MAROS MACROBOTANICALS: AN ARCHAEOBOTANICAL ANALYSIS OF BRONZE AGE AGRICULTURE IN THE MAROS SITE OF SANTUL MIC

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Honors Thesis in the Department of Anthropology and the Museum of Anthropology
University of Michigan
April 27, 2010

ACKNOWLEDGEMENTS

Thanks must be given first and foremost to all those who provided so much data, advice, and support for this thesis, particularly to Dr. Lisa Young, Laura Motta, and Dr. John O'Shea. They read many drafts, provided so much written and spoken feedback (in addition to numerous bagels), and taught me much about the research process. I would also like to thank the incredible anthropological archaeology graduate students, especially Amy Nicodemus, Paul Duffy, Amanda Logan, and Ashley Lemke for additional sources, advice, and moral support. Credit also due to Katie Lacy, as well as my peers in the senior honors thesis seminar, Megan Victor, Katherine Carlton, and Cynthia Kazanis, for all their continuous support and editing help. Many thanks to the Museum of Anthropology, for the space, equipment, and supportive research environment. Lastly I must thank my mother and father, Barbara and Peter Oas, who's editing, support, and love throughout all stages of my education, research, and writing have been so important.

ABSTRACT

The Bronze Age was a time of great social change with the long distance trade of metals throughout Europe and increased emphasis on hierarchical relationships between settlements. Within the Bronze Age Maros Culture of the Carpathian Basin, elements of these wider changes in expanded trade networks and metal craft production have been seen in the analysis of cemeteries and settlement organization. However this region requires further research as previous studies have not yet provided a clear view of social organization or the level of social complexity within Maros settlements. In addition to burial and settlement evidence, it is critical to understand the subsistence economy in looking at the presence or emergence of greater social complexity, as it an important and initial source of elite power. This study used an archaeobotanical approach to look at the subsistence economy, particularly the processing, storage, and consumption of cultivated plants, to explore the economic relationship of a small Maros tell site of Santul Mic to a near a larger contemporaneous site.

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INTRODUCTION

To explore social complexity within the Maros Culture, I used an archaeobotanical approach to look at agricultural evidence for the presence of, or potential for, increased social complexity.

In the 3rd millennium (around 2500) B.C. the Maros culture developed in the marshy alluvial plains along the Maros River and other rivers of the Carpathian Basin within modern day Hungary, Romania, and Northern Yugoslavia. During the transition from the Copper Age to the Bronze Age, this culture was one of many regional groups which emerged as the use and trade of metal became widespread and metallurgy was practiced on a local level.

The Maros culture settled on tells in the marshy region located between the Carpathian Mountains, a rich source of metal, and the cultures of the plains region. These tell settlements were strategically located in places to control trade along the Maros River. This location allowed the Maros culture to act as "middlemen" in the long distance trade of metals which emerged in the Bronze Age. Because the area between the mountains and the large rivers constrained the trade routes, it is an ideal location to examine the effects of long distance trade and increasing social complexity during the Bronze Age.

Although this culture was clearly a part of the expansive Bronze Age trade network, the nature of the relationships between the settlements of the Maros culture, and the social frameworks shared between them, is not well understood. Two models have been proposed for the relationship between sites based on the analyses of settlement and mortuary remains. One model suggests a complex chiefly society with multi-tiered settlement hierarchies (Earle 2002). The other suggests a model of interacting autonomous settlements linked through kin connections (O'Shea 1996).

Much of the archaeological research in the Maros region has focused on analysis of artifacts, especially ceramics and metal objects, from the cemeteries, to establish chronologies. Our understanding of the subsistence economy is very limited but critical for addressing questions of changes in social complexity. Specifically, the agricultural system provides that economic foundation on which the specialized production and distribution of metals and other goods was based (Earle 2002). The creation and distribution of agricultural surplus would have allowed for a portion of the Maros population to specialize in the production of these craft and trade goods.

Through the analysis of archaeobotanical materials from a small early Bronze Age site (Santul Mic) in the Maros region, I examine how the ancient inhabitants of this village utilized the surrounding environment and organized their agricultural system. I aimed specifically to identify the types of plants that were utilized; where, when and how they were processed and stored to explore questions about the organization of agricultural labor (Fuller 2005).

An understanding of agricultural practices provides important information for assessing the production of surplus and the control over arable land that are often key components in chiefly societies (Earle 2002). Thus it is important to look for evidence for the increased control and production of agricultural surplus, land, and the labor which would be needed for more intense agricultural production (Fuller 2005).

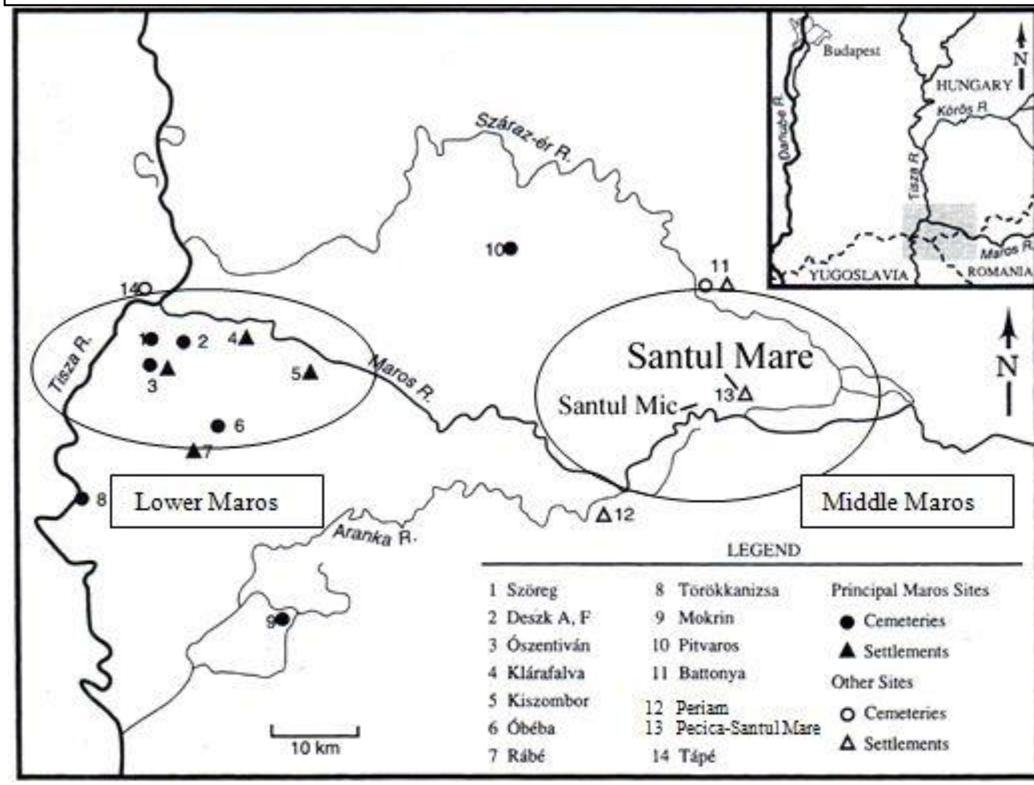
My examination of the archaeobotanical remains from the Maros site of Santul Mic will contribute to the regional discussion of emerging social complexity. Through the analysis of macrobotanical remains (e.g. carbonized seeds, chaff) in a village that was part of a settlement hierarchy, I explore whether there was an increase in specialization and mass production over the life span of the site to identify whether this small site was a component in an emerging chiefly social hierarchy. I will also examine agricultural strategies favoring risk aversion (e.g. spring and winter sowing, and a diverse variety of wild and domestic species) then that might suggest that Santul Mic was an autonomous settlement.

Chapter One

The CARPATHIAN BASIN IN THE BRONZE AGE

Until recently, the early Bronze Age in the region of Transylvania and the Romanian Banat have received relatively little scholarly attention, particularly in terms of settlement patterns. Additionally within the study of the Maros culture, the settlements found upon the lower Maros river (e.g. Kiszombor, Kláraflava), have been the focus of more modern research than the site of this investigation, Santul Mic and the nearby tells of Pecica-Santul Mare and Periam, which are further upstream (Fig. 1). Many of the questions that exist for this area, and the Maros culture settlements found there, are of interest as they tie into broader questions about the economic and social organization in the Bronze Age, in the Carpathians and in Europe in general. Changes to the subsistence economy would form a basis for a more complex social structure, and thus are central in an investigation of social organization.

Figure 1: Map Showing Principle Maros Settlements and Cemeteries (after O'Shea 1996: 28)



Climate and Geography

The Bronze Age falls during the Sub-boreal climatic period, which means that it was a generally warm and dry period. It was preceded by a warm wet Atlantic period and a cool wet Sub-Atlantic period followed (Harding 2000). However these conditions were not the same across all of Europe and they varied on a small scale as the Bronze Age progressed. Unfortunately, a detailed pollen sequence is not available from the area of Romania that is the focus of this study. However the general pollen records for the Carpathian Basin do indicate the fairly stable presence of mixed oak forests, grasses, cereals, and cultivated weed seeds from the Early Bronze Age onwards (Coles 1979).

The Maros culture established settlements along the major rivers of Eastern Hungary, Western Romania, and Northern Yugoslavia (Fig. 2), this region was a flat plain, cut through by the Maros, Tisza, and Köros rivers and their river valleys. Until the flood control projects of 19th century these valleys were prone to frequent flooding, which created large areas of permanent or semi-permanent marsh. Additionally as they flooded the rivers created a "region with thick fans of redeposited loess" (O'Shea 1996: 39). Loess is well aerated sediment composed mostly of windblown silt and clay. It is considered some of the richest and most productive soil for agriculture.

Figure 2: Map Showing Major Rivers and Topography of Carpathian Basin (after O'Shea 1996: pg 39)

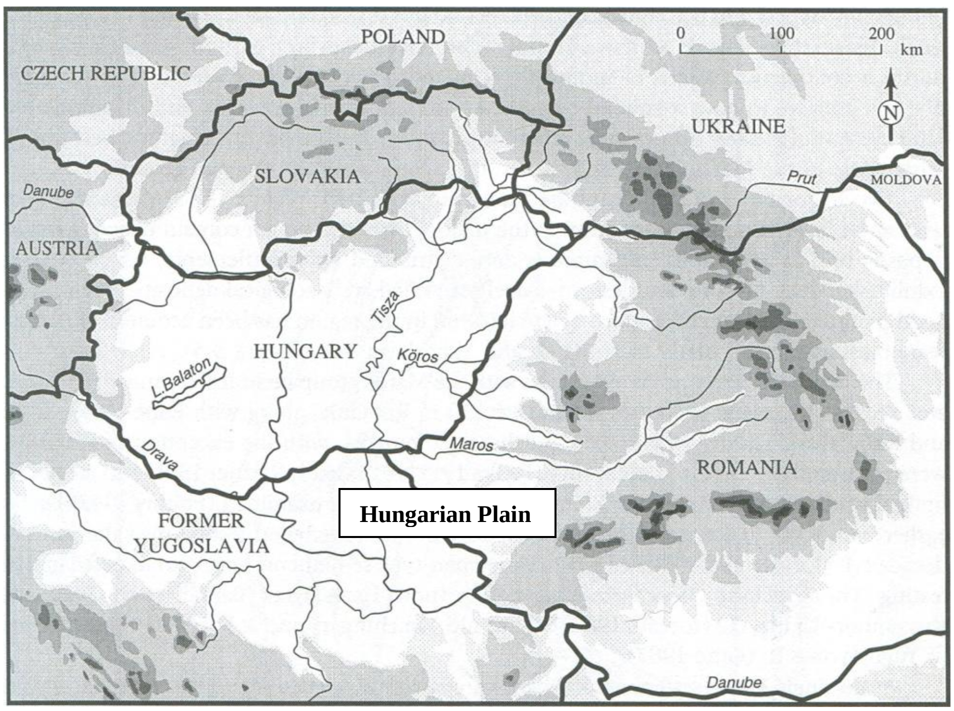
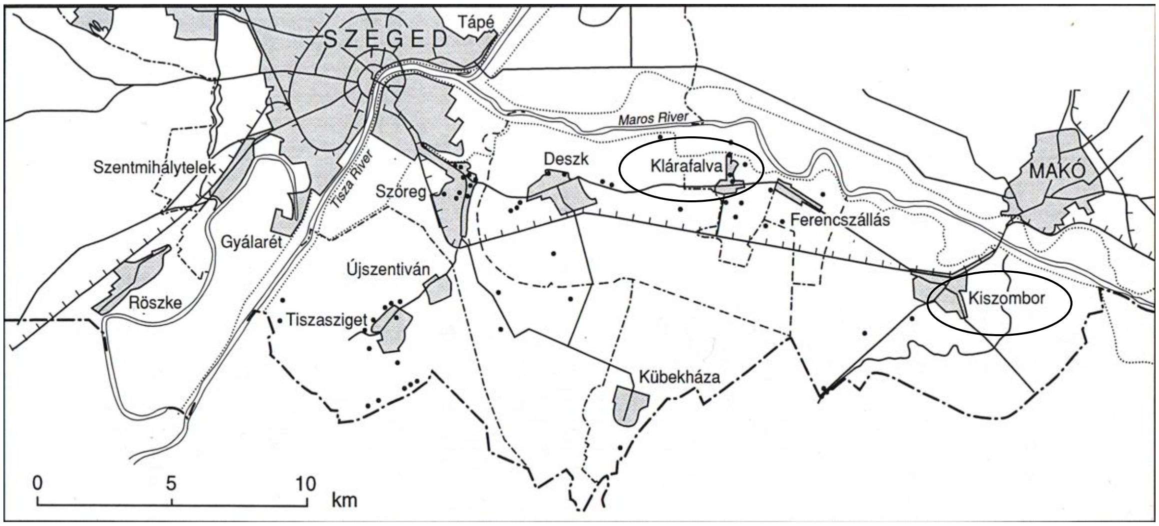


Figure 3: Map of Kláraflava, Kiszombor, and Other Maros Period Sites in Southern Hungary (after O'Shea 1996: 41)

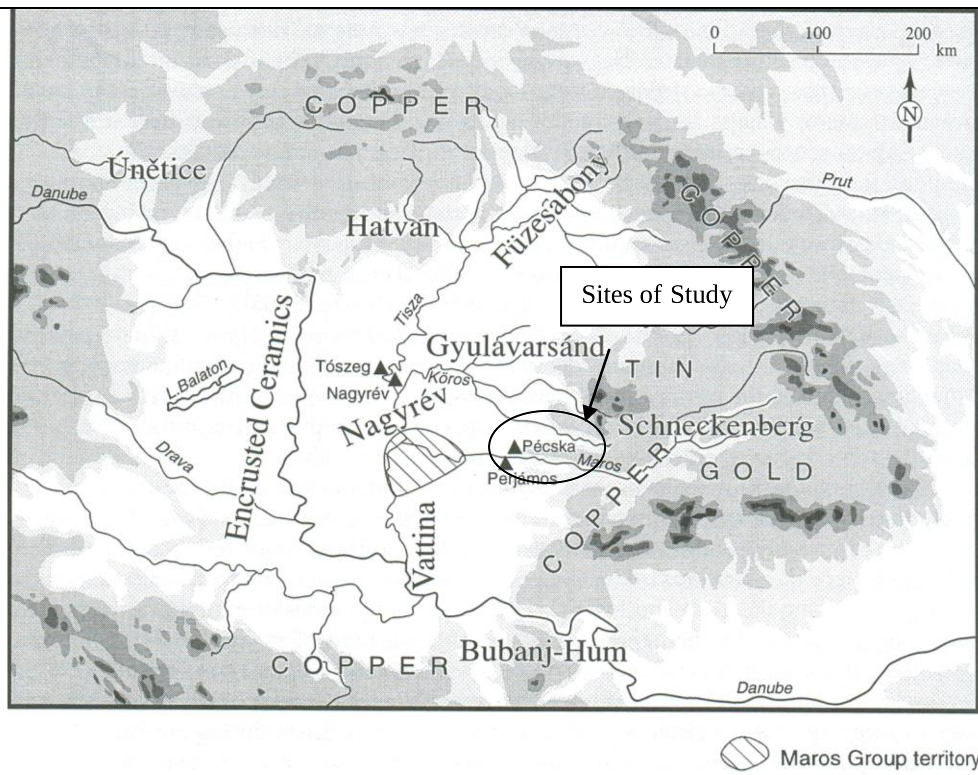


The lower region of the Maros River where it meets with the Tisza River in Eastern Hungary was occupied by the major Maros tell sites of Kláraflava and Kiszombor (Fig. 3). During the Bronze Age this region would have been a fertile basin of swamps and marshes interrupted by the occasional area of elevated land. As loess was deposited it raised these areas above the surrounding alluvial (flood) plain and formed a natural mosaic pattern. These areas of higher land would have been essential for settlement and agriculture as they were the only land above water all year.

