Identification and interpretation of botanical remains from Neolithic 'Ais Yiorkis, Cyprus

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IDENTIFICATION AND INTERPRETATION OF BOTANICAL
REMAINS FROM NEOLITHIC 'AIS YIORKIS, CYPRUS

by

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2007

A thesis submitted in partial fulfillment
of the requirements for the

Master of Arts Degree in Anthropology
Department of Anthropology
College of Liberal Arts

Graduate College
University of Nevada, Las Vegas
May 2007

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The Thesis prepared by

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Entitled

"Identification and Interpretation of Botanical Remains from Neolithic 'Ais Yiorkis, Cyprus"

is approved in partial fulfillment of the requirements for the degree of

Master of Arts in Anthropology

Examination Committee Chair

Dean of the Graduate College

Examination Committee Member

Examination Committee Member

Graduate College Faculty Representative
ABSTRACT
Identification and Interpretation of Botanical Remains From Neolithic ‘Ais Yiorkis, Cyprus

by

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Dr. Alan Simmons, Examination Committee Chair
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The botanical remains from the 2005 field season at ‘Ais Yiorkis, Cyprus demonstrates a distinct economic assemblage that has yet to be identified in the Aceramic Neolithic of Cyprus. In addition to the unusually high proportions of two-grained einkorn and the low ratios of other plant parts, ‘Ais Yiorkis is characterized by an atypical architectural phenomenon in the form of raised circular platform structures. Furthermore, the archeology is marked by a distinct lithic and groundstone tool industry as well as a massive faunal assemblage, which includes the presence of cattle, previously rare in the Neolithic. Together with the archaeology of ‘Ais Yiorkis, the botanical assemblage is suggestive of a unique upland occupation demonstrating a site-type not previously seen in the Cypro-PPNB.
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ACKNOWLEDGEMENTS

This research would not have been possible without the support and guidance of Dr. Alan Simmons and Dr. Susan Colledge. As my academic advisor, Dr. Simmons allowed me the opportunity to work in Cyprus for the 2005 and 2006 field seasons. During the past two years, he has helped in my academic and professional growth. I would like to thank Dr. Colledge for her direction, support, and friendship during the field recovery and laboratory analysis of the 'Ais Yiorkis assemblage.

Additionally, I would like to thank Drs. Karen Harry and Lisa Frink for their comments and academic support. I would like to thank Susan Thompson and the International Studies Abroad Program for their financial support. Without their financial backing, my research to Cyprus and London would not have happened.

Most of all, I would like to thank my mother for her emotional and financial support throughout my education and life. She has been a major guiding force and without her I would have no direction. I would also like to thank my father, my grandparents, and my little sister for their support and interest in my education. Finally, I would like to thank Mr. Thomas Lucas for his unfailing support during the writing of this thesis and for all his comments.
CHAPTER 1

INTRODUCTION

The earliest and most intensively studied area where the economic shift from a hunter-gatherer adaptation to food production, the “Neolithic Revolution,” occurred is in Southwest Asia during the Late Pleistocene and Early Holocene around 10,000 years ago. This region includes the modern countries of Iran, Iraq, Turkey, Syria, Israel, Jordan, and, now, Cyprus (Peltenburg 2003: i). This thesis will encompass the theories surrounding the origins of agriculture in the Near East, in general, and more specifically the spread of the “Neolithic Crop Package” from the Near East to the island of Cyprus. Researchers prior to the 1990s believed that Cyprus played a minor role in the spread of the agricultural strategy from the Near East. The earliest immigrants to the island were thought to have brought with them a fully developed agricultural package along with a distinguishable cultural tradition, the Khirokitian cultural tradition (KC), dating to cal. 7000 BC., which lacked a formative Cypriot precursor (Peltenburg 2003: xiii).

In the late 1980s the site of Akrotiri-Aetokremnos yielded data suggesting an earlier exploration to the island pre-dating the once believed earliest inhabitants. The excavation of Akrotiri-Aetokremnos revolutionized Cypriot pre-history by creating a chronological and occupational gap in the pre-history of the island from ca. 10,000 to 7000/6500 calibrated BC (Simmons 1999). This gap is now

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beginning to be bridged with recent excavations of multiple Aceramic Neolithic sites in western Cyprus dating prior to the Khirokitia tradition and post-Akrotiri, referred to as the Cypro-Pre-Pottery Neolithic B (Cypro-PPNB). The excavations of Kissonerga-Mylouthkia, Kalavasos-Tenta, and Parekklia-shillourokambos have changed the archaeological interpretation of Cypriot prehistory placing Cyprus in the forefront, not periphery, of the early transmission of the agricultural tradition from Southwest Asia. Within the context of these Cypriot Aceramic Neolithic sites is yet another one, the site of Kritou Marottou-'Ais Yiorkis, currently being excavated by the University of Nevada, Las Vegas.

This thesis analyzes the exceptionally well-preserved charred macrobotanical remains from the 2005 excavation season at 'Ais Yiorkis, located in the low mountains east of Paphos, Cyprus. This research will explore the changing paradigm that has occurred in Cypriot prehistoric archaeology by adding the results and interpretation of the plant remains present at 'Ais Yiorkis. The significance of the analysis of the botanical remains from 'Ais Yiorkis is paramount to the interpretation of Cypriot prehistory as well of the origins and spread of plant domestication in the Near East.

Analysis of the 'Ais Yiorkis macrobotanical assemblage will be compared to other Cypro-PPNB sites with the goal of situating 'Ais Yiorkis within its Cypriot prehistoric context, assessing assemblage continuity or lack thereof. The botanical economic data from 'Ais Yiorkis has great potential in adding to the Cypriot prehistoric plant record due to its unique location, site type, and quality as well as quantity of preserved remains. Of the Cypro-PPNB sites under
investigation, 'Ais Yiorkis is the only upland site not located near the coast. Additionally, the quality of the botanical remains from the other sites demonstrates either poor preservation or a lack of charred plant remains; as in the case of Shillourokambos, for example, where the crop assemblage data comes primarily from seed impressions left on *pisa* (Willcox 2003:234).

Research Questions and Directions

As will be discussed in detail in Chapter 2, domesticated plants appear in the Near East, with certainty, beginning in the early phases of the Pre-Pottery Neolithic B. New evidence from early Cypro-PPNB sites has demonstrated a quick dispersal of the same domesticated crop assemblage from the Near Eastern mainland to the island of Cyprus. Of the founder cereal crops under investigation, wild barley is the only one thought to be endemic to the island in antiquity. With this in mind, it can be assumed that any cereal assemblage on Cyprus would be the result of Near Eastern immigrant dispersal. Additionally, it can be hypothesized that continuity will be demonstrated in regards to the suite of crops being exploited on the island in regards to site type and site location. What can be expected from the botanical data from 'Ais Yiorkis 2005 is that it will demonstrate similarities in crop assemblage with the other early Pre-Pottery Neolithic sites on the mainland as well as with the early Aceramic Neolithic sites on Cyprus.

The interpretation of the charred plant remains from 'Ais Yiorkis 2005 will address research questions pertaining specifically to 'Ais Yiorkis, to Cyprus in
general, and to the Near East in the broader perspective (Table 1). Questions relating specifically to 'Ais Yiorkis include: What are the plant taxa present at 'Ais Yiorkis? What does the botanical assemblage suggest about the economy of the site's inhabitants? And more specifically, are the inhabitants of 'Ais Yiorkis exploiting the wild endemic flora of Cyprus or are they cultivating/farming domestic plants brought from the Near East? Questions placing 'Ais Yiorkis in its Cypriot context include: Is the plant assemblage present at 'Ais Yiorkis, whether wild or domestic, consistent with the botanical assemblages from the other Aceramic Neolithic sites on Cyprus? Are there regional or geographical patterns in the plant assemblages from the Aceramic sites that correspond with site type and site location? And further, what does the botanical data from 'Ais Yiorkis suggest about early economic strategies on Cyprus and its role in the origins and spread of agriculture in the Near East?

The background information needed to interpret archaeobotanical data correctly and to address the research questions of this thesis, in particular, will include: a description of 'Ais Yiorkis; the paleoenvironmental and climatic context of the site, Cyprus, and the Near East in general; theories and evidence used to support the origins of agriculture in the Near East; theories surrounding the subsequent spread of agriculture to Cyprus; paleoethnobotanical interpretation; and a review of the Aceramic Neolithic in the Near East, in general, and more specifically, the Aceramic Neolithic of Cyprus.
Table 1: Table outlining the research questions that will be addressed in this thesis and the data needed to address each question.

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Data Needed to Address Research Questions</th>
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<tbody>
<tr>
<td>1) What are the plant taxa present at ‘Ais Yiorkis?</td>
<td>1) Field Recovery (Flotation), Identification</td>
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<tr>
<td>2) Are the plant taxa of the domestic or wild form?</td>
<td>2) Modern Reference Collection and Comparison to archaeobotanical reports</td>
</tr>
<tr>
<td>3) What does the botanical assemblage suggest about the economy of the site’s inhabitants?</td>
<td>3) Literature Review and botanical data from ‘Ais Yiorkis</td>
</tr>
<tr>
<td>4) Is the plant assemblage present at ‘Ais Yiorkis consistent with the botanical assemblages from the other Aceramic Neolithic sites on Cyprus?</td>
<td>4) Literature Review and qualitative comparisons to other botanical reports</td>
</tr>
<tr>
<td>5) Are there regional or geographical patterns in the plant assemblages from the Aceramic sites that correspond with site type and site location?</td>
<td>5) Literature Review and comparison to other Aceramic sites on Cyprus using quantitative methods</td>
</tr>
<tr>
<td>6) What does the botanical assemblage at ‘Ais Yiorkis suggest about the site’s occupation in terms of seasonality, sedentism, and site function?</td>
<td>6) Literature Review and botanical data from ‘Ais Yiorkis</td>
</tr>
<tr>
<td>7) What does the botanical data from ‘Ais Yiorkis suggest about early economic strategies on Cyprus?</td>
<td>7) Literature Review and botanical data from ‘Ais Yiorkis</td>
</tr>
<tr>
<td>8) How does the botanical data from ‘Ais Yiorkis contribute to the understanding of the origins and spread of agriculture in the Near East?</td>
<td>8) Literature Review and botanical data from ‘Ais Yiorkis</td>
</tr>
</tbody>
</table>
Descriptive Outline of Thesis

The present chapter of this thesis introduces the focus of this paper and provides a brief summary of the contemporary geography and climate of Cyprus, the archaeological findings at 'Ais Yiorkis, thus far; and a brief discussion, including presently used terminology and chronology, of the Aceramic Neolithic traditions of Cyprus and the Near East. The research questions and directions are outlined as well as the constitution of the thesis.

The background information, in Chapter 2, will be two-fold. The first section will summarize the archaeological backdrop in which agriculture arose in the Near East, including the corresponding archaeological phases in Cyprus. This is followed by an overview of the theories and lines of evidence used in the study of the origins and spread of Near Eastern agriculture. The chapter will conclude with current thoughts on the spread of the Neolithic archaeological complex and subsistence strategy to Cyprus.

Chapter 3 will introduce the nature of archaeobotanical interpretation of charred plant remains given that the plant remains recovered from 'Ais Yiorkis were preserved through prehistoric charring. The following chapter, Chapter 4, will begin with a history of the methods used in the recovery of plant remains preserved through charring, and conclude by providing an overview of methods used in Cypriot archaeology and, specifically, the methods used at 'Ais Yiorkis. The archaeobotanical remains from 'Ais Yiorkis were recovered by water flotation, with the aim of separating the charred remains from the organic
materials. Flotation was conducted at the Lemba Archaeological Research Center (LARC), Cyprus under the guidance of Dr. Sue Colledge and the center manager, Dr. Paul Croft. Laboratory methods include the sorting of charred materials from modern intrusions and the identification of the plant material. Identification entails comparing morphological characteristics of the preserved botanical remains from 'Ais Yiorkis to a modern reference collection. The modern collection used will be from Dr. Gordon Hillman's botanical reference collection housed at the Institute of Archaeology, University College London. Attribution of domestication of the plant taxa will be inferred based on morphology, grain size, and information of known endemic wild plant taxa on Cyprus, presently and in antiquity.

The presentation of results, Chapter 5, will include the presentation of taxa present at 'Ais Yiorkis and a discussion of the methods used to identify the plant remains and to determine whether they represent wild or domesticated varieties. Chapter 6 will comprise the interpretation of the data, including site specific inferences as well as inferences that place 'Ais Yiorkis in its Cypriot and Near Eastern perspectives.

Cyprus

Cyprus is the third largest island in the Mediterranean with an area of approximately 3,572 square miles, placing third to Sicily and Sardinia: 9,831 square miles and 9,196 square miles, respectively. It is situated about 40 miles
south of Turkey and 65 miles west of Syria. More specifically, Cyprus is located at 34°33'-35°41' N. and 32°17'-34°35' E (Meikle 1977:1).

Geographically, Cyprus can be summarized under four general headings: 1) The Coastal Belt; 2) The Kyrenia or Northern Range; 3) The Troodos or Southern Range; and 4) The Mesaoria or Central Plain (Figure 2). Many areas of the coast are fertile and tilled almost to the edge of the sea, which is characterized primarily of rocky or stony shores with the exceptions of small sandy bays. The Kyrenia or Northern Range runs approximately 50 miles west to east, "like a high wall" (Meikle 1977:1). The Northern range is, for the most part, uncultivated. The south-facing side of the ridge experiences much hotter and drier conditions, as well as a lack of sufficient ground water resulting, unsurprisingly, in less floral variation (Meikle 1977:1-2). The Mesaoria or Central Plain, as Meikle states, is a fertile, tree-less plain that runs right across the island, for a distance of about 55 miles, transversed by several seasonal rivers with limited flora apart from the areas of marshy ground (Meikle 1977:2-3).

‘Aïs Yiorkis is situated in the foothills of the Troodos or Southern Range. This geographical area, as Meikle states, is predominantly igneous, consisting of rounded masses of pillow lavas in the lower part, rising to steep, rocky, but rarely precipitous, peaks of gabbro, diabase and serpentine at the centre of the Range (Meikle 1977:2). The lower slopes of this range are covered with forests of *Pinus brutia* and the endemic *Cedrus libani* ssp. *Brevifolia*. 

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Climate

Although Cyprus is described as having an arid Mediterranean climate, with a relatively short, cool, wet winter and a long, dry, very hot summer, the floral record is diverse due to the above mentioned varied topographic ranges. The annual rainfall, although extremely varied as a result of common prolonged droughts, is approximately 500 mm. per year. Most of the rainfall occurs between November and March and the amount of rainfall varies according to elevation and topography range. Like rainfall, temperature varies with altitude as well as season (Meikle 1977:3).

Paleoclimate

Regarding the various techniques used to make paleoenvironmental inferences, including terrestrial vegetation reconstructions based on pollen cores, geomorphological sequences, biogeographic interpretations of fluctuating faunal spectra, dendrochronology, botanical, and pollen data, Simmons (2007:35) cautions that these interpretations must be made with care due to the range of conflicting deductions.

In reference to the Cypriot paleoenvironment, Meikle (1977:4) remarks that if the comments of Eratosthenes are to be believed than Cyprus was heavily forested in antiquity. He also states that parts of these forests still survive on the Troodos and Kyrenia Ranges. Simmons states the nature of this climax vegetation was more than likely oak-pine Mediterranean woodland (2007:42). Moreover, Steel (2004:4) summarizes the floral composition as including Pine forest, comprising Aleppo pine (*Pinus brutia*) and cypress (*Cupressus*)
sempervirens), which she states still make up the largest natural habitat of wild flora on the island.

As stated by Simmons (2007:41), paleoenvironmental analyses for Cyprus are limited so it must be assumed that the overall pattern observed on the mainland also pertained to the island of Cyprus. Furthermore, "It is assumed that the island experienced the same reforestation generally agreed to have occurred in the less arid zones of the Near East by circa 10,000 BP" (Simmons 1999:12). With this being said discussions on the environment of Cyprus in antiquity must rely on inferences regarding the complex environmental reconstructions of the Near East in general.

Using data from pollen cores, van Zeist (1982:289-290) summarizes the vegetation during the early Holocene as follows:

In the coastal areas of Turkey and Syria forest vegetations had established themselves. In northwestern Syria (Ghab pollen evidence) forest reached its greatest extent in the early Holocene. In northern Israel, on the other hand, conditions for tree growth were less favourable than during the Late-glacial. In this area steppe had expanded at the expense of forest vegetation. In the interior of the Near East at best forest-steppes were found as is suggested by the pollen record of Zeribar and Mirabad in western Iran and of Lake Van in southeastern Turkey....It was not c. 4000 BP that present-day distribution of forest and steppe had established itself in broad outline.

As illustrated the vegetation of the Near East in antiquity is just as complex as today due to the various phytogeographical regions.

Fauna

As an oceanic island, Cyprus was never connected to the mainland by a land bridge, even at the maximum of sea regression during the Pleistocene. Consequently, the endemic fauna and flora on the island were sea-borne, and the species present in the Holocene
were either sea-borne or introduced by human settlers (Steel 2004:4).

Although Cyprus demonstrates great floral range, the indigenous fauna is not as diverse. Simmons states the following regarding the faunal context of Cyprus, "Most of the faunal species presently on the island were introduced by humans. The most notable mammalian endemic fauna were the Cypriot pygmy hippopotamus and pygmy elephant. No carnivores are endemic to Cyprus" (Simmons 1999:8). In further support of humans being the source of the introduction of the contemporary Cypriot faunal assemblage, Simmons reiterates the following, "Despite its large size, Cyprus is one of the most geologically and biogeographically isolated of the Mediterranean islands. Its origin is oceanic, and the island is separated from the southern seaboard of Anatolia and the Syro-Palesinian littoral by two deep submarine features...it is therefore unlikely that the endemic animals arrived on most of the islands by a Pleistocene land bridge" (Simmons 1999:27). The ten "indigenous" species, all presumably introduced by humans, are the moufflon, fox, hare, rat, shrew, and hedgehog, two forms of mice, Persian fallow deer, and wild boar (Simmons 1999:8).

Kritou Marottou-'Ais Yiorkis

Kritou-Marottou- 'Ais Yiorkis is an Aceramic Neolithic site located in the foothills of the Troodos Mountains approximately 25km northeast of Paphos, Cyprus (Figure 1). At an elevation of around 460m above sea level overlooking the Ezousas River, the upland site is landscaped with the presence of Aleppo pine, Hermes oak, and wild olive (Simmons 1998:2 DOA). The site was first
recorded during the Palaipaphos Survey by D. Rupp (1984:152) and colleagues and thought to have reflected a small "hamlet" site relating to deer or pig exploitation (Simmons 1998:2; Simmons 2005:23).

Dr. Alan Simmons of the University of Nevada Las Vegas (UNLV) began test excavations at the upland site in 1997. The location of the site is on two adjacent modern agricultural terraces. Along with natural erosion processes recent agricultural activities, including bulldozing of the lower terrace, have caused tremendous damage to the site (Simmons 1998:3). Simmons states that the results from 1997 were significant, documenting the presence of a "large and well-manufactured stone assemblage, a small portion of a structure wall, and, most importantly, the presence of limited cattle (Bos sp.) remains (2005:25)."

The implications of cattle on Cyprus during the Cypro-PPNB are noteworthy because it changes traditional paradigm, which has demonstrated a Bronze Age introduction of cattle to Cyprus. Additionally, it provides insight into early Neolithic sea-faring technologies and animal domestication (Vigne 2001:57-58). This will be discussed in detail in Chapter 2. The 1997 test excavations substantiated the need for further investigations which led to a small scale excavation season in the summer of 2002. The results from the 2002 season revealed a substantial chipped-stone assemblage (including obsidian artifacts and projectile points), groundstone, pircrolite ornaments, fresh-water shell, deer, pig, caprines, cattle, and a large structure, termed Feature 1 (Simmons 2005:25). Every subsequent year, findings have added more to the significance of the site and demonstrated the site's unique location, architecture, chipped-stone
assemblage, symbolic representations, and faunal assemblage. Simmons (2007:241) reports thirteen radiocarbon determinations indicating an occupation between 8720 and 6840 ± 40 BP. This places the site within the Middle Cypro-Pre-Pottery Neolithic and the Late Cypro-Pre-Pottery Neolithic, and a Khirokitia transition is likely (Simmons 2007:241).

This thesis will further authenticate site significance by analyzing the botanical assemblage recovered from ‘Ais Yiorkis 2005 season. In regards to previous botanical analysis, the 2003 season produced a preliminary report of charred macrobotanics. Simmons states, “Flotation from the midden deposit yielded several charred seeds. These were examined by Dr J. Hansen, who identified small amounts of two grained einkorn or emmer wheat as well as other materials” (2005:26). A further investigation into the plant remains present at ‘Ais Yiorkis is presented in this thesis.

Chronology and Terminology

The Aceramic Neolithic of the Levant is currently subdivided into Pre-Pottery Neolithic phases: the Pre-Pottery Neolithic A (hereafter PPNA, ca. 9500 to 8500 BC), the Pre-Pottery Neolithic B (hereafter PPNB, ca. 8500-7000 BC), and the Final Pre-Pottery Neolithic or PPNC (Table 2) (Simmons 2007:234). The cultural traditions that characterize the Aceramic Neolithic include: increases in maximum settlement sizes, architectural innovations (i.e., use of lime plastered walls and floors and a shift in architectural house forms from circular to rectangular), the appearance of architectural monuments and communal structures, a spread of figurine symbolism, a change in funerary practices, and a marked decline in
microlith technology with an increase in use of sickle blades for cereal harvesting (Bellwood 2005:54-55). The cultural traditions of the corresponding phases of the Aceramic Neolithic in Cyprus are distinguishable in many respects and are assigned to Cypro-Aceramic phases. Peltenburg argues for the difference in terminology on the basis of “the impressively wide spectrum of links with North Syria and SE Anatolia combined with the emergence of an insular identity” (2003:xiii).

Regarding previous views of the Cypriot Neolithic, Simmons (2007:233) states that the Aceramic Neolithic of Cyprus was represented solely by the Khirokitia Cultural tradition (KC). He states:

The Akrotiri Phase apparently was not ancestral to the KC, and before the discovery of Aetokremnos, it was believed that the KC represented the island’s earliest occupation, starting around 8000 BP and ending about 6500 BP. Thus, approximately 2,500 years separated the Akrotiri Phase from the PPN. Similar to the mainland, the KC is followed, after another apparent hiatus, by the PN (Sotira Culture of SC), starting around 6100 BP and ending about 5000 BP.

