-	2

after they had been made more tasty by roasting, were eaten as such and that the intact or cracked nuts were spat out, after which they ended up in the refuse pit?

Mention is made here of the botanical record of the seven samples from fill deposits inside Channelled-house DI (table 23). In general, the floral composition of these samples conforms to that of other samples of occupational fill. What is striking, however, is the extraordinarily large number of '*Lycium*-type' seeds. In one of the samples 1170 specimens were counted. As has already been discussed (3.7.3), the species identity of this type is still puzzling. The concentration of '*Lycium*-type' seeds suggests that somewhere in this particular area a supply of these seeds had been stored. Whether or not the seeds were stored in house DI remains uncertain. On the other hand, the circumstantial evidence is indicative of the intentional gathering of this seed type or alternatively of fruits which contained the seeds. From the sample with the many '*Lycium*-type' seeds, a surprisingly great number of *Ziziphora* diaspores (53 specimens) were recovered. Was *Ziziphora* collected purposely?

It has been emphasized that the botanical contents of the Çayönü samples are usually of mixed origin. In only one case is there convincing evidence that we are dealing with the almost pure remains of a crop-plant supply. This concerns the bitter vetch (*Vicia ervilia*) deposit which has already been mentioned in 3.2.3. A concentration of bitter vetch seeds was observed in the fill of a room in house DF, square 17N, attributed to the Cell-plan sub-phase. The six samples from this deposit are shown in table 12. A seventh bitter vetch sample from the adjacent square 17M is probably from the same supply. This sample from outside house DF has a greater admixture of cereal remains. The latter sample is to some extent a complicating factor. As to the bitter vetch deposit inside the house, one could imagine that in the fire catastrophe the charred remains of the food supply stored on the ground floor or on the upper storey had naturally come to rest there and had subsequently been covered by other debris. If the sample from outside the house derives from the same bitter vetch store, man must have had a hand in the spreading of the charred remains; for instance, in the process of levelling the house site after the fire.

From only one container a few soil samples have been secured for botanical examination. This concerns a bin in Large-room house BF (table 24). Modest numbers of peas and lentils recovered from these samples could be interpreted as evidence of the storage of these pulses in the bin. However, two samples from the fill in

Table 24. Samples from Large-room house BF. square 28-29/K-L.

Sample number . 1970/	bin U 3(16)	U 4(16)	U 4(30)	U 5(49)
Pisum	c. 4	c. 7	1	c. 25
Lens	c. 18	c. 7	c. 8	c. 60
Vicia ervilia	1	-	-	2.5
Pistacia fragments	x	-	-	-

other parts of house BF give a similar picture. This makes one wonder whether the fill and its botanical contents in the whole of the house are of the same (secondary) origin, in which case the charred seeds in the bin would have no relation to what originally had been stored in it. On the other hand, the almost exclusive occurrence of pulses in the fill indicates that these seeds represent the charred remains of pulse-crop supplies which had been stored in house BF, perhaps on the upper floor.

5.4. 'Roasting pits'

One of the non-architectural features at Çayönü is the so-called roasting pits: circular depressions packed with cobbles interspersed with black earth and charcoal. From the features themselves it cannot be determined whether they served for roasting meat, parching glume wheat or for some other household activity. As for the way of functioning, Michael K. Davis (pers. comm.) advocates the following experimentally tested hypothesis. In a circular pit a wood fire was lit. When the fire was burning well, cobbles were gradually added along with additional fuel. When filled with cobbles, after a high temperature had been reached and before the fire was spent the pit's contents were covered over by a layer of clay. On this clay sealant, which soon became hot from the heat-battery of stone below, the foodstuff to be roasted was laid. Long use of the sealant's safe heat was possible as it remained relatively constant for more than two days. While the pits could have been reused after cooling, by removing the mass of cobbles and repeating the firing process, the pits excavated at Çayönü appeared to have been left with their contents undisturbed.

Irrespective of the question whether Davis're-construction of the operating of the Çayönü roasting pits is correct, one may wonder to what extent plant remains recovered from the fill of the pits could inform us on what has been roasted or otherwise prepared in these structures. The same applies to other features which presumably served for food preparation, such as ovens and fire places. The samples taken for botanical examination are usually from soil that had been deposited after the feature had fallen into disuse, implying that the plant remains that were found may have no relation with the household activity performed there. Be this as it may, the Çayönü roasting pit samples are not particularly informative in this respect.

As appears from table 25, in addition to wood charcoal, only one sample (No. 87/11) yielded more than an occasional identifiable particle. From various samples only wood charcoal was recovered. The few non-wood remains in samples 87/7, 87/16 and 86/146 may be considered as settlement noise: scattered waste in low densities. The composition of sample 87/11 is not indicative of any particular food-processing activity, but rather points to a refuse deposit. The scarcity of plant remains other than wood charcoal could indicate that meat and not vegetable food was prepared in these pits. If vegetable food was processed, it should not have been in direct contact with the fire or hot ash, which would support Davis' view of a clay cover over the fire. If parching of glume wheat spikelets had been carried out on these structures (prior to dehusking), one would have expected more chaff remains in the samples examined. This activity would have resulted in much chaff around the roasting pits.

