Title

Sustaining Community under Empire: An Archaeological Investigation of Long-Term Agricultural Production and Imperial Interventions at Dhiban, Jordan, 1000 BCE - 1450 CE

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Sustaining Community under Empire: An Archaeological Investigation of Long-Term Agricultural Production and Imperial Interventions at Dhiban, Jordan, 1000 BCE - 1450 CE

by

Alan S Farahani

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Committee in charge:

Professor Benjamin W. Porter, Chair
Professor Christine A. Hastorf
Professor Carlos F. Noreña

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Abstract

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Large, pre-modern complex agricultural societies faced significant environmental and social challenges in sustaining and maintaining the intensification of agricultural production that facilitated wide-scale redistributive food systems. Yet how agricultural societies embedded in larger social and economic networks balanced the needs of non-local political entities and the necessities of everyday local life is not often explored for communities living on the margins of polities who utilized written language. The archaeological site of Dhiban in the contemporary Hashemite Kingdom of Jordan has been occupied for at least 3,000 years by sedentary agricultural communities. Nevertheless, regional elites wrote little about the settlement. It is still unknown how successive communities managed to flourish despite the environmental challenges of inhabiting a semi-arid landscape with annual precipitation too low for reliable rain-fed farming. This dissertation focuses on the Byzantine (300 - 640 CE) and Mamluk (1260 - 1450 CE) empires, who oversaw two separate attempts to increase the production of agricultural goods within their respective political territories. The specific trajectories and economic prerogatives of those empires differed, and therefore provide insight into how varying political and ideological institutions affected local lifeways at Dhiban. Archaeological data derived from the excavation of the mounded archaeological site in 2009, 2010, 2012, and 2013, and the high-resolution sampling, recovery, and analysis of paleoethnobotanical data, combine to explore empirically the local agricultural practices of historical farmers in Dhiban and their responses to state intervention via the agricultural economy.

Contrary to perceptions of timeless and unchanging agricultural practices in the Eastern Mediterranean, the results of the project reveal that communities at Dhiban in these two periods exercised considerable agency in the choice of agricultural crops, the composition of agricultural fields, and the organization of agricultural labor and crop processing. Mamluk period archaeological deposits contain paleoethnobotanical evidence of an irrigated wheat and barley monocropping strategy with significant crop-processing occurring on site, although there is also archaeological evidence of periodic site abandonment. Byzantine pe-

riod deposits, in contrast, contain no evidence of abandonment, and little crop-processing occurring on site. Nevertheless new varieties of agricultural crops appear in Mamluk period deposits, such as plum and sorghum, as a result of trade or garden-plot cultivation. Therefore, although these communities faced environmental constraints in the range of crops that could be grown, and participated in the unique economic networks of each political intervention, they demonstrated choice in the kinds and proportions of agricultural goods produced. The theoretical contributions of this project thus apply both to the archaeological and general scientific community concerned with sustainability by providing a diachronic paleoethnobotanical data-set nuanced by the influence of human decision-making.

For my mother, father, sister, and brother, always.

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Acknowledgments

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Chapter 1

Introduction

In a provocative 1981 monograph entitled *Poverty and Famines: An Essay on Entitlement and Deprivation*, Nobel-prize winning economist Amartya Sen re-analyzed and contested the standard contemporary economic models surrounding the reasons for widespread hunger in many places in the world, such as Bangladesh and Ethiopia. Sen argued that it was not a simple shortage in the availability of food (i.e. quantity) which increases in real production could rectify, but unequal social mechanisms of the distribution of that food (what Sen called entitlement) that led to nutritional deprivation among large swaths of global populations. For many within the social science community, the recognition by an econometrician who, in the very same book, provided 20 pages of appendices with econometric formulae detailing his formalized models of exchange, price valuation, and utility, that so-called "social factors" could determine economic outcomes within economic exchanges, was notable (Osmani 1995). It is worth quoting Sen's summary of his final results in full (Sen 1982: 154, italics added):

> A food-centred view tells us rather little about starvation. It does not tell us how starvation can develop even without a decline in food availability. Nor does it tell us – even when starvation is accompanied by a fall in food supply – why some groups had to starve while others could feed themselves. *The over-all food picture is too remote an economic variable to tell us much about starvation.* On the other hand, if we look at the food going to particular groups, then of course we can say a good deal about starvation. But, then, one is not far from just describing the starvation itself, rather than explaining what happened. If some people had to starve, then clearly, they didn't have enough food, but the question is: why didn't they have food? What allows one group rather than another to get hold of the food that is there?

The most relevant aspect of Sen's larger argument to this project is not the impact of the entitlement approach on economic theory (Atkinson 1999; Pressman and Summerfield 2000), or even on the vast food security and risk literature (Shipton 1990; Bohle et al. 1994; Pottier 1999; Devereux and Maxwell 2001; Schmidhuber and Tubiello 2007; Mooney and Hunt 2009), but the recognition that phenomena that were assumed to be explainable by mathematical modeling alone, needed to extend into "social, political, and legal issues". Ultimately, Sen noted that (1982: 158, italics added):

> It is not my purpose to deny the importance of food production, or of some of the well-analysed issues in international food policy...The focus that emerges from this monograph looks at a different direction, namely the need to view the food problem as a *relation between people and food* in terms of a *network of entitlement relations.*

While Sen's analysis of the factors that led to contemporary global starvation did not go unchallenged (see a mostly favorable review in Devereux 2001), it represents one node in a web of interest in the entanglement between food, food production (especially through agriculture), human politics, and non-human ecology and the environment, that has only increased since the publication of this monograph, and which has become a pressing and increasingly studied topic across many disciplines (White 1990; Holling 2001; Berkes et al. 2003; Wimberley 2009; Farina 2010; Leslie and McCabe 2013). Archaeological data have come to play a prominent role in this discourse (Redman 1999, 2004, 2005; Bawden and Reycraft 2000; Diamond 2005; Hayashida 2005), as archaeologists have called attention to the discipline's ability to produce robust multi-disciplinary data-sets for socio-natural phenomena spanning historical cycles greater than those observable by modern research methods alone (van der Leeuw and Redman 2002). Indeed, Kintigh et al. (2014) named "human-environment interactions" one of their "grand challenges in archaeology" which the discipline was uniquely suited to address. Nevertheless, many of these archaeological studies, while recognizing the complexity of the relationship of people to their environment (Redman 1999), have not taken the same analytic turn that Sen did in his own entitlement approach. That is to say, these studies have not similarly reconceptualized the human and non-human ecological spectrum where "*relations* between people and non-human ecology" are seen as an essential driving factor in the complex networks created by cuisine, food production (agriculture, hunting, gathering, etc.), human politics, climate, and non-human animals. In contrast, a good portion of earlier archaeological research focused on what was perceived to be the single most important variable that affected all of these processes: the environment (Wright 1993; Nunn 2003; Coombes and Barber 2005).

The primary objective of this dissertation is to address directly this larger debate across the social and natural sciences, which involves bringing greater clarity to the tangled intersections of human life and non-human ecologies. In particular, the research questions underlying this project touch on anthropology, history, and ecology, and are couched within the framework of environmental archaeology more specifically, which seeks to "uncover the ecology of human communities" (Reitz et al. 2008: 2). The main question answered by this dissertation project is: how do different polities separated by time, with varying social, political, and economic arrangements, attempt to intensify the production of agriculture in the same bounded area? Like Sen's recognition that the elucidation of the problems underlying starvation meant not just a focus on the production of food itself, but identifying the relations between people and that food, so too does the research question structuring this dissertation understand the concentration of agricultural production as fundamentally embodied in the relations between people and the plants that they carefully managed. Therefore, while this project utilizes the data provided by the subset of environmental archaeology known as paleoethnobotany (Renfrew 1972; Pearsall 2000), or the study of past people through archaeological plant remains (Popper and Hastorf 1988), it does not take a solely biological approach to those remains as the end of the analysis unto itself, nor does it likewise only focus on the biological ramifications of human subsistence or caloric intake. Either of those approaches misses the historical and social relations that conditioned the context of the production, distribution, and consumption of the agricultural goods that sustained and reproduced these past communities.

The motivation for this research question derives from the larger archaeological and anthropological literature surrounding both the process of agricultural intensification (Boserup 1965; Brookfield 1972; Kirch 1994; Morrison 1994; Redman 2004; Stanish and Marcus 2006; Thurston and Fisher 2007), as well as the ways in which communities negotiate the intervention of non-local polities in their local lifeways (D'Altroy and Hastorf 2002). In southwest Asia and the Eastern Mediterranean, that is, the larger geographic and cultural space in which this study is situated, the intensification of the production of agriculture is often an explicit goal of the elites of so-called imperial polities (Sinopoli 1994: 165-5). To answer this research question, the role of agricultural production and practice is explored at the 12.5 hectare archaeological site of Dhiban from the Iron II (ca. 900 BCE) period until the Middle Islamic II period (ca. 1250 CE). Dhiban (Lat/Long: 31°30' 6.97" N, 35°46' 35.33"E) is located in the west-central portion of the contemporary Hashemite Kingdom of Jordan, east of the Dead Sea on a plateau named after the settlement (Porter et al. 2004, 2010). The site straddles a Mediterranean and Irano-Turanian bioclimate (Cordova 2004: 30), although contemporary vegetation around the site might be more accurately characterized as a mixture of Irano-Turanian and Sudanian. The precipitation regime of the immediate area is semi-arid and Mediterranean, with the majority of precipitation falling in the cool, winter months (November - February), and as such it is too low (256 mm per annum) for reliable dry farming. Nevertheless archaeological evidence has ascertained that, despite the challenges presented by this environment, sedentary agricultural communities have occupied the artificial mound for over 2,500 years (Porter et al. 2004, 2010).

Within this long span of time, this project identifies differences in the paleoethnobotanical and artifactual remains found in archaeological deposits specifically dating to the Byzantine (ca. 320 - 650 CE) and the Middle Islamic II (Mamluk) periods (ca. 1260 - 1450 CE). Through the analysis of macrobotanical and wood charcoal evidence, the project explores how differences in the deposition of these latter remains connect to changes in agricultural practices by the populations that lived in Dhiban during these two periods. The Byzantine and Middle Islamic periods of political intervention are of considerable interest as they 1) represent non-local political intervention, 2) are the category of human political craft known as "empire", 3) occupied the same territory (Dhiban) over a considerable, but distinct, span of time, and 4) are argued to have attempted to intensify agricultural production separately.

Previous scholarship (presented in detail in Chapter 4) on the history and rich documentary and epigraphic sources dating to these periods, also nuances and enhances understanding of the myriad social, religious, and economic factors that structured and were structured by these communities in their every-day lives.

Therefore, the results of the analysis of paleoethnobotanical remains from archaeological deposits at Dhiban dating to these two periods of imperial intervention address both the larger research questions of how successive communities at Dhiban negotiated the demands of these two empires ("external impact") in pursuit of increased agricultural production ("intensification"), as well as questions of more specific historical relevance to these two empires, such as the local outcomes of different strategies of crop taxation. The perspective used by this study to understand relations between the people of Dhiban and their non-human ecology, is that of Historical Ecology. Historical Ecology offers several empirical postulates to see the landscape as "a place of interaction with a temporal dimension that is as historical and cultural as it is evolutionary...upon which past events have been inscribed" (Balée 2006: 78). Moreover, Historical Ecology focuses on the cyclical interaction between people and their landscapes through time (Balée 2006: 82), which this study recognizes in its attention to the outcomes of past agricultural practices. In sum, the approach of Historical Ecology permits understanding of these political and ecological phenomena not as undeniably distinct, but mutually constitutive.

1.1 Overview

To that end, **Chapter 2** delineates how the conceptualization of environmental archaeological research within the history of archaeological practice in southwest Asia and the Eastern Mediterranean has developed. The goal of this conceptual history is to highlight the often unstated assumptions that motivate archaeologists' decisions not to collect organic remains from archaeological sites dating to periods where written documents are simultaneously available. It also discusses arguments that use the environment as a monocausal factor in human social change, and opposing attempts to exclude the environment from investigations of human social phenomena. It is shown that there is a strong temporal dimension to the collection of archaeological plant remains. The latter, it is argued, is an effect of an implicit nature / culture dichotomization that structures archaeological thought in this culture-area, and which has concomitant effects on archaeological practice. The solution that is proposed for researchers concerned with past entangled human-ecological relationships is a form of the aforementioned Historical Ecology as advocated by Crumley (1994), Balée (2006), and Erickson (2006). Nevertheless, several other competing theoretical perspectives current in the archaeological, social scientific, and natural scientific literature, are also acknowledged and contested, especially human behavioral ecology and human niche construction. The conclusion points to successful past research which has begun to utilize this perspective, and argues for a form of Braudelian *longue durée* perspective that aids in distinguishing long-term practices and the short-term departures from them.

In **Chapter 3** the environmental and historical trajectories specific to Dhiban are outlined. First, the major research questions of the study are proposed, and agriculture is argued to be a particularly fruitful avenue of research for understanding the human and ecological relationships. A new narrative is introduced in this chapter that extends into the next, focused on the "Corrupting Seed", or the capacity of agriculture to form new kinds of social ties through the assisted reproduction of plant remains. After this brief introduction, Dhiban is then situated in the intersecting zones of the Eastern Mediterranean and southwest Asia. General features of Mediterranean-type environments are discussed, including the effects of precipitation, groundwater availability, and soils, as well as the interaction of the Mediterranean and Irano-Turanian bioclimatic zones. The topography of the area is highlighted through the major geological and geomorphological features of the Dhiban plateau, especially the deep escarpments cut by the seasonal rivers (wadis) that form it. The flora of the region is briefly outlined from what is known in contemporary studies by botanists and ecologists, observations by the author, and more detailed studies by other researchers from nearby archaeological sites. Finally, the evidence for paleoclimatic and paleoecological reconstructions of the past 3,000 years is examined from a variety of proxies in the region. These paleoclimatic and paleocological proxies illustrate that major large-scale changes in vegetation occurred during the Byzantine and Middle Islamic periods. In turn, these data illustrate how the specific and unique practices of the communities in the Byzantine and Middle Islamic period could effect landscape change, while being affected in turn by such change.

In **Chapter 4**, the major historical narratives of the Byzantine (320 CE - 650 CE) and Middle Islamic II Periods (1260 - 1500 CE) are detailed. The first part of this narrative concerns past approaches to agricultural intensification, and the conclusion drawn from this review of previous research is a focus on the actual practices that underly efforts to intensify agriculture, rather than the origins of these "systems". In addition, the literature surrounding the consequences of non-local political intervention into communities is briefly surveyed. The outcome of this literature is to recognize the fundamental importance of consumption and production, especially of agricultural goods, within the ideological and extractive apparatus of most historical empires (Dietler and Herbich 2001; Bray 2003; Dietler 2010). In the Byzantine period, for instance, it has been argued that the region experienced its agricultural and economic *floruit* (Watson 2008). Much later, during the Middle Islamic period, it has similarly been argued that the *iqta'at* system imposed by the Mamluks caused "Jordan's rich farmland [to be] exploited to its maximum potential" (Walker 2008: 80), much like the Byzantine period 600 years earlier. The narrative and archaeological setting of this concentrated increase in production is outlined, as well as 15th century CE decline narrative associated with it. Then the Byzantine and Mamluk empires are compared and contrasted, especially the ways in which the elites of these two polities sought to (or sought not to) intervene in the lives of communities in the southern Levant, such as Dhiban. Hypotheses are offered regarding the first and second narratives with respect to the kinds of archaeological data that would be expected given the dominant narratives postulated above in the secondary literature.

In **Chapter 5** the depositional framework is established that enables the interpretation of paleoethnobotanical remains recovered on the archaeological site of Dhiban. It is emphasized that archaeological deposits are not static repositories of environmental data altered by human agency but are the byproducts of the continuous interaction of Byzantine and Middle Islamic communities at Dhiban with the site through culturally mediated depositional practices. It is argued that sampling is at the core of the methodological apparatus that allows paleoethnobotanists to construct inferences about past on-site agricultural activities, and therefore address larger research questions such as intensification. The critical importance of taphonomy is continually underscored for archaeological plant remains, as not every archaeological context can be assumed to be food detritus or in primary context. The taphonomic routes that are most common in southwest Asian sites are presented, and offer a four-fold model to identify which combinations of model items are most applicable to Dhiban given the current evidence.

Following this, the Dhiban Excavation and Development project is discussed, and the current research design for excavations during the 2009 through 2013 seasons is introduced. The methods of excavation, the location of excavation units, and introduction to the sampling strategy, given the aforementioned importance of the depositional framework, are covered in detail. The preliminary results of stratigraphy, uncovered architecture, artifacts, phasing, and absolute chronology are presented. In the second half of the chapter the sampling strategy at Dhiban is discussed over these five years of excavation in considerable detail, focusing on statistical issues, spatial variability in synchronic deposition using GIS modeling, and the results from macrobotanical and heavy fraction analyses. The deposits themselves are identified, first by chronologically identifying them using operationalized cultural time (Byzantine vs. Middle Islamic) and then by ^{14}C anchored deposit phasing. Multivariate and univariate statistics are utilized, as well as spatial analyses, on select classes of recovered light and heavy fraction data to show that differences in deposition are highly correlated to and associated with the periods from which they derive. Byzantine period deposits are more likely the result of routine cooking accidents and Middle Islamic deposits are likely crop processing byproducts and dung burned as fuel. In conclusion, it is argued that the depositional practices of the Byzantine and Middle Islamic communities are unique to each and contingent on the historical and cultural practices of each community, and that conceptions of "timeless" agriculture in this area are inaccurate.