This thesis will cover the period up through the KC tradition, focusing primarily on the chronological and occupational gap between the Akrotiri and Khirokitian cultural phases; more specifically, the Pre-Pottery Neolithic B phases of Cyprus.

Origins of Agriculture in the Near East

Peter Bellwood summarizes the transition to agriculture and plant/animal domestication in the Fertile Crescent. Issues include the timing of the transition, which relates to the first stable and continuing amelioration of post-glacial climate which occurred in a region with very marked seasonal rainfall. Furthermore the
transition involved a combination of cereal, legume, and animal domestication and was Aceramic and Neolithic in technological orientation (i.e., no pottery in the early stages, and no smelted as opposed to hammered metal)” (Bellwood 2005:44). This thesis will address in detail the nature of the evidence used to support the theories on agricultural origins and its subsequent spread to Cyprus.

Near Eastern Neolithic Subsistence Economy

During the Epipalaeolithic there was a reliance on wild plant and animal resources. It is not until the PPNB that domestic crops in the Levant can first be identified with certainty. There are a total of eight crops that compose the Neolithic agricultural package. In order of their importance as crops at the inception of agriculture, the crops are: emmer wheat, barley, einkorn wheat, lentil, pea, chickpea, bitter vetch, and flax (Zohary 1992:82; Zohary 1996: 143-144, Colledge 2001:8). Bellwood states that certainly by the late PPNB, and probably well before, the full complement of the major domestic animals were also in use. The suite of domesticated animals include: goat, sheep, cattle, and pig (Bellwood 2005:62).

Regarding the involvement of Cyprus in the Epipalaeolithic and early Neolithic prior to the addition of botanical evidence from the recently discovered Aceramic sites, Peltenburg cites Zohary and Hopf (1993) and states, “It (Cyprus) only merited attention in the context of present distributions of wild barley, one of the founder crops that were to play such a fundamental role in the development of agriculture. Of the eight founder crops, wild barley is the only cereal endemic to
Cyprus today as well as the only cereal thought to have grown in antiquity (2003: xii)."

Significance

The significance of this research is paramount in changing the way we look at the origins and spread of plant domestication in the Near East. ‘Ais Yiorkis is an unique Aceramic Neolithic site that is part of a larger Cypriot context and Cyprus is, in turn, part of a larger regional system of Southwest Asia. ‘Ais Yiorkis is the only Cypro-PPNB site having botanical evidence that is located away from the Mediterranean coast. The addition of the archaeobotanical assemblage of ‘Ais Yiorkis will add to the changing views of Cypriot prehistory and further illuminate the role Cyprus played in the early spread of plant domestication.
Figure 1 Map of the western portion of Cyprus, showing the location of 'Ais Yiorkis (Simmons 2005:2).

Figure 2 Geological map of Cyprus (Steel 2004:2).
Table 2 Table showing the chronology of the Neolithic in Cyprus and the Mainland Levant (dates compiled from Peltenburg 2003: xi).

<table>
<thead>
<tr>
<th>Dates</th>
<th>Cyprus</th>
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<tr>
<td>Cal. BC</td>
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<td>Late Neolithic</td>
<td>Pottery Neolithic</td>
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<td>Final PPNB/PPNC</td>
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<td>LPPNB</td>
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<td>6500-7000-</td>
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<td>MPPNB</td>
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<td>Khirokitian</td>
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<td>Cypro-EPPNB</td>
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<tr>
<td>9500-10000-</td>
<td>Akrotiri Phase</td>
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<td>10000-10500-</td>
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<td>11000-11500-</td>
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CHAPTER 2

BACKGROUND RESEARCH

Introduction

The transition from a hunter-gatherer economic strategy to one of agriculture is among one of the most extraordinary events in the course of human prehistory. This event entailed not only a change in the way humans interacted, and continue to interact with their environments, but the way in which humans interacted and continue to interact with each other (Price and Gebauer 1995:3). This transition is most often referred to as the “Neolithic Revolution,” a term coined by Australian prehistorian, V. Gordon Childe in the early part of the twentieth century (Balter 2005:2). The impact of this transition could not be better stated than by Michael Balter in, The Goddess and the Bull 2005. He states:

For better or worse, the first roots of civilization were planted along with the first crops of wheat and barley, and the mightiest of today’s skyscrapers can trace its heritage to the Neolithic architects who built the first houses from stone, mud, and timber (Balter 2005:3).

Additionally, "nearly everything that came afterwards...—in short, all the blessings and curses of modern civilization—can be traced to that seminal moment in human prehistory..."(Balter 2005:3). This quote, following the position of Harris and Hillman (1989), aims merely to highlight the consequences of the transition of agriculture and to substantiate the importance of its study, rather
than to imply that the transition was a single event in the development of human society. The position taken here views the transition as but one aspect of the long-term evolution of plant exploitation (Harris and Hillman 1989b: xxxi), and moreover, views the interaction between people and plants as a continuum (Harris and Hillman 1989a:2).

As Bellwood (2005:2) states, we have evidence of relatively independent agricultural origins in western Asia, central China, the New Guinea highlands, Mesoamerica, the central Andes, the Mississippi basin, and possible evidence for independent agricultural development in western Africa and southern India; all occurring at different times between about 12,000 and 4,000 years ago. What is known is that the environments, chronologies, and cultural trajectories of the multiple regions differed and therefore, research should be regionally contextualized. The area under focus here is southwest Asia, where agriculture is thought to have developed first, c. 10,000 years ago.

Seeing as the transition to agriculture involved changes in the structure and organization of societies, in addition to the domestication of plants and animals, it is necessary to discuss the archaeological backdrop for which this influential transition occurred in the Near East. This chapter will first provide a summary of the Near Eastern archaeological phases for which the origins of agriculture arose, followed by an overview of the corresponding archaeological complexes in Cyprus, putting the following in its chronological and archaeological context. An outline of some general terms used in the discussion on the origins of agriculture will be given, as well as a synopsis of the various theories surrounding the origins
of agriculture in the Near East and the different lines of evidence used to support them. The overview of the origins of agriculture will address the fundamental questions of where, when, why and how the domestication process occurred. The chapter will conclude with a discussion of the botanical evidence used to support the origins of agriculture in the Near East and its subsequent spread to Cyprus.

Near Eastern Archaeological Background

This thesis encompasses the duration of the Epipalaeolithic, the Aceramic or Pre-Pottery Neolithic and the Pottery Neolithic cultural entities in the Near East and Cyprus. As Colledge (2001:4) clarifies, the Near Eastern cultural entities have been categorized based on techno-typological and geographical classifications, as well as relative and absolute chronologies. Her outline of the Levantine chronology—and the summary of the following cultural entities, is an exceptional and concise overview from the perspective of an archaeobotanist of the archaeological background and will therefore be paraphrased here. Following Colledge (2001:4-5), the discussion of the material culture from the entities under discussion will focus primarily on the artifacts associated with the possible procurement and processing of food, and consequently, other aspects of the material culture will be briefly presented.
Table 3 Table showing the Near Eastern archaeological phases and dates (dates from Colledge 2001).

<table>
<thead>
<tr>
<th>Phase</th>
<th>Date Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kebaran (and related)</td>
<td>c. 20,000 – 14, 500 BP</td>
</tr>
<tr>
<td>Geometric Kebaran (and related)</td>
<td>c. 14,500 – 12,800/12,500 BP</td>
</tr>
<tr>
<td>Mushabian</td>
<td>c. 14,000 – 11,700 BP</td>
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<tr>
<td>Natufian</td>
<td>c. 12,800/12,500 – 10,500 BP</td>
</tr>
<tr>
<td>Harifian</td>
<td>c. 10,700 – 10,000 BP</td>
</tr>
<tr>
<td>Khiamian (and related)</td>
<td>c. 10,500 – 10,200 BP</td>
</tr>
<tr>
<td>Sultanian/PPNA</td>
<td>c. 10,200 – 9,500/9,300 BP</td>
</tr>
<tr>
<td>PPNB</td>
<td>c. 9,500/9,300 – 8,000 BP</td>
</tr>
<tr>
<td>Final PPNB/PPBC</td>
<td>c. 8,000 – 7,500 BP</td>
</tr>
<tr>
<td>Pottery Neolithic</td>
<td>c. 8,000/7,500 – 7,000/6,500 BP</td>
</tr>
</tbody>
</table>

The Kebaran

The Kebaran and contemporary Epipalaeolithic cultural entities are concentrated primarily in the upland and lowland areas of the Mediterranean vegetation zone and are thought to have been seasonal occupation sites (Colledge 20001:5). Bar-Yosef states that cold, dry conditions limited the exploitation of the desertic regions farther inland, so that occupation was limited to the coastal ranges and the western sector of the Trans-Jordanian plateau (1989:633). Further, mobility was dictated by the spatial and seasonal distribution of gazelle, fallow deer, wild cereals, pulses, acorns, and fruits (Bar-Yosef 1989:633). Besides organic circular huts, these Epipalaeolithic sites are generally characterized by a lack of architecture. The stone tool technology is characterized typically of bladelet tools constructed from single platform cores.
and, appearing less are small assemblages of groundstone tools, including deep 
vessels and mortars. Trade has been established in the Epipalaeolithic in the 
form of Red Sea shells (Colledge 2001:5).

The Geometric Kebaran

The ensuing Geometric Kebaran and contemporary cultural entities are 
similar to the preceding Kebaran in regards to site size, seasonal occupations, 
marine shell trade and architecture. There are differences in geographic 
distribution and stone tool technologies. The geographic distribution of the 
Geometric is greater due to climatic conditions being more favorable with an 
increase in annual rainfall, and therefore permitting occupation in drier regions of 
the Levant (Colledge 2001:5; Bar-Yosef 1989:633). Although there is greater 
variability in the chipped-stone industry, the Geometric Kebaran differs from the 
preceding Kebaran in that it is distinguished by geometric microliths formed by 
blades and bladelets. In regards to food procurement, small numbers of 
groundstone tools are found, including handstones, grinding slabs, mortars and 
pestles, and anvils and pounders (Colledge 2001:5).

The Mushabian

Like the previous cultural phases, the seasonal occupations between the 
upland and lowland regions and the lack of architecture mark the Mushabian 
cultural complex. The geographic distribution differs in that the sites extend over 
most of the arid zones of the southern Levant. In addition, the chipped stone 
technology differs in respect to food procurement with groundstone tools being a
rarity as well the prevalent use of the microburin that distinguishes the technology itself (Colledge 2001:5).

The Natufian

The ensuing Natufian developed from the Geometric Kebaran and is divided into early and late phases dating to 12,800/12,500 – 11,250 and 11,250 – 10,500 BP, respectively. The geographic distribution of Natufian sites differs from the preceding in that they extend throughout the Levant. Additionally, site size differs by a wider variation with three size ranges; small to large with the smallest between c. 15-100 m² and the largest covering areas over c. 7,000 m². Site occupation also differs with evidence of base and transitory camps and the presence of substantial architecture. Colledge summarizes the material culture of the Natufian being “far richer, both in quantity and quality, than that of the preceding Epipalaeolithic complexes” (2001:5-6). Furthermore, Colledge quotes Henry (1989:202) stating that the Natufian demonstrates the first evidence of decorative and artistic expressions in material culture in the Levant (Colledge 2001:6) and “produced more incised and carved imagery objects than any earlier site” (Bar-Yosef 2001:139).

The Natufian also provides evidence for cultural developments in the direction of increasing social complexity (Bellwood 2005:53-54). As highlighted by Simmons (2007:46), Bar-Yosef (2002) states, “A prerequisite for investigating the origin of the Neolithic Revolution...is to review the archaeological evidence from the Natufian culture and its contemporary entities.” With respect to regional approaches to agricultural origins, the Natufian cultural entity answers one of the
key questions of agricultural origins in the Near East: which came first, sedentism or domestication? Simmons states (2007:46-47), "during the Natufian, there is evidence for some degree of sedentism without major plant or animal domestication." To summarize, following Simmons' (2007:84-85) outline, the following key points about the Natufian will help shed light on the ensuing Neolithic.

1) The Natufian entity shared cultural characteristics with various Epipaleolithic groups in other areas of the Near East and the Natufian cultural entity lasted for approximately 2,500 years.

2) Some Natufian groups were most likely sedentary or semisedentary.

3) Material culture is relatively rich with high concentrations of artifacts, especially in terms of portable art illustrating animals.

4) Evidence from burials suggests social differentiation in the form of grave goods reflecting achieved, as opposed to ascribed, status.

5) More elaboration and stability, especially in terms of sedentism and material culture during the Early Natufian and less elaborate and more mobile adaptations over a larger geographic area in the Late Natufian.

6) The Natufian were minimally complex foragers with a broad spectrum economic strategy and cultivation of plants is likely.

7) Deteriorating environmental conditions might have set the stage for ensuing plant domestication due to the need for intensification of cereal-grain exploitation.
The Harifian

The Harif point, an innovative projectile point, is a hallmark of the Harifian cultural complex. This entity is an arid-adapted regional development of the Late Natufian of the Negev, and it is thought to be a development as a result of climatic deterioration. The Harifian has similarities with the Late Natufian in regards to stone tool technology, including the groundstone assemblages (Colledge 2001:6).

The Khiamian

The Khiamian and contemporary cultural traditions are considered the transitional complex between the Late Natufian and the fully developed traditions of the early Neolithic, and consequently, share similar groundstone assemblages with the Natufian. This transitional period is poorly documented, but what is known is the following: the settlements are located at low elevations in the core Mediterranean woodland zone, near to permanent water sources, and although architecture is poorly defined, year-round occupation is likely (Colledge 2001:6).

Sultanian/Pre-Pottery Neolithic A

The Sultanian/Pre-Pottery Neolithic A cultural entity is marked by a variety of additions to the Near Eastern archaeological sequence, including: the first evidence of mud brick in the construction of semi-subterranean round or oval structures; the addition of carved human figurines, particularly female figurines; evidence of the first appearance of polished axes; and of long distance connections between Anatolia, the Mediterranean and Red Sea. Regarding groundstone tools, there appears to be about a 20% increase in assemblages.
from the Late Natufian. The chipped stone assemblage is based largely on blades as opposed to bladelets (Colledge 2001:6-7).

Pre-Pottery Neolithic B

The Pre-Pottery Neolithic B cultural entity is more complex with the introduction of stone-built rectangular structures throughout the fertile areas of the Mediterranean region and the continuing circular architecture in the arid zones. Colledge states, “the walls and floors of buildings were often plastered, and there were internal fixtures and compartments, possibly for storage” (2001:7). In addition to the plaster floors, innovations in chipped-stone technology included heat treatment in order to make possible pressure flaking. Jericho, Byblos, and Amuq points, in addition to sickle blades, groundstone, grinding stone and plaster vessels make up the chipped-stone assemblage of the PPNB. Most notably of the PPNB is the establishment of permanent agricultural villages which appear abandoned towards the close of the cultural complex (Colledge 2001:7). Bar-Yosef (2001:149) comments that variable reasons can account for the abandonment of the villages during this phase including over-exploitation of the immediate environment, societal conflicts, or the negative impact of consecutive droughts.

Additionally, the PPNB is often regarded as an “interaction sphere.” Bellwood discusses this in brief and states:

We might argue for ever about how many ethnic groups constituted the PPNB, but one thing is clear—they communicated efficiently...As it spread, so it replaced or incorporated the regional late hunter-gatherer and PPNA cultures into a relatively homogeneous whole, albeit with continuing foci of regional diversity (2005:64).
This period also demonstrates, thus far, the first evidence of agricultural dispersal into Cyprus, at which time they brought with them their crops—domesticated einkorn, emmer, and barley as well as their livestock—cattle, sheep, goat, pigs and fallow deer (Bellwood 2005:71). The spread of the PPNB into Cyprus will be discussed below.

The Final Pre-Pottery Neolithic B/Pre-Pottery Neolithic C/early Late Neolithic Complexes

Since it is believed that the archaeological entities during this time are a reflection of regional adaptations to resources and environment, Colledge divides her summary into two regions: central, southern and east-central Levant; and northern and southern Levant. Changes seen in the former region are evident in the chipped-stone assemblage, with flakes being the dominate type, as opposed to blades and bladelets, and minimal occurrence of groundstone tools due to the believed greater group mobility. In regards to architecture, there appears to be a dichotomy between simpler single room habitation structures and more complex, "corridor buildings" (Colledge 2001:7).

The latter division has its greatest innovation with pottery. Colledge summarizes this archaeological complex as follows: “Architectural styles are varied on these sites, and both circular and rectilinear structures are present. Denticulate sickle blades, bifacial knives and proto-tabular scrapers are innovative flint tool types in the Yarmukian. The ceramics include bowls, chalices, platter basins, and jars” (2001:8).
Cyprus Archaeological Background

As previously discussed, researchers prior to the 1990s believed that Cyprus played a minor role in the spread of the agricultural strategy from the Near East. The earliest immigrants to the island of Cyprus were thought to have brought with them a fully developed agricultural package along with a distinguishable cultural tradition, the Khirokitian cultural tradition (KC), dating to cal. 7000 BC., which lacked a formative Cypriot precursor (Peltenburg 2003: xiii). In the late 1980s the site of Akrotiri-Aetokremnos yielded data suggesting an earlier exploration to the island pre-dating the once believed earliest inhabitants. The excavation of Akrotiri-Aetokremnos revolutionized Cypriot pre-history by creating a chronological and occupational gap in the pre-history of the island from ca. 10,000 to 7000/6500 calibrated BC (Simmons 1999). This gap is now beginning to be bridged with recent excavations of multiple Aceramic Neolithic sites in western Cyprus dating prior to the Khirokitia tradition and post-Akrotiri, referred to as the Cypro-Pre-Pottery Neolithic B (Cypro-PPNB). The excavations of Kissonerga-Mylouthkia, Kalavasos-Tenta, and Parekkliasha-Shillourokambos have changed the archaeological interpretation of Cypriot prehistory placing Cyprus in the forefront, not periphery, in the early transmission of the agricultural tradition from Southwest Asia. This section will briefly discuss the archaeology of the Aceramic Neolithic of Cyprus and the previously mentioned sites.

The corresponding phases of the Cypriot prehistoric record are similar in regards to terminology, with an Aceramic, or Pre-Pottery Neolithic, and a Pottery Neolithic phase (Simmons 1999:15). In regards to Dikaios's proposed alternative
to the cultural/chronological sequence of prehistoric Cyprus, which named periods after sites and thus inferring “site-types;” Steel argues that the sequence (Khirokitia, Sotira, and Erimi) takes little account of cultural continuity and of internal Cypriot regional variation (2004:14). Considering that, the preferred chronological/cultural sequence used here will be the one previously mentioned and outlined in Peltenburg, which refers to chronological and archaeological phases (2003).

Akrotiri Phase

The earliest phase of human activity on Cyprus is the Akrotiri Phase; which is one of the only phases for which will be referred to for its site; the other being Khirokitia. The site of Akrotiri-Aetokremnos is marked by stone tools and hearths in association with bones of the endemic pygmy hippopotamus. Artifacts from the site were uncovered from the collapsed rock shelter for which the site is named and the archaeological complex is characterized (Simmons 1999:34, Steel 2004:16). A significant and controversial issue surrounds the evidence of human activity in relationship with pygmy hippopotami. Simmons states:

The site is one of the few archaeological examples indicating that humans may have played a role in the extinction of Pleistocene vertebrate fauna. The precise mechanism of this remains unclear, but if these animals already were on the verge of extinction because of environmental deterioration, the new threat posed by human predators may have been just the trigger to push them to final extinction (2001:14-15).

Akrotiri has provided more than just evidence for a human role in Pleistocene faunal extinction. As Simmons argues, the ultimate significance of the Akrotiri-Aetokremnos investigations is that it caused a serious re-thinking of the nature of
archaeological inquiry in Cyprus in regards to how, when and why the
Mediterranean island were initially populated (2001:15). Moreover, what is
unknown about the earliest phase of Cypriot prehistory is whether “these early
peoples were simply visitors to Cyprus, staying only a brief time until the
hippopotamus populations were no longer viable, or if they were actual
colonizers of the island” (Simmons 2001:14). Only time and future investigations
will be able to answer the questions of the earliest explorers and bridge the gap
between the earliest phases of Cypriot prehistory with the Aceramic Neolithic of
Cyprus; more specifically, the gap between the first human activities at Akrotiri-
Aetokremnos and the earliest communities of Parekklisha-Shillourokambos and
Kissonerga-Mylouthkia, for which we will now turn.

Cypro-PPNB

The successive archaeological phase for which there is evidence on Cyprus
is the Aceramic Neolithic, more specifically, the Cypro-PPNB. In the broader
sense, the material culture in the Aceramic Neolithic can be described as follows:
an undistinguished chipped stone assemblage and an elaborate polished
groundstone collection, including axes, picrolite ornaments, and a very
sophisticated stone vessel industry (Simmons 1999:16). Seeing as the botanical
data from ‘Ais Yiorkis will be compared solely with other botanical data from
contemporary sites, this summary will limit itself to the few Cypro-PPNB sites that
have provided botanical data.

“The site of Parekklisha Shillourokambos has for the first time in Cyprus
provided concrete evidence for an early phase of the Aceramic Neolithic,
belonging to the second half of the 9th millennium cal. B.C.E." (Guilaine and Briois 2001:37). This southern site, which is located 6 km east of Limassol, Cyprus, is currently divided into two main periods of occupation: Early Phases A and B (8200-7500 B.C.E.) and the Middle and Late Phases (from 7500 B.C.E.).

As paraphrased by Guilaine and Briois (2001:37), the earliest phases of site occupation at Shillourokambos are marked by deep wells, large wood enclosures for livestock, the induction of stone and mud for architectural construction, the choice to use translucent chert in the manufacture of projectile points and sickles, and the high incidence of imported Anatolian obsidian. The second phase, the Middle and Late Phases, marks the appearance of the “typically Cypriot cultural traits, such as the use of local opaque chert, the production of robust blades, the development of harvesting knives that replace the multiple elements for sickles, and a decline in the incidence of obsidian” (Guilaine and Briois 2001:37).

