

The Aceramic Site of Aşıklı and its Ecological Conditions Based on its Floral and Faunal Remains

Akeramik Aşıklı Höyük Yerleşmesinin Bitki ve Hayvan Kalıntılarına Göre Ekolojik Koşulları

Ufuk ESİN*

Keywords: Aşıklı, Aceramic Neolithic, Central Anatolia, Ecology, Flora, Fauna.
Anahtar Sözcükler: Aşıklı, Akeramik Neolitik, Orta Anadolu, Ekoloji, Bitkiler, Hayvanlar

Orta boyutta bir höyük olan Aşıklı, Orta Anadolu'da, Aksaray ili'nin 25 km güneydoğusunda yer almaktadır. Birçok obsidien yataklarının bulunduğu Batı Kapadokya'nın volkanik doğası içinde akan Melendiz nehrinin kıyısında konumlanmıştır. Aşıklı'da en eski yerleşme, güneyde Melendiz nehrinin kıyısında ve esas höyük konisi dışında kazılmıştır. Höyük üzerinde ise bugüne kadar 3 kültür tabakası gün ışığına çıkarılmıştır. Bunlardan 2. tabaka on evrelidir ve uyarlanmış¹⁴C ölçümlerine göre M.Ö. 8. binyıla tarihlendirilmektedir.

Geniş yahut dar sokaklarla ayrılmış mahalleleriyle kerpiçten mimarisi, dini amaçlara yönelik yapı kesimi ve son 3 yapı evresinde ortaya çıkan çevre duvarı Aşıklı'nın dikkate değer mimari öğeleridir. Yontma taş tekniğindeki obsidien endüstrisi, kemik/boynuz, öğütme ve cilalı taş teknolojileri günlük kullanım için geliştirilmiştir. Pişirilmiş veya yarı pişirilmiş kilden eşyalar, sıcakken işlenmiş bakır (pyro-technology) daha o zamanlar keşfedilmiştir. Gömüt geleneği yerleşme içidir. Besin ekonomisi, av hayvanları ve yenebilen bitkilerin toplanmasının yanında az da olsa ilk tarımsal ürünlerin elde edilmesine de bağlıdır.

Antropolojik, arkeo-botanik ve arkeo-zoolojik verilere göre Aşıklı Höyüğü'nün ekolojisi bu yazıda yerleşmelerin kısa bir tanıtımından sonra incelenmektedir.

Introduction

The aim of this paper is not to overemphasize the effectiveness of the palaeoecology upon the life and culture of ancient man from a deterministic point

of view. It is only to try to demonstrate the relations of both sides, between man and his surroundings. In other words, it is to try here at least, to understand the

*İstanbul Üniversitesi, Edebiyat Fakültesi, Prehistorya Anabilim Dalı, Beyazıt 34459, İstanbul / Türkiye

relations between the prehistoric inhabitants of the "Aceramic Neolithic" site of Aşıklı and their abiotic and biotic environment in Western Cappadocia ten thousand years ago. This is because, as is known, short before and during this episode, the most dramatic changes in the climate took place every where in the Old World due to the shifting from the Pleistocene into the Holocene. Depending on these climatic changes and on the beginning of neothermal conditions the founding of permanent village-type settlements occurred during the Aceramic Neolithic Period in the Near East and in Anatolia. It became the reason of a "new way of life for the human culture". This has been named by V. Gordon Childe as "Neolithic Revolution", because of the beginning of domestication of plants and animals initiated by the village farming communities (Childe 1958, 59-86).

In this connection it could also be asked not only to what extent the human population of the pre-pottery neolithic site of Aşıklı could make use what was offered to them by the environment for their "new way of life", but also why did they choose Aşıklı as their permanent settlement. In order to discuss these questions, the geographical and cultural setting of Aşıklı mound in Kızılkaya village (province of Aksaray) and in its neighborhood will be described first. Thenafter according to ^{14}C assessments and archaeobotanical and archaeozoological analyses the possible ecological conditions of ten thousand years ago in the same area will be presented.

Aşıklı Höyük and Its Ecological Conditions

1. Geographical and Cultural Factors

Aşıklı Höyük is situated at the village of Kızılkaya, 25 km south-east of Aksaray in Western Cappadocia which is a part of the high plateau of Central Anatolia. It lies on a bank of Melendiz river which is a

branch of the Ulurmak river. The Mamasundam's réservoir on the Ulurmak in the vicinity of Aşıklı will soon raise the water level, so that the Aşıklı mound will become partially submerged in coming years (Esin et al. 1991, 159, pl. 1).