In **Chapter 6**, the available data are deployed to focus exclusively on the issue of agricultural production for the Byzantine and Middle Islamic communities at Dhiban, and more specifically, agricultural intensification. First, the macrobotanical evidence is summarized for crop domesticates, having established the depositional origin of these sample assemblages in the last chapter. It is illustrated that many of the agricultural crops indicate economic prerogatives consonant with what is known about each period: for instance, a large proportion of Byzantine period samples contain the remains of grape, whereas Middle Islamic deposits are more likely to contain wheat and barley. The practices that led to this production are investigated through morphometric studies of free-threshing wheat (*Triticum aestivum/durum*) and barley (*Hordeum vulgare*), illustrating both continuity and change in cultivation. Finally, the macrobotanical evidence of agricultural field weeds is presented to re-construct past Byzantine and Middle Islamic agro-ecologies. Using exploratory and multivariate techniques, differences in weed composition and hence probable field and cultivation practices are established. Finally, rare and infrequently occurring planta taxa from the paleoethnobotanical and heavy fraction data are analyzed to illustrate potential community agency in the acquisition of both plant and non-human animal goods that may have acquired new and significant meanings. For example, parrotfish remains from the Indo-Pacific ocean, as well as abundant fish remains more generally in Middle Islamic deposits, indicate the new trade routes and landscape practices in which the Middle Islamic Dhiban community engaged. Using the combination of these data, the claim is made that agricultural production as reconstructed from Byzantine period deposits seems to indicate a mostly autonomous community, while indicating the opposite during the Middle Islamic period, where based on the available evidence the latter might be described as an "industrial farm".

In **Chapter 7**, the summary and conclusion, the complete picture provided by the available paleoethnobotanical data, the paleoecological data, and the historical narratives is recapitulated and synthesized. It is emphasized that a long-term empirical perspective using rigorously sampled archaeological plant remains as the primary data permitted the identification of differences in Byzantine and Middle Islamic period deposits. Likewise, through a focus on the entangled relationship of people and agriculture in these two periods, it could be seen that neither a deterministic environmental model ("nature") nor an emphasis on the mental autonomy of disembodied agents ("culture") adequately categorized the agricultural changes seen through time. Instead, data indicate that the practices of Byzantine and Middle Islamic period farmers at Dhiban are historically specific and contingent. The broader impact of this research therefore not only applies to archaeologists and historians interested in the political and social effects of agricultural practice, but environmental scientists concerned with the consequences of state and community intervention in agriculture over longer periods of time than observable by contemporary research methodologies.

Chapter 2

Nature and Culture in the Archaeology of the Eastern Mediterranean and Southwest Asia

> "'I have a question for you,' he said, taking out of his pocket a crumpled piece of paper on which he had scribbled a few key words. He took a breath: 'Do you believe in reality?'"
> - Latour (2000: 1)
>
> Archaeology is, by its nature, ultimately empirical. The great debate is far more than a matter of philosophical abstractions. It is a fundamental reevaluation of the conceptual framework of archaeological research, a quest for a paradigm that will rationalize both the laborious data gathering and the frustrating interpretive activities of the discipline.
> - Butzer (1982: 3)

In 1952, Douglas Tushingham, Fred Winnettt, and William Reed, members of the American Center of Oriental Research, were in the process of excavating the south-east corner of the archaeological mounded (*tall*) site of Dhiban, located in west-central Jordan east of the Dead Sea (**Figure 2.1**). During their excavation they came upon fragments of a thick-walled jar in the corner of an unearthed structure. The jar itself, from the perspective of its form, manufacture, and style, was discussed without serious comment or extended investigation (Reed 1957: 7; cf. Winnettt and Reed 1967: 43). What was salient to the excavators, and William Reed in particular, was that all around the jar were scattered small, carbonized bits of organic material. William Reed, with the aid of Jason R. Swallen, the Head Curator of the Department of Botany at the Smithsonian Institution, identified these as "Moabite grain" (Reed 1957: 9). In fact, the archaeologist was far ahead of his time – although Willard Libby had only recently discovered in 1949 the usefulness of the decay of the radioactive isotope of carbon-14 for establishing artifact-independent chronologies (Malainey 2011: 91), Reed submitted a sample to the "Magnolia Research Company" three years later in order to ascertain the dates of these seeds (Reed 1957: 9). Much to his delight, the seeds dated to the

10th through 7th century BCE, in culture-historical phasing this span of time includes the Levantine Iron IIa and IIb periods, even despite the significant errors introduced in earlier scintillation and calibration methods (Stuiver and Polach 1977).[1] The Iron II period was historically pivotal as it was during this time that many books of the Hebrew Bible were being composed into a form that would be roughly recognizable to contemporary readers, and when several of the states that make an appearance in books such as 2 Kings (e.g. Edom, Ammon, etc.), all saw their establishment or institutional reification at this time (Herr 1997; Joffee 2002; Porter 2004; Routledge 2004).

Unfortunately for Reed, Dr. Swallen could only identify the "Moabite grain" as "most probably a relative of wheat", and lamented that the herbarium "very seldom has any caryopses for comparison". What Dr. Swallen identified as wheat is indeed a relative of wheat, that is, a member of the grass family Poaceae, but is not a species of wheat (*Triticum* sp.), but domesticated hulled barley, *Hordeum vulgare* (**Figure 2.2**).[2] As identification of carbonized caryopses of cereals native to southwest Asia was still in its infancy (Warnock 1998), it is not surprising that Swallen, a biologist accustomed to the examination of viable specimens, might have mis-identified archaeological organic remains that had undergone taphonomic processes that had altered their surface morphology (Boardman and Jones 1990; Hubbard and al Azm 1990).

Dr. Reed's interest in biological remains is somewhat remarkable considering his subject of interest: the intense and culturally far-reaching narrative portions of the Hebrew Bible which chronicle the cultural and political transformations that beset the then-contemporary communities surrounding Judah and Israel in the 10th century BCE (Winnett and Reed 1964: 6-9). Carbonized seed remains were, in his formulation, a piece of evidence that could *help* understand the nature of these historical social and political transformations. As Reed avers, "it [the seed cache] represents a bit of archaeological evidence *which helps to explain this ancient land as a place of refuge for Israelite families*" (Reed 1957: 10; my italics). The question of how Dr. Reed associated a seed cache ("a bit of archaeological evidence") and a social phenomenon unique to the context of Moabite history ("a place of refuge for Israelite families") was, however, left unexplored. How is it possible to connect carbonized seeds to history?

The answer to this question is not entirely deducible from the excavation report alone, as despite the chance find of this cache and the recognition by the excavators that these seeds could potentially "represent" a bit of archaeological evidence to understand a historical

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[1] The published uncalibrated date of the seeds was 2815 +/- 165 BP (Reed 1957). Calibration of these dates by the author using the most current calibration curves (IntCal09) in more current calibration software (OxCal 4.2) yields a calendar date of 1435 - 547 cal BCE at the two-sigma level (95.4% confidence), although the largest portion of the probability density of the curve (91.7%) is between 1435 and 736 cal BCE.

[2] The morphological differences between these two species is visible in the compression in the distal end of the caryopses (the apex, Jacomet 2006) which is diagnostic to hulled barley and is not present in either the free-threshing wheats (*Triticum durum* / *aestivum* / *compactum*) or the hulled wheats (*Triticum dicoccum* / *monococcum*). Likewise, the visible length to breadth ratio fits within the known degree of variation of archaeological hulled Hordeum vulgare remains (Jacomet 2006)

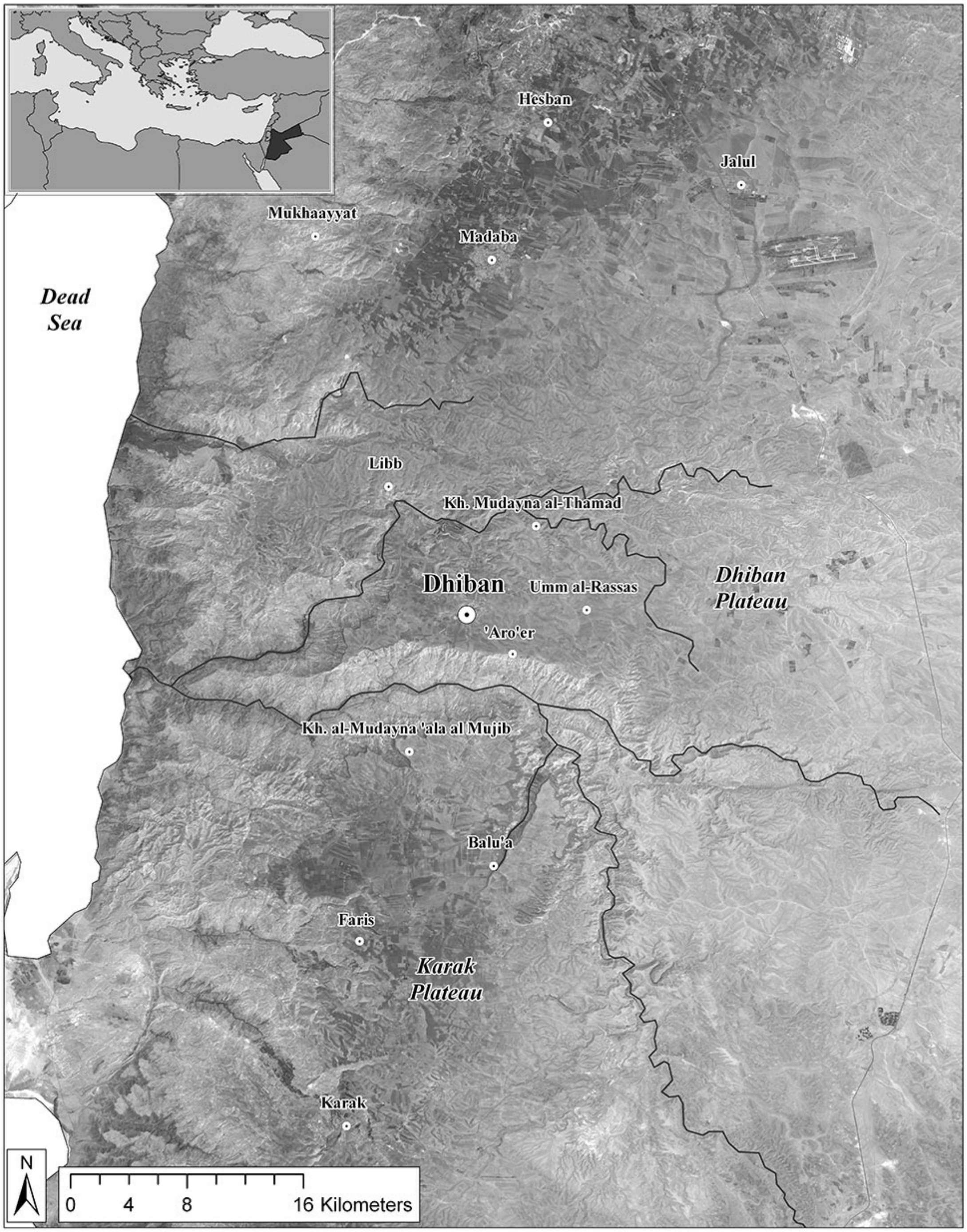

Figure 2.1: West-central Jordan with an emphasis on Dhiban (Courtesy of Andrew Wilson)

event, the systematic acquisition of archaeological plant (or faunal) remains was not included in the research design of any subsequent field season in Dhiban until renewed excavations began by the Dhiban Excavation and Development Project in 2004, half a century later. In comparison, the first systematic and comprehensive collection of archaeological plant remains in the immediate region of the Dhiban plateau did not take place until 1974 at the site of Hesban (Gilliland 1986), to the north of the site (**Figure 2.1**)). It is arguable that improvements in archaeological methodology since Winnett and Reed first conducted their field research at Dhiban in the mid-20th century account for the later collection of these remains alone, as some of the first large-scale operations to systematically recover carbonized archaeological botanical material did not take place in southwest Asia until 1963, through the work of Danish paleoethnobotanist Hans Helbaek in the region of Deh Luran in Iran (Hole et al. 1969).[3] The impact of these changes in methodology for the process of recovery of carbonized plant remains at Deh Luran was quickly recognized by the excavators there:

> "the reader will note that our preliminary report on the 1961 season states confidently that 'plant remains were scarce at Ali Kosh.' Nothing could be farther from the truth. The mound is filled with seeds from top to bottom; all that was 'scarce' in 1961 was our ability to find them, and when we added the 'flotation' technique in 1963 we recovered a stratified series of samples totaling 40,000 seeds." (Hole et al. 1969: 24)

So while conceding that methodological changes in recovery techniques certainly affected (and affect) the process of recovery itself, it still does not address the underlying *research motivation* for the recovery of those remains *at all* as evidence to answer a particular archaeological, ecological, or historical question. A focus on methodology alone to explain these changes in field practice for archaeologists in the region does not take into account, for instance, the pronounced and fundamental rethinking of the conceptual framework of archaeological research that has simultaneously transformed field practice in the decades since Winnett and Reed first came upon their cache of "Moabite grain" in 1951.

The goal of this chapter is to examine how archaeologists in this geographic space (southwest Asia and the Eastern Mediterranean) have been affected by and participated in the building of that framework, and to construct an explicit motivation for the collection of archaeological plant remains. As this dissertation connects specific seeds recovered through recent excavation at the site of Dhiban to specific historical periods, it is the work of this chapter then to establish what the conceptual link is between them, as well as to elucidate how and why botanical remains that are the products of past agricultural practice and production are crucial for understanding historical events, persons, places, and cultures. As it will be demonstrated, however, Winnett and Reed were, and continue not to be, alone in their failure to collect archaeological plant remains beyond chance finds alone. A core argument of this chapter developed in full below is that many archaeologists have not implemented or included rigorous sampling strategies on excavations in southwest Asia *specifically* for time

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[3] Although the excavations of Braidwood and Howe (1960) in Iraqi Kurdistan three years earlier included a paleoethnobotanical component, it was Helbaek's pioneering work at Deh Luran that arguably established the importance of such research in the region.

Figure 2.2: “Moabite Grain”, cf. *Hordeum vulgare* (Reed 1957: Fig 2).

periods in which there is written language available in the form of texts, inscriptions, etc., or for which there are established historical narratives. The reason for this contrast in collection imperatives between time periods, it will be shown, is that it is structured by a latent conceptualization of nature and culture. The research questions that stimulate field practice *a priori* partition non-human environmental phenomena (“nature”) and phenomena that are considered uniquely pertinent to human beings (“culture”). This implicit framework has facilitated the creation of two binary, although not necessarily discrete, theoretical poles.

By engaging discursively with the intellectual histories that have informed the research paradigms of historic-period societies in this culture-area, this chapter presents a new framework in which the role of organic remains is considered essential to archaeological research, particularly when complementary information based on inscriptions, historical texts, and other written language is available. Yet it is not a goal of this chapter to provide an exhaustive overview of archaeological theory, or the historical development, role and impact of current theories from other disciplines (especially the social and natural sciences) on archaeology. Instead, the solution offered to bridge these theoretical paradigms for those researchers interested in the entanglements of the non-human environment and ecology with human practices is the perspective of historical ecology, as advocated by Carole Crumley (1994) and more recently by William Balée (2006). Unlike past conceptualizations of the relationship between human and non-human ecology, historical ecology acknowledges the many potential factors internal to human actors that impact human decision-making and which cannot be reduced to uni-dimensional predictors of large-scale societal change (Hill 2000; Dobres and Robb 2000; Butzer 2012). A historical ecology nuanced by human agency, practice, and cognition avoids the theoretical quagmire of causal determinacy (external vs internal; culture vs nature) by adopting a synthetic perspective which views nature and culture not as distinct and “uniquely real” entities (in the sense of Mishler 2010) but as continuous spectra of a dynamic and mutually constitutive relationship. This perspective thus binds the entire research arc of the rest of the dissertation, in that it provides a framework to unite the results of paleoecological research (Chapter 3) with historical narratives (Chapter 4) to generate hypotheses answerable through a paleoethnobotanical sampling strategy (Chapter 5) to identify the empirically obtained agricultural consequences of past imperial intervention in Dhiban's long history (Chapter 6).

2.1 Past Agriculture and the Establishment of a Paleoethnobotanical Agenda

To illustrate the consequences of this latent conceptualization structuring archaeological research in the area, it is profitable to return to the "Moabite grain" discussed by Winnett and Reed. One of the ways that Reed contextualized the cache of seeds within Dhiban's history was through agriculture specifically. As Reed (1957: 9) points out, the presence of these grains at the archaeological site of Dhiban substantiate the claim that "ancient Palestine" was a breadbasket, that is an area of fecund agricultural production. In confirmation of this sentiment, the authors provided an image that escapes comment in the main body of the text of the excavation report detailing the results of the authors' research seasons in 1950 and 1951, and yet is found in the final plates. The image (**Figure 2.3**) displays unnamed individuals whose faces are completely obscured, with a caption entitled "Harvesting Grain in Moabite fields near Dhiban". It is ostensibly the same Moabite grain that was discovered in the storage jar found between the two walls dating to the Iron II (ca. 850 BCE) period (**Figure 2.3**); Winnett and Reed 1964: 69). With this image, the agricultural connection between the grain that is in the fields, and the seeds of that grain discovered archaeologically, are established by the authors. Yet while the majority of the caption can be parsed, including "harvesting", "grain", and even "Dhiban", the function of "Moabite" in this context, considering that the image was taken in the early 1950's, is less clear. That is to say, it is difficult to assess what makes these fields Moabite other than their location in a territory once self-designated as Moab. In order to answer that lacuna, it is necessary to possess knowledge not about Jordan at the time of the excavation (1950 CE), but about the bounded geographic area of the Dhiban plateau in the first millennium BCE.