Further upstream in Western Romania in the middle region of the Maros River were located the Maros sites of Periam, Pecica-Santul Mare, and Semlac-Santul Mic, the focus of this research. Modern day Romania is roughly divided into three regions, the mountainous regions of Transylvania, the lowland region on the lower Danube, and the Romanian Banat, which is part of the Hungarian Plain (Coles 1979). The Romanian Banat region is where these Maros settlements were established, a region which afforded a greater amount of useable dry land (e.g. suitable for settlements and agriculture), for settlements located some distance north from the river.

While the inhabitants of settlements in this environment would have access to a variety of resources, agriculturally and from the wild riverine resources, the location of these settlements directly upon the riverbanks may also have been influenced by trade along the river. This region of the Hungarian plain was completely lacking in raw metal resources (e.g. copper, tin, and gold). These resources would have been obtained from the Carpathian Mountains which form the eastern edge of the Carpathian Basin, and then traded to groups like the Maros, and to those groups farther west in the Hungarian Plain (Fig. 4)

Figure 4: Map Showing Resource Distribution and Surrounding Cultural Groups of the Maros Culture (from O'Shea 1996: 50)



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The Maros River, which flows east to west across the plain, would have provided the easiest and most likely path for trade in comparison with overland travel through the marshes. The Maros settlements would have been well situated to benefit from, interact with, and perhaps control portions of this trade from their strategic position on the banks.

Historical Background

Domestic agricultural traditions, once they are established, tend to remain fairly constant. (Fuller 2005) Thus in this study of Maros Bronze Age agriculture it is important to understand the entire span of agricultural history for this region, beginning with the earliest agriculture introduced in the Neolithic, in order to understand its development and practice in the Bronze Age.

The Neolithic Age:

During the Early Neolithic (6500-6000BC) period in the Carpathian Basin, farming villages were established in distinct areas. One settlement type was found on the alluvial plain itself along the rivers. Choosing an environment with conditions more favorable for fishing, hunting, and gathering, was probably continuing the lifestyle patterns of the earlier Mesolithic communities (Sümegi 2003). In contrast the other type of settlement was populated by groups, perhaps from the Balkans, with agricultural strategies from a colder, drier environment. They would have been comfortable with the dry loess-covered environments, and generally occupied these natural "islands" of agriculturally-rich loess found on the floodplain.

These high points served as a transition point between previous production strategies and the acquisition of new environmental resources (Gyulai 1993; Sümegi 2003). The higher, drier elevations allowed for more extensive crop cultivation and procurement of a wider range of wild food resources (e.g. fish). Cereal crops could be grown on the alluvial floodplain because of the high water tables, and in particular spring-sown wheat with an accelerated three month cycle could be used (Plate 1). This agricultural strategy allowed for both the cultivation of spring and winter-sown crops (with a nine month cycle) or alternatively permitted for the land to be used as winter grazing areas (Sherratt 1980).

By the Late Neolithic (5000-4500 BC) this region had a well established and stable agricultural organization. Settlements were located on the loessy tells, and their subsistence strategies incorporated agriculture, pastoralism, and the exploitation of river resources (O'Shea 1996). Additionally the tell settlements in this period were part of settlement hierarchies with the smaller sites in their vicinity (Sümegi 2003). The small settlements surrounding these large tell sites were most likely related to them through kin or ritual connections, however they were not part of a centralized or institutionalized social structure (Sümegi 2003).

The Copper Age:

By the Copper Age (4500-2500BC) several economic shifts occurred. A change to an increasingly pastoral economy, a growing investment in metallurgy, and the introduction of plow agriculture, are all thought to be major factors in the notable changes in social organization. The Baden culture which emerged in the Late Copper Age was far more widely distributed than the preceding culture in both the layout of within individual settlements and their geographic distribution.

The appearance of the simple plow in the Copper Age is thought to be one of the main reasons for this wider distribution (Shenann 1993, Sheratt 1997). The plow permitted farmers to use a far greater range of soils (Childe 1929). Previous agricultural practices, done by hand, had limited farmers to only the easiest, richest soils. Plow agriculture also changed the amount of labor and the number of laborers required. Farmers invested more in equipment and animals than before and were able to produce more with less labor and fewer laborers. A more extensive system with lower labor needs allowed for the creation of agricultural surplus. With the generation of surplus and time, “potential elite could pursue to a greater extent social and economic power” (Duffy 2010).

The Bronze Age:

The transition into the Early Bronze Age (2500 BC) is marked by the development of smaller, distinctive cultural groups, which contrasts with the broad regional similarities found at Copper Age sites. The causes of the social shifts between the Copper and Bronze Age are not fully understood. Traditionally most of these major changes were seen as the result of various migrations. However, archaeologists now argue that these cultural changes occurred within the populations over an extended period of time, rather than a rapid change brought by outside peoples. Consequently, while some of the social and cultural shifts may have been caused or influenced by the migration of ethnic groups, other mechanisms, economic and internal, are now thought to contribute to these processes (O’Shea 1996, Sherrat 1997).

O’Shea (1996: 363-364) has suggested in particular that the causes for this social change may be significantly affected by internal competition for resources and trade goods within the cultures. Metals which had been an exotic commodity in Copper Age become for the first time a major trade item in the growing European networks. Many objects were being made for the first time out of metals, in particular arms and armor

(Duffy 2010). Evidence for the widening scale of Bronze Age trade and metals is seen in the variety of metal types found in Maros graves, and from evidence for metallurgy in Maros settlements (O'Shea 1996).

In the Bronze Age, overall, there are two main kinds of settlement found within the Maros region: large tells and smaller open settlements. This settlement organization was similar to the patterns of settlement seen from Neolithic groups. This similarity between the Bronze Age and Neolithic settlements has raised questions over whether the Bronze Age settlements were also organized in settlement hierarchies (Sümegi 2003).

Yet in the case of the Bronze Age settlements the reasons for this variation in site size and structure is not yet clear. As O'Shea (1996: 40) mentions, "There is no evidence to date to suggest any differences in the function or activities associated with the two Maros settlement types." The tell sites generally have deeper stratification; however these multiple layers may have been the result the limited high ground along the rivers on which settlements could have been established. Open settlements located on lands less constrained by seasonal flooding would have been able to spread out further and thus one would have shallower deposits. Additionally tell settlements may have purposefully built up sediment deposits strategically for additional protection from seasonal flooding (O'Shea 1996).

In contrast to the changing settlement distribution and the increasing scale of trade, the subsistence practices used by these villages are thought to be similar to those used from the Late Neolithic onwards (O'Shea 1996, Sümegi 2003). However until recently limited archaeobotanical analysis has been undertaken in this region and more will have to be done to really understand to what extent the agricultural system remained stable.

By the Middle Bronze Age (2000 BC) the settlements of the Maros culture reached their greatest extent along the river. After this point many of the settlements and cemeteries are abandoned, such as Kiszombor in the lower regions of the Maros. Additionally the large tell site of Periam and Santul Mic, the focus of this research, were abandoned at this point. The reasons for this shift in occupation and population concentration are not yet understood. Nevertheless the settlements of Santul Mare and Kláraflava, located down-river, remain and continue to flourish into the Late Bronze Age (1700 BC) (O'Shea 1996).

Chapter Two:

SOCIAL MODELS AND MAROS ARCHAEOLOGY

In looking at the changes which occurred in the Bronze Age and the subsequent transition to larger, more hierarchically organized societies of the Iron Age, several models have been suggested to address questions of social organization and complexity for the Maros culture. The archaeological evidence available for assessing how these models has come primarily from funerary and settlement excavation, as work at these sites (especially funerary) has been the focus of Maros archaeology in past century. Thus I will give a general summary of the two models of social organization that contrast chiefly with middle-range organization, and discuss how these might be seen in funerary or settlement contexts. I then explain what is currently understood of the Maros culture from funerary and settlement excavations, and describe how an agricultural perspective could contribute to the understanding of Maros social organization.

Chiefly Organization

Models of chiefdoms were characterized by the scale of "integration, centrality of decision making, and stratification" (Earle 2002:53). Earle (1997) argues that chiefdoms are created and maintained by a variety of economical, military, and ideological strategies. The economic aspects of the chiefly power often serve as the foundation for the other sources of power. Both serving to "buy" loyalty of followers and maintain relationships with neighboring communities, and through control of staple surplus and wealth to exclusively support their own position of central power (Earle 1997).

While kin groups would still be an important part of societal organization and structure, in a chiefly society this would be mixed with a central organizing institution serving to further integrate and structure the population. In a chiefdom regional populations would probably number in the thousands, more densely populated in central locations with subsidiary smaller settlements, and one would expect to see evidence for inherited social rank and economic stratification (Harding 2000).

In a chiefdom the rise to power and the stability of authority would come from the control of potential power sources, such as the subsistence economy and the production and flow of prestige goods (Earle 2002). Thus, when distinctions suggesting differential access to these goods are found in burials, they may show differences in social rank, and an ability of certain individuals to control the flow of goods though a central institution.

In particular burial evidence for inherited wealth and social positions and for social differentiation on a household level would all indicate the potential for individuals and families to gain and control wealth (Earle 2002). Even if these households or individuals did not fully establish and centralize their power, these distinctions could show the potential or the beginnings of increasing social complexity.

Within the settlements of chiefdoms, hierarchical distinctions would be expected between elites and non-elites, and distinctions would also be expected between the central settlement and other dependent sites. Earle argues that populations would be larger than those of middle range societies and most likely concentrated primarily in the central largest settlement (Earle 2002) The smaller dependent settlements would be scattered around the central site, and evidence for their relationship with the central power would ideally be seen in terms of site-function difference. Within the settlement itself the presence of a stratified elite might also be seen in the architecture and layout.

In settlement patterns of two or three tiers, the smallest sites would have focused on agricultural or other material production, and the smaller fortified tells on managing the producer sites and supplying the chiefly center site. The intensification of agricultural production and creation of a controlled surplus is an important part of hierarchical societies. This “staple finance” would provide support for the elite and could be used additionally for feasting and the production of intoxicants and to enhance their regional networks (Earle 2002). Thus the intensification and organization of agricultural resources and sites would have been an extremely important change, facilitating the emergence of a chiefly elite and the stabilization of its centralized institutions.

Middle-Range Societies

In contrast with the chiefly model, it is possible that the relationships between Maros settlements were more autonomous and not integrated by any central institutions. Fairly autonomous villages that were not characterized by hereditary hierarchical relations are called middle-range societies. This type of social organization would be structured more in terms of horizontal equivalent relationships than vertical hierarchical ones.

Villages would express these horizontal relationships in kin connections and exchange rather than in settled hierarchies with specialized production centers as expected in a hierarchal society (O’Shea 1996). In the study of societal complexity O’Shea cautions that while chiefdoms are the frequently suggested and assumed model, the possibility for mid-range societies with an “intermingling of inequality and local autonomy,” needs to be considered (1996:5).

In a tribal or middle range society leadership would be based on personal charisma and would probably only be overtly expressed in special circumstances. Thus while wealth gained from local or exotic sources would have been a mark of status, it would not be well controlled or organized, and it would not likely be used as a social marker in death. Established political offices with substantial power would not be expected in a middle-range society, nor would the presence of an elite class be seen from burial analysis. However some burial differences could reflect some social stratification in areas of craft specialization and in religious contexts (Harding 2000).

In middle range settlements no associated specialized settlement sites would be expected. Each village, with a much smaller expected population, would be largely economically-self sufficient, and would manage its own production and defense. Wealth, reflected in terms of herd size and stored agricultural produce, would not be permanent, and would be distributed within families (O'Shea 1996). There would be no real currency in a tribal society, only in the quantities of things amassed, and social standing in the society would be earned through the distribution of this wealth.

Social Models and Maros Archaeology

To contextualize the small site of Santul Mic within the Maros society at large, I will discuss the evidence for Maros social organization focusing on the settlement excavation and burial analysis. The Maros culture has a long history of archaeological investigation spanning over one hundred years, which has been largely focused on excavation and analysis of burials. In particular, data about Maros social structure has come from John O'Shea's analysis of grave goods and funerary remains from the Maros cemetery of Mokrin (1997). O'Shea's analysis compared the cemetery layout and burial materials from Mokrin with other Maros cemeteries previously excavated in the region. Most of these cemeteries were located in western Hungary, near the sites of Kláraflava and Kiszombor, where the lower Maros and Tisza rivers join (Fig. 1).

In recent years there has also been a renewal of interest in the excavation of Maros settlements. In 2005 survey and excavation began on the Bronze Age portions of the great tell site of Pecica-Santul Mare. This project built on previous excavations at the site that began in the late 19th century at Santul Mare, and were continued by M. Roska (1912). Later excavations were undertaken at a nearby smaller site, Santul Mic by F. Golgâtan (1996).

Burial Evidence:

Within Maros cemeteries, the most constant and widespread burial practices were to position the body in a flexed position facing east. However, the direction of the head differs by gender. Females were buried with their heads to the south and males with their heads to the north. The burials within cemeteries were also clustered into different regions, which has been argued to reflect the different village populations who shared these cemeteries (O'Shea 1996)

The skeletal remains themselves often display physical trauma, which suggests that widespread warfare may have been common in this period. Weapons were found in burials throughout the Bronze Age, also suggesting an emphasis on warfare as an important means of marking an individual's place in society. While later in the Bronze Age, social display is often less expressed through funerary remains in these cemeteries, the use of these weapons remains fairly constant throughout the Bronze Age (O'Shea 1996).

Exotic goods (e.g. faience beads, exotic fine ware ceramics) and metal ornaments were also funerary markers and important recurring symbols of social status used over many generations. The use of these items as grave goods provides an indication of the regularity and significance of long distance trade for this culture (O'Shea 1996). Interestingly there is also no change seen in the treatment of craft specialists over time, perhaps suggesting the stability of craft production and of the social standing of craftsmen in the Maros culture.

Roughly a fifth of the graves at Mokrin contained these metal ornaments, and evidence was also seen in the burial items (e.g. weapons and headdresses) for both male and female hereditary assigned offices. O'Shea argues that these hereditary offices would have had only one occupant and that they would have been held until death. This pattern indicates some type of vertical social segmentation within cemetery clusters, and suggests that the Maros culture had community-level hereditary social positions and it raises questions about the level of social complexity and the potential for some inherited social status. However there has also been little evidence to suggest differences in social standing on a household level based on burial analysis, only for these specific individuals (O'Shea 1996).

Furthermore, while certain social or political offices are suggested by the burials, the variations seen in the inclusion and distribution of grave artifacts within these cemeteries appear to be, "marking qualitatively specific social statuses or offices that were recognized or shared across the Maros villages" (O'Shea 1996: 255) In other words while status differences existed in some form within a village, they were also part of the shared regional identity of these villages.

Settlement Evidence:

In Maros settlements houses were small and rectangular, with prepared clay floors, wattle and daub walls, and matted reed roofs. These houses were small and probably only housed one family. Within these houses ovens, hearths and subterranean storage pits have been found. These features were found in all villages, regardless of the size. Storage pits were often large, suggesting long-term storage of substantial quantities of food. Furthermore the location of these features within houses suggest that food preparation and storage were probably managed on the household level.

Maros houses vary from Neolithic ones, which were larger, probably housing several families or extended families. Like the earlier Neolithic settlements, Maros settlements also range from large tells to small hamlets, but unlike the Neolithic settlements, there is little evidence of functional differences between these large tells and nearby smaller sites (O'Shea 1996). Evidence for the presence of violence and warfare is also seen in the presence of defensive ditches at virtually all Maros settlements (O'Shea 1996).

It is thought that typical lower Maros settlements would have contained 6-8 households or about 40 to 50 people, and no evidence has yet been seen from excavated settlements of distinctions in site function or social stratification in the settlement layout and architecture. (O'Shea 1996).

Summary:

Thus from what is currently understood from Maros burials and settlements, there is archaeological evidence that suggests elements of both chiefly and middle range models.

