CROP PROCESSING IN THE EARLY BRONZE AGE HOUSES OF İKİZTEPE: IDENTIFICATION AND ANALYSIS OF ARCHAEOBOTANICAL REMAINS

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

CEREN ÇİLİNGİR

IN PARTIAL FULLFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE
IN
SETTLEMENT ARCHAEOLOGY GRADUATE PROGRAM

FEBRUARY 2009

Approval of the Graduate School of Social Sciences

Prof. Dr. Sencer Ayata
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science.

Prof. Dr. Numan Tuna
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

Asst. Prof. Dr. Evangelia Pişkin
Supervisor

Examining Committee Members

Prof. Dr. Numan Tuna	(METU, SA)	
Asst. Prof. Dr. Evangelia Pişkin	(METU, SA)	
Prof. Dr. Vedat Toprak	(METU, GEOE.)	
Prof. Dr. Yılmaz Erdal	(HÜ., ANTH.)	
Asst. Prof. Dr. Jan Bertram	(METU, SA)	

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Ceren Çilingir

ABSTRACT

CROP PROCESSING IN THE EARLY BRONZE AGE HOUSES OF İKİZTEPE: IDENTIFICATION AND ANALYSIS OF ARCHAEOBOTANICAL REMAINS

Çilingir, Ceren

M. Sc., Settlement Archaeology Graduate Program

Supervisor: Asst. Prof. Dr. Evangelia Pişkin

February 2009, 123 pages

İkiztepe is the largest excavated mound type settlement of prehistoric times in the Black Sea region in Turkey. It is located ca. 55 km northwest of Samsun, 7 km northwest of Bafra and is within the boundary of the present day village of Ikiztepe. The carbonised seeds and fruits secured from the occupation levels of İkiztepe houses dating from Chalcolithic to the Transition period are used to identify the crop processing activities conducted within the domestic units. Areas of fine sieving activity and the storage areas could be detected by the help of the analysis of the archaeobotanical materials. A comparison of the crop processing habits of the occupants of İkiztepe and other Early Bronze Age settlements in Anatolia is also made.

Keywords: Archaeobotany, Early Bronze Age, İkiztepe, Seed, Crop Processing

ÖZ

İKİZTEPE ERKEN TUNÇ ÇAĞI EVLERİNDE EKİN İŞLEME: ARKEOBOTANİK MALZEMENİN TANIMLANMASI VE ANALİZİ

Çilingir, Ceren
M.Sc. Yerleşim Arkeolojisi Lisansüstü Programı
Danışman: Yard. Doç. Dr. Evangelia Pişkin

February 2009, 123 sayfa

İkiztepe Karadeniz Bölgesi'nde prehistoric çağlara ait şu ana kadar kazısı yapılmış en büyük höyük tipi yerleşim yeridir. Samsun'un yaklaşık olarak 55 kilometre kuzeybatısında, Bafra'nın 7 kilometre kadar kuzeybatısında, günümüz İkiztepe yerleşim yerinin sınırları içerisinde yer alır. Bu çalışmada, İkiztepe'de çeşitli yapı katlarından ele geçen ve Kalkolitik devirden Erken Tunç Çağı III- Orta Tunç Çağı I'e kadar tarihlenen karbonlaşmış tahıl ve meyve tohumlarının yardımıyla ev içlerindeki ekin işleme aktiviteleri anlaşılmaya çalışılmıştır. Arkeobotanik malzemelerin incelenmesiyle ince eleme işleminin yapıldığı ve depo olarak kullanılan alanlar tespit edilmiştir. Ayrıca İkiztepe ve Anadolu'daki diğer Erken Tunç Çağı yerleşimlerinin ekin işleme alışkanlıklarındaki farklılıklar ve benzerlikler tartışılmıştır.

Anahtar Sözcükler: Arkeobotani, Erken Tunç Çağı, İkiztepe, Tohum, Ekin İşleme

ACKNOWLEDGEMENTS

The idea of this study is formed by the courses of the Settlement Archaeology Graduate Program at the Middle East Technical University. I would like to thank here and express of my gratitude to my supervisor Asist. Prof. Dr. Evangelia Ionnidou Pişkin who had first introduced the field of environmental archaeology and patiently helped and supported me throughout my thesis. I would also like to thank warmly Prof. Dr. Numan Tuna for his generous guidance and for his excitement which gave me spirit for writing this thesis.

I would like to thank Prof. Dr. Önder Bilgi and Assoc. Prof. Dr. Şevket Dönmez from University of Istanbul, Department of Protohistory and Near Eastern Archaeology, who provided me the archaeobotanical samples of Ikiztepe, and trusted me in using these materials for my thesis.

I also like to thank the staffs of British Institute of Archaeology at Ankara for permitting me to use the laboratory's facilities in the process of identifying my samples.

I wish to express my special thanks to my friend Nadire Atıcı who cheered me up when I was fed up with studying and supported me everytime I was blue.

I also would like to thank Cem İpek, who encouraged me during the study and was there for me everytime I needed.

I can not finish the acknowledgements before I mention the delicious cookies which my aunt Nermin Çilingir cooked for my thesis exam. Well, thank you very much indeed! I

also would like to thank my cousins Elif Sandal Önal and Saygın Önal for their precious support both during the last days before my thesis exam and in the day of the exam.
I again would like to thank here my one and only grandmother and her mother (!) who prayed for me everytime I fell in trouble.

My aunt (Prof. Dr.) Nesime Merev was the one who introduced me the world of plants when I was 7 years old. She has been my rolemodel throughout these years. Thank you for all you have done for me, my sweet aunt. I wish I can be like you someday.

Lastly, I surely owe the deepest thanks to my family for their endless support, patience and interest throughout my whole life.

TABLE OF CONTENTS

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

CHAPTER I

INTRODUCTION

Environmental Archaeology, as one of the major subdisciplines in the field of archaeology, is an endeavour to reconstruct the relationship between past people and the past environment they lived in. According to cultural evolutionist perspective, cultural evolution of human is an adaptive process on the basis of the interaction between human and environment; therefore it can be scientifically reconstructed and predicted.[1] In the light of this perspective, reconstruction of past environments becomes an essential part of the archaeology to study the past people through their material traces. Environmental Archaeology encompasses several other disciplines for this objective such as, bioarchaeology (archaeobotany and zooarchaeology) and geoarchaeology (archaeopedology and archaeosedimentology).[2] Palaeoethnobotany deals with the socio-economical effects of the relationships between human and palaeobotanic environments through reconstruction by using palaeobotanic remains such as; pollen, seeds, vegetal remains etc. These studies try to provide answers to questions of domestication of crops, crop processing, technologies, mode of agricultural activities, economical relations. However, these applications are rarely included in the excavation projects in Turkey; therefore insufficient amount of information is obtained from these studies concerning their respective settings. In addition, these studies constitute a vital part of the processes to understand past human socio-economic behaviour together with the studies on the relation between material culture and human behaviour. Under these circumstances, I

---

[1] Dincauze, 2000, 23.

[2] Wilkinson and Stevens, 2003, 16-17.

have decided to involve in the ongoing project on paleoethnobotanical research of İkiztepe.

The main aim of this thesis is to identify archaeobotanical remains and understand their spatial distribution within the houses of the Early Bronze Age İkiztepe in order to reconstruct crop processing activities. The archaeobotanical assemblages that are recovered from the houses of Tepe I in İkiztepe 2003 campaign will constitute essential data for the study.

1.1. İKİZTEPE

1.1.1 Excavation History

Ikiztepe was first discovered in 1941 by a team consisting of İ. Kılıç Ökten, Tahsin Özgüç, Nimet Özgüç and the research was directed by Prof. Dr. Şevket Aziz Kansu. It was suggested that the settlement of İkiztepe dated to Hittite and Copper Age periods because of the Copper Age and Hittite potsherds spread over the area.

The investigations were carried on by Dr. Charles A. Burney, Winfried Orthmann and James Andrew Dengate until the Samsun survey which is under the direction of Prof. Dr. Bahadır Alkım in the years of 1971-1974.

An excavation started in 1974 on the reasons that İkiztepe was once located both on the Black Sea coast and on the bank of Kızılırmak river and that none of the potsherds collected during the surveys of 1971 and 1972 were from the Hittite Imperial Period. They seemed to be dating to the period between the Early Bronze Age III and the Old Hittite Ages ("Transitional Period"), which are proposed to be called as the "Early Hittite Period".

The excavation in İkiztepe was directed by Prof. Dr. Bahadır Alkım until 1980 and the research continues under the direction of Prof. Dr. Önder Bilgi since 1981.[3]

1.1.2 Description of the Site

İkiztepe is the largest excavated mound type settlement of prehistoric times in the Black Sea region in Turkey. It is located ca. 55 km northwest of Samsun, 7 km northwest of Bafra and is within the boundary of the present day village of İkiztepe (see fig. 1). It is spread over four natural elevations and four saddles which date throughout a period of Late Chalcolithic to Middle Bronze Age[4] (see fig. 2).

The architectural construction of İkiztepe dwellings was understood by ethno archaeological studies in the rural areas of the region. Comparisons were made between the construction of modern houses of İkiztepe and Early Bronze Age dwellings of İkiztepe.[5]

The dwellings of İkiztepe are constructed with wooden materials and plaster. Absence of stone or mud-brick architectural elements may be related to the far distance from stone quarries and the vulnerability of mud-brick in humid environment. These houses were built by combining the untreated heavy logs in framework technique (superimposing on each other). The logs are placed on to one another and they are joined together at the corners forming a rectangle. The evidence of this kind of construction is the traces of the

[3] Alkım et. al. 1988, 1-2.

[4] Ibid., 3-4.

[5] Bilgi, 2003, 78.

logs on the surface of the ground forming deep grooves as there are no traces of post holes.

Figure 1 The location of İkiztepe (Van Zeist 2003, 580)

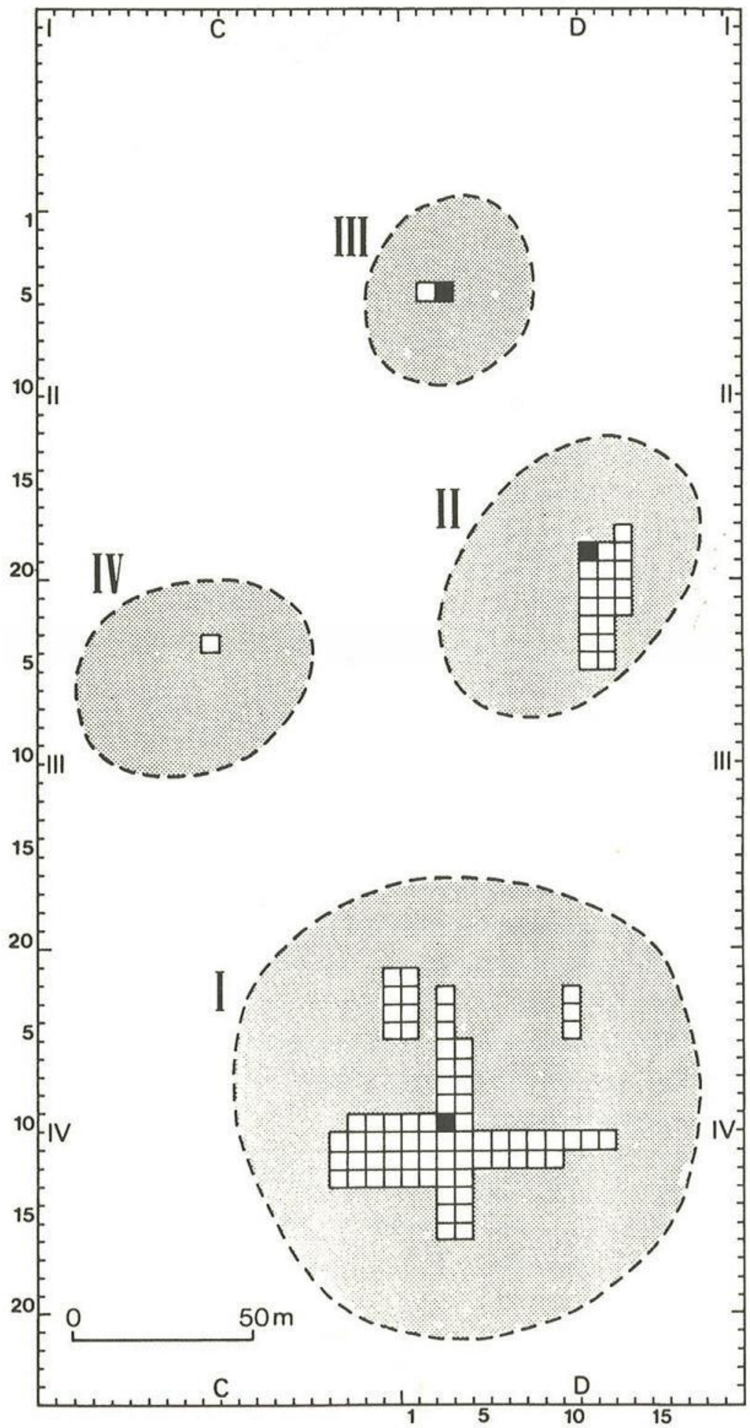


Figure 2 Lay-out of İkiztepe with mounds I to IV including the trenches of Van Zeist's samples (Van Zeist 2003, 581)

The wooden walls of these buildings are known to be plastered with clay in order to prevent the draught and protect the villagers against bad weather conditions. The plaster remains having traces of untreated logs on themselves are the evidence of this type of construction. If this type of construction was built on a smooth surface the foremen of Early Bronze Age placed flat stones randomly under the lowest logs, in order to prevent the decay of the lowest logs and stabilise the building. If the building was located at a sloping area, the difference in elevation was eliminated by the use of wooden posts. This type of construction is seen in the buildings before Early Bronze Age.[6]

These kinds of houses are single or multi-roomed. Single-roomed houses are built with or without courtyards (see fig. 3). The houses with courtyards have hearths in the courtyards. Multi-roomed houses have 2 or more rooms (see fig. 4).

Considering the fact that survival of these wooden materials is very low, architectural finds are mainly trodden earthen floors in the buildings that are built on smooth surfaces and in many cases these floors represent burnt levels. Some houses built with particular care have boarded floors. The boarded floors are formed by placing untreated small logs next to one another. The houses which are built in the sloping areas have always boarded floors and these are made up of treated logs.

The presence of windows is questionable because of the absence of evidence of walls. However it is only an assumption that there were small windows near the ceiling when the modern village examples are examined. The small holes on the wooden walls originating from the construction technique may have been the main way for sunlight to be allowed in the buildings.[7] The entrances are on the longer or shorter walls and have stone or clay doorposts to open the wooden doors easily. These entrances also have wooden apprentices.

---

[6] Bilgi, 1999, 64.

[7] Harmankaya, 2002 ; Bilgi, 1999, 64-65.

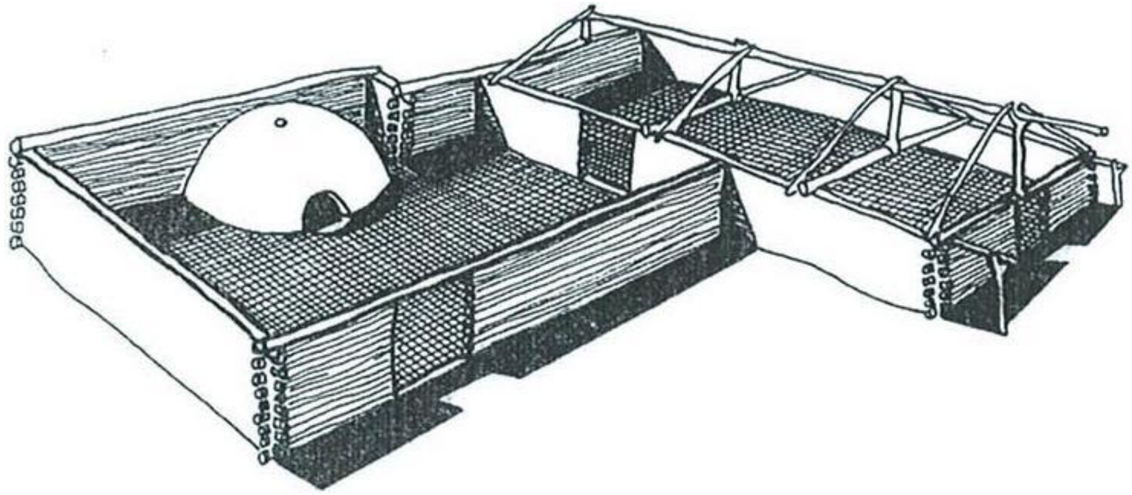


Figure 3 The restitution of a single room building with a courtyard (Bilgi 1999,68)

Figure 4 The restitution of a multi-roomed construction with a shelter (Bilgi 1999,69)

There is little evidence to interpret the construction of roofs in İkiztepe houses but the dwellings most probably did not have flat roofs. Dried reeds of branches of trees may have been used for roof construction.

There is no evidence of hearths, kilns or workshops in the buildings. These kinds of constructions are in the courtyards, which are enclosed by simple fence walls that are made up of wooden logs. A small part of the courtyards were capped by a light material, so called apprentice, of bent fresh branches covered by a thick layer of clay plaster. In these circumstances Bilgi states that cooking and daily life activities went on these courtyards and the wooden dwellings are used at nights and in bad weather conditions.[8] He also assumes that these enclosed courtyards may have been used as pens and sties to protect the domesticated animals from harm at nights depending on the examples of usage of these kinds of courtyards in the modern villages of the region.[9]

On the other hand there are examples of monumental kilns which do not belong to a building (see fig. 5). It is noted that production of pottery and clay objects and metal casting were performed here. The evidence of these activities is the small finds that are recovered nearby. It is thought that these places are the workshops of the settlement that are used in common by the villagers.[10] In the monumental kilns, the dome was first built as an enclosure by branches twisted when they were green, and then the upper and lower part of this dome were plastered in a thick layer of clay.

The wooden houses are spread into the village in groups, but in free-standing order. On the other hand it is claimed that the people of İkiztepe lived in larger groups before Early Bronze Age II because of the size of wooden dwellings (see fig. 6). The surface areas of these dwellings were from 100 m^2 to 150 m^2. The villagers begun to live in smaller

---

8 Bilgi, 1999, 65.

9 Ibid., 65. ; Harmankaya, 2002.

10 Bilgi, 1999, 65.

groups as families dating from Early Bronze Age II (see fig. 7) and the surface areas of the dwellings varied from 25 m^2 to 70 m^2 .[11]

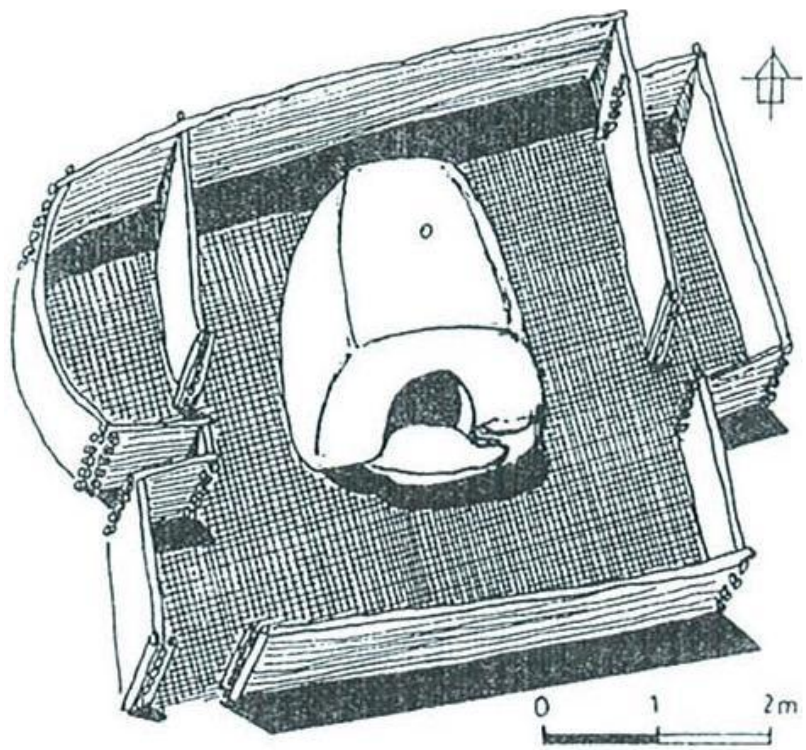


Figure 5 The drawing of a monumental kiln (Bilgi 1999,73)

[11] Ibid., 65.