Dhiban, known in the Hebrew Bible as *Dibon*, was the likely capital of a self-organizing polity known as Moab from approximately 900 to 700 BCE (Routledge 2004). Moab was locked in conflict with the historical kingdoms of Israel and Judah to whom it was reported to be a vassal, but from whom it rebelled "after the death of Ahab" likely in the mid-ninth century BCE (2 Kings 1:1; cf. 2 Kings 3:1-27; Routledge 2004). Important for the enduring posterity of the site was the discovery in 1868 of a stele independently recalling the biblical events of Moab's rebellion from Israel, yet from the perspective of the self-proclaimed king Mesha (Dearman 1989; Na'aman 1997; Routledge 2000, 2004; van der Steen and Smelik 2007).[4] Archaeological research and interest into the history of the site intensified only after

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[4] The discovery of this stele came at a time of growing "Orientalomania" gripping Victorian England, Second-Empire France, and Imperial Germany, fueled by the objects unearthed by the excavations of Austin Layard at Nineveh, Khorsabad, and Nimrud, by Champollion's decipherment of Egyptian hieroglyphics in

Figure 2.3: Harvesting Moabite Grain around mid-20th century Dhiban (Winnett and Reed 1964: Plate 29-2).

Figure 2.4: Bani Hamida children harvesting *Triticum durum* on the southern end of the Dhiban plateau, July 2011 (Photo Alan Farahani, 2011)

the discovery of the stele and subsequent revelation of its connection to events in the Hebrew Bible, culminating in the excavations of Winnett and Reed in 1950. Indeed the pursuit of this "Biblical history" was so intense that the authors admit (1967: 11 n.42) that they demolished the structures of later periods (Byzantine and Ummayad) on the top of the site, as they posed "an almost insuperable obstacle" to the excavation of material from their time period of interest. The term "Moabite", therefore, is best understood an appellation for a geographic area in the mid first millennium *BCE*, and not the second millennium *CE*.

The authors clearly conceived of some manner of unchanging landscape practice and timeless Mediterranean agriculture in their connection of the agricultural activities of the contemporary Bani Hamida community (whom they recognize as present; Winnett and Reed 1964: 12) to the polity of Moab nearly 3,000 years earlier. The caption to the image assumes that one could substitute the individuals in the image for the Moabites 3,000 years earlier, with little change to either the landscape or to the practices of sowing, handling, and harvesting the grain which is also assumed to inhere a kind of fixed Platonic essence. The authors' latent supposition can itself be seen as a proxy for a much larger phenomenon – the idea of a timeless agricultural landscape – that has operated as a very powerful narrative in southwest Asia and the Mediterranean, but has been especially durable in the historical discourses of past agricultural communities in the Eastern Mediterranean (Barker 2005; Knapp and Blake 2005).

Agriculture is, however, a long-lived and critical lifeway in this part of the world (Zeder 2008). The long-term consequences of agriculture as a *social* mechanism binding communities together via plant reproduction is a topic that will be explored in detail in Chapter 4. For now, it is enough to note the recent history of these practices within the same area, as a July 2011 picture of grain harvesting from the exact same part of the contemporary Dhiban plateau attests (**Figure 2.4**). In this image the local Bani Hamida children are not collecting "Moabite grain", but macaroni wheat, *Triticum durum* (Palmer 1998: 135) known for its high yield and low water requirements (Carr 2011) in a desire to increase output due to their entanglement with a globalized economy.

The choice of agriculture by Winnett and Reed as a way of understanding the past was therefore not accidental, as they recognized a connection between the past grain they uncovered archaeologically and agricultural practices observable during their excavations. Although relatively under-theorized and under-explored at the time, the investigation of agriculture within archaeology has been a topic of considerable empirical research in the area since Hole and Flannery's aforementioned investigations of agricultural village life in Deh Luran (1969) as well as Richard MacNeish's investigation of maize (*Zea mays*) domestication and agriculture in the Tehuacan valley in Mexico. Therefore new theoretical and empirical developments have emerged that allow researchers to answer the question of how to connect "seeds to history", and crucially, to human culture and society, which the excavators left open in the 1950's.

1824, and by the concordances that Neo-Assyrian cuneiform held in relation to biblical events, the latter conditioned by the partial decipherment of cuneiform by H.C. Rawlinson in the 1840s (Holloway 2002: 9-12).

More recently, interest in agriculture as a window into past human life has been linked to a larger concern about whether the environment and ecology, in which agriculture is enmeshed, "matter" in explaining or describing past human experience (in archaeological terms, "ecological functionalism"; Hodder 1982; Diamond 1997; Butzer 2012), a topic deeply discussed since Julian Steward's (1955) concrete formalization of this relationship in the 30's and 40's as cultural ecology. The recent archaeological and scientific re-emphasis on the importance of the environment and ecology in human affairs is also a component of enhanced contemporary anxieties regarding the global role of human beings in, and the long-term sustainability of, various contemporary agricultural and other resource-extractive practices, not to mention the sustainability of what is dubbed "civilization" (Turner et al. 2003; Eakin and Luers 2006; Rockstrom et al. 2009; Foley et al. 2011; Steffen et al. 2011). Numerous archaeological articles and books now contain titles such as "Prehistoric Agricultural Methods as Models for Sustainability" (Denevan 1995), "Sustainability of Complex Societies" (Tainter 1995), "The Archaeology of Sustainability: Mesoamerica" (Scarborough 2009), and even attempts to claim that via "Sustainability out of the Past...Archaeology Can Save the Planet" (Guttmann-Bond 2010).

As such, agriculture is a phenomenon with considerable analytic potential as it sits at the intersections of both ecology and past cultural practices in southwest Asia and the Eastern Mediterranean. Agriculture is an appropriate locus of analysis as it is the outcome of a large set of entangled human, non-human animal, environmental, climatic, and ecological variables which are mutually constitutive (**Figure 2.5**). Moreover, agricultural production underpins almost all of the processes that have historically reproduced and maintained societies in this region for the past 8,000 years: durable food surpluses (the control of which can lead to institutionalized inequality; Price and Bar-Yosef 2010), extreme specialized division of labor (most people no longer have to engage in food production, only food processing), and routine, seasonal, large-scale, coordinated communal labor (Johnson and Earle 1999; Redman 1999: 81-126; Fuller and Stevens 2009). The seasonal, cyclical nature of agricultural production itself, linked by communities to intimate knowledge of precipitation, climate, and the landscape (Ingold 2000: 77-88) can be viewed as a sequence of routine, embodied, and enacted practices, which through their motion, reproduce both the practices and groups that are bound by them (cf. Latour 2004). The ideological counterpart of these embodied landscape-linked practices has been described by A. Sherratt (1997: 276) as a "sustained commitment to farming". Indeed the commitment to farming is evident on the Dhiban plateau, as the connection of the cache of "Moabite grain" dating to roughly 850 BCE, and the contemporary farming of *Triticum durum* indicate.

Furthermore, human relationships with wild plants that became agricultural crops extend beyond the crops themselves, as agricultural fields are embedded in landscapes with their own productive potential and ecological challenges (Vandermeer 2011: 254-260). The myriad practices used for tillage, manuring, harvesting, and processing are tightly interwoven with the human management of domesticated non-human animals, as seen in agro-pastoral strategies in many places around the world (Miller and Marston 2012; Miller 2013). In short, the agricultural process is

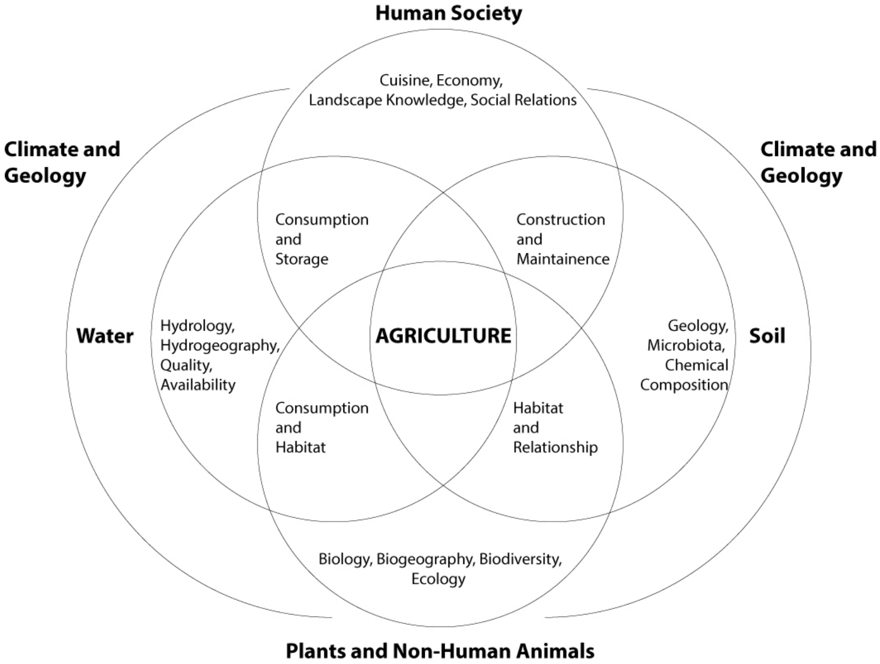


Figure 2.5: Overlapping biophysical and socio-economic factors that comprise agriculture.

> not planting a seed and harvesting a crop. Agriculture is making a contract among people to provide for one another, using seeds and harvests to do so. Studying agroecosystems is not simply studying the way a crop uses nitrogen. It is studying the way, for example, an economic blockade by the United States plus the failure of the Soviet Union plus the geological background that led to oxisol formation plus the culture of eating sweet potatoes together resulted in the development of new strains of Azotobacter, which provides nitrogen to the sweet potatoes growing on Cuba's inherently poor soils today. (Vandermeer 2011: 26)

Thus what defines an agro-ecosystem and agroecology is the combination of both human-planned and unmanaged ecological dynamics that cannot be reduced to its non-human biological components because social relations enable and constrain this interlocked production system that simultaneously draws on the non-human environment (Wojtkowski 2004: 7-8).

Crucially, these agricultural relationships are detectable in the archaeological record through the recovery of agricultural plant remains, or paleoethnobotany (Hastorf 1988), an important component of the larger research paradigm of environmental archaeology which aims to uncover "the ecology of human communities" in the past (Reitz et al. 2008: 3). Beyond chance finds, paleoethnobotanists have refined recovery methodology in Eurasia to the extent that through the analysis of carbonized seeds and chaff, and thanks to a confluence of ethnoarchaeological, experimental, and laboratory research, it is possible to identify crop processing strategies, crop husbandry, seasonal planting practices, and a host of other human activities important in the research of archaeologists, anthropologists, and historians

(Bogaard 2004; van der Veen and Jones 2006; Fuller et al. 2008; Marston 2011). From an ever increasing amount of paleoethnobotanical (or archaeobotanical) data for "complex" societies, it is now possible to speak of an "archaebotanical" agenda (Fuller and Stevens 2009).

One of the few monograph-length attempts to dynamically integrate these data sets to investigate the relationship of the ways in which crops "make a contract among people" for large complex societies anywhere in the world has been paleoethnobotanist Christine Hastorf's *Agriculture and the Onset of Political Inequality before the Inka* (1993). The most crucial contribution to articulating agricultural change in pre-Inka Sausa societies is her recognition that "political influence [of various competing groups] should be reflected in the [paleoethnobotanical] crop production data" (Hastorf 1993: 185). Thus her study recognizes and empirically identifies the interdigitation of agricultural and political practice as argued by Vandermeer (2011:26). To do so, she surveys a wealth of data from the Jauja region of contemporary Peru (e.g. environmental, geological, ethnographic, etc.) as well archaeological data pertinent to the analysis of these changes (settlement surveys, architecture, changes in artifact types, etc.). A key strength of her study, and one which other environmental archaeologists argue lies at the heart of these multi-disciplinary endeavors (Dincauze 2000: 21), is that she contextualizes her non-paleoethnobotanical data within the frameworks of their own disciplines before their reintegration into the main narrative argument (e.g. 1993: 58-82). An incorporation of the kinds of agroecological considerations argued for by Vandermeer (2011), and shown in practice by Hastorf (1993), alongside complementary archaeological, historical, and linguistic ones, would be able to highlight the bio-social linkages that maintained and reproduced communities in the past.

One of the many lines of complementary evidence uniquely available to paleoethnobotanists working in southwest Asia and the Mediterranean is written language (Liverani 1999). As Zimansky (2005: 308) notes, "archaeology in the Middle East has been intimately tied to the written record". One of the reasons for this relationship is the longevity of the tradition of writing itself in the region: the "chronological fault line" between archaeology and the ability to compose a historical narrative from written sources alone lies near 2,350 BCE (Matthews 2003: 152 *pace* Brinkman 1983: 170). In the Levant, and indeed across southwest Asia, written language has been an increasingly salient part of people's lifeways since the Iron Age if not earlier (Joffe 2002; Zimansky 2005), that is for the past 3000 years. Although uneven in time and space (Matthews 2013), the number of different kinds of media containing written language, including stela, papyri, and texts, provide a complimentary perspective to archaeological research. Considering that a critical aspect of the manifold overlapping domains of agriculture is the *human* component (**Figure 2.5**), the addition of written language that could sharpen or at least complicate the identification of the social, economic, cultural, linguistic, religious and other factors which would have undoubtedly affected agroecosystems given the model and arguments presented above, would be of enormous analytic benefit. Therefore it might be hypothesized that in periods in which there is written language, archaeologists would be more eager to incorporate these sources of data to nuance their own understandings of the societies which they are investigating, and the data which they generate from excavation. Indeed, paleoethnobotanists might be more inclined to pursue research in these periods, since as early as 1976, Robin Dennell (1976: 243) called for “shifting attention from the numerical frequency with which a plant is represented to the type of activity represented [by it]”. That is, moving away from the tabulation of species alone, as Sherratt (1991) has furthermore remarked that people do not eat species, they eat food. The contributions of written language, therefore, could represent one of the many ways in which those “represented activities” might be more precisely defined in an attempt to move beyond species lists.

2.2 Paleoethnobotanical Research in Southwest Asia

Yet the reality of archaeological practice in this geographic area and for this span of time is that the investigation of archaeological plant remains has not occurred. Quantitative data on the number of paleoethnobotanical reports published for excavations of sites in Southwest Asia (and by extension the Eastern Mediterranean) compiled by Naomi Miller (1991) and Reinder Neef (1997) illustrate a trend opposite to the one hypothesized above (**Figure 2.6: A; Table 2.1**). The counts of the numbers of paleoethnobotanical studies per time period actually peak in the period between 9000 BP (19 studies) and 5000 BP (21 studies), roughly from the Neolithic to the Chalcolithic within regional archaeological periodization. As one approaches the historic period, at the precise moment where written language is available as a complementary source of information, the number of paleoethnobotanical studies drops precipitously. What is clear from this analysis is that archaeologists working in the Palaeolithic and Neolithic periods recognize that plant remains answer crucial questions regarding demographic, social, and cultural phenomena, and this recognition in turn affects the likelihood of field sampling through the organized integration of these techniques. The research questions of interest in these periods are well known; for 9000 BP, it is the “Neolithic Revolution”, and near 5000 BP, it is the “Urban Revolution”. Both of these periods command substantial academic and popular interest as they are both origins narratives, which are so often identified as archaeological preoccupations (Gamble 2007: 10-32). A more recent appraisal of available published reports (as Miller and Neef’s compilation only included material up to 1997) by Dorian Fuller (2012: 111-112; **Figure 2.6: B**) has tracked this increase in interest for Neolithic southwest Asia alone in the past 30 years. Within that span of time, there has been an 85 percent increase in quantitative article output. The number of articles dealing with flotation in the “Near East (pre-ceramic only)” jumps from 10 in “pre-1970” to 50 in 2001-2005. When considering all archaeobotanical reports, that is not just reports that deal with macrobotanical remains but also wood charcoal, phytoliths, and starches, the number jumps from 10 to over 70 available articles. In India and Pakistan the trend is even more dramatic, with an increase from less than 10 articles before 1970, to over 120 in the 2001-2005 period (but again, for the Neolithic alone). Even considering more recent studies, as Fuller does, a similar trend in the same geographic area for paleoethnobotanical research on societies dating from 2000 BCE onward (i.e. in the historic period) has not yet occurred.

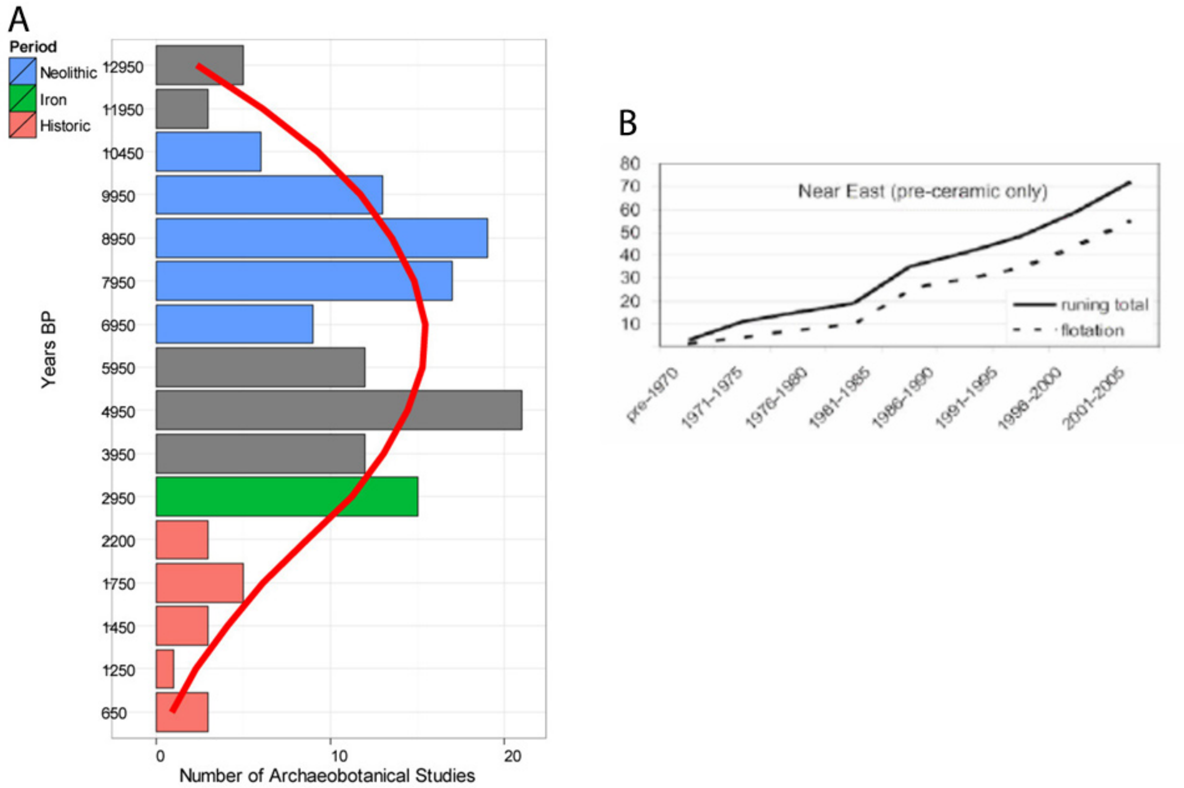


Figure 2.6: (A) is published paleoethnobotanical studies for southwest Asia based on the absolute numbers of reports published by period (data from Miller 1991; Neef 1997). A smoothing curve has been fitted to illustrate general trends. The color of the fills on the histogram represent three periods of interest: the Neolithic, Iron Age, and Historic periods. (B) is the number of paleoethnobotanical studies published for the Pre-Pottery Neolithic alone since 1970 up to 2005 (Fuller 2012: 111).