The faunal assemblage of Shillourokambos is marked by the presence of fox, domestic dog, cat, domestic pig, Mesopotamian fallow deer and “predomestic” sheep, goat and cattle. Vigne reports that all phases of occupation provided evidence of faunal remains. Interestingly, evidence of shell, fish, bird and small mammal remains were scarce, thus suggesting that marine resource and small game exploitation played a smaller part in the early subsistence strategy at Shillourokambos (2001:55).

In addition to the faunal assemblage at Shillourokambos generating questions regarding early maritime technologies, it raises concerns about animal domestication in general. Specifically, the presence of “predomestic” cattle
challenges previous evidence which had demonstrated a late Bronze Age introduction. Furthermore, a reassessment of domestication criteria in general is in order. This stems from the fact that the bone assemblage from Shillourokambos lacks the distinct morphological markers for domestication. Seeing as this assemblage lacks morphological traits for domestication status and the animals must have been under some form of human control for sea transportation, other early bone assemblages should be re-evaluated giving recognition to non-morphological domestication criteria (Vigne 2001:57-58).

An additional CPPNB site is Mylouthkia. Mylouthkia is a multi-period coastal site located at the northern end of the Ktima Lowlands in the Paphos District, western Cyprus with three periods of occupation: Period 1, Aceramic Neolithic, 2 Early Chalcolithic and 3, Middle Chalcolithic. Lemba Archaeological Project excavations from 1989 to 2000 revealed five wells, a semi-subterranean structure and three pits belonging to the Aceramic Neolithic (Peltenburg et al. 2000:844). The Aceramic phase or, Period 1, is characterized by two of the earliest known water-wells. These wells consist of deep, vertical, cylindrical shafts about 90 cm in width and 8.5 and 7 m in depth with evidence of climbing up and down the shafts. Human and animal bones, chipped stone, groundstone, and charred macrobotanics were all recovered from the water-wells (Peltenburg et al. 2001:65-66).

The third CCPNB site that has produced botanical evidence is Kalavasos Tent. Tent is located 3.2 km north of the southern coast between the modern towns of Limassol and Larnaca. Results from five seasons of excavation,
between the years 1976-1984, revealed five occupational phases. Period 5 is now thought to be contemporary with the earlier phases of Shillourokambos; “dating in mainland terms to the PPNB” (Todd 2001:106). As Todd reports, although initial occupation or utilization of the site lacks solid standing architecture, there does appear to be a series of approximately forty-five post or stake holes and pits cut into natural deposits suggesting the overall extent of the remains from this early phase being somewhat substantial (2001:98-108).

The architecture of Tenta-Period 4 is marked by circular domestic structures, a considerable encircling wall, and a ditch cut in the havara. This period “marks the erection of the first permanent architecture including the initial phase of the wall which encircled the village and its accompanying ditch” (Todd 2001:97-98).

Next, the third period demonstrates an increase in mud-brick domestic structures as well as the addition to the outer wall for the function of strengthening it. The second period is the best known of the Aceramic phases and exhibits a continued increase in domestic mud-brick architecture within the encircling wall, as well as the construction of domestic structures outside of the wall. Due to natural erosion processes and agricultural activity the final period of the Aceramic Neolithic of Tenta remains unknown (Todd 2001:98-99).

Khirokitia

As Le Brun states, the site of Khirokitia Vouni (hereafter Khirokitia) documents the end of the Cypriot Aceramic Neolithic, which began with Shillourokambos. The site is situated on a slope covering nearly one and a half hectares about 6 km from the southern coast, in the Maroni river valley.

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1 Secondary limestone (Todd 2001:97)
Surrounding Khirokitia is a stone and mud brick wall that represents substantial labor investment. Curiously, in regards to domestic structures, the basic architectural unit demonstrates a dichotomy with contemporary mainland sites with circular structures dominating from the earliest to the latest occupation levels. Interior domestic space is marked by fireplaces, pits, and basins (Le Brun 2001:111).

“Khirokitia differs in many respects from Shillourokambos—by its location, its massive architecture, its chipped and ground stone industries, the scarcity of obsidian, and its faunal assemblage” (Le Brun 2001:109). There appears to be a significant decrease in the incidence and assumed value of obsidian at the close of the Aceramic from the early Aceramic Neolithic. Additionally, the chipped stone industry could be characterized as “rough” and “shows little variation” (Le Brun 2001:113).

In reference to the chipped-stone industry in the Aceramic Neolithic in general, Peltenburg et al. report western Asiatic links demonstrated by the assemblages of Mylouthkia and Shillourokambos. The industry is marked by prismatic blades, Syrian Byblos points, Amuq points with contemporary developments in technology up through the Cypro-LPPNB (Peltenburg et al. 2000:848).

“Preliminary results from Shillourokambos suggest that by the end of the 9th millennium, all four species were in some way herded on the mainland and spread far enough from their point of origin to be transported to Cyprus by sea” (Vigne 2001:57). The faunal assemblage at Khirokitia is similar to other Aceramic
sites with fallow deer, sheep, goats, and pigs dominating. Unlike Shillourokambos and ‘Ais Yiorkis, Khirokitia lacks cattle remains. What can be determined about the Aceramic Neolithic faunal assemblage, in general, is that the introduction of domesticated cattle, pig, sheep and goat in the Cypro-EPPNB is well documented even though the morphological evidence for domesticated status is limited (Peltenburg et al. 2000:850).

Regarding similarities between the earliest phases of Aceramic occupation at Tenta, Todd draws artifact parallels with Shillourokambos. In short, Todd states, these three sites could be considered representative of the PPNB in Cyprus (2001:106). In opposition, Simmons argues that there is no one site type and the CPPNB demonstrates great diversity. Simmons states,

What clearly stands out is that none of the CPPNB sites are similar. Shillourokambos appears to have been a small village with relatively ephemeral architecture, and Mylouthkia also may have functioned as a village, although supporting data are sparse. Early Tenta has some features similar to Shillourokambos, but we do not know the full composition and extent of its CPPNB occupation. ‘Ais Yiorkis also may be a village, albeit and upland one.... (2007:257).

Origins of Agriculture in the Near East

Why

Prior to 10,000 years ago, humans subsisted on a hunter-gatherer lifestyle. Why humans consciously or unconsciously chose to adopt an agricultural way of life when they did has been a subject of much archaeological debate and has produced various theoretical perspectives. Investigations into the origins of agriculture has in the past been limited due to the paucity of relevant data that
could be used to address the fundamental questions of where, when, why and how. Addressing these fundamental questions involves many fields of study including, botany, anthropology, history, archaeology, and geology. Recent advancements in the fields of archaeology and botany has brought light to archaeological sequences of domesticated plants that not only answer questions of when, where, and how plants were domesticated but perhaps why they were domesticated at all (MacNeish 1992:3).

Bellwood summarizes the different theoretical perspectives as follows, “Some explanations (for the origins of agriculture) focus on a background of affluence, others on stress, especially environmental or population stress. Some favor conscious choice, others prefer unconscious Darwinian selection. Some like revolution, other prefer gradualism” (2005:21). Additionally, Price and Gebauer classify the general explanations for the transition to agriculture into exogenous factors and endogenous factors, the former reflecting natural forces over which populations have little control and the latter reflecting internal societal changes (2005:4). The three general factors they mention as primary explanations for the origins and spread of agriculture are 1) climatic or environmental change, 2) population pressure, and 3) changes in social organization, the first two being exogenous, and the third endogenous (Price and Gebauer 1995:4). It is with this introduction that the early theoretical perspectives explaining the transition can be briefly discussed.

Exogenous, or stress-caused, explanations of agricultural origins began with V. Gordon Childe’s Oasis Theory, with climate change and oasis refuges in the
context of animal domestication at its core (Watson 1995:23). As stated by Patty Jo Watson (1995), following the increased desiccation after the last Ice Age, is that people and animals were forced to co-habit near the few permanent water sources (oases), and eventually—"with the aid of grain and stubble from their crop lands—tamed some of the animal species" (Watson 1995:23). Like all, Childe was a scientist of his time and the basic assumptions to which his explanation relied were suitable then, including environmental determinism; the natural spread of new innovations; and the natural progression of societies from simple to complex, with agriculture and pastoralism at the latter end (Watson 1995:24).

The following exogenous explanation, following Childe's propinquity theory, was the Hilly Flanks theory, developed from new archaeological and geological data from Robert J. and Linda Braidwood's interdisciplinary Iraq-Jarmo project (Watson 1995:24-25). The assumptions to which Braidwood's explanation relied were similar to Childe's explanation. The differences between the two explanations are the location in which the transition occurred, and the fact that Braidwood, as opposed to Childe, had evidence to support his explanation from multiple disciplines, including geology, paleobotany, and zoology. The evidence supported the upland regions of the hilly flanks (within the Fertile Crescent) as the location of co-habitation, due to the location of the wild progenitors of the domesticated plants and animals (Watson 1995:25-26).

In the 1940s and 1950s the modern interdisciplinary studies were being established along with innovative types of data collection from multiple disciplines

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including archaeology, botany, and zoology. This period of interdisciplinary research into the origins of agriculture continued into the early 1960s with the inclusion of palynology, ethnobotany, taxonomic botany, phytolithic studies, and isotopic studies (MacNeish 1992:6).

Another stress-based explanation for the origins of agriculture and the theory that marked the beginnings of the processual movement in modern archaeological theory, beginning in the 1960s, is that of Lewis Binford and Kent Flannery. They, extending on the work of Braidwood and Childe, proposed population pressure as the cause that led to an outflow of people into marginal zones where cereal cultivation was necessary to increase food supplies (Bellwood 2005:22). Another aspect, extending yet modifying Braidwood's explanation, is their hypothesis that plant cultivation occurred on, as Bellwood cites Flannery (1969), the “edges of the wild ranges of the plants concerned, because stresses in supply here would obviously be higher than in core areas (of the wild progenitors) of plentiful and reliable supply” (Bellwood 2005:22).

In the 1980s dissatisfaction with these single factor models (i.e., population pressure and climate) was apparent and new models were introduced with multiple factors contributing to the transition including changing environments, demography, foraging economy, settlement patterns and social organization (Bogucki 1999:189). The 1990s gave rise to the models which attributed social factors as the impetus for the transition and consequently, as Bogucki addresses, required crossing a wider inferential gap than previous explanations (1999:191). Brian Hayden’s competitive feasting theory is one of these models. This model
attributes the transition to the demands of cultural feasting and views the
economic resource (i.e., domesticated plants and animals) as a resource that
can be used to gain control over labor (Bogucki 1999:190-191). Additionally,
Barbara Bender suggests that the success of agriculture may be in the ability for
the food items to be used as valuable trade items (Gebauer and Price 1992:3).

An additional social factor that was not previously considered and is now
receiving more attention is the relationship between the origins of agriculture and
the changes in the human use of space and sexual labor patterns (Peterson
2002:146). In the past there was little research dealing with how early
agriculturalists organized their work in terms of sexual divisions of labor, in
addition to family and community structure. These changes in the archaeological
record in the form of architecture and social structure were obviously a crucial
aspect in the success of the early agricultural societies (2002:1). Peterson
draws attention to engendering the prehistory of the Neat East and to the
complexities of this transition. She concludes:

When the skeletal analyses are combined with archaeological and
ethnographic data relevant to the human use of space and sexual
labor patterns, they provide unique opportunities to integrate social
variables more fully into our understanding of the original

Such gender studies are rare for the Cypriot Neolithic, specifically, but are
gaining more attention as well. Bolger and Serwint (2002:8) highlight the
importance of engendering Cypriot prehistory in consideration of the role Cyprus
played in early Mediterranean prehistory and it's contributions to the region. This
contribution, they state, "surely rests on factors such as geology, geography,
economics, trade and mercantile exchanges, technological developments, and politics," which are "fueled by women and men and the roles they assumed and preformed to accomplish social, cultural, political and economic agendas" (2002:8).

In the late 1980s, Harris and Hillman, in their introductory chapter to the pivotal edited volume, *Foraging and Farming: The Evolution of Plant Exploitation* 1989, changed the approach to understanding agricultural origins by debating not the "hypothetical explanations of the origins of agriculture" like previous researchers, but by focusing on the "processes and effects—biological, ecological, demographic, economic, and social—of the exploitation of plants by people (1989:7)." Moreover they stress that the processes are not unidirectional and they by no means imply irreversibility but are progressive in the since of a continuum of increasing input of human energy per unit area of exploited land (Hillman 1989:12). The theoretical framework used in this thesis follows the model presented by Harris and Hillman (1989). This model is ecological and evolutionary; the former because of the human-plant interaction and the latter because the "results of the processes involved in domestication and the emergence of agriculture...are assumed to be the products of selection working on both biological and cultural variation (1989:12). In summary, they view human exploitation of plant resources as a continuous global evolutionary process (Harris and Hillman 1989:2-3).

It is with this brief summary that we now turn to contemporary approaches, paying particular attention to the archaeobotanical evidence for where, when,
why and how the transition to agriculture occurred in the Near East. The plants and animals under discussion will be outlined followed by current views on where and when agriculture began and how the domestication process may have developed.

Current Thoughts

The archaeological and botanical fieldwork from the late 1950s to the early 1970s recognized two key points about the origins of the cereal-based farming economies of Europe and southwest Asia; firstly, they had their origin in the "Fertile Crescent" and secondly, the earliest domesticates appear about 10,000 radiocarbon years ago (Nesbitt 2002:113).

Where: Locating the Origins of Near Eastern Agriculture

The botanical evidence demonstrates that the wild ancestors of most of the Neolithic crops grew solely in the Fertile Crescent. Additionally, the earliest settlements with domesticated plant remains appear archaeologically in the Fertile Crescent. Its spread is evidenced by the later farming villages appearing outside of the Fertile Crescent (Nesbitt 2002:113). For clarification, the Fertile Crescent runs from the Jordan Valley northwards through inland Syria, into southeastern Turkey (Anatolia), then eastwards through northern Iraq, and finally southeastward along the Zagros foothills of western Iran and can be described as a "zone of open woodlands and grasslands, with stands of wild cereals and legumes" (Bellwood 2005:44).

Zohary names eight founder crops of Neolithic agriculture; three cereals along with five other taxa. In order of their importance as crops at the inception of
agriculture, the cereals are: emmer wheat (*Triticum turgidum* subsp. *dicoccum*), barley (*Hordeum vulgare*), and einkorn wheat (*Triticum monococcum*). The remaining five that played a significant part are as follows: lentil (*Lens culinaris*), pea (*Pisum sativum*), chickpea (*Cicer arietinum*), bitter vetch (*Vicia ervilia*) and flax (*Linum usitatissimum*) (Zohary 1992:82; Zohary 1996: 143-144; Colledge 2001:8). In addition to the recognition of these eight species, Zohary states that the subsequent expansion of Neolithic agriculture was based on this particular assemblage of crops (1989:358).

For clarification as to where, specifically, agriculture arose in the Near East it is imperative to discuss the natural habitats of the wild progenitors of the founder cereal crops (einkorn wheat, emmer wheat, and barley), which will be discussed in detail below. For an in depth look at the location of the wild progenitors of the remaining five taxa (lentil, pea, chickpea, bitter vetch, and flax) refer to Zohary and Hopf (2000) and Zohary (1989).

When: The Origins of Near Eastern Agriculture

Similar to *where*, answering the question of exactly *when* agriculture arose in the Near East is not as simple as one might initially think. With that in mind, dating the beginning and end of wild plant cultivation is crucial for assessing the success of explanations of agricultural origins that invoke environmental, technological or socio-cultural change (Nesbitt 2002:115). Since agriculture is the cultivation of domesticated plants, and domestication is more easily detected in the archaeological record then cultivation, documenting the first appearance of domesticates is important for establishing a firm chronology for which to look for
cultivation (Nesbitt 2002:115). In light of Harris's (1990:13) four-fold model of the progression from foraging for wild plant-foods to fully established agriculture, Colledge (2002:141) argues for the need to understand pre-domestication cultivation on the basis that cultivation represents a significant increase in investment of energy. Considering the points of Colledge, Nesbitt, and the following statement by Moore (1989:620), the discussion below will look at the preceding stage to the Neolithic, the Epipalaeolithic in an effort to clarify when agriculture began in the Near East: “the agricultural way of life characteristic of the earliest Neolithic developed in the preceding stage, the Epipalaeolithic, as a result of changes that, in turn, had their roots in the way of life of the Upper Palaeolithic groups (Moore 1989:620).”

There are different ideas on when the first domesticates appear in the Near East. Colledge argues for evidence of domestication on Levantine sites dated to the Sultanian/PPNA period (Colledge 2001:8). Nesbitt disagrees and summarizes the evidence from the PPNA stating that the sites with the most abundant well-dated and well documented cereal remains show no sign of cereal domestication and the sites with the least material and poorly dated plant remains demonstrate domestication (2002:121). In opposition, he argues for the first unequivocal evidence of plant domestication for the PPNB. The botanical evidence for both will be discussed below.

How: The Domestication Process

Harris and Hillman suggest three pathways to the state of domestication, which they note are not mutually exclusive. The first pathway, they state,
“selects for very rapid genotypic change involving the loss of the ability of the plant to survive in the wild;” and the second selects for “gradual genotypic change, and again involves (eventual) loss of ability of the plant to survive in the wild.” The third is different from the first two altogether. This process involves only reversible ‘plastic’ phenotypic change determined by the unaltered genotype, and like the first, these phenotypic changes can occur rapidly (Harris and Hillman 1989:6-7). They suggest “domestication could be achieved within 20-30 years, if the crop is harvested near-ripe by sickle-reaping or uprooting, and if it is sown on virgin land every year taken from last year’s new plots” (Bellwood 2005:57; Hillman and Davies 1990:189).

Another debate pertains to the mode of domestication of the various cultivated plants. This is whether the plants were taken into cultivation many times and thus in several locations, resulting in “polyphyletic evolution.” Alternatively, the wild progenitor may have been taken into cultivation only once resulting in a single domestication event and “monophyletic evolution” (Zohary 1996:142). In addition to cytogenetic evidence from the wild progenitors, Zohary’s position is supported by several lines of evidence indicating that at least some of the crops associated with the beginnings of food production in Southwest Asia being taken into cultivation only once or, at most, a very few times (Zohary 1989:369; Zohary 1996:142).

Bellwood highlights the fact that we may never know exactly how the process of domestication finally occurred but he notes three activities which definitely helped along the way: the adoption of sickle-harvesting (and thus selection for
non-shattering rachis); planting of the sickle-harvested population outside of the natural range; and a delay of harvesting until the plants are partly or fully ripe (2005:58). The approach taken here in answering the questions of how, when, and where agriculture developed in the Near East is to stress the complexity of the matter rather than to provide crude answers. To specify, where, when and how agriculture arose within the Near East, we will turn now to the subsistence data, particularly, the botanical evidence.

Documenting Cultivation and Domestication

Terminology

In reference to documenting domestication, the subsequent terminology will be used: Gathering "is the collection of wild plants from their natural habitat. Modifications to natural habitat, if any, involve low investment of labour, for example, burning." Cultivation "is the sowing and harvesting of wild plants in tilled soil." Domestication "is the process in which humans take control of the reproduction of plants and animals, consciously or unconsciously select for attributes favourable to human use. For cereals control of reproduction means repeated sowing and harvesting of the same population and the key attribute selected for is loss of the ability to disseminate seed without human intervention." Agriculture or farming "involves (for cereal and pulse crops) the cultivation of domesticated plants" Nesbitt (2002:115).

Identifying Domestication

Identifying plant remains as either wild or domestic is a useful marker in understanding the transformation from cultivation of wild plants by hunter-
gatherers to fully agricultural societies (Nesbitt 2002:115). There are multiple lines of evidence that are used in documenting plant domestication, including pollen, phytoliths and stone tool use. Nesbitt makes clear that these types of evidence have proved to be misleading on the grounds that pollen and phytoliths are insufficiently diagnostic to species and stone tools (i.e. sickle blades and grinding stones) are not necessarily associated with domesticated plant species (2002:116). He further argues for and summarizes the use of domesticated cereals, as opposed to pulse crops, as the more reliable data for an indicator of domestication. Since pulse crops have proved to be unreliable for domestication, this thesis will discuss the criteria for domesticate determination of charred cereal remains (Nesbitt 2002:117).

Criteria for Domestication

Grain Shape

Although grain shape has commonly been used to identify cereal domestication, Nesbitt cautions against using it as a sole marker. For example, for some genera of the Triticeae grasses the identification of cereals by grain shape is problematic due to their morphological similarities (Nesbitt 2002:116). Nesbitt argues the more reliable diagnostic parts of the cereals are the rachis and glumes because the loss of natural dispersal mechanisms (which are mediated by the rachis) is fundamental to domestication (Nesbitt 2002:116-117). Therefore, identifications for the status of domestication of wheat are more reliable when supported by chaff (Nesbitt 2002:116).
Chaff Morphology

In wild cereals (wheat, barley and rye), the ripe rachis naturally disarticulates below each spikelet at maturity. This allows the spikelets to fall naturally to the ground, leaving a clean disarticulation scar. Since the loss of this dispersal mechanism is fundamental to domestication it would follow that domestic cereals will demonstrate a rough scar where the rachis is broken during post-harvesting threshing. Determining domestication using the chaff alone, however, is not without problems either. Two concerns with chaff are that it is sometimes absent, and that the lower spikelets of wild cereals do not always naturally disarticulate, causing a less than fresh disarticulation scar on what should be a clean break (Nesbitt 2002:117).

Wild Progenitors

Harris and Hillman (1989:6) state that the principal value of studying the present-day distribution of wild progenitors (or their nearest modern relatives) of domesticates lies not in what the distribution patterns suggest about where those plant communities occurred in the past, but in what they can reveal about their natural habitat preferences. With the aid of genetic tests, the locations of the wild progenitors of the three founding cereal crops of Near Eastern agriculture have been identified (Zohary 1989: 22). This section will discuss the present day distributions of the principal founding cereal crops, paying particular attention to what the distributions suggest about their habitat preferences.

What is known of the wild progenitors of the founder crops is that they are all predominately self-pollinated (autonomous) annual plants (Zohary 1996:145).
Zohary argues that this should come as no surprise because self-pollination presented extreme advantages at the start of domestication including the “quick build-up of reproductive isolation barriers such as cross-incompatibility, hybrid inviability or hybrid sterility between diverging populations” (Zohary 1996:145).