5.5. Field weeds

The archaeobotanical evidence informs us fairly well on the crop plants of the Çayönü farmers. The abundant chaff remains indicate that the dehusking of the glume wheats was carried out on the site, as was to be expected. What can be said about other aspects of arable farming, such as the condition of the fields and harvesting methods?

In view of the present soil and climatic conditions (see 1.1.1) one may assume that the physical environment put no limitations on plant cultivation at early-Neolithic Çayönü. In principle, inferences about

Table 25. Roasting-pit samples.

Sample number	70/R18	87/7	87/16	86/147	87/11	86/146	70/R17	70/R14	70/R12
Square	27L	28L	28L	27L	27L	28L	27L	27L	27L
Sub-phase	bp	bp?	bp-ch	bp-ch	ch	ch	ch	ch	cp
Triticum spikelet forks	-	-	2	-	8	1	-	-	-
Cereal grain fragments	-	-	-	-	x	-	-	-	-
Cicer	-	-	-	-	0.3	-	-	-	-
Lathyrus cicera/sativus	-	-	-	-	1	-	-	-	-
Pistacia fragments	-	x	x	-	x	x	-	-	-
Celtis	-	-	-	-	1	-	-	-	-
Vicia	-	-	-	-	1	1	-	-	-
Vicia fragments	-	-	-	-	x	-	-	-	-
Lolium	-	-	-	-	2.5	-	-	-	-
Wood charcoal	+	+	+	+	+	+	+	+	+

Table 26. Potential segetal taxa attested for aceramic Çayönü. Total number of samples included is 230.

	Total number of seeds	Sample frequency
Vicia spp.	800	115
Astragalus	1	1
Medicago	2	1
Medicago radiata	2	2
Melilotus	4	1
Lolium cf. *rigidum*	48	35
Aegilops umbellulata[1]		
Bromus	6.5	5
Echinaria	9	4
Anchusa	1	1
Lithospermum arvense[1]		
Silene	1	1
Vaccaria pyramidata	0.5	1
Chrozophora tinctoria	15.5	6
Ziziphora	63	6
Malva	1	1
Fumaria	1	1
Rumex	3	2
Adonis	1	1
Ranunculus arvensis type	1	1
Galium	16	13
Verbascum	1	1

[1]reported by Stewart (1976)

agricultural practices of the past can be drawn from arable field weeds represented in the archaeological plant record. This approach, which starts from the flora of traditionally cultivated fields of the recent past, is commonly applied in archaeobotanical research, although the dangerous sides of its actualistic principle are well recognized. Table 26 lists the (potential) field-weed taxa established for the aceramic levels with the total numbers of occurrences (and numbers of samples in which the type is present).

At first sight it would seem that the arable weed flora is fairly well represented. However, it should be emphasized that the seed types concerned only possibly derive from weeds in the fields of the Çayönü farmers. Most of the taxa have been identified to the genus level only, implying that they could represent arable weeds but also species from other habitats. Moreover, many present-day segetal plants are believed to originate from steppe vegetations. Steppe (and forest-steppe) species would have invaded the fields of the ancient farmers to become arable weeds by adapting themselves to the particular conditions in cultivated fields. Thus, for many of the taxa listed in table 26 it is not certain whether they actually occurred as arable weeds at aceramic Çayönü. Yet irrespective of this question, most of the potential field weeds are scarcely represented in the seed record. Eleven taxa were found in one sample only, 9 of which with only one seed. Three types, viz. *Vicia*, *Lolium* cf. *rigidum* and *Galium*, occur in more than 10 of the 230 samples, wild vetch being by far the most numerous. Wild vetch seeds may have been gathered intentionally (3.6.1), which could explain their great numbers.

The scarce representation of (potential) arable weeds in the archaeobotanical record does not necessarily imply that the fields of the Çayönü farmers were almost free of weeds, but it may rather be ascribed to the harvesting methods employed. If the cereals were reaped by cutting or plucking the individual ears or by uprooting the plants, only few field-weed diaspores are to be expected in the unprocessed corn crop. Pulses are usually harvested by uprooting. In this way only small numbers of arable weed seeds would unintentionally have been carried to the site. The burning of dung fuel is thought to have contributed substantially to the charred seed contents of archaeological deposits (Bottema, 1984; Miller & Smart, 1984). At aceramic Çayönü, sufficient firewood must still have been available, and moreover, domestic animals, mainly sheep, appeared only in the uppermost aceramic levels, in the Cell/Large room and Large room sub-phases (Lawrence, 1982).

From the above speculations it appears that the Çayönü floral record is not very informative on plant husbandry questions other than food-plant species and food-plant proportions.