As Naomi Miller notes, “the Late Bronze Age, Iron Age, and later periods are poorly represented by archaeobotanical finds” (Miller 1991: 152), and it is particularly telling that there is no discussion of the reports for the period after the end of the Iron Age (ca. 500 BCE) in the same article. Riehl and Nesbitt in their even more recent survey of the paleoethnobotanical literature of Iron Age Near Eastern archaeological sites (2003), conclude that the number of sites available for such a synthesis, 25 in total, is admittedly not very impressive when compared to the forty years over which they were collected. The authors note that a lack of systematic sampling might be due to the “apparently unchanging appearance of the Near Eastern landscape” which, critically, “mask[s] substantial changes in agriculture and diet over the last 3,000 years” (Riehl and Nesbit 2003: 301). This, it should be noted, is precisely the same sentiment intimated as early as Winnett and Reed’s claim in the mid-20th century that the Bani Hamida were harvesting “Moabite Grain”. Furthermore, most of the excavation reports which contain these published paleoethnobotanical and other “specialist” data appear in the appendices only (e.g. McNicoll et. al. 1992; for a Mesoamer-

Table 2.1: Paleoethnobotanical Reports for SW Asia as Tabulated by Miller 1991 and Neef 1997

Archaeological Period	Uncal BP	Published Studies	Operationalized Period
Epipaleolithic	12950	5	Epipaleolithic
Epipaleolithic	11950	3	Epipaleolithic
Aceramic Neolithic	10450	6	Neolithic
Aceramic Neolithic	9950	13	Neolithic
Aceramic Neolithic	8950	19	Neolithic
Neolithic	7950	17	Neolithic
Neolithic	6950	9	Neolithic
Chalcolithic	5950	12	Chalcolithic
Early / Middle Bronze	4950	21	Bronze
Late Bronze	3950	12	Bronze
Iron	2950	15	Iron / Historic
Hellenistic	2200	3	Historic
Roman / Parthian	1750	5	Historic
Byzantine / Sasanian	1450	3	Historic
Umayyad / Abbasid	1250	1	Historic
Mamluk	650	3	Historic

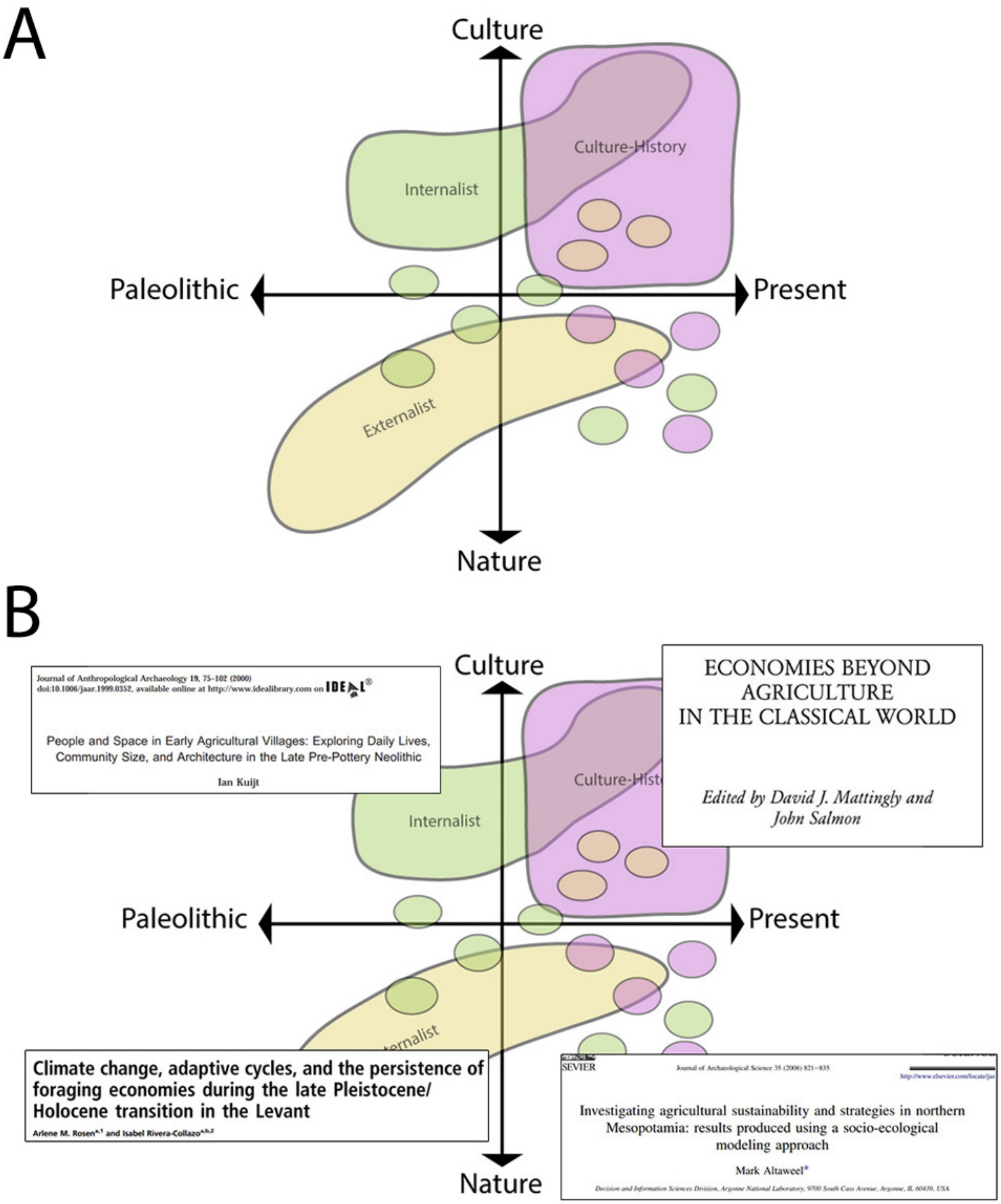
ican perspective, see Morehart and Morell-Hart 2013). The relegation of these reports to the end-margins of excavation reports casts them as "ancillary" information. In turn, this suggests that the practices and processes that engendered the plant remains found by these excavators are somehow independent of the ever-dynamic social and cultural milieu which the other archaeological data purport to reveal. It is clear, then, that the remains of agricultural production and practice for historic-period societies in southwest Asia and the Eastern Mediterranean, particularly at the level of the household, have avoided systematic investigation: "[i]t is as if plants did not participate in or reflect these changes" (Hastorf 1999: 57). Though optimistic, the claim by Matthews (2003: 25) that Braidwood's pioneering inclusion of organic remains in his investigation of Neolithic Jarmo in Iraq in 1960 changed archaeological research design in the region where "seeds and bones were [hereinafter] to be as important as crowns and chariots", has not yet seen fruition.

2.3 The Theoryscape and its Consequences

It is therefore apparent that there is a strong temporal dimension structuring the investigation of archaeological plant remains in southwest Asia and the Eastern Mediterranean. The further in time one moves back in terms of archaeological research on a given culture or society, the more likely one is to encounter a paleoethnobotanical report. And yet, for those sites dating closer to the present and in periods in which there is written language available, it is less likely that archaeological plant remains will have been collected or reported. It is argued here that it is actually an **effect**, not a cause, of a larger structural orientation to the way archaeological research is conceived of and executed in this geographic area, if not beyond. This orientation is best represented in the form of a highly schematic "theoryscape" (**Figure 2.7**). In this representation, the x-axis represents the aforementioned temporal dimension, that is the Paleolithic to the Present. The y-axis, in turn, represents the spectrum between "nature" and "culture". The main argument of this section and the next is that the *a priori* conceptualization of a duality between nature and culture, between the environment and human actors, and so on, is responsible for facilitating those perspectives among archaeologists that do not encourage the collection of plant remains during historical periods. In the first part, the definition and influence of two separate theoretical approaches to human behavior - the externalist and internalist - will be reviewed, especially with respect to the ways in which these theoretical orientations align themselves within the theoryscape. In the following section, more attention will be paid to the nature and culture binary in particular, and to its research ramifications. In short, following the graph, it will be shown that the closer one is to the Paleolithic, the more "natural" human phenomena are assumed to be, and therefore plant remains, construed as *solely* natural, are far more intensively collected. In contrast, the closer one is on the axis to periods in which there is written language available as a form of evidence, which is assumed to be more obvious evidence of "culture", plant remains, again assumed to be natural, are not collected as they are not seen as relevant to "cultural" questions.

The range of scholarly interest in intertwined human and ecological networks represented in the graphical depiction of the "theoryscape" operates in tandem with a narrower archaeological debate of the various models of human behavior that have been contested for more than three decades. The latter has been informed, in turn, by broader trends in the social sciences and humanities (White 1990; Haraway 1991; Luke 1997; Milton 1997; Scoones 1999; York and Mankus 2009; Wimberley 2009; Kendal et al. 2011; Bloch 2012). The boundary at one end of this spectrum of archaeological thought is concerned with the contextual, particularistic, and internal understandings of human lifeways, shared by post-processualists and some theoretically oriented culture-historians (e.g. Morris 2000; Hodder 2001). The latter are marked as "internalists". On the other end of the spectrum are "externalists", typified by early "processual" archaeologists, who attempt to model past human phenomena that are solely empirical, extrinsic to human actors, and driven by formalized behavioral mechanisms (e.g. Binford 1965; Schiffer 1972) such as "subsistence" and that view cultural practices as 'epiphenomenal' (Dunnell 1978). In many ways archaeological research involving past human and ecological relationships in southwest Asia and the Eastern Mediterranean has been caught between these two larger paradigms of archaeological thought, particularly with respect to the role of the environment and ecology in human life.

For instance, in certain corners of the natural sciences and in earlier processual archaeological research, the environment was perceived to be the most important variable (a "prime mover") that *explained* all human phenomena from evolution, to political change, to ritual practice (Wright 1993; Erickson 1999; Nunn 2003; Coombes and Barber 2005). The reaction to this was a post-structural push away from what was perceived to be the over-arching climatic and ecological determinism that characterized most of the cultural explanations of processual archaeologists, which Brumfiel (1992) early characterized as "breaking and entering the ecosystem". A perspective arose inside some prominent corners of archaeological thought, and more broadly in the social sciences, that re-emphasized the contingency, fluidity, and heterogeny of the human constitution and perception of reality (Shanks and Tilley



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People and Space in Early Agricultural Villages: Exploring Daily Lives, Community Size, and Architecture in the Late Pre-Pottery Neolithic

Ian Kuijt

ECONOMIES BEYOND
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Edited by David J. Mattingly and
John Salmon

Climate change, adaptive cycles, and the persistence of foraging economies during the late Pleistocene/ Holocene transition in the Levant

Arlene M. Rosen[a,1] and Isabel Rivera-Collazo[a,b,2]

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Investigating agricultural sustainability and strategies in northern Mesopotamia: results produced using a socio-ecological modeling approach

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Figure 2.7: (A) is a schematic representation of theoryscape, with colored “blobs” representing different theoretical positions (see text for discussion), and (B) is the same, with representative studies superimposed. The studies, based on location, are UL: Kuijt 2000, LL: Rosen and Rivera-Collazo 2012, LR: Altaweel 2008, UR: Mattingly and Salmon 2001.

1992: 55-56 ; Hodder 1997; Meskell 1999; Latour 2000), and yet in which the role of the non-human environment and ecology was underemphasized.

The impacts of this re-orientation have been so far-reaching that even natural scientists well-disposed to social theory have noticed that "in moments of metaphorical extravagance, the material 'reality' of landscape disappears altogether" (Demeritt 1994b: 172 *pace* Scoones 1999: 487). The impact of the rise of what is self-labeled as "science studies" (Latour 2000), an interrogation of scientific practice, its on-the-ground functioning, the way that its culturally specific discourse produces meaning, and the embeddedness of science within human social affairs (gender, class, ideology, politics, etc.), has been so great that Bruno Latour, an early and vociferous supporter of science studies, found himself defending against his interlocutor as given in the quote at the beginning of this chapter. The anxious psychologist questioned Latour directly as to whether he believed in "reality" since many of science studies' central investigative tenets include "how...the realities of scientific practice become transformed into statements about how science is done" (Latour 1993: 29). Indeed, for many in the discipline of geography, both nature and the landscape were confidently announced to have no basis in what positivists labeled "reality" by the turn of the second millennium (Bird 1987; Greider and Garkovich 1994; Geber 1997; Proctor 1998; Demeritt 2002; Crist 2004). The end result of at least two decades of vitriolic philosophical debate engulfing the entire intellectual community (e.g. for physics: Sokal and Bricmont 1998) has been a kind of archaeological theoretical détente (or a "community of discourse", Hodder 2001:3) where archaeologists on both sides of the these theoretical poles have embraced many aspects of the other (Hegmon 2003).

In response, archaeological theory has witnessed the emergence of the "new pragmatism" within "internalist" approaches in particular, that has given much attention to issues such as "the meanings people attribute to their worlds" (Preucel and Mrozowski 2010: 32) and acknowledgment of the social elements in natural landscapes (Preucel and Mrozowski 2010: 54). Nevertheless, within internalist perspectives broadly, very little attention is given to the congeries of *analytic* methods needed to establish the non-human components of these landscapes upon which people supposedly discursively attach meaning. Indeed, as Hodder (2001: 28) declares, these perspectives became more concerned with "the social" and "radical cultural difference".[5] As a result, much, but not all, archaeological thought and field research that has employed organic remains in archaeological interpretation has continued to gravitate theoretically toward externalist models of human behavior, which continue to be explicitly concerned with the non-human environment and ecology. Externalist perspectives are exemplified by processual and cognitive-processual models of past cultural practices, such as human behavioral ecology or the functionalist ends of cultural and human ecology (e.g. Kennet and Winterhalder 2006; Gremillion and Piperno 2009; Marston 2011), even though much of the early processual attachment to the "ecosystem" approach (i.e. systems theory) has largely abated.

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[5] As an indication, Preucel's (2006) *Archaeological Semiotics* contains only one mention of the word landscape.

The division of these perspectives and their influence on archaeological research in this area is most clearly visible when representative studies are superimposed on top of the theoryscape (**Figure 2.7: B**). Since externalist perspectives are more likely to utilize datasets supposedly characteristic of nature, in the Paleolithic one can see a concern with "climate change, adaptive cycles, and the persistence of *foraging* economies" (Rosen and Rivera-Collazo 2012; italics added). In contrast, in roughly the same period, an exploration of daily life, hence "culture", (Kuijt 2000) in agricultural villages in the pre-pottery Neolithic, does so not with organic remains, but with clear evidence of "culture", i.e. architecture. Therefore it should not be surprising that in investigations of agriculture in more recent periods (the lower right of **Figure 2.7: B**) for which there are written sources, studies that explicitly use paleoethnbotanical or organic remains gravitate toward externalist models using socio-ecological modeling to understand the phenomenon of interest: agriculture.

To some degree, this explains why archaeologists working in the Eastern Mediterranean and southwest Asia in historical periods, long allied to culture-historical archaeology, history, and philology and all of their theoretical disciplinary implications (Morris 2000: 38-41; Snodgrass 2006: 13-14) have until very recently resisted any kind of "environmental" or "ecological" model, view of, or nuance to the past, thereby avoiding the rancorous theoretical debates that engulfed anthropological archaeology in the 1980's and 90's (e.g. Johnson 1999: 184-5). For example, historians Peregrine Horden and Nicholas Purcell in the "The Corrupting Sea", a putative history of the Mediterranean from 3000 BCE until 1500 CE, explicitly make this connection:

> The strictly ecological approach to history is, for us, disabled by the undesirability of treating human beings solely as organisms forming part of a biological system, even one of very wide and uncertain boundaries. (Horden and Purcell 2000: 48)

The "strictly ecological approach" is most probably one of the externalist behavioral or ecological models of human "behavior" adumbrated above and represented in the 'theoryscape'; that is, those theories that posit extrinsic, non-anthropocentric causes for human behavior and "refer not to mental states as explanations [sc. of people's actions] but to environmental causes" (de Villiers and de Villiers 2003: 71). For the authors, a structural-functionalist anthropologist like Roy Rappaport and his *Pigs for the Ancestors* (1984) represents the most "sophisticated" (Horden and Purcell 2000: 46) possibility of what an ecologized view of human behavior, ritual, or history might look like, despite considerable anthropological critique of Rappaport's theoretical stance (e.g. Kottak 1999). Nevertheless, the authors do not establish what is analytically unsatisfactory about an "ecological approach" apart from what they claim is the "undesirability" of such an analysis. Yet what that "undesirability" represents is never fully defined by them. This is an important observation as the *Corrupting Sea* has been hailed as an "innovative vision of how the history of the Mediterranean ought to be done" (with reservation, naturally, Shaw 2001: 453).