Therefore archaeological salvage excavations are carried out at Aşıklı by the Prehistory Section of the Faculty of Letters, of the Istanbul University since 1989 (1). Aşıklı mound stands on an elevation of 1119.45 m above the sea-level. It measures 230 m in east-west and 150/240 m in north-south direction. It covers an area approximately 35000/40000 square meters. Nearly one third of the mound seems to have been eroded in the course of time due to many changes in the riverbed of Melendiz, either during the Early Holocene or later on because of several climatic changes and thenafter due to much ploughing at the site (Op. cit. 161, pl. 3; Esin 1996, 31, fig. 1).

In the course of seven excavation-campaigns ca. 4000 square meters have been unearthed at the Aceramic Neolithic site of Aşıklı (figs. 1-3). On the other hand a small part of an settlement earlier than those on the mound has been discovered directly on the shore of Melendiz river (Esin 1995, 71, fig. 3). It lies outside of the mound to its south and continues into the riverbed of Melendiz, underneath an alluvial deposit of 1.5 height probably accumulated by a sudden flood of the river. The settlement was abandoned because of that flood. In this earlier settlement a few houses made of mud-brick and rectangular in plan formed small living-quarters. These were separated from each other by narrow corridors or small court-yards measuring ca. 1X3.5 square meters (ibid). The burial customs were intramural (Esin 1996, 35, fig. 9). It seems that the mud-brick architecture and the settlement-pattern in this earlier habitation became the most traditional one throughout the later occupations on the mound (ibid).

On the mound, as so far excavated three cultural layers are revealed (figs. 1-3). From top to the bottom from layer 1 only a few architectural remains are left. On the other hand the cultural layer 3 has been reached recently at a depth of 7.20 m from the modern surface and not excavated yet. Of the three cultural layers, layer 2 has been exposed more extensively than the others. 10 building phases, (some of them including also subphases) belonging to the layer 2 have been brought to light only in the northern step-trenches (trenches 4 F-H, fig 3). It seems that during the latest 3 subphases of Layer 2, the settlements were surrounded to the east by a monumental enclosure wall (fig. 3). It was built of large tufa and limestone blocks together with mud-brick (Esin 1995, 71, fig. 4; 1996, 34, fig. 6). This enclosure wall of Aşıklı is the oldest known example of the city walls in Anatolia (Esin 1996, 42, footnote 25).

Houses made of mud-brick walls and rectangular, trapezoidal (sometime one of the walls is rounded) in plan, seem to extend from the enclosure wall in three directions, to the north, west and south. A large, free space which seems to be a working and dumping area is located within the living-quarters to the north-east of the mound (trenches 6-7 J-K; fig. 3).

On the other hand a main road of 2-4 m width and paved with pebble stones runs to the middle of the settlements in each phases (trenches 3-7 N-O; figs. 2-3). To the south-west of the main road are situated two large buildings connected with each other by large court-yards and additional rooms (trenches 3-4 N-R; fig. 3). Also stone walls like temenos walls partly surrounds this section on the north-east.

The north wall of one of these buildings consisted of a "chest-wall system" which is the oldest known example of this kind of architecture and the ancestor of the city-wall system of the Hittites (Esin 1994). The exterior wall of this building is made of mud-bricks to the south-west of the

main road and its interior wall is constructed of rows of tufa and limestones imbedded in clay mortar (*ibid*). The second building south of the former one is considerably destroyed. In each phase, floors, interior walls and mud-brick benches are painted in red. In the 4th building-phase the floor is restored and painted partly in yellow. It seems that these 2 large buildings were used for religious purposes (*cf.* Hauptmann 1993). Therefore this indicates probably a social stratification among the settlers of Aşıklı.

The living-quarters of the inhabitants of Aşıklı consisted of a few mud-brick houses which had of 1, 2 or 3 rooms. The hearths are usually placed in one corner of the one-room houses (Esin et al. 1991, 166, pl. 8; fig. 2; Esin 1996, 36, 38, figs. 10, 13). The living-quarters were separated from each other by very narrow passages (50-40 cm wide) or small court-yards (fig. 3). The entrances into the houses seemed to be from the roof. Because the door-ways were only made between rooms of the houses, but not into the passages or court-yards. This settlement-pattern indicates a planning of the space for living-quarters as well as for the religious sector.