5.6. The vegetation in the surroundings of aceramic Çayönü

The TAVO (*Tübinger Atlas des Vorderen Orients*) map of early-Holocene (c. 8000 BP) vegetation in the Near East (Bottema & van Zeist, 1990) indicates 'cold deciduous montane woodland with evergreens' for the Çayönü area. This map of the inferred early-Holocene vegetation, which is based mainly upon palynological evidence, had to be confined to presenting major vegetation zones, within which the plant cover may have varied locally and regionally. Moreover, as the early Holocene, comprising several thousands of years, witnessed considerable changes in the vegetation, the date of c. 8000 BP (cal. c. 7000 BC) is only a rough approximation. From the above it will be clear that for any given early-Holocene site, the vegetation may have deviated somewhat from that as defined for the whole of the vegetation zone. However, in broad outline the TAVO map mentioned above should provide a fair picture of the early-Holocene vegetation in the Near East.

The charred wood and seed evidence indicates that deciduous oak (*Quercus brantii* and perhaps other oak species), pistachio (*Pistacia atlantica*, *P. khinjuk*), and probably ash (*Fraxinus rotundifolia*) were major constituents of the arboreal vegetation in the Çayönü area. On the other hand, the absence of coniferous wood remains suggests that juniper (*Juniperus*), listed for the early-Holocene woodland zone, was not or only scarcely found near Çayönü. The density of the arboreal vegetation is uncertain. Was it woodland, that is to say, forest of well spaced trees (crown cover not more than

50%), or was it more open, a kind of transitional stage between steppe and woodland? The pollen record obtained for Lake Zeribar in western Iran (see fig. 1) suggests that in such a case grasses may have played a predominant role in the steppe-like ground cover (van Zeist & Bottema, 1977). Grasses are not abundantly represented at Çayönü, and the type which is most frequent, viz. *Lolium* cf. *rigidum*, is typical of ruderal and segetal vegetations. Other taxa which include characteristic steppe plants (Chenopodiaceae, Umbelliferae, Leguminosae, Compositae) are scarcely or not at all recorded. Because of its small, fragile seeds, wormwood (*Artemisia* spp.) is not to be expected in the charred seed record. The above does not necessarily imply that steppe plants were not common in the Çayönü area, but the chances for the seeds of these taxa of becoming incorporated in the settlement deposits in a charred condition may have been minor. One such negative factor may have been that no dung fuel was used. One typical steppe plant is recorded, viz. *Stipa* (feathergrass).

In conclusion, we are left with the uncertainty whether the Çayönü upland vegetation was of the woodland type or forest-steppe. For the farmers this difference in vegetation may have been crucial. In the case of woodland they would have been forced to cut down at least some of the trees in laying out their fields. In the case of forest-steppe it would have sufficed to clear the ground vegetation, which could easily have been done by burning.

Trees and shrubs which are characteristic of river-valley forest, such as *Populus (euphratica)*, *Platanus orientalis* and *Tamarix* sp., have not been demonstrated for Çayönü. Apparently the stream at the foot of the site was too small for the development of riverine forest. Among the taxa attested for Çayönü, *Scirpus maritimus* (sea club-rush) is characteristic of marshy habitats. Obvious habitats of sea club-rush in the Çayönü area must have been the stream valley and pools which carried water during part of the year. Also wild grape vine (*Vitis vinifera*) could have grown along the stream at the foot of the mound (if the berries had not been brought in from further away).

Speculations on the synanthropic field-weed flora are presented in the previous section (5.5).

6. CONCLUSIONS

The following conclusions with respect to the plant husbandry of aceramic Çayönü are drawn here:

– There is no firm botanical evidence of plant cultivation in the earliest occupation levels (the Rounded-huts sub-phase);

– Both cereals and pulses were grown by the Çayönü farmers. A characteristic feature of Çayönü is the predominance of pulses over cereals, which in the course of the aceramic occupation became even more pronounced;

– Cereal cultivation was confined to einkorn and emmer wheat. Morphologically defined wild emmer wheat in the early stages of the occupation was most probably cultivated. The absence of chaff remains of shattering wheats suggests that the wild-type emmer grains are of plants which already had a semi-tough rachis and which consequently may be considered as domestic. The same may have been the case with the wild-type einkorn wheat;

– The scarce barley remains (grains, rachis internodes) point to wild *Hordeum spontaneum* that was neither cultivated nor gathered purposely;

– Among the pulses, bitter vetch played a predominant role in addition to lentil and field pea;

– The great quantities of wild vetch (*Vicia* sp.) seeds suggest that these were gathered intentionally, probably for human consumption;

– *Pistacia* fruits must have been collected intensively throughout the entire aceramic occupation;

– The archaeological plant record provides only little information on agricultural practices.

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8. NOTES

1. The term 'Basal pits' has been used in several recent Çayönü papers, so it is probably wise to retain the name. However, these pits are not truly basal, in the sense that they do not proceed downwards from the real base of the occupation. Until further excavation in achieved, it now seems most likely that they proceed downwards, stratigraphically, only from between the end of the uppermost grills and the beginning of the channel houses. Although they have been found to have been cut downwards into the sterile soil, it is the Round-house sub-phase that is the true basal level This comment of Robert J. Braidwood describes the situation in 1991.
2. The full record is on file at the Biologisch-Archaeologisch Instituut of the State University of Groningen, the Oriental Institute of the University of Chicago, and the Prehistory Section of Istanbul University.

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