In the orientation of their perspectives, moreover, much like Winnett and the other past excavators of Dhiban, it is Horden and Purcell's *rejection of the a priori theoretical* *position* that "human beings...form part of a biological system", which condition the tenor and trajectory of their own analysis (and also guides them in the *manner* of their analysis - one of a thick and descriptive dialogue with documentary sources). Within the *Corrupting Sea*, the everyday activities of traders, craftspeople, farmers, families, and individuals are situated within the connectivity afforded to these communities around a body of water (the Mediterrnean sea) characterized by a series of spatially fragmented micro-ecologies (Horden and Purcell 2000: 123-172).[6] These micro-ecologies are main explanatory devices used to understand the ebbs and flows of historical human societies over this long time-span. That is to say, within their work, non-human ecological concerns are still as important for historical causation as the practices of people in the communities of the historical Mediterranean. The presence of a large, synthesizing work such as Horden and Purcell's, and the recognition by some ancient historians, those who are the most attuned to the investigation of "culture in the present" (according to the schema of the "theoryscape"), that a re-analysis of humans and their environment in the Mediterranean "raises important - and disturbing - questions about the way that we conceive of our world and the way that we write our history" (Morley 2004: 63), are indications that the traditional dichotomies that have separated "prehistoric" from "historic" periodized research, as well as "nature" and "culture", are being re-examined in this area. On the diagram, this is represented by discrete circles of color that are rooted in one tradition ("culture history", "externalist", "internalist"), but nevertheless gravitate towards another. Few *archaeologists*, however, have attempted a similar broad interpretive sweep of historical change in southwest Asia or the Eastern Mediterranean. In part, this is for reasons already mentioned: a general unease with cultural over-generalizations and essentialisms that have defined post-processual anthropological approaches and have been incorporated in almost all theoretical perspectives (Knapp and Blake 2005).

Many studying historical-period societies in this area, however, still utilize epistemologies similar to Horden and Purcell's to structure their inquiries of past cultures. In the Southern Levant, for instance, Benjamin Porter calls attention to the fact that archaeologists in pursuit of early Iron Age (ca. 1000 BCE) lifeways often interpret inorganic material culture assemblages using "ethnicizing" or "historicizing" frameworks that seek categorical constants within archaeological datasets with large internal variability (Porter 2011: 28-9). For the Levant in particular, the presence of an authoritative and powerful religious tradition encapsulated by the Hebrew Bible has exercised a lopsided influence on contemporary archaeological practice to the extent that Israel Finkelstein, a noted Israeli archaeologist, entitled an article "Bible Archaeology or the Archaeology of Palestine in the Iron Age?" (Finkelstein 1998). The pithy yet informative title is so named because the research questions that have dominated regional archaeological practice have focused on debates surrounding the veracity of these authoritative texts (hence "Biblical Archaeology"), rather than investigations demarcated by changes in daily lived practices and their material outcomes (hence "Palestine in the Iron Age"). The same perspective extends to organic remains, such as faunal remains,

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[6] In fact, this a model used to describe the empirical observations of botanists and biologists working in the Mediterranean (e.g. Blondel et. al. 2010: 113 136; Thompson 2005).

where these data are often used to fix problematic historical identity-categories ("Philistine" vs. "Israelite") instead of exploring how Levantine communities have discursively influenced their local ecology and have been influenced by it (Lev-Tov et al. 2011: 67-8).

These issues are not restricted to the Iron Age Levant, however. In periods in which there are text-artifacts available, the environment often serves as the aforementioned "scene" to the presumed more important human political and social actors in the periods under investigation (e.g. Morley 2004: 63). One example far from the Levant and rooted in the historical period is a large recent compendium of current research of Achaemenian Persian Iran (550 331 BCE), where eight separate sections explore religion, architecture, archaeological settlement survey, and gender, but there are no articles devoted to the analysis of archaeological organic remains or the fundamental importance of agriculture, food, or cuisine to these societies (Curtis and Simpson 2010).[7] Concomitantly, when paleoethnobotanists working in these time periods analyze archaeological plant remains, their research questions are often restricted to physiognomic changes in the plants themselves, such as the investigation of the spread of certain domesticate phenotypes and changes in seed morphology (Nesbitt and Summers 1988), and not the ways in which these plants served increasingly important roles in the communities who carefully reproduced them.[8]

2.4 Nature/Culture Dualisms and the Framing of Research

The main orienting axis (the y-axis) of the "theoryscape" of this geographic area thus represents the implicit dichotomy between nature and culture that has structured the framing of research in this area. It is difficult to find a phrase that encapsulates this claim more than Braidwood's (1957: 22) appraisal of hunter-gatherers:

> A man [sic] who spends his whole life following animals just to kill them to eat, or moving from one berry patch to another, is really living just like an animal himself.

One could marshal any number of other citations from innumerable other authors that convey an almost identical position. In Braidwood's eyes, what separates a human from a non-human animal is *the manner of food production* of those humans, and clearly agriculture

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[7] One of the largest repositories of detailed information concerning economic transactions from a native perspective in the imperial capital of Persepolis actually includes large numbers of documents directly concerning the distribution of seed and grain for farmers (Hallock 1969: 22), as well as meticulous records of the rationing of processed and raw foodstuffs to various personnel (Hallock 1969: 25-50).

[8] Many of these studies are absolutely fundamental, however, in their approaches to determining criteria necessary for taxonomic identification. In the Nesbitt and Summers article cited (1988), the authors usefully review the major diagnostic features of millet as its cultivars spread throughout Turkey and Iran in the Bronze and Iron ages. Without these empirical parameters of identification, many paleoethobotanists' conclusions about the presence, absence, or change of certain taxa would be unfounded. Therefore, what is argued for here is not an abandonment of this fundamental research but analyses that build upon these critical foundations to investigate the social relations that condition the presence of these plants.

represents just such a dramatic change from an "animal-like" lifestyle. The latter is clearly influenced by unilineal evolutionary notions of "absolute progress", a model of archaeological explanation of "social evolution" since Lewis Henry Morgan's *Ancient Society* (1877), who identified a supposedly universal sequence of stages of human development from savagery to barbarism, with British 19^{th} century Victorian colonial society at the apex of human achievement, and which was influential on later anthropologists such as Leslie White (1947). One of the key aspects of this sequence was the notion that only when human beings were emancipated from "natural" constraints, could their cognitive potential could be realized (Yoffee 2005). For instance, in a discussion of the urban revolution, G.V. Childe (1950: 8) points out that a consequence of new sedentary ways-of-being and the aggregation of people into high-density population centers "will be to rescue such specialists from nomadism". That "nomads" would need "rescuing" is only apparent if one imagines that a supposed liberation from the "shackles" of nature is mandatory. At the basis of this is a fundamental categorization of human beings and culture as fundamentally *not natural.* The implications for methodological practice should have been made clear above – for prehistorians and paleoanthropologists, "where the latter seek the evolutionary origins of human beings within nature, the former seek the decisive moment at which humanity transcended nature, and was set on the path of history" (Ingold 2000: 78). Thus it should not be surprising that so much paleoethnobotanical research concentrates on those very periods when it is presumed that "humanity transcended nature" (e.g. the Neolithic).

One of the most attentive and pertinent commentators of this nature/culture dichotomy within archaeological and anthropological research has been the above-cited Tim Ingold. Ingold deserves special mention for the fact that he, unlike others, draws awareness to the specific tensions that sometimes characterize anthropological and archaeological research specifically - a recognition on the one hand that human beings are biological organisms, part of and constituted by global non-human processes, but on the other hand, are also endowed with distinct characteristics through the explanatorily problematic vehicle of "culture". A commitment to the dissolution of this binary has often pushed other researchers toward universal determinism or extreme cultural relativism (Ingerson 1994; Scoones 1999: 487). Yet not so for Ingold – he observes that many highly relativistic internalist perspectives that overemphasize human uniqueness or the incommensurate quality of human social or cognitive phenomena with other non-human animals, do not often explain "how human acts of world-making differ from the processes whereby non-human animals fashion their environments" (Ingold 2000: 173-174). Ingold compares this view to those perspectives that are implicitly dualist in their formulation, since "to suggest that human beings inhabit discursive worlds of culturally constructed significance is to imply that they have already taken a step out of the world of nature within which the lives of all other creatures are confined" (Ingold 2000: 14). Bruno Latour has also remarked that (2000:105) "the very notion of culture is an artifact created by bracketing Nature [sic] off".

These authors are responding to a form of cultural relativism that emerged as a reaction to externalist adaptationist perspectives in which "nature" was seen a cultural construction (and therefore not real in any empirical sense), and that human existence in "nature" was

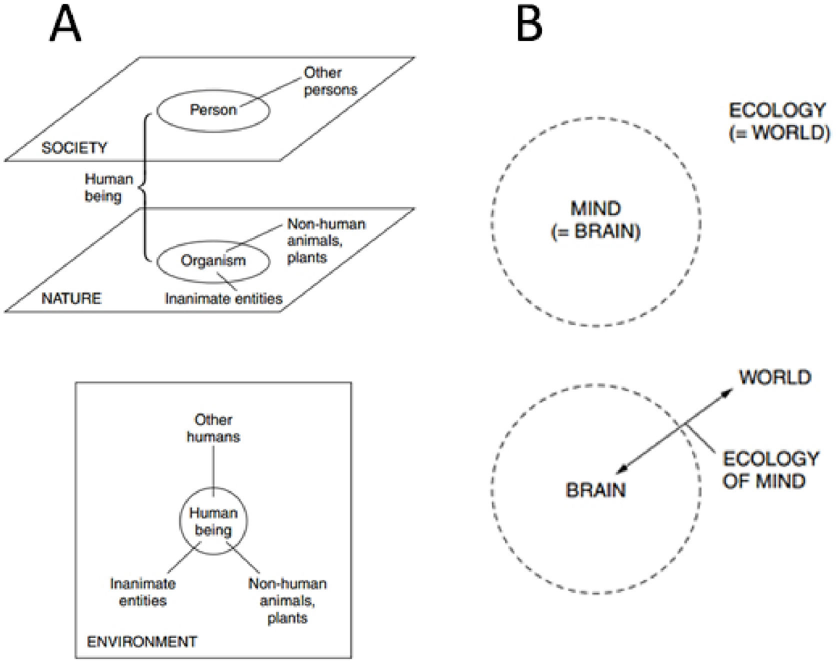

Figure 2.8: Perceptions of Nature and Culture, in (A) human society is considered independent of "nature", with society composed only of other persons and not organisms (Ingold 2000: 46), and in (B) the human mind is imagined to be independent of ecology (i.e. the world) versus an ecology of mind (Ingold 2000: 18).

in fact a world of hermeneutic discourse about that "nature", and not any uniquely real, independent entity (see the longstanding debate in geography about the landscape cited above). This is in contrast to a strong "realist" perspective which posits that phenomena exist independent of human ability to perceive them (Turner 2007: 27-34). The "realist" perspective is most apparent in studies that utilize buzzwords such as "impact": these imply that human beings are also outside of nature (for different reasons than the internalist-discourse model), and therefore impinge upon it rather than manipulate it through their situated and embodied knowledge (Ingold 2000: 16-19; **Figure 2.8**). The general tenor of Ingold's argumentation, and one which informs this research project, is that both of these conceptualizations - internalist and externalist - disassociate human beings from the worlds in which they live, and imagine that the human mind, for instance, is an encapsulated, delimited object operating independently from a real, knowable, and physical reality (Ingold 2000: 158-171). In order to avoid this dichotomization, a perspective is necessary which does not artificially disarticulate human beings from the very evolutionary processes that engendered them and indeed with which they share great affinity to all other organisms on the planet, nor to deny humans the explanatory force owed to those features (e.g. cognition, language, etc.) that have made human beings undeniably distinct.

Although Ingold does not advocate an extreme relativist position with respect to the nature/culture binary, he is nonetheless opposed to externalist explanations such as Human Behavioral Ecology on theoretical and empirical grounds. He convincingly argues that the same dichotomy that conditions a disjunction between nature and culture also conditions analyses of “economic man” from “hunter-gatherer man” (Ingold 2000: 27-39). Human Behavioral Ecology (henceforth “HBE”) approaches are more common among studies of hunter-gatherers than those groups assumed to engage in “economic” activities (Hawkes et al. 1997; Winterhalder and Smith 2000; Marlowe 2005). This is clear in the descriptions of the field by many HBE practitioners, such as Bettinger (2006: 304) who argues that “the thrust of most HBE contributions has been to show that humans play by the same rules as other species, or at least to illuminate certain aspects of human behavior with reference to the behavior of other species”. The highly binarized view that human evolutionary descent and phylogenetic relatedness to all other living organisms is an either / or proposition (i.e. either subject to biology or not) is further made clear by Bettinger (ibid): “The biology that makes humans like other animals, however, provides no special place for anthropology. The part left over the ’non-biological component’ - provides that place.” What is the “non-biological component”? Latour argues there is neither nature nor culture, but only “nature-cultures”. Although Latour might not desire to be affiliated with this research, within the realm of cognitive psychology and neuroscience, a growing number of studies have documented that motor neurons that fire during physical activity also activate when individuals think about performing a physical act - giving strong empirical evidence to the claim that many mental processes are embodied (Garbarini and Adenzato 2004; Markman and Brendel 2005; Mahon and Caramazza 2008). Embodied cognition might provide empirical validation of the concept of “nature-cultures”.

Within the environmental archaeological literature itself, the dichotomy of nature and culture conditions the expectations and understandings of social phenomena. In a summary article of the utility of paleoethnobotanical data for understanding North American prehistory, archaeobotanist Richard Ford offered a model for understanding paleoethnobotanical remains in this regional context by use of a scatter plot with “nature” and “culture” on the x and y axes (**Figure 2.9**). Those items that are in the lower-right, that is closer to the x-axis, are presumed to be activities more indicative of the “natural” world, which is conceived of as separate and distinct from the “cultural” world, which is represented by the y-axis. Using this scalar perspective, therefore, the logical extension is that in some way “social and religious symbols” are less dependent on “nature” or “natural” phenomena, that is biotic and abiotic processes within a discrete space broadly constituted. Nevertheless, in the text, Ford recognizes the dynamic interplay between these two supposedly independent domains, in that “in each situation a culture defines appropriate plant resources, and the behavioral consequence of their extraction modifies to some degree the structure and composition of the local plant communities” (Ford 1979: 290). Likewise, Ford uses the ethnographic example of US southwest Pueblo rituals of the harvesting of the purple-blossomed daisy (*Trigeron divergens*), which often grows far from these Pueblo communities, to argue for a “dialogue between nature and culture”. Despite the acknowledgment of the dynamic interplay of these

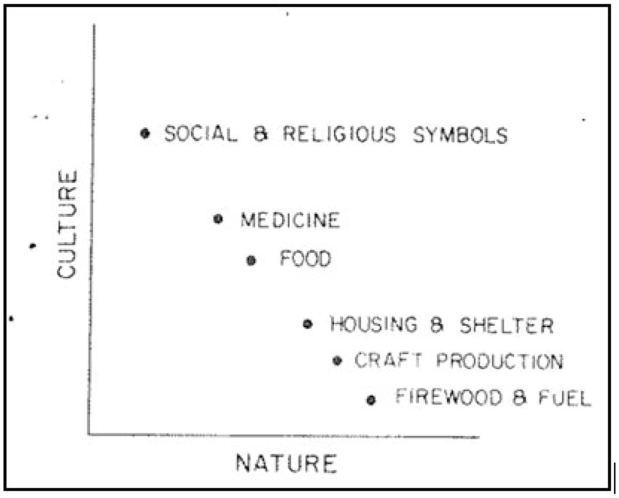

Figure 2.9: A scatterplot of the relationship of paleoethnobotanical phenomena to the axes of nature and culture (Ford 1979: 289, Figure 9.2).

two domains, the division of what are assumed to be two "uniquely real", bounded, and discrete phenomena is not questioned.

Even Ingold, who himself argues for the dissolution of this binary, sometimes frames his discussion in similar terms. He has argued for the close alliance of social-cultural anthropology, biological anthropology, and archaeology – in his words, a "necessary unity" (1993: 152). With respect to the nature / culture dichotomy he is likewise quite clear on the theoretical reorientation needed to approach human and environmental interactions: for instance he notes that farmers are not masters over nature, but rather a farmer "submits to a productive dynamic that is immanent in the natural world itself, rather than converting nature into an instrument to his own purpose" (Ingold 2000: 81). That is to say, humans are bound to the world through materials and through evolution, and therefore, "those who toil on the land...are assisting in the reproduction of nature, and derivatively of their own kind" (Ingold 2000: 81). Nonetheless, when he turns to an ethnographic example of a Canadian First Nations' Cree hunter confronting a wild caribou during a hunt, and the attendant mental representations (the "emic" view) of the Cree hunter as to his activities, Ingold argues that

> [f]or anthropologists, however, explaining the behaviour of caribou is none of their business. Their concern is rather to show how hunters' direct experience of encounters with animals is given form and meaning within those received patterns of interconnected images and propositions that, in anthropological parlance, go by the name of 'culture'. (Ingold 2000: 14)

That is to say, understanding the behavioral ecology of the caribou, its physiology, or cognition, is not important for the task of the anthropologist. The caribou (nature) is independent of the received patterns of interconnected images and propositions (culture, in Ingold's own self-reflexive use of the term).