While some burials show evidence of different social rank, and possible hereditary social positions, these are limited to specific individuals. Household level social distinctions have not been seen from Maros burial analysis. The main burial distinctions from cemeteries in both the upper and lower sections of Maros River are expressed in terms of gender. The individuals with special rank and community-level social offices appear to also be a region-wide Maros tradition. However these offices are not normally considered to be part of middle-range tribal societies with primarily household based social organization. Consequently the possible presence of these community level positions and the extremely close proximity of the sites like Santul Mic and Santul Mare raise questions about the potential for greater social complexity to have emerged in this period.

As yet there are no apparent status distinctions architecturally or in the layout of settlements between the Maros tell and hamlet sites based on settlement excavations. The settlements themselves currently appear to be functionally similar, small scale settlements with a household level of organization. This in conjunction with the small estimated populations would support O'Shea's assessment of Maros villages as being more autonomous than integrated in a complex social system. However even if social distinction were not evident on a household level in burial, it is important to look at the subsistence economy, as it would be the initial source of power for emerging elites (Earle 2002), particularly as burial evidence does show that social distinctions were recognized by the Maros culture.

Changes in social organization, not visible from burial or current settlement evidence, could have been reflected agriculturally before they would have appeared in burial or settlement contexts. Thus it is important to look at changes in agricultural practice, production, and storage, in order to evaluate the investment and organization of land and labor throughout the Bronze Age and between the different kinds of Maros settlements. Although Maros villages may have been more autonomous, an agricultural perspective could shed light on a society moving towards greater complexity.

Maros Agriculture

O'Shea (1997) has proposed that within the Maros culture, social standing would have been associated with the size of one's flocks, harvest and stored surplus Control over the subsistence economy, access to the best land, tools, and agricultural surplus, would have been essential for any emerging elite. As Earle writes, "control over the economy thus stabilizes and restricts long-term access to other media of power" (1996: 13).

The placement of middle Maros settlements on the high riverbanks was not only highly strategic for involvement in the regional trade networks, but also gave its occupants access to a rich diversity of resources. The regions of elevated soil provided space for domesticated animals and plants, while the River itself and surrounding wetlands provided an abundance of wild food resources. Similar to Late Neolithic groups, Bronze Age farmers relied on these wetlands for foods, especially fish. These wild foods were important to balance out the risks associated with domestic agriculture, especially periods of both drought and the seasonal river flooding. (O'Shea 1996, Sümegi 2003).

Within the Maros culture region recent excavations and analysis offer some understanding of what plant species were extensively cultivated. A variety of domestic species have been found continuously at sites starting in the Neolithic sites. These species include: einkorn (*Triticum monococcum*), and emmer (*Triticum turgidum subsp. dicoccum*), as well as barley, lentils (*lens culinaris*, and peas (*pisum sativum*) (Gyulai 1993).

The fairly wet climate of the Carpathian Basin in the Bronze Age and the Maros river alluvial plain would have supported water loving spring-sown crops such as barley (*Hordeum vulgare*) and millet (*Panicum miliaceum*) (Sherratt 1980). From archaeobotanical work done at Kláraflava (Jones), wheat and barley were the most commonly cultivated cereals. This is expected as both species produce low risk, low yield crops for wet unpredictable environs.

Of these species of wheat (Triticum), it has been seen in this region that the Maros culture favored einkorn (*Triticum monococcum*) as the dominant wheat species. Although secondary to einkorn, barley was also an important cereal, cultivated both for human consumption and animal feed (Gyulai 1993). Both of these grains were glume based (Plates 4 and Plate 7), meaning that the seed was covered in a tough, non-shattering series of layers or "glumes," which remain attached to the seed even after harvesting the seeds. This trait makes it easier to harvest the grains, as they don't separate during harvest, but also results in the plant being dependent on human cultivation for propagation. Additionally the glumes protect the seeds during the winter, and the grains would have been stored within the glumes in storage (Sherratt 1980).

As these cereals were harvested, wild weed seeds growing in or near fields would also have been gathered. Of these weed species *Chenopodium, Polygonum, and Bromus sp* have been found in Maros settlements. The presence of these weedy species "indicates that the majority of samples were the result of grain cleaning, probably fine sieving, which is a late stage of crop processing, often carried out piecemeal at a domestic level." (Jones n.d.) (Plate 2: step 9). In other words these seeds are a characteristic waste product of domestic grain preparation (Hillman 1984). The presence of weedy species further shows the importance of cereal stores in Maros subsistence, which from initial analysis at Kiszombor and Kláraflava appears to constitute most of diet. It is interesting to see such heavy reliance on cultivated species and relatively little incorporation of wild species despite sometimes poor cultivation conditions (Jones n.d.)

From recent archaeobotanical work both wild and cultivated food resources were used by Maros villagers, and the storage and preparation of these foods seems to have been managed on a household level. Additional information about harvesting and crop processing, labor organization and scale, and the storage strategies, would further address questions of social organization and integration. This could shed light on the relationship between specific sites like Santul Mic and Santul Mare, and be of use in further comparisons with different kinds of Maros sites throughout the Carpathian Basin.

Chapter Three:

METHODOLOGY AND RESULTS

From the flotation samples taken from Santul Mic, a fortified Maros tell settlement located quite near (2 km) to the large tell Santul Mare, I looked for patterns of subsistence change which might provide insights into agricultural strategies and social organization at this site. This section describes the procedures used to recover and analyze the charred plant remains from Santul Mic during the 2007 field season. I also explain the guidelines used for identification, which was done using light microscopy. Additionally the range of biases affecting the samples before and after excavation will be discussed as they relate to my analysis and the research questions guiding it.

Methods

Analyzed samples

The initial excavation of Santul Mic was undertaken by F. Golgâtan in 1996. During 2007, John O'Shea revisited Golgâtan's trench to clean it and drew the stratigraphic profile. This was done to allow for future comparisons with the continuing excavations of Santul Mare and for a better understanding of Santul Mic's occupation span. The east profile proved to generate the clearest view of the stratigraphy and it was excavated into the sterile, non-cultural levels, to ensure the full site occupation was seen. From this eastern profile a 1x2 meter trench was excavated, from which several carbon samples were taken for dating, and flotation samples were collected for botanical analysis. Samples were taken, generally in 10L buckets, from each recognized stratigraphic layer visible in the profile. Additional samples were also taken from several post holes on the northern profile, but they are not included in this study. Of the 30 samples available, only 25 were examined in this study in order to show the entire occupational span of the site.

The column sampling strategy allowed for the flotation samples to be removed at the same time with a clear visible profile to guide the sampling and documentation. However the range of information from column samples is limited in that it only samples from one portion of the site examined. In other words while it clearly shows the vertical or temporal sequence of the site, it presents only a single view with no horizontal equivalent samples to balance this bias. There is no way to absolutely guarantee that the site use or deposition of charred materials remained constant over time from the small profile sampled. Many factors can affect the composition and identification of flotation samples, such as the material's chances of surviving charring, archaeological deposition, and recovery. Thus ideally by comparing adequate horizontally equivalent samples for regularity, the vertical changes over time become more distinct and reliable. However these are the only flotation samples that are available and that have been examined from Santul Mic or Santul Mare. As the first analyzed sequence of samples from this area the samples do provide important descriptive information about what species were present. Additionally with further quantitative analysis I could also use them to view changes in agricultural strategies over time, and to apply this information to address questions of social change and complexity.

As I analyzed a fairly small number of samples, comparisons could be direct and fairly simple. While these samples in isolation cannot be used to definitively prove complex temporal changes in complex agricultural processes or the function of specific archaeological features, they do offer important insights and lay a foundation for future archaeobotanical work. In comparison with archaeobotanical results and other archaeological information from Santul Mare, and more generally with the wider Maros region, the biases affecting the results of this research will be minimized.

Flotation Methods and Laboratory Analysis

Bulk samples were processed by machine assisted water flotation. Using agitated water to separate the less dense organic materials from the remaining soil. This separation, by density, and the fine screens used to collect the fractions, allowed for a greater quality and range of botanical materials to be preserved than can be recovered through *in situ* or screening techniques. Charcoal, seeds, and small, more delicate portions of plant remains (e.g. glume bases and spikelet forks) become available with machine flotation.

Two kinds of fractions were generated by each sample during the flotation process. A "heavy fraction," what was left in the mesh after the soil has been washed away, and a "light fraction" flot, what floated to the surface and was collected in a very fine screen. For this research I only analyzed the light fraction of the Santul Mic flotation samples as this portion of the fraction contained all of the relevant botanical remains. More particularly for my analysis and research focus at Santul Mic the analysis of the light fraction allowed me to look at agricultural practices, especially those of cereal sowing, harvesting, and processing.

Once floated, the samples were then sieved to sort the charred plant remains recovered in the light fraction by size. The weight and volume of each sample was taken before sieving, and each sample separated into four sizes: >2.0mm, >1.0mm, >0.5mm, and <0.5mm portions. This sieving process was used to separate the samples into portions more practical for microscope analysis. A Swift Ultra Light microscope was used for sorting and identification with a magnification up to 4.4x.

Sorting procedures for certain remains varied by material size. Although the current research focuses exclusively on seeds, wood charcoal was collected, weighed, and saved for future analysis from the >2.0mm sieve. A similar procedure was also used for any bone or shell fragments, although the weights for these materials were not taken. Modern uncharred plant remains, insects and geological remains were also separated from the charred remains.

Identification

A comparative collection of Mediterranean and Middle Eastern plant materials from regions which shared similar cereal and weed species to the Banat region of Romania, was used to aid in the identification of the charred remains from Santul Mic. When it was possible plant remains were identified to a species level using the online sources from the Royal Botanic Garden Edinburgh's *Flora Europaea* and Ohio State University's Department of Horticulture and Crop Science *Seed ID Workshop*. I also used Stefanie Jacomet's *Identification of cereal remains from archaeological sites* 2nd ed. (2006), Werner H. Schock's 1988 *Botanical macro-remains*, Albina F. Musil's 1963 *Identification of Crop and Weed Seeds Agricultural Handbook No. 219*, and W. Beijerinck,1947. *Zadenatlas der Nederlandsche flora*. However as charring, deposition, and recovery greatly affect the preservation of the remains, I chose to be cautious in my identification. Remains were only identified beyond the genus level when the species identification could clearly be defended. Additionally for some genera (e.g. Carex) with many species, it was not possible in the context of this project to fully identify species even with well preserved samples. Some of the very smallest wild seeds were also not identified in this study but I separated them for potential future identification. In particular seeds that were likely members of the Brassicaceae family were grouped and counted, but not further identified. Additional well-preserved small seeds were counted and separated for further identification and their count was not recorded with that of the general non-identifiable seed category (Table 1).

Crop Processing Analysis

Through a better understanding of how the villagers of Santul Mare were processing, storing, and consuming their cereal crops this study examines how the agricultural strategies and daily use of cereals can address questions of social interaction and complexity with Santul Mare. I looked at the presence and ratio of charred grains, chaff, and weed seeds in each sample to try and reconstruct some of these agricultural practices. This approach is built off the models of G. Hillman (1981, 1984) (Plates 2-5) and G. Jones (1987) (Plate 6), which look at the characteristic by-product waste generated by each stage of crop processing (e.g. harvest, threshing, course and fine sieving, and storage). The goal of these models was to evaluate sites as ‘primary-producers’ generating grain for exchange or tribute, or as ‘consumer’ sites receiving and storing grain from elsewhere. (Hillman 1984).

However in the application of these models, it has been seen that evidence for ‘producer’ or ‘consumer’ sites is difficult to find and not reflected in the most kinds of archaeobotanical assemblages (Fuller 2005, Stevens 2003a). Thus I used the Hillman and Jones models to show the stages of crop processing visible in the Santul Mic samples, and addressed my questions of site relationship and social complexity using the more recent crop processing models of C. Stevens and D. Fuller.

In general most charred assemblages recovered from sites are the mixture of many different activities, burning events, and depositions. Thus they do not often reflect specific actions (e.g. yearly harvesting and threshing) or the function of their final context. (Fuller 2005) They do however reflect daily, routine activities, as these actions would produce the most material and have the greatest chance of both fire-exposure and of surviving through charring. (Fuller 2005, Stevens 2003a). Consequently while these mixed samples may not reveal a site as a ‘producer’ or ‘consumer’ they do reflect the normal, daily activities associated with later stages of processing and consumption once the grain has been stored. (Fuller 2005)

Stevens used this view into routine crop processing as a way of looking at how labor may have been distributed and organized in ancient societies. Where large pools of organized laborers are available crop production in the initial stages is carried out further. In contrast where less laborers are present more of the processing (labor) is kept for the later domestic stages. Thus the state of stored grains and the by-products that come from the sieving and processing of these grains can reveal the investment and organization of labor involved in at the earlier stages (Stevens 2003a).

One could expect in a site receiving grain from elsewhere (a consumer site) that the producer site, as a site focused and organized on crop production, would have carried out more of the processing and thus produced further processed semi-cleaned grains for the storage in the consumer site. The waste from semi-cleaned grains would be mostly charred chaff and grains, as the rest would have been removed prior to storage. In sites where less labor would have been mobilized for crop production and processing, more weed seeds, large and small, as well as chaff could be expected from grain stored as semi-threshed spikelets (Stevens 2003a).

Thus within sites integrated into a chiefly society, with far greater social organization and the ability to more efficiently mobilize labor and resources, the presence of specialized consumer and producer sites may be seen in the agricultural strategy of processing the harvest more initially. In autonomous societies the agricultural strategies employed by the people would save more of the processing labor for post-storage daily domestic activities as the pool of labor during and after harvest would be smaller and less organized (Fuller 2005, Stevens 2003a).

Results

The constrained nature of a column sample and the lack of known soil volume for all the samples taken introduce some potential biases and did not allow me to use any complicated statistical analysis in my analysis. However by looking at the presence and proportion of species, in other words taking a more qualitative than quantitative approach the common, domestic stages of processing were seen. Additionally using proportions of grain, chaff, and weeds (large and small) I was able to compare the composition of my samples with the expected ratios for cereal waste from semi-cleaned or semi-threshed grain stores.

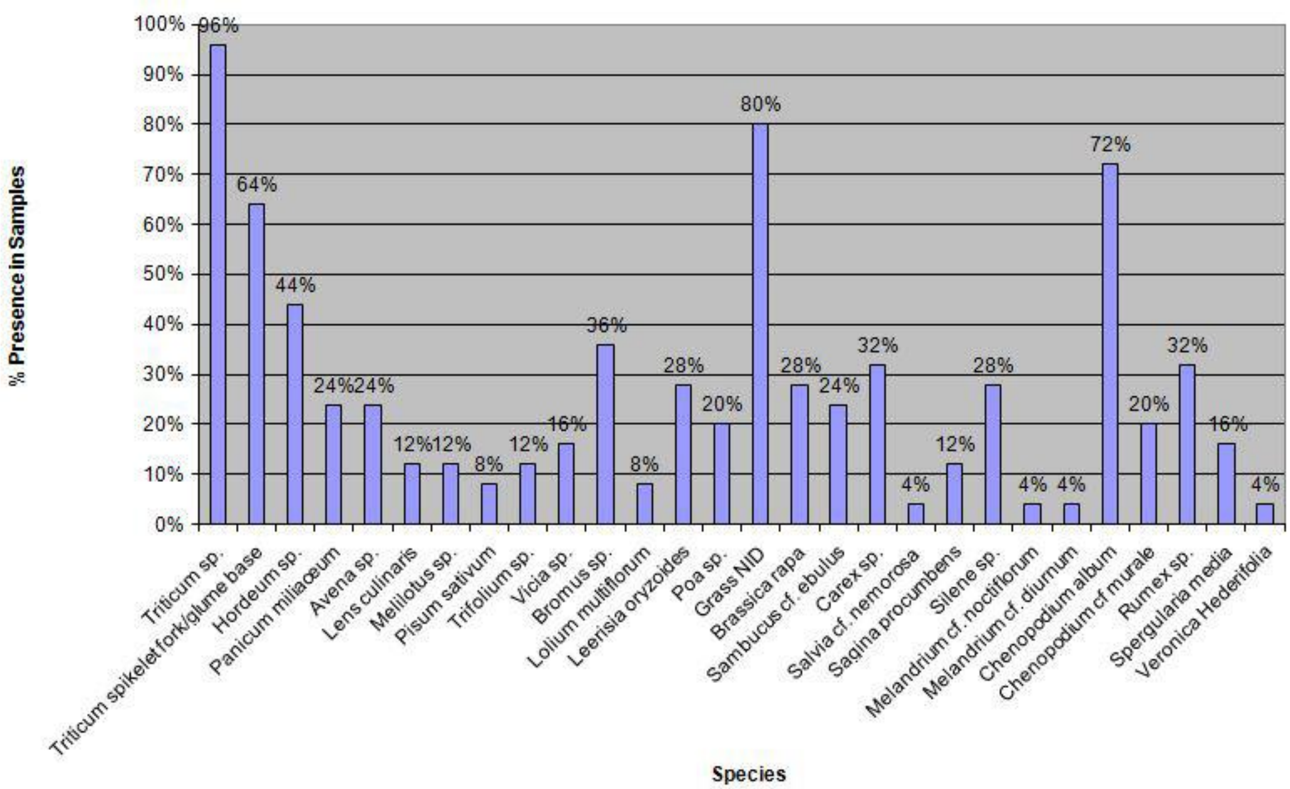
General Assemblage

The most apparent was the predominance of the Poaceae, or grass family throughout the span of Santul Mare's samples. Members of this family, especially cultivated grains, composed most (almost 76%) of the total count of seeds (Table 1), and with wheat being nearly ubiquitous (Fig. 5).