Figure 6 An example of a large building dating before EBA II (Bilgi 1999,74)

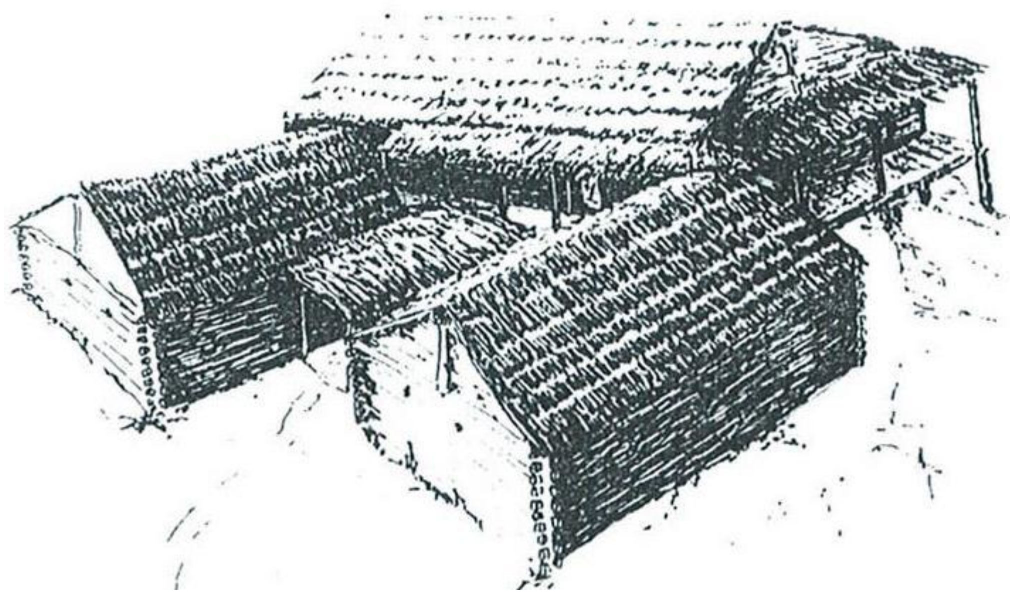


Figure 7 The appearance of a group of wooden construction after EBA I (Bilgi 1999,74)

Mound I was inhabited during the Early Bronze Age I, II and III and the first phase of the Middle Bronze Age (~ 3200 to 1700 BC) and each phase is represented by several building levels. Mound II saw occupation from Late Chalcolithic times through Early Bronze Age II (~ 4200 to 2400 BC) with several building levels representing each period. Mound III has Early Bronze II and III, Middle Bronze Age, Late Iron Age and Hellenistic occupations (~ 2800 to 1700 BC and ~650 to 100 BC). Mound IV has only a trace of Middle Bronze Age (~1900 to 1700 BC). İkiztepe was abandoned at the end of the first phase of the Middle Bronze Age until the seventh century BC when a settlement with Late Iron Age central Anatolian characteristics was established (see Table 1) .[12]

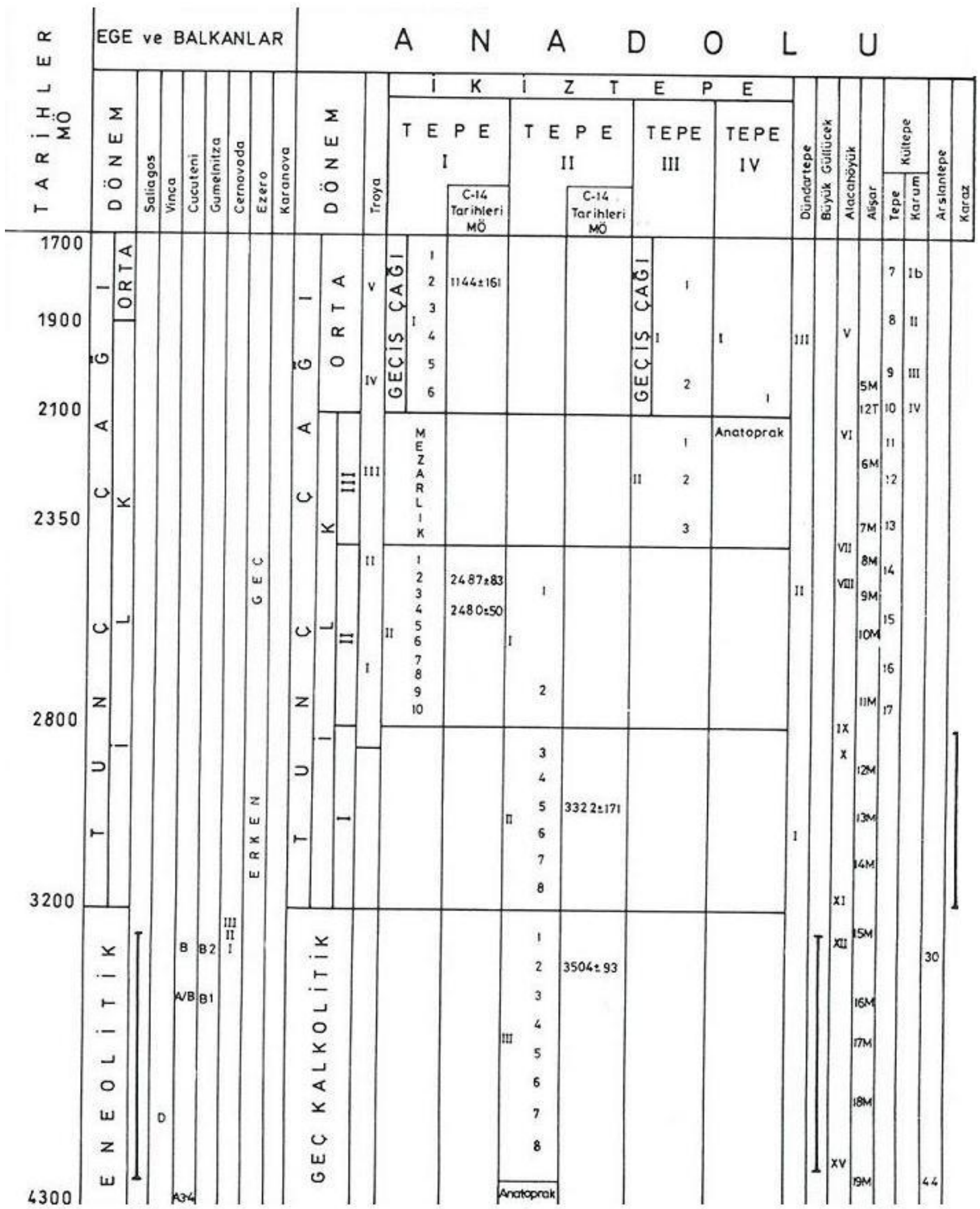
Before the Middle Bronze Age the pottery is dark surfaced and handmade, the clay contains mineral inclusions and sometimes shell and chopped straw. Vessels are usually well-slipped and polished. The main shapes of pottery are bowls (different colours on the exterior and interior, horned lugs, simple lugs and horned or loop handles are characteristic) jars with or without necks, fruit-stands and *pithoi*. In the Late Chalcolithic and Early Bronze Age I and II vessels may be decorated with white paint applied outside. From Early Bronze Age II the vessels may be decorated with incision or grooved lines or in a reserved technique. Patterns are geometric in all periods. Examples of relief decoration also occur. The Middle Bronze Age pottery is made on fast wheel and none of them are decorated. Shapes include beakers, bowls, beak-spouted pitchers, ewers, spoons, ladles, jugs and *pithoi*.

1.1.3 Tepe I

Tepe I is the largest mound of İkiztepe. Excavations in Tepe I was first conducted in 1974 and restarted in 2000. The excavations yielded trodden earthen floors and

[12] Bilgi et. al. 2003, 341.

Table 1 The chronology table of İkiztepe (Alkım et.al. 2003, 341)



workshop areas belonging to different phases of Early Bronze Age II.[13] Trench M, area C19/IV 8 and 9 and C20/IV8 in which the plant remains of this thesis is recovered, is in the northern slope of the hill. Beaten earthen floors are recovered from these areas and it is thought that they are dating to Early Bronze Age II levels 5 and 6. 2 loom weights, 3 terracotta weights, 3 piercing and cutting artefacts were recovered from the first phase of level 5. A bowl, 2 small pots, 2 figurines, 5 weights, 10 loom weights, one bead, 9 piercing artefacts made up of bone, a spoon, a polishing artefact, 6 cutting artefacts and a pendant made up of oyster cortex were in the finds of level 6.[14]

The research about the plant remains of İkiztepe mainly concentrated on the results of charred seeds and fruits secured from Late Chalcolithic, Early Bronze Age and Early Hittite (EBIII / MBI transitional period) occupation levels of the site. The plant remains of İkiztepe were studied by Willem van Zeist at the early stages of the excavation.
The original vegetation of the region consists of mixed deciduous forest. The samples were obtained in the field and usually two or four buckets (of 10 litres) of soil were taken. Charred seeds, fruits and other plant remains were recovered from the samples by a simple manual water separation method.[15]

The spatial analysis that will be made will be a contribution to understanding the function of activity areas within the houses and an actual patterning of plant remains will be searched in order to specify the uses of these areas. The use of the places especially inside the dwellings and in the courtyards could not be clearly specified because of the lack of traces of architecture, apart from kilns, hearths and clay benches. Also, no spatial analysis of small finds has been done. I think it will be helpful to examine the plant remains and try to answer the questions of function of these areas by specifying the plant remains and examining the concentration of these remain within the context.

---

[13] Alkım et. al. 1988, 15.

[14] Bilgi, 2004, 21-22.

[15] Van Zeist, 2003, 547-550.

CHAPTER II

LITERATURE REVIEW

2.1 PLANT REMAINS OF İKİZTEPE

Palaeoethnobotany deals with the socio-economical effects of the relationships between human and palaeobotanic environments through reconstruction by using palaeobotanic remains such as; pollens, seeds, vegetal remains etc. These studies try to provide answers to questions of domestication of crops, crop processing, technologies, mode of agricultural activities, economical relations etc. However, these applications are rarely included in the excavation projects in Turkey; therefore insufficient amount of information is obtained from these studies concerning their respective settings. In addition, these studies constitute a vital part of the processes to understand past human socio-economic behaviour together with the studies on the relation between material culture and human behaviour. Under these circumstances, I have decided to involve in the ongoing project on Paleoethnobotanical research of Ikiztepe.

The research about the plant remains of İkiztepe mainly concentrated on the results of charred seeds and fruits secured from Late Chalcolithic, Early Bronze Age and Early Hittite (EBIII / MBI transitional period) occupation levels of the site. The plant remains of İkiztepe were studied by Willem van Zeist in the years of 1975-2003.

The samples were obtained in the field and usually two or four buckets (of 10 litres) of soil were taken. Charred seeds, fruits and other plant remains were recovered from the samples by a simple manual water separation method.

2.1.1 The agricultural crops

Wheat

Triticum dicoccum, *Triticum monococcum* and *Triticum durum/aestivum* are the wheat species that are recovered from İkiztepe.

- *Triticum dicoccum* (emmer wheat): It is the predominant wheat through all periods represented in the seed record of İkiztepe.
- *Triticum monococcum* (einkorn wheat): It is found in fair numbers of samples but much less than *Triticum dicoccum*. It is likely to be a minor crop which was grown either as a crop in its own right or mixed with emmer wheat.
- *Triticum durum/aestivum* (hard wheat/bread wheat): No distinction can be made between the charred grains of hard wheat and bread wheat. The climate of İkiztepe is very suitable for the cultivation of bread wheat but the hard wheat is well adapted to the Mediterranean type climate.

Barley

Barley played a less prominent role than wheat in İkiztepe. *Hordeum vulgare* was the only apparent type of barley cultivated and the twisted grains and the rachis internodes point to this six-rowed type barley. It could have been grown for human consumption and for feeding domestic animals.

Chickpea (Cicer Arietinum)

It is the best represented among the pulse-crop materials. The chickpea may be cultivated in Chalcolithic times but not afterwards.

Pea (Pisum Sativum)

It is well represented in the Chalcolithic and Early Bronze Age periods but not in the EBIII/MBI transitional period.

Bitter Vetch (Vicia Ervilia)

It is seen in all periods represented in the seed records.

Lentil (Lens Culinaris)

It must have been a major foodstuff of the inhabitants. It is seen in all periods.

Grass pea (Lathyrus Sativus)

There is evidence that it may be cultivated in the EBIII/MBI transitional period.

Flax /Linseed (Linum Usitatissimum)

It could have been grown for its oleaginous seeds or for its fibres from which linen cloth is manufactured.

2.1.2 Fruits and Nuts

Pips of grape vine (*Vitis vinifera*) were recovered from the samples of İkiztepe. The species are wild so that cultivated grape-vine can not be observed in the site and that the species were collected from wild. As İkiztepe lies within the distribution area of wild fig (*Ficus carica*) figs could also be collected from the wild.

Representations of nutshell remains of hazel (*Corylus*) are few in the arrchaeological context. Corylus colurna, is the type of hazel that is mostly seen in İkiztepe.

Oak (Quercus), cotoneaster (Cotoneaster), hawthorn (*Crataegus pentagyna*), barberry (*Berberis vulgaris*), elder (*Sambucus nigra*), dwarf elder (*Sambucus ebulus*) and bramble (Rubus) are other types of remains belonging to fruits and nuts group in İkiztepe.

2.1.3 Weeds

The weeds can be divided into subgroups as weeds of arable fields, gardens, waste places and roadsides. Taxa of arable fields include *Adonis* (pheasant's eye), *Avena* (oat), *Bromus sterilis* (barren brome), *Lithospermum arvense* (corn gromwell), *Phalaris* (Canary grass), *Polygonum convolvulus* (black bindweed) and *Vicia* (vetch).

Digitaria (finger-grass), Echinochloa (cockspur grass) and Setaria (bristle-grass) are the weeds of millet fields but as millet could not be cultivated in İkiztepe, these grasses may have been found in kitchen gardens in or nearby the settlement. Other possible garden weeds are *Chenopodium album* (fat hen), *Fumaria* (fumitory), *Portulaca oleracea* (purslane), *Solanum nigrum* (black nightshade) and *Stellaria media* (chickweed).

Species of waste ground must have been found in the settlement itself on refuse heaps and in unused corners. Weeds of waste places include *Atriplex* (orache), the goosefoot species *Chenopodium hybridum* and *C. murale*, *Hyoscyamus* (henbane), *Polygonum aviculare* (knotgrass), *Rumex* (dock) and *Sambucus ebulus* (dwarf elder).

2.2. THE EARLY BRONZE AGE IN TURKEY

The urban life of Anatolian settlers has attracted and still attracting the attention of investigators since decades. These settlements had an improved technology in the cut stone industry and trade as well as agricultural activities and the use of bronze in a very limited extent. Despite these facts, there seem to be no clues about the social organization, stratification and spatial differentiation in the structural buildings which clarify the difference of "states" and "pre-state societies" of the Early Bronze Age.

There had been a series of important developments in agricultural activities in Anatolia until the 3rd millennium B.C. The first was the improvement of interregional trade relationships covering long distances. It was followed by the foundation of new settlements which possessed differences in construction and spatial distribution of the buildings. The third and the last were the improvements in the processing techniques of bronze, which is an alloy of tin and copper.[16]

Early Bronze Age I (3000 – 2800/2700 B.C.)

The most important difference of Early Bronze Age settlements is that they were founded with a great need of security. The improvements in agriculture and collecting surplus leaded to a specialization in statecraft so that the princes or kings served as administrative members of the community controlling the economy. Community life became more complex by the introduction of trade and professionals in metallurgy. Religious activities played an important role in communities' social life.

Anatolia became the source of trade so as other regions lacked the resources which Anatolian settlements hold in hand; Mesopotamia and Aegean depended on the

[16] Aktüre, 1997, 179.

Anatolian supply. The trade relationships developed as the need for the resources increased by time, thus leaded to the expansion of the networks of trade.[17]

Early Bronze Age II (2800 – 2300/2200 B.C.)

The appearance of fortified towns and the highly burnished pottery which are based on metal prototypes are introduced in the Early Bronze Age II. The red slipped pottery was replaced by the black slipped burnished ones.

By the end of Early Bronze Age II there seem to have been a great destruction of the cities which brought an end to the Early Bronze Age II. The arrival of Luwians in northwest Anatolia from Thrace some time in Early Bronze Age has been theorised and a second invasion has occurred around 2300 B.C which caused the people to move east and south.[18]

A crisis occurred between the Early Bronze Age II and Early Bronze Age III periods which the settlements were abandoned because of the inhabitant's incompetency in preventing the destruction or invasion.[19]

Early Bronze Age III (2200 – 1900 B.C.)

The key factors which formed the Early Bronze Age III societies were higher population densities and shared cultural ideas in ceramics, metallurgy, the megaron architectural design and *pithos* burial practices. The spread of ceramic types included the "wheel

---

[17] Joukowsky, 1996, 143.

[18] Mellaart, 1971, CAH, 407-408.

[19] Joukowsky, 1996, 144-145.

made platters, incised spindle whorls, and handmade forms including *depas* cups, tankards, beak and cutaway-spouted jugs, and red-cross bowls."[20]

2.3 THE FORMATION PROCESS AND CHRONOLOGY OF THE EARLY BRONZE AGE SETTLEMENTS IN ANATOLIA

The formation process of the first states can be summarised by the principles of Gordon Child's theories of Neolithic revolution and urban revolution. Five phases can be listed as the reasons of the emergence of the first states. [21]

The first phase involves the activities of the hunter gatherer communities which learned agriculture and animal husbandry gathering their knowledge throughout thousands of years. These communities succeeded in producing their own food and became sedentary towns of Neolithic.

The second phase was the creation of a Neolithic society which can produce surplus in the suitable areas like southern Mesopotamia, the valley of Nile and Indus. By the help of this economic profit, this society could assist craftsmen specialized in activities other than agriculture.

The technological improvements continued in the third phase and the use of bronze which is an alloy of copper and tin became widespread towards 3000 B.C. The production of bronze tools was definitely a matter of specialization and required an organization. The assurance of production depended on the supply of raw material from long distances. Thus the exchange of processed material and the goods which the society

[20] Joukowsky, 1996, 145-146.

[21] Aktüre, 1997, 20-21.

can not produce, leaded to an improvement on external trade. So forth, the self-sufficient Neolithic societies begun to disappear. The community had to increase the surplus to feed the specialized craftsmen who play an important role in processing of the copper and tin.

Important improvements took place in the agricultural technology during the fourth phase. From the beginning of 3000 B.C in Egypt and Mesopotamia, the use of plough, the creation of water channels and the use of wheel and sailboats in the transportation, increased the surplus and paved the way for its transportation. The developments in transportation provided long distance trade to progress.

The rise of external trade caused an increase in the relationships of societies, and this leaded to a sudden expansion in technological improvements. Thus, the production caused the population to increase and the settlements to expand. A king and administrative communities arose which took the control of the surplus. The capital was used to build palaces, temples and monumental buildings.

At the end of these five phases, the simple Neolithic societies which deal with plant and animal husbandry only in the suitable lands developed to be the settlements of Bronze Age which have a more complex character.

Gordon Child summarises the differences of Neolithic societies and the first urban settlements in 10 steps.[22] These can be listed as follows.

1) The very first settlements must have been much more densely inhabited and populated. It is calculated that the Sumerian settlements of Mesopotamia had a population around 7000 to 20000.

[22] Child, 1950, 9-16; Aktüre, 1997, 11-13.

2) Although the majority of the population dealt with agricultural activities, all the urban settlements had to have different communities dealing with activities other than agriculture. These were specialized craftsmen, labourers of transportation, tradesmen, military men and priests.

3) Every urban society had to have a godlike "king" who controlled the surplus which is gathered from the small producers that produce the goods in very limited technological possibilities.

4) The monumental building symbols the gathering of surplus in the urban settlements other than the mission of separating the urban settlements from towns.

5) The priests and the martial administrators formed a managerial class by controlling the collection and distribution of surplus which is stored in the store rooms of the palace or the temples, although, they did not take place in the production.

6) The need for recording some events, keeping official records, collecting the income of the temples caused a symbol system to arise. These symbols were recorded on papyrus in Egypt and on clay tablets in Mesopotamia.

7) The improvements in geometry and astronomy, the invention of calendars to arrange the sowing and collection time of agricultural goods and the existence of mathematical knowledge were also the signs of urbanity.

8) The Neolithic societies preferred to picture natural objects in a manner of discrete geometrical impressions. Despite, the craftsmen which deal with picturing and statuary in the urban settlements of Egypt, Sumer and Indus generally preferred conceptualization in their works.

9) The existence of interregional long distance trade relationships was the common character of the very first civilizations and the settlements which belong to them.

10) The administrators, priests, craftsmen and agriculturalists formed an organic cooperation which served for each other. This was the most important property which separated the civilized societies from the primitive ones.

The chronology of Bronze Age depends on some studies of pottery and character of metal tools recovered from archaeological excavations in Anatolia and it is dated between 2800-1200 B.C in three phases as follows;[23]

Early Bronze Age – 2800-1900 B.C
Middle Bronze Age – 1900-1400 B.C
Late Bronze Age – 1400-1200 B.C.

In the beginning of Early Bronze Age, the cultures were still maintaining the characteristic of Chalcolithic towns which depended on the agricultural activities. The major technological discovery of this age was the four wheelers and the use of bronze was not common yet.[24]

Anatolia had been through an economically good age towards the middle of the 3rd millennium B.C. The interregional trade and the use of bronze were widespread. The invention of potter's wheel helped the production capacity to expand and this invention could be seen as a first step of production for the market.[25] The first city-states of

[23] Aktüre, 1997, 98-100; Lloyd, 1958, 93-113; Esin, 1969.

[24] Aktüre, 1997, 98.

[25] Ibid., 98; Akurgal, 1988, 27.

Anatolia were founded by the facilitation of the improvements in production and trade. The earliest city-state in Anatolia was Troia II, which is founded on the debris of Troia I.

Troia I, Demircihöyük, Kusura, Semayük, Alacahöyük, Karaoğlan, Beycesultan, Tarsus, Alişar, Arslantepe, Norşuntepe, Pulur, Köşkerbaba, Kaniş (Kültepe) III-IV[26] and İkiztepe were the most important settlements recovered from archaeological investigations which belong to this period.

2.4 THE EARLY BRONZE AGE CULTURES IN ANATOLIA

2.4.1 Western Anatolia

The most important cultures of this region in the Early Bronze Age are Troia (Troia I-V), Yortan, Beycesultan and Aphrodisias.

The towns were commonly fortified and the architecture of the buildings contained mud-brick walls with stone foundations. The fortification walls sometimes included projecting towers as in the example of Troia II. The megaron plan was applied in the construction of the buildings and some houses included circular hearths in them.[27] In the later periods of Early Bronze age the plans improved and the buildings formed groups of 2 or more with megaron plans.

A wide range of artefacts like metal needles, pins, awls, hammer stones, grinders, querns are found. The ceramics corpus includes monochrome- black burnished ware

[26] Mellaart, 1957, 64.

[27] Joukowsky, 1996, 152.

(sometimes with white-filled incisions), beak spouted jugs, tripod cooking pots as well as *depas*, tankard which are introduced by Troia and *askoi*.[28]

2.4.2 Cilicia and the Central Anatolian Konya Plain

The developments in Cilicia and Konya Plain occurred almost at the same period. There had been autonomy of the individual sites in the region than in the southwest and there seem to have been no connection between these cultures and the west. We assume that there have been stylistic cultural influences by the evidence derived from ceramics.[29] The sites of this region were destructed by burning in 2300-2200 B.C.

The fortification walls were built around the towns with rectangular bastions in some of the settlements like Alişar. The buildings were constructed with mud-brick walls on stone foundations as in Western Anatolia. Rectangular roomed houses and royal tombs with rectangular plans were constructed in Alacahöyük.

The ceramics included approximately the same shapes as in Western Anatolia.

2.4.3 Southeastern Anatolia

The chronology of south east Anatolia corresponds with Mesopotamian dates. By the end of Late Chalcolithic period in the southeast, a culture change occurred. This period is defined as Protoliterate in Mesopotamia. After this period the Jemsat Nasr (3100-2900

[28] Joukowsky, 1996,145-164.

[29] Ibid., 149.