The traditional raw material for the architecture of Aşıklı was mud-brick. It seems that the use of stone in the architecture occurred during the last 5 building-phases.

The burial customs were intramural throughout the all phases of cultural layer 2 (Esin et al. 1991, 167, pl. 9/1). Bodies were put in earthen pits which were dug into the clay plastered floors of the rooms. They were buried mostly in hocker position and a few lay on one side of the body with legs were bent backwards. On one skull of a young woman a brain operation (trepanation) was observed (Esin et al. 1991, 167, pl. 9/1). Burial gifts were mainly necklaces or bracelets consisting of pierced beads made of semi-precious, simple stones or of hot-worked native copper and deer-teeth (Esin 1995, 73, 74; figs. 6, 8, 10).

Because of a consistence series of ^{14}C assessments in the cultural layer 2, Aşıklı can be dated in calibrated system to the 8th Mill. B.C. or ten thousand B.P. (calendar years; fig. 4).

The industries of the inhabitants of Aşıklı consists mainly of obsidian, bone/horn tools (Esin et al. 1991, pls. 12-16). Ground and polished stone artefacts have been also used (ibid. 169, pl. 11). The raw material for the obsidian, bone and ground/polished stone utensils and weapons were brought to the site from the vicinity of Aşıklı. The occupants of Aşıklı even knew how to prepare and use half-baked and baked clay objects or figurines. This may indicate how they invented hot-working of copper (ibid. 168, pl. 10; Esin 1995).

Although the domestication of game animals had not started yet, hunting existed throughout the cultural layer 2 (Buitenhuis 1996). A few cultivated cereals and legumes together with collected plants were attested at the aceramic site of Aşıklı (van Zeist and de Roller 1995). Thus, the subsistence economy was based mainly on intensified hunting and collecting of edible fruits and greens together with cultivated plants.

2. Ecological Factors

As far as the ecology of Aşıklı concerns, today a continental climate prevails in the Aksaray region and the economy is mainly based on crops, gardening, wine and animal husbandary of sheep and cattle. In addition fishing is possible in the river. The average rainfall in winter is about 330 mm and it makes possible the lower end of the range for dry farming. The Central Anatolian steppe terrain is dominant in the surrounding area. Groves of mixed hackberry (*Celtis*) and oak occur at intervals in the alluvial, narrow valley of Melendiz that leads to the slopes of the Hasandağ mountains. According to satellite maps, it is likely that some small shifts have occurred in the main bed of the Melendiz river since

the beginning of the Holocene. However no major changes seem to be happened.

Information on the climatic conditions and the ecology of Aşıklı and its environs ten thousand years ago is based on analyses of pollen, plant remains, phytoliths and of animal bone remains from the archaeological excavations (Respectively, Woldring 1998; van Zeist and de Roller 1995; Buitenhuis 1996).

In addition pollen samples obtained from Akgöl which lies about 100 km west of Aşıklı in the district of Ereğli in the province of Konya, have also aided in a reconstruction of the ecological conditions (Bottema and Woldring 1984). A palynological study by H. Woldring indicates that the pollen record from Aşıklı and that derived from the latest phase of the Last Glacial Age of Akgöl are comparable (Woldring 1998).

At the time Aşıklı was being settled, important changes occurred, particularly in the environs of the volcanic mountains of Hasandağ, Karacadağ and Karadağ almost between 9600-8420 years ago (uncal.; Bottema and Woldring 1984). During this period oak trees which were attested before on those mountains disseminated. Junipers multiplied, hazelnuts, hornbeam, alder and hophornbeam appeared on the scene. Grasses of various species began to multiply and diffused over the plains. This affected also rainfall and the climate had become warmer.

The plant remains that were recovered in the settlements of cultural layer 2, at Aşıklı are witness that the rainfall and temperatures between almost 9966-9400 years ago (cal. 8016-7479 B.C.) were favorable for the cultivation of legumes and grains like wheat and barely (cf. van Zeist and Roller 1995). Wild pistachia, elm, hackberry trees and a rather wide variety of grassy plant species become available some of which could be used for food and others for medical purposes.