Along with cultivated wheat, barley, and millet, other likely domesticated species were present throughout Santul Mic's occupation. Most of these belong to the Fabaceae, or bean family. Lentils, *Lens culinaris*, Peas *Pisum Sativum*, and species related to the Fava Bean (in the *Vicia* genus) all were found in small numbers throughout the occupation. Several other weed species of the Fabaceae family were found including clover, *Trifolium sp.* and sweet clover, *Melilotus sp.*. In addition to the bean family, members of the Brassaceae or cabbage family were also found. Among these wild turnip, *Brassica rapa*, may have been cultivated by the inhabitants of Santul Mic as a food or for oil. As these species may have been a wild gathered resource I have included them in the counts of non domesticated "other" seeds.

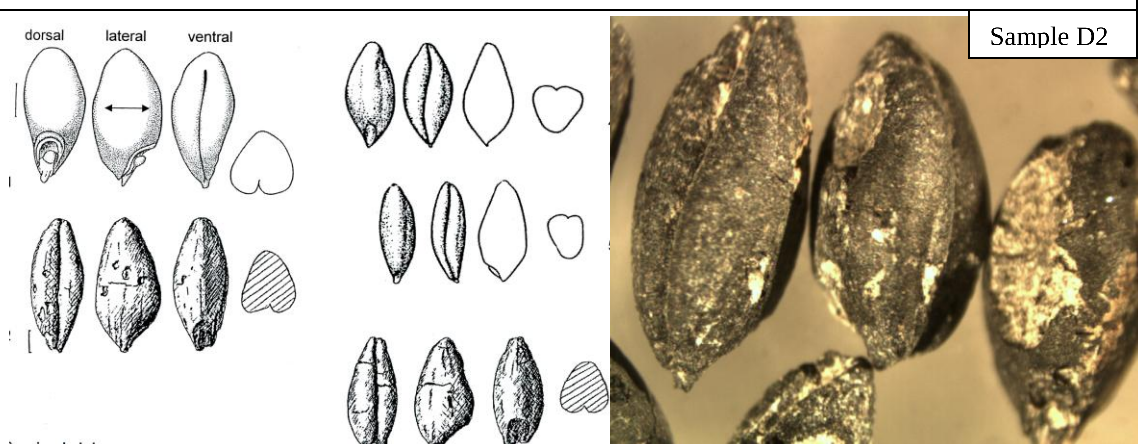
Of the wild and weed seeds found, (not including wild grasses), *Chenopodium album*, *Spergularia media*, *Silene*, *Rumex sp.*, *Carex sp.*, the shrub *Sambucus cf. ebulus*, and *Sagina procumbens* were the most common (Fig. 5)

Figure 5: Seed Ubiquity



<u>Cultivated Grains</u>

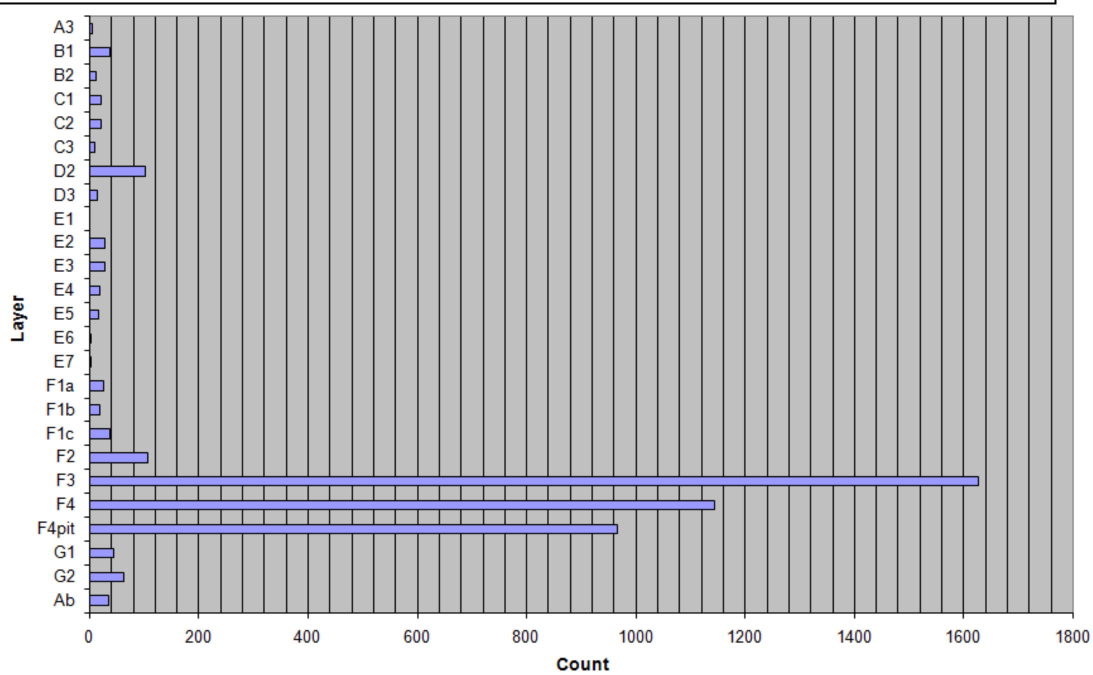
Figure 6: Einkorn Wheat *Triticum monococcum* Charred Grain (Drawings from Jacomet 1996)



Of all the species present in the samples wheat, specifically einkorn (*Triticum monococcum,)* was clearly dominant (composing roughly 75% of the total seeds, although other species of wheat may be present amongst the more puffed and fragmented charred seeds. Of the charred seeds with less clear identifying traits however I was more inclined to consider them einkorn *Triticum sp.* (tentative level of identification), because of the prevalence of clear einkorn seeds and the lack of other cereals reflected in any identified chaff remains. In general the einkorn seeds present in these samples were slightly thicker than the standard seed dimensions (Jacomet 2006) (Fig.6). Based on chaff remains and the presence of other morphological features however, I felt confident that these were einkorn.

Wheat was present in virtually every sample (although only represented by chaff in E1). The highest concentrations of wheat were found in the “F” layers, especially F2-F4 (Fig.7), but a notably large portion was found in layer D2. 85% of the total wheat found was contained in the F3, F4, and F4pit samples.

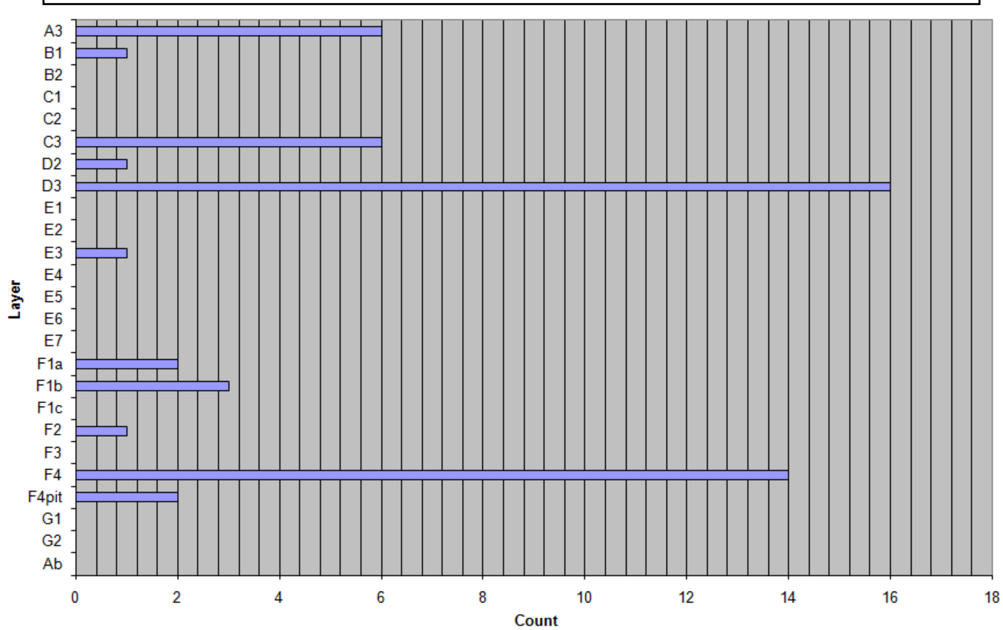
Figure 7: Total Seed Counts of Wheat



Of the other cultivated cereals present, barley, *Hordeum vulgare*, was the next most common (Fig.8). It is also present throughout the entire column though in much smaller quantities than the wheat. Unlike wheat, however there is no clear concentration of Barley in any area of the column. The highest concentrations were found in D3, and F4, but the seeds are fairly evenly spread amongst all the samples (Fig.9).

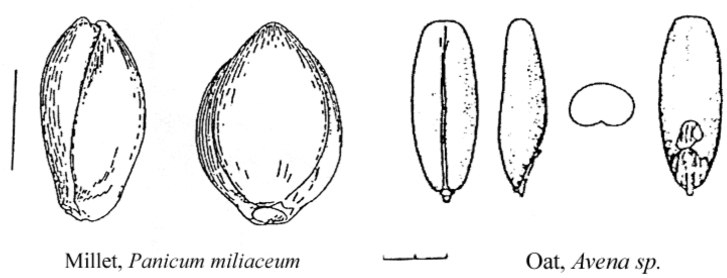
Figure 8: Barley *Hordeum vulgare* (Drawings from Jacomet 2006)

Figure 9: Total Seed Counts of Barley



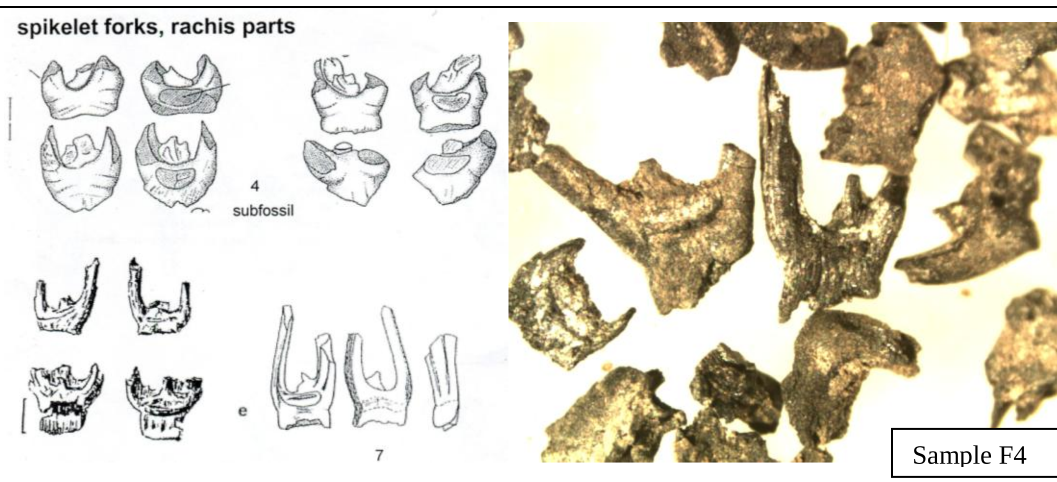
Millet, *Panicum miliaceum* (Fig 10), was found in small amounts throughout most of the column (first appearing in layer D). Millet is a water loving plant known as a commonly cultivated food plant from late Bronze Age. It produces a starchy fruit used to prepare bread and soup, and ripens in Autumn. Oats, *Avena sp.* (Fig.10) were also found, in even smaller quantities, and are only found in the earlier occupation layers, mostly concentrated in layer F. These may either have been cultivated or represent a 'large' weed seed.

Figure 10: Millet, *Panicum miliaceum* and Oat, *Avena sp.* (Drawings from Jacomet 1996)



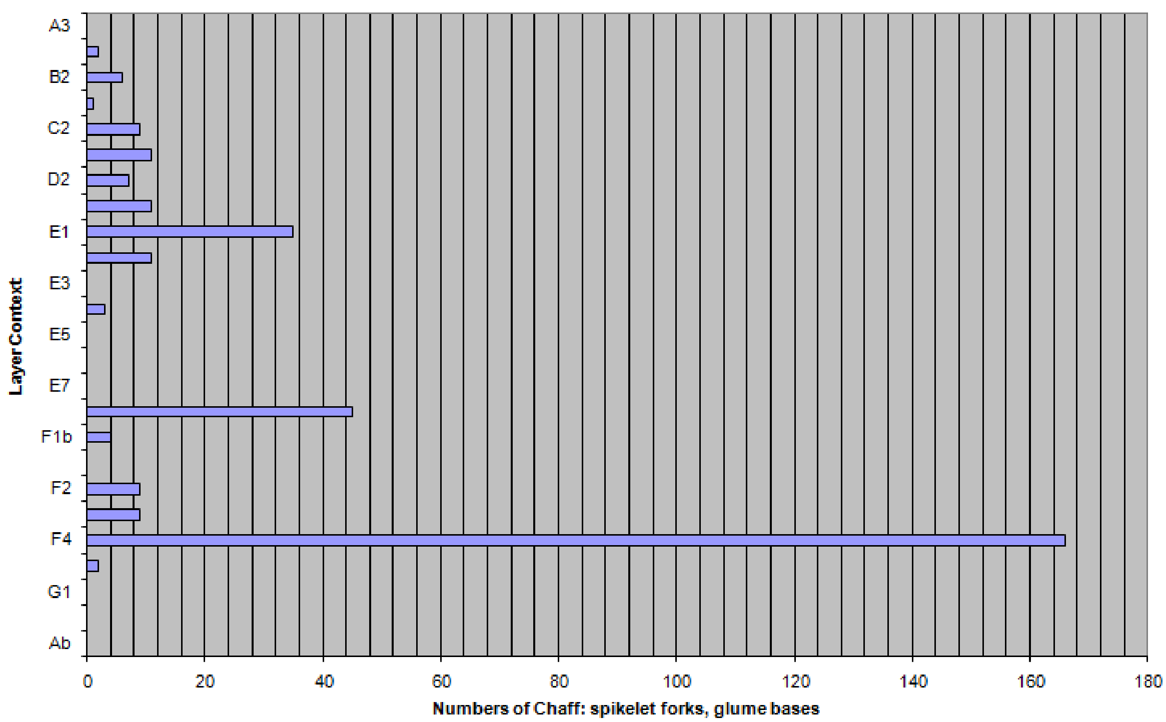
<u>Cereal Chaff</u>

Figure 11: Fine Sieving Wheat Chaff: Spikelet Forks, Rachis Segments (Drawings from Jacomet 1996)



In the samples from Santul Mic the only kinds of cereal chaff recovered were those that Hillman describes as the characteristic waste or by-product from the fine sieving stages of crop production (Fig.11) (Plate 2) (Plate 3) (Plate 4) (Plate 7) This chaff was found in a fairly evenly spread concentration from C2-E2, with a higher concentration in E1 (Fig 12). It was also spread fairly evenly in the F layer, but in F1a, and especially in F4 there were high counts of wheat spikelet forks and glume bases. F4 alone contained 166 pieces or roughly half of all the chaff recovered from my samples. In contrast only two pieces were recovered from the F4pit feature.