B.C.)- Early Dynastic I (2900-2700 B.C.) period begins and there occurs an increase in population.
South-eastern Anatolia and Mesopotamia develops simultaneously because of the need of Mesopotamia for raw materials which they get from south-eastern Anatolia. There are two cultures in south east Anatolia known as Amuq and Anatolian Bronze Age culture because of the influence of Mesopotamia and Syria.

By the end of Early Bronze II in southeast Anatolia a period of uncertainty occurred as well as in Palestine. The incursions of the Akkadian rulers to Syria and the movement of eastern tribes in to the area affected the Palestine. The ceramics also reflected the movement of these people. They consisted of plain simple wares, reserved slip wares, multiple brush painted wares, red-black burnished wares, brittle orange wares, stone wares, smeared wash wares, grey spiral ring burnish wares, early Khabur wares, hand burnished cooking pot wares and incised and impressed wares.[30] In 2200 B.C the eastern Anatolian culture replaced that of earlier south-eastern traditions except the local ones but there were still settlements in the southeast which resisted change and maintain their own traditions.[31]

In the Early Bronze Age III a classification can be made according to the settlement size such as villages (0.5 hectares to 1.5 hectares), towns (5 hectares) and large centres (13 to 25 hectares). Towns and villages seem to be located near centres and they also seem to be independent.[32]

The settlements of south-eastern Anatolia were compact and fortified. They had small houses connected to courtyard walls or constructed back-to-back. The fortified upper cities or citadels served as administrative or religious centres. The lower cities or towns

---

[30] Braidwood&Braidwood, 1960.

[31] Joukowsky, 1996,174.

[32] Ibid., 175.

were also fortified. The buildings were irregular and bunched together. There were stone chamber tombs with multiple burials which included grave goods of metal and ceramics.[33]

2.4.4 Eastern Anatolia

The settlements of this geographical region lied in the highlands in the Tigris and Euphrates drainages. There were contacts with north-western Iraq and Iraq in the east, in the north with Caucuses, to the west with the eastern part of central Anatolia and with Syria in the southeast. The urban centres of eastern Anatolia emerged in the basin of the Euphrates. The traditions of Mesopotamia affected the Elazığ and Malatya area while western Iran influenced the Lake Van area.[34]

The planned urban centres with monumental architecture similar to Mesopotamian and Syrian cultures developed in the Early Bronze Age III. Norşuntepe and Korucutepe were examples of urban centres with palaces, shrines and large storage areas of this period.

Characteristic pottery was black burnished. Red on white painted wares, Pulur type lids and incised black wares were also common. These were mixed with Syrian plain wares and reserve slip wares. Animal shaped figurines were also present.[35]

2.4.5 The Black Sea Region

The widely populated areas of the Black Sea Region in the 3rd and 2nd millennium B.C. were situated towards the Kızılırmak valley and the ancient alluvial deltas. The largest

---

[33] Joukowsky, 1996, 176.

[34] Ibid., 176-177.

[35] Ibid., 180.

of these mentioned alluvial deltas was the Bafra plain which was limited by the geographical formations of Canik and Isfendiyar mountains. The Early and Middle Bronze age inhabitants occupied the area provided by these mountains low hilly territories.[36]

The distribution of Bronze Age settlements in Çarşamba plain is not well-recorded because of the difficulty of identification because of the vegetation cover and thick deposits of alluvial soils. Tepecik and Kilistepe are examples of Early Bronze Age settlements in this region which are mounds located in higher elevations.[37] İkiztepe was also a settlement which was situated in the Bafra Plain and was occupied since the Late Chalcolithic period.

The hinterland of the Black Sea region covering the area between Merzifon and the north of Amasya was also densely populated in the Bronze and Iron Ages. Although the Yeşilırmak delta is fertile and partly wooded, there are no clues of the prehistoric settlements dating to the late prehistoric period, thus, the reason may have been the alluvial nature of the terrain.

Both Sinop and Kastamonu seem to have been occupied during the Early Bronze Age according to the information gathered from the archaeological investigations.[38]

According to the results derived from the archaeological excavations, the population of Çoruh valley and Bayburt valley was not dense and the occupation can be interpreted as seasonal. The drainage and the soil type of the area prevented the settlements economy to improve in the sedentary communities. Pulur, İvceklerin Tepesi, Siptoros Höyük and

---

[36] Yakar, 2000, 285.

[37] Ibid., 285; Yakar, 1980, 81.

[38] Yakar, 2000, 286.

Hindi Höyük are the examples of sites inhabited in the Bayburt valley in the Early and perhaps in the Middle Bronze Age.[39]

The evidence gathered from the settlements of Bronze Age in the Black Sea region sheds light into 3 different types of settlements which are small villages on mountain and hill slopes, small hill-top villages and larger settlements on flat terrain and low natural elevations. The small mounds were located generally around larger settlements and it seems logical to think that these small mounds were hamlets socio-economically linked to larger towns or villages. As a result, the settlement hierarchies may have been formed from the third or the fourth millennium B.C.[40]

2.5 THE ARCHAEOBOTANICAL REPORTS OF THE SETTLEMENTS IN ANATOLIA DATING TO THE EARLY BRONZE AGE

The archaeobotanical studies concerning the settlements of Anatolia have been conducted during the ongoing excavations in the region. Thus, the summaries and some important results of these studies which belong to the settlements in western, eastern, central, south eastern and southern Anatolia will be defined here.

2.5.1 Western Anatolia

Troia

The archaeobotanical studies in Troia yielded some important results about the agricultural activities within the region. As mentioned in the previous section, Troia I-III are the phases of the settlement which date to Early Bronze Age. Although there said to

[39] Ibid., 300.

[40] Ibid., 286.

be an overlap between Troia I and II, the archaeobotanical investigations concentrates on the periods Troia I until Troia VII. The thickness of the layers is not the same, so that the periods of the settlement are not represented equally in the site in relation with the excavations, thus, there are no samples belonging to Troia III and V. Despite this fact, the layers of Troia I/II which belong to the Early Bronze Age are represented in the sample record.[41]

The archaeobotanical samples of Troia were collected from 6 different activity areas which can be summaries as;

- Floors: The floors may sometimes contain storage areas and the floors inside the building represent the activity areas which people live in.
- Fills: Many of the Early Bronze Age samples come from the fills which can be defined as the areas close to any kind of wall.
- Ovens and Hearths: These are units built within the houses in which the crop and food processing activities may occur.
- *Pithoi* and other pottery: The *pithoi* and other kinds of pottery may contain archaeobotanical samples which may prove storage facilities of a building.
- Burial contexts
- Rubble: They were mostly related to the structural elements of the buildings, and were used in construction of foundations.

The samples dating to Early Bronze Age levels mainly come from the fills and waste and storage facilities although the above list contains different areas of activity.[42]

Quantitative analysis was applied depending on the data derived from the recovery of samples from the field. The raw data was modified in order to apply correspondence and

[41] Riehl, 1999, 8.

[42] Ibid., 27.

canonical discriminant analysis. By the help of correspondence analysis, the clusters of plant taxa according to their characteristics such as dating, function or ecological groups was tested; while the canonical discriminant analysis was used to determine the stages of crop processing.

The canonical discriminant analysis was used by Glynis Jones, in her studies in Greece. Four groups of remains which represent the crop processing activities were listed as, winnowing by-products, coarse-sieve by products, fine-sieve by-products and fine-sieve products. The characteristics of the weed seeds such as seed size, tendency to remains in heads and aerodynamic qualities were also included in the analysis.

The analysis of the archaeobotanical samples had driven some results about the distribution of species. The results are summarised below.

- *The pit within the building near the entrance (BP24, n=24):* Fifty percent of the sample is consisted of hulled wheat chaff remains and weeds; while the remaining part consists of wild plants from water habitats (Fimbristylis cf. bisumbellata, Chara sp., Salsola kali, Berula erecta, Alopecurus geniculatus etc.). A high percentage of the grasses consist of Alopecurus geniculatus, Eragrostis sp. and Phalaris aquatica/paradoxa. Small seeded legumes were also present in the sample. The interpretation of this sample was made such that the pit was used to store dung cakes ready to be used as fuel.
- *Pots (BP21, n=67, BP22, n=46):* Two pots were sampled within the same room. The largest component of the pots was the chaff remains of hulled wheat. These are interpreted as the wastes accumulated from the floor during the collapse of the building.
- *Another room of the same house or outside the building (BP10, n=45, BP23, n=26)*: BP23 has a high percentage of bitter vetches while BP10 contains species of *Graminae* and *Cyperacae*. Thus, freshwater and marine habitats and

open vegetation is represented. The composition of the sample is again interpreted as the use of dung as fuel.

- *A Profile from the North of Megaron IIA*: High numbers of hulled wheat chaff, a broad species spectrum of wild plants and grass species (*Alopecurus spp., Phalaris spp., and Eragrostis sp.*) were recovered. Water or moisture indicating plants such as *Trifolium sp.* and *Chara sp.* were also recovered. The water indicating plants seemed to decrease towards the surface and species from maquies vegetation such as *Ficus carica* were apparent only in the upper parts of the profile. On the other hand, bitter vetch decreased towards the upper parts of the profile.
- *Canal dating to early Troia II (trench E4)*: It has been thought that the canal may have been a water supply for the settlers of Troia and that the canal was connected to a well which are several on the hill. The sample consisted of typical composition of Early Bronze Age archaeobotanical samples such as emmer and einkorn chaff with slight dominance of emmer and a broad spectrum of grass species. The most important find of this sample is that it also included oogonia from Chara sp. This indicated that the lumps of whole plants were swept into the canal and that they disturbed the water to flow and a need for dredging them out has risen.[43]

Yenibademli Höyük

The crop plants of Yenibademli Höyük (Gökçeada) were studied by Emel Oybak Dönmez from Hacettepe University.

The samples were recovered from 15 contexts such as floors, hearths, burnt layers and *pithoi* which were floated manually.

[43] Ibid., 30.

The cereals consisted of all glumed wheats such as *Triticum monococcum*, *Triticum dicoccum* and *Hordeum L.* The types of legumes recovered are *Vicia ervilia*, *Vicia faba L.*, *Lathyrus sativus L./L. Cicera L.*, *L. Clymenum L.*, *Pisum sativum L.*, *Lens culinaris Medik.* and *Trifolium L.*. *Vitis slyvestris* Gmelin/*V. Vinifera L.* as fruits and *Lolium L.*, *Galium L.*, *Bromus L.* and *Rumex L.* were recovered as species of weeds. [44]

Storage activities were interpreted depending on the samples from *pithoi* recovered from the burnt layers of a room. Bitter vetch and hulled wheats were found together in a *pithos* while a mixture of fava bean and barley was found in another. These contents of *pithoi* were interpreted as maslins formed for risk-buffering reasons.[45]

The diversity of crops in Yenibademli Höyük is said to be depending on the idea to reduce the chance of complete crop failure. It is stated that legumes were used to maintain crop fertility in the fields, while Spanish vetchling seeds were stored as a crop or was a contaminant of another stored legume species.[46]

Storage of seed corn for fodder plants is examined by the find of clover seeds while small quantities of grape pips are recovered from Yenibademli Höyük.

The interpretation of the cleaning of the crops after harvest is made depending on both the range and quantity of weedy plants and rye grass seemed to be the most common weed of the settlement.[47]

---

[44] Dönmez, 2005, 10, 42.

[45] Ibid., 10, 46.

[46] Ibid., 10, 47.

[47] Ibid., 10, 47-48.

Liman Tepe

The archaeobotanical samples of Liman Tepe were recovered from the northern, central and southern parts of the floors of 3 houses located radially.[48]

The crop species include *Triticum monococcum*, *Triticum dicoccum*, *Triticum aestivum/durum*, *Hordeum* and *Poaceae.* The legumes are *Lens culinaris*, *Vicia ervilia*, *Lathyrus sativus/ L. cicera*, *Pisum sativum L.*, *Fabaceae, Trifolium L.* and *Trifoliae. Ficus carica and Vitis sylvestris Gmelin/ V. Vinifera* are recovered as species of fruits while *Lolium L.*, *Galium L.*, *Circium*, *Adonis L.* and *Polygonum L.* are the species of weeds.[49]

The quantity of cereals are higher than the pulses and the major cultivated crops are the glumed wheats especially *Triticum dicoccum*. As well as grains, the fragments of spikelet belonging to the glumed wheats were also found. The percentage of lentils is higher than *Vicia ervilia*, *Lathyrus sativus* and *Pisum sativum*. The existence of bread wheat in the samples proves that *Triticum aestivum/durum* was cultivated from the beginning of Early Bronze Age in the sea shore of Western Anatolia while it is seen in Troia from the beginning of Middle Bronze Age.[50]

The question of cultivation of grape and figs in Liman Tepe is questionable because of the difficulty of identification between the wild and cultivated ones. Thus, the settlers of Liman Tepe may have collected them from the wild so as they are the main components of Mediterranean vegetation in the Early Bronze Age I.[51]

---

[48] Ibid., 542.

[49] Dönmez, 2006, 542-543.

[50] Ibid., 543.

[51] Ibid., 544.

The weeds are species of open vegetation such as *Lolium L.*, *Galium L.*, *Adonis L.* and *Polygonum L.* which may have been mixed with the crops during harvest and may be amalgamated in to the floor deposits during the sorting of the crops before consumption or storage. The abundance of fragments of spikelet found in the northern part of a house represents the pounding process which took place in the area. The weeds found in the various parts of other houses also prove the sieving stage of crop processing activities took place inside the houses.[52]

2.5.2 Central Anatolia

The archaeobotanical investigations dating to the Early Bronze Age in central Anatolia is very limited so we can only mention species diversity of Alacahöyük.

Alacahöyük

The crop species include *Triticum durum* and *Triticum compactum* while *Hordeum vulgare* and *Hordeum disticum* can be recorded as species of barley. The weeds are *Lathyrus hirsutus*, *Cerinthe minor*, *Ornithogallum*, *Gittago segetum* and *Bifoae*. *Cerinthe minor* has the majority of all the weeds.[53]

2.5.3 Eastern Anatolia

Arslantepe

A number of 30 samples were recovered from the floor of the house A607 in Arslantepe. The layer where the archaeobotanical samples were recovered contained cooking pots and three large storage *pithoi*.[54]

---

[52] Ibid., 545.

[53] Koşay, 1936, 177-178.

[54] Sadori (et.al.), 2005.

Hordeum vulgare, Triticum aestivum/durum, Triticum dicoccum and *Cicer arietinum* represent the majority of the crops while *Pisum sativum L*. and *Lens culinaris Medik*. are the most important pulses found. *Vitis vinifera* as a species of fruits and *Polygonum sp*. as a species of weeds are found also.

It is stated that the location of the archaeobotanical samples within the house unit represents that the crops were either stored or processed in the house, but carefully cleaned. The *pithoi* which were used for storage were concentrated in the central and south eastern parts of the room, near the fireplaces while the chickpea samples were founded near the western working bench with the two large *pithoi.* Barley is said to be spread everywhere on the floor, but the majority was still near the south eastern bench embedding with a grinding stone. The wheat seeds were always seen with barley in a small amount. The use of crops and their spatial distribution within the sampled area are described as follows;

"Crops were stored according to their type and use, with chick peas separated from barley and probably kept mainly in the large storage *pithoi*, whereas barley was probably kept in bags, but not in wooden boxes as there are no charcoal remains in concentration with this last find. Cereals and legumes could have been dried on the fixed wooden structure, placed near the oven and made of stakes of at least five kinds of wood."[55]

2.5.4 Southeastern Anatolia

Titriş Höyük

The primary contexts of Titriş Höyük included floor and suprafloor deposits and the contents of hearth and other features which are in direct relation with architectural elements; pit and midden deposits and tomb fills.[56]

---

[55] Sadori (et.al), 2005.

[56] Algaze (et.al.), 1995, 21, 28.

- Cereals: The samples of cereals were not pure therefore the samples are thought to be accumulated through years in the deposits. The pits and silos included more grains than other contexts. Hulled barley (*Hordeum sativum*) is the most common type of cereal found in the samples. Emmer and *Triticum durum/aestivum* are the types of wheat which are equally represented in the samples.
- Pulses: There is a high proportion of *Lens culinaris*. Large quantities of *Lathyrus cf. cicera/sativus* is found in an oven.
- Fruits: *Vitis vinifera, Pistacia, Crataegus sp*. and *Prunus* are recovered as species of fruits in Titriş Höyük.
- Weeds: *Galium*, *Silene*, *Lolium* and *Aegilops* are the weeds represented in the area.[57]

Kurban Höyük

The archaeobotanical samples of Kurban Höyük were recovered by flotation from a number of 320 deposits such as hearths, pits, floors and fills. 99 of these samples have been sorted and identified.

It is stated that food or fodder include wheats such as *Triticum monococcum, Triticum dicoccum, Triticum aestivum/durum*; barleys such as *Hordeum distichum* and *Hordeum vulgare,* lentil, vetch, pea, chickpea, vetchling and flax which is said to be an industrial crop used to produce oil or fibre. Grape as a fruit and pistachio, almond and acorn as wild nuts are identified.

---

[57] Ibid., 29-30.

Naomi Miller states that the most of the crops were of types which are planted and harvested every year while fruits such as grapes require a long period of labour through years to get a high quality product.[58]

Kenan Tepe

The sampling strategy involved collecting samples from every locus excavated. Hearths, pits and floors were sampled and most of the samples were composed of cultigens, field weeds, riparian plant seeds, weed seeds and other plant parts. Unfortunately, the species of cereals were not identified in detail but the identified ones dating to Early Bronze Age were *Onobrychis* and *Heliotropium.* [59]

İmamoğlu Höyük

The species recovered from the excavations in İmamoğlu Höyük are *Hordeum L., Pisum L.*, *Lens culinaris Medik.*, *Vicia L.*, *Trigonella L.*, *Fabaceae indet.*, *Ajuga L.*, *Chenopodium foliosum* and *Galium L.*. [60]

Barley and pea were the most dominant types of crops in the settlement indicating that they were important elements of food production in the Early Bronze Age. Lentils play a minor role in crop production while the amount of *Fabacae* seeds recovered indicates contamination from the wild. *Ajuga L.*, *Chenopodium foliosum* and *Galium* are the proofs of infestation of the fields.

---

[58] Miller, 1986, 13, 88.

[59] Parker, 2003, 29, 122.

[60] Dönmez, 1997, 47, 173-175.

The samples recovered from floor deposits indicate that the crops were stored separately and most of them were barleys except one, which is pea.[61]

2.5.5 Southwestern Anatolia

Tell Kurdu

A total number of 115 samples of Tell Kurdu were collected from floor surfaces, ceramic vessels and ovens. Consequently 14 samples were sorted and identified for further analysis. The crop species represented are, *Hordeum sp.*, *Triticum sp.*, *Cicer arietinum*, *Lens culinaris* and *Pisum sp.* Most of the samples which contain barley species contain whole grains with an absence of threshing debris such as rachis or spikelet forks. This is interpreted as the presence of a storage area.[62]

The weed species include *Medicago*, *Rumex*, *Polygonum*, *Linum*, *Galium*, *Centaurea*, *Crucianella*, *Chenopodiacea*, *Amaranthus*, *Thymelaea*, *Echium* and *Umbelliferae*.

[61] Ibid., 176.

[62] Ekstrom, 2000, 26, 81-82.

CHAPTER III

METHODOLOGY

3.1 RECOVERY OF THE MATERIAL AND THE PROCESSES OF THE LABORATORY WORK

For the analysis of İkiztepe archaeobotanical assemblages, the identification of the archaeological materials was the first stage of the study as a laboratory work. Trenches C19/IV8 and 9 and C20/IV8 of Tepe I were the pilot areas from which the assemblages of the study were collected. 10 assemblages were analysed. The volume of the soil varied between a maximum of 61 litres to a minimum of 11 litres. The assemblages were examined both with naked eye and under a microscope in the laboratory of British Institute of Archaeology at Ankara. For the identification of the material, the reference collection of British Institute of Archaeology at Ankara was used.

A database including attributes of identified material was designed to be used for the rest of the interpretive work. Attribute data included information as sample number, tepe number, area number, locus number, level, phase, type of deposit, species, part of plant and the volume of soil processed.

The archaeobotanical remains of the houses of İkiztepe are gathered from five different areas (from the northeast corner, the northwest corner, the southeast corner, the southwest corner and the middle) within the trenches of the site. Therefore it enabled us to apply a detailed analysis of the distribution of these remains within the houses. A comparison was made between the previous work done about the concentration of the plant remains in other excavated areas and the material which we collected for this study.

These interpretations are meant to be including not only reconstruction of domestic activities, but also a description of plant processing as will be attested in the İkiztepe samples and of crop production and related economic activities in accordance with the standard archaeobotany methods.

3.2 METHODOLOGY OF ANALYSING THE RAW DATA

In archaeobotanical analysis, interpreting the past human behaviour is very much related to determining a unit which results from a single human activity. Thus the unit is called as the "unit of analysis" and the activity is described as the "behavioural episode". Jones states that, if there is a well- defined archaeological context, the unit of analysis may be chosen as the archaeobotanical sample which represents a single behavioural episode. It seems as a disadvantage for the archaeobotanical context to have a mixed origin and be heterogeneous in the case of sample description but turns out to be an advantage in the interpretation of the assemblage.

After considering the "unit of analysis", attention should be given to the choice of descriptive variables to classify and also identify the archaeobotanical samples and the level of quantitative detail which will be applied should be discussed.

In this thesis both semi-quantitative and fully quantitative descriptions are used for the observation of the raw data. During the interpretation of spatial and stratigraphic importance of the archaeobotanical samples, it is necessary to apply a rapid scanning technique with allows us to save valuable time and effort. By that means, the semi-quantitative description involves recording the plant materials not easily counted (for example cereal bran, stem and root fragments), dealing with large numbers of mixed samples and selecting samples for detailed examination. On the other hand the fully-quantitative description works with a "unit of observation" which means a standardised way of counting plant fragments. As the number of seeds, glumes etc. is not standard it is a problem to estimate the minimum number of individuals according to the exact count of the plant materials. Therefore for each plant part, a feature is selected for counting which is archaeologically durable, definable and identifiable. This method also leaded us to select samples for detailed examination.

In this thesis, embryo tips are counted for representing the grain, the bases of the glumes and the culm nodes are counted to represent the chaff (glume, rachis, lemma, etc.) and straw in the case of glumed wheat and; in the case of free threshing cereals, rachis nodes are used (see fig. 8).