With regards to self-pollination and the Near Eastern founder cereal crops, Zohary and Hopf (2000:17) state:

Several facts suggest that self-pollinated plants were better suited to domestication than cross-pollinated candidates. One major advantage of self- over cross- pollination in incipient domesticates is the fact that selfing isolates the crop reproductively from is wild progenitor. It enables the farmer to grow a desirable cultivar in the same area in which its wild relatives abound, without endangering the identity of the cultivar by genetic swamping...

*Triticum* sp.

*Triticum* is a genus with about twenty species across Europe, West Asia and the Mediterranean. This genus is known to be the most nutritious of all cereals (Gale and Culter 2000:363). It is an annual or biennial grass which is almost completely self-pollinating. The wild progenitor of the cultivated *Triticum monococcum* is *Triticum boeoticum*. Einkorn wheat is divided into two varieties: one-seeded and two-seeded, termed *Triticum aegilopoides* and *Triticum thaodar*, respectively. The distribution centre of wild einkorn lies in the Near Eastern arc which entails northern Syria, southern Turkey, northern Iraq, and adjunct Iran (Figure 3). This species is massively distributed as a component of oak part-forests and steppe-like formations. Additionally, this species can be found growing as a weed and therefore a colonizer of secondary habitats. For
example, the distribution can include the edges of cultivated fields or roads (Zohary and Hopf 2000:35).

Domestication of wild einkorn occurred in southeast Turkey. This area contains native spikelets having both one-seeded and two-seeded varieties. More specifically, one-seeded einkorn occurs in the Balkans and Aegean and the two-seeded occurs in the eastern part of the Fertile Crescent (Nesbitt 2006:91). As opposed to cultivated einkorn, which is dependent on human threshing for grain disarticulation, wild einkorn is marked by brittle ears that enable the grain to disarticulate at maturity to disperse the seed without human assistance (Zohary and Hopf 2000:35). Most cultivated einkorn produce one caryopsis per spikelet, but there also exists cultivars with two grains per spikelet.

The one-seeded and two-seeded varieties have different eco-geographical zones in which they are common. The smaller one-seeded spikelets prevail in the north and north-west part of its range and the larger two-seeded are more common in the summer-dry southern areas. Einkorn currently grows in extensive stands in southeastern Turkey, at elevations between 600 and 2,000 meters. The distinctions between one-seeded and two-seeded einkorn appear to occur on a eco-geographical continuum with a series of intermediate forms appearing in central Anatolia, Transcaucasia and adjacent territories of Iran (Zohary and Hopf 2000:36). In regards to Cyprus there are four species that are found on the island. They are as follows: *T. spelta*, *T. durum*, *T. turgidum*, *T. aestivum*.

Van Zeist reports of the presence of the two-seeded variety of wild einkorn at Tell Mureybit, in northern Syria. He discusses the above mentioned
geographical differences between the two varieties as follows: the small *Triticum boeoticum* Boiss. Emend. Schiemann var. *aegilopoides* (Bal.) Schiemann, which is distributed in the Balkans and western Anatolia, and the much larger var. *thaoudar* (Reut, Schiemann, which is found in southeastern Turkey, in Iran and Iraq (170-171).

Zohary and Hopf (2000:42-43) state that hulled emmer, *T. turgidum* subsp. *dicoccum*, was the principal wheat of Old World agriculture in the Neolithic and early Bronze Age, but survives currently as a relic crop grown periodically in some parts of Europe and southwest Asia. The wild progenitor of domesticated einkorn is *Triticum dicoccoides*. Unlike einkorn wheat, emmer wheat does not develop into weedy races and thus its distribution is almost entirely in primary niches (Zohary 1989:363). Additionally, its distribution is more restricted and confined ecologically than wild einkorn (Figure 4). The distribution range covers Jordon, southwest Syria, Lebanon, southeast Turkey, North Iraq, Israel, and western Iran. Further, wild emmer wheat grows as “common annual components in the herbaceous cover of the Tabor oak park forest belt and related steppe-like herbaceous plant formations” (Zohary 2000:44).

*Hordeum* sp.

*Hordeum* is a genus with nearly forty species from the northern temperate regions. It is a hardy annual or biennial herb that can grow in cold, dry and poor-soiled environments. Cultivated species of barley yield a highly nutritious cereal grain. Historically, it has been processed into barley malt and additionally used in
fermentation throughout Europe and the Mediterranean. The stems and chaff (the waste from processing) can be used as a tempering medium for clay bricks and other ceramics (Gale and Culter 2000:319).

The wild progenitor of domesticated barley, *Hordeum spontaneum*, derives from one region of the Fertile Crescent (most probably Israel or Jordan) (Nesbitt 54:2006) (Figure 5). Barley under domestication can be divided into two principle types, *Hordeum distichum* L. and *H. hexastichum* L; the former containing only two rows of fertile spikelets thus producing two grains, and the latter producing three grains from one spikelet having therefore six rows, as opposed to two, of fertile spikelets (Zohary and Hopf 2000:60). More specifically, two-rowed barley produces three spikelets per floret but only the central spikelet produces a grain. Conversely, six-rowed barley consists of three spikelets but all three spikelets produce fertile grains. In regards to the presence of barley on Cyprus, there are eight species of *Hordeum* found on the island. They are as follows: *H. bulbosum, H. glaucum, H. leporinum, H. geniculatum, H. marinum, H. spontaneum, H vulgare, and H. distichon*.

Presence outside natural range

"The presence of a species outside the range of the wild ancestor is a powerful argument for its dispersal by humans, whether through the cultivation of the wild or domesticated form" (Nesbitt 2002:117). Nesbitt states that we are not entirely sure of the wild distribution of cereals 12-10,000 years ago. Still, documenting the presence of plants outside their natural range, or their preferred
habitats, can be a useful marker for domestication due to the human role in the transportation of the crops outside of their natural habitats.

Weeds and domestication

Zohary and Hopf (2000) discuss the likelihood of the weeds, *Avena sativa* and *Camelina sativa*, being, “secondary crops,” or crops that entered domestication through “the back door of weed evolution.” This occurs when the weeds transfer from being an annoyance in the tilled fields to a crop the cultivator begins to utilize and harvest (Zohary and Hopf 2000:11, Zohary 1986:13). Although this revolution in secondary crops sheds light on the history of crops like *Avena sativa*, it also provides additional evidence for domestication at a site with the consideration of weeds that typically grow in cultivated fields making it possible to infer cultivation at a site.
Figure 3 Distribution of wild einkorn wheat, *Triticum boeoticum*. “The area in which wild barley is massively spread is shaded. Dots outside this distribution centre represent more isolated populations, usually weedy forms” (Zohary 1989:360).

![Map of wild einkorn wheat distribution](image)

Figure 4 Distribution of wild emmer wheat, *Triticum dicoccoides* (Zohary 1989:361).

![Map of wild emmer wheat distribution](image)
Figure 5 Distribution of wild barley, *Hordeum spontaneum* "The area in which wild barley is massively spread is shaded. Dots outside this distribution centre represent more isolated populations, usually weedy forms" (Zohary 1989:360).
The Subsistence Economy of the Archaeological Complexes

Epipalaeolithic

The following synopsis on the archaeobotanical evidence for the Near East is taken from the Nesbitt (2002) and Colledge (2001). “Evidence from archaeozoological and archaeobotanical studies indicates that for the duration of the Epipalaeolithic period, there was a reliance on wild plant and animal foods and, moreover, that the seasonal availability of these resources dictated the movement of groups between settlements” (Colledge 2001:8). Three sites have supplied evidence for wild cereal exploitation in the Levantine Epipalaeolithic: Ohalo II, Abu Hureyra, and Mureybit; the former in Israel and the latter two in Syria (Nesbitt 2002:120). Colledge adds to these finds from the Natufian period. She includes Hayonim Cave, in the northern Levant, which provides evidence of wild barley exploitation (Colledge 2001:8). As for evidence of domestication in this period, Nesbitt summarizes, “While it is impossible to rule out domestication in the Epipalaeolithic, almost all the cereal remains at Epipalaeolithic sites are wild. When domesticates appear, they are in very small quantities, and are either undated or, at Abu Hureyra, mostly date as intrusives from higher levels of the site. Given that intrusion is a well documented archaeological phenomenon, it is likely the best explanation for the presence of domesticates in this period (120).” Although Nesbitt is skeptical on the definite appearance of domestication in the Epipalaeolithic, Colledge states that the few grains of domestic rye in the Late Epipalaeolithic occupation levels at Abu Hureyra represent the earliest evidence of domestic crops in the Near East (Colledge 2001:8).
Although evidence for domestication in the Epipalaeolithic is debatable, what is evident is that Epipalaeolithic levels at Abu Hureyra provided indication of a broader spectrum of plant foods exploited especially when compared with the apparently narrow spectrum of foods exploited during the Neolithic (Hillman et al. 1989:261).

**Aceramic Neolithic**

Returning to the discussion on whether domesticates appear first in the PPNA (Colledge) or PPNB (Nesbitt), Colledge states, “Domestic crops have been found on Levantine sites dated to the Sultanian/PPNA periods, archaeozoological evidence, however, indicates that during this time, there was a continued reliance on wild game” (Colledge 2001:8). More specifically, seven PPNA sites have produced plant remains; most of all lack definite evidence of domesticated cereals (Nesbitt 2002:120). Of the seven, three have provided evidence of cereal domestication: Iraq ed-Dubb, Jericho, and Tell Aswad with Tell Aswad providing the better evidence of the three. The evidence from Tell Aswad comes from the earliest levels in the form of domesticated emmer and barley. Although the grains and chaff remains are of the domesticated form, the dating of the level from which they came is problematic. Clarification of domestication status of Tell Aswad has potential if the grains themselves were radiocarbon dated. Nesbitt summarizes the evidence from the PPNA stating the sites with the most abundant well-dated and well documented cereal remains show no sign of cereal domestication and the sites with the least material and poorly dated plant remains demonstrate domestication (2002:121).
The PPNB phases, however, provide the first unequivocal evidence of plant domestication, with abundant domestic einkorn and emmer grain and chaff at the early occupation levels of Nevali Cori as well as minimal remains of domesticate-type grains of emmer and einkorn at the southeastern Turkish site of Cafer Hoyuk (Nesbitt 2002:121). Colledge states, “There was a reliance on cultivated crops throughout this period, although there is evidence for continued use of supplementary wild resources” (2001:10). Additionally, by the 10th millennium BC, the first domestic animals (goat and sheep) appear in the Levant.

Plant exploitation during the early phases of the PPNB is marked by continued use of domesticated cereals at Tell Aswad and Jericho, and continued exploitation of wild resources at the other sites. What is significant during the early phases is the evidence from Cyprus. Cyprus provides evidence of transported domestic crops and animals from the Levantine mainland (Colledge 2001:10). The archaeobotanical evidence from Cyprus will be discussed in detail below.

The middle and late phases of the PPNB provide evidence of cereal domestication at a number of sites. It is stated that during the middle-PPNB, the Neolithic crop package of cereals comes together, with domesticated barley for the first time and low occurrences of domesticated rye and naked barley (Nesbitt 2002:122). The middle PPNB demonstrates an increase in the amount of evidence for the use of domestic crops, as well as an increase in the diversity of crop domestication.
The late phases of the PPNB (Final PPNB/PPNC) demonstrate settlement abandonment with occupation ending at Jericho, Beidha, and Tell Aswad. Colledge states that for the sites that continued occupation, the plant remains remain unchanged from the middle PPNB. In addition to cereal exploitation during this period, lentil, pea, chickpea, bitter vetch and flax were exploited as well. By the Pottery Neolithic, “agricultural villages were widespread in many areas beyond the boundaries of the Levant (Colledge 2001:10).” Being that we are concerned primarily with the Aceramic Neolithic, the Pottery Neolithic will not be discussed here.

The Spread of the Neolithic Subsistence Package to Cyprus

In regards to the botanical evidence, the nature of the dispersal of the Neolithic crop package could not be better stated than by Daniel Zohary (1996:156):

...once the technology of crop cultivation was invented, and the domesticated forms of wheats, barley, pulses and flax first appeared, they probably spread over the Near Eastern arc in a manner similar to the way in which they later spread into Europe: not by additional domestication in each species but by diffusion of the already existing domesticates. In other words, soon after the first non-shattering and easily germinating cereals, pulses and flax appeared, their superior performance under cultivation became decisive, and there was no need for repeated domestication of the wild progenitors.

This would imply, as Bellwood states, that once the major cereals and legumes were domesticated they “pre-emptively” spread, rendering it non-economic for anyone to attempt to domesticate, separately, the local wild varieties (2005:49). Furthermore, in her discussion on the Cypriot-Near Eastern
botanical connection, Hansen reports the following differences in the types of plants represented.

Both wild and domesticated types of wheat and barley are found at a number of PPNA and PPNB sites, while no wild types are recorded on Cypriot settlements. The Near Eastern sites are somewhat earlier than the Cypriot ones and are located in areas where the wild cereals were naturally growing and were probably domesticated (Hansen 2001:123).

Although this was the case in 2001, new evidence from early Cypriot sites is changing traditional views. The gap between the earliest Near Eastern sites with evidence of domesticated cereals and the earliest sites on Cyprus with domesticated plants is becoming smaller with domesticated plants appearing nearly as early on Cyprus as the mainland. To summarize, "Data from the Cypriot Aceramic Neolithic sites so far indicate the presence of domesticated cereals only—i.e., einkorn wheat, emmer wheat and hulled barley. If the wild progenitors of einkorn and emmer were not present on the island, early settlers must have brought the domesticated forms of these taxa with them" (Peltenburg et al. 2001:71)

This is in agreement with the known Cypriot endemic flora. Particularly, wild barley is the only cereal founder crop progenitor species that is endemic to Cyprus today. It is also assumed to have been the only progenitor species to grow on the island in antiquity. To date, there has been no archaeobotanical data that can infer the exploitation of this wild cereal species in the Cypriot Aceramic Neolithic. Additionally, wild einkorn and wild emmer have not been recorded archaeologically, and to date there appears to be no recorded evidence
to indicate that these taxa were endemic in antiquity; however, this does not rule out the prospect of their presence in the past.

On the other hand, Willcox (2003) provides an exception to this paradigm. He argues for the exploitation of wild, as opposed to domesticated forms of, all three founder cereals crops: barley, einkorn, and emmerwheat. This evidence comes in the form of plaster impressions of the species left in mud-brick in addition to a scant amount of poorly preserved plant remains from Shillourokambos (Peltenburg 2001:71, Simmons 2007:238, Willcox 2003:234).

With this introduction we now turn to the botanical evidence for the earliest prehistory of Cyprus. A brief discussion on some of the key botanical findings will precede a table outlining the major botanical taxa reported for the Aceramic Neolithic of Cyprus. The Akrotiri phase of Cyprus was unsuccessful in recovering botanical samples. Simmons reports that seven flotation samples were examined by Dr. Julie Hansen and there were virtually no preserved remains. What she could identify was small amounts of *Pinus* sp., *Genista*-type remains, and indeterminate conifer (Simmons 1999:229). Of the multiple Aceramic Neolithic sites only seven have produced plants remains thus far. Including 'Ais Yiorkis, they are: Mylouthkia, Khirokitia, Kalavasos Tenta, Cape Andreas Kastros, Kholetria Ortos, and Dhali Agridhi. Following Hansen (2001) Dhali Agridhi will not be included in this discussion based on the paucity of plant remains recovered from the site.

The *Mylouthkia* plant assemblage is modest but, as Peltenburg argues, their importance far outweighs their paucity since they are amongst the earliest
recovered from Cyprus and the Near East. The charred plant assemblage includes all three founder cereal crops, einkorn wheat, emmer wheat, hulled barley, in addition to the associated cereal chaff (spikelet forks, flume bases, rachis internodes, and culm nodes), plus the following taxa: lentils, large seeded legumes, linseed/flax, pistachio, nuts, roots/tubers/wild/weed taxa (particularly wild grasses), and wood charcoal. To summarize the significance of the botanical assemblage: “The Mylouthkia archaobotanical data demonstrates that the agricultural tradition evident in the Khirokitian was already established on the island by the late 9th millennium B.P. and perhaps as early as the 10th millennium” (Peltenburg et al. 2001:71). For a more detailed report of the botanical results from Mylouthkia refer to Colledge (2001) and Murray (2001) and for a complete list of taxa refer to table 3.

As previously stated, the botanical data from Shillourokambos comes primarily from impressions in pise. Willcox attributes this to the adverse affect of the precipitation of calcium carbonate, which encrusted the plant remains causing serious damage to the quality of preservation (2003:234). The plant assemblage includes the presence of brittle-rachised barley, which is morphologically wild; in addition to emmerwheat (supported by chaff). The domestication status of the emmer grains and chaff is unknown. Willcox (2001:129) summarizes his results as follows:

The results, based on the finds of the 1999 campaign, indicate the use of wild barley during the early phase A. Emmer is also present, but for the moment the remains do not allow a distinction between wild and domestic morphologies. The identifications of einkorn are problematic, if present, it occurs as the two grained wild variety which can be confused with small emmer types in small samples.
Domestic barley appears in the middle and late phases...These new results with those from *Khirokitia* and *Cap Andreas-Kastros* suggest that the agricultural economy evolved independently of the continent.
Table 4 All botanical taxa from Cypriot Aceramic Neolithic sites. "*" All wild/weed taxa are in the order of the Flora of Cyprus (Meikle 1977,1985), "**"-denotes and identification of cf., "x"-denotes presence, "-"—denotes absence, "*x"—denotes domestication status unconfirmed. A figure following presence is the ubiquity of that species at that particular site reported by Hansen 2001 (Peltenburg et al. 2001:72, Hansen 2001:119-128 and data from Shillourokambos compiled from Willcox 2001:129-135).

<table>
<thead>
<tr>
<th>Site</th>
<th>Myouthkia 165 samples</th>
<th>Tonta 241 samples</th>
<th>Khirokitia 23 samples</th>
<th>Cap Andreas Kastro 40 samples</th>
<th>Kholetria Ortos 40 samples</th>
<th>Shillourokambos</th>
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<td>x</td>
<td>x 19%</td>
<td>x</td>
<td>x 78%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Triticum monococcum</em> 1g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Einkorn wheat</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>x 22%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Triticum monococcum</em> 2g</td>
<td>-</td>
<td>-</td>
<td>x 40%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Einkorn wheat</td>
<td>-</td>
<td>-</td>
<td>x 16%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Emmer wheat</em></td>
<td>x</td>
<td>x 21%</td>
<td>x 29%</td>
<td>x 87%</td>
<td>x 7%</td>
<td>'x'</td>
</tr>
<tr>
<td><em>Triticum dicoccum</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heeded barley</td>
<td>x</td>
<td>x 14%</td>
<td>x 65%</td>
<td>x 20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Hordeum vulgare/sativum</em></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><em>Hordeum bulbosum</em></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><em>Hordeum type murinum</em></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><em>Hordeum spontaneum</em></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Legumes (large seeded)</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Lentil (<em>Lens spp.</em>)</td>
<td>x</td>
<td>x 35%</td>
<td>x 39%</td>
<td>x 91%</td>
<td>x 80%</td>
<td></td>
</tr>
<tr>
<td>Pea (<em>Pisum sativum</em>)</td>
<td></td>
<td></td>
<td>x 3%</td>
<td>x &lt;1%</td>
<td>x 13%</td>
<td></td>
</tr>
<tr>
<td><em>Pisum elatus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grass Pea</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Lathyrus sativus/Lathyrus sp.</em></td>
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<tr>
<td>Site</td>
<td>Myouthkia</td>
<td>Tento</td>
<td>Khirokitia</td>
<td>Cap Andreas</td>
<td>Kholetria</td>
<td>Shillourokambos</td>
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<tr>
<td></td>
<td>165 samples</td>
<td>241 samples</td>
<td>23 samples</td>
<td>40 samples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horse bean</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Vicia faba/arborensis)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Vetch (Vicia spp.)</td>
<td>x</td>
<td>x 7%</td>
<td>x 6%</td>
<td>x 4%</td>
<td>x 12%</td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fig (Ficus spp.)</td>
<td>x</td>
<td>x 7%</td>
<td>x 14%</td>
<td>x 9%</td>
<td>x 5%</td>
<td></td>
</tr>
<tr>
<td>Grape (Vitis spp.)</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Pistachio (Pistacia sp.)</td>
<td>x</td>
<td>x 10%</td>
<td>x 18%</td>
<td>x 13%</td>
<td>x 47%</td>
<td>x</td>
</tr>
<tr>
<td>Hackberry (Celtis sp.)</td>
<td>-</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plum (Prunus sp.)</td>
<td>-</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Pear (Pyrus sp.)</td>
<td>-</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bramble berries (Rubus sp.)</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caper (Capparis spinosa)</td>
<td>-</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Oil Plants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olive (Olea spp.)</td>
<td>-</td>
<td>-</td>
<td>x 3%</td>
<td>x 30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linseed (Linum spp.)</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Wildweed taxa*</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Adonis sp. dentata</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fumaria sp.</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cf. Silene/Malva sp.</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinoleta arvensis</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molina sp. hyphestris minoris</td>
<td>x</td>
<td>-</td>
<td>x*</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genista sp.</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicago sp. cf. minima</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trifolium resupinatum/Trifolae tribe</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Astragalus sp.</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Scorpusus sp.</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Site</td>
<td>Mylouthkia</td>
<td>Tenta 165 samples</td>
<td>Khirokitia 241 samples</td>
<td>Cap Andreas Kastros 23 samples</td>
<td>Kholetria Ortos 40 samples</td>
<td>Shillourokambos</td>
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</tr>
<tr>
<td>LEGUMINOSAE</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cf. Pimpinella sp.</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UMBELLIFERAE</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galium sp.</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td></td>
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</tr>
<tr>
<td>COMPOSITAE</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buglossoides sp./</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>arvensis.tenuiflorum/v officinale</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Echium sp.</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amaranthus retroflexus</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beta vulgaris</td>
<td>x</td>
<td>-</td>
<td>-</td>
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<td></td>
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</tr>
<tr>
<td>CHENOPODIACEAE</td>
<td>x</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Polygonum sp.</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>-</td>
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<tr>
<td>Rumex sp.</td>
<td>x</td>
<td>-</td>
<td>-</td>
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<tr>
<td>LILIACEAE</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schoenus nigricans</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cf. Carex sp.</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Lökum sp./cf. perenne/nigulum</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avena sp.</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td></td>
<td>A. fatua</td>
</tr>
<tr>
<td>Pholiota sp.</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bromus sp.</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agropyron sp.</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td></td>
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<tr>
<td>Hordeum cf. murinum</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td></td>
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</tr>
<tr>
<td>Hordeum sp.</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cf. Setaria sp.</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td></td>
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<tr>
<td>GRAMINAE</td>
<td>x</td>
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</tbody>
</table>
CHAPTER 3

PALEOETHNOBOTANICAL INTERPRETATION

Introduction

Paleoethnobotany is a word given currency in the 1960s by Hans Helbaek (1960), Richard Yarnell (1963), and others who perceived themselves as applying an ethnobotanical perspective to the archaeological record (Cowan and Watson 1992:3). Although current literature uses the terms paleoethnobotany and archaeobotany as synonyms for the study of plant remains in archaeological contexts, Hastorf and Popper (1988:2) outline a clear distinction between the two. According to these authors, archaeobotany is the study of plant remains from archaeological contexts with a focus on the recovery and identification of plant assemblages. This term contrasts with paleoethnobotany which is the study of plant remains cultivated or utilized by human populations which have survived in archaeological contexts. While the former is data oriented, focusing on the methods for collection and analysis of the data, the latter applies the data to larger research questions pertaining to the interaction between people and plants of the past (Hastorf and Popper 1988:2). Note that Hans Helbaek of the Danish National Museum in Copenhagen coined paleoethnobotany to refer to the identification and cultural interpretation of plant remains from archaeological sites (Watson 14:1997).
Dincauze describes three classes of botanical data: macrobotanical, microbotanical, and chemical residue. Macrobotanical remains are the pieces of wood, seeds and fruits, stems and roots, leaves, buds, and cuticles that are visible and recognizable to the naked eye. Microbotanical remains are the plant parts and products that require magnification for study, including primarily pollen and spores, algae, diatoms, opal phytoliths, and calcitic crystals. The chemical residues are from sediments, charred crusts and animal tissues (Dincauze 2000:330). Although Dincauze’s classification is accurate, one concern is that microscopic analysis is just as essential for the study of macrobotanical remains as in the analysis of microbotanical assemblages.