Figure 12: Wheat Chaff Totals

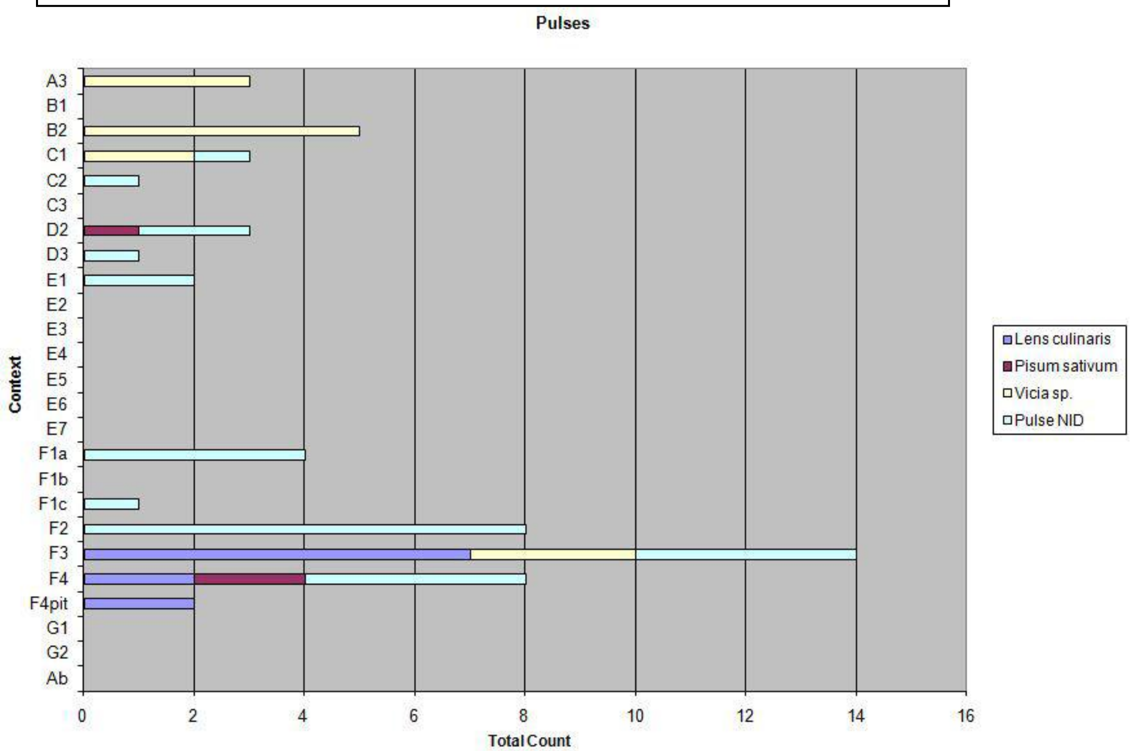


<u>Fabaceae</u>

Most of the species found were present in small numbers throughout the samples, although they were only recovered from one (E1) layer in E (Fig 13). In general more species were recovered from the lower F layers, although the numbers of recovered

Fabaceae species is quite low in all the samples. I did note that Lentils (*Lens culinaris*), were only found them in the lower F layers, mostly concentrated in F3. In addition to cultivated vegetable species of Fabacea, pulses, I also recovered a few species of clovers. These weeds may have been used as feed for animals and were additionally important agriculturally as nutrient (nitrogen) replacing plants. They are considered 'small' weeds, more often associated with the cleaning of less processed stored grains, and as a low growing weed they also suggest that the cereals were being harvested low to the ground (Stevens 2003a).

Figure 13: Total Seed Counts Pulses



<u>Wild Species and Grasses</u>

Wild species were present in most of the samples from Santul Mic, they have a surprisingly high concentration in the later period of occupation (B1-C1), and then again in the F layer (F1a and F4 in particular) (Fig.14) The species found included potentially wild food resources, the Brassaceae-cabbage family and potentially wild sage (*Salvia cf. nemorosa*), but were mostly composed of seeds from various weeds, and sedges (*Carex)*.

Wild grasses were also frequently recovered, though most were non identifiable to genus or species level. However *Bromus sp.*, *Lolium multiflorum*, *Leerisia oryzoides,* and *Poa sp.* were identifiable in many of the samples. These seasonal grasses may have been used for pasturing, fodder, or they may have been considered weed species and harvested along with the closely related species of wheat or barley (Schoch 1988).

A shrub from the Honeysuckle Family, Dwarf Elder (*Sambucus cf. ebulus*) was also present in a few samples throughout the site's occupation. This species is found commonly since the Neolithic, and is a bush with offensive odor in fertile soils of clearings or water meadows. Its fruit ripens in autumn and is a poisonous plant with some medicinal uses, as well as a potential source of (blue) dye (Schoch 1988)..

Weed Species

Of the weed seeds found that could be possible segetals (weeds harvested during a grain harvest) or ruderals (weeds that grow in fallow arable fields), depending on seasonality and the context of grains they were found with, Fat Hen or *Chenopodium album* was the dominant species both of the entire group of non domesticated seeds and generally within the wild seed composition of each sample (Fig.5). *Chenopodium* is a 'small' weed seed found commonly from the Neolithic period onwards, and present in almost all settlements. It is a widely distributed plant in refuse sites and arable fields, and in times of need the seeds could be used for flour (Schoch 1988).

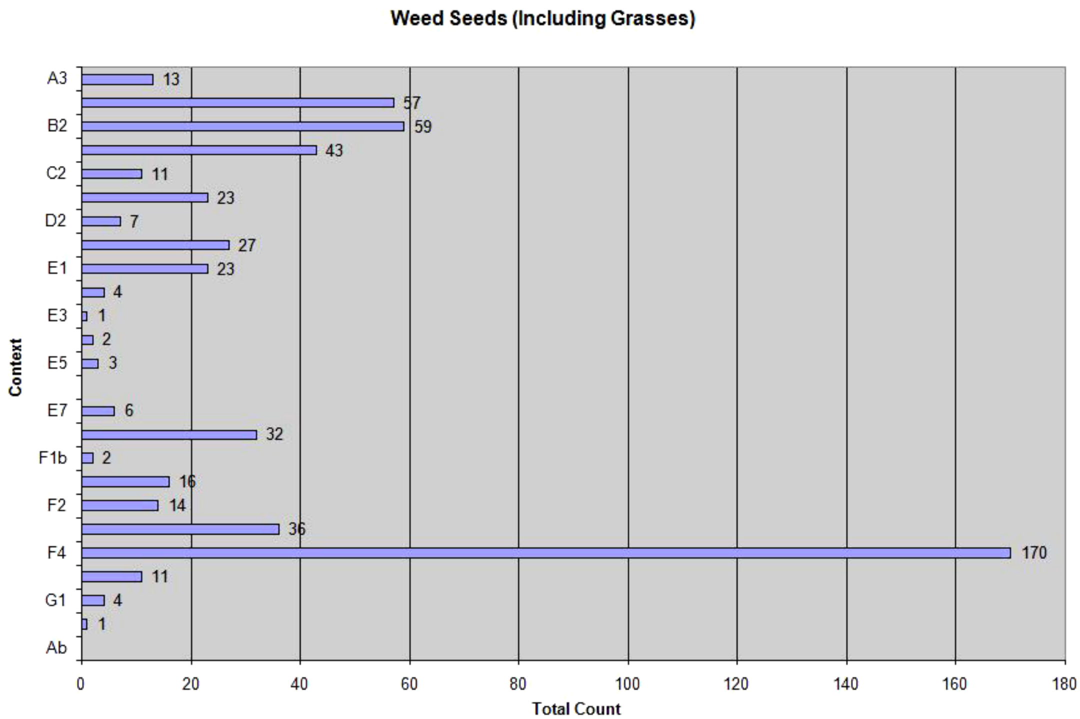
In the context of Santul Mic it is likely that it came from being harvested with a summer or fall cereal-harvest. Wheat from this environment would likely have been harvested June-August and *Chenopodium* ripens from the summer onwards. Furthermore as it was found in greatest quantities in samples with cereal grains and chaff, the inclusion with layers with high chaff (F1a and F4 especially) are of particular interest. From the size of the seed, its presence separated from the harvested grains likely suggests that it was removed in the fine sieving domestic stage of crop processing. This is supported by the presence of high amounts of cereal chaff, in particular spikelet forks and glume bases. These are also considered to be the characteristic waste products from fine sieving (Hillman 1984). Furthermore as it is considered a “small weed” it suggests that the grains which were being sieved were stored in more rough and unprocessed form (Stevens 2003a).

However it should also be noted that there are high percentages of Chenopodium in the higher B and C layers, which do not contain very high amounts of cereal grains and chaff (Fig. 7)(Fig. 12). Nor does a particular abundance of Chenopodium appear in E1 which has high chaff (the third highest with F4 and F1a), and charcoal components.

Nettle-leaved-Goosefoot (*Chenopodium cf murale*), *Sagina procumbens, Silene*, and *Spergularia media,* are all other ‘small’ weed seeds, which favor roads or cultivated fields and thus are likely also segetals (Schoch 1988).

Sedges (*Carex sp.*) may also have been included in the segetal category due to the environmental constraints on agricultural land in this region. Sedges are mostly found in wetlands (e.g. marshes, fens, pond edges and ditches) where they are often the dominant vegetation (Schoch 1988). As the Maros villages were cultivating domesticated species in fields bordered by wetland environments, it is likely that these weeds would mix in and be harvested with the grains. Docks and sorrels (*Rumex sp.)* found in alluvial woodlands, banks, and ditches probably were also included with harvested cereals for this reason and can also be counted as a ‘small’ weed (Schoch 1988).

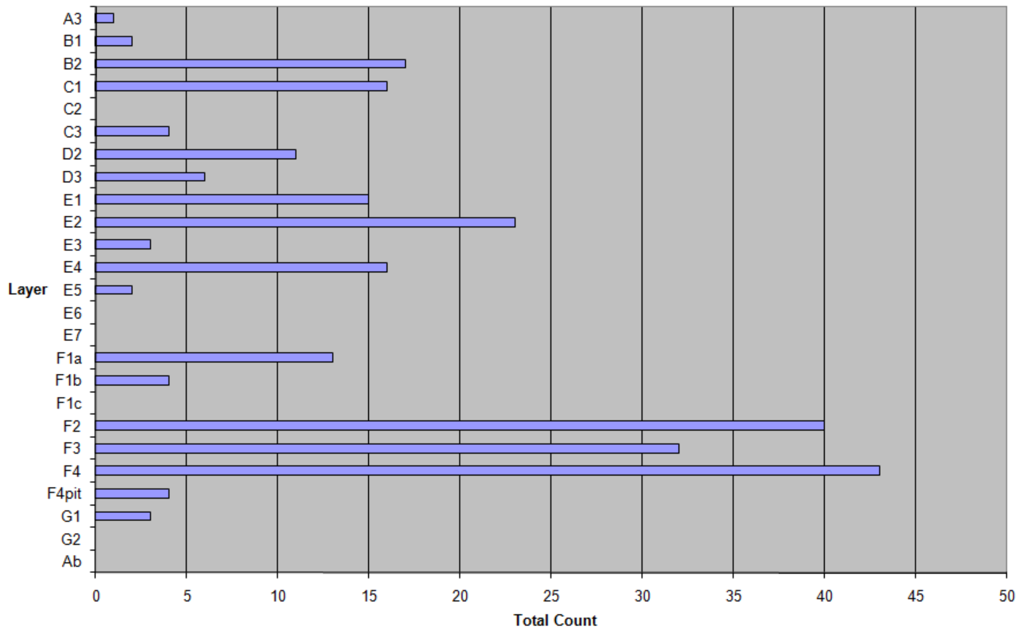
Figure 14: Total Counts of Weeds



<u>Non Identifiable Seeds</u>

Non Identifiable seeds, either because of poor preservation or because of constraints of time and extremely small size, composed about 4% of the all the counted seeds and were fairly evenly distributed (Table 1). The highest concentrations were found in layers F2, F3, and F4, however they composed only a small portion of the F4pit feature (Fig. 15).

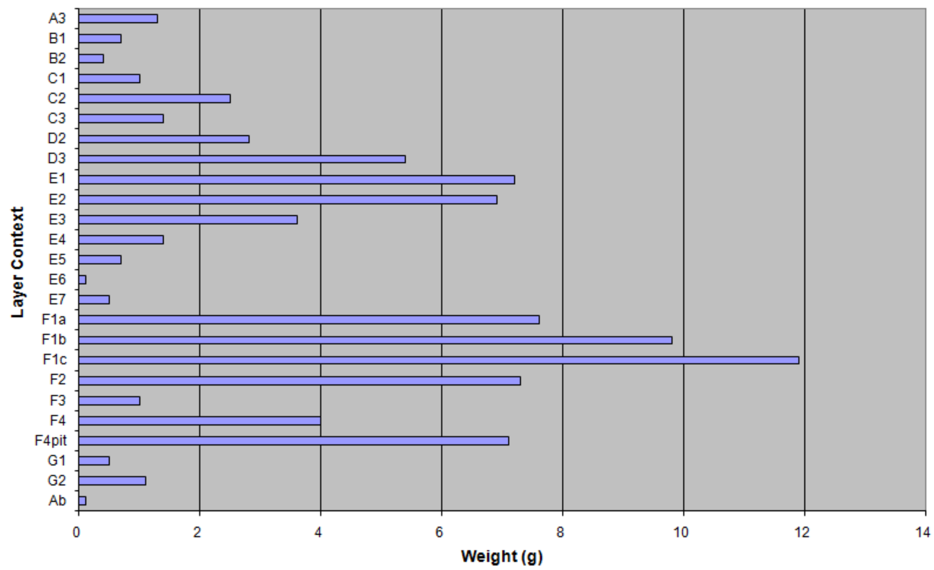
Figure 15: Non Identifiable Seeds Total Count



<u>Wood Charcoal</u>

Without the soil sample size, creating densities of charred materials to soil was not possible. However the weight of wood charcoal from each of the samples was taken and does provide important information about the burning event that may have caused the charring of the seeds, and the possible identification of features within the stratigraphy. Relatively high concentrations of charcoal were found in D3-E2 and most of the F layer (Fig 16). However I was surprised to see that the single highest concentration of wood charcoal was found in the F1c layer, which contained relatively few grains and no chaff. Layer F3 in turn had the highest amount of cultivated grains and one of the lowest wood charcoal amounts of the entire column.

Figure 16: Wood Charcoal (by weight)



Chapter Four:

ANALYSIS

The plants which I identified from the Santul Mic's light fraction corresponded closely with to the species identified from Hungarian Maros sites. (Gyulai 1993) (Jones n.d.). The sample contained only species that could be expected from an early to middle Bronze Age (2500-1700 BC) settlement in an environment mixed with forests, annual flooding, and thick alluvial layers. Although there are environmental variations between the settlements in the upper and lower regions of the Maros River, the similarities in the domestic agricultural species may reflect a regional shared Maros agricultural tradition.

The near ubiquity of wheat (Fig.5) and the presence of barley, millet, and cultivated vegetables show the importance of cereal agriculture and domestic species in the subsistence economy of the villagers. Wild turnips, *Brassica rapa*, may also have been cultivated or they may represent some of the wild plants gathered in addition to domestic plants.

From the stratigraphy, several of the flotation samples appear to come from the floors of different sequences of structures built during Santul Mic's occupation. The earliest of the carbon dates taken from the column was from a burnt floor layer, F2, which dated to 2080 BC, or roughly the beginning of the middle Bronze Age. The second was taken from layer C2, which dated to 1820 BC, about one hundred years from the late Bronze Age, roughly when the settlement was abandoned.

Production and Consumption

In addition to gaining a deeper knowledge of the domestic and wild species used by Maros villages in Romania, one goal of this research was to look at the scale and organization of agricultural labor at Santul Mic, and if possible to see evidence of a ‘producer’ or ‘consumer’ site distinction. Evidence for these, or any other changes seen in site use or subsistence patterns, could make the relationship between Santul Mic and Santul Mare clearer, and show the potential for greater social organization.