Analyses of the bones of the game and wild animals that were recovered from the excavations of Aşıklı further demonstrate that a highly varied animal world existed in the vicinity. None of the animals had yet been domesticated (Buitenhuis 1996). Making their home in the local area of Aşıklı and caught as game during the period when it was being settled, were aurochs, wild sheep, wild goat, wild boar, fallow and red deer, wild horse, wolf, fox, rodentia (mouse-type), hare, beaver, duck, bustard, crow, vulture, falcon, red-falcon, owl, tortoise, various fresh-water fish and some species of snail (Buitenhuis 1996). In the light of the above mentioned plant and animal remains from the settlements here obtained during the course of excavations at Aşıklı, climatic and economic conditions were obviously favorable to support the life of human societies.

NOTES

(1) These excavations are supported by funding from the General Directorate of the Ancient Monuments and Museums of the Ministry of Culture, by the Turkish Academy of Sciences (TÜBA) and by the Research Fund of the Istanbul University (Project Nos.: 595 and 994).

Also a side project undertaken by the Biologisch, Archaeologisch Instituut of the State University at Groningen has been running since 1990 with the aim of archaeo-botanical and archaeo-zoological analyses of the pollen, plant and animal bone remains and for 14C dates of Aşıklı. The collaborators in this project are Professors Dr. S. Bottema, Dr. W. van Zeist, Dr. H. Woldring, Dr. H. Buitenhuis, Dr. J. de Roller and Dr. van der Pflicht.

REFERENCES

- BOTTEMA, S. and WOLDRING, H., 1984, "Late Quaternary Vegetation and Climate of Southwestern Turkey. Part II", *Palaeohistoria* 26: 123-149.
- BUITENHUIS, H., 1996, "Archaeozoology of the Holocene in Anatolia: a review", *Archaeometry* 94. (Eds. ş. Demirci, A.M. Özer and G.D. Summers). The Proceedings of the 29th International Symposium on Archaeometry. Ankara 9-14 May 1994. The Scientific and Technical Research Council of Turkey (TÜBİTAK). Ankara: 411-421.
- CHILDE, V.G., 1958, *Man Makes Himself*. Man's Progress Through the Ages. 6. printing. A Mentor Book MD 154. New York, The New American Library.
- ESIN, U., 1994, "Zum Ursprung der Kastenbauweise in Anatolien", *Istanbul Mitteilungen*, 43 (1993): 123-128.
- ESIN, U., 1995, "Early copper metallurgy at the pre-pottery site of Aşıklı", *Readings in Prehistory: Studies Presented to Halet Çambel*, Istanbul, Graphis: 61-77.
- ESIN, U., 1996, "On Bin Yıl Öncesinde Aşıklı: iç Anadolu'da Bir Yerleşim

Conclusions

Parameteres that can assist our understanding of why the human communities of ten thousand years ago abandoned a semi-nomadic way of life and could for the first time ever make a transformation to a permanent settled village-life at Aşıklı are clear. Because they had a water resource like Melendiz river and the meadows in its valley. They had tracts of land suitable for farming, however limited, small woods of mixed trees in the valley and at higher altitudes steppe cover on the treeless volcanic earth, existed. A variety of animal species lived in this environment, some in the woods and some on the steppe, meadows, in the water or on the banks of the Melendiz river. Finally sources of raw materials adequate to supply construction needs, preparing artefacts and weapons were also available for the inhabitants of Aşıklı.

In 1995 a new project was undertaken by the Prehistory Section of the Istanbul University together with the Anthropology Department of Hacettepe University and the Biology Department of Barcelona University in Spain for anthropological studies, DNA and 13C analyses. Also research for phytoliths, obsidian micro-wear, trace and element analyses and geomorphological studies for Aşıklı are being made in collaborations with many other specialists and laboratories especially with those scholars coming from CNRS in France such as Mme. Cl. Cauvin, P. Anderson, Catherine Kuzucuoglu and others.

Thus I wish to extend my sincere thanks to all these collaborators and institutions for their valuable support and assistance.