A look at how charred macrobotanical remains arrive in archaeological contexts must first be discussed before an outline of the methods used in the recovery and analysis of charred remains from 'Ais Yiorkis can be presented. This discussion will be structured on the chronological sequence of formation processes effecting plant remains on archaeological sites from the time the plant remains are charred to the time the remains are recovered archaeologically. Research into formation processes is usually organized in terms of "object histories." The object’s history is the chronological sequence of events or processes that the object has undergone from the time it was produced as a cultural artifact until its remains are unearthed and studied by the archaeologist. In the analysis of formation processes that affect botanical assemblages, ethnoarchaeological research has provided the greatest insight in the predictable sequences that effect preservation (Renfrew and Bahn 2005:123). The logic
behind studying the formation processes is to evaluate the representativeness of
the charred plant remains found on archaeological sites, rather the "degree to
which the assemblages resemble the original constituents and composition of the
plant material utilized at the sites" (Colledge 2001:18).

Formation Processes

The first set of questions in a discussion of how plant remains preserve
archaeologically surround plant preservation and deposition. Michael Schiffer
(1987) has referred to this as formation, or 'site' formation processes. Formation
processes refer to all behavioral, mechanical, and chemical processes that,
either, alter or physically relocate the object, in this instance; charred
macrobotanics (Renfrew and Bahn 2005:121). Colledge emphasizes the
implications of Schiffer's (1987) publication, Formation Processes, by highlighting
the importance of identifying formation processes before behavioral and
environmental inferences are made (Colledge 2001:18). Furthermore,
"interpretation must always be tempered by consideration of biases in data:
depositional bias (what gets into the site in the first place), preservation bias
(which deposited materials survive), and recovery bias (what comes out of the
site)" (Pearsall 2000:188).

Macrobotanical Preservation

Plant remains preserve archaeologically in various ways. Zohary and Hopf
provide six manners in which plant materials survive in archaeological contexts.
Plants can be 1) preserved through charring, either during handling or by
conflagration; 2) preserved as impressions in either pottery or in bricks and daub;
3) preserved as parched remains in either arid or temperate regions, the former in caves and tombs and the latter in sealed containers; 4) preserved as waterlogged remains as in lakes, bogs, seawater, or wells; 5) preserved by metal-oxide as a result from contact with silver, copper, or iron; or 6) preserved as petrified remains as a process of either siliceous or calcareous mineralization (Zohary and Hopf 2000:3).

Plant remains can leave impressions on pottery, daub, and bricks. The impressions left on pottery are often difficult to identify, especially from early ceramic technologies, but when identification is possible the plant remains can be culturally classified and dated (Zohary and Hopf 2000:5). Parched plant remains become preserved in arid environments due to extreme dryness and this environment’s ability to block bacterial and fungal decomposition. Anaerobic conditions as well as bronze, silver and iron environments are all preservation conditions that keep the plant from decomposing; the former by humic acids in bogs and the latter by impregnating the plant remains with metal oxides which are toxic to bacteria and fungi. Lastly, preservation of plant remains by mineralization is caused by the filling of the organic plant remain with the content of cell walls of inorganic substances (Zohary and Hopf 2000:6).

Charred plant remains become carbonized upon exposure to high temperatures turning the plant’s organic compounds into charcoal (Zohary and Hopf 2000:4). Carbonization, or reduction of organic materials, occurs when the burning environment lacks enough oxygen for complete combustion. Water and various compounds are driven out and the remaining materials are converted to
a chemically stable mineral state (Dincauze 2000:334). Charcoal, due to this stable mineral state, preserves well in archaeological contexts due to its resilience to destructive organisms (Zohary and Hopf 2000:4, Gale and Cutler 2000:2).

This discussion of formation processes effecting plant remains will be limited to the reasonably predictable object histories of charred macrobotanics. The first question regards the nature of how plant remains become charred in the first place. Plant remains can be charred or burned archaeologically as a result of multiple circumstances. For instance, they can be charred as a consequence of a domestic fire or conflagration; the former as a result of cooking and the second as the end result of either accidental or deliberate structure destruction (Colledge 2001:18).

Plant-Food Processing

A brief discussion of the different types of plant-processing techniques is useful in understanding what plants and plant parts survive archaeologically. Stahl summarizes the various plant-food processing techniques as follows: grinding/pounding/grating; soaking/leaching; drying; heat treatment; and fermentation (1989:172). Seeing as this thesis deals exclusively with charred plant remains, this discussion on plant-food processing will discuss the food-processing technique of heat treatment. Plant remains can be cooked by exposure to several types of heat: dry, moist or hot oil. These different exposure methods result in, roasting and parching (the result of dry heat), boiling, steaming
or simmering (as a result of moist heat), and frying (as a result of hot oil use) (Stahl 1989:181).

It is imperative to note that what gets burned and what survives, archaeologically, is more of an indication of what was thrown away, as opposed to what was actually consumed. Dennell (1976), as quoted by Colledge, notes that “It is certainly a disturbing possibility that much of our archaeobotanical evidence might provide a more accurate indication of what was thrown away than of what was actually eaten” (2001:19).

Additionally, Dincauze states that the occurrence of charred plant remains in, for example, pits, hearths, house floors, and middens is related to site function, duration and mode of deposition (2000:334). She provides more detail citing Hally (1981), who identifies five sources of variability related to the presence and recovery of plant remains. They are as follows: 1) the duration of occupancy (including seasonal occupational inferences), 2) the site’s function (including a suite of activities), 3) the nature of abandonment (i.e., as a result of a structure fire); 4) the timing of abandonment (whether it was gradual or abrupt), and 5) the sampling and excavation methods (Dincauze 2000:334).

Post-Deposition Processes

Once the plant assemblages are deposited within archaeological contexts, they continue to experience processes that effect their movement and preservation. Various post-depositional processes include: pedoturbation (caused by the mixing of soils), faunalturbation (caused by animal burrowing), floralturbation (caused by plant growth), cryoturbation (caused by the action of
freezing and thawing), graviturbation; agilliturbation (swelling or shrinking of clays), aeroturbation (gas, wind, and air); aquaturbation (water), crystalliturbation (growth and wasting of salts), and seismiturbation (earthquakes) (Colledge 2001:20).

Representativeness

Colledge elucidates that archaeobotanical assemblages are unlikely to be representative of the original constituents and composition of plant material exploited in the past. This is due to the quantity and quality of plant's preservation being depended upon the nature and frequency of the fire, in addition to the reality that only a portion of the assemblage will come into contact with the fire, the preservation of plant parts depend on the vigor of the plants themselves, and the difficulty of identifying single behavioral activities due to depositional and post-depositional processes. For that reason there is bound to be an over-representation of seeds and an under-representation of other plant parts due to the resilient nature of grains. Coincidently, seeds are “attractive” sources of evidence for past plant use due to the ability to identify to species and therefore more confidently infer details of the past (Colledge 2001:20-21).

Missing Foods

Regarding ‘missing foods,’ plant remains provide a predictably incomplete picture of past diet due to the inevitable gaps in the archaeological record and the nature of preservation by charring (Hillman 1989:218). The missing foods would include the foods that can be eaten raw or cooked by boiling and therefore miss the high-temperatures needed for charring (Colledge 2001:21).
Consequently, charred food remains seldom include foods based on leaves, flowers, shoots, or tissues from organs such as tubers, rhizomes, corms, and bulbs (Hillman et al. 1989:260). Moreover, seed food that is likely to have been exploited as food but are absent in the archaeological record are those seed-based foods that do not require roasting or parching for consumption (Hillman et al. 1989:261).

Contributions to Diet

Following the position of Colledge (2001) and, thus van Zeist and Bakker-Heeres (1982), "no assumptions will be made about the relative importance of plant taxa on the basis of the abundance of seeds found on the sites" (Colledge 2001:22). This is due to the concerns with representativeness in archaeobotanical assemblages. Contributions to diet will therefore be on the presence of taxa, as opposed, to the quantity of particular taxa in the assemblage.

Seasonality

"The season of occupation of transitory camps can be inferred from patterns of exploitation of plant and animal resources. The most diagnostic plant taxa for this purpose are those which have a short season in which they are viable. The presence of these taxa makes it possible to bracket the period of occupation of a site more accurately" (Colledge 2001:22). For example, in their discussion of seasonality at Epipalaeolithic Abu Hureyra, Hillman et al. (1989) used three components of seasonality to infer that the site was occupied possibly year-round. The components were: seasons of plant-food availability, probably
seasons of gathering, and the possible seasons of site occupation. In regards to
seasons of occupation, it is important to consider the ability to store dry seeds
and many 'root' foods making the inference of site occupation at that time difficult
(Hillman et al. 1989:263).

Identification

Identification of the plant remains involves using a modern reference collection
to compare morphological and anatomical characteristic of the preserved
archaeobotanical remains, using well-preserved and securely identified
archaeological specimens (if available), pictures, drawings, and descriptions of
plant morphology. Prior to excavations at Abu Hureyra, identifications of cereals
remains from archaeological contexts remained quite problematic due to limited
understandings of the nature of variation in cereal populations from Southwest
Asia. Gordon Hillman, as a result of problems with identification of the plant
remains from Abu Hureyra, assembled an extensive reference collection of
cereals, fruits and seeds from his research area (Hillman 2000:341). This
reference collection has become a significant factor in development of research
in the origins and spread of agriculture in the Near East and is the reference
collection used in this analysis.

It is important during identification to take in consideration the effects of
prehistoric charring on grain morphology. Charred remains retain most of their
morphological and anatomical characteristics when charred at a slow pace and in
mild fires. They lose their morphological and anatomical integrity when exposed
to fairly high temperatures, ranging from 200 to 400 °C, or depending on the amount of water present in the seed at the time of charring (i.e. the more water present the greater the deformation) (Zohary and Hopf 2000:4). Zohary and Hopf state, “In cereals, the most obvious changes are shrinkage in the length of the kernel together with a relative increase or ‘puffing’ in its circumference. Size reductions and/or cracking appear also after the charring of seeds of flax, broad bean, pea, and several other grain crops...some plants do not generally survive charring (2000:4).”

Interpretation

The objective of paleoethnobotany is to generate data that can shed light on the interrelationship of past people and plants. Organizing archaeobotanical data into qualitative and quantitative data will reveal patterns in plant assemblages and provide insight into the past: qualitatively, documenting the occurrence of botanical taxa present within an assemblage, and quantitatively by using non-multivariate or multivariate statistics. Documenting the presence of plant remains in archaeological contexts, as stated by Pearsall (2000:192), can provide information of seasonality of site occupation, past vegetation and ecology, diet, subsistence practices, trade, and domestication. Quantitative analysis produces a mathematical dimension to the analysis of plant remains. The simplest measure being the ratio and more specifically, density ratio which calculates the amount of archaeobotanical remains per liter of volume floated (Pearsall 2000:196).
CHAPTER 4

METHODOLOGY

History of Flotation

Modern paleoethnobotany owes much to the early discoverers of the flotation method. In 1860, H. Unger began experimenting with flotation by submerging, in water, material from ancient mud bricks. Jones followed Unger in the 1930s with a similar technique he applied to the Arvatovi Pueblo. The following decade, the botanist Hugh Cutler used the technique in the American Southwest (Smith 1995:36). Although the foundations of flotation were being explored in various regions by Unger, Jones, Cutler, and others its wide-spread application and systematic methodological advancement is most often attributed to Stuart Struever (Hunter and Gassner 1998:143). The earliest publications dealing specifically with the techniques used to separate the inorganic plant materials from soils sampled from archaeological contexts can be traced to two authors, Stuart Struever (1968) and Hans Halbaek (1969).

With Struever at the forefront of the processualist movement in American archaeology the theoretical foundation for methodological developments in flotation techniques led to his systematic technique for the recovery of charred remains from archaeological contexts. Within this paradigm arose the research questions pertaining to past human subsistence strategies and diet and thus a
necessity to incorporate flotation analysis in research designs. Struever argues that without the use of flotation procedures, "inferences about prehistoric subsistence patterns from faunal and floral remains are sharply biased in favor of hunting, over natural plant food collecting, since conventional screens are not adequate for recovery of most plant remains or small animal bones (353:1968)."

Flotation

In 1968, Stuart Struever published, *Floatation Techniques for the Recovery of Small-Scale Archaeological Remains*. This publication has been repeatedly credited as the beginnings of flotation techniques and thus of the sub-discipline of paleoethnobotany within the American tradition (Brady 1989: 208, Cobb and Faulkner 1978:4, Kidder 1997:40, Pearsall 2000:20, Moeller 1982:3). When his methodology is examined in detail, any discussion of the history of flotation and the result of the various modifications of the technique used today should be structured around his two step recovery process. Initially, Struever describes, the soil should be processed in the field by a water-separation technique (refer to figure 6), followed by a chemical flotation process in the laboratory (refer to figure 7) (353:1968).

Struever describes his recovery technique as being a simplified water separation system adapted to free-flowing streams where the current and hand agitation separate ecofactual materials from their archaeological matrixes (Cobb and Faulkner 1968:4). Flotation operates under the assumption that charred ecofactual materials will float while heavy artifacts will settle due to differences in
density. As Struever states, drawings often convey pictorially, better than words, the basic ideas of this technique (1968:362).

Figure 6 Diagram illustrating the principle of differential settling rates used in the water-separation process (Struever 1968:356).

![Diagram of water-separation process](image)

Figure 7 Diagram illustrating the chemical flotation process (Struever 1968:356).

![Diagram of chemical flotation process](image)

Struever (1968) states that, in combination, the two steps produce the best results in the recovery of small-scale food remains; more specifically, carbonized plant remains. He summarizes the water-separation technique as yielding two products: “1) bone and plant remains retrieved with a tea strainer (termed the
light fraction); and 2) stone, burnt clay, small pottery sherds, etc. recovered from the tub bottom (termed the heavy fraction).” He further states, that although this technique is often termed “flotation”, water-separation is the preferred term since the recovery of the two fractions is based on differential settling rates and that only occasional plant fragments actually float in the initial processing, as illustrated in figure 6.

Since, Struever noted, only a portion of the plant fragments are recovered during the initial processing, the light fraction requires additional processing. The additional processing of the light fraction requires the use of chemicals to further separate the materials. Struever (1968) reports an almost 100 percent separation of the charred material using a zinc chloride solution, with the lighter plant materials rising to the top and the denser bone fragments settling to the bottom.

Under the European tradition, Hans Halbaek utilized recovery methods for archaeobotanical retrieval at Deh Luren (Smith 1995:36). He describes his version of the technique in the publication, Plant collecting, dry, farming, and irrigation agriculture in prehistoric Deh Luran 1969. Halbaek (1969:385) describes his method as follows:

This process in its most primitive form is carried out by drying soil or ash sample and then pouring it into a basin with water. Under cautious stirring, the water is slowly poured through fine mesh sieve, the plant matter floating on the surface and being retained in the sieve. When the mineral matter approaches the lip of the basin, the process is stopped and the sediments, as circumstances indicate, either thrown away, or dried again and subjected to other kinds of examination. After drying the plant material is ready for the microscope.

80
There are various adaptations used today that extend on Struever's simplistic bucket flotation and Halbaek's sieve-technique and utilize various modern equipment and chemicals. The variations used today fall under three general methodological classifications; manually agitated: machine assisted, and machine assisted with the use of air compression and frothing/chemical agents (Pearsall 2000:19). Although a technique can be classified under one of the three variations, in practice it is more likely that the methods are combined to some extent depending on the materials at hand, availability of a water resource, economic considerations, specific research questions, and the nature of the soil matrix.

For instance, in reference to adaptations to the early flotation techniques of Struever and Halbaek, Kidder (1997) and Ford et al. (1998) present their data on experiments with alternatives to Struever's chemical flotation in an effort to maximize recovery rate of charred plant remains from clay rich or moist soils. Kidder states that chemical flotation is but one means of separating carbonized plant remains from heavy fractions. He proposes a less expensive and less hazardous alternative to Struever's chemical processing. The proposed solution, as opposed to toxic chemicals, is sugar. Sugar, it is stated, is capable of floating charcoal and seeds, but not dense enough to float heavy fractions such as bone, lithics, or fired clay (Kidder 1997:39). This technique, as with chemical flotation, proved to be less ideal because the following reasons: there is a significant risk of contamination that jeopardizes the integrity of the plant remains for use in radiocarbon dating; there is the possibility of fragmentation due to the nature of
sugar and its re-crystallization qualities; and there is the possible damage caused by pests attracted to the sugar during curation of the charred materials (Ford et al. 1998:370, Kidder 1997).

Since the earliest publications dealing primarily with flotation techniques, there have been numerous experiments that have tested the differing field recovery techniques, chemicals, and equipment used in flotation with the aim of unearthing the most consistent and accurate field recovery technique for charred macrobotanics. The consensus is that all variations produce damage to and loss of charred materials from archaeological contexts. Logically, it would be expected that the techniques that use the gentlest agitation, the least amount of processing and no chemicals would be the techniques that produce the least amount of damage to and recovery of charred material. Although the simplistic of methods are ideal, the choice to use a particular field recovery technique over another depends on multiple factors, such as project-specific sediments, budget, available field equipment, field location and conditions, as well as time (Wagner 1988:28). Additionally, research questions, pertaining specifically to dating, will determine the decision to further process the light fraction with chemical agents.

**Field Recovery**

Before the soil can undergo water flotation, the sample must be properly taken from the archaeological context. Hastorf and Popper (1999) describe three common strategies for the retrieval of flotation samples: 1) pinch or grab, used for ephemeral occupations and trash middens; 2) column, used to interpret
chronological change in large differentiated deposits; and 3) bulk, used to get information about cultural context by taking a standard amount from a specific location in every excavation level.

Struever reports his results of bulk processing and states that often features devoid of plant materials yielded sizable quantities of plant remains when bulk sampling was conducted. Struever (1968:361) additionally highlights the usefulness of taking multiple samples from one feature, one each from several different fill-types, or archaeological contexts. An important method to accompany any of the three sampling strategies is the retrieval of control samples to compare with the remains of richer deposits (Struever 1988:6). Wright (2005) addresses the concern of not how to choose a sampling technique, but rather what is the best method for calculating the size\(^2\) of the samples once the sampling strategy has been determined.

Limitations of Flotation

The limitations of flotation in general include the realization that not all possible artifacts will be recovered and that there will occur differential breakage of plant remains depending on the methods and equipment used in recovery (Wagner 1988:23). Pearsall (2000:15) states, regarding the limitations of simplistic flotation techniques in particular, “most manual flotation systems are less consistent and effective in recovering small remains than mechanized or machine-assisted systems...manual agitation may not be vigorous enough to

\(^2\) Wright states that size can be established by weight or by the volume measured in the ground before excavation or measured in a calibrated bucket. It is important to note that sediment weights vary according to moisture content present in the matrix (2005:20).
float some dense material (nut shells, dense wood charcoal, and the like), resulting in incomplete recovery." This critique of simplistic flotation methods can be questioned when two issues are considered. Firstly, the possibility of recovery of more complete macro remains resulting from gentle hand agitation, as opposed to mechanized or machine-assisted is greater. Additionally, the heavy or more dense fractions would be recovered equally, both in manual and in machine-assisted techniques because the heavy fractions in both methods would be dried and thereafter sorted.

Cyprus-Flotation Methods

Given that this thesis deals primarily with the Aceramic Neolithic of Cyprus, the most appropriate approach in a discussion of common flotation methods used in Cyprus is to summarize what is reported from some of the Aceramic sites with charred materials.