For the environmental anthropological archaeologist, avoidance of the behavior, the behavioral ecology, or ecology of the organisms whose entanglement with human beings is the object of archaeological analysis, is not possible. As Hans Helbaek, the Danish pioneer of paleoethnobotany in the Middle East noted in his analysis of plant remains from Ali Kosh, Iran, "it is clear that any domesticated plant is an *artifact*, a product of human manipulation" (Helbaek 1969: 365). A voluminous empirical literature, primarily concerned with the origins of agriculture in southwest Asia and elsewhere, has begun to emphasize with vigor the profound biological entanglements between human beings and the non-human animals and plants they have domesticated, which it should be noted, is a continuous and ongoing process (Fuller et al. 2010). For instance, the loss of rachis shattering among southwest Asian cereal grasses (e.g. einkorn wheat) in the slow rate of local domestication (Fuller 2007) made these cereals "essentially dependent upon the farmer to disperse the grain" (Fuller et al. 2010: 15). In turn, since the redistribution and management of these new crops made the farmers dependent on them, a complex entanglement of social authority and biological reproduction developed. Therefore, understanding the biology, ecology, and geography of an organism is just as crucial to an environmental archaeologist as the mental representations of those organisms by the humans that have encountered and manipulated them in the past.

Externalist perspectives such as HBE or various forms of cultural ecology that ascribe a nature acting *upon* humans in terms of explanation of culture change are especially popular theoretical stances of archaeologists who work with organic remains, even those working in more recent periods (e.g. Marston 2011). As already indicated, few paleoethnobotanists have actually taken up the task of using plants to understand people, and even fewer archaeologists working in historic period societies view those plants as important to society. It is unsurprising, then, that in periods in which there is written text, and a researcher is interested in "culture" alone, plants and non-human animals are assumed to be autonomous of and independent from the "second nature" created by people who have freed themselves from the shackles of their animal associations. Moving beyond this nature /culture dichotomy involves changing the analytic framework which informs many studies of the place of non-human organisms within human society.

2.5 Historical Ecology and the Longue Durée

One of the most promising attempts to resolve the tension between the interwoven biological and social realities of human life in the past and present has been the perspective of Historical Ecology as framed by William Balée and first postulated by Carole Crumley. This perspective is part of a renewed human-ecological emphasis in the social and biological sciences that has recently inspired a slew of hyphenated words in archaeological thought that encapsulate the relationship of people to the environment: eco-dynamics, socio-natural systems, socio-ecosystems, etc. (Kirch 2005: 412-413). Historical Ecology inverts the past ecological and functionalist socio-cultural anthropological paradigm of human adaptation "to" the environment, and takes an explicitly anthropocentric perspective of environmental change (Balée and Erickson 2006: 2-6). It is important to note what is meant here by "environment" and what is meant by "ecology". Ecology is the interaction of an organism with its environment, and it includes groupings at various analytic hierarchical scales: individuals, communities, populations, etc. (Mayhew 2006: 9). In contrast, the environment is the collection of abiotic and biotic elements that comprise an organism's surroundings (Dincauze 2006: 3). Historical Ecology, therefore, studies the interactions of a given organism (human beings) with its surroundings. In this case, these surroundings can be creations, or artifacts, of the organisms themselves.

Historical Ecology, originally proposed by Carole Crumley in the important volume bearing the same name (1994), critically differentiates itself from cultural ecology, environmental history, systems theory, ecological anthropology, and other functional or adaptationist theories through its reliance on several empirically verifiable postulates (Crumley 1994: 3-4; Balée 2006: 79-81). As envisioned by Crumley, the main contribution of Historical Ecology is in tracing "the ongoing dialectical relations between human acts and acts of nature, made manifest in the landscape" (Crumley 1994: 9). By focusing on the practices that maintain and modify these landscapes, historical ecology grants agency to the human actors who reproduce them, and are reproduced in them. The perspective of Historical Ecology is highly amenable to studies of past complex societies, precisely because it was partially triggered by the problem of applying economic anthropology to complex societies (Balée 2006: 76).

The four postulates of Historical Ecology are: a) all environments on earth are affected by humans, b) there is no human genetic predisposition to augment or lessen species diversity, c) the impacts of societies are uneven, and d) human environments may be studied as a "total" phenomenon. Each one of these carries contextual repercussions in the case of previous understandings of Mediterranean ecologies and anthropogenic impacts upon them. The first postulate is a direct result of worldwide archaeological research that has shown that "pristine" environments do not exist, such as were thought in pre-Columbian North America (Denevan 1992) or South American Amazonia (Denevan 2006). In the Mediterranean, the idea of "timeless" Mediterranean landscapes and ecologies has held powerful sway over popular and some academic thinking (Barker 2005) with the result that later historical societies' effects on the Mediterranean are either overemphasized ("degradation") or under-contextualized (action on a "constant"). More data have now been assembled to show, in short, that "human activity should be considered as an integral ecological feature of the region" (Blondel et al. 2010: 202). Palynological, archaeobotanical, isotopic, and recently plant genetic data have all converged to show that ecological-human interaction cannot be viewed as independent but instead as interdependent and mutually constitutive phenomena, and that Mediterranean landscapes, since at least the Neolithic, have been anthropogenic in origin (Roberts et al. 2001; 2004; Blondel 2006; Jalut et al. 2009;). Thus, from the perspective of Historical Ecology, it is the long-term negotiation with and creation of these landscapes (Balée 2006: 75) that is the object of historical study, and situates each society in its unique social and historical context while acknowledging the manifold drivers of local biodiversity and action.

Points (b) and (c) are also critical for understanding past Mediterranean ecologies. Understanding "humans-in-Mediterraneans" requires abandoning the *a priori* assumption that all anthropogenic inputs into local ecologies are necessarily detrimental. A debate concerning non-equilibrium ecology has emerged within the field of ecology as a whole, in which the idea of a stable-state nature, that is, ecological networks which are in a self-regulating state of homeostatic "equilibrium", has been questioned (Sullivan and Rohde 2002; Rohde 2005; Vetter 2005). Disturbance is increasingly being seen as an active factor in maintaining ecological relationships, rather than as a factor for decomposing them (Balée and Erickson 2006). In the Mediterranean, the consequences of a Historical Ecological and non-equilibrium perspective include a reevaluation of the concept of degradation in Mediterranean semi-arid areas. For instance, Brett Hill, in his analysis of human ecology in the Wadi al-Hasa in southern Jordan, notes that degradation has been a term that has served multiple purposes and with multiple meanings, yet with little consistency beyond a general appeal to unfavorable human intervention in ecological networks (Hill 2006: 23). As Balée (2006: 83) emphasizes, "each landscape needs to be understood in terms of its specific cultural and historical influences on succession without prejudice toward human nature".

Understanding that each landscape must be investigated with respect to its cultural and historical particulars critically allows for a historical dimension to an analysis of human-ecological interaction. Balée and Erickson focus on the landscape in particular, viewing it as "a totality - that is, as a multiscalar, diachronic, and holistic unit of study and analysis" (2006: 2-3). To address this, Balée and Erikson argue for an analysis of the "physical record of intentionality" over multiple temporal and spatial scales. Here lies one of the key distinctions between Historical Ecology and many of the ecologically and environmentally minded perspectives of human environmental interactions: Historical Ecology includes human agency. As Balée and Erickson noted, the landscape is viewed as a record of intentionality. The authors go to great lengths to illustrate that other perspectives overlook the fact that "the environment, once changed by human hands, exert[s] a longer-term effect on subsequent human cultures in the region of the changes" (Balée and Erickson 2006: 2). In Balée's larger synthesis, he has characterized this as "anthropocentric", largely, it is argued, to avoid the kind of environmental determinism found in other diachronic archaeological research worldwide. Specifically, the authors argue that humans are "endowed with unique and formidable cognitive, intellectual, and aesthetic ability as well as with inimitable agency in terms of environmental resources and productive strategies" (Balée and Erickson 2006: 5).

Couched in terms of agency and intentionality, it is clear that the role of human cognition cannot be understated in human-environmental interactions. Karl Butzer, whose Archaeology as Human Ecology revised neo-adaptationist models of people-in-landscapes, similarly and independently recognized the "pivotal role of human cognition" (Butzer 1982: 32). In fact, with respect to ecology, he noted (Butzer 2005: 1774) that

> [t]he environmental sciences can contribute substantially to an [sic] recognition of 'what' happened in terms of change, but they are only one component of understanding 'why' something changed. Causation in environmental history is more than just a complex

> 'systemic' issue, because it involves intrinsically different variables that range from empirical to existential.

Causation in the case of human-environmental interaction therefore must be seen as mutually constitutive and not unidirectional. In evolutionary biology, this has been recognized and mathematically formalized as "niche construction theory", in which the ecological inheritance of an area can influence the evolution of a species that has modified its environment. That is, it introduces the idea of "reciprocal causation" (Kendal et. al. 2011: 786) in evolution, which shifts from an external perspective of adaptation to a pre-existing environment, and interaction with (hence, an "interactionist" theory of evolution) of the environment. The latter conceptualization is a robust model for historic periods in southwest Asia and the Eastern Mediterranean, where the unique human configurations of power known as empires

> are arguably the types of societies that most closely resemble our own, with similar global political and economic infrastructures connecting nation-states worldwide. As with other societies, it is difficult to isolate climatic factors and human responses without considering politics, economies, and ideologies (Rosen 2007: 150).

The inability to isolate individual factors that explain communities' reactions to climate in "empires", which will be a key thematic principle in Chapter 3, underlines the necessity for perspectives such as historical ecology that envision these socio-ecological phenomena as fundamentally entangled.

The final consideration needed for a historical ecological approach is scale: Balée and Erickson argue that in order to understand human intentionality in the landscape, multiple temporal and spatial scales are necessary. The insistence on multiple temporal scales, or in its guise as "change through time", was heavily theorized by French historians in the 1930's and 1940's (Knapp 1992: 4) and subsequently incorporated into much archaeological practice. The Annales School exemplified by the work of Fernand Braudel, has had an influence that extends far beyond the initial historical interests of the original formulation (e.g. Kirch and Green 2001: 277). The analysis of temporal scale is critical in historical ecology because each landscape occupied by a particular community has been inherited from the past community; successive communities shape previously shaped landscapes. For example, a study from Central France has shown that contemporary forest biodiversity in the Troncais Forest is directly linked to past Roman agricultural practices (Dambrine et al. 2007). Within the 10,000 hectare forest, no fewer than 109 Roman settlements were found dated to a period before the fifth century CE (Dambrine et al. 2007:1432). A series of soil samples collected from the center of ten Roman sites alongside full excavation of four structures for artifacts and ecofacts complemented the investigation. The researchers found dense concentrations of archaeological anthropogenic charcoal in these sites, probably from the initial clearing of the forest in the early 1st millennium CE for agricultural land. Since the abandonment of these structures in the 4th century CE, the majority of woody vegetative colonization has been of acidophilous species (Dambrine et al. 2007: 1436). The authors note that P and N cycling, probably due to fertilization of these Roman cadastres, facilitated the continuous and contemporary maintenance of soil and vegetation patterns. Their statistically confirmed conclusion is that without knowledge of previous Roman settlement, other contemporary environmental variables (such as hydromorphic, or well-drained, soils) could not predict the high densities of vegetative (mainly vascular) plant diversity in these areas. Thus the landscape that is visible today is itself a byproduct of past human agency: environmental scientists and ecologists can not ignore the historical, and yet nor can archaeologists and historians ignore the ecological.

The theoretical heart of the issue, therefore, is how best to move from local actions to larger environmental, ecological, or landscape repercussions. As John Robb and Timothy Pauketat have recently framed it, it necessitates moving "from moments to millennia" (Robb and Pauketat 2013). Knapp has proposed that a long term perspective "should encourage analysis within one or between two time scales, e.g. analysis of short, periodic, discontinuous variations within long-term trends" (Knapp 1993: 13). Braudel has been criticized by some scholars for his structural-ecological determinism and lack of specificity for how best to move empirically between these different scalar levels (Knapp 1993: 6;). In Braudel's own study of the Mediterranean, he resolved the issue through physical division: part one of his major study of the Mediterranean in the 16th and 17th centuries CE (1972) was devoted to a discussion of the environmental characteristics of the Mediterranean and enduring social trends within them (e.g. "Towns" 1972: 224-325), and the second largely devoted to traditional political narratives associated with anecdote: "[t]hese apparently trivial details tell us more than any formal description about the life of Mediterranean [sic] man" (1972: 758). Yet what of the archaeologists who do not have such anecdotes available?

A potential solution is a *longue durée* perspective on "socioecology" (Barton et al. 2004), which has been advocated by a number of archaeologists working both from anthropological (van der Leeuw and Redman 2002) as well as cultural-historical (Morris 2000) traditions. The emphasis is on the ability for studies of long-term change to illuminate social, economic, or environmental phenomena that may seem unique to one historical period but in fact are products of past interactions, and for which there may be little to no historical documentation (Kirch 2005: 412-413). This perspective has been embraced by those working in many parts of the world, such as in Polynesia (Kirch 2010), the Andes (Hastorf and Johannessen 1993), Central Asia (Nesbitt and O'Hara 2000), Mesopotamia (McCorriston and Weisberg 2002) and California (Lightfoot et al. 2013). Indeed, one of the most successful examples of these perspectives that utilize archaeological plant remains and historical documents to construct a historical ecological narrative in the Mediterranean Basin is the work of Graeme Barker (1996), D. Gilbertson, and D. Mattingly in the Libyan pre-desert, between contemporary Mizda and Ghirza, as part of the UNESCO Libyan Valleys Archaeological Survey.

Barker et al. assembled a large multidisciplinary teams to determine the causes for the "striking contrast between the barrenness of the present and the apparent fertility of the past" (Barker 1996: 18) in the Tripolitanian pre-desert of Libya. This Mediterranean littoral area of Libya contains dense concentrations of Roman-period archaeological sites that include fortified hilltop sites, farmsteads, and mausolea dating to the 2nd to 3rd centuries CE, and yet is practically uninhabited today due to heavily degraded soils (1996: 8-13).

As Barker explains, the two primary explanations for the gradual abandonment of this area have been climate or institutional mismanagement (1996: 19). Nonetheless the research team sought to identify the long-term "agencies of change" that might have precipitated this abandonment and loss of ecological diversity. To achieve this, the UNLV team employed a host of methods: survey, excavation, remote sensing, geomorphology, paleoenvironmental sampling, sedimentology, documentary and epigraphic studies, and finally, zooarchaeology and paleoethnobotany (Barker and Gilbertson 1996: 21-48).

Though the team included a paleoethnobotanist, the individual was unfortunately not present to sample these sites and therefore provide more robust data to test the hypotheses of the UNLV team. As van der Veen et al. (1996: 230) report "the archaeobotanist of the project should have overseen the recovery of the botanical data, to ensure standardized techniques of recovery and recording". Despite the efforts of the team to include the results of their paleoethnobotanical research, only one year out of the four could be included in the final analysis. Nevertheless, the data that emerged from initial archaeobotanical analyses highlight a diverse crop economy up to the 7th century CE (van der Veen et al. 1996: 255): remains of Mediterranean (olive, grapes, figs, etc.) and African (water melon, dates, Christ thorn berries, etc.) domesticates were found. The complementary investigations of the irrigation structures and olive presses in the landscape (Gilbertson and Hunt 1996: 191-225), when coupled with these archaeobotanical data, show how effective the Romano-Libyan farmers were in their ability to utilize floodwater from seasonal rainfall. Contrary to climatic hypotheses that argued for increasing aridity (and hence gradual site abandonment), there was no reduction of crop diversity or rise in salt (or drought) tolerant crops due to soil salinization or erosion (van der Veen et al. 1996: 263).

What then caused the observed abandonment of these sites in the 7th century CE? The authors postponed their historical contextualization of these changes (for much is known from epigraphic, documentary, and literary sources) in order to "let the archaeological data speak for themselves" (Mattingly 1996: 319). Despite the major dislocations precipitated by the Vandal conquest of Roman Africa in 430 CE, the complex system of agricultural labor, irrigation, and crop production that existed in early periods did not end. In fact, Mattingly, while he petitions "special factors of social organization" (Mattingly 1996: 342) that kept agriculture productive in this area, nonetheless notes that successive episodes of warfare may have affected these populations' concern with personal safety and stability, and combined with earthquakes, seem to have caused the population to have gradually abandoned these volatile urban areas. The results of excavations show that by the late 3rd century CE, some of the sites on more marginal land (i.e. furthest from wadis which would seasonally flood) began to be abandoned. Therefore, the authors conclude that complex changes in local economic networks, the later emergence of new forms of social obligation (in the form of "warlord-ism"; Mattingly 1996: 338), and endemic warfare contributed to the gradual abandonment of these effective agricultural practices.

While the UNLV researchers of the latter study did not explicitly utilize the perspective of Historical Ecology in their research design, the study is a successful example of the potential to construct a historical ecological narrative utilizing a multitude of complementary

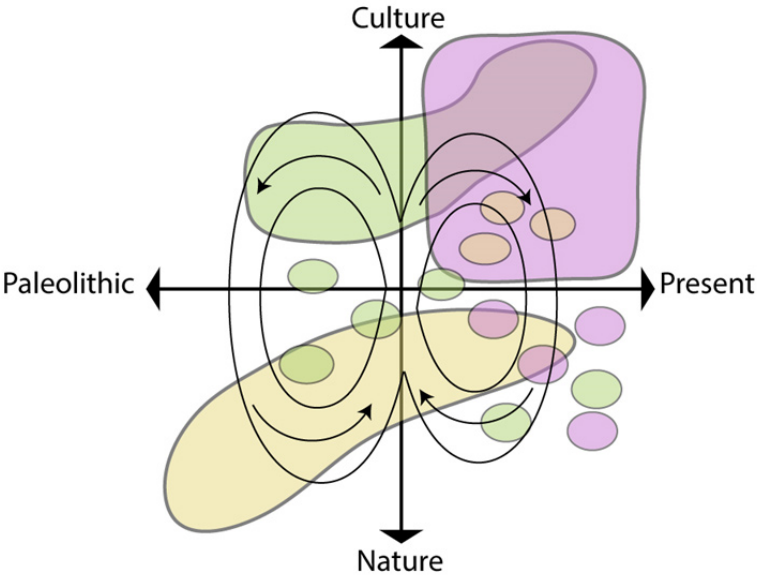

Figure 2.10: The resolution of the theoryscape through Historical Ecology – the Mobius strip represents an integrated, long-term perspective that does not distinguish nature and culture but dialectically loops between the two, while recognizing the effect of the past on the phenomenon under study.

archaeological, ecological, environmental, and documentary data sets. Without paleoethnobotanical evidence from different structures dating to a period over 500 years, the authors could not have determined the timing, range, productive capacity, or sustainability of the agricultural practices in these periods. Importantly. the paleoethnobotanical data illustrated the desire of these farmers to grow a diverse range of crops (both African and Mediterranean) whose production did not seem to have been impacted by a hypothesized “climate change” or deleterious over-farming. Instead, the entanglement of mutually constitutive human and environmental factors such as political organization and soil quality were noted as part of a larger web of interlocking changes in land management practices, as there was a shift from cultivating tree crops on the wadi floors in the 2nd to 4th centuries CE to later cereal-based farming at some point between the 5th to 7th centuries CE. This shift changed the pattern of soil use and nutrient cycling, and in turn, affected successive attempts to produce the crops which communities depended on for their own reproduction (Barker et al. 1996: 277-8). Yet without the initial recognition by these researchers that paleoethobotanical data could address these complex socio-ecological issues, these remains would not have been collected.