Modeli", *Tarihten Günümüze Anadolu'da Konut ve Yerleşme*. Türkiye Ekonomik ve Toplumsal Tarih Vakfı. İstanbul: 31-42. (Eng.: "Aşıklı, Ten Thousand Years Ago: A Habitation Model From Central Anatolia" (Transl. by Joyce Matthews), *Housing and Settlement in Anatolia: A Historical Perspective*. History Foundation. İstanbul: 31-42).

ESIN, U., BIÇAKÇI, E., ÖZBAŞARAN, M., BALKAN ATLI, N., BERKER, D., YAĞMUR, İ., ATLI, K.A. 1991, "Salvage Excavations at the Pre-pottery Site of Aşıklı Höyük in Central Anatolia", *Anatolica*, XVII: 124-174.

HAUPTMANN, H., 1993, "Ein Kultgebäude in Nevalı Çori", *Between the Rivers and Over the Mountains. Archaeologia Anatolica et Mesopotamica. Alba Palmieri Dedicata*. (Eds. M. Frangipane, H. Hauptmann, M. Liverani, P. Matthiae, M. Mellink). Roma, Università di Roma, "La Sapienza": 37-69.

WOLDRING, H., 1998, "A Pollen Diagram From a River Sediment in Central Anatolia", *TÜBA-AR 1* (in this volume).

van ZEIST, W., de ROLLER, G.J., 1995, "Plant remains from Aşıklı Höyük, a Pre-Pottery Neolithic Site in Central Anatolia", *Vegetation History and Archaeobotany* 4: 179-185.