Khirokitia

Waines and Price report on the plant remains present from the 1972 brief sounding of Khirokitia in 1972. Previous excavations from 1936-1946 produced no plant materials due to the lack of knowledge of flotation techniques at that time. They report, “The total volume of earth which was wet-sieved was only a little over 2 cu.m; the plant remains were recovered through flotation using a mesh 1.6 mm square (281:1977).” In addition to the limited methodological description of flotation techniques, Waines and Price also provide their methodology of identification of plant remains. Identification of domestication
status used for the Khirokitia plant remains is grain size and comparison to modern day cultivated forms of the three cereals; *Triticum monococcum, Triticum diococcum*, and *Hordeum vulgare*. They state, "From the size of the grains and from the lack of evidence to the contrary, the cereals are assumed to be of these domesticated forms. Grain size of each species is similar between the two phases of Tholos XLVI and the morphology approaches that of present-day cultivated forms (281:1977).” Along with the description, Waines and Price report the measurements (in mm) of the cereal grains as well as the frequency and density of seeds by context.

Although Miller presents the botanical results from the Khirokitia 1977 and 1978 excavations, very little is discussed in terms of flotation methods. Like Waines and Price, Miller uses grain size in determining domestication status. The catalog of samples from Khirokitia are reported, including; provenience; liters floated per sample; weight in grams of material, seeds and charcoal; and the density of material per bucket (184:1984).

In regards to flotation methods Hansen (1984) reports that total liters floated in the four seasons of excavation at Khirokitia (1986, 1988-1990). She discusses very little in her preliminary report about characteristics of plant identification as well as attribution to domestication. She, however concludes, “The plant remains from the last four seasons of excavation at Khirokitia are comparable to those from previous seasons...the plants remains are representative of the products of cultivating fields of emmer and einkorn wheat and lentils (394:1994).”
Hansen (1991) does provide more detail in regards to flotation methods in *Paleoethnobotany in Cyprus*. She reports, "The flotation process consisted of pouring a sample of dirt slowly into water, stirring, and pouring the floating fraction into a sieve of about 1 mm mesh. Samples were taken from areas where carbonized material was evident, as well as from hearths and basins. Thus, not every excavated stratum was sampled, making it impossible to draw comparisons among samples throughout the site and introducing a bias into the data" (226:1991).

**Kalavasos-Tenta**

In the most recent publication on the excavations at Kalavasos-Tenta, Julie Hansen (2005:323) reports on the field methods used in the recovery of the charred botanical material. She describes the flotation methods, designed by A.J. Legge and built by D. Ahn, as a “froth flotation system.” It is further reported that in the initial years of recovery, PPG\(^3\) was used as the frothing agent followed by paraffin, which was added to aid in flotation. The last couple of years of excavation, only paraffin was used. Not only does she discuss briefly the methods used in recovery but goes on to describe the sampling strategy as well, "Approximately 10 liters of every excavated deposit were passed through the flotation system, although additional material was processed from deposits that appeared, *in situ*, likely to be rich in botanical remains" (Hansen 2005:323). Additionally, identification was based on morphological comparisons with modern specimens (Hansen 2005:323).

\(^3\) PPG (polypropylene glycol) is a frothing agent used in flotation.
Mylouthkia

Mary Anne Murray, on her botanical findings from Mylouthkia, reports that the charred materials were recovered by flotation, using 1 mm and 250 micron mesh sieves (2003:59). She additionally discusses the sample sizes (in liters) and the proportion of charred plant material and wood charcoal. Like the plant remains from the other Aceramic sites on Cyprus, identification of the plant taxa was based on morphology and comparisons with modern specimens. Murray provides a detailed description of the quantification methods used in the analysis of the plant remains and argues for the methods assisting in the recognition of the multiple pre- and post-depositional factors affecting the composition of the botanical assemblage as well as depositional history and sample size. The quantification methods she reports include ubiquity, density, abundance, diversity and preservation (2003). Additionally, Colledge (2003:239) reports on the methods used in the Mylouthkia samples as follows: “Simple bucket flotation was used to separate the plant remains from the ashy sediments. A total of 2,450 litres were sampled and processed from four contexts...”

Field Methodology- ‘Ais Yiorkis 2005

The archaeobotanical remains from ‘Ais Yiorkis were preserved through prehistoric charring, and recovered archaeologically by water flotation. The main objective of the sampling strategy was to acquire a representative sample of the site’s paleobotanical assemblage. The samples were retrieved by troweling and measured with 10 liter buckets. The soil samples were labeled with relevant
provenience information and carried off-site in sugar bags. The decision to float the soil samples off-site was based on the field conditions including the remote nature of the site as well as a lack of water and technical resources. Flotation was conducted at the Lemba Archaeological Research Center (LARC) under the guidance of Dr. Sue Colledge and the center manager Dr. Paul Croft. Seventeen samples were taken from the 2005 field season with sampling size ranging between 8 liters to 160 liters per sample totaling 1,156 liters (refer to table 3.1). Note that additional samples were taken from the 2006 field season, but this thesis presents the results from the 2005 season exclusively.

The samples were floated in an eighty-five liter metal barrel in 10 liter increments, changing the water after each sample to prevent cross-sample contamination. Within the barrel was a 1 mm mesh used to catch heavy fractions greater than 1 mm. The heavy fractions were labeled and dried out of direct sunlight and thereafter sorted at LARC. The heavy fraction was sorted in the field resulting in small artifacts of bone and chipped stone. No charred botanical remains were found in the heavy fraction.

The charred plant remains were retrieved manually by gentle hand agitation. The inorganic materials were elevated to the top of the barrel by a low running tap below the >1mm mesh. Water overflows from the low running tap were caught either by a 250 μm mesh bag or two metal sieves (one >1 mm and the other >250 μm); the latter being used when the former was unavailable. The bags, or metal sieves, were dried out of direct sunlight and labeled with the following: the amount of liters per sample, the date retrieved, the sample field
Laboratory Analysis- ‘Ais Yiorkis 2005

Laboratory analysis consisted of first sorting the plant remains from all modern organic materials, then identifying the plant taxa and finally, tabulating the plant assemblage (Hastorf and Popper 1988:7). All laboratory analysis was conducted at University College London during the spring of 2006 under the instruction and guidance of Dr. Colledge. Initial processing of the samples involved a division of the samples into <1mm and >1mm sub-samples, which were thereafter treated as separate entities. Both entities were sorted under a low power binocular microscope. The >1mm samples were sorted with the aim of separating the charred remains from modern disturbances such as rootlets and twigs; with the exception of wood charcoal which was not separated from the sample. The charred plant remains were then grouped into two categories; identifiable and indeterminate. The identifiiables were further identified to genus and, if possible, species. The indeterminates were weighed and recorded.

In the interest of laboratory time and the predicted retrieval of plant remains, the <1mm samples were sorted on the basis of >1mm relative sample abundance. The <1mm sample were further divided into half, quarter, and eighth of samples. An eighth of the <1mm samples with the greatest yields from their corresponding >1mm samples were sorted and divided into two categories;
indeterminate and identifiable. The indeterminates were weighed and recorded and the latter were identified to genus and recorded.

The plant remains were identified on the basis of plant morphology as well as with comparison to modern plant taxa. Hillman's Near Eastern Reference collection housed at the Institute of Archaeology, University College London was used as the comparative collection for the identification of the plant taxa present. Identification by means of plant morphology was provided under the guidance of Dr. Colledge.

The Samples

Seventeen samples were taken from four units: 15N25W NEQ (Feature 5, Feature 10), 20N35W SEQ (Feature 7), 20N40W SWQ (Feature 4), and 20N45W SWQ. Six samples from 15N25W NEQ were taken totaling 333 liters. Two samples were taken from Feature 5 (SFN 27 and SFN 31), two were from Feature 10 (SFN 33 and SFN 34), and two were from Feature 11 (SFN 53, 58). Unit 20N35W SEQ contained Feature 7 and produced a sample of 50 liters from one SFN 42. Feature 4 (20N40W SWQ) comprises seven samples (SFN 28, SFN 32, SFN 37, SFN 43, SFN 46, SFN 49, and SFN 51) with a total volume of 680 liters. Lastly, unit 20N45W SWQ comprised three samples (SFN 48, SFN 56, SFN 57) totaling 143 liters. In sum, the 2005 field season floated 1156 liters.
Table 5 Table briefly describing the feature from which the flotation samples were taken.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>20N40W</td>
<td>Pit</td>
</tr>
<tr>
<td>5</td>
<td>15N25W</td>
<td>Plastered Pit</td>
</tr>
<tr>
<td>7</td>
<td>20N35W</td>
<td>Pit (possibly natural)</td>
</tr>
<tr>
<td>10</td>
<td>20N45W</td>
<td>Pit</td>
</tr>
<tr>
<td>11</td>
<td>15N25W</td>
<td>Pit</td>
</tr>
</tbody>
</table>
Table 6  Table presenting samples, the amount of liters per sample, and general sample provenience information (SFN= sample field number, N= North, S= South, E=East, W=West, Q=Quadrant, L=Level, F=Feature).

<table>
<thead>
<tr>
<th>Sample Field Number</th>
<th>Provenience</th>
<th>Liters</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFN 27</td>
<td>15N25W NEQ L6 F5</td>
<td>8</td>
</tr>
<tr>
<td>SFN 31</td>
<td>15N25W NEQ L9</td>
<td>15</td>
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<tr>
<td>SFN 33</td>
<td>15N25W NEQ F10</td>
<td>50</td>
</tr>
<tr>
<td>SFN 34</td>
<td>15N25W NEQ F10</td>
<td>100</td>
</tr>
<tr>
<td>SFN 53</td>
<td>15N25W NWQ L11.2</td>
<td>50</td>
</tr>
<tr>
<td>SFN 58</td>
<td>15N25W NEQ L9</td>
<td>60</td>
</tr>
<tr>
<td>SFN 42</td>
<td>20N35W SEQ F7 L3</td>
<td>50</td>
</tr>
<tr>
<td>SFN 28</td>
<td>20N40W SWQ L6 F4.1</td>
<td>160</td>
</tr>
<tr>
<td>SFN 32</td>
<td>20N40W SWQ L7 F4.2</td>
<td>160</td>
</tr>
<tr>
<td>SFN 37</td>
<td>20N40W SWQ L8 F4.3</td>
<td>150</td>
</tr>
<tr>
<td>SFN 43</td>
<td>20N40W SWQ L6 F4W</td>
<td>110</td>
</tr>
<tr>
<td>SFN 46</td>
<td>20N40W SWQ L7 F4.2W</td>
<td>50</td>
</tr>
<tr>
<td>SFN 49</td>
<td>20N40W SWQ L8 F4.3W</td>
<td>25</td>
</tr>
<tr>
<td>SFN 51</td>
<td>20N40W SWQ L9 F4.4</td>
<td>25</td>
</tr>
<tr>
<td>SFN 48</td>
<td>20N45W SWQ L9.2 F9.2W</td>
<td>48</td>
</tr>
<tr>
<td>SFN 56</td>
<td>20N45W SWQ L10.2 F10</td>
<td>20</td>
</tr>
<tr>
<td>SFN 57</td>
<td>20N45W SWQ L2 F13.1</td>
<td>75</td>
</tr>
</tbody>
</table>
CHAPTER 5

PRESENTATION OF DATA

Gordon Hillman's botanical reference collection housed at the Institute of Archaeology, University College London was the modern reference collection used in the identification of botanical data from 'Ais Yiorkis. The guidance in the identification process of Dr. Susan Colledge was fundamental to the proper identification of taxa and was greatly appreciated. The criteria used in identifying each of the plant species will first be outlined followed by multiple tables (tables 7-13) presenting the taxa present in each unit addressing the first research question outlined in chapter 1: What are the plant taxa present at 'Ais Yiorkis? Additionally, the question of whether the taxa present are of the wild or cultivated form will be addressed in the discussions for the identification of each taxa.

Cereals

Before an outline of the criteria used in taxa identification can be presented, an introduction to basic plant morphology is necessary and is as follows. A grain is a single-seeded kernel often referred to as 'caryopsis.' The caryopsis is more or less ovoid with brush (or hairs) at the apex. A groove is visible from the apical to the embryo end (bottom tip) on the ventral side and an outline of the embryo is visible on the bottom portion of the dorsal side (Lone et al. 14:1993). Within a
genus are morphological characteristics that distinguish individual species. Species in which the kernel is not released during threshing and has glumes attached to it at maturity are referred to as glume wheats and conversely, naked wheats are those species that have loose grain that detach from the chaff at maturity with greater ease (Lone et al. 1993:14).

Figure 8 Photo of a charred grain of *Triticum monococcum* 2g, Illustrating the terms of description used here (photo by Susan Colledge 2006).

The Plant Remains

The seventeen samples are composed primarily of two-grained einkorn wheat and barley in addition to low ubiquities⁴ of a couple of fragments of pulse/oil

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⁴ Ubiquity is the determination of presence of individual taxa and is quantified by the number of samples in which it occurs.
plants and a variety of wild taxa. The ubiquity (refer to table 14) for the cereal grain taxa present, or the percentage of samples for which the cereal grain taxa are present, are as follows: *Triticum monococcum* 2g\(^5\) demonstrates a ubiquity of 47%, *Triticum monococcum* 1g\(^6\) demonstrates a ubiquity of 5.8%, and *Hordeum vulgare* demonstrates a ubiquity of 29.4%. The cereals that were not identified to a particular species demonstrate a ubiquity of 64.7%. In addition to the cereal grains of *Triticum monococcum*, there was a low ubiquity (5.8%) of glume bases that most resembled those of *Triticum monococcum*. As for the pulse/oil plants, the ubiquity for both the fragments of *Pisum/Vicia* sp. and *Pistacia* sp. is 11.7%. The remaining wild taxa are as follows; *Lolium* sp., *Avena* sp., *Stipa* sp., *Bolboschoenus* cf. *maritimus*, and *Cruciferae* cf. *Brassica/Sinapis*. The ubiquity scores for the wild taxa are as follows: *Lolium* sp. 11.7%, *Avena* sp. 17.6 %, *Stipa* sp. 5.8%, *Bolboschoenus* cf. *maritimus* 5.8%, and *Cruciferae* cf. *Brassica/Sinapis* 5.8%.

*Triticum monococcum* 2g (two-grained einkorn wheat)

The einkorn recovered from ‘Ais Yiorkis was identified based on morphology, grain size, and known habitats of its wild progenitor to be of the domesticated variety. Two-grained einkorn grains are asymmetrical in cross-section, they have a rounded lateral appearance, a flat ventral surface, a lop-sided dorsal ridge and their apical ends appear tapered. As previously stated, two-grained einkorn dominate the ‘Ais Yiorkis 2005 botanical assemblage with a ubiquity of 47%.

There are a total of 250 grains of two-grained einkorn from the seventeen

\(^5\) 2g denotes two-grained  
\(^6\) 1g denotes one-grained
The distribution of two-grained einkorn is rather distinctive, with 241 of the 250 total grains on site coming from the southwest quadrant of unit 20N40W (96.4%). The remaining 5.6% of two-grained einkorn distribution is split unevenly between the northeast quadrant of unit 15N25W (3.2%) and the southwest quadrant of unit 20N45W (2.4%). Unit 20N40W appears to represent the largest quantity of identifiable remains from the 2005 season and will therefore be discussed in more detail in chapter 6.

*Triticum cf. monococcum* 2g

The total number of grains that were unable to be assigned with great confidence to *Triticum monococcum* 2g was 17. The assigned grains were characterized as morphological variants of the two-grained einkorn variety but appeared to have a more puffed or blown up look in addition to an apical end that is more rounded and a dorsal ridge that is less pronounced. The distribution of these grains is quite distinctive, with all 17 total grains appearing in one sample within the southwest quadrant of unit 20N40W, SFN 28.

*Triticum monococcum* 1g (one-grained einkorn)

The single grain of einkorn from the one-grained variety was identified based on the following morphology: a strong dorsal ridge in cross-section, rounded ventral cheeks, tapered apical and embryo ends, an asymmetric dorsal keel,

---

7 The cereal indeterminates were given a calculated whole grain equivalent by weighing the sum of three whole grains of *T. monococcum* 2g and two whole grains of *H. vulgare* resulting in 0.05 grams. The decision on the proportion weight was made on the general proportion of cereal taxa within the samples. The weight of the cereal indeterminates for each context were then divided by 0.05 grams and multiplied by 5 resulting in the whole grain equivalent figure.
lateral compression, and a rounded ventral surface. As previously discussed, the ubiquity of one-grained einkorn at ‘Ais Yiorkis is 5.8%. The one sample from which this single grain of one-grained einkorn appeared is from the southwest quadrant of unit 20N40W, SFN 37.

*Triticum cf. monococcum* (glume bases)

There were three glume bases that most resembled those of einkorn wheat. The distribution of the three glume bases was consistent with the two-grained einkorn grain distribution. One glume base was present in the greater than 1 mm portion of SFN 32 and two glume bases were present in the less than 1 mm portion of SFN 32; all three found in the southwest quadrant of unit 20N40W.

*Hordeum vulgare* (barley)

In addition to the einkorn wheat being of the domesticated variety, barley was identified as being of the domesticated form. The identification of *H. vulgare* was identified based on an angular cross-section, a wide and shallow ventral groove, a convex ventral and dorsal surface, a tapered apical and embryo end, in addition to the presence of longitudinal ridges and the absence of a dorsal ridge. As previously mentioned, the ubiquity of barley at ‘Ais Yiorkis is 29.4%. Similar to the einkorn wheat distribution, the distribution of barley is solely from the southwest quadrant of unit 20N40W. The total number of grains from this unit, and therefore the site, is 65 with the greatest quantity of barley coming from SFN 28 (45 grains).

The cereal indeterminates were grains that could not be identified to either *Triticum monococcum* or *Hordeum vulgare* and the total number of grains is 97.
given in weight. The weight in grams for the indeterminates was 912 grams with a ubiquity of 64.7%. Over ninety-seven percent of the total weight of indeterminates came from the southwest quadrant of unit 20N40W (889 grams). The remaining 23 grams were recovered from the northeast quadrant of unit 15N25W and the southwest quadrant of unit 20N45W; the former having 15 grams and the latter having 8 grams.

Pulses/Oil Plants

*Pisum/Vicia* sp.

The three large fragments of *Pisum/Vicia* sp. could not be identified to species with great confidence so, were identified as either from the genus of pea or vetch. The ubiquity for these two species for the 2005 excavation season is 11.7%. All three fragments were recovered from the southwest quadrant of unit 20N40W; one from SFN 32 and two from SFN 37.

*Pistacia* sp.

The pistachio fragments were identified based on its thin rounded shell. Pistachio demonstrated a ubiquity of 11.7%. A total of 3 fragments were recovered from the 2005 season: two fragments from the southwest quadrant of unit 20N40W (SFN 32) and one fragment from the northeast quadrant of 15N25W. In general pistachio is a genus of about 9 species from the Mediterranean to Afghanistan, Southeast Asia, East Asia, Malaysia, the United States, Mexico, and Guatemala. The genus consists of shrubs and small trees which produce edible nuts (Gale and Culter 2000:177). In addition, as Murray (2003:66) cites van Zeist (1988), "apart from their fruits, which are also rich in fat
and may have been a source of oil, pistachio trees are exploited for their resin and wood."

Wild Taxa

*Lolium* sp.

Morphologically, *Lolium* (ryegrass) was identified by the following: a ventral/dorsal compression and a v-shaped palea groove with a noticeably wide and shallow indentation. The ubiquity of ryegrass from the 2005 season at ‘Ais Yiorkis is 11.7%. The distribution of the species is consistent with the cereal assemblage, with *Lolium* being recovered exclusively from the southwest quadrant of unit 20N40W. The total number of grains present in SFN 28 and SFN 32 is 12. Although the embryo shapes of the twelve *Lolium* grains in this assemblage most resembled the species *L. temulentum* a definite species assignment was impossible. This is due to the paucity of grains within the samples and the obvious morphological diversity within and across species of ryegrass. Nevertheless, the grains present at ‘Ais Yiorkis most resembled *L. temulentum*, which is characterized by a wide indentation (as opposed to a furrow), a relatively wide embryo, and an expressed ventral and dorsal compression.

Generally speaking, *Lolium* is a perennial or annual comprising about eight species. It is native to Europe, North Africa, and temperate Asia. The species is important as a forage crop, as lawn grass, or as weeds of cultivated crops (Nesbitt 2006:54). Two species of *Lolium* that are found in crop fields are *L. remotum* and *L. temulentum*. The former of the two varieties can be found in
fields of flax and the latter in cereal fields restricted to Mediterranean type climates (Nesbitt 54:2006).

*Avena* sp.

The oats in the assemblage were identified based on a morphologically round, or rather ovular cross-section, the presence of a slight depression above the embryo, a narrow and exceptionally shallow ventral groove, and an anatomy that is elongated from the apical to embryo end. Like most of the species in this assemblage, *Avena* sp. is present in the southwest quadrant of unit 20N40W. The ubiquity is 17.6% with five grains from SFN 28, two from SFN 32 and one grain from SFN 38, totaling a meager 8 grains. Generally speaking, *Avena* is a genus of about seventy species from temperate zones and tropical regions. It is an annual herb that has the ability to grow in a wide range of soils and is more tolerant than wheat of cooler climatic conditions. Economically, the grains of *Avena* sp. are edible and an excellent source of non-gluten flour (Gale and Culter 2000:299).

*Stipa* sp.

The *Stipa* sp. comprised 5.8% of the samples. It was identified morphologically on its small grain size in addition to its circular cross-section, tapered embryo end, rounded apical end, and its lateral compression. The one grain fragment of *Stipa* sp. from the 2005 season at ‘Ais Yiorkis came from the northeast quadrant of unit 15N25W (SFN 53). *Stipa* is a genus of nearly three hundred species from tropical to temperate climates. Ethnographically the leaves have been used for cordage, ropes, basketry, and pot scourers (Gale and Culter 2000:360).
**Bolboschoenus cf. maritimus**

The ubiquity of seeds most resembling *Bolboschoenus maritimus* is 5.8%; with the total seed count being 1. The single seed was recovered from the southwest quadrant of unit 20N40W, SFN 37.

**Cruciferae cf. Brassica/Sinapis**

The total number of seeds that most resembled *Cruciferae Brassica/Sinapis* was one, resulting in a ubiquity of 5.8%. Like the seeds that most resembled *Bolboschoenus maritimus*, the three fragments were recovered from the southwest quadrant of unit 20N40W, SFN 37. Zohary and Hopf (2000:139) report the difficulty in distinguishing between the charred remains of the genera, *Brassica* and *Sinapis*, within the mustard family. Additionally, they note that the wild forms of these crops include aggressive races of weeds which infest agricultural lands.