There are some other quantitative measures which may be added to the archaeobotanical analysis. These are the amount of soil processed which may be useful to record in terms of numbers of items (e.g. seeds) per unit volume or weight of soil, the description of carbonised remains (needed to measure the degree of distortion and state of preservation), the level of distortion in the carbonised material and the state of preservation.

The spatial distribution of the material was examined by using this database and the plans of the excavated areas. The first step was to identify the character of each sample and the crop processing stage or other activity from which it derived. The parts of the plant of the domestic species present as well as the size of the weeds/wild fruits to be found in any assemblage, give us clues to the type of activity from which the samples

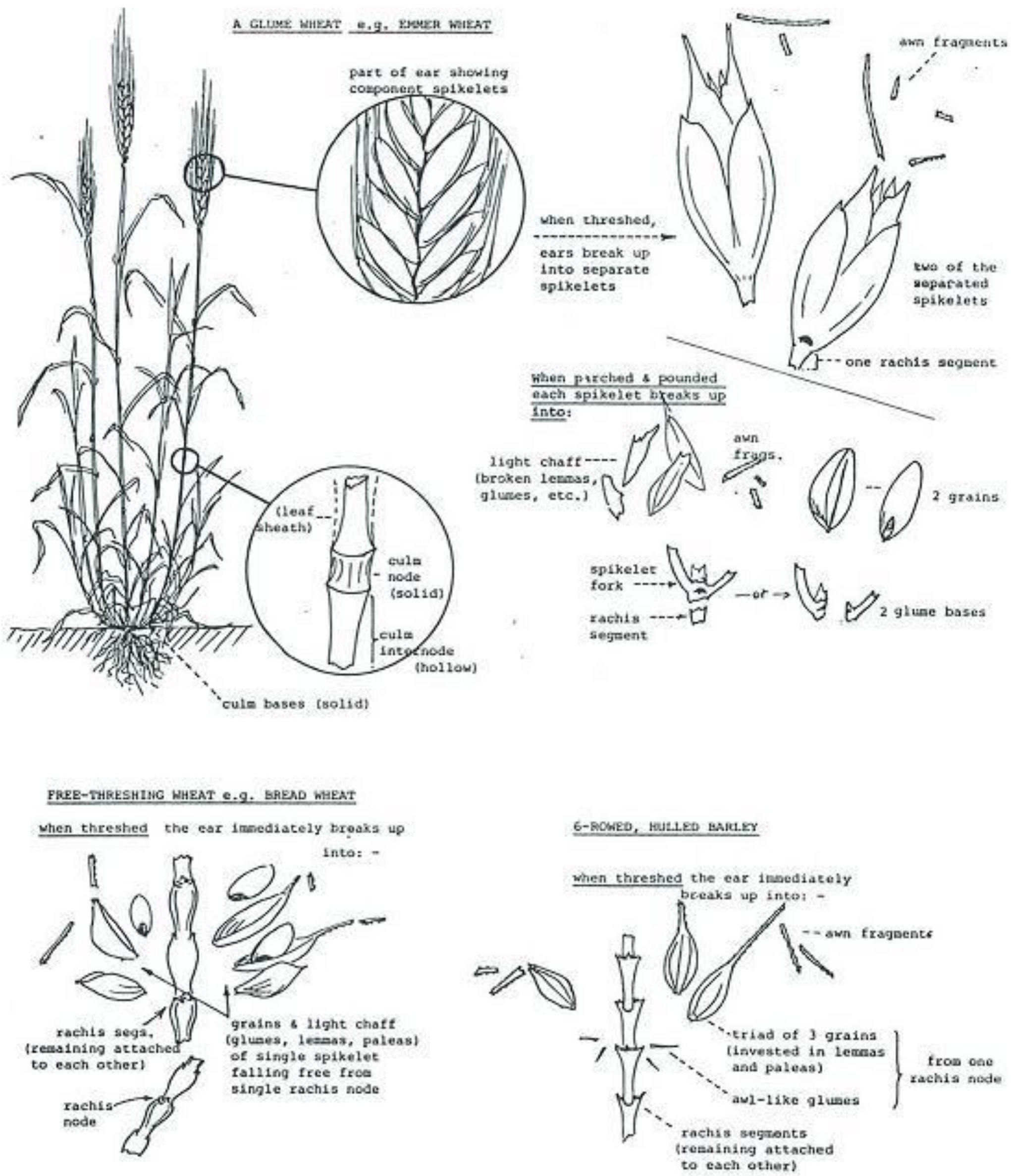


Figure 8 The components of plants (Hillman 1984, 2)

resulted.[63] These techniques are not unmistaken and they have got their limitations nevertheless they are widely used as guides. Also, the density of the plant remains in comparison to the volume of soil collected will be examined to test the concentration of plant remains in the sampled area. This is believed to give clues to whether or not the particular area is designed as a place where plant related activities were taking place, such as storage, cooking, eating. The type of remains will also help to understand the type of activity: For example a dense concentration of pure grain will be apparently a storage area whilst as dense sample of mixed species of edible seeds will be more likely a cooking or eating refuse.

The initial studies of crop processing revealed a question of whether a site is a consumer or a producer. Two models which, were applied by G. Hillman and Martin Jones, were introduced to identify the categories of the sites.

Hillman applied his model to Iron Age and Roman sites in Britain.[64] He argued that the vast majority of the cereal chaff (cereal culm nodes and rachis internodes) indicates that a site is cereal producer.[65] The model assumes that the crops are either stored or exchanged as cleaned grain or as semi-clean spikelet in the case of glumed wheat. As a result the producer settlements will contain waste from the first processing stages after harvesting and before exchange. Hillman concludes that the waste products which remain from the first processing stages of cereals do not occur in the consumer settlements. He adds that both the settlement types will contain carbonised remains of grain, large weed seeds and glume bases in case of glumed wheat. On the other hand producer sites will have high numbers of culms, rachis internodes and weed seeds of all sizes which are the parts of plants that can be characterised as the wastes of early stages of crop processing. In consumer sites, the grains will dominate the carbonized

[63] Hillman, 1984. ; Jones, 1984.

[64] Hillman, 1981, 142.

[65] Ibid., 142.

assemblages rather than chaff and weeds seeds as the chaff and weeds seeds remains will be in higher proportion than the grain in the producer sites.[66]

The second model for the identification of producer or consumer settlements was introduced by Martin Jones which was based on his studies at the sites on the various gravel terraces rising above the Thames River.[67] The basic assumption of Jones model is that grain was less valued on arable producer settlements where it was seen in high proportions. He stated that the occupants of the consumer settlements were not dealing with growing grain as they received it through exchange, so that the majority of carbonised assemblages of grain are mostly seen in producer sites. He used scatter grams to plot the three-way ratio between grains, chaff and weed seeds. Different sized symbols were used to indicate the density of seeds per litre of sediment in these scatter grams.[68] One disadvantage of the analysis is that, it doesn't examine the type of the deposit whether it is primary or secondary deposit and assume that all weeds recovered are the weeds of cereal crops.[69]

Marijke van der Veen was the first to criticise the models of both Hillman and M. Jones. She stated that Hillman's model did not take into account the required quantification of cereal straw and rachis internodes although it is critical to identify a site is a consumer or a producer.[70] She also added that the absence or presence of such plant parts is not enough for identifying sites agricultural activities because they can be easily destroyed by charring.[71] She suggested that the only way to identify producer or consumer sites by Hillman's model is to "examine the ratio of wheat grains to glumes; the amount of cereal

[66] Hillman, 1984.

[67] Jones, 1985, 120.

[68] Ibid., 118.

[69] Smith, 2001, 286.

[70] Van der Veen, 1991, 358.

[71] Ibid., 352.

grain found and the ratio of barley rachis internodes to barley grains; and the presence of straw nodes".

Van der Veen noted that M. Jones thought that the samples represented the site as a whole. She disagreed with this point of view as she thinks that the site should be interpreted with other forms of archaeological and historical data. [72]

Wendy Smith discusses that "the chaff-rich sites can be biased toward cereal chaff remains as a result of the activities occurring in the vicinity". She points out that the sites which Martin Jones identified during his study in the Thames valley were raising cattle and the buildings of the site were made up of wattle-and-daub walls and thatch roofing, therefore she insists that the identification of producer or consumer sites must depend on additional data like the possible building materials and agricultural activities. [73]

Wendy Smith also suggests that her studies in the late antique Egypt (Kom el-Nana) revealed a result that no exact identification of the site can be made as producer or consumer. She found out that the monasteries received donations of food and crops either as grain or cereal chaff. She also stated that the historical documents proving the presence of the sale, trade and gift of cereal chaff; and that meant the cereal chaff can also be a consumer product as cereal grain. Consequently, she thinks that the identification of the site as "producer" or "consumer" can not be made in the late antique Egypt.[74]

Smith suggests that the usage of the scatter grams is an oversimplified model of crop processing and that the examination of the ratio of cereal chaff: cereal grain: weeds of crops are still favourable. She thinks that pie or bar charts are more suitable for graphical

[72] Ibid., 359.

[73] Smith, 2001, 288.

[74] Ibid., 289.

presentation of archaeological results rather than scatter grams of Jones.[75] She finishes with the suggestion that the conflict between the two models lies on the different interpretations of the same data.[76]

C. Bakels listed four limitations for the consideration of the producer and consumer settlement in the two models of Hillman and M. Jones. She noted that the first assumption which limited our studies of crop cultivation and production is that "the models developed by Hillman and Jones were accepted as "the" models so that they lead us to an idea that every single carbonised cereal was a result of parching before de-husking."[77]

Her second concern was about the identification of the wastes of actual crop processing activities in the household scale and the waste produced from the activities of exchange or trade. Bakels decided that the species of the waste produced during the household activities would be much less than the species of waste produced for other activities like exchange, storage or trade. She added that the dominance of one species may put forth the surplus growing unless the soil and climate conditions limits the occupants of the settlement to produce more kinds of cereals.[78]

Another problem which Bakels pointed out was about taphonomy. The percentage of the occurrence of culm-bases in our records depends on preservation of the archaeobotanical materials. "If crops were cut, culm-bases were left behind on the fields. If they were uprooted, they had perhaps not much chance to survive by carbonization".[79]

[75] Ibid., 290.

[76] Ibid., 288.

[77] Bakels, 2001, 299.

[78] Ibid., 300.

[79] Ibid., 300.

Bakels listed the source of the recovered material regarding her considerations which affect the identification of the type of the settlements. She thought that the handicap is that the occupants of the settlements may not be processing the crops inside the settlement but we may not be detecting it as far as most of the carbonised assemblages come from the excavated areas inside the settlement.[80]

Ethnobotanical studies of cereal harvests in Turkey and Greece which were applied by Gordon Hillman and Glynis Jones have formed the foundation of current understanding of cereal-crop processing activities. Both of them argued that there are limited ways which the crop processing techniques can be applied and so that the physical properties of plants produced from these activities can give us clues about the individual stage of crop processing activity going on in a specific area.[81] This theory depends on the idea that the traditional methods of crop processing applied in modernity is much similar to the one used in the prehistoric times and so that the techniques did not change much.

Gordon Hillman divided the principal stages of crop processing into two groups as the processing of free-threshing cereals like bread wheat and rye and the processing of glume wheats like emmer, spelt and einkorn.

Processing Stages of Free Threshing Cereals

1) **Harvesting:** It can be both done by reaping and uprooting. In the reaping process the principal components of the prime products are ears, straws and weeds. By uprooting ears, straws, culm-bases and weeds are processed.

---

[80] Ibid., 300-301.

[81] Hillman, 1981; 1984; Jones, 1984.

2) **Drying:** The drying process takes place in the field, in barns or rarely in ovens/kilns. Therefore the products are exposed to fire and the preservation can possibly be by charring. Roots and culm-bases are often chopped-off at this point.

3) **Threshing:** It means to free grain and chaff from rachis or ear. Threshing can be done by either flailing/lashing or by trampling/sledging. Flailing/lashing is done indoors or in wet areas and the principal components of the prime products are a bulk of undamaged straw, mostly rachises and coarse weeds. Straw stores are produced and these stores are than used for thatching, flooring etc. Trampling/sledging are done outdoors and free grain, fine chaff (glumes, lemmas, awns etc.), some broken straw, some rachises and weed heads and seeds are processed.

4) **Raking:** Coarser straw fragments, some rachises, awns and coarse weeds are the components of waste straw store. These stores are used for fuel, fodder and coarse temper.

5) **Winnowing:** Winnowing is applied twice or four times. Grain, heavy straw nodes, some rachis fragments and mostly weed seeds are processed when it is applied twice. As the number of winnowing increases light chaff, longer straw fragments, lightest weed seeds and heads, more rachises and mostly awn fragments are found. These are stored in the light chaff store which is used for fuel, fodder and temper.

6) **1st Sieving:** The next stage is sieving. Medium-coarse riddle is used to remove contaminants coarser than grain. Grain, occasional rachis fragments (the heavy, basal rachis segments are disproportionately well represented in the primary products relative to the lighter upper segments), awn fragments and weed seeds are the principal components. These components pass through the sieve. The components that retain in the sieve are mostly remaining straw nodes, weed heads

and more rachis fragments. These are stored in the cleanings store I which is used for fuel and fodder.

7) **2nd Sieving:** Wheat sieve is used to remove contaminants finer than prime grain. Prime grain, weed seeds of same size as prime grain and rare rachis fragments retain in the sieve. Tail grain, most weed seeds smaller than prime grain and small rachis segments and awn fragments passes through the sieve. These are stored in the cleanings store II which is used for storing food for animals (especially fowls); also famine food for humans or burned.

8) **Kiln-Drying:** This stage is applied in wet areas to avoid spoilage. Bulk grain store is formed. If prime products are stored in pits, then annual cleansing of those pits by firing will char any grain adhering to the sides.

Processing Stages of Glume Wheats

1) **Harvesting:** It can be both done by reaping and uprooting. In the reaping process the principal components of the prime products are ears, straws and weeds. By uprooting ears, straws, culm-bases and weeds are processed.

2) **Drying:** It takes place in the field, in barns or rarely in ovens/kilns.

3) **Threshing:** It means to break ear into component spikelet. It can be applied both by flailing/lashing (indoors-in wet areas) and by trampling/sledging. By flailing spikelets, some broken straw, mostly awns, culm-bases and many weed seeds and heads are processed. By lashing, bulk of undamaged straw, coarse weeds etc. are processed which turns out to be intact straw store which is used for thatching and flooring etc.

4) **Raking:** The principal components of the prime products are spikelets, some broken straw fragments, most awns, culm bases, many weed heads and seeds. The principal components of the major by-products are all longer straw fragments and some awns etc.

5) **1st Winnowing:** Spikelets, heavier straw nodes, culm bases, weed heads and mostly seeds are processed. Longer straw fragments, most awns and lightest weed seeds and heads and the principal components of the major by-products form broken straw store and this store is used for fuel, fodder and coarse temper.

6) **1st Sieving:** When the coarsest riddle is used semi-clean spikelets, smaller weed heads and weed seeds passes through the sieve. Longer straw nodes, culm bases, weed heads and abortive spikelets retain in the sieve and form the caning store which is then used for fuel or coarse temper. The materials which pass through the sieve with the coarsest riddle is then processed with the medium-coarse riddle. Spikelets and weed heads retain in the sieve. Weed seeds and culm nodes pass through the sieve. The material which retains in the sieve is taken in to the drying stage. The seed grain is separated at this stage for next year's sowing, cleaned further and put into store.

7) **Drying:** It is applied in wet climates to avoid spoilage in store. Bulk spikelet stores are formed. From this point – in wet climates- domestic processing is done piecemeal, day-to-day.

8) **Parching:** Parching is applied to render chaff brittle in all wet areas.

9) **Pounding:** It means to release grain from spikelet; also breaks up weed heads. Free grain, chaff and free weed seeds can be listed as principal components of the prime products.

10) **2^{nd} Winnowing:** Grain, denser chaff fragments, smaller straw nodes (especially conspicuous are the basal rachis segments left at the top of the straw) and weed seeds are the principal components of the prime products. Light chaff (lemmas etc.), most of awns, more of very light weed seeds form the light chaff store which is used for fodder, fuel and temper.

11) **2^{nd} Sieving:** Medium-coarse riddle is used in this stage. Unbroken spikelet, straw nodes and large weed seeds form the cleanings store used for animal feed (especially fowls and also famine food for humans). The material which passes through the sieve gets into the 3^{rd} sieving stage.

12) **3^{rd} Sieving:** Wheat sieve is used. Prime grain, many of the spikelet forks and weed seeds of same size as prime grain retain in the sieve. They form the bulk grain store in areas with dry summers. Tail grain, small weed seeds, heavy bits of chaff (e.g. glume basis and rachis segments) which passes through the sieve also form the cleanings store as the 2^{nd} sieving stage.

The principal stages of crop processing of free-threshing cereals and glume wheats are the same in the preparation of grain products for food. The stages of preparation of grain products for food are as follows;

- **4^{th} Sieving:** The same wheat sieve of step 12 in the glume wheat processing is used. Prime grain and weed seeds are the principal components of the prime products. Coarse contaminants are brought to surface by agitation. They scoop of the surface in the sieve and flip over the edge in the winnowing basket. Further small weed seeds, tail grain, some of remaining heavy chaff fragments pass through the sieve, get straight onto fire or into cleanings store as the coarse contaminants.

- **Hand Sorting:** Clean prime grain is sorted out. Weeds of same size as prime grain and many of the remaining fragments of heavy chaff (e.g. spikelet forks) get straight onto fire or into cleanings store.

- **De-Husking of Hulled Grains:** De-husking of hulled grains is done with loosely-set rotary querns, saddle and trough querns, wheel 'scraper querns', or by pounding in large wooden or stone mortars.

- **Winnowing or Dunking:** It means to separate the freed husks by wind or floatation respectively. Rubbed (milled) grain is produced. Husks and some awn fragments form the fine chuff store and the husks store.

<u>Groats Preparation</u>

- **Grain Boiling**

- **Grain Drying**
- **Bran Removal:** Bran removal is generally applied with scraper querns or sometimes by pounding.

- **Winnowing:** The aim is to separate bran. Peeled grain is processed and the bran is kept in the bran store.

- **Grain Cracking:** Grain cracking is applied by loose querning or by pounding.

- **Sifting:** Groats sieve is used in this stage. Cracked grain retains in the sieve and crushed grain (flour) passes through it. Prime groats for main meals are stored in the cracked wheat store. Buttermilk or yoghurt is produced from the material stored in the fine groats store. It is dried into hard balls for making soups as ‘yayla’ or ‘tarhana’ at a later date.

Roast Grain and Toasted Groats Preparation

- **Grain Roasting:** Grains are roasted on hot stone or metal. Toasted grains are produced for direct consumption as the Turkish ‘kavurmaç’ or the Arabic ‘qaliye’. Burned grains are picked out and discarded.

- **Coarse or Fine Grinding**

- **Sifting:** Crushed, toasted grain which is called as burstin is produced. Husks are discarded. Burstin store is used for main meals, scones and milk or buttermilk (louts).

The next two stages are both for groats preparation and roast grain and toasted grain preparation.

- **Flour-Milling Sequence:** Flour and bran are stored.

- **Malting Sequence**

As described above, the harvested crop goes through a series of processing activities creating the products and by-products during the sequence like grains, chaff, straw and weeds. A high proportion of these products and by- products tends to be short-lived and mixed with other by-products. The ones which are likely to be preserved archaeologically are the ones which are long-lived and have the chance to survive by getting in to contact with fire. The products and by-products which are most likely to be preserved are the winnowing by-product, the coarse sieve by-product, the fine sieve by-product and the fine sieve product.

Before the application of multivariate analysis to detect the crop processing stages, a cut point for the standardization and analysing the raw data should be selected. The number of seeds in a sample may not be equal to the number of seeds from another sample. This is because the number of seeds found in one sample depends on the sample size and the density of the samples in a deposit. Therefore the percentage values of grains, chaff and weeds as a percentage of the total for each category of the data is used. The transformation of the data is also used to make the data more suitable for statistical analysis. The square roots of each value are used to analyse the data.[82]

The method of Gordon Hillman to detect the crop processing stages depends on the relative quantities of grains, weeds and chaff. The flow-diagrams of Hillman are used to determine the crop processing activities.[83]

First, the number of glume bases to glumed wheat grains is calculated. The glumed wheat species in the samples are detected by the identification of the samples. Then, as the individual species have their own proportion of the number of glume bases to glumed wheat on a spikelet an average ratio is calculated. For example, in the case of emmer wheat, the ear of emmer is made up of spikelets which contain two glumes and two grains; so that the ratio turns out to be 2:2=1. According to this calculation, if the ratio of the glume bases to glumed wheat bases is higher than 1 in a sample indicating that there are more glume bases than grains, the sample is called to be representing a fine-sieving residue. If the ratio is less than 1 and there are more grains than glume bases, we can assume that a cleaned product is formed. A ratio of ca. 1 either represents a sample consisting of complete ears or spikelet store as the glumed wheat are often

[82] Jones, 1983, 49.

[83] Hillman, 1981, 4-6.

stored in semi-cleaned spikelets. The dehusking of the grains is made piecemeal throughout the year.[84]

Secondly, the number of rachis internodes to grains is calculated. The ratios are calculated according to the number of rachis internodes and grains in a spikelet of barley, rye or bread wheat. The ratio of rachis internodes to grains for barley usually equals to 0.3. A ratio of much more than 0.3 represents the presence of early processing residues such as the by-products of winnowing and coarse-sieving. If the ratio is less than 0.3 then we can assume that the later crop processing activities went on in the area. A ratio of ca. 0.3 represents a sample with complete ears. Similar ratios can be calculated for each type of wheat species.

The last calculation of the ratios involves the number of weeds to the number of grains. If the number of grains is higher than the number of weeds, then the sample represents a cleaned product. If the situation is vice versa, the sample represents the presence of cleaning residues. [85]

---

[84] Van der Veen, 1997, 82.

[85] Ibid., 82-83.

CHAPTER IV

RESULTS AND DISCUSSION

4.1 PILOT SAMPLES

A number of 9 pilot samples of the study can be listed as Sample 4, Sample 5, Sample 7, Sample 8, Sample 10, Sample 11, Sample 15, Sample 17 and Sample 19. The tables including the information about the species which concern the methodology followed are shown below (see Table 2).