2.6 Exploring Dhiban through Time and through Agriculture

It is clear from the examples above that archaeological plant remains have been an overlooked data-set for exploring long-term change at multiple levels of archaeological analysis in southwest Asia and the Eastern Mediterranean during periods in which there is written language. A dichotomy between nature and culture is at the core of the theoretical impetus for assuming that social and political phenomena are disarticulated and insulated from non-human ecologies. In the Mediterranean, increasing empirical evidence has revealed that its landscapes are anthropogenic in origin, and have been since the Neolithic (ca 9000 BP). Nevertheless, archaeological investigations of the changes that have beset communities living in southwest Asia and the Eastern Mediterranean do not include plant remains as part of the analytical toolkit once text-artifacts appear. The latter is especially pronounced for time periods in which authoritative texts used in Western European identity negotiation (e.g. the Hebrew Bible, New Testament, Classical authors) appear with frequency (cf. Dietler 2010). Nevertheless, archaeological plant remains have the unique capacity to reveal the entanglements of people and non-human ecological phenomena.

To return to Winnett and Reed's early interest in plant remains, it is now possible to see how a historical ecological approach answers how the seed cache that the excavators found in Dhiban explains a social phenomenon. Indeed, because there is no dichotomy between culture and nature, the seed cache itself is an embodied product of an inseparable relationship conditioned since southern Levantine hunter gatherers began experimenting with new kinds of cultivation and selective (i.e. domestication) practices. As Dhiban has been settled for over 2,500 years by sedentary agriculturalists who have continuously negotiated with the realities of food production within the semi-arid environment of the site, a historical ecological approach predicts that the institutions, organization, and management of these practices will vary with each successive community that has occupied the mounded site. Moreover, this approach requires that non-human biological data be seen as invaluable sources of evidence for changes in people's daily practices. A schematization of the integration of the axes of the theoryscape illustrates how the perspective of historical ecology encourages a dialectical "looping" through nature and culture (the totality of the landscape) through time (**Figure 2.10**). In the next chapter, the current archaeological research project, which resumes the work of Winnett and Reed at the archaeological site of Dhiban, is presented alongside the introduction of a new empirically constrained narrative of regional agricultural change and production to illustrate how past communities at Dhiban actively negotiated these entangled human-ecological networks.

Chapter 3

From the Corrupting Sea to the Corrupting Seed: Dhiban's Spatial and Temporal Contexts

> "And there were no cisterns inside the city [of Dhiban] at Qarho and I said to all the people, 'Make for yourselves each one a cistern in his house'."
> -Mesha, "king" of Moab ca. 850 BCE (after Routledge 2000: 136).

As discussed in the previous chapter, two of the key postulates of a historical ecological approach to the past are the unevenness of communities' influences on the landscape and the totality of that landscape. In southwest Asia and the Eastern Mediterranean, each community's involvement with their landscape has been heterogeneous and historically situated, although ecological principles might apply universally (Holling 2001: 396; York and Mancus 2009). Therefore the timeless harvests of "Moabite grain" by the Bani Hamida envisioned by Winnet and Reed and discussed in Chapter 1.1 is *ipso facto* an extreme simplification. The grain harvested by the Bani Hamida community both in 1950 and today (2014) on the Dhiban plateau has undergone considerable genetic and phenotypic change due to long entangled human-ecological relationships, as have the agricultural practices used for collecting that grain (Palmer 1998). Furthermore, a 'totalizing' approach to this geographic area considers humans not as outside influences on the landscape, but as embedded and constitutive, albeit keystone, elements (Balée and Erickson 2006), of them. These two principles lay the foundations for an investigation of the paleoecological and historical narratives around Dhiban focused specifically on the role of agriculture in the reproduction and maintenance of the societies in this area, as well as the significance of agricultural production within their own internal worlds of meaning.

To achieve this, the first step is to generate research questions about long-term agricultural production and practice at Dhiban during periods of imperial intervention, which are informed by the perspective of Historical Ecology, and which can be addressed with paleoethnobotanical and related archaeological data. The second goal is to establish the intertwined ecological and historical narratives that underscore the myriad human and non-human contexts of state institutions, local decision making, climate, and plants, and the ways in which they mutually reproduced each other in and around the Dhiban plateau in these specific moments of imperial intervention.[1] This narrative places agriculture at the center of the discussion of these historical societies (e.g. Barker 2005; Marston 2012). It also explores how decision-making related to it has shifted through time (Riehl 2008) and highlights how these decisions have fueled concatenated ecological and societal transformations since the Chalcolithic (ca. 4000 BCE; Fall et al. 2004) as a consequence of episodic intensifications of agricultural production. Horden and Purcell identified Hesiod's *Theogony* as the source of the title of the *Corrupting Sea*; the 8th/7th century BCE Greek author despaired the connectivity of cultures afforded through maritime travel on the Mediterranean sea as an invitation for moral catastrophe (Horden and Purcell 2000: 300). The authors locate it as one of two defining and unique characteristics of this geographic area (2000: 175).

In the narrative focus of this chapter and the next, the shift is from a "Corrupting Sea" to a "Corrupting *Seed*", where the capacity of agriculture to unite, bind, and ultimately sustain communities in this region is emphasized with respect to its historical and ecological specifics. The latter includes an increasing reliance by them on a suite of domesticated plants particular to the area through time; this domesticate suite includes wheat (*Triticum*), barley (*Hordeum*), lentil (*Lens*), and olive (*Olea*) (Willcox 2012). Mediterranean agricultural lifeways also involved and involve a "system" of agro-pastoralism dependent on and enabled by widespread cereal agriculture, as well as forms of creative water management and soil stabilization necessary to deal with unreliable precipitation, hydrology, and micro-climatic phenomena (Horden and Purcell 2000: 179-182, 201-209; Roberts et al. 2001; Blondel 2006). Much of the current paleoethnobotanical and archaeological evidence on the adoption of these new plants by hunting and gathering southwest Asian and Eastern Mediterranean communities (and which the last chapter has shown, the data for which is especially abundant) illustrates that it spread quickly throughout the region starting around 9000 cal BCE (Fuller et al. 2011). It should be emphasized that there are myriad ways in which human communities around the world drew (and can draw) both food and meaning from their landscape (Harris 1989), and the continued resilience and commitment (to use Sherratt's term) of groups in this area to agriculture *specifically* is particularly marked (Blondel et al. 2010: 202-233). One of the more surprising results of decades of research, in one case referred to as a "paradigm shift", is that there were multiple origins of domestication in this region, rather than a presumed central origin from which this new way of life diffused (Zeder 2008; Fuller 2010; Riehl et al. 2013). The significance of the latter observation is that communities were each experimenting with new ways of life independently over longer periods of time than previously assumed (>3kya), and thus these episodes of careful plant management "were potentially highly contingent on particular cultural practices that need

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[1] A re-evaluation of the use and role of narrative in archaeological historical writing places an emphasis on the explicit recognition of the "story-telling" character of these narratives, and the acknowledgment that other equally compelling narratives might be written on the same or similar data-sets (White 1975; Stone 1979; Joyce and Preucel 2002).

not have unfolded in a similar way for each domestication" (Fuller 2010: 10). A consequence of this shift in attention to these multiple centers of domestication is increasing recognition that the archaeological evidence also shows that "plants emerge as important components of community interactions and ritual performances involving suprahousehold groups that were mediated through communal food consumption" (Asouti and Fuller 2013: 299).

The communal aspect of agriculture that binds communities together, then, is the joint problem of labor and distributed knowledge induced by the management of the plants themselves (Fuller et al. 2010), as well as the physical infrastructure that is necessary to hold harvested plants and the incidental material used to support them: cisterns, granaries, grinding stones (querns), field boundaries, agricultural tools, etc. (Bar Yosef 1998). Each of these created new kinds of roles for individuals in society that structured new meanings, hierarchies, and dependencies (Price 2010).[2] In this respect, attention to agriculture in the following narratives is manifestly *not* about resource exploitation and subsistence, but an investigation of the ways in which the repeated practices of plant generation structured daily life, and the ways in which people's perceptions of the landscape affected their choice of assisted plant reproduction (Ingold 2000). In the historical Mediterreanean basin and southwest Asia, entire mythologies involve agriculture as a central theme, gods are often associated with specific plants (Ceres the Roman goddess of cereals; Spaeth 1996), and the act of the creation of agriculture itself is seen as divine. In one Sumerian text known as the "debate between sheep and grain" (Black et al. 2004: 225-220) dated to near 1,800 BCE (Cohen 2007: 416), an anthropomorphic domesticated barley and sheep argue about which is more useful to humankind. Their description is in the most glowing terms: "grain standing in her furrow was a beautiful girl radiating charm; lifting her raised head up from the field she was suffused with the bounty of heaven" (Black et al. 2004: 227,l.43-53.). Indeed, barley (as is indicated by the sign DINGIR.ŠE.TIR; Cohen 2007: 416 n.3) ends up winning this exchange precisely by emphasizing its own social value: "I foster neighborliness and friendless. I sort out quarrels between neighbors" (Black et al. 2004: 227, l.71-82).

Yet agriculture, once an inseparable aspect of community life, also exposes communities to vulnerability during periods of conflict. It has been noted, for instance, that Classical (500 - 300 BCE) Greek war campaigns involved the specific destruction of the fields, farmsteads, and vineyards of enemies, highlighted and bemoaned in many historical texts and tragedies (Hanson 1998). Indeed the depth to which the power of the management of plant reproduction became entangled within these societies is deftly addressed in Brent Shaw's (2013) *Bringing in the Sheaves*, where he canvasses the profound role of agricultural metaphor in everyday life in Roman, Near Eastern, and medieval European worlds. One could draw upon many such other examples, but it is worth noting that this recognition of social dynamics inherent to agriculture has been argued for many agricultural societies world-wide. In the

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[2] For instance, in a quantitative ethnography of agricultural production in the pseudonymously named village of "Kosona" in the Peloponnesos in Greece in the 1970s (Forbes 1989: 91), agricultural tracts were highly fragmented and scattered, some given to arboriculture, others to legumes or cereals. Crucially, these were often owned by different individuals from different households who had to plan *amongst themselves* how best to manage this arrangement, highlighting the interdependency created by these field arrangements.

Andes, for instance, Hastorf (2009) has averred that in many respects the inscribed practices of agriculture were a "metaphor for the...[Inka] state". Kirch (2006: 207), moreover, highlights that in Futunua in Western Polynesia, the "immense efforts that go into the production of a successful *katoaga* feast (a kind of competitive feast between paramount chiefs) underscores the force that social production can have on agricultural efforts". In both cases, agriculture exists not solely as a way to sustain basic biological functioning, but also plays a critical role in the maintenance of human relationships, indeed in many ways influencing them.

These narratives do not operate in an intellectual vacuum, however. A considerable amount of research has taken place in this geographic area, and much of it is strongly demarcated by disciplinary boundaries (Matthews 2003: 1-26). The Eastern Mediterranean and southwest Asia comprise both a geographic zone and a temporal spectrum; the investigation of either is and has been the investigative territory of archaeologists from various traditions (Anthropological, Classical, Near Eastern), historians, geographers, geologists, ecologists, climatologists, and many more (Cordova 2007). By necessity, an analysis of the landscape as a totality must connect the data generated by these different disciplines in its many forms (Kirch 2005: 412-413), even while focusing the discussion on the archaeological data of interest, archaeobotanical / paleoethnobotanical remains, which constitute the physical evidence for agricultural practice and change in the past.

This narrative is constructed in two parts. This chapter describes the site of Dhiban, its location in the geographic area of the Eastern Mediterranean and southwest Asia, and the non-human environment and ecology of the plateau on which it is found. The second part, presented in the next chapter (Chapter 4), outlines the historical and archaeological narratives related to the polities that will receive the most focus: the Byzantine (ca. 320 - 650 CE) and Mamluk (ca. 1250 - 1450 CE) empires.[3] Both polities attempted to increase the production of agricultural goods as well as extend the limits of potentially farmable land, and their attempts to do so fell within the same bounded semi-arid landscape of the Dhiban plateau. Yet the specific historical trajectories and economic prerogatives of these two polities differ in a number of important and identifiable ways. Thanks to an abundance of historical texts, inscriptions, papyri, tax documents, and other forms of written language in each of these periods of imperial intervention, it is possible to nuance the archaeobotanical and archaeological data with specific details concerning the influence of political institutions, labor management, and even culinary preferences. These polities are also separated by nearly 600 years, although both intervened in the lifeways of communities at Dhiban during these distinct moments in time. This temporal disparity presents a unique opportunity to examine the ways in which successive communities at Dhiban negotiated the demands of these imperial states through agricultural production and practice in roughly the same landscape (as argued below). Although the environment/ecology and historical narratives are disarticulated for purposes of analytic clarity, they are not assumed to be separate, given the long discussion of Historical Ecology in the previous chapter. Where possible, elements of one

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[3] The cultural periodization I utilize is derived from Walmsley (2008) and Watson (2008).

will appear in the other. For instance, a discussion of the ecology of the Dhiban plateau by extension involves a partial elaboration of long term agricultural production and community interaction with the Dhiban landscape. The discussion of the unique economic configurations and agricultural practices of Byzantine and Mamluk period-communities in this area, in turn, will often require paleoenvironmental and paleoecological data for landscape contextualization.

Given the longevity of agriculture in southwest Asia, the longevity of occupation at Dhiban, the presence of large territorial empires that intervened in the lifeways of these communities increasingly after 1000 BCE, and the postulates of Historical Ecology, two research questions can be proposed:

1. Were the depositional practices of successive communities on the *tall* of Dhiban qualitatively and/or quantitatively different from each other?
2. Do the presence and quantity of specific agricultural crops in temporally distinct archaeological deposits correlate to any given imperial intervention?

The specific hypotheses that address each of these research questions are presented in Chapter 4.4, the following chapter. A partial enumeration of these research questions will explain their significance to the larger project. The research questions both address the Historical Ecological postulate of the *unevenness* and specificity of a given community's interaction with the landscape. The qualification of "successive communities" locates agricultural practices broadly through the inclusion of depositional practices at multiple temporal scales. As Chapter 5 will illustrate in detail, the identification of depositional practices of past communities at the level of the site reveals the ways in which people processed, used, and then discarded plant remains at specific moments in time. The second question treats the influence of non-local imperial polities, and the responses of the community at Dhiban to them. In effect, it asks whether particular archaeological plant remains appear in the deposits of some periods and not others, and whether those periods are also ones known to correlate to moments of imperial intervention. In this respect, the historical narratives that surround these polities are a key source of information concerning the potential range of paleoethnobotanical variation that might be present in these deposits.

Each of these two research questions can be addressed with paleoethnobotanical data; they can both be investigated through macrobotanical remains, that is the physical archaeological residues of agricultural crops, weeds, and chaff (through rachis and culm, or straw, nodes). In both cases, the interpretation of these archaeological remains is contingent on the geographic and temporal contexts in which the archaeological site of Dhiban is located.

Figure 3.1: Tall Dhiban and the surrounding contemporary community (Courtesy of Google Imaging 2014, image oriented toward true, not magnetic, north).

3.1 Episodes of Occupation at the Settlement of Dhiban

The archaeological site of Dhiban is located in the contemporary Hashemite Kingdom of Jordan, and straddles the Eastern Mediterranean (115 km east of the eastern coast of the Mediterranean) and the Levantine corridor in southwest Asia (see **Figure 2.1**). The site itself is a 12.5 hectare kidney-bean shaped *tall*, an artificial mound created through the repeated human habitation of the site and the deposition of occupational debris that accumulates through time in stratigraphically discrete layers (Steadman 2000). Though the tall is the most visible archaeological site in the contemporary town, preliminary investigations by the Jordanian Department of Antiquities (al-Mahameed 2003) have identified the remnants of a diffuse occupation immediately to the southeast of the tall, which probably comprise a second *tall*. The second mound was also noted through visual reconnaissance around the site in the late 19th century and by Winnet and Reed from 1950 to 1953 (Winnet and Reed 1967: 7). As the homes, schools, shops, and hospitals of the contemporary Bani Hamida community occupy the probable second *tall*, no excavations in this area have taken place.