**Tabulations**

The following descriptions of tabulation are useful in understanding the subsequent tables. The weight and taxa present in the <1mm samples were multiplied by 8 as a result of only an eighth of the sample being analyzed. The <1mm and >1mm were added together to get a proper representation of each context. The total grain figures were calculated by taking the higher of the apical and embryo end fragments and adding that figure to the whole grain number resulting in a total minimum number of grains. The cereal indeterminates were given a calculated whole grain equivalent by weighing the sum of three whole grains of *T. monococcum* 2g and two whole grains of *H. vulgare* resulting in 0.05
grams. The decision on the proportion weight was made on the general proportion of cereal taxa within the samples. The weight of the cereal indeterminates for each context were then divided by 0.05 grams and multiplied by 5 resulting in the whole grain equivalent figure. Ubiquity is the determination of presence of individual taxa and is quantified by the number of samples in which it occurs. Murray (2003:59) states:

Due to the effects of plant characteristics (e.g., number of seeds), processing, charring, disposal, deposition, sampling, and recovery, this method is a more reliable measure of the relative proportion of taxa than a simple count of items since it is impossible to assume that the absolute numbers of seeds accurately reflect the original proportions (or the relative importance) of any plant taxa on an ancient settlement.

Determination of domestication status of the following cereal crops was inferred based on morphology, grain size, and information of known endemic wild plant taxa on Cyprus, presently and in antiquity.
Table 7 Identification criteria for the cereal and non-cereal taxa. Notes were provided at the University College London by Colledge and Colledge (2001:225).

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Notes compiled by Author</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Triticum monococcum</em></td>
<td>Grains from a two-seeded spikelet of <em>Triticum monococcum</em> were identified based on the following morphological characteristics: an asymmetrical cross-section, convex lateral sides, flat ventral surface, lop-sided dorsal ridge and tapered apical ends.</td>
</tr>
<tr>
<td><em>Triticum monococcum</em></td>
<td>The single grain of einkorn, from a one-seeded spikelet present within the assemblage was identified based on the following morphology: a strong dorsal ridge in cross-section, rounded ventral cheeks, tapered apical and embryo end, asymmetric dorsal keel, laterally compressed, and a convex ventral surface.</td>
</tr>
<tr>
<td><em>Triticum cf. monococcum</em></td>
<td>The grains assigned to cf. were most similar to <em>Triticum monococcum</em> 2g. The assigned grains were characterized as morphological variants with a more puffed or blown up appearance, an apical end that is more rounded, and a less pronounced dorsal ridge.</td>
</tr>
<tr>
<td><em>Hordeum vulgare</em></td>
<td>The identification of <em>H. vulgare</em> was identified based on the following: an angular cross-section, wide and shallow ventral groove, the presence of longitudinal ridges, convex ventral and dorsal surfaces, tapered apical and embryo ends, and the absence of a dorsal ridge.</td>
</tr>
<tr>
<td><em>Pisum/Vicia</em> sp.</td>
<td>Large- but no way to tell for sure</td>
</tr>
<tr>
<td><em>Pistacia</em> sp.</td>
<td>Small fragments of thin nutshell were assigned to the category of <em>Pistacia</em> sp.</td>
</tr>
<tr>
<td><em>Lolium</em> sp.</td>
<td><em>Lolium</em> is characterized by the following: ventral/dorsal compression and a v-shaped palea groove with a noticeably wide and shallow indentation.  (Although based on embryo shape the twelve whole grains in this assemblage most resembled the species <em>L. temulentum</em> a definite species assignment was impossible due to the quantity within the samples and the obvious morphological diversity within and across species. <em>L. temulentum</em> is characterized by a wide indentation (as opposed to a furrow), relatively wide embryo, and is ventral and dorsally compressed).</td>
</tr>
<tr>
<td><em>Avena</em> sp.</td>
<td>The grains of <em>Avena</em> were identified based on a morphologically round, or rather ovular, cross-section, a slight depression superior to the embryo, narrow and very shallow ventral groove, and an anatomy that is elongated from the apical to embryo ends.</td>
</tr>
<tr>
<td><em>Stipa</em> sp.</td>
<td><em>Stipa</em> was identified based on small grain size, circular cross-section, tapered embryo end, rounded apical end, and laterally compressed.</td>
</tr>
<tr>
<td><em>Bolboschoenus</em> cf. <em>maritimus</em></td>
<td>Most resembled <em>B. maritimus maritimus</em> although no way to assign to species let alone subspecies with great confidence.</td>
</tr>
<tr>
<td><em>Cruciferae</em> cf. <em>Brassica/Sinapis</em></td>
<td>Most resembled <em>Brassica/Sinapis</em></td>
</tr>
</tbody>
</table>
Table 8 Table presenting the data from unit 20N40W SWQ (southwest quadrant). "-" denotes absence, "w" denotes whole grains, "a" denotes apical fragments, "e" denotes embryo fragments, "i" denotes indeterminate fragments, "cf." denotes most similar to, "cf" denotes cotyledon fragments, "gb" denotes glume bases, "g" denotes grain (1g=one-seeded and 2g=two-seeded), "f" denotes fragments, "sp." denotes species, and "SFN" denotes Sample Field Number.

<table>
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</tr>
<tr>
<td>Triticum monococcum 2g</td>
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<td>22</td>
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</tr>
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<td>-</td>
<td>-</td>
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<tr>
<td>Hordeum vulgare</td>
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<td>1</td>
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<tr>
<td>i</td>
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<td>6</td>
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<tr>
<td>Cereal indeterminates (weight in grams)</td>
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<td>1.41</td>
<td>.41</td>
<td>.41</td>
<td>.28</td>
<td>&lt;.01</td>
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<tr>
<td>Pisum/Vicia sp.</td>
<td>cf</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
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<tr>
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<td>-</td>
<td>-</td>
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</tr>
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</tr>
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</tr>
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</tr>
<tr>
<td>w</td>
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<td>-</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>a</td>
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<td>-</td>
</tr>
<tr>
<td>e</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Stipa sp.</td>
<td>f</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bolboschoenus cf. maritimus</td>
<td>w</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cruciferae cf. Brassica/Sinapis</td>
<td>f</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
</tbody>
</table>
Table 9 Table presenting the data from unit 20N40W SWQ (southwest quadrant). This data represents the finds from the less than 1 mm portions of the SFN numbers. It should be noted that only 1/8 of each <1mm samples was sorted. "-" denotes absence, "w" denotes whole grains, "a" denotes apical fragments, "e" denotes embryo fragments, "i" denotes indeterminate fragments, "cf." denotes most similar to, "cf" denotes cotyledon fragments, "gb" denotes glume bases, "g" denotes grain (1g=one-seeded and 2g=two-seeded), "f" denotes fragments, "sp." denotes species, and "SFN" denotes Sample Field Number.

<table>
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<th>37</th>
</tr>
</thead>
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<td><strong>Liters</strong></td>
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<td>160</td>
<td>150</td>
</tr>
<tr>
<td><strong>AMS Dates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cereals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triticum monococcum 2g</td>
<td>w</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>a</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>e</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Triticum cf. monococcum 2g</td>
<td>w</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>a</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>i</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Triticum monococcum 1g</td>
<td>w</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Triticum cf. monococcum</td>
<td>gb</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td><strong>Hordeum vulgare</strong></td>
<td>w</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>a</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>e</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>i</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Cereal indeterminates (weight in grams)</strong></td>
<td>.12</td>
<td>.04</td>
<td>.07</td>
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<td><strong>Pulses/Oil Plants</strong></td>
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</tr>
<tr>
<td>Pisum/Vicia sp.</td>
<td>cf</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pistacia sp.</td>
<td>f</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Wild Taxa</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Loliun sp.</td>
<td>w</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Avena sp.</td>
<td>w</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>a</td>
<td>-</td>
<td>-</td>
</tr>
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<td></td>
<td>e</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>i</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Stipa sp.</td>
<td>f</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Boissochoenus cf. maritimus</td>
<td>w</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Cruciferae cf. Brassica/Sinapis</strong></td>
<td>f</td>
<td>-</td>
<td>-</td>
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</tbody>
</table>
Table 10 Table presenting the data from unit 15N25W NEQ (northeast quadrant). "-" denotes absence, "w" denotes whole grains, "a" denotes apical fragments, "e" denotes embryo fragments, "i" denotes indeterminate fragments, "cf." denotes most similar to, "cf" denotes cotyledon fragments, "gb" denotes glume bases, "g" denotes grain (1g=one-seeded and 2g=two-seeded), "f" denotes fragments, "sp." denotes species, and "SFN" denotes Sample Field Number.

<table>
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<th>58</th>
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<tbody>
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<td>60</td>
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<tr>
<td>Cereals</td>
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</tr>
<tr>
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<tr>
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<td>-</td>
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<tr>
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</tr>
<tr>
<td>Stipa sp.</td>
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<tr>
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<td>f</td>
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</table>
Table 11 Table presenting the data from 20N45W SWQ (southwest quadrant). "-" denotes absence, "w" denotes whole grains, "a" denotes apical fragments, "e" denotes embryo fragments, "i" denotes indeterminate fragments, "cf." denotes most similar to, "cf" denotes cotyledon fragments, "gb" denotes glume bases, "g" denotes grain (1g=one-seeded and 2g=two-seeded), "f" denotes fragments, "sp." denotes species, and "SFN" denotes Sample Field Number.

<table>
<thead>
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<td>AMS Dates</td>
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<tr>
<td>Cereals</td>
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<td></td>
<td></td>
</tr>
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<td>w</td>
<td>-</td>
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</tr>
<tr>
<td>Trifolium sp.</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Triticum cf. monococcum 2g</td>
<td>e</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Triticum cf. monococcum 1g</td>
<td>w</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hordeum vulgare</td>
<td>a</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Triticum monococcum</td>
<td>i</td>
<td>-</td>
<td>5</td>
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<td>Cereal indeterminates (weight in grams)</td>
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<td>.03</td>
<td>.02</td>
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<tr>
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<td>cf</td>
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</tr>
<tr>
<td>Pistacia sp.</td>
<td>f</td>
<td>-</td>
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<td>Wild Taxa</td>
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<tr>
<td>Lolium sp.</td>
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<td>-</td>
</tr>
<tr>
<td>Avena sp.</td>
<td>a</td>
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<td>-</td>
</tr>
<tr>
<td>Stipa sp.</td>
<td>e</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bolboschoenus cf. maritimus</td>
<td>i</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cruciferae cf. Brassica/Sinapis</td>
<td>f</td>
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</tr>
</tbody>
</table>
Table 12 Table presenting the data from 20N35W (southwest quadrant). "-" denotes absence, "w" denotes whole grains, "a" denotes apical fragments, "e" denotes embryo fragments, "i" denotes indeterminate fragments, "cf." denotes most similar to, "cf" denotes cotyledon fragments, "gb" denotes glume bases, "g" denotes grain (1g=one-seeded and 2g=two-seeded), "f" denotes fragments, "sp." denotes species, and "SFN" denotes Sample Field Number.

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<td>w -</td>
</tr>
<tr>
<td>Triticum cf. monococcum 2g</td>
<td>a -</td>
</tr>
<tr>
<td>Triticum monococcum 1g</td>
<td>w -</td>
</tr>
<tr>
<td>Triticum cf. monococcum</td>
<td>gb -</td>
</tr>
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</tr>
<tr>
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</tr>
<tr>
<td>Pistacia sp.</td>
<td>f -</td>
</tr>
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<td>Wild Taxa</td>
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</tr>
<tr>
<td>Lolium sp.</td>
<td>w -</td>
</tr>
<tr>
<td>Avena sp.</td>
<td>w -</td>
</tr>
<tr>
<td>Stipa sp.</td>
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<tr>
<td>Bolboschoenus cf. maritimus</td>
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<tr>
<td>Cruciferae cf. Brassica/Sinapis</td>
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Table 13 Table showing total number of items per SFN and ubiquity (refer to table 14) per sample. Italicized numbers denote ubiquity in percentage. "-" denotes absence. "g" denotes total number of grains. "wg" denotes whole grain equivalent for cereal indeterminates, "gb" denotes total number of glume bases, "f" denotes total number of fragments, "s" denotes total number of seeds, and "cf" denotes total number of cotyledon fragments.

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<td>g</td>
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<td>g</td>
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<tr>
<td>Bolboschoenus cf. maritimus</td>
<td>5.8</td>
<td>s</td>
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<td>5.8</td>
<td>s</td>
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</table>
Table 14 Table showing the ubiquity for the cereal assemblage from the estimated total number items. Note that two-grained einkorn dominates the cereal assemblage at Ais Yorkis.
CHAPTER 6

INTERPRETATIONS AND CONCLUSIONS

As previously outlined, the interpretation of the charred plant remains from ‘Ais Yiorkis 2005 will address research questions pertaining specifically to ‘Ais Yiorkis, to Cyprus in general, and to the Near East in the broader perspective. To reiterate, the following questions will be addressed here: 1) What does the botanical assemblage suggest about the economy of the site’s inhabitants? 2) Is the plant assemblage present at ‘Ais Yiorkis consistent with the botanical assemblages from the other Aceramic Neolithic sites on Cyprus? 3) Are there regional or geographical patterns in the plant assemblages from the Cypriot Aceramic sites that correspond with site type and site location? 4) What does the botanical assemblage at ‘Ais Yiorkis suggest about the site’s occupation in terms of seasonality, sedentism, and site function? 5) And what do the botanical data from ‘Ais Yiorkis suggest about early economic strategies on Cyprus and its role in the origins and spread of agriculture in the Near East?

The most suitable approach in which to address these research questions and to discuss the interpretations of the data presented in Chapter 5 is to start with site-specific inferences and then to discuss the more general questions regarding Cyprus and the larger Near Eastern perspective. First, a brief summary from the field notes of the southwest quadrant of Unit 20N40W

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(Feature 4) will be discussed followed by an interpretation of the feature in addition to any botanical inferences that can be made. Second, the research questions pertaining to 'Ais Yiorkis, specifically, will be addressed followed by the larger research questions, which discuss the role Cyprus played in Near Eastern agricultural origins.

In addition to limitations associated with paleoethnobotanical interpretation (see Chapter 3) there are various botanical limitations that deal specifically with 'Ais Yiorkis. It is important to note that the botanical assemblage presented in Chapter 5 is from one excavation season at 'Ais Yiorkis 2005. The 2006 excavation season and the upcoming 2007 summer excavation have much to offer in the final botanical interpretation of this upland site, and will be presented in my subsequent doctoral research. Therefore, the following interpretations are preliminary given that the unanalyzed material has the potential to change the way we view the botanical evidence from 'Ais Yiorkis, as was seen in the analysis of the botanical remains at Khirokitia.8

Additionally, it should be noted that the interpretation presented here are based primarily on data obtained from one unit, the southwest quadrant of Unit 20N40W. This unit will be the only unit discussed in the interpretation, seeing as the majority of the assemblage came from samples taken from this unit (Feature 4). Furthermore, the only taxa that will be discussed here is the cereal assemblage. This is due to the low densities and ubiquities of the remaining seven taxa: *Pisum/Vicia* sp., *Pistacia* sp., *Lolium* sp., *Avena* sp., *Stipa* sp.,

8 Hansen (1994) reports on the finds of emmer on the floor level in large quantities. This find changed the interpretation of emmer at Khirokitia. Previous interpretations placed einkorn as the predominant species. Now it is held that emmer, like einkorn, was grown as a separate crop.
Bolboschoenus cf. maritimus and Cruciferae cf. Brassica/Sinapis. When these taxa are mentioned in the discussion, it is merely to substantiate any interpretations inferred from the cereal evidence, including crop harvesting and processing inferences.

Southwest Quadrant of Unit 20N40W: Feature 4

Seeing as the majority of the cereal assemblage and other taxa came from a portion of Feature 4 in Unit 20N40W, the details of this unit and the context of the following samples will be discussed: SFN 28, SFN 32, SFN 37, SFN 43, SFN 46, SFN 49, and SFN 51. For specific context densities of each of the samples refer to Table 16. The subsequent information from this unit comes from the 2006 unpublished field notes of Thomas Lucas (see appendix 1). Lucas was the supervisor of the southwest quadrant of unit 20N40W from the 2004-2006 excavation seasons. The following Feature 4 interpretations include the 2006 season. It is important to note that the archaeobotanical references in the field notes include the preliminary findings from the 2006 season, which are not included in this thesis and therefore not included in Chapter 5. The samples will be discussed below with the addition of the contextual information provided from the interpretation of Lucas.

He states that the oval pit (Feature 4) would have measured a projected 5 x 4 meters. He summarizes the pit as follows:

The pit was excavated by the Neolithic diggers down to the hardened limestone strata on the south side and through a more homogenous silty, limestone flecked, soil on the northern side. This was due to a probable gully feature that was investigated by a 50 x
50cm test slot and sampled for archaeobotanical remains. The evidence of charred seeds in the slot below the pit suggest that the pit was excavated after the site was in use and that the seeds washed into the pit soon after construction and then permeated through the base and then down the gully feature and into the soil (Lucas notes 2006).

SFN 28 yielded the largest amount of botanical finds from ‘Ais Yiorkis thus far. From the 160 liters sampled, there were a total of 119 grains of two-grained einkorn, 17 grains identified as being most similar to two-grained einkorn, 45 barley grains and 548 grains from the total grain equivalent for unidentified cereals. Additionally, this level and SFN contained the largest quantity of wild taxa: Lolium sp. and Avena sp., both with 5 total grains. The total cereal grains present from this sample is 729. The context of this sample, reported by Lucas, is from Level 6/ Feature 4.1. This level is the top of Feature 4 and is previously referred to as Feature 8, which is characterized as a chipped stone rich cache within Feature 4. Lucas states that “Levels 4.1/2 and 4.3 are characterized by dense concentrations of bone and chipped stone with articulations of animal bones again suggesting dumping as opposed to hill wash deposition” (Lucas notes 2006).

Second to Level 6 (Feature 4.1), Level 7 contained comparable botanical information. The total grains recovered from SFN 32 are as follows: 76 grains of two-grained einkorn, 17 glume bases for einkorn wheat, 14 grains of barley, 173 total grains of unidentified cereal grains, 7 grains of Lolium sp., and 2 grains.

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9 This refers to a sample that was taken in the 2006 season and therefore the results of this test slot are not included in this interpretation.

10 This figure was based on the presence of 1 glume base in the >1 mm sample and 2 glume bases in the <1 mm sample. As discussed previously, the total number of glume bases for the <1 mm was multiplied by eight since only an eighth of the <1mm sample was analyzed. Sampling a portion of the <1mm samples is a common procedure and is done in an effort to maximize laboratory time (Colledge personal communication).

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of Avena sp. In addition to this level containing a relatively high number of cereals and wild taxa, it contained both pulses/oil plants recorded for ‘Ais Yiorkis, thus far: Pisum/Vicia sp. and Pistacia sp.

Level 8 (also referred to as the east section of Feature 4.3) is associated with SFN 37. Lucas reports that this level contained less cultural inclusions than both Levels 6 and 7. Although fewer artifacts were excavated from this Level, it is associated SFN contained all three types of botanics: cereals, pulses/oil plants, and wild taxa. The botanical assemblage recovered from SFN 37 are as follows: 19 two-grained einkorn grains, 1 one-grained einkorn grain, 4 grains of barley, 97 total grains of unidentified cereals, 2 fragments of Pisum/Vicia sp., in addition to three species of wild taxa, Avena sp., Bolboschoenus cf. maritimus, Cruciferae cf. Brassica/Sinapis.

The Western Section of Feature 4: Unit 20N40W

The western section of this pit contained substantially less charred remains from the southern section. SFN 43 was sampled from the western section of Feature 4 (Feature 8). The botanical contents of Level 6 are as follows: 17 grains of two-grained einkorn, 1 grain of barley and 41 grains for unidentified cereals. There were no other taxa recovered from this sample. Level 7 of the western section of Feature 4 contained bone and chipped stone in addition to burnt building material. The botanical evidence from this Level from SFN 46 demonstrates a similar pattern to the previous Level, with 10 grains of two-grained einkorn, 1 grain of barley, and 28 grains of unidentifiable cereals. SFN 49 also comes from the western section of Feature 4. Similar to the previous two
levels, Level 8 contained a medium density of chipped stone, bone, and shell. Unlike the previous two levels, there were no botanical materials recovered from this sample. This could be due to a definite absence of botanical materials or as a result of a limited amount of liters being sampled. The lowest level of the western section is Level 9. The SFN associated with this Level and the final flotation sample taken from the 2005 field season is SFN 51. SFN 51 has a limited presence of charred material, with a total of 2 grains of unidentifiable cereals.

Botanical Interpretation of the Southwest Quadrant of Unit 20N40W

The plant remains were likely preserved through accidental prehistoric charring and then swept or dumped into the pit, Feature 4. This is in consideration of artifact distribution, previously discussed by Lucas, in addition to their association with the charred plant remains; with all ecofactual and artifactual materials having arrived in the pit in the same manner. It is likely that the botanical assemblage from Feature 4 was the result of one or maybe a few depositional episodes. This is due to the assemblage being restricted to a small portion of the unit, most notably the southern section of Feature 4 including SFN 28, SFN 32, and SFN 37.

Furthermore, Colledge (2003:244) discusses possible explanations for the high proportions of cereals and pulses in the samples of *Mylouthkia* as representing the burnt debris from storage contexts which were located elsewhere on site and had been deliberately burnt due to storage infestation or spoiling. Since there appears to be no sign of insect burrowing in the cereal and
pulse assemblage, Colledge concludes that the likely explanation for the high density is due to accidental burning of the harvested products as opposed to storage infestation (2003:244). The inference that the 'Ais Yiorkis samples were burnt in the same manner is also a reflection of a lack of evidence of storage infestation or spoiling.