TRENCH C19/IV 8, b. 3801

Sample 4

The main crop represented in Sample 4 is Triticum mon./dic. with a high amount of glume bases and a relatively small number of grains. A number of 255 glume bases and 47 Triticum mon./dic. seeds were recovered from the sample. Triticum aest./dur. and Hordeum vulgare seeds were uncovered as clean grains as no rachis segments were found for both of them. The number of Hordeum vulgare seeds is 14 and 15 Triticum aest./dur. seeds were recovered. Weed seeds were scarcely represented in Sample 4 with 8 Lolium spec. seeds, 2 Rumex seeds and 3 Polygonum seeds. 2 Avena sativa seeds are also treated as weed seeds since they are very few in the sample to be interpreted as cereals of any processing sequence. Accordingly, the pulse-crop species are scarcely

Table 2 The pilot samples and their contents

Species	Sample 4	Sample 5	Sample 7	Sample 8	Sample 10
Tr. mon./dic. grain	47	95	10	26	0
Tr. mon./dic. glume base	255	118	74	464	3
Tr. dur/aest. grain	15	20	0	12	0
Hordeum vulg. grain	14	28	19	9	0
Hordeum vulg. rachis segment	0	0	0	2	0
Tr. Spec.	23	29	0	14	2
Avena sat.	2	4	0	1	0
Secale cereale	0	4	0	1	0
Vicia ervilia	3	2	5	3	0
Vicia sativa	3	0	0	0	0
Lens culinaris	5	8	1	2	0
Pisum sativum	0	2	0	0	0
Vitis vinifera	0	2	0	2	0
Phalaris	0	0	2	0	0
Setaria	9	0	0	0	0
Lolium spec.	8	0	3	0	0
Digitaria	0	0	2	0	0
Rumex var. ty.	2	0	0	0	0
Polygonum	3	3	0	0	0
Chenopodium album	0	2	0	0	0

Table 2 (continued) The pilot samples and their contents

Species	Sample 11	Sample 15	Sample 17	Sample 19
Tr. mon./dic. grain	27	278	4	2
Tr. mon./dic glume base	255	967	30	0
Tr. dur./aest. grain	5	34	0	0
Hordeum vulg. grain	3	13	0	2
Hordeum vulg. rachis segment	2	4	0	1
Tr. Spec.	1	0	0	0
Avena sat.	1	0	0	0
Vicia ervilia	2	1	0	0
Vicia sativa	0	0	0	0
Lens culinaris	5	15	0	0
Pisum sativum	0	1	0	0
Lathyrus sativus	0	9	0	0
Cicer arietinum	0	0	1	0
Vitis vinifera	0	0	0	1
Pyrus	0	0	0	5
Prunus	0	1	0	0
Phalaris	0	0	0	3
Crataegus pont.	0	0	1	0
Bromus	0	2	0	0
Lolium spec.	0	2	0	0

represented in Sampe 4 as 5 Lens culinaris seeds, 3 Vicia ervilia and 3 Vicia sativa seeds could be identified.

The ratio calculations of Sample 4 refer to fine sieving residues of Triticum mon./dic., with a result 5,42. It should be pointed out that the crop processing activity may have taken place inside the houses as Sample 4 was collected from the samples of the square C19/IV8, b. 3801, and related activities can be traced in Sample 5 and 7.

Several activities may have been taking place in the area where Sample 4 was recovered, as the processing activity may be conducted piecemeal day-by-day. Thus, the accumulation of pulse-crop species and weeds together with the crop species in the same area seems reasonable. On the other hand, the high amount of glume bases found refers to a clear fine sieving activity, as they may have been separated from the grains and thrown somewhere else, so that the remaining clean grain could be consumed.

Triticum aest./dur. and Hordeum vulgare grains are recovered as clean grains from the sample. These crops may have arrived inside the house as cleaned grains so as they were processed somewhere else; for example in the courtyard or out of the village in threshing floors close to fields. They may also be bought as clean grains and consumed inside the domestic units of İkiztepe. The interpretations about the processing sequences and areas of free-threshing cereals are uncertain since only the clean grains of Hordeum vulgare and Triticum aest./dur. could be identified.

Sample 5

Triticum mon./dic. is the major crop represented in Sample 5. The number of glume bases and grains of Triticum aest./dur are very close to each other as 95 for Triticum mon./dic. grains and 118 for glume bases. There are 20 Triticum aest./dur. and 28 Hordeum vulgare seeds recovered from the samples while other represented cereals are different species of Triticum with a number of 29. 2 Vitis vinifera seeds are identified as fruits while 8 Lens culinaris seeds, 2 Vicia ervilia seeds and 2 Pisum sativum seeds (see fig. 9) were the only samples that could be identified as pulses. The seeds of Avena sativa and Secale cereale were treated as weeds again as in Sample 4, with total number of 8 weed. The remaining weeds seeds represented in the sample were Polygonum and Chenopodium album with 3 and 2 seeds in sequence.

Figure 9 The seeds of Pisum sativum recovered from Sample 5

Although the ratio I calculation for Sample 5 is 1,24 and that it refers to fine sieving residues, the sample should be interpreted as storage since the amount of glume bases and grains are very close to each other and it is critical to put strict borders in the interpretations of crop processing activities. In addition to this, Sample 5 seems to be somehow linked to the activities conducted in area C19/IV8 b.3801, since Sample 4 and

Sample 7 were also collected from the same area in a line in approximately same depths. A third reason supporting the interpretation of Sample 5 as storage area is the volume of the sample which is 61 litres. Thus the number of glume bases recovered from Sample 5 must have been higher when it is compared with the other pilot samples with low volumes but high amounts of glume bases recovered. Lastly, the number of weeds recovered from the sample is again very low, so that it can be assumed that if there had been a weeding out process of the product collected from the field in the area where Sample 5 was uncovered, indicating a fine sieving activity; the number of weeds would also be expected to be higher than it is represented in the sample.

The pulse-crops and fruits recovered from the sample may be interpreted as the results of several different activities related to consumption conducted day-by-day so that it is questionable to interpret the pulses and fruits as products of any single activity. They may have been mixed with other stages of crop processing or consumption.

The free-threshing cereals like Hordeum vulgare and Triticum aest./dur. are found as clean grains, that no rachis segments were identified in the sample. They may have come inside the house in final processed stage where the previous activities could not be detected certainly. As in Sample 4, they my have been processed in the courtyard or in the vicinity of the site where the threshing floors were located. It is probable that they could have been bought from somewhere else near the settlement of İkiztepe.

Sample 7

The cereals represented in Sample 7 are Triticum mon./dic. and Hordeum vulgare. Hordeum vulgare grains seems to be the major crop type identified in the sample although the plant parts of Triticum mon./dic. are more representative. (see fig. 10) A number of 19 barley seeds and 10 glume wheat seeds are uncovered from Sample 7 while 74 glume bases could be identified. Only one lentil seed and 5 bitter vetch seeds

Figure 10 The Hordeum vulgare grains recovered from Sample 7

are recovered from the sample as pulses. 7 weed seeds were recovered from the sample in total while 2 of them are Phalaris, 3 of them are Lolium species and 2 of them are Digitaria seeds.

The ratios of Sample 7 refer to fine sieving residues of Triticum mon./dic. while Hordeum vulgare seeds seem to be representing a cleaned product. The result of ratio I for Sample 7 is 7,4. The information gathered from the sample composition and calculations is not sufficient to interpret the area as an area of any clear crop processing activity. Thus, the information gathered from the sample is not taken into consideration while detecting the crop processing activity areas inside the domestic units, as it is only sufficient for gathering relevant information about the species of crops present in the area.

The barley seeds and other pulse-crop seeds together with the weed seeds collected from the area can be residues of different processing or consumption activities conducted in the area throughout the day. Therefore, the accumulation of the clean grains of barley, pulses and weeds can be interpreted as stray finds of different or related crop processing activities. The clean grains of barley may again be bought from somewhere else or may have arrived the site in clean form after being processed in the threshing floors nearby the settlement.

Sample 7 is collected from the same depths with Sample 4 and Sample 5. As described above, Sample 4 was interpreted as an area of fine sieving where the residues were left, and Sample 5 seemed to be a storage area. Sample 7 was collected from the same line with Sample 4 and Sample 5 near the western face of the trench C19/IV8 b.3801. Consequently, this sample is considered to be in the periphery of the activity areas of Sample 4 and Sample 5, therefore the sample seems to weak as it is composed of only the residues of other activities conducted in the areas where Sample 4 and Sample 5 are collected.

Sample 15

Sample 15 is composed of 278 Triticum mon./dic. grains (see fig. 11) and 967 Triticum mon./dic. glume bases (see fig. 12). The free-threshing cereals uncovered from the sample are Triticum aest./dur and Hordeum vulgare seeds. There are 34 Triticum aest./dur. seeds recovered from the sample (see fig. 13) while the number of Hordeum vulgare seeds is 13. A number of 4 rachis segments of Hordeum vulgare were recovered from the sample. The most dominant pulse crop uncovered is Lens culinaris (see fig. 14) with 15 seeds. The remaining pulses are 1 Pisum sativum, 1 Vicia ervilia and 9 Lathyrus sativus. Only one Prunus seed was recovered from the sample as fruit while a total of 4 weed seeds could be identified. These were 2 Setaria seeds and 2 Bromus seeds.

The main crop represented in the sample is Triticum mon./dic. The ratio of glume bases to grains of Triticum mon./dic. is 3,47, which refers to a fine sieving residue. The conflict of interpreting the results of the ratios appears here as a problem again. Thus, the number of glume wheat grains can not be ignored although the number of glume bases is much higher than the grains. Therefore the sample is considered to be representing a storage area with high numbers of glume wheat grains and glume bases. The area may have been used as an area where the glumed wheats arrived inside the houses in semi-clean form and processed in the area before storage. It also can be assumed that some part of the cleaned grains was used in consumption and the remaining was stored so that the numbers of glume bases were found in high numbers.

Although the volume of the sample is only 24 litres, the clean grains recovered from the sample is relatively higher than the clean grains identified in other examined samples with approximately same volume.

The free-threshing wheat seeds are recovered as clean grains in the sample as no rachis segments were identified belonging to the Triticum aest./dur. On the other hand, few rachis segments were identified which belong to Hordeum vulgare.

Figure 11 The Triticum monococcum/dicoccum seeds recovered from Sample 15

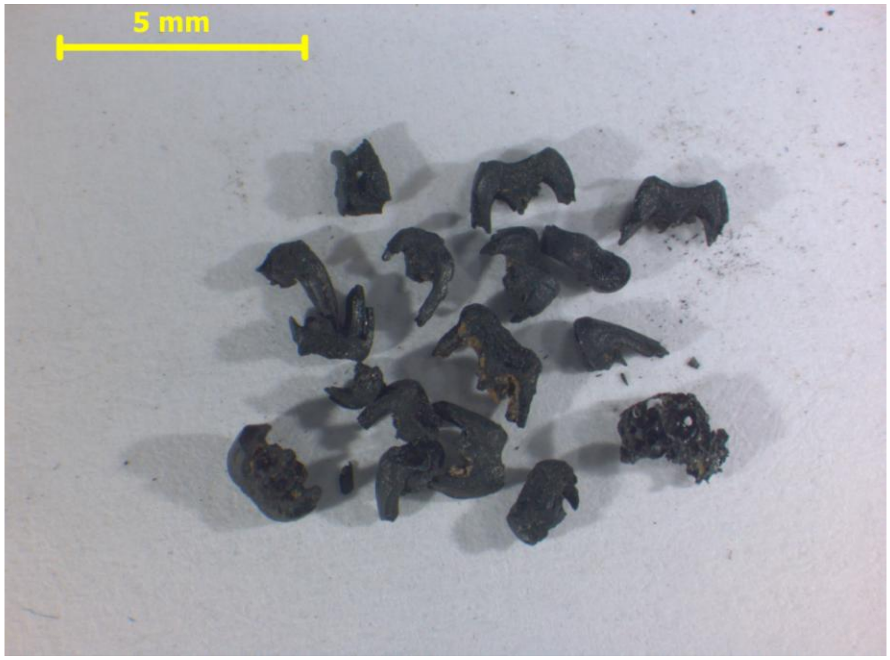


Figure 12 The Triticum monococcum/dicoccum glume bases recovered from Sample 15

The ratio calculations of free-threshing cereals refer to later processing stages indicating that they were stored in clean form. As only 4 Hordeum vulgare rachis segments were recovered from the area, it can be assumed that the area was again an area of several activities conducted throughout the day. Therefore, both the clean grains of free-threshing cereals and pulses together with only one fruit seed and weed seeds can be a result of this accumulation.

As Sample 15 was recovered above the floor, inside the domestic units of İkiztepe, an area where Triticum mon./dic. had been stored could be detected by examining the archaeobotanical remains gathered from the area.

Figure 13 The Triticum aestivum/durum seeds recovered from Sample 15

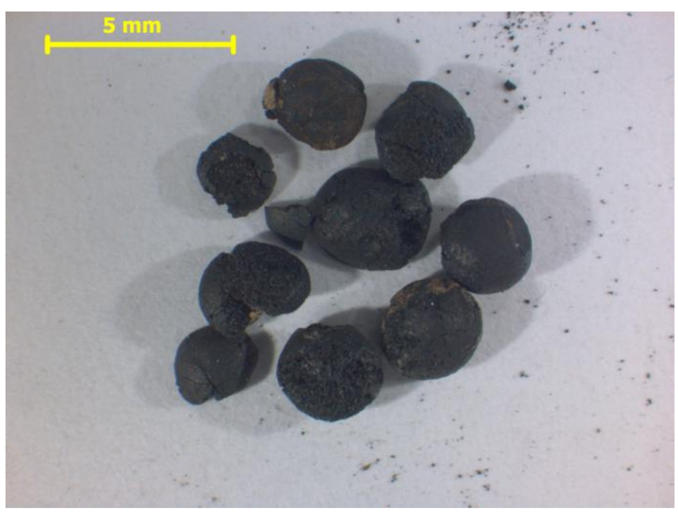


Figure 14 The Lens culinaris seeds recovered from Sample 15

Sample 17

Sample 17 is a sample recovered above the floor of C19/IV8, b.3801. The depth of Sample 17 is again very close to Sample 15, so that they are the samples which are collected from the same floor level.

This sample is very weak with only 4 grains of Triticum mon./dic. seeds together with 30 glume bases recovered. There are no free-threshing cereals recovered from the area while only one pulse-crop, Cicer arietinum, and one Crataegus pontica seed are identified.

No specific crop processing activity is interpreted as taking place in the area where the sample is collected. The remains of archaeobotanical remains are caused of the spread of foods while being consumed. So that, the area where Sample 17 was taken, is interpreted as the periphery of the ongoing activity conducted in the area where Sample 15 was recovered.

TRENCH C19/IV9 b. 3802

Sample 19

Sample 19 is recovered from the debris area above the floor with a volume of 9 litres. 2 Triticum mon./dic. seeds were recovered from the sample while no glume bases belonging to Triticum mon./dic. could be identified. 2 Hordeum vulgare seeds and only one Hordeum vulgare rachis segments are recovered from the area where the sample was taken. The number of fruit seeds is relatively higher than the cereal seeds as 1 Vitis vinifera and 5 Pyrus seeds could be detected. Only one Phalaris seeds as weeds seed could be found.

The dominant crop type in the sample could not be detected as the number of Triticum mon./dic. seeds and Hordeum vulgare seeds is equal to each other. The sample is interpreted as a weak sample because of the proportion of plant seeds is very low when compared with volume of the sample. This may indicate that the area was not used as a place of crop processing activities or that the deposition of the archaeobotanical materials is not sufficient because of the difficulties of preservation as the sample was recovered from a debris area. The sample may be representing a stray find related a crop processing activity conducted somewhere nearby.

Sample 8

The major crop of Sample 8 is Triticum mon./dic. with 26 seeds and 464 glume bases. The free-threshing cereals are represented by Triticum aest./dur with 12 seeds and Hordeum vulgare with 9 seeds. The number of Hordeum vulgare rachis segments is 2. Other species of wheats are represented with 14 seeds in the sample while pulses have a total number of including 3 Vicia ervilia seeds and 2 Lens culinaris seeds. The only represented fruit was Vitis vinifera with 2 seeds while Avena sativa and Secale cereale were interpreted as weeds having a total number of 2 seeds.

The sample is interpreted as a clear fine sieving residue of Triticum mon./dic. The ratio of glume bases and grains of Triticum mon./dic. is 17,84 representing a clear crop processing activity. Sample 8 was recovered from the southeast corner of the trench within the rubble area placed on the floor. Therefore the fine sieving acvitivity could have taken place in this rubble area.

The processing activity should be taking place day by day inside the domestic units of İkiztepe so that different species of pulses together with fruits and cereals are found together from the same area. The rachis segments of Hordeum vulgare may have entered inside the house accidentally with the grains. The same situation may be repeated with pulse and fruit species. Hordeum vulgare and Triticum aest./dur may have been processed somewhere else in the field or may have been bought as clean grains as it can be also traced in other pilot samples studied.

Sample 10

Sample 10 is the weakest sample among all pilot samples as it is composed of only 3 Triticum mon./dic. glume bases and 2 species of Triticum. This may be because that the sample is only 4 litres. No indications of crop processing could be detected in the area where Sample 10 was collected so that no interpretations relevant to crop processing could be made.

TRENCH C20/IV8 b.3803

Sample 11

Sample 11 is composed of 27 Triticum mon./dic. seeds and 255 glume bases. The number of Hordeum vulgare grains is 3 while the rachis segments is 2. There are 5 Triticum aest./dur. seeds in the sample and 1 different species of Triticum. 5 Lens culinaris seeds and 2 Vicia ervilia seeds are present in the sample as pulses. 1 Avena sativa seed is interpreted as a weed.

The ratio of glume bases to glume wheat seeds is 9,44. Thus the sample is interpreted as fine sieving residue of Triticum mon./dic. It can be assumed that the crop processing activity had taken place inside the domestic unit, but the interpretations are limited since there is only one sample collected from the area.

The interpretations about the free-threshing cereals is uncertain as there are very few plant parts belonging to Triticum aest./dur. and Hordeum vulgare. Thus, the accumulation of pulses with free-threshing cereals may indicate that they have arrived the site either in clean form or are processed in the courtyards or in the field.

Some generalizations can be made depending on the interpretations of the pilot samples. These can be listed as follows;

1. The main crop of all the pilot samples is Triticum mon./dic. The number of glume bases of Triticum mon./dic. are higher than the grains of Triticum mon./dic. in almost all of the samples.
2. 3 samples are interpreted as fine sieving residues of Triticum mon./dic (Sample 4, 8 and 11) and 2 samples are interpreted as referring to a storage of Triticum mon./dic. (Sample 5 and 15). The remaining samples are considered to be insufficient to detect any crop processing activity (Sample 7, 10, 17 and 19).
3. The samples mainly come from the debris above the floor (Sample 4, 5, 7, 11 and 19) or from the floor (Sample 8, 10, 15 and 17). Sample 17 and 15 are from the floor below the debris where Sample 4, 5 and 7 are collected in Trench C19/IV8, b. 3801. Sample 8 and 10 are from the floor of trench C19/IV9, b.3802 while Sample 19 is recovered from the debris above. Sample 11 is the only sample recovered from C20/IV8, b.3803.
4. A pattern for crop processing activities can also be detected. Sample 4, Sample 5 and Sample 7 are recovered from the same trench and approximately same depths. They were samples in an imaginary line; Sample 7 from the middle of the eastern face of the trench, Sample 4 from the middle of the trench and Sample 5 from the western face of the trench. As Sample 5 was interpreted as recovered from a storage area, Sample 4 as the residues of fine sieving and Sample 7 is interpreted as a weak sample with only stray finds, it can be assumed that these three samples are indications of a series of crop processing activity conducted in the same area.

5. Some samples are interpreted as a mixing of different species of cereals, pulses, fruits and weeds which are coming from previous activities conducted in the areas. Since several activities could have been taking place in the same areas throughout the day and the consumption may have been made piecemeal, different species of plants can be found in the same area.
6. Two species, Avena sativa and Secale cereale, are interpreted as weeds rather than cereals because that they were represented in very small amounts in four of the samples (Sample 4, 5, 8 and 11).
7. Two free-threshing cereals, Triticum aest./dur and Hordeum vulgare are recovered as clean grains in Sample 4, 5, and 7. The rachis segments of these species are represented scarcely in Sample 8, 11, 15 and 19. No rachis segments and grains can be found in Sample 10 and 17. The presence of rachis segments in the samples is inadequate to interpret any crop processing activity. Therefore, it is assumed that the free-threshing cereals have arrived the domestic units in their final form and processed to be clean grains outside the occupation areas, in the threshing floors of the fields or in the courtyards. Another option for the interpretation of these clean grains is that they were bought from somewhere else in clean form.

4.2 WILLEM VAN ZEIST'S SAMPLES

4.2.1 Tepe I

EBA III-MBI

There are a number of 7 samples examined dating to Early Bronze Age III-Middle Bronze Age I (Transition period) collected from Tepe I. These samples are Sample 1.1, 1.2, 1.3, 1.4, 1.5, 1.6 and 1.7. The species represented in these samples are Triticum mon./dic., Triticum aest./dur., Hordeum vulgare, Vicia ervilia, different species of Vicia, Lens culinaris, Ficus carica, Lathyrus sativus, Linum ussitatissimum, Vitis vinifera, Lolium spec., Polygonum convolvulus, Setallaria media, Scirpus maritimus, Chenopodium of various types, Sambucus nigra, Various types of Galium, Solanum nigrum, Rumex, Phalaris and Antirrhinum. (see Table 3)

The main crop represented in the samples is Triticum mon./dic. while Vicia ervilia is the outstanding type of pulses. Different species of Lolium are the most promising weed among all the weeds represented n the samples. No rachis segments of Triticum aest./dur. Hordeum vulgare are found within the samples which lead to an interpretation of the grains as clean grains. On the other hand the free-threshing cereals seem to be more frequent within the samples.

Most of the samples refer to cleaned product although a problem in the interpretations of the samples arises. Although the number of both glume bases and grains of the glumed wheats are very close to each other, the interpretations turn out to be “cleaned products” because that the number of glumed wheat grains are slightly higher than the number of glume bases. Thus the samples may be representing a mixed area with several activities conducted day by day, so that a mixture of the residues of different activities could have occurred. The samples are represented as very weak samples to make clear definitions of the area such that Sample 1.1, 1.2, 1.3, and 1.4 refer to cleaned products while Sample 1.5, 1.6 and 1.7 refer to fine sieving residues although the number of seeds, glume bases and rachis segments recovered is insufficient to derive certain results. No storage could be detected in the area where the samples were collected.