The culture-area in which Dhiban is located, the southern Levant, has not been characterized as part of a strong tradition of sedentism and urbanism unlike other areas in the Eastern Mediterranean (Lawler 2012: 796).[4] The development of state and urban institutions in the Levant seems to have been through contact with early urban centers (ca. 3000 BCE) to the south in Egypt and to the south-east in Mesopotamia (Falconer and Savage 1996; Joffe 2002). The available archaeological data show that, in contrast to traditions of dispersed and non-nucleated settlement in other communities in the southern Levant (Wilkinson 2003: 133-135), communities at Dhiban repeatedly resettled the mounded site for nearly 5,000 years. The evidence for this settlement is visible through monumental walls, on-site domestic structures, and myriad artifacts and ecofacts (Porter et al. 2004; 2007; 2010). Intriguingly, human occupation at Dhiban does not precede the adoption of agriculture, as the earliest identifiable human occupation on the tall dates to the Early Bronze Age (EBA: ca. 3100 -2000 BCE; Richard 1980). The evidence for the EBA occupation, however, is only substantiated by ceramics found interspersed in archaeological deposits dated to the Iron II period, as well as Cannanean flint blades.[5] There is evidence of both a Middle Paleolithic occupation of the Dhiban plateau (Cordova et al. 2005: 50) in the form of Mousterian lithics found on the Wadi al-Koum terrace in the north-east, and of a later Neolithic occupation of the Wadi al-Thamad (7055 - 6600 cal BCE, 2σ, Cordova et al. 2005: 46; Cropper 2006). Yet evidence of occupation on the *tall* of Dhiban earlier than the Early Bronze Age, if it ever occurred, has probably been removed through repeated habitation and significant re-building and re-use of prior architectural material.

In order to accurately identify the sequence of occupation at the site, twenty three AMS ^{14}C dates were procured from several different contexts on the tall of Dhiban during excavations in 2005, 2009, and 2012. The results reveal settlement stretching from the Iron I period (1209 - 1010 cal BCE 2s, 2907 BP +/- 26, OxA-23487), until the Ottoman period (1522 - 1799 cal CE 2s, 263 +/- 24, OxA-23486).[6] Of the samples, 18 are derived from annual seeds of cereals, legumes, or woody taxa that produce annual fruits (*Hordeum sp., Triticum sp., Vicia ervilia, Vitis vinifera*), while 5 are from pieces of unidentified wood charcoal (Appendix G). The contexts from which these samples derive will be discussed in greater detail in Chapter 5, though they are displayed in the calibration curve below (**Figure 3.2**).[7] On the graph, the two sigma range (94.6% date probability density) for each date is

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[4] For archaeological evidence complicating the urban / rural distinction in the southern Levant, see Falconer 1995; Falconer and Savage 1995; Chesson and Philip 2003.

[5] As Tushingham reports (1972: 5): "In each season of excavation, Early Bronze Age sherds have been found, but not one wall certainly attributable to this period has been identified". For the published Early Bronze Age pottery, see Tushingham 1972: Figure 3.52. Nevertheless, earlier unpublished excavations by William Morton uncovered diagnostic Canaanean blades dating to the Early Bronze Ib period (ca. 3100 2750 BCE; Routledge 2004: Fig. 84). For an extended discussion of the contemporary evidence, see Porter et al. (2007: 317; 2010: 7).

[6] Funding for 10 of these dates (DHB-RC-10 - DHB-RC-18)and a significant portion of the 2012 excavation season was generously provided by the National Science Foundation for co-PI Alan Farahani (BCS# 1135042).

[7] All dates generated in Oxcal 4.2.1 using the IntCal09 calibration curve (Reimer et al. 2009). Dates in

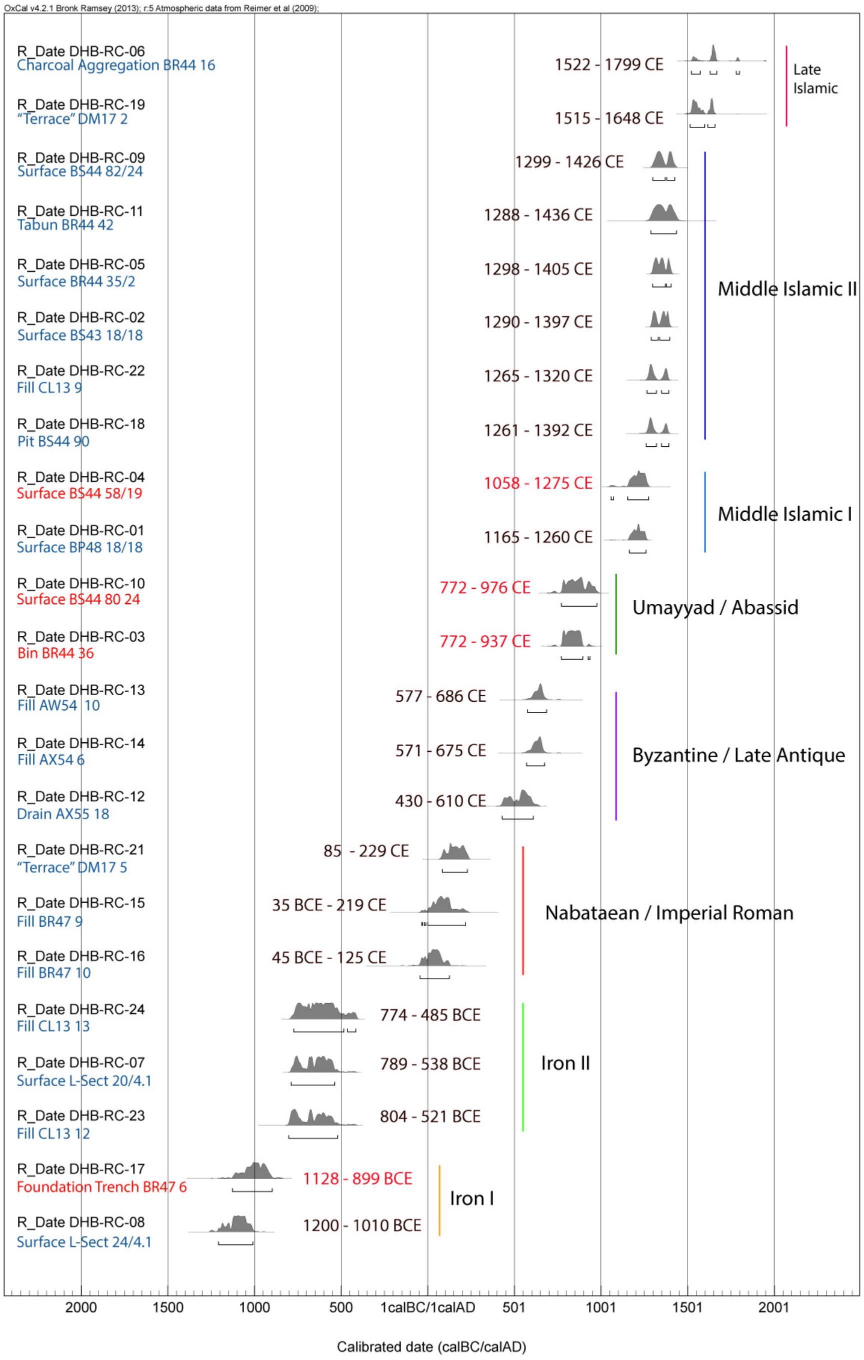

Figure 3.2: AMS ^{14}C chronology of Dhiban (data collected, analyzed, calibrated, and graph created by author; courtesy of Dhiban Excavation and Development Project). Dates in red are considered anomalous considering the stratigraphic position of the original sample. Project ^{14}C numbering sequence provided on left (in form DHB-RC-#), with sample context and provenience (Unit Locus/Subgrid) beneath.

reported, along with the culture-historical period with which it overlaps. It is clear from the calibration curve alone that Dhiban has been occupied almost continuously since the Iron II period (ca. 900 cal BCE), except for a considerable gap between ca. 500 cal BCE until ca. 50 cal BCE. The gap overlaps with the political periods of the Achaemenian empire and Hellenistic successor states, during which time it is said that the southern Levant was less intensively settled than during the earlier Iron II period or the later Nabataean and Roman period (Stern 2001; Tal 2005). The current absolute dating evidence seems to corroborate this hypothesis, although further work will have to establish whether this trend presents evidence of settlement absence or is due to an absence of date-able evidence.

3.2 Contemporary Non-Human Ecology and Environment of the Dhiban Plateau

The AMS ^{14}C dates thus establishes that for over 3,000 years, sedentary human communities have been present at Dhiban. These communities would have grappled with the environmental and ecological challenges necessary for the kind of sustained reliable agriculture needed to maintain them as outlined in the introduction to the chapter above. To recapitulate the model of agriculture presented in Chapter 1.1, agriculture is constrained and enabled by a variety of hydromorphic, geological, and climatic factors. The latter would have affected the kinds of crops grown, and in many ways, canalized or at least directionalized certain kinds of water management and food storage strategies (Perez 1990; Foote et al. 2011). As Algaze has cogently described the situation (2008: 147): “environmental and geographic factors are only permissive, not prescriptive”. The variegated micro-climates and micro-ecologies of the Eastern Mediterranean and SW Asia are all found in bioclimatic zones (Quezail and Medail 2003), which are based on vegetation types, precipitation, and seasonal temperatures (Thompson 2005: 12-35; Blondel et al. 2006: 23-31). In addition, the topography and geomorphology of these areas condition precipitation gradients. The location of Dhiban on the eastern edge of the Eastern Mediterranean and southwest Asia places it at the intersection of no fewer than three bioclimatic zones: the Mediterranean, Irano-Turanian, and Sudanian (**Figure 3.3**).

Depending on the environmental variables selected, some surveys show a Mediterranean bioclimate enveloping the area of contemporary Dhiban (Cordova 2007: xii; Ammari et al. 2011: 429), while others place Dhiban almost entirely in an Irano-Turanian / Sudanian zone (al-Bakri and Suleiman 2004: 3899). Precipitation data collected by the Water Authority of Jordan place the mean annual precipitation of Dhiban at 256.56 mm. This amount is too low for reliable rain-fed agriculture (Wilkinson 1998, 2004), and inter-annual variation is extremely high, a feature of precipitation climatology across Jordan (**Figure 3.4**; Karawneh

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red are anomalous given their stratigraphic position. For example DHB-RC-10 is found in a room dated to the Middle Islamic II period (1300 - 1400 CE) based on ceramic and other artifactual data, yet the returned date is found in the Umayyad-Abbassid period.

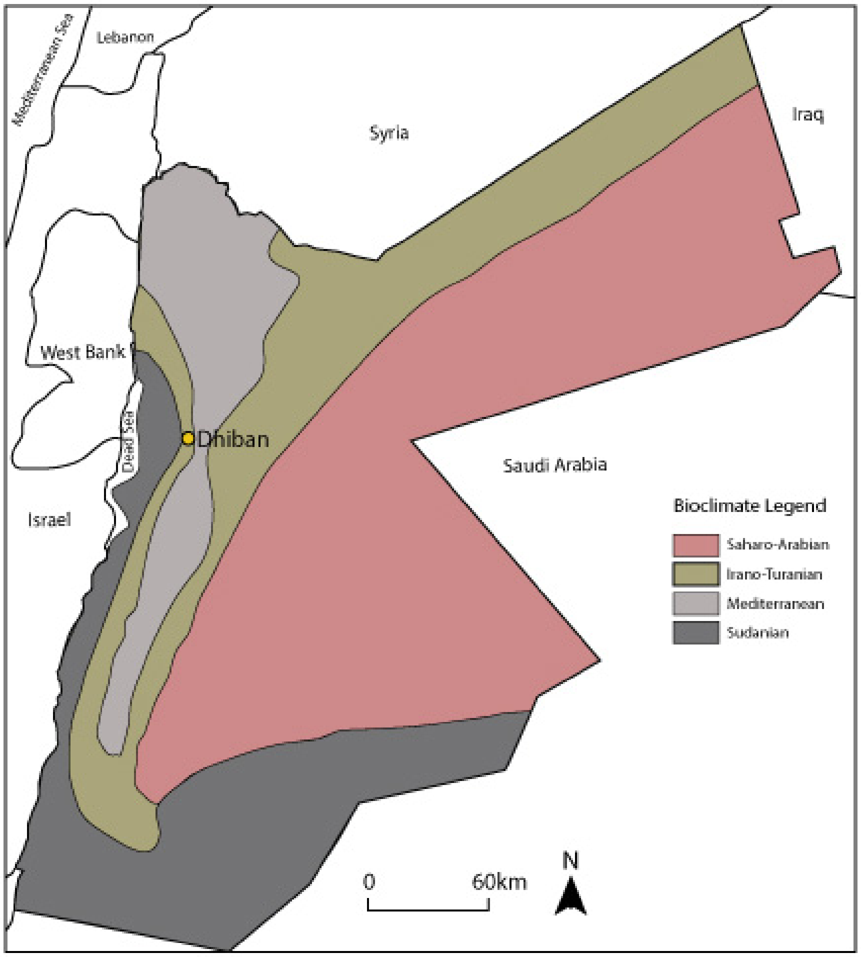

Figure 3.3: Bioclimatic Zones of Jordan (adapted from al-Bakri and Suleiman 2004: Figure 1 [3899]).

and Kadioglu 2002: 11). Preciptation data collected since 1960 of inter-annual preciptation variation shows that relatively wet years are possible (three in forty years were greater than 400mm), though any year with relatively more precipitation might be followed by a year with very low precipitation (e.g. 400 to 100 mm). As with all Mediterranean-type bioclimates, data from nearby stations show that the majority of precipitation occurs in the period between December and March (Cordova 2007: 43-44; Tarawneh and Hadadin 2009: 190). One of the structuring factors of Mediterranean bioclimates is if winter precipitation is three times higher than summer precipitation (Köppen 1936), and the resulting Mediterranean "summer drought" is a well-known phenomenon (Quezail and Medail 2003). As a result of these manifold influences, rainfall values in the Mediterranean basin can range from 100mm to 2000mm per annum (Jalut et al. 2009: 5).

From the perspective of precipitation, therefore, Dhiban straddles an Irano-Turanian and

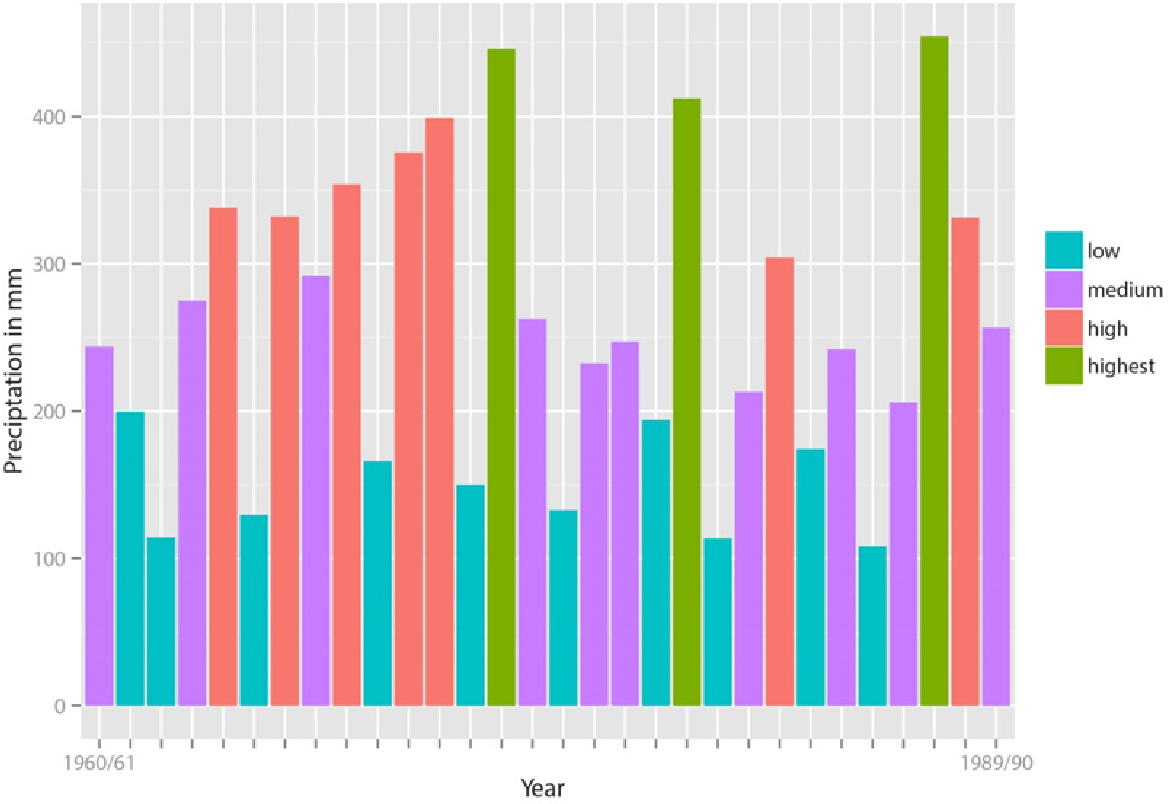

Figure 3.4: Per Annum Precipitation at Dhiban (in millimeters, analyzed by author, data from El-Naqa 1993)

Mediterranean bioclimate, as the upper bound of Irano-Turanian precipitation is 300 mm, which is also the lower bound for Mediterranean-type climates (al Bakri and Suleiman 2004: 3899-3900). Rainfall is often the limiting factor for plant growth (apart from the nutrient load of soil; Vandermeer 2011: 161-208), and in the arid and semi-arid environments around Dhiban, agriculture is dependent on the ability of communities to successfully encourage and maintain plant growth in the face of the considerable variation in precipitation (Barker and Gilbertson 2000). Despite these challenges, contemporary plant diversity in these areas is high: though the five Mediterranean bioclimatic regions of the world occupy less than 5% of the Earth's surface, they harbor about 48,250 known vascular plant species, that is, 20% of the world total (Cowling et al. 1996: 362). Several agriculturally important plant species and weedy species in the area of Dhiban are affected by these bioclimatic variations. For instance, *Malva palviflora* (cheeseweed), a medicinal plant known ethnobotanically as a salve for wounds and as a gastro-intestinal calming agent in Jordan, has a shorter growth season in cooler areas that contain more precipitation than in warmer areas which nevertheless create larger plants as measured by total leaf area (Elkarmi and Abu Eideh 2006). Similarly the