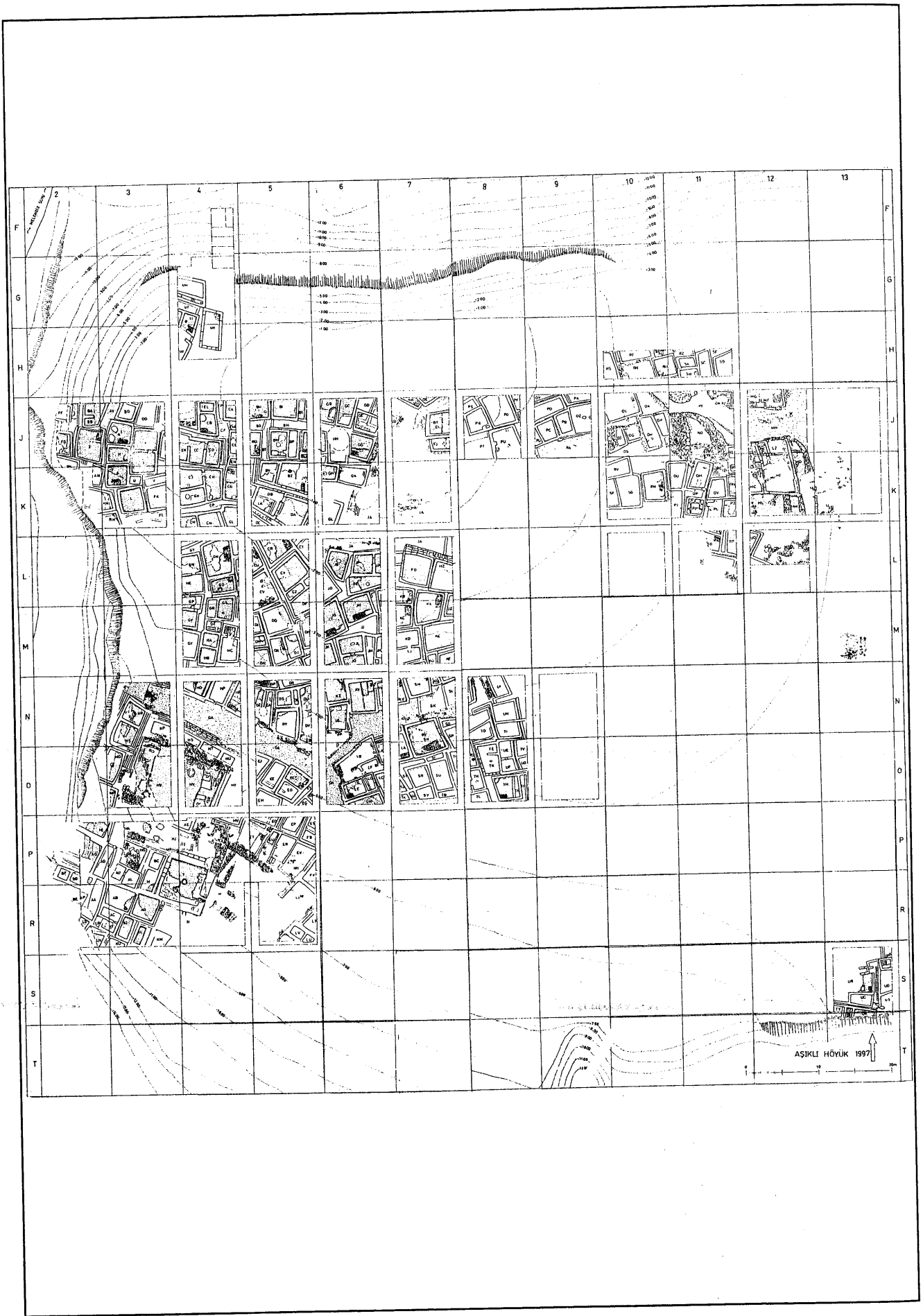


Figure 3: Schematic Plan of Aşıklı 1997. Cultural Layer 2.

Aşıklı Calibrated 14 C Dates (*)

Lab #	Cal.yr.B.C.	¹⁴ Cyr.B.P.	Cal.yr.B.P.	Layer/Phase	Trench	Room/Grid
GrN 19366	7479 7458 7442	8400 ± 40	9429 9408		3P	HG 5/d-e
GrN 19365	7484 7451 7449	8420 ± 30	9434 9401		3P	HG 2/e
GrN 19114	7534	8515 ± 40	9484	2	5L	CY 6/e
GrN 19868	7537	8530 ± 110	9487		7J	JA,21,-0.95/1
GrN 19358	7541	8550 ± 70	9491	2	4H	S 8/d
GrN 20355	7541	8550 ± 60	9491	8e	3R	NM,-9.70
GrN 19866	7543	8560 ± 40	9493		4H	JV, 2/e
GrN 20356	7543	8560 ± 60	9493		14AB	NV,-14.63
GrN 19359	7545	8570 ± 70	9495	1	4H	S 10/e
GrN 20041	7546	8575 ± 20	9496		6N	KY, 5-8/b-e
GrN 19862	7547	6580 ± 50	9497		3P	HK, 1-3/b-c
GrN 19364	7548	8585 ± 45	9498		3P	HK 2/d
GrN 19121	7549	8590 ± 80	9499	2	2K	AN G under
GrN 19361	7570	8595 ± 60	9520	2	6J	GD 7/b
GrN 18619	7575	8610 ± 55	9525	1b	2R	AA 9/a-b
P 1239	7575	8611 ± 108	9525		N Slope	
GrN 19362	7580	8630 ± 30	9530	2	6J	GD 8-9/c
GrN 19867	7580	8630 ± 50	9530		2R	LS,7/g
GrN 19863	7583	8640 ± 20	9533		7L	JA, 5-6/b
GrN 19861	7612	8670 ± 60	9562		7J	JA, 3/g
GrN 20351	7612	8670 ± 40	9562	2b	5J	BI,-1.79
GrN 19363	7670 7623	8675 ± 25	9620 9573	2b	4H	C 1/g
GrN 19360	7695	8695 ± 25	9645	2	4H	C7 Fire place
GrN 19115	7830 7700	8710 ± 100	9780 9650	2	4J	EN 8/k
GrN 19117	7830 7700	8710 ± 130	9780 9650	2	2K	AN 10/c
GrN 20354	7834 7828 7699	8710 ± 70	9784 9778	2a	4J	EN,-2.47
GrN 18620	7845 7824 7702	8720 ± 55	9795 9774	2	3J	AM 2/h-i
GrN 19860	7845 7824 7702	8720 ± 50	9795 9774		7J	JA, 6/i
GrN 19870	7845 7824 7702	8720 ± 80	9795 9774		GN	KY,-5-8/b-e
GrN 20352	7845 7824 7702	8720 ± 40	9795 9774	2c	4K	CK,-3.25
GrN 20684	7845 7824 7702	8720 ± 70	9795 9774		14AB	NV,-14,63
GrN 18618	7850 7822 7703	8725 ± 50	9800 9772	2b	3J	1 4-5/g
GrN 18617	7857 7820 7705	8730 ± 45	9807 9770	2	4H-G	E
GrN 19869	7870 7816 7707	8740 ± 70	9820 9766		GO	LB,6-7/b
GrN 20353	7870 7816 7707	8740 ± 60	9820 9766	2e	4G	MS,-4.92
GrN 19118	7885 7805 7730	8760 ± 45	9835 9755	2	2K	AN 10/c
GrN 19119	7885 7805 7730	8760 ± 40	9835 9755	2	2K	AN
GrN 19858	7892 7782 7765	8770 ± 90	9842 9732		4M	JY, 7-9/c
P 1242	7896 7761 7739	8778 ± 128	9846 9711		NW	
P 1241	7904 7754 7747	8793 ± 127	9854 9704		NW	
P 1238	7912	8807 ± 128	9862		N Slope	
GrN 19120	7916	8815 ± 70	9866	2	2K	AN 9/b
GrN 20349	7930	8840 ± 50	9880	2e	4H	MS,-4.68
GrN 19865	7952	8880 ± 70	9902		4H	JY
GrN 19116	7973	8920 ± 50	9923	2	2J	FF 6/b
P 1240	8016	8958 ± 130	9966		NW	