Most of the samples are collected from a debris area so that the mixture of the samples seems reasonable as the accumulation of different species is probable for debris areas. The clean grains of free-threshing cereals may either be bought from somewhere else in

Table 3 Tepe I EBAIII-MBI samples of Willem Van Zeist

Species	Sample 1.1	Sample 1.2	Sample 1.3	Sample 1.4	Sample 1.5	Sample 1.6	Sample 1.7
Tr. mon./dic. grain	5	4	25	11	13	4	1
Tr. mon./dic. glume base	2	0	0	7	34	8	15
Tr. aest./dur. grain	4	13	13	8	0	0	1
Hordeum vulg. grain	2	5	12	6	4	1	4
Tr. species	0	0	0	0	8	0	0
Vicia ervilia	4	6	11	6	3	0	1
Vicia spec.	0	1	3	0	0	0	0
Lens culinaris	0	3	7	14	2	0	0
Ficus carica	0	1	0	2	0	0	0
Lathyrus sativus	0	0	1	0	0	0	0
Linum usitatissi	0	0	0	2	0	0	0
Vitis vinifera	1	0	0	0	0	0	0
Lolium spec.	6	9	18	16	10	0	0
Polygonum convolvulus	1	0	0	0	0	0	0
Setallaria media	1	0	0	0	0	0	0
Scirpus maritimus	1	0	0	0	0	0	0
Chenopodium var. ty.	1	0	0	0	0	0	0
Sambucus nigra	0	0	1	0	0	0	0
Antirrhinum	0	0	1	0	0	0	0
Galium var. ty.	0	0	2	1	0	0	0
Solanum nigrum	0	0	0	1	0	0	0
Rumex	0	0	3	1	1	0	0
Phalaris	0	0	0	0	0	1	0

the vicinity of İkiztepe or may have been processed in the threshing floors located in the field as described previously in the examination of the pilot samples of the study.

EBA III

Sample 1.8, 1.9, 1.10, 1.11, 1.12, 1.13, 1.14 and 1.15 belong to Tepe I Early Bronze Age III. The species represented in the samples are Triticum mon./dic., Triticum aest./dur., Hordeum vulgare, Vicia ervilia, Lens culinaris, Ficus carica, Phalaris, Sambucus ebulus, Crataegus pentagyna, Rubus, Polygonum concolvulus, Polygonum spec., various types of Chenopodium, Echinochloa, various types of Galium, Hyoscyamus, Lolium, Setaria, Medicago, Poa, various types of Rumex and two-sided Carex (see Table 4).

The main crop represented in the samples is Triticum mon./dic. with high numbers of glume bases. Triticum aest./dur. and Hordeum vulgare are underrepresented since almost no rachis segments and a few grains of these species could be recovered. Different species of Lolium are the most outstanding types of weeds represented in the samples.

Sample 1.8, 1.11, 1.12 and 1.13 are very weak samples to be representative of any kind of specific activity conducted in the area where the samples are recovered. On the other hand Sample 1.9, 1.10, 1.14 and 1.15 refer to clear fine sieving activities with high numbers of glumed wheats recovered. The number of glume bases recovered in Sample 1.9 is 550 while only 9 grains of Triticum mon./dic. are recovered. 360 glume bases were recovered in Sample 1.10 with 8 seeds of Triticum mon./dic. Only one seeds of Triticum mon./dic was uncovered from Sample 1.14 although 360 glume bases was identified in the same sample. Lastly, a proportion of 670 glume bases to 4 grains of Triticum mon./dic. was calculated for Sample 1.15. All of these four samples consequently refer to clear fine sieving activities conducted within the area. The residues

Table 4 Tepe I EBA III samples of Willem Van Zeist

Species	Sample 1.8	Sample 1.9	Sample 1.10	Sample 1.11
Tr. mon./dic. grain	0	9	8	0
Tr. mon./dic. glume base	7	550	360	23
Tr. dur./aest. grain	1	0	0	0
Hordeum vulgare grain	3	8	3	1
Hordeum vulgare rachis segment	0	0	5	0
Vicia ervilia	0	5	0	0
Lens culinaris	1	0	0	0
Ficus carica	3	2	0	0
Phalaris	1	0	0	0
Rubus	0	1	0	0
Chenopodium var. ty.	0	1	0	1
Echinochloa	0	3	0	0
Galium var. ty.	0	1	0	0
Hyoscyamus	0	2	0	0
Lolium spec.	0	23	1	0
Setaria	0	0	1	0
Medicago	0	0	0	0
Rumex var. ty	0	1	0	0

Table 4 (continued) Tepe I EBA III samples of Willem Van Zeist

Species	Sample 1.12	Sample 1.13	Sample 1.14	Sample 1.15
Tr. mon./dic. grain	4	1	1	4
Tr. mon./dic. glume base	10	24	360	670
Tr. dur./aest. grain	0	0	2	1
Hordeum vulgare grain	18	0	2	12
Vicia ervilia	0	0	0	3
Lens culinaris	0	0	0	1
Phalaris	0	0	0	0
Sambucus ebulus	1	0	0	0
Crataegus pentagyna	0	0	0	1
Polygonum con	0	1	0	0
Polygonum spec.	1	0	0	0
Chenopodium var. ty.	1	0	0	0
Hyoscyamus	1	0	0	0
Lolium spec.	1	2	0	8
Setaria	0	1	1	1
Medicago	1	0	0	0
Poa	3	0	0	0
Rumex var. ty	3	0	0	0
Carex (two-sided)	0	10	0	0

are of Triticum mon./dic. which is interpreted as the main crop processed within the area.

The activities relevant to crop processing may have been separated in the areas where the samples were collected, such that, it can be assumed that two imaginary groups can be formed like Sample 1.9 and 1.10 at one side and Sample 1.14 and 1.15 in the other. These samples may have been taken from two different areas where whole data set was collected from, so that the remaining samples which are interpreted as weak samples may be at the periphery. So that, the weaker samples may represent the areas where the residues of crop processing activities conducted in other sampled areas have accumulated.

A total number of only 4 seeds of Triticum aest./dur. could be recovered from the samples of Tepe I dating to EBA III. All of these seeds are clean grains as there are no rachis segments of Triticum aest./dur recovered from the area. On the other hand, 5 rachis segments of Hordeum vulgare are recovered from Sample 1.10, while no rachis segments of Hordeum vulgare could be identified in other samples. These 5 rachis segments are probably mixed with other residues of fine sieving conducted in the area during the activity where Sample 1.10 was collected. However, the free-threshing cereals identified in the samples are again interpreted as processed in the threshing floors of the nearby fields or bought from somewhere else in clean form.

EBA II

There are a number of four samples examined by Zeist belonging to Early Bronze Age I in Tepe I. These samples are Sample 1.16, 1.17, 1.18 and 1.19. The species represented in these samples are Triticum monococcum/dicoccum, Triticum aestivum/durum, Hordeum vulgare, Vicia ervilia, Lens culinaris, Ficus carica, Linum ussitatissimum, Vitis vinifera, Phalaris, Avena, Echinochloa, Lolium spec., Rumex, various types of Triticum, Crataegus pentagyna, Crataegus monogyna, Polygonum convolvulus, Polygonum aviculare, Sambucus ebulus, Setaria, Bromus sterilis, Silena, Cotoneaster, Physalis alkekengi, Rubus, Malva, Sparganium and Carex (two-sided) (see Table 5).

All of the samples refer to fine sieving activity within the domestic units. Residues of fine sieving is relatively better represented in Sample 1.16 and 1.17 which include a

Table 5 Tepe I EBA II samples of Willem Van Zeist

Species	Sample 1.16	Sample 1.17	Sample 1.18	Sample 1.19
Tr. mon./dic. grain	14	33	1	2
Tr. mon./dic. glume base	635	678	101	50
Tr. dur./aest. grain	1	16	0	0
Tr. dur./aest. rachis segment	0	0	2	0
Hordeum vulg. grain	7	46	4	2
Vicia ervilia	1	3	1	0
Lens culinaris	4	1	0	0
Ficus carica	0	2	0	0
Linum ussitas.	0	3	0	1
Vitis vinifera	0	0	5	0
Phalaris	0	4	1	1
Avena	1	0	0	0
Echinochloa	0	1	0	0
Lolium spec.	173	124	17	3
Rumex	16	40	7	5
Tr. Spec.	0	16	0	0
Crataegus pent.	0	2	6	0
Crataegus mon.	0	0	1	0
Polygonum con.	0	1	0	0
Polygonum avic.	0	0	0	1
Sambucus ebulus	0	1	0	0
Setaria	0	1	1	0
Bromus ster.	1	0	0	0
Silene	2	0	0	0
Cotoneaster	0	0	13	0
Physalis alk.	0	3	3	0
Rubus	0	0	39	0
Malva	0	0	1	0
Sparganium	0	0	1	0
Carex (two-sided)	0	0	0	1

number of 635 and 678 Triticum mon./dic. glume bases in sequence. Thus, the main crop represented in the samples is Triticum mon./dic. The free-thereshing cereals like Triticum aest./dur. and Hordeum vulgare are represented as clean grains in the samples except Sample 1.18 with only two rachis segments of Triticum aest./dur. identified. On the other hand, the free-threshing cereals seem to be better represented in EBA III samples than in EBA II samples.

The weed species are better represented in EBA II samples of Tepe I than in EBA III samples as there are relatively higher numbers of Lolium species found other than Rumex, Polygonum species, Setaria, Bromus, Silene, Physalis alkekengi, Malva and Sparganium. The evidence of weed seeds found in the samples strengthens the fact that fine sieving activity was conducted within the area. The free-threshing cereals found in the area can again be interpreted as clean grains and that it can be assumed that the cereals have arrived the site in clean form either as processed previously in the field or bought from somewhere else in clean form.

4.2.2 Tepe II

EBA II

The Early Bronze Age II samples belonging to Tepe II are Sample 2.1, 2.2, 2.3 and 2.4. Two of these samples (Sample 2.1 and 2.4) indicate crop processing activities while two of them (Sample 2.2 and 2.3) are very weak to indicate any activity.

The species represented in the samples are Triticum monococcum/dicoccum, Triticum aestivum/durum, Hordeum vulgare, Lens culinaris, Lathyrus sativus, Vicia spec., Ficus carica, Vitis vinifera, Corylus, various types of Galium, species of Lolium, Polygonum convolvulus, Polygonum aviculare, various types of Rumex, Cotoneaster, Physalis alkekengi, Bromus sterilis, Fumaria, Setaria and Cladium (see Table 6).

Table 6 Tepe II EBA II samples of Willem Van Zeist

Species	Sample 2.1	Sample 2.2	Sample 2.3	Sample 2.4
Tr. mon./dic. grain	3	0	2	0
Tr. mon./dic. glume base	205	2	7	83
Tr. dur./aest. grain	4	0	1	0
Hordeum vulg. grain	0	0	1	0
Lens Culinaris	3	0	0	0
Lathyrus sativus	0	0	0	1
Vicia spec.	0	0	0	1
Ficus carica	0	0	6	0
Vitis vinifera	0	0	1	0
Corylus	0	0	0	3
Galium var. ty.	0	1	0	0
Lolium spec.	115	5	1	0
Polygonum convol.	2	1	0	0
Polygonum aviculare	0	0	5	0
Rumex various ty.	3	0	1	0
Cotoneaster	0	0	4	0
Physalis alkekengi	0	0	5	1
Bromus sterilis spec.	0	0	2	0
Fumaria	0	0	1	0
Setaria	0	0	1	0
Cladium	0	0	1	0

Sample 2.1 and 2.4 are representatives of fine sieving activity conducted within the area. There are a number 205 and 83 Triticum mon./dic. glume bases identified in Sample 2.1 and 2.4 in sequence, thus, the residues of Triticum mon./dic. which results from fine sieving activity could be detected. In addition to this, a number of 115 Lolium species were also found in Sample 2.1. Consequently, the areas where Sample 2.1 and 2.4 were recovered are interpreted as areas where clear crop processing activities took place. On the other hand, the areas where Sample 2.2 and 2.3 were recovered do not show any significant evidence of crop processing activities. So that, it is assumed that those areas were not used for any crop processing or cooking activity.

There are no rachis segments of any free threshing cereals detected in the samples while few grains of Triticum aest./dur. and Hordeum vulgare could be identified. As stated in previous samples, this situation indicates that the clean grains of Hordeum vulgare and Triticum aest./dur. may have been bought from a producer site around, or may have been processed in the vicinity of İkiztepe.

EBA I

The Early Bronze Age I samples belonging to Tepe II are Sample 2.5, 2.6, 2.7, 2.8, 2.9, 2.10 and 2.11. These samples include species like, Triticum mon./dic., Hordeum vulgare, Lens culinaris, Lathyrus sativus, Vicia ervilia, species of Vicia, Pisum sativum, Ficus carica, Vitis vinifera, Prunus, Rubus, Sambucus nigra, Sambucus ebulus, species of Lolium, Malva, Portulaca, Adonis, Hyoscyamus, Medicago, Silene, Solanaceae, Cladium, species of Scirpus, Physalis alkekengi, various types of Chenopodium, Cuscuta, Polygonum convolvulus, species of Polygonum, Carex (two-sided), Carex (three-sided), Phalaris, various types of Rumex, Scleranthus annuus and Schoenus nigricans (see Table 7).

All of the samples refer to fine sieving residues except Sample 2.5 with 15 Triticum mon./dic. grains and 7 glume bases. Sample 2.7, 2.8 and 2.9 are the strongest samples

Table 7 Tepe II EBA I samples of Willem Van Zeist

Species	Sample 2.5	Sample 2.6	Sample 2.7	Sample 2.8
Tr. mon./dic. grain	15	7	45	18
Tr. mon./dic. glume base	7	55	300	233
Hordeum vulg. grain	68	3	0	2
Lens culinaris	2	28	9	0
Lathyrus sativus	0	0	0	1
Vicia ervilia	1	0	7	3
Vicia spec.	1	0	0	0
Pisum sativum	2	5	1	1
Ficus carica	0	0	30	4
Vitis vinifera	0	0	0	0
Rubus	0	0	2	0
Lolium spec.	3	0	7	6
Malva	8	3	0	0
Portulaca	1	3	0	0
Adonis	0	1	0	0
Hyoscyamus	0	1	0	0
Medicago	0	1	0	0
Silene	0	1	0	0
Solanaceae	0	5	0	0
Cladium	0	1	1	1
Scirpus spec.	0	1	0	0
Physalis alkekengi	0	0	1	0
Chenopodium var. ty.	0	0	5	0
Cuscuta	0	0	1	0
Polygonum convolvulus	0	0	2	0
Carex (two-sided)	0	0	1	0
Carex (three-sided)	0	0	1	0
Cuscuta	0	0	0	2
Phalaris	0	0	0	1
Rumex var. ty	0	0	0	2

Table 7 (continued) Tepe II EBA I samples of Willem Van Zeist

Species	Sample 2.9	Sample 2.10	Sample 2.11
Tr. mon./dic. grain	10	1	21
Tr. mon./dic. glume base	500	69	65
Hordeum vulg. grain	2	1	2
Lens culinaris	4	3	2
Lathyrus sativus	0	0	0
Vicia ervilia	2	1	5
Vicia spec.	0	0	1
Pisum sativum	1	0	0
Ficus carica	240	0	0
Vitis vinifera	45	0	0
Prunus	1	0	0
Rubus	12	0	0
Sambucus nigra	1	0	0
Sambucus ebulus	1	0	0
Lolium spec.	8	1	0
Cladium	1	0	0
Scirpus spec.	1	0	0
Physalis alkekengi	5	0	0
Chenopodium var. ty.	6	0	0
Carex (two-sided)	1	0	0
Carex (three-sided)	1	0	0
Rumex var. ty	3	0	0
Polygonum spec.	2	0	1
Scleranthus annuus	2	0	0
Schoenus nigricans	6	0	0

representing fine-sieving activity within the areas while Sample 2.5, 2.6, 2.10 and 2.11 are considered as weak samples although they represent cleaned products or fine sieving residues. There are 300 glume bases and 45 grains of Triticum mon./dic. in Sample 2.7; 233 glume bases and 18 grains of Triticum mon./dic. in Sample 2.8 and 500 glume bases and 10 grains of Triticum mon./dic. in Sample 2.9 in sequence.

The accumulation of fruit seeds in Sample 2.7 and 2.9 is also remarkable. The Ficus carica seeds recovered from Sample 2.7 and 2.9 is very high, but as one fruit contains much more than one seed in figs, the numbers should not be interpreted as referring to storage of Ficus carica.

The samples belonging to the Early Bronze Age I of Tepe II differ from the previous samples examined in one way. That is; there are no Triticum aest./dur. grains or glume bases recovered dating to this period in Tepe II. On the other hand, the main crop represented in Sample 2.5 is Hordeum vulgare with 68 seeds identified. The barley seeds may have arrived the site in clean form after being processed in the field or bought from somewhere else, while Triticum aest./dur. was not a crop for consumption in the domestic units.

CHALCOLITHIC

The largest data set was used for examining the samples of Tepe II dating to Chalcolithic period which included 14 samples. These samples were, Sample 2.12, 2.13, 2.14, 2.15, 2.16, 2.17, 2.18, 2.19, 2.20, 2.21, 2.22, 2.23, 2.24 and 2.25. These samples included species like Triticum monococcum/dicoccum, Triticum aestivum/durum, Hordeum vulgare, species of Triticum, Avena, Lens culinaris, Vicia ervilia, species of Vicia, Lathyrus sativus, Pisum sativum, Cicer arietinum, Linum ussitatissimum, Vitis vinifera, Rubus, Sambucus ebulus, various types of Chenopodium, various types of Galium, Hyoscyamus, Lolium, Phalaris, various types of Rumex, Stachys arvensisly, Polygonum convolvulus, Scirpus maritimus, species of Scirpus, Carex (two-sided) and Scleranthus annuus (see Table 8).

Sample 2.12, 2.18, 2.19, 2.21, 2.22, 2.23, 2.24 and 2.25 are considered to be relatively strong samples so that the interpretations about these samples seemed to be much clearer. Thus, Sample 2.12 is considered to be a clear example of fine sieving residues of Triticum mon./dic. with 900 glume bases and 20 grains identified. This interpretetion is supported by the the weed seeds found in the sample. Other examples of fine sieving residues of Triticum mon./dic. could be seen in Sample 2.21 with 106 glume bases and 8 grains; Sample 2.22 with 135 glume bases and 4 grains; Sample 2.23 with 460 glume bases and 3 grains; Sample 2.24 with 960 glume bases and 9 grains and Sample 2.25 with 139 glume bases of Triticum mon./dic. and no grains. Sample 2.18 and 2.19 are recovered from the areas where stores of Vicia ervilia and Triticum monoccocum/dicoccum grains were located. This interpretation was derived from the ratios of both glume bases and grains of Triticum monococcum/diccocum and Vicia ervilia seeds found. There are 351 Triticum mon./dic. grains and 188 glume bases identified in Sample 2.18 in addition to 50 Hordeum vulgare seeds and 400 Vicia ervilia seeds. Sample 2.19 is again interpreted as storage as a number of 605 Triticum mon./dic. grains and 80 Hordeum vulgare seeds are recovered in clean form. A number of 1350 Vicia ervilia seeds were also recovered from Sample 2.19. The rest of the samples (Sample 2.13, 2.14, 2.15, 2.16, 2.17 and 2.20) are very weak to be considered as evidence of clear processing activities although they refer to fine sieving residues or clean products of Triticum mon./dic. from the ratio calculations.

Most of the free-threshing cereals seem to have arrived the site in clean form as all of the species are found in clean form in the samples except Sample 2.23 with 2 rachis segments of Triticum aest./dur. and Sample 2.25 with only one rachis segment of Hordeum vulgare recovered. These can be interpreted as stray finds as both of the samples refer to clear fine sieving activity conducted in the area.

Table 8 Tepe II Chalcolithic samples of Willem Van Zeist

Species	Sample 2.12	Sample 2.13	Sample 2.14	Sample 2.15
Tr. mon./dic. grain	20	6	0	0
Tr. mon./dic. glume base	900	11	14	6
Hordeum vulg. grain	2	0	2	6
Tr. spec.	0	0	0	4
Lens culinaris	7	0	0	2
Vicia ervilia	9	4	2	0
Vicia spec.	0	0	0	0
Lathyrus sativus	1	0	0	0
Rubus	1	0	0	0
Sambucus ebulus	2	0	0	1
Chenopodium var. ty.	1	0	0	0
Galium var. ty.	13	1	0	0
Hyoscyamus	2	0	0	0
Lolium spec.	39	0	0	0
Phalaris	1	0	0	0
Rumex var. ty.	7	1	0	0
Carex (two-sided)	1	0	0	0

Table 8 (continued) Tepe II Chalcolithic samples of Willem Van Zeist

Species	Sample 2.16	Sample 2.17	Sample 2.18
Tr. mon./Dic. grain	7	12	351
Tr. mon./Dic. glume base	2	41	188
Hordeum vulg. grain	3	6	50
Tr. spec.	0	0	0
Avena	0	1	0
Lens culinaris	3	7	2
Vicia ervilia	1	5	400
Vicia spec.	0	0	1
Lathyrus sativus	2	4	3
Pisum sativum	0	0	3
Cicer arietinum	0	0	2
Vitis vinifera	0	0	1
Rubus	0	0	1
Galium var. ty.	7	4	4
Phalaris	0	0	0
Rumex var. ty.	1	0	0
Scleranthus annuus	0	0	1

Table 8 (continued) Tepe II Chalcolithic samples of Willem Van Zeist

Species	Sample 2.19	Sample 2.20	Sample 2.21	Sample 2.22
Tr. mon./dic. grain	605	3	8	4
Tr. mon./dic. glume base	0	25	106	135
Hordeum vulg. grain	80	4	1	2
Lens culinaris	9	4	1	2
Vicia ervilia	1350	2	2	2
Vicia spec.	1	0	0	0
Lathyrus sativus	13	1	1	0
Pisum sativum	1	0	0	0
Cicer arietinum	1	0	0	0
Galium var. ty.	4	0	0	0
Stachys arvensisly	0	0	1	0
Scirpus spec.	0	0	0	1

Table 8 (continued) Tepe II Chalcolithic samples of Willem Van Zeist

Species	Sample 2.23	Sample 2.24	Sample 2.25
Tr. mon./dic. grain	3	9	0
Tr. mon./dic. glume base	460	960	139
Tr. dur./aest. rachis segment	2	0	0
Hordeum vulg. grain	3	5	0
Hordeum vulg. rachis segment	0	0	1
Lens culinaris	1	1	0
Vicia ervilia	10	31	48
Vicia spec.	0	2	0
Linum ussitass.	0	1	0
Galium var. ty.	0	2	1
Lolium spec.	2	6	0
Phalaris	0	0	1
Rumex var. ty.	0	1	1
Polygonum convol.	1	0	0
Scirpus maritimus	2	0	0

4.2.3 Tepe III

EBA III – MBI

The samples examined dating to Early Bronze Age III - Middle Bronze Age I (Transition period) are Sample 3.1, 3.2, 3.3 and 3.4. The species identified within these samples are Triticum monococcum/dicoccum, Triticum aestivum/durum, Hordeum vulgare, Lens culinaris, Vicia ervilia, Linum usitasissimum, Ficus carica, Physalis alkekengi, Phalaris, Lithospermum arvense, Lolium, various types of Rumex and various types of Chenopodium (see Table 9).