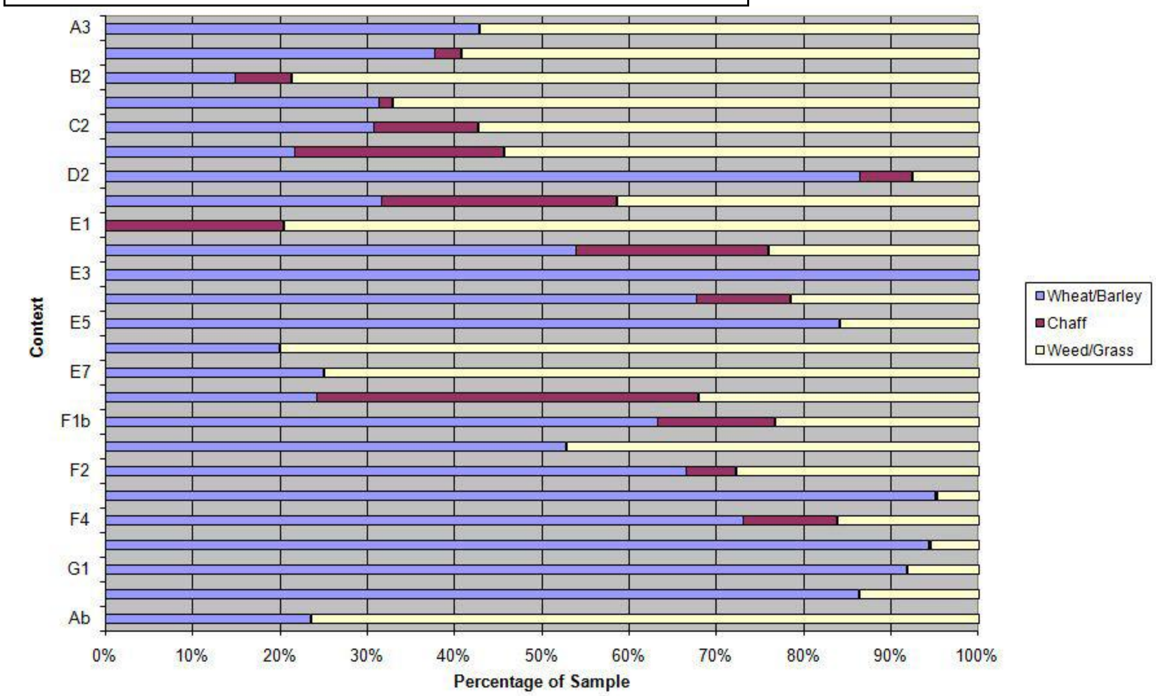
As a producer site Santul Mic could have been part of a settlement hierarchy and perhaps provided agricultural surplus for an emerging chiefly center (Santul Mare). In looking for agricultural evidence for a site specializing in cereal production, I would have expected to find some of the crop processing by-products associated with the initial stages of production (e.g. threshing, winnowing) in the flots. These would only be carried out on sites that grew the crops, as the later stages of production would have been done domestically in both producer and consumer sites. (Hillman 1984).

In my samples the only chaff recovered were spikelet forks and glume bases (Table 1). These are characteristic of the fine sieving stage of production, done within individual households. Thus their presence does not indicate whether the domestic structure belonged to either a settlement specializing in crop production or one consuming grain from such a specialized dependent site elsewhere.

An additional difficulty with distinguishing Santul Mic as a primary production center is the lack of horizontal context-all the analyzed samples came from a single column. Evidence for early stages of production may be present in other (not sampled) regions of the site. Even if evidence for early stages of crop production were seen in the samples, these results would then have to be compared with equivalent archaeobotanical samples from Santul Mare. To really see if Santul Mic was supplying surplus for Santul Mare, one would have to see additional evidence from Santul Mare acting as a consumer site. Further archaeobotanical samples and other archaeological features, like large storage pits, would be essential in establishing this relationship.

Although a ‘producer’ or ‘consumer’ level of distinction is not visible from my samples, the stages of post-storage processing do give a view of daily life and domestic Maros crop processing. Furthermore the composition of grain, chaff, and weeds from the burned waste of domestic grain processing, shed light on the labor involved in earlier communal stages of crop production (Fig. 17)

Figure 17: Grain, Chaff, and Weed Composition



Daily Activities

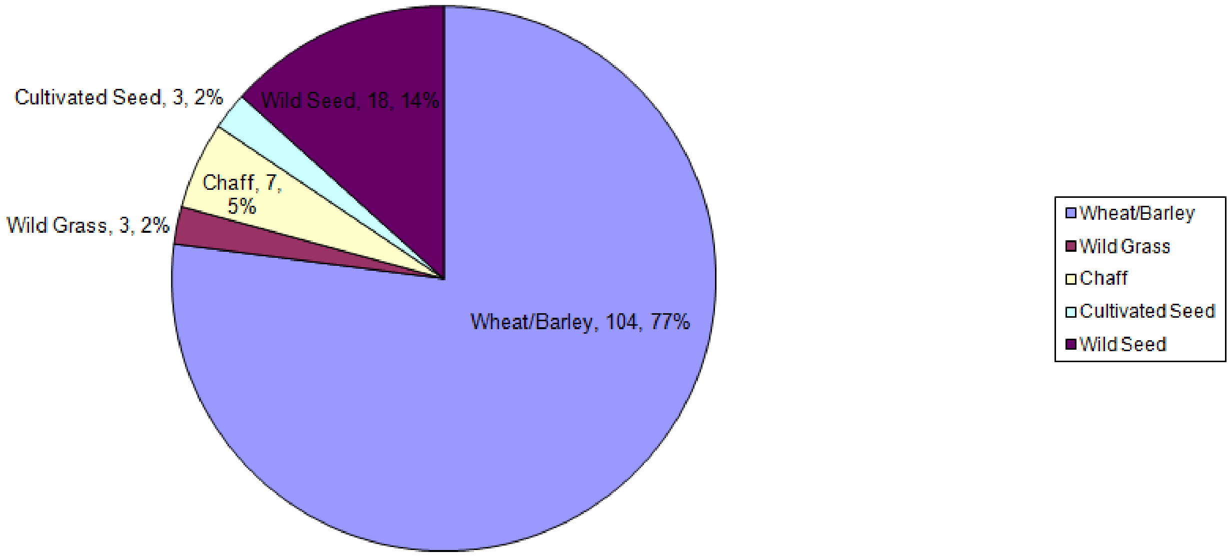
The Santul Mic profile (Table 8) shows a series of structures with visible prepared floors separated by layers of “fill” which built up during the use or in the destruction of the structures. In general both the quantities of species found (diversity) and the numbers of each species were higher in the flots from the lower samples of the column (especially layer F). While this trend is biased by the lack of horizontal visibility (inherent with a single column sample), the consistency of this pattern across all the categories of my analysis-the domesticated species of grains and beans, the wild grasses, other wild seeds, chaff, and charcoal-make this more interesting.

The samples from the A, B, and C layers in general tended to be more mixed, and are visibly interrupted with both ancient and more recent animal burrows. The samples from the G and Ab layers also were taken from below the lowest identified occupation layer to test the stratigraphy, and, as they do appear to be below real occupation layers they contained very few remains and little could be seen archaeobotanically. However I was able to clearly see burned waste from fine sieving and hand sorting from floor and fill layers in D, E, and F.

Layer D2 appears to be a floor feature (Plate 8), and it is interesting to note the relatively high count of wheat grains recovered from the sample (Fig 17). It contains the highest count of cereal grains outside of the F samples, though both less chaff and less charcoal than D3. Given that charred grains made up over 75% of the sample (Fig 17), and that both chaff and wild species were present in such low numbers, D2 may represent a sample of clean grain. This would mean that it had undergone the final stages of crop processing, hand sieving, which would have removed the final chaff components and the weeds which would have remained after fine-sieving. (Hillman 1984)

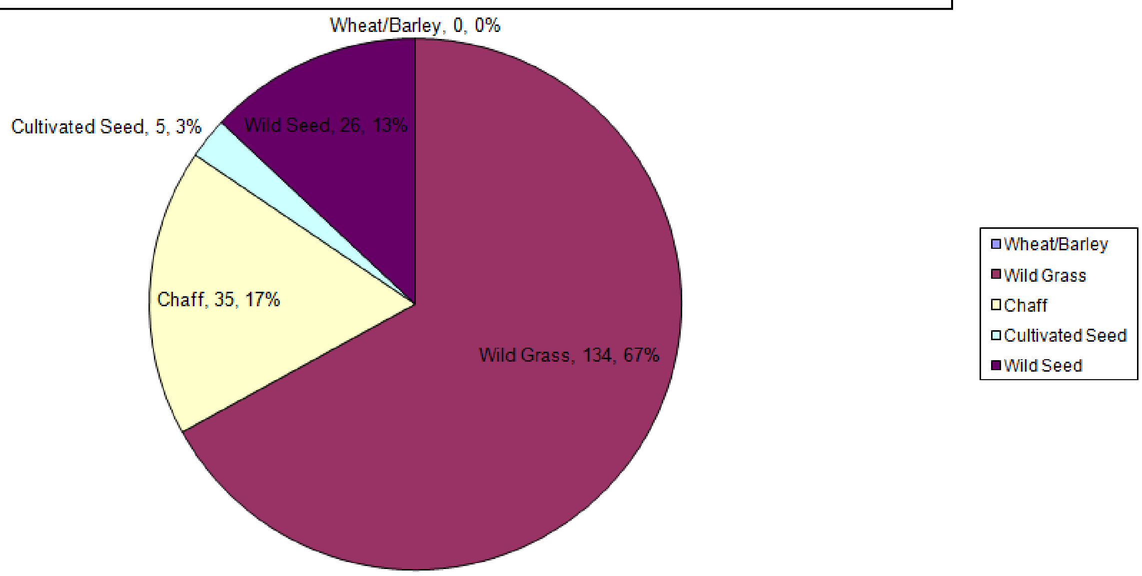
As such this sample could reflect grains which were cleaned, but burned before (in storage) or during cooking. It is especially interesting to think about this sample reflecting cooking and food preparation, as a small amount of burned food residue was recovered with these grains in D3.

Figure 18: D2 Sample Composition



In contrast with D2, E1 stands out as a likely example of burned fine sieving by-product (Fig 18). E1 contained the highest single concentration of wild grass seeds (Fig.), the third highest amount of chaff of all the samples I analyzed, and it also had one of the highest charcoal weights (Fig. 16). It was the only sample with a complete absence of any charred grains.

Figure 19: E1 Sample Composition



Floors, Hearths and Storage Pits

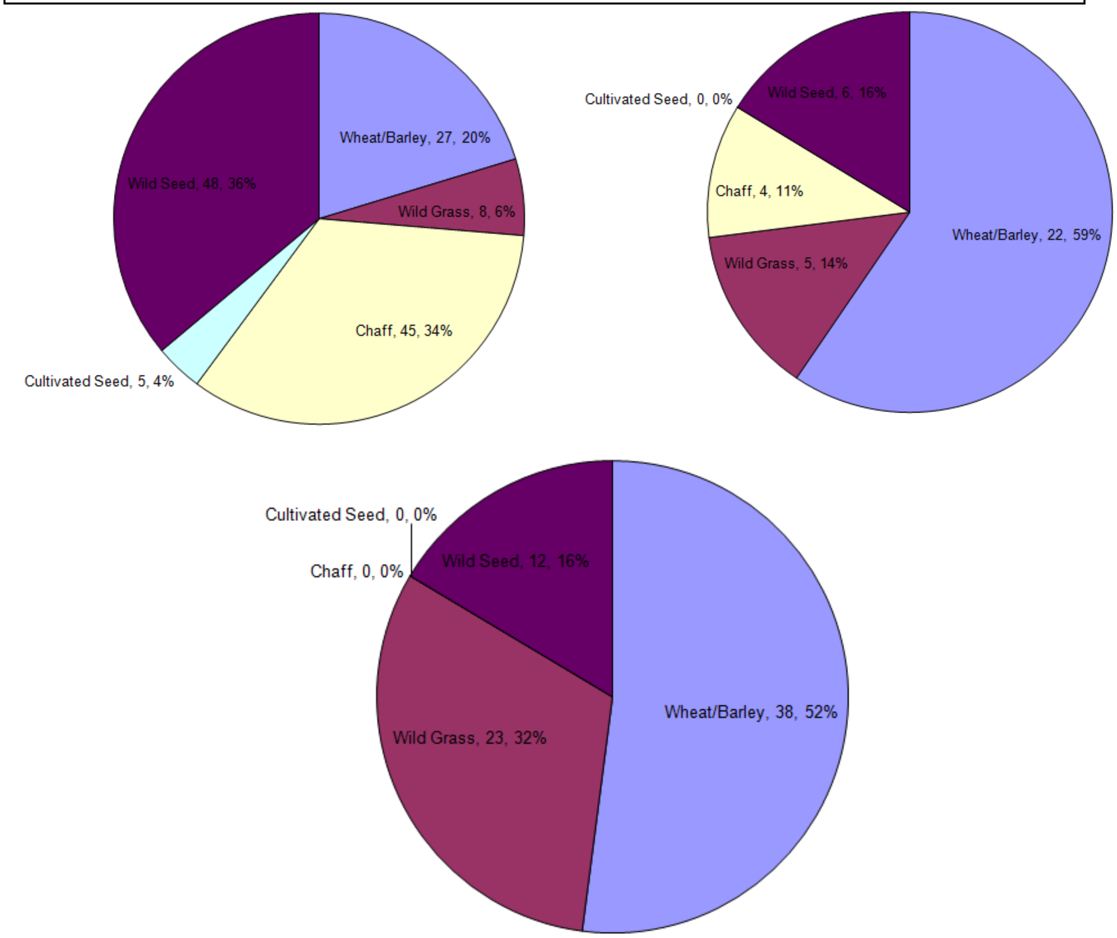
While most of these samples only reflect the 'background' daily processing and consumption of cereals, a few of these samples do provide more specific information about the contexts they were recovered from. In particular the burnt floor, possible hearth, and the burned pit with a storage vessel in the F layers. The burnt storage vessel within the pit in particular is an important sample as it reflects a single burning event *in situ*. (Fuller 2005, Stevens 2003a). Unlike the mixed floor deposits, which likely reflect the work of many activities thrown into the fire and then deposited on floors or elsewhere, these primary deposits show a single event and can reflect the function of the context it was sampled from.

Layer F:

The greatest diversity of species, cultivated and wild, and the highest counts of species all came from the F layers. With the exception of F1a, the other samples were all dominated with cereal grains and wild grasses, and only in sample F2 (Fig 21) did this portion include large amounts of wild grasses. Thus the majority of F samples contained very high counts of burned grains.

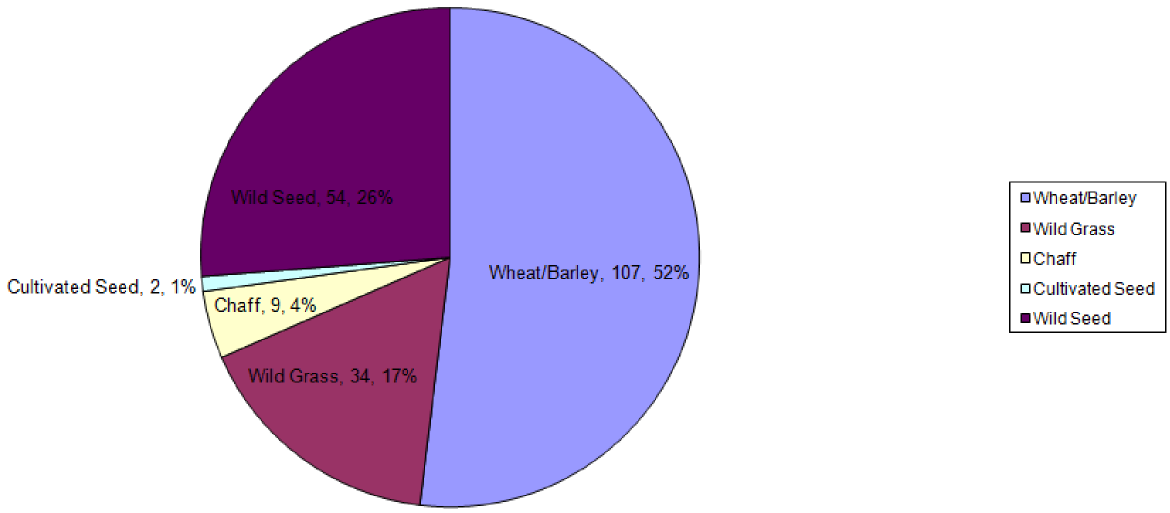
F1a was similar to E1 in the extremely large amount of chaff (second highest) found in the flot (Fig 12). It also contained high amounts of both wild weeds and grasses, all of which likely represent burned fine sieving by-product (Fig 19). Within the three samples of F1, I observed that while the counts of cereals were in general low, they contained significantly more wood charcoal than the other samples, especially F1c (Fig 16). It may be that the structure represented by the F2 floor (also with a fairly high amount of charcoal) burned and formed the thick fill seen in the stratigraphy (Plate 8).