(*) For calibration *CALIB rev.3.0.3* has been used with calibration dataset 1 and calculation method A: Intercept with curve.(M.Stuiver -P. Reimer: Quaternary Laboratory/University of Washington)

Figure 4: Some of the Calibrated 14 C Assessments of the Cultural Layer 2 of Aşıklı.

TÜBA-AR

Türkiye Bilimler Akademisi Arkeoloji Dergisi

YAYIN KURULU

Ufuk ESİN
Yayın Kurulu Başkanı

Mehmet ÖZDOĞAN

Bruce HOWE

Sema BAYKAN

Zafer KARACA

ONURSAL YAYIN KURULU

Ekrem AKURGAL
Sedat ALP
Halet ÇAMBEL
Jale İNAN
Nimet ÖZGÜÇ
Tahsin ÖZGÜÇ

DANIŞMA KURULU

Haluk ABBASOĞLU
İstanbul Üniversitesi
Sedat ALP
Türkiye Bilimler Akademisi
Ayda AREL
Ege Üniversitesi
Güven ARSEBÜK
İstanbul Üniversitesi
Nuşin ASGARİ
İstanbul Arkeoloji Müzeleri
Güven BAKIR
Ege Üniversitesi
O. BAR YOSEF
Harvard Üniversitesi
Cevdet BAYBURTOĞLU
Ankara Üniversitesi

Marie-Claire CAUVIN
CNRS
Ali DİNÇOL
İstanbul Üniversitesi
Kutlu EMRE
Ankara Üniversitesi
Harald HAUPTMANN
İstanbul Alman Arkeoloji Enstitüsü
Peter KUNIHOLM
Cornell Üniversitesi
Machteld MELLINK
Byrn Mawr Koleji
Nimet ÖZGÜÇ
Türkiye Bilimler Akademisi
Wolfgang RADT
İstanbul Alman Arkeoloji Enstitüsü

YAZIŞMA ADRESİ

Sema Baykan - Uzman Arkeolog Prehistorya Anabilim Dalı
Edebiyat Fakültesi İstanbul Üniversitesi, Beyazıt 34459 İstanbul, Türkiye
Tel: 0 212-519 45 92 Fax: 0 212-519 45 92

ISSN 1301-8566

Fiyatı: 2.000.000 TL Kurumlar: 5.000.000 TL Yurtdışı: \$ 30
Banka Hesap No: Türkiye İş Bankası Başkent Şubesi 4299 304210 452824

Yayın Yönetmeni: Zafer Karaca, Sanat Yönetmeni: Ödül (Evren) Töngür, Teknik Yönetmen: Duran Akca
Yayın Ekibi: Sema Subat-Alp Akoğlu Teknik Ekip: Aytaç Kaya-Yiğit Özgür

TÜBA (TÜRKİYE BİLİMLER AKADEMİSİ)
TÜBİTAK Atatürk Bulvarı No: 221, Kavaklıdere 06100 Ankara, Türkiye
Tel: 0 312-427 06 25 Fax: 0 312-427 66 77
e-posta: tuba-ar@tubitak.gov.tr Internet: www.tuba-ar.tubitak.gov.tr