Table 9 Tepe III EBA III-MBI samples of Willem Van Zeist

Species	**Sample 3.1**	**Sample 3.2**	**Sample 3.3**	**Sample 3.4**
Tr. mon./dic. grain	1	4	0	2
Tr. mon./dic. glume base	440	17	24	250
Tr. dur./aest. grain	0	0	0	1
Hordeum vulg. grain	2	0	2	1
Lens culinaris	0	0	0	1
Vicia ervilia	0	1	0	0
Linum usi.	1	0	0	0
Ficus carica	1	0	0	0
Physalis alk.	0	0	9	0
Phalaris	0	0	0	1
Lithospermum arven.	2	0	0	0
Lolium spec.	2	0	0	4
Rumex var. ty.	1	0	0	0
Chenopodium var. ty.	0	0	0	1

Two of the samples (Sample 3.1 and 3.4) are considered to be clear examples of fine sieving residues of Triticum monococcum/dicoccum. A number of 440 glume bases were recovered from Sample 3.1 with only one grain represented. Sample 3.4 included a number of 250 Triticum mon./dic. glume bases with 2 grains. The rest of the samples (Sample 3.2 and 3.3) are considered as very weak to be interpreted as any crop processing activity. Thus they are interpreted as the mixed samples which were spread around during the crop processing activity conducted nearby.

The free-threshing cereals are found in clean form as no rachis segments of both Triticum aest./dur. and Hordeum vulgare could be identified. The free-threshng cereals may be again considered as mixed with the crops processed since the number of grains recovered is insufficient to be a product of any crop processing activity. Thus, they may be considered to be weeded out from the grains of Triticum mon./dic. during the fine sieving process.

EBA III

Four samples are examined dating to Early Bronze Age III in Tepe III which are Sample 3.9, 3.10, 3.11 and 3.12. A number of 32 species could be identified which can be listed as Triticum monococcum/dicoccum, Triticum aestivum/durum, Hordeum vulgare, Avena, Lens culinaris, Pisum sativum, Lathyrus sativus, Linum ussitassissimum, Vicia ervilia, species of Vicia, Vitis vinifera, Crataegus pentagyna, Cotoneaster, Berberis, Physalis alkekengi, Bromus sterilis, Digitaria, Echinochloa, various types of Galium, Lolium, Phalaris, Polygonum aviculare, Polygonum convolvulus, various types of Rumex, Setaria, Silene, Cynodon, Lithospermum arvense, Ranunculus, Carex (two-sided), Eleocharis and Convolvulus (see Table 10).

Table 10 Tepe III EBA III samples of Willem Van Zeist

Species	Sample 3.9	Sample 3.10	Sample 3.11	Sample 3.12
Tr. mon./dic. grain	1	15	8	28
Tr. mon./dic. glume base	18	600	44	83
Tr. dur./aest. grain	0	6	0	0
Hordeum vulg. grain	0	11	6	5
Avena	0	1	2	1
Lens culinaris	0	0	1	1
Pisum sativum	1	1	0	1
Lathyrus sativ.	0	1	0	0
Linum usi.	0	2	0	3
Vicia ervilia	0	0	1	0
Vicia spec.	0	2	0	0
Vitis vinifera	0	0	1	0
Crataegus pent.	0	0	1	0
Cotoneaster	0	2	1	0
Berberis	0	1	0	0
Physalis alke.	0	1	5	1
Bromus sterilis spec.	0	1	0	0
Digitaria	0	3	1	1
Echinochloa	0	2	1	0
Galium var. ty.	0	2	0	0
Lolium spec.	3	120	35	51
Phalaris	0	2	1	1
Polygonum avi.	0	1	1	2
Rumex var. ty.	0	4	8	9
Setaria	0	3	1	1
Silene	0	2	2	1
Cynodon	0	0	2	0
Lithospermum arv.	0	0	1	1
Polygonum convol.	0	0	4	0
Ranunculus	0	0	1	0
Carex (two-sided)	0	0	1	0
Eleocharis	0	0	2	1
Convolvulus	0	0	0	1

All of the samples refer to fine sieving activity conducted in the areas. The glume bases of Triticum mon./dic. are the residues with were derived from the sieving activity while Triticum mon./dic. is the main crop represented in the samples. Sample 3.10 is the most outstanding sample above all with a number of 600 glume bases and 15 grains of Triticum mon./dic recovered. The rest of the samples are considred to be weak samples although they refer to fine sieving depending on the ratio calculations. The high number of Lolium species found in Sample 3.10, 3.11 and 3.12 also supports the interpretations of fine sieving.

The free-threshing cereals are again found in clean form in the samples which may indicate that they have arrived the areas in clean form being processed previously in the field. Another option is that they may be bought from somewhere else again in clean form.

The generalizations which can be derived from the interpretations of Zeist's samples using the ratio calculations relevant to crop processing activities may be listed as follows;

1. The main crop represented in almost all of the samples is Triticum monococcum/dicoccum except Sample 1.2 from Tepe I dating to EBA III-MBI, Sample 1.12 from Tepe I dating to EBA III and Sample 2.5 from Tepe II dating to EBA I.
2. The free-threshing cereals are in minority with mostly clear grains represented in the samples which are interpreted as derived from crop processing activities conducted nearby. The clean grains may have arrived the site after being processed in the threshng floors of the fields in the vicinity of İkiztepe or may be bought in clean form from somewhere else.

3. The fruits seeds may be interpreted as mixed from the previous acitivities of cooking or consumption. Therefore, they may have been found in minority in the samples with few seeds represented.
4. The seeds of Avena and Secale are interpreted as weeds since they were found in very small amounts in the samples.
5. Two storage areas could be detected in Tepe II dating to Chalcolithic period. These storages included Triticum monococcum/dicoccum and Vicia ervilia. (Sample 2.18 and 2.19)
6. The fine sieving activity was conducted throughout all periods in the domestic units. The exact location of the crop processing activities could not be detected because of the lack of information relevant to the samples which are collected.
7. Lolium is the most abundant weed type seen through all periods.

CHAPTER V

CONCLUSION AND LIMITATIONS

5.1 CONCLUSION

Some conclusions of the study can be made relevant to overall calculations of the samples collected from three Tepes of İkiztepe dating from Chalcolithic period to the Transition period. These are;

1. All of the samples come from inside the domestic units.
2. Fine sieving activity took place inside the domestic units.
3. The residues of Triticum monococcum/dicoccum are found in majority.
4. Lolium spec., Rumex, Carex, Physalis alkekengi, Polygonum aviculare are the main weeds of crops in sequence.
5. Most of the samples which give high values of fine sieving residues in the ratio calculations are recovered from debris or pise remains.
6. No processing of free-threshing cereals could be detected inside the domestic units as they were assumed to be arrived the site after processed in the threshing floors of the fields nearby or may have been bought in clean form from somewhere else.
7. The ratio calculations referred to 3 storage areas which are Sample 5 of the Pilot samples, Sample 2.18 and 2.19 of Zeist’s samples. The storage detected in Sample 5 is dating to the EBA II wihe the other two storages are dating to the Chalcolithic period.

8. Both Tepe I and Tepe II in the EBA II period give clear results referring to fine sieving residues of Triticum monococcum/dicoccum although the number of Hordeum vulgare seeds is higher than Tr. monococcum/dicoccum seeds in EBA II period of Tepe I. The same situation is repeated in the samples of EBA III in Tepe I and Tepe III.
9. A kitchen area was detected by Bilgi, and the samples collected from the kitchen area referred to both weeds and crops which were the results of cleaning of the products or the components of storage area. Storing as food or fodder may have taken place in the area. The cleaning of the crop may have also taken place simultaneously before cooking. Another prediction about the preparation of the crops for use may be about the pits uncovered near the sampled area. The chaff and glumes of the cereal may have also thrown into the refuse pits, but this is also questionable since the refuse pits were not sampled. (B118, Sample 2.7 and 2.8)
10. The plant remains of İkiztepe are mostly similar to the remains in the Western Anatolian sites; Troia, Yenibademli Höyük and Limantepe. The samples in these sites are recovered from floors, fills, ovens, hearths, so called inside the domestic units. The main crop processed inside the houses of these sites is Triticum dicoccum/monococcum. Hordeum vulgare takes the second place in Troia and Yenibademli Höyük while Triticum aestivum/durum is in the second rank in Liman Tepe.
11. Species of Hordeum are recovered from the domestic units of Arslantepe (Eastern Anatolia), Titriş Höyük and İmamoğlu Höyük(Southeastern Anatolia) and Tell Kurdu (Southwestern Anatolia) although the stage of crop processing could not be detected.

The aim of this study is reached as the crop processing activities conducted within the domestic units of İkiztepe could be detected in the sampled areas although some of the samples were very weak to be an evidence of any crop processing activity conducted. The methodology included the ratio calculations of crops which helped the author to derive results about certain activities took place within the houses of İkiztepe. The research may be widened by using the weed counts to make detailed analysis of crop processing activities took place in the site. Further studies may include the examination of the rural areas of İkiztepe aiming to detect the locations of the threshing floors in the fields of the settlement.

5.2 LIMITATIONS

There are two limitations considering the pilot samples used. The first one is that the number of pilot samples used in the study is insufficient to derive sufficient results about the crop processing activities. The second limitation can be stated such as the exact locations of the samples are unknown because of the lack of the information in the field records. Thus, the function of specific areas where the samples were collected could not be detected.

The most important limitation considering the methodology of the study is about the ratio calculations. Thus, although the calculations may have helped to detect the crop processing activities in the site, the exact calculations may not be always reliable for the interpretations. That is to say, some samples are very weak to determine any crop processing activity although they refer to fine sieving or winnowing in the ratio calculations.

Another limitation of the methodology is that the archaeobotanical material of the study is only collected from the possible domestic units of İkiztepe. Therefore, as there are no samples collected from the possible field areas, the areas of crop processing in the vicinity of İkiztepe could not be detected. The excavated areas may not reflect overall context for archaeobotanical patterns.

The last limitation of the methodology is that the interpretations of Ratio III are doubtful as this ratio can only be used when the sample includes concentrations of the same wheat type only, such as storage. When a predominant wheat is detected, the remaining wheats may be considered as weeds.

Some general limitations can be listed as follows;

- Survival of the material during the past decades may be difficult as the several factors may lead to the lack of preservation.
- The contexts may not be purely isolated.
- The reference collections used may not be sufficient and reliable.

REFERENCES

Algaze, G. et.al. (1995) Titriş Höyük, A Small EBA Urban Center in SE Anatolia The 1994 Season, *Anatolica 21,* pp. 13-32.

Alkım, U., B., Alkım, H., & Bilgi, Ö. (1988). *İkiztepe I: Birinci ve İkinci Dönem Kazıları: The First and Second Season Excavations (1974-1975).* Ankara, Türk Tarih Kurumu Publications.

Alkım, U., B., Alkım, H., & Bilgi, Ö. (2003). *İkiztepe II: Üçüncü, Dördüncü, Beşinci, Altıncı, Yedinci Dönem Kazıları (1976-1980).* Ankara, Türk Tarih Kurumu Publications.

Bakels, C. (2001) Producers and Consumers in Archaeobotany: A comment on "When method meets theory: the use and misuse of cereal producer/consumer models in archaeobotany. In U. Albarella, *Environmental Archaeology: Meaning and Purpose*, pp. 299-301.

Bilgi, Ö. (1996). İkiztepe Kazılarının 1994 Dönemi Sonuçları. In *17. Kazı Sonuçları Toplantısı, 1*, (pp.157-168). Ankara, Anıtlar ve Müzeler Genel Müdürlüğü Publications.

Bilgi, Ö. (1998). İkiztepe Kazısı 1997 Dönemi Sonuçları. In *20. Kazı Sonuçları Toplantısı, 1*, (pp. 485-505). Ankara, KTB Publications.

Bilgi, Ö. (1999). Karadeniz Bölgesi Kıyı Kesimi İlk Tunç Çağı Mimarisi. In *Çağlar Boyunca Anadolu'da Yerleşim ve Konut Uluslararası Sempozyumu: Bildiriler.* İstanbul, Ege Yayınları.

Bilgi, Ö. (1999). Samsun-İkiztepe Arkeolojik Kazıları Tepe III Çalışmaları. In *Anadolu Araştırmaları, XV*, (pp. 190-230). İstanbul, Edebiyat Fakültesi Basımevi.

Bilgi, Ö. (2001). Ikiztepe Kazılarının 2000 Dönemi Sonuçları. In *23. Kazı Sonuçları Toplantısı, 2,* (pp.245-254). Ankara, KTB Publications.

Bilgi, Ö. (2002). Ikiztepe Kazılarının 2001 Dönemi Sonuçları. In *24. Kazı Sonuçları Toplantısı, 1*, (pp. 17-28). Ankara, KTB Publications.

Bilgi, Ö. (2003). İkiztepe Kazılarının 2002 Dönemi Sonuçları. In *25. Kazı Sonuçları Toplantısı, 1*, pp. 19-22. Ankara, Ktb Publications.

Bilgi, Ö. (2004). Ikiztepe Kazısı 2003 Dönemi Çalışmaları. In *26. Kazı Sonuçları Toplantısı, 1*, pp. 21-28. Ankara, KTB Publications.

Dennell, R. W. (1974). Botanical Evidence for Prehistoric Crop Processing Activities. In *Journal of Archaeological Science, 3*, pp. 275-284.

Dincauze, D. F. (2000). *Environmental Archaeology: Principles and Practice.* United Kingdom, Cambridge University Press.

Dönmez, E. (2005) Early Bronze Age Crop Plants from Yenibademli Höyük (Gökçeada), Western Turkey. *Environmental Archaeology 10*. pp.39-49.

Dönmez, E. & C. Doğan (1997) Plant Remains from Liman Tepe and Bakla Tepe in the İzmir Region. In *The Aegean in the Neolithic, Chalcolithic and the Early Bronze Age. Urla, İzmir* pp. 398-406.

Dönmez, E. & Ş. Demirci (1997) Early Bronze Age Plant Remains from İmamoğlu Höyük, SE Turkey. *Anatolian Studies 47*, pp. 173-176.

Ekstrom, H. (2000) Archaeobotanical Remains From the 1998 and 1999 Seasons at Tell Kurdu. *Anatolica 26.* pp. 80-83.

Harmankaya, S., & Erdoğu, B. (2002) The Archaeological Settlements of Turkey- 4a: EBA. Istanbul, TASK Foundation Publications.

Hastorf, C. A., & Popper, V. S. (1997). *Current Palaeoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains.* Chicago&London, Univ. of Chicago Press.

Hillman, G. (1981). Reconstruction of crop husbandry practices from the charred remains of crops. In *Farming Practice in British Prehistory*, Edinburgh University Press, Edinburgh, pp. 123-62.

Hillman, G. (1984). Interpretation of Archaeological Plant Remains: The Applications of Ethnographic Models from Turkey. In *Plants and Ancient Man, Proceedings of the 6th*

Symposium of the International Workgroup for Palaeoethnobotany, Grogingen. ,pp. 1-41, Rotterdam and Boston.

Jones, G. E. M. (1984). Interpretation of Plant Remains: Ethnographic Models from Greece. In *Plants and Ancient Man, Proceedings of the 6th Symposium of the International Workgroup for Palaeoethnobotany, Grogingen.*,pp. 43-61, Rotterdam and Boston.

Jones, M. K. (1985) Archaeobotany beyond subsistence reconstruction. In G. Barker and C. Gamble (eds.) *Beyond Domestication in Prehistoric Europe*, Academic Press, London, pp. 107-28.

Joukowsky, M. S. (1996) *Early Turkey: An Introduction to the Archaeology of Anatolia from Prehistory Through the Lydian Period*. Kendall/Hunt Publishing Company.

Koşay, H.Z. (1936) *Alacahöyük 1936 Hafriyatında Çıkan Tohumlar*. pp.177-178.

Malfore, L. et. al. (1985)The Chicago Euphrates Archaeological Project 1980-1984: An Interim Report. *Anatolica 13*, pp. 85-91.

Martin, A. C., & Barkley, W. D. (1961). *Seed Identification Manual.* Berkeley, Univ. of California Press.

Martin, G. J. (1996). *Ethnobotany*. London, Chapman&Hall.

Parker, B. J. (2003). The archaeobotanical remains of Kenan Tepe. *Anatolica 29*, pp. 121-125.

Pearsal, D. M. (1989). *Palaeoethnobotany: A handbook of Procedures*. San Diego, Academic Press.

Renfrew, J. M. (1973). *Palaeoethnobotany*. New York, Columbia University Press.

Riehl, S. (1999). Bronze Age Environment and Economy in the Troad: The Archaeobotany of Kumtepe and Troy. *BioArchaeologica 2*. Mo Vince Verlag, Tübingen.

Sadori, L. (2005). Archaeobotanical Data and Crop Storage Evidence from an Early Bronze Age 2 burnt house at Arslantepe, Malatya, Turkey.

Smith, W. (2001). When method meets theory: The use and misuse of cereal producer/consumer models in archaeobotany. In U. Albarella, *Environmental Archaeology: Meaning and Purpose*, pp. 283-298.

Van Zeist, W., & Casperie, W. A. (1984). *Plants and Ancient Man: Studies in Palaeoethnobotany*. Balkema.

Van der Veen, M. (1991). Consumption or production? Agriculture in the Cambridgeshire Fens? In J. Renfrew (ed.) *New Light on Early Farming: Recent Developments in Palaeoethnobotany*, Edinburgh University Press, Edinburgh, pp. 349-61.

Van Zeist, W. (1991). *Progress in Old World Palaeoethnobotany*. Rotterdam, Balkema.

Van Zeist, W. (2003). An Archaeobotanical Study of İkiztepe, Northern Turkey. In *From Village to Cities: Early Villages in the Near East, 2*, (pp. 547-581). İstanbul, Arkeoloji ve Sanat Publications.

Wilkinson, K. & Stevens, C. (2003). *Environmental Archaeology. Approaches, Techniques and Applications.* Great Britain, Tempus Publishing Ltd.