Figure 20: F1a, F1b, F1c Sample Composition



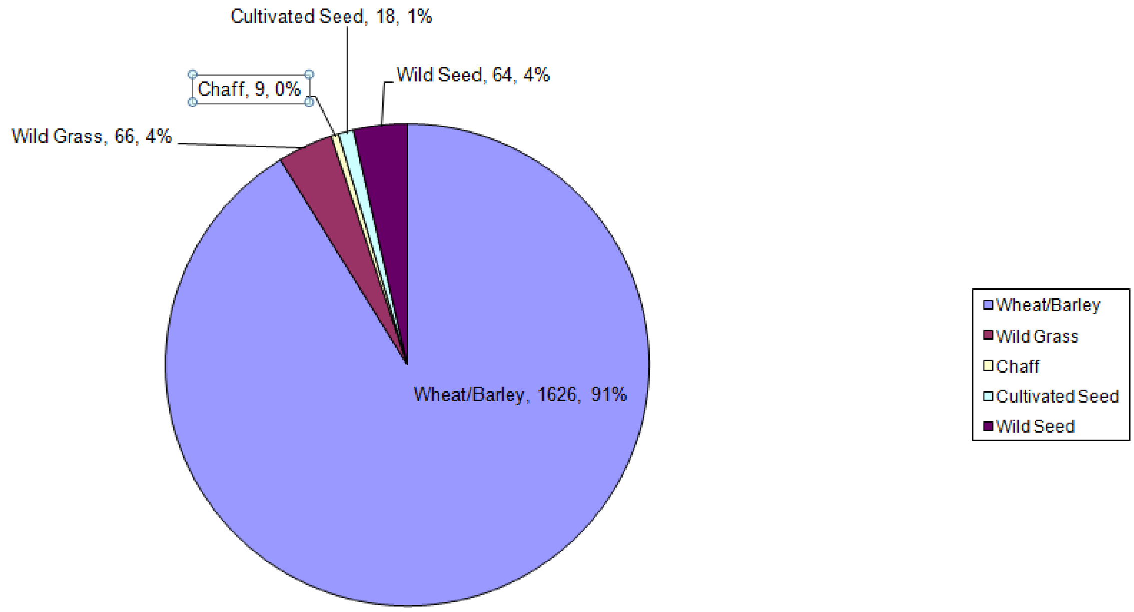
Starting with F2 and especially from the lower F3, F4, and F4pit samples there is a notable change in sample composition. Although its grain count is closer to layer D2 than those in F3 and F4, the sample from F2 still contained more grain seeds than all the F1 samples put together (Table 1). The sample was composed (Fig. 20) of about 50% with burned grain, these grains were almost evenly balanced with wild weed and grass species, and a relatively low amount of chaff (Fig 12). It also had the greatest amount of wood charcoal of all the samples (Fig 16), in addition to the grain-weed mixture. Thus the sample seems to have both the processing by-product, which might be expected to build up on a floor, and an unusually large amount of burned wood. As the above F1 samples also contained high amounts of wood charcoal, this may further support that the structure, which layer (F2) formed the floor of, may have burned down, laying down a thick charcoal-dense deposit.

Figure 21: F2 Sample Composition



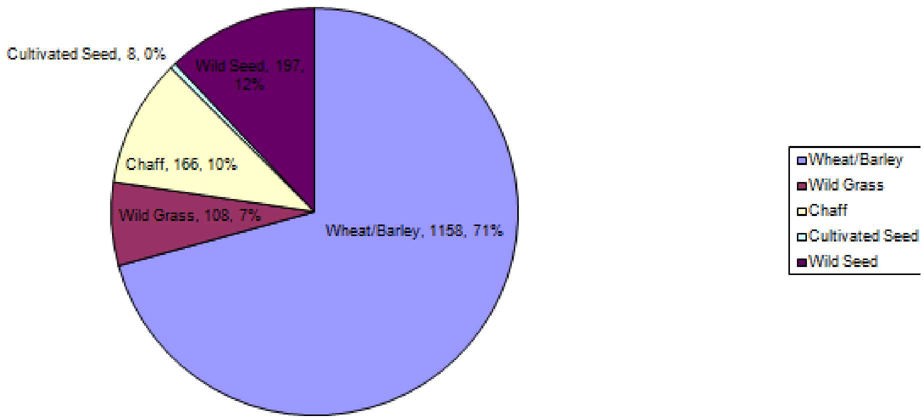
Of all the samples I found the highest number of burned cereal grains in F3, making up (Fig. 21) roughly 90% of the samples seed count. Fairly high amounts of wild seeds and grasses were also found and the highest amount of cultivated, Fabaceae, seeds. However there was a very low chaff presence, especially when compared with the other F samples. When compared with the F2 sample, F3 contained far less charcoal, but a substantially larger amount of grain. The richness of this fill layer was interesting particularly as the F4 layer beneath it, is visibly oxidized and possibly a hearth feature (Plate 8). The high amount of cleaned grain is surprising, however as I would not expect such a waste of valuable fully processed grain.

Figure 22: F3 Sample Composition



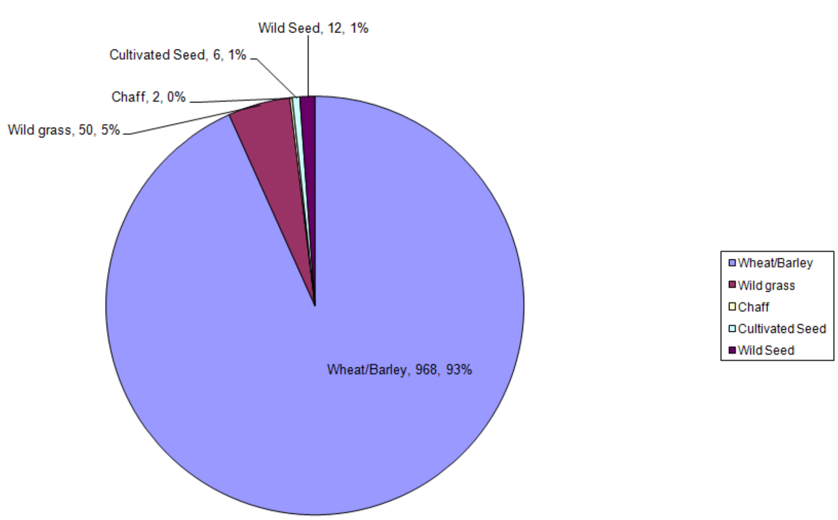
The potential hearth, the F4 sample, also contained a very grain rich composition (Fig. 22), as well as a high diversity and count of both wild and domesticated species. It also contained the single highest count of chaff remains, which stood out even more when compared with the F3 sample above it. The high presence of chaff and weed seeds, particularly *Chenopodium*, would be expected if F4 represented a hearth which was used by the structure's occupants to dispose processing by-products after sieving and hand sorting. Furthermore the presence of *Chenopodium*, as a 'small' weed also could suggest that the processed grains, taken from storage, were more likely being stored in a semi-threshed as opposed to semi clean state. Because of a lack of organization or available participants during the harvest and initial processing stages, more of the labor may have been reserved for the later domestic stages of sieving, sorting, and cooking at Santul Mic.

Figure 23: F4 Sample Composition



Although it was taken from the same layer, the pit feature from F4 contains a strikingly different composition (Fig. 23). The sample was taken from a pit, in which a broken storage vessel was found, and it contains almost purely domestic seeds, of which almost all were einkorn wheat (the third largest concentration). As very few weed species and almost no chaff was recovered in this sample, it suggests to me that this pit and the contents of the storage vessel were likely cleaned both by fine sieving and hand-sorting. This pit and vessel do not reflect grain stored after harvest, as they would be stored in spikelet form (semi-threshed or semi-cleaned), but a store of grains burnt before the cooking process.

Figure 24: F4pit Sample Composition



SUMMARY

These samples make it apparent that the floors and other features excavated at Santul Mic were very likely part of domestic structures, which were engaged in daily domestic levels of crop production, fine sieving, storage, and cooking. While no evidence for earlier stages of crop production were found, as would be expected at a production site, these remains are usually only preserved when deposited in great numbers due to their delicate nature, and thus only in contexts where threshing or winnowing were taking place. As the column sample is limited in what portions of the site it makes visible these initial stages of crop processing may have been present at Santul Mic during its occupation, but additional horizontal samples would be required to look for these. What can be seen, is the storage and use of domesticated food plants, particularly wheat, barley, and vegetables. Based upon evidence from the floor layers these were processed, at least in the final stages, on a domestic level and the by-product waste was likely thrown into hearths. Additionally from the food residue remains found in D3 and the cleaned grains from the F4pit, evidence of specific cooking events may be visible.

The wild species present in the samples provide more information about the layers they were taken from. Wild vegetables and herbs may have been collected or grown to supplement the domesticated species that were grown by the Maros villagers, and the weed species present can show the stage of crop-processing carried out domestically. Weeds also provide information about the season and environment which domestic crops were grown in. Where segetals, *Carex*, were found it is also possible to discuss their use as reed-building material in the structure of the houses in addition to their potential as segetals. If these were brought into the village to repair or construct portions of buildings this would mean that the villagers were gathering the reeds in late summer or early autumn, as this is when the species produces its seed.

While looking at any sample in isolation can only give a limited view of the actions which took place in its layer and in the formation of the sample (the burning event), when I looked at all the samples of F a few things consistently stood out. It does seem likely that the floors associated with samples F2 and F4 represent houses which stored, sieved, sorted, and cooked wheat, barley, and vegetables. It is also possible that the F2 structure at some point burned down and formed a thick wood-charcoal heavy layer above it.

When compared with other layers higher in the stratigraphy the decrease in species diversity, both wild and domestic, and the general decrease in seed count also stood out. While additional samples from equivalent horizontal layers would have to be taken to test this, it does seem that grain processing and cooking occurred throughout the occupation of Santul Mic. However these samples suggest that these processes were carried out on a greater scale in the F layers, around 2080 BC the early middle Bronze Age, than around 1820 BC nearer to Santul Mic's abandonment at the end of the middle Bronze Age. Furthermore from the burnt waste of routine fine-sieving, the presence of "small" weeds in the by-products suggests that the processed grains, taken from storage, were more likely being stored in a semi-threshed as opposed to semi-clean state. While the samples size is not large, the analysis of Santul Mic's macroboanicals reflects a smaller scale more autonomous level of agricultural organization in the semi-threshed as opposed to semi-clean storage of wheat. Thus from the available archaeobotanical analysis, Santul Mic appears to reflect a level of social organization more suited for a middle-range than chiefly society.

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Appendix I: DATA TABLES

Table 1: Total Seed Count

	A3	B1	B2	C1	C2	C3	D2	D3	E1	E2	E3	E4	E5	E6	E7	F1a	F1b	F1c	F2	F3	F4	F4pit	G1	G2	Ab
Triticum monococcum	6	12	4	12	11	4	29	13		2	6	6	2		2	18	5	8	75	1450	1091	403	45	57	17
Triticum cf. monococcum		13		2	2		37			21	12	10	11	2			8	6							
Triticum sp.		12	8	7	8	6	37			4	9	3	3			7	6	24	31	176	53	563		5	18
T. monococcum spikelet fork		2	3	1	5	7	7	10	17	10		2				27	4		9	5	77	2			
T. monococcum glume base		1																							
Triticum sp. s.f./g.b.			2		3	4		1	18	1		1				18				4	89				
Hordeum vulgare								10													1				
Hordeum sp.	6	1				6	1	6			1					2	3		1		13	2			
Cereal NID*	•	•	•	•	•	•	••	••	•	•	•	•	•	•	•	•	•	•	•	••	••••	•	•	•	•
Panicum miliaceum								1	2	1		1				2					2				
Avena sp.												1						1	1	3	2	2			
Lens culinaris																				7	2	2			
Melilotus sp.								1		1									1						
Pisum sativum							1														2				
Trifolium sp.	1								2							1									
Vicia faba	3																								
Vicia ervilia			5	1																1					
Vicia sp.				1																2					
Pulse NID				1	1		2	1	2							4			1	8	4	4			
Bromus sp.				2	4			1	4									2		6	7	1		1	
Lolium multiflorum					1															1					
Leersia oryzoides				2	1	1		1	9											1	5				
Poa sp.										1						2		1		8	5				
Grass NID		2	2	2	28	8	3	8	119	9		5		8		4	5	19	32	47	87	47		8	55
Brassica rapa		3			1		1	1	4	1									2						
Brassaceae	4								2							8				14	5				
Sambucus cf. ebulus	4		1	1	2			2												1					
Carex paniculata																					4				
Carex sp.	1			1	1	1	2	2	1												9				
Salvia cf. nemorosa	2																								
Sagina procumbens			11	4											6										
Silene sp.							1									1			1	15	18	8	2		
Melandrium cf. noctiflorum			1																						
Melandrium cf. diurnum			1																						
Chenopodium album	2	49	43	31	4	15	1	1	3	2		1	2			20	2	12	11	1	48				
Chenopodium cf murale		1	3	1					1				1										1		
Rumex cf. sanguineus		2	2	2			2	2												1	2				
Rumex sp.		4						2								1					1				
Spergularia media	3															5					67		1		
Veronica Hederifolia						1																			
NID**											2	2				13			1	22	11	1			
NID	1	2	17	16		4	11	6	15	23	1	14	2				4		39	10	32	3	3		
TOTAL	33	104	103	87	72	57	##	69	199	76	31	46	21	10	8	133	37	73	205	1783	1637	1038	52	71	90

* Presence of non-identifiable cereals by relative weight

** Seeds not identified with potential future identification

Table 2: Wood Charcoal

Context	A3	B1	B2	C1	C2	C3	D2	D3	E1	E2	E3	E4	E5	E6	E7	F1a	F1b	F1c	F2	F3	F4	F4pit*	G1	G2	Ab	**Total**
Wood Charcoal (g)	1.3	0.7	0.4	1	2.5	1.4	2.8	5.4	7.2	6.9	3.6	1.4	0.7	0.1	0.5	7.6	9.8	11.9	7.3	1	4	7.1	0.5	1.1	0.1	**79.2**

Appendix II: PLATES

Plate 1: Diagram showing Rainfall and Flood Regimes (from Sherratt 1980: 320)