Colledge (2003:241) demonstrates that there is both greater representation of taxa and higher numbers of remains in the larger samples. She argues that the number of taxa and charred items are directly proportional to the volume of soil sampled. This is also the case with the 'Ais Yiorkis samples taken from 2005 (refer to Table 17). The larger the sample (i.e., SFN 28, SFN 32, and SFN 37) the greater the quantity of plant remains in addition to a higher number of taxa. On the contrary, this could also be the result of the difference in the contexts from which the samples were taken. The samples with the highest representation of taxa and greatest quantity of recovered items are also the samples that were taken from the same unit, the southwest quadrant of unit 20N40W. It is additionally noted that “contexts such as middens and rubbish tips commonly have higher densities of charred plant material than features incorporated within the living spaces of the site”(Colledge 2003:244). So, it could be said that the nature of the unit from which the greatest quantity of plant materials was recovered at 'Ais Yiorkis was more likely to produce the greatest amount of material. Additionally, the preservation of the plant remains from the

11 Considering the similarities in context type from the Mylouthkia pits and 'Ais Yiorkis Feature 4, comparisons in this regard will be limited to these two sites. (Shillourokambos is excluded in this discussion based on the botanical material coming primarily from impressions on pise and Khirokitia is excluded based on the samples coming from between structures and structure floors in addition to it not dating to the Cypro-PPNB)
southwest quadrant of unit 20N40W can be the result of the nature of the feature itself. The 'Ais Yiorkis samples demonstrate great preservation and relatively little fragmentation. As with the Mylouthkia samples taken from the pits, the 'Ais Yiorkis charred materials were likely to have been deposited within the pit or feature and thus protected from post-depositional disturbances that could have jeopardized the charred materials preservation and fragmentation (Colledge 2003:244).

Colledge argues that the wild taxa recovered from Mylouthkia were likely introduced into the samples as contaminants of the harvest since a number of the taxa, including Lolium sp., commonly grow alongside cereal and pulse crops as weedy species (2003:243:244). It is therefore likely that the presence of both Lolium and Avena in the 'Ais Yiorkis assemblage was introduced into the assemblage in much the same way as the wild taxa at Mylouthkia. The difference between the two wild taxa assemblages present in the pits at Mylouthkia and 'Ais Yiorkis is the ratios in which they occur.

In reference to the Mylouthkia samples, Murray (2003:64) concludes that the plant assemblage from both phases of occupation are likely a result of the residue from the fine sieving stage of crop cleaning. These samples, she states, “are characterized by high ratios of glume bases and weeds to grains and low number of grains per liter” (2003:64). She reports the grains per liter for the Mylouthkia 1A and 1B as follows: 0.1 wheat grains per liter for both periods and 0.3 and 0.1 for barley grains, respectively. The wild/weed taxa at Mylouthkia, as stated by Murray (2003:66), “constituted 52% of the Mylouthkia Period 1
assemblage and they are present in 100% of samples from both periods. There are 0.5 wild/weed taxa per liter in Period 1A and 2.0 per liter in Period 1B.” In agreement with Colledge, Murray concludes that the wild/weed taxa likely “arrived on site as weeds of the cereal crops and through various operations, such as winnowing, sieving and hand sorting; the weed seeds and chaff were gradually processed out to obtain a clean grain product.” Further, “these residues were then burned as fuel, thus becoming charred and preserved (Murray 2003:66).”

Hansen (1991:231) reports the ratios of the cereal assemblages at Khirokitia and Tenta in her comparison of the two site’s botanical evidence. At Khirokitia, einkorn wheat represents 35% of the total remains of the site, while emmer represents only 5%. The reported glume base and spikelet forks percentage is 45%. She notes the predominance of spikelet forks and glume bases with einkorn wheat chaff being more abundant than emmer wheat, in addition to wild species appearing in small numbers (1994:394). Further, the plant remains are representative of the products of cultivating fields of emmer and einkorn wheat and lentils. She comments on the paucity of barley indicating that it was grown with the wheat as opposed to a separate crop. As for Tenta, einkorn and emmer represent almost equal percentages, with a slight difference between the phases. The approximate percentage for Periods 2-4 represents less than 5% of the assemblage for both einkorn and emmer. The majority of taxa come from

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12 The difference, as stated by Hansen, may not represent a change in crops due to the small sample size (1991:232-233)
wild species, which predominant (*Lithospermum arvense* 20%) (Hansen 1991:233).

The ‘Ais Yiorkis ratios\(^\text{13}\) are considerably different to all the ratios reported for *Mylouthkia*, *Tenta*, and Khirokitia. Two-grained einkorn wheat represented 91.3% of the botanical assemblage, with 1.68 grains per liter sampled. The representation of barley is 5.1%, with a meager 0.095 grains per liter. The wild/weed taxa contributed to 1.7% of the assemblage with approximately 0.032 grains per liter. The representation for wheat glume bases is 1.3%, with 0.025 per liter.

The differences in the ratios for the botanical composition present at ‘Ais Yiorkis and the other Aceramic sites reported are substantial. What implications do these considerable differences in ratios offer? As previously stated, it is important to note the limitations of making inferences on the economic strategy of ‘Ais Yiorkis before the complete botanical data has been analyzed, in addition to the final interpretations of the site. With that said, the ratios could demonstrate a quite different economic situation at this upland site. The ratios of wild/weed taxa are suggestive of a different stage in the crop processing then those suggested at *Mylouthkia*. Perhaps the low percentages of wild/weed taxa and glume bases at ‘Ais Yiorkis are indicative of the end result of crop processing, the clean grain product. Notwithstanding sampling issues, if this proves to be the case, then where were the cleaned grains coming from if they were not grown and processed near or on site? Were they brought in from other upland sites that

\(^{13}\) The ratios calculated for ‘Ais Yiorkis 2005 came solely from the southwest quadrant of Unit 20N40W. Note the total number of liters sampled from the southwest quadrant of Unit 20N40W is 680.
have yet to be found or were they brought in from the coast? If the assemblage was brought from the coast it suggests that there are still coastal sites to be found because the cereal assemblage present at ‘Ais Yiorkis represents a striking dichotomy with the rest of the Cypriot Aceramic sites excavated thus far.

Hansen (2005:327) and Willcox (2003:237) discuss the Cypriot Aceramic Neolithic botanical data and note that the main differences seen among the sites are the high proportion of einkorn at Khirokitia and the abundance of ryegrass at Cape Andreas-Kastros. She states the following:

While it is possible that einkorn was a dominant crop at Khirokitia, it is equally possible that the remains simply reflect a bias in preserved remains. There is no obvious reason, such as edaphic conditions, that would preclude the successful cultivation of emmer around Khirokitia. The large quantity of ryegrass at Cape Andreas-Kastros may be refuse from crop cleaning, but it seems equally plausible that the grass was collected deliberately as a food resource, either for human consumption or possibly as a fodder. Its relative scarcity at the other Aceramic Neolithic sites in Cyprus could be a reflection of cleaner crops, cultural preferences or sample bias" (Hansen 2005:327).

The ‘Ais Yiorkis 2005 botanical data adds to the discussion and demonstrates a botanical assemblage not yet seen in the early Neolithic occupations of Cyprus (refer to Table 15). Most evident is the extreme dominance of two-grained einkorn at this unique upland site. As stated, two-grained einkorn represented 91.3% of the botanical assemblage with a ubiquity of 47%. Although it does not represent the Cypro-PPNB, Khirokitia is the only other Aceramic site that reports a significant presence of einkorn. Einkorn represents 35% of the Khirokitia assemblage with a strong difference in the ubiquity reported for two-grained einkorn versus one/two-grained; 6% and 78% respectively. Following Hansen,
this could be a reflection of a sampling or a preservation bias because there is no apparent reason for the profound difference.

Willcox (2003:236) hypothesizes the possible origins of the Cypriot botanical assemblage as being in the region of south-east Anatolia based on the suite of cereal crops recovered from sites in this area. He states the following (Table 15):

The Cypriot EPPNB assemblage consists of three wheat taxa and barley. Sites in the southern Levant dated to the Xth millennium are all characterized by a barley/emmer assemblage including the most northerly site, that of Aswad in the Damascus basin. Sites in the Syrian Middle Euphrates are characterized by two-grained einkorn and barley. It is only at the sites situated in south-east Anatolia that the four cereals, emmer, two-grained einkorn, one-grained einkorn and barley are found together. This assemblage corresponds with the EPPNB Cypriot material. Perhaps more important is the presence of single-grained einkorn at Mylouthkia, because the centre of domestication of single-grained einkorn has been located with some precision.

The presence of two-grained einkorn at ‘Ais Yiorkis contributes to ideas regarding the origin of the Cypriot farmers. As stated by Willcox (2003:236) the center of domestication of single-grained einkorn has been located with some accuracy. This is also true for the centre of domestication for the two-grained variety. What is intriguing about the ‘Ais Yiorkis two-grained einkorn abundance is that it adds to the Aceramic Neolithic of Cyprus a variety of einkorn that develops under different growing conditions than the variety of einkorn represented on Cyprus thus far, one-grained einkorn (Willcox 2005:537).

Research Questions and Conclusions

1) What does the botanical assemblage suggest about the economy of the site’s inhabitants? The botanical evidence from ‘Ais Yiorkis 2005 suggests the possibility that the site’s inhabitants were bringing the domesticated wheat (along
with the wild/taxa and barley as possibly weedy species) to the upland site from another location. This is due to the high ratios of grains per liter and low ratios of glume bases and weeds to grains, which demonstrates a completely different pattern from any other Cypriot Aceramic site. Additionally, the inhabitants’ cereal assemblage consisted primarily of two-grained einkorn, which again, is different than any other Aceramic Neolithic site on Cyprus.

2) Is the plant assemblage present at ‘Ais Yiorkis consistent with the botanical assemblages from the other Aceramic Neolithic sites on Cyprus (Table 18), and 3) are there regional or geographical patterns in the plant assemblages from the Aceramic sites that correspond with site type and site location? Yes. There appears to be a major dichotomy between the early coastal sites and ‘Ais Yiorkis, with ‘Ais Yiorkis suggesting a different economic strategy and possibly a different site function.

4) What does the botanical assemblage at ‘Ais Yiorkis suggest about the site’s occupation in terms of seasonality and sedentism? Questions of site function are generated when thinking about seasonality and sedentism at ‘Ais Yiorkis. Since it has been suggested that the inhabitants of ‘Ais Yiorkis imported two-grained einkorn to the upland site based on the lack of evidence for harvesting and crop processing inferences on seasonality and sedentism are hard to make with certainty. The botanical evidence does add to interpretations on site-function and possibly seasonality and sedentism when viewed with the archaeology of the site. The botanical assemblage at ‘Ais Yiorkis thus far is not the only form of evidence that highlights the uniqueness of this Cypro-PPNB site.
As previously stated, the architecture in the form of multiple raised circular platforms in addition to stone and picrolite bowls, broken groundstone, obsidian tools, and large amounts of faunal remains, including cattle, might distinguish ‘Ais Yiorkis as a site-type not yet recorded on Cyprus for the PPNB. The botanical and archaeological data from ‘Ais Yiorkis might illustrate an upland ritual site with communal feasting a possibility.

Peltenburg et al. (2001:73) discuss the significance of the Mylouthkia botanical assemblage as confirmation that the establishment of the agricultural tradition occurred some time after the Akrotiri Phase. They state, “This Aceramic crop complex continued to be the typical assemblage of Cypriot crops and associated field weeds throughout the period and beyond.” Further, “the long-lasting stability of this very early agricultural complex is a measure of its success, as most of its elements recur in the Khirokitian and later prehistory, and many remain important in the Cypriot diet today” (2001:73). The ‘Ais Yiorkis botanical data is in agreement with this, although its distinctive economic and archaeological evidence adds a considerable dimension to the early prehistory of Cyprus. It highlights the complexity of early Cypriot economic strategies and shows that these strategies varied considerably. Not only is there no one consistent site-type, as discussed by Simmons (2007:257), but there is no one typical suite assemblage of domesticated crops. The earliest agriculturists of Cyprus were exercising their choices of what suite of founder crops they wanted to exploit in different regions and geographical areas.
5) What also can not be understated is that the botanical data for the Aceramic Neolithic of Cyprus are limited and if the earliest “targeted” location in the spread of the Neolithic crop package from the Near Eastern mainland is to be understood more clearly, then future botanical research is necessary. What is known about the PPNB interaction sphere between Cyprus and the mainland is that they communicated efficiently, as stated by Bellwood (2005:64). This interaction between Cyprus and the Near East is evident in view of the botanical evidence as well. If the gap between the earliest explorers and the Cypro-PPNB proves to be a gap created by site and excavation bias alone, then the strong connection between the mainland and Cyprus is substantiated by the fact that the suite of founder crops found on Cyprus differ regionally and chronologically. 'Ais Yiorkis, Mylouthkia and Shillourokambos have recovered some of the earliest domesticated plants in the Near East. Additionally, these sites have demonstrated the complexity and variation in Cypro-PPNB site-type and site location. These recently excavated sites have changed traditional views about the earliest inhabitants of Cyprus and in turn have placed Cyprus in the forefront of agricultural origins in the Near East.
Table 15 Table showing the various cereal assemblages from multiple regions under investigation. For descriptions on dates and sites included in this table refer to Wilcox 2003:233.

<table>
<thead>
<tr>
<th>Region</th>
<th>Einkorn 1g</th>
<th>Einkorn 2g</th>
<th>Barley</th>
<th>Emmer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern Levant</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Middle Euphrates and Iraq</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern Anatolia</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Cyprus</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>‘As Yiorkis</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 16 Table showing the cereal densities for the samples taken from the 2005 season of the southwest quadrant of unit 20N40W, Feature 4.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Density for Cereals</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFN28</td>
<td></td>
</tr>
<tr>
<td>SFN32</td>
<td></td>
</tr>
<tr>
<td>SFN37</td>
<td></td>
</tr>
<tr>
<td>SFN43</td>
<td></td>
</tr>
<tr>
<td>SFN46</td>
<td></td>
</tr>
<tr>
<td>SFN49</td>
<td></td>
</tr>
<tr>
<td>SFN51</td>
<td></td>
</tr>
</tbody>
</table>

Context Density for Cereals
Feature 4
Table 17 Table showing the relationship between the volumes of liters sampled with the number of identifiable items per liter for the southwest quadrant of unit 20N40W.

<table>
<thead>
<tr>
<th>Numbers of Identifiable Charred Items per Liter</th>
<th>Volume of Samples (liters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>120</td>
<td>200</td>
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<tr>
<td>140</td>
<td>400</td>
</tr>
<tr>
<td>160</td>
<td>600</td>
</tr>
<tr>
<td>180</td>
<td>800</td>
</tr>
</tbody>
</table>

Diagram: Identifiable Charred Items in Relation to Sample Size
Table 18 Table showing the cereal assemblage for the Aceramic Neolithic sites with charred plant remains. Shillourokambos was not included due to the nature of the type of evidence used. Italicized numbers denote approximations, “x” denotes presence, “-” denotes absence, and percentages denote reported ubiquities (Peltenburg et al. 2001:72, Hansen 2001:119-128 and data from Shillourokambos compiled from Willcox 2001:129-135, Colledge personal communication).

<table>
<thead>
<tr>
<th>Site</th>
<th>‘Ais Yiorkis</th>
<th>Mylouthkla</th>
<th>Tenta</th>
<th>Khirokitia</th>
<th>Cap Andreas</th>
<th>Kholetria</th>
<th>Ortos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Einkorn wheat</td>
<td>x 5.8%</td>
<td>x 20%</td>
<td>x 19%</td>
<td>x</td>
<td>x 78%</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><em>Triticum monococcum</em> 1g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Einkorn wheat</td>
<td>x 47%</td>
<td></td>
<td></td>
<td>x 6%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>Triticum monococcum</em> 2g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Einkorn wheat</td>
<td></td>
<td></td>
<td></td>
<td>x 40%</td>
<td>-</td>
<td>x 22%</td>
<td></td>
</tr>
<tr>
<td>unspecified</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emmer wheat</td>
<td></td>
<td>x</td>
<td>x 16%</td>
<td>x 26%</td>
<td>x 87%</td>
<td>x 7%</td>
<td></td>
</tr>
<tr>
<td><em>Triticum dicoccum</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hulled barley</td>
<td>x 29.4%</td>
<td>x 60%</td>
<td>x 21%</td>
<td>x 14%</td>
<td>x 65%</td>
<td>x 20%</td>
<td></td>
</tr>
<tr>
<td><em>Hordeum vulgare/sativum</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 1
Lucas Field Notes: Feature 4

Excavation

Following excavations in 2004/5 of half of the Neolithic pit feature 4, the 2006 season saw its continuation and completion. During the spring of 2006 the site had been visited by Alan Simmons and Paul Croft, in the more favourable conditions the pit had been delineated to produce a rough limit of the feature to aid the summer excavation. The 2006 season began with a pre excavation plan before continuing excavation in 20N 45W SE Quad on levels 13.1/2 and 13.3. These levels had previously been identified as distinct stratigraphic levels of a pit (feature 13) within the fill of feature 4. The pit within a pit summation was dropped in favour of later infilling episodes of feature 4 as there was no conclusive cut to fulfil the original hypothesis. Levels 13.1/2 and 13.3 were re-assigned as 4.1/2 and 4.3.

Excavation continued through level 4.4, a silty fill predominately on the south side of the pit and overlay level 4.5, a 'cobbly' layer that appeared to have infilled from the SW edge towards a lowest point in the northern half of the pit. This ashy deposit had a very dense animal bone concentration and a large chipped stone assemblage. The articulation of some of the animal remains and the relative sharpness of the chipped stones would support a suggestion of a deliberate infilling as opposed to a hill wash deposit. C.20cm in depth, level 4.5 effectively sealed in level 4.6 which contained the remains of feature 8.

Feature 8 has been interpreted as the debris from an in situ chipped stone workstation based on a possible 'sitting stone' loosely associated with the dense chipped stone feature unearthed in a previous season's excavation. The feature, extending c. 150 x 90 cm, was contained within level 4.6, an ashy deposit with a notable 30 – 40 % of the bones showing some charring.

Stratigraphic level 4.7 was excavated as an infilling phase on the northern side of the pit, from the top of the perceived cut to close to the base. Difficult to distinguish from the pit edge and relatively sterile of artefacts, the fill could be a slumping episode, although is more likely to have been an early erosion fill. On the south side of the pit level 4.8 was characterised by frequent angular and sub angular stone. Very few artefacts were recovered, although these were notable for the 'core' nature of the chipped stone.
Level 4.9 was excavated as the primary pit fill along the base of the feature. A single large piece of chipped stone was interpreted as lying on the base of the pit; otherwise the fill was artefact free.
Levels 4.10 and 4.11 were excavated in a 50 x 50 cm test slot to try to recover archaeobotanical remains at levels below the perceived base of the pit. The slot, and further intrusive investigation, revealed a possible natural gully feature dominated by large limestone and sandstone blocks. Water permeating through the base of the pit and directed by the gully may account for the abundant charred seed remains and there is no reason to doubt the association of these remains with the Neolithic fill of feature 4. A shallow stake hole was identified in the base of the pit, matching the example revealed in 2004. The northern extent of the pit was followed and excavated in 20N 45W NEQ to try to produce a better estimated size of the feature.

Interpretation

Excavation of feature 4 has been a learning process that has culminated in the stratigraphic excavation of half of the feature in 2006. The careful excavations of 2006, with a guiding section and delineated edges from a more fortuitous seasonal investigation, have allowed for the following interpretations to be put forward.

The fully excavated pit would have measure a projected 5 x 4m oval shape with a maximum depth of c.1.30. Suggestions as to why the pit was originally dug range from mining activities refuse disposal, to subterranean dwellings. Although some of these hypotheses can be postulated with some backing evidence, the excavation of the pit leans towards one original reason for construction and a series of use and abandonment phases.

The pit can be seen to have been excavated originally to mine either the clay rich soils and/or the limestone boulders and ‘cobbled’ sized stones for building purposes. This can be attested to by the platform features constructed with similar sized materials and the frequent burnt soil/daub/adobe finds from across the site. It would appear to be a rather large undertaking to dig such a large pit to fill with refuse and it was not utilised in this way immediately after construction.

The pit was excavated by the Neolithic diggers down to the hardened limestone strata on the south side and through a more homogenous silty, limestone flecked, soil on the northern side. This was due to a probable gully feature that was investigated by a 50 x 50cm test slot and sampled for archaeobotanical remains. The evidence of charred seeds in the slot below the pit suggest that the pit was excavated after the site was in use and that the seeds washed into the pit soon after construction and then permeated through the base and then down the gully feature and into the soil beneath. This can be further investigated when the base of the adjacent pit (feature 9) is fully excavated in future seasons.
The first infilling of the pit (level 4.9) can be assessed as an erosion fill containing similar material to the base of the feature on the south side. This would suggest an abandonment phase of possibly a winter season with heavy rainfall. The stake holes on either side of the base of the pit appear to have been cut through both the primary fill of the pit and the base of the pit itself. This would suggest a return to the pit and the start of an in situ use phase.

Level 4.7 and 4.8 were infilling phases on each side of the pit and were relatively sterile of artefacts. These could be slumping phases as the pit edge deteriorated. Although the stake holes were not detected in these fills they may well have been missed during excavation and could therefore be loosely associated with the first culturally rich fill (4.6). This ashy fill contained many animal bones, ground stone and chipped stone, notably feature 8, 10,000 plus chipped stones spread over c.150 x 90 cm with a maximum depth of c.20cm. This has been interpreted as an in situ flint knapping station. Supported by a possible sitting stone, two stake holes for a possible lean to shader and the position in the most sheltered area of the pit make this use phase interpretation quite probable. As attested in other chipped stone concentrations (Croft personal communication), level 4.5 appears to be a deliberate ‘capping’ of the workstation. The cobbles of level 4.5 sit directly on feature 8 and would have covered the sharp mess of debris. The pit then appears to have been utilised sporadically as a midden. Levels 4.1/2 and 4.3 are characterised by dense concentrations of bone and chipped stone with articulations of animal bones again suggesting dumping as opposed to hill wash deposition. Level 4.4 however is less artefact rich possibly indicating a lower level of activity within or around the pit following the ‘capping’ of the chipped stone workstation before becoming a heavily used midden. The plough zone may well have removed the top of the pit and any evidence for a final abandonment episode.

The ‘life’ of the pit maybe more fully understood when pit 9 has been excavated in a more conventional manner incorporating the lessons learnt whilst excavating pit 4. Supporting evidence from the bone and charred seed remains may reveal to what extent the use and abandonment phases into possible seasonal patterns.

All measurements, levels etc. can be found on the submitted HUL forms.
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