APPENDICES

Appendix A: The simplified version of Gordon Hillman's crop processing tables

STAGE	ACTIVITY	PRODUCT	WASTE	STORE
Stage 1a	Harvesting by Reaping	Ear, straw, weed	-	-
Stage 1b	Harvesting by Uprooting	Ear, straw, culm-bases, weeds	-	-
Stage 2	Drying	Ears, straw	Culm-bases, roots	-
Stage 3a	Threshing by flailing/lashing	Free grain, fine chaff (glumes, lemmas, awns, etc.), some broken straw, some rachises, weed heads&seeds	Bulk of undamaged straw, rachis, coarse weeds	Straw store (for thatching, flooring etc.)
Stage 3b	Threshing by trampling or sledging	Free grain, fine chaff (glumes, lemmas, awns, etc.), some broken straw, some rachises, weed heads&seeds	Coarse weeds	-
Stage 4	Raking	Free grain, fine chaff (glumes, lemmas, awns, etc.), some broken straw, some rachises, weed heads&seeds	Coarser straw fragments, some rachises and awns, coarse weeds	Waste straw store (for fuel, fodder and coarse temper)
Stage 5a	Winnowing x2	Grain, heavy straw nodes, some rachis fragments and mostly weed seeds	Chaff, straw, weed seeds	-

STAGE	ACTIVITY	PRODUCT	WASTE	STORE
Stage 6	1st Sieving	Grain, occasional rachis fragments, awn fragments and weed seeds	Straw nodes, weed heads and more rachis fragments	Cleanings store I (for fuel and fodder)
Stage 7	2nd Sieving	Prime grain, weed seeds of same size as prime grain and rare rachis fragments	Tail grain, most weed seeds smaller than prime grain and small rachis segments and awn fragments	Cleanings store II (for animals espec. Fowls, also famine food for humans of burned)
Stage 8	Kiln-Drying	Grain	Bulk Grain	Bulk grain store
STAGES FOR PREPARATION OF GRAIN PRODUCTS FOR FOOD				
Stage 9	3rd Sieving	Prime grain, weed seeds of same size as prime grain	Further small weed seeds, tail grain and some of remaining heavy chaff fragments (e.g glume bases)	Straight onto fire or Cleanings store
Stage 10	Hand Sorting	Clean prime grain	Weeds of same size as prime grain and many of the remaining fragments of heavy chaff (e.g spikelet forks)	Straight onto fire or Cleanings store
Stage 11	De-Husking of Hulled Grains	Clean prime grain	-	-
Stage 12	Winnowing	Rubbed (milled) grain	Husks and some awn fragments	Fine chaff store, Husks store
Stage 13	Dunking	Rubbed (milled) grain	Husks and some awn fragments	Fine chaff store, Husks store
GROATS PREPARATION				
Stage 14	Grain Boiling	-	-	-
Stage 15	Grain Drying	-	-	-

Stage 16	Bran Removal (with scraper querns or by pounding)	-	Bran	-
STAGE	**ACTIVITY**	**PRODUCT**	**WASTE**	**STORE**
Stage 17	Winnowing	Peeled grain	Bran	Bran store
Stage 18	Grain Cracking (by loose querning or by pounding)	-	-	-
Stage 19	Sifting	Cracked grain (flour free), crushed grain (flourey)	-	Cracked wheat store (prime groats for main meals), Fine groats store (buttermilk or yoghurt, griddle cakes)
ROAST GRAIN & TOASTED GROATS PREPARATION				
Stage 20	Grain Roasting	Toasted grains (for direct consumption)	Burned grains	-
Stage 21	Coarse (of fine) Grinding	-	-	-
Stage 22	Sifting	Burstin (crushed, toasted grain)	Husks etc.	Burstin store (for main meals, scones, milk or buttermilk)
Stage 23	Flour-Milling Sequence	Flour, Bran	-	Flour store, Bran store
Stage 24	Malting Sequence	-	-	-

STAGE	ACTIVITY	PRODUCT	WASTE	STORE
Stage 1a	Harvesting by reaping	Ears, straw, weeds	-	-
Stage 1b	Harvesting by uprooting	Ears, straw, culm-bases, weeds	-	-
Stage 2a	Threshing by flailing or lashing	Spikelets, some broken straw, most awns and culm-bases, many wedd heads and seeds	Bulk of undamaged straw, coarse weeds etc.	Intact straw store (for thatching, flooring etc.)
Stage 2b	Threshing by trampling or sledging	Spikelets, some broken straw, most awns and culm-bases, many wedd heads and seeds	Straws etc.	-
Stage 3	Raking	Spikelets, some broken straw fragments, most awns, culm bases, many weed heads and seeds	Longer straw fragments and some awns etc.	Broken straw store (for fuel, fodder and coarse temper)
Stage 4	1st Winnowing	Spikelets, heavier straw nodes, culm bases, weed heads and mostly seeds	Longer straw fragments, most awns and lightest weed seeds and heads	Broken straw store (for fuel, fodder and coarse temper)
Stage 5a	1st Sievings (with coarsest riddle)	Semi-clean spikelets, smaller weed heads, weed seeds	Larger straw nodes, culm-bases, weed heads, abortive spikelets	Cavings store (for fuel or coarse temper)
Stage 5b	1st Sievings (with medium-coarse riddle)	Spikelets, weed heads	Weed seeds, some culm nodes	Cavings store (for fuel or coarse temper)
Stage 6	Drying	-	-	Bulk spikelet store
Stage 7	Parching	-	-	-

STAGE	ACTIVITY	PRODUCT	WASTE	STORE
Stage 8	Pounding	Free grain, chaff, free weed seeds	-	-
Stage 9	2nd Winnowing	Grain, denser chaff fragments, smaller straw nodes and weed seeds	Light chaff (lemmas etc.), most of awns, more of very light weed seeds	Light chaff store (for fodder, fuel and temper)
Stage 10	2nd Sieving (with medium coarse riddle)	Prime grain, many of the spikelets forks and weed seeds of same size as prime grain	Unbroken spikelets, straw nodes and large weed seeds	Cleanings store (for animal feed espec. Fowls, also for famine food (for humans))
Stage 11	3rd Sieving	Prime grain, many of the spikelets forks and weed seeds of same size as prime grain	Tail grain, small weed seeds, heavy bits of chaff (e.g glume basis and rachis segments)	Cleanings store (for animal feed espec. Fowls, also for famine food (for humans)), Bulk grain store
STAGES FOR PREPARATION OF GRAIN PRODUCTS FOR FOOD				
Stage 12	4th Sieving	Prime grain, weed seeds of same size as prime grain	Further small weed seeds, tail grain and some of remaining heavy chaff fragments (e.g glume bases)	Straight onto fire or Cleanings store
Stage 13	Hand Sorting	Clean prime grain	Weeds of same size as prime grain and many of the remaining fragments of heavy chaff (e.g spikelet forks)	Straight onto fire or Cleanings store
Stage 14	De-Husking of Hulled Grains	Clean prime grain	-	-
Stage 15	Winnowing	Rubbed (milled) grain	Husks and some awn fragments	Fine chaff store, Husks store
STAGE	**ACTIVITY**	**PRODUCT**	**WASTE**	**STORE**
Stage 16	Dunking	Rubbed (milled) grain	Husks and some awn fragments	Fine chaff store, Husks store
GROATS PREPARATION				
Stage 17	Grain Boiling	-	-	-
Stage 18	Grain Drying	-	-	-
Stage 19	Bran Removal (with scraper querns or by pounding)	-	Bran	-
Stage 20	Winnowing	Peeled grain	Bran	Bran store

Stage 21	Grain Cracking (by loose querning or by pounding)	-	-	-
Stage 22	Sifting	Cracked grain (flour free), crushed grain (flourey)	-	Cracked wheat store (prime groats for main meals), Fine groats store (buttermilk or yoghurt, griddle cakes)
ROAST GRAIN & TOASTED GROATS PREPARATION				
Stage 23	Grain Roasting	Toasted grains (for direct consumption)	Burned grains	-
Stage 24	Coarse (of fine) Grinding	-	-	-
Stage 25	Sifting	Burstin (crushed, toasted grain)	Husks etc.	Burstin store (for main meals, scones, milk or buttermilk)
Stage 26	Flour-Milling Sequence	Flour, Bran	-	Flour store, Bran store
Stage 27	Malting Sequence	-	-	-

Appendix B: The provenance tables of the samples

Sample No	Date	Tepe No	Area	Locus	Level	Phase	Context	Volume of Sample
Sample 1.1	EBA III - MBI	I	D3/IV10	B615	I	III	Debris	40 lt.
Sample 1.2	EBA III - MBI	I	D3/IV10	B620 I	I	IV	Debris	60 lt.
Sample 1.3	EBA III - MBI	I	D3/IV10	B620 II	I	IV	Debris	40 lt.
Sample 1.4	EBA III - MBI	I	D3/IV10	B857 I=622	I	V	Debris	30 lt.
Sample 1.5	EBA III - MBI	I	D3/IV10	B857 II	I	V	Beaten clay	20 lt.
Sample 1.6	EBA III - MBI	I	D3/IV10	B859	I	VI	Debris	50 lt.
Sample 1.7	EBA III - MBI	I	D3/IV10	B864	I	VII		
Sample 1.8	EBA III	I	D3/IV10	B869 I=1008	II	I	Debris	30 lt.
Sample 1.9	EBA III	I	D3/IV10	B869 II	II	I	Pise remains	70 lt.
Sample 1.10	EBA III	I	D3/IV10	B1017 Ia	II	III	Debris	10 lt.
Sample 1.11	EBA III	I	D3/IV10	B1017 Ib	II	III	Pise remains	20 lt.
Sample 1.12	EBA III	I	D3/IV10	B1017 Ic	II	III	Charcoal layer	20 lt.
Sample 1.13	EBA III	I	D3/IV10	B1017 I-II	II	III	House floor	
Sample 1.14	EBA III	I	D3/IV10	B1017 IIa	II	III	Pise remains	20 lt.
Sample 1.15	EBA III	I	D3/IV10	B1017 IIb	II	III	Debris	20 lt.

Sample No	Date	Tepe No	Area	Locus	Level	Phase	Context	Volume of Sample
Sample 1.16	EBA II	I	D3/IV10	B1019 I	II	IV		40 lt.
Sample 1.17	EBA II	I	D3/IV10	B1019 II	II	IV		20 lt.
Sample 1.18	EBA II	I	D3/IV10	B1019 I	II	IV		40 lt.
Sample 1.19	EBA II	I	D3/IV10	B1020 II	II	V		10 lt.
Sample 2.1	EBA II	II	D11/II19	B101	II	I	Debris	40 lt.
Sample 2.2	EBA II	II	D11/II19	B109 I	II	II	Pise remains	40 lt.
Sample 2.3	EBA II	II	D11/II19	B109 II	II	II	Pise remains	40 lt.
Sample 2.4	EBA II	II	D11/II19	B113	II	II	Debris	40 lt.
Sample 2.5	EBA I	II	D11/II19	B116 I	II	III	Pise remains+Debris	20 lt.
Sample 2.6	EBA I	II	D11/II19	B116 II	II	III	Pise remains+Debris	20 lt.
Sample 2.7	EBA I	II	D11/II19	B118 I	II	IV	Pise remains+Debris	40 lt.
Sample 2.8	EBA I	II	D11/II19	B118 II	II	IV	Debris+Floor	20 lt.
Sample 2.9	EBA I	II	D11/II19	B120	II	V	Debris+Floor	40 lt.

Sample No	Date	Tepe No	Area	Locus	Level	Phase	Context	Volume of Sample
Sample 2.10	EBA I	II	D11/II19	B123 I=700	II	VII	Debris	40 lt.
Sample 2.11	EBA I	II	D11/II19	B123 II	II	VII	House floor	20 lt.
Sample 2.12	Chal colit hic	II	D11/II19	B710	III	I	Decayed timber	40 lt.
Sample 2.13	Chal colit hic	II	D11/II19	B711 I	III	I-II	Layer	20 lt.
Sample 2.14	Chal colit hic	II	D11/II19	B711 II	III	I-II	Earth with bones in	20 lt.
Sample 2.15	Chal colit hic	II	D11/II19	B711 III	III	I-II	Sandy soil	40 lt.
Sample 2.16	Chal colit hic	II	D11/II19	B717	III	III	Pise remains	40 lt.
Sample 2.17	Chal colit hic	II	D11/II19	B718	III	IV	Debris	30 lt.
Sample 2.18	Chal colit hic	II	D11/II19	B719A	III	V		30 lt.
Sample 2.19	Chal colit hic	II	D11/II19	B719B	III	V		10 lt.
Sample 2.20	Chal colit hic	II	D11/II19	B720 I	III	VI	Debris	20 lt.
Sample 2.21	Chal colit hic	II	D11/II19	B721 I	III	VII	Debris	10 lt.
Sample 2.22	Chal colit hic	II	D11/II19	B721 II	III	VII	Beaten clay	30 lt.

Sample No	Date	Tepe No	Area	Locus	Level	Phase	Context	Volume of Sample
Sample 2.23	Chalcolithic	II	D11/II19	B721 III	III	VII	Debris	30 lt.
Sample 2.24	Chalcolithic	II	D11/II19	B721 V	III	VII	Debris	20 lt.
Sample 2.25	Chalcolithic	II	D11/II19	B721 VI	III	VII	Pise remains	30 lt.
Sample 3.1	EBA III-MBI	III	D3/II5	B800 I+II	I	I	Pise remains	20 lt.
Sample 3.2	EBA III-MBI	III	D3/II5	B800 III	I	I	Debris	30 lt.
Sample 3.3	EBA III-MBI	III	D3/II5	B801 I+II	I	II	Pise remains	50 lt.
Sample 3.4	EBA III-MBI	III	D3/II5	B801 III	I	II	Debris	30 lt.
Sample 3.9	EBA III	III	D3/II5	B805 I	II	II	Plaster	10 lt.
Sample 3.10	EBA III	III	D3/II5	B805 II	II	II	Debris	40 lt.
Sample 3.11	EBA III	III	D3/II5	B805 IIIa	II	II	Plaster+Charcoal	10 lt.
Sample 3.12	EBA III	III	D3/II5	B805 IIIb	II	II		
Sample 4	EBA II	I	M/C19/IV8	B3801	II	VI	Soil centre of square	24 lt.
Sample 5	EBA II	I	M/C19/IV8	B3801	II	VI	Carbonised earth	61 lt.

Sample No	Date	Tepe No	Area	Locus	Level	Phase	Context	Volume of Sample
Sample 7	EBA II	I	M/C19/IV8	B3801	II	VI	Floor/charcoal layer	
Sample 8	EBA II	I	M/C19/IV9	B3802	II	VI	Next to stones	27 lt.
Sample 10	EBA II	I	M/C19/IV9	B3802	II	VI	Floor	4 lt.
Sample 11	EBA II	I	M/C20/IV8	B3803	II	VI	Carbonised earth	11 lt.
Sample 15	EBA II	I	M/C19/IV8	B3801	II	VI	Above the rubble	24 lt.
Sample 17	EBA II	I	M/C19/IV8	B3801	II	VI	Floor	21 lt.
Sample 19	EBA II	I	M/C19/IV9	B3802	II	VI	Floor	9 lt.

Appendix C: The tables including the ratio calculations of the samples

Sample No	RATIO 1	RATIO 2		RATIO 3	
	Tr. Mon./Dic.	**Tr. Dur./Aest.**	**Hordeum vulg.**	**Weeds/All crops**	**Weeds/Dominant crop**
Sample 1.1	2/5=0,4 cleaned product	0/4= -	0/2= -	10/11= 0,90 cleaned product	10/5= 2 cleaning residues
Sample 1.2	0/4= -	0/13= -	0/5= -	9/22= 0,40 cleaned product	9/13= 0,69 cleaned product
Sample 1.3	0/25= -	0/13= -	0/12= -	24/50= 0,48 cleaned product	24/25= 0,96 cleaned product
Sample 1.4	7/11= 0,63 cleaned product	0/8= -	0/6= -	19/25= 0,76 cleaned product	19/11= 1,72 cleaning residues
Sample 1.5	34/13= 2,61 fine sieving residue	0/0= -	0/4= -	11/17= 0,64 cleaned product	11/13= 0,84 cleaned product
Sample 1.6	8/4= 2 fine sieving residue	0/0= -	0/1= -	1/5= 0,2 cleaned product	1/4= 0,25 cleaned product
Sample 1.7	15/1= 15 fine sieving residue	0/1= -	0/4= -	0/6= -	0/4= -
Sample 1.8	7/0= -	0/1= -	0/3= -	1/4= 0,25 cleaned product	1/3= 0,33 cleaned product
Sample 1.9	550/9= 61,11 fine sieving residue	0/0= -	0/8= -	31/17= 1,82 cleaning residues	31/9= 3,44 cleaning residues
Sample 1.10	360/8= 45 fine sieving residue	0/0= -	5/3= 1,66 early processing residues	2/11= 0,18 cleaned product	2/8= 0,25 cleaned product

Sample No	RATIO 1	RATIO 2		RATIO 3	
	Tr. Mon./Dic.	**Tr. Dur./Aest.**	**Hordeum vulg.**	**Weeds/All crops**	**Weeds/Dominant crop**
Sample 1.11	23/0= -	0/0= -	0/1= -	1/1= 1	1/1= 1
Sample 1.12	10/4= 2,5 fine sieving residue	0/0= -	0/18= -	11/22= 0,5 cleaned product	11/18= 0,61 cleaned product
Sample 1.13	24/1= 24 fine sieving residue	0/0= -	0/0= -	14/1= 14 cleaning residues	14/1= 14 cleaning residues
Sample 1.14	360/1= 360 fine sieving residue	0/2= -	0/12= -	1/5= 0,2 cleaned product	1/4= 0,25 cleaned product
Sample 1.15	670/4= 167,5 fine sieving residue	0/1= -	0/12= -	9/17= 0,52 cleaned product	9/12= 0,75 cleaned product
Sample 1.16	635/14= 45,35 fine sieving residue	0/1= -	0/7= -	192/22= 8,72 cleaning residues	192/14=13,71 cleaning residues
Sample 1.17	678/33= 20,54 fine sieving residue	0/16= -	0/46= -	193/95= 2,03 cleanşng residues	193/46=32,16 cleaning residues
Sample 1.18	101/1= 101 fine sieving residue	2/0= -	0/4= -	51/5= 10,2 cleaning residues	51/4= 12,75 cleaning residues
Sample 1.19	50/2= 25 fine sieving residue	0/0= -	0/2= -	11/4= 2,75 cleaning residues	11/4= 2,75 cleaning residues
Sample 2.1	205/3= 68,33 fine sieving residues	0/4= -	0/0= -	120/7= 17,14 cleaning residues	120/4= 30 cleaning residues
Sample 2.2	2/0= -	0/0= -	0/0= -	6/0= -	6/0= -
Sample 2.3	7/2= 3,5 fine sieving residue	0/1= -	0/1= -	21/4= 5,25 cleaning residues	21/2= 10,5 cleaning residues

Sample No	RATIO 1	RATIO 2		RATIO 3	
	Tr. Mon./Dic.	**Tr. Dur./Aest.**	**Hordeum vulg.**	**Weeds/All crops**	**Weeds/Dominant crop**
Sample 2.4	83/0= -	0/0= -	0/0= -	1/0= -	1/0= -
Sample 2.5	7/15= 0,46 cleaned product	0/0= -	0/68= -	9/83= 0,10 cleaned product	9/68= 0,13 cleaned product
Sample 2.6	55/7= 0,71 cleaned product	0/0= -	0/3= -	17/10= 1,7 cleaning residues	17/7= 2,42 cleaneing residues
Sample 2.7	300/45= 6,66 fine sieving residue	0/0= -	0/0= -	19/45= 0,42 cleaned product	19/45= 0,42 cleaned product
Sample 2.8	233/18= 12,94 fine sieving residue	0/0= -	0/2= -	12/20= 0,6 cleaned product	12/18= 0,66 cleaned product
Sample 2.9	500/10= 50 fine sieving residue	0/0= -	0/2= -	36/12= 3 cleaning residues	36/10= 3,6 cleaning residues
Sample 2.10	69/1= 69 fine sieving residue	0/0= -	0/1= -	1/2= 0,5 cleaned product	1/2= 0,5 cleaned product
Sample 2.11	65/21= 3,09 fine sieving residue	0/0= -	0/2= -	1/23= 0,04 cleaned product	1/21= 0,04 cleaned product
Sample 2.12	900/20= 45 fine sieving residue	0/0= -	0/2= -	64/22= 2,90 cleaning residues	64/20= 3,2 cleaning residues
Sample 2.13	11/6= 1,83 fine sieving residue	0/0= -	0/0= -	2/6= 0,33 cleaned product	2/6= 0,33 cleaned product
Sample 2.14	14/0= -	0/0= -	0/2= -	0/2= -	0/2= -
Sample 2.15	6/0= -	0/0= -	0/6= -	1/6= 0,16 cleaned product	1/6= 0,16 cleaned product
Sample 2.16	2/7= 0,28 cleaned product	0/0= -	0/3= - 0,8	8/10= 0,8 cleaned product	8/7= 1,14 cleaning residues

Sample No	RATIO 1	RATIO 2		RATIO 3	
	Tr. Mon./Dic.	**Tr. Dur./Aest.**	**Hordeum vulg.**	**Weeds/All crops**	**Weeds/Dominant crop**
Sample 2.17	41/12= 3,41 fine sieving residue	0/0= -	0/6= -	4/18= 0,22 cleaned product	4/12= 0,33 cleaned product
Sample 2.18	188/351= 0,53 cleaned product	0/0= -	0/50= -	5/401= 0,012 cleaned product	5/351= 0,014 cleaned product
Sample 2.19	0/605= -	0/0= -	0/80= -	4/685= 0,005 cleaned product	4/605= 0,005 cleaned product
Sample 2.20	25/3= 8,33 fine sieving residue	0/0= -	0/4= -	0/7= -	0/4= -
Sample 2.21	106/8=13,25 fine sieving residue	0/0= -	0/1= -	1/9= 0,11 cleaned product	1/8= 0,125 cleaned product
Sample 2.22	135/4= 33,75 fine sieving residue	0/0= -	0/2= -	1/6= 0,16 cleaned product	1/4= 0,25 cleaned product
Sample 2.23	460/3= 153,33 fine sieving residue	2/0= -	0/3= -	5/6= 0,83 cleaned product	5/3= 1,66 cleaning residues
Sample 2.24	960/9= 106,66 fine sieving residue	0/0= -	0/5= -	9/14= 0,64 cleaned product	9/9= 1
Sample 2.25	139/0= -	0/0= -	1/0= -	3/0= -	3/0= -
Sample 3.1	440/1= 440 fine sieving residue	0/0= -	0/2= -	5/3= 1,66 cleaning residues	5/2= 2,5 cleaning residues
Sample 3.2	17/4= 4,25 fine sieving residue	0/0= -	0/0= -	0/4= -	0/4= -
Sample 3.3	24/0= -	0/0= -	0/2= -	9/4=2,25 cleaning residues	9/4= 2,25 cleaning residues

Sample No	RATIO 1	RATIO 2		RATIO 3	
	Tr. Mon./Dic.	**Tr. Dur./Aest.**	**Hordeum vulg.**	**Weeds/All crops**	**Weeds/Dominant crop**
Sample 3.4	250/2= 125 fine sieving residue	0/1= -	0/1= -	6/4=1,5 cleaning residues	6/2= 3 cleaning residues
Sample 3.9	18/1= 18 fine sieving residue	0/0= -	0/0= -	3/1= 3 cleaning residues	3/1= 3 cleaning residues
Sample 3.10	600/15= 40 fine sieving residue	0/6= -	0/11= -	144/32= 4,5 cleaning residues	144/15= 9,6 cleaning residues
Sample 3.11	44/8= 5,5 fine sieving residue	0/0= -	0/6= -	67/14= 4,78 cleaning residues	67/8= 8,375 cleaning residues
Sample 3.12	83/28= 2,96 fine sieving residue	0/0= -	0/5= -	70/33= 2,12 cleaning residues	70/28= 2,5 cleaning residues
Sample 4	255/47= 5,42 fine sieving residues	0/15= -	0/14= -	24/76= 0,31 cleaned product	24/47= 0,51 cleaned product
Sample 5	118/95= 1,24 fine sieving residue	0/20= -	0/28= -	9/143= 0,06 cleaned product	9/95= 0,09 cleaned product
Sample 7	74/10= 7,4 fşne sieving residue	0/0= -	0/19= -	7/29= 0,24 cleaned product	7/19= 0,36 cleaned product
Sample 8	464/26= 17,84 fine sieving residue	0/12= -	2/9= 0,22 later crop processing activities	0/47= -	0/26= -
Sample 10	0/3= -	0/0= -	0/0= -	0/0= -	0/0= -
Sample 11	255/27= 9,44 fine sieving residue	0/5= -	2/3= 0,66 early processing residues	0/35= -	0/27= -

Sample No	RATIO 1	RATIO 2		RATIO 3	
	Tr. Mon./Dic.	**Tr. Dur./Aest.**	**Hordeum vulg.**	**Weeds/All crops**	**Weeds/Dominant crop**
Sample 15	967/278= 3,47 fine sieving residue	0/34= -	4/13= 0,30	4/325= 0,01 cleaned product	4/278= 0,01 cleaned product
Sample 17	30/4= 7,5 fine sieving residue	0/0= -	0/0= -	0/4= -	0/4= -
Sample 19	0/2= -	0/0= -	1/2= 0,5 early processing residues	3/4= 0,75 cleaned product	3/4= 0,75