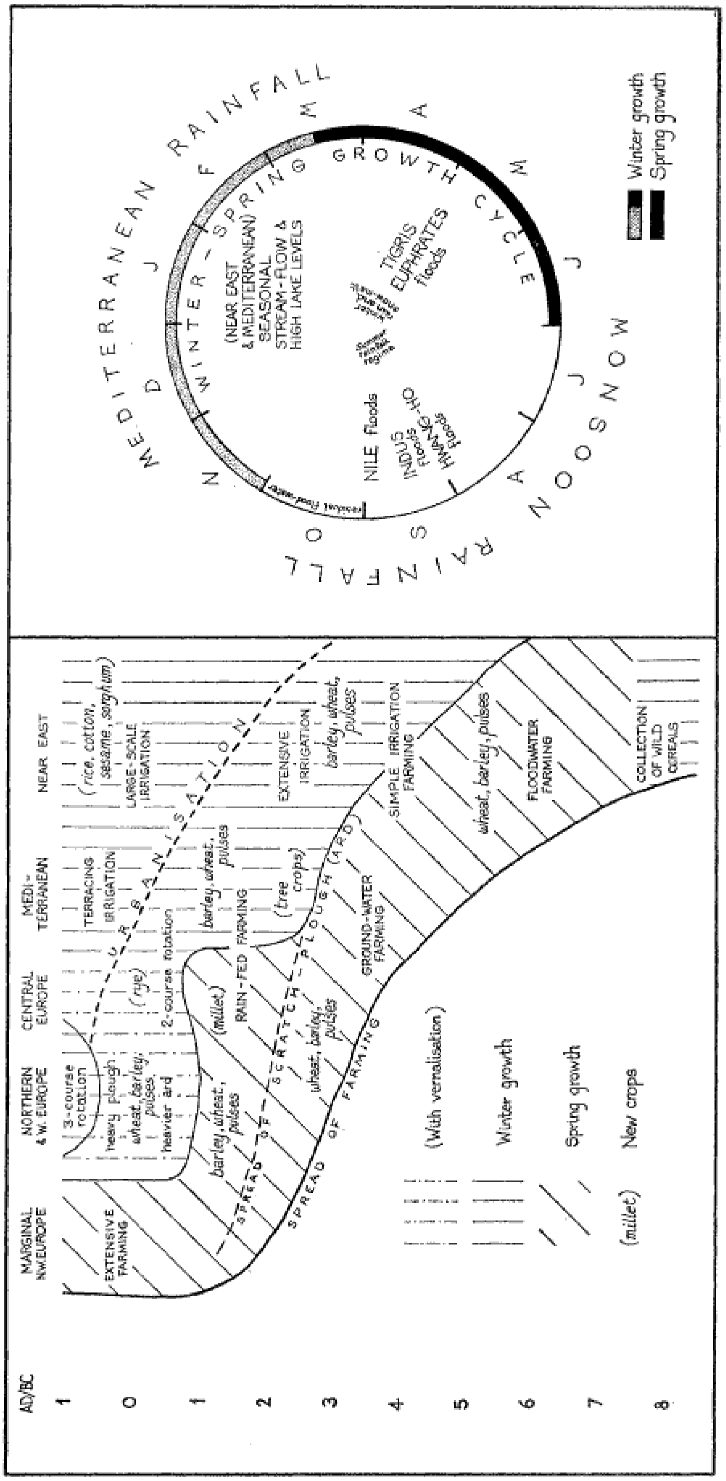
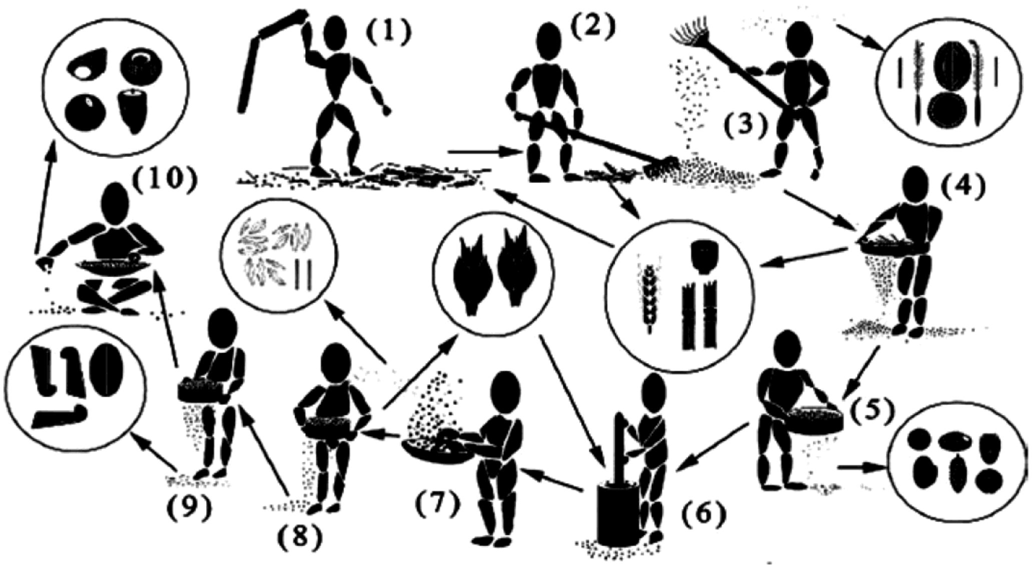


Plate 2: Cartoon of the main crop-processing stages for *glume wheats* (from Stevens 2003: 63)



1. Threshing. 2. Raking. 3.Winnowing. 4. Coarse sieving [note return of some by-products to threshing]. 5. Fine-sieving. 6. Pounding (dehusking). 7. Winnowing. 8. Coarse sieving (to return undehuksed spikelet to previous step). 9. Fine sieving. 10. Hand-picking

Plate 3: Diagram of Crop Processing Stages with By-Product Proportions (from Stevens 2003d)

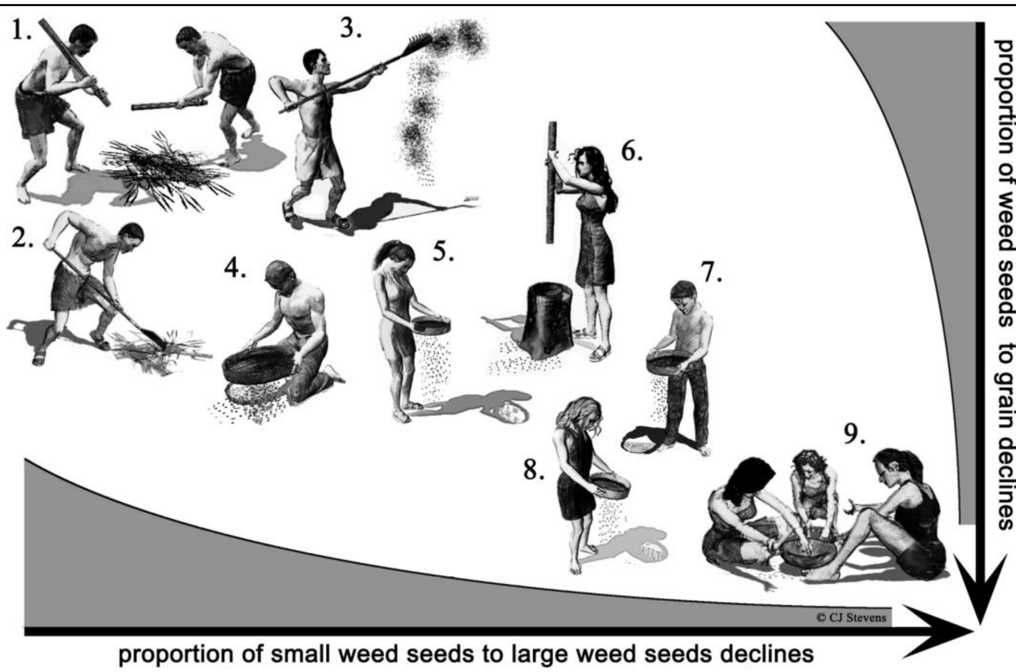


Plate 4: Glume Wheat Grain and Associated Chaff (from Hillman 1984: 2)

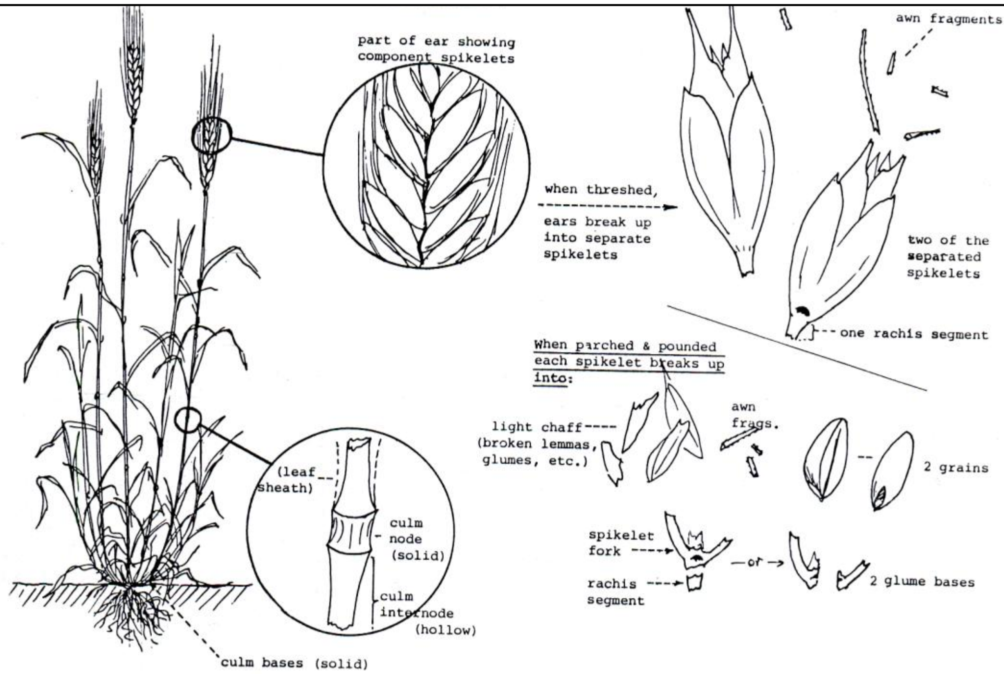


Plate 5: Glume Wheat Crop Product Composition and Likelihood of Survival (from Hillman 1984: 10)

TABLE 1. COMPOSITION OF THOSE CROP PRODUCTS LIKELY TO SURVIVE IN CHARRED REMAINS FROM ARCHAEOLOGICAL SITES - GLUME WHEATS ONLY

▬ = very rare
X = few
XX = some
XXX = lots
Items in brackets '[ ]' = present only if crop was harvested by uprooting.
Small encircled crosses '(XXX)' = items released only as a result of fragmentation of other items (such as whole spikelets) after the latter have been charred.
The symbol '≡' = 'the equivalent (of)'.
Σ = 'sum of ...' .

product number (used only in this table)	the crop processing stages which generate each class of product (numbered as in figures 3 and 4)	crop product classification code (as used at Cefn Graeanog)		a culm bases	b culm nodes	c awn segments	d intact spikelets (non-basal)	e intact spikelets (basal, abortive)	f spikelet forks	g glume bases	h non-basal glume fragments 1	i rachis internode segments	j grain - prime	k grain - tail	l weed heads - much larger than spikelts	m - ± same size as spikelets	n - smaller than spikelets	o seeds larger than prime grain though smaller than spikelets	p seeds of same size as prime grain	q seeds smaller than prime grain	commonest amalgamations (pre- and post-burning)
1.	not numbered	BΣ (≡ of all B classes combined).	Residues from burning of whole sheaves (either from accidental burning of sheaf-stores or delib. sheaf-burning as in side-loop of figure 3)	[XX]	XX	XX	XXX	XX	XXX	XXX	XXX	XXX	XXX	X	XX	XX	X	X	XX	XXX	
2.	4, 5, 6a	B 1	'Straw waste' from raking, 1° winnowing, and coarse riddling (ie. threshing floor waste)	[XX]	XX	XX	▬	XX							XX			X	XX	XXX	
3.	8	≡ of B2 + B3 + B4 + B5 combined.	Threshed spikelets charred during parching and, in wet areas, accidental burning of spikelet stores	[X]	X	X	XXX		XXX	XXX	XXX	XXX	XXX	X		XX	X	X	XX	XXX 3	
4.	11 (+ 6b)	B2	Coarse sievings (larger than prime grain)	[X]	X		X	XX									X	▬			
5.	12 (+ 13b)	B3	Fine sievings (smaller than prime grain)	[▬] 5	▬ 5				XX	XXX		XXX		XX						XXX	
6.	follows 13	B4	Semi-clean grain in bulk storage charred as a result of accidents in grain stores or in course of sterilization of storage pits	[▬] 6	▬ 6	▬			X	X		▬	XXX	X					XXX	X	
7.	14	B5	Cleanings from hand-sorting (applied immediately prior to the grain being prepared as food)	[▬] 6	▬ 6	▬			X	X		(▬)							XXX 4	X 4	
8.	24	B6	Clean prime grain (charred during roasting, etc.)										XXX	X							

Plate 6: Crop Processing Sequence with Associated By-Products (from G. Jones 1984: 44 adapted from Hillman Model)
***Ethnobotanical details taken from modern Aegean context**

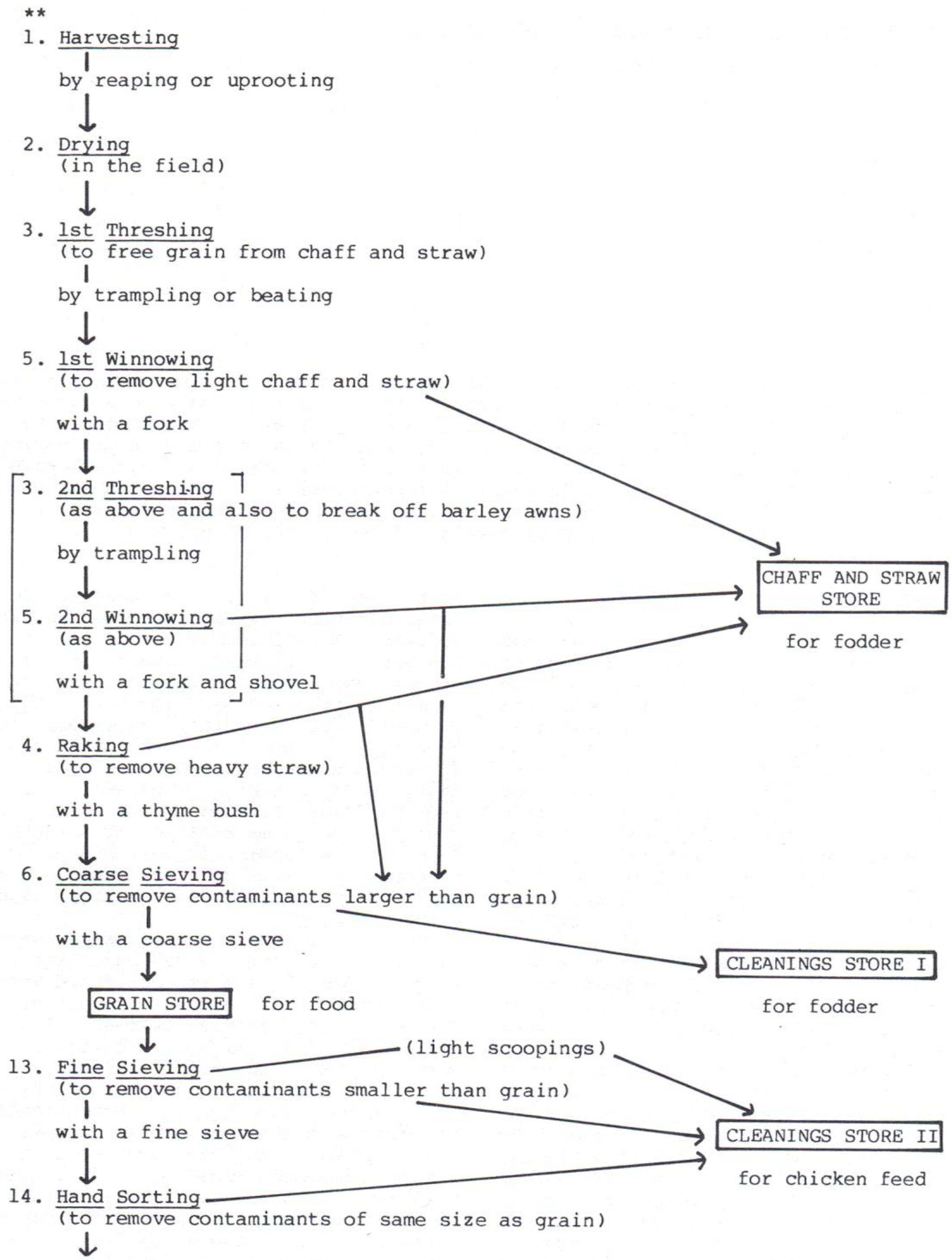


Figure 1. The processing sequence for free-threshing cereals and pulses*

Plate 7: Important Wheat Chaff Components (from Jacomet 1996)

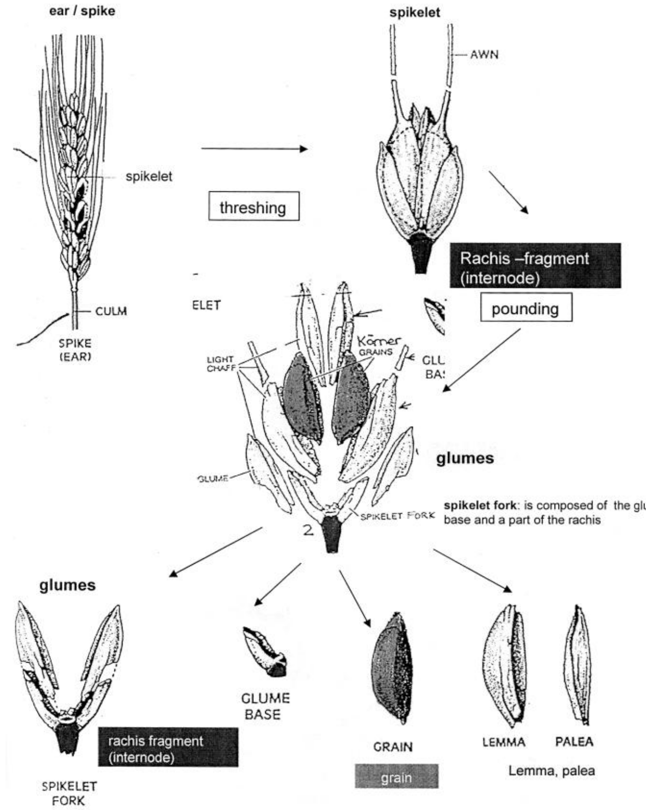


Plate 8: Santul Mic: East Profile Stratigraphy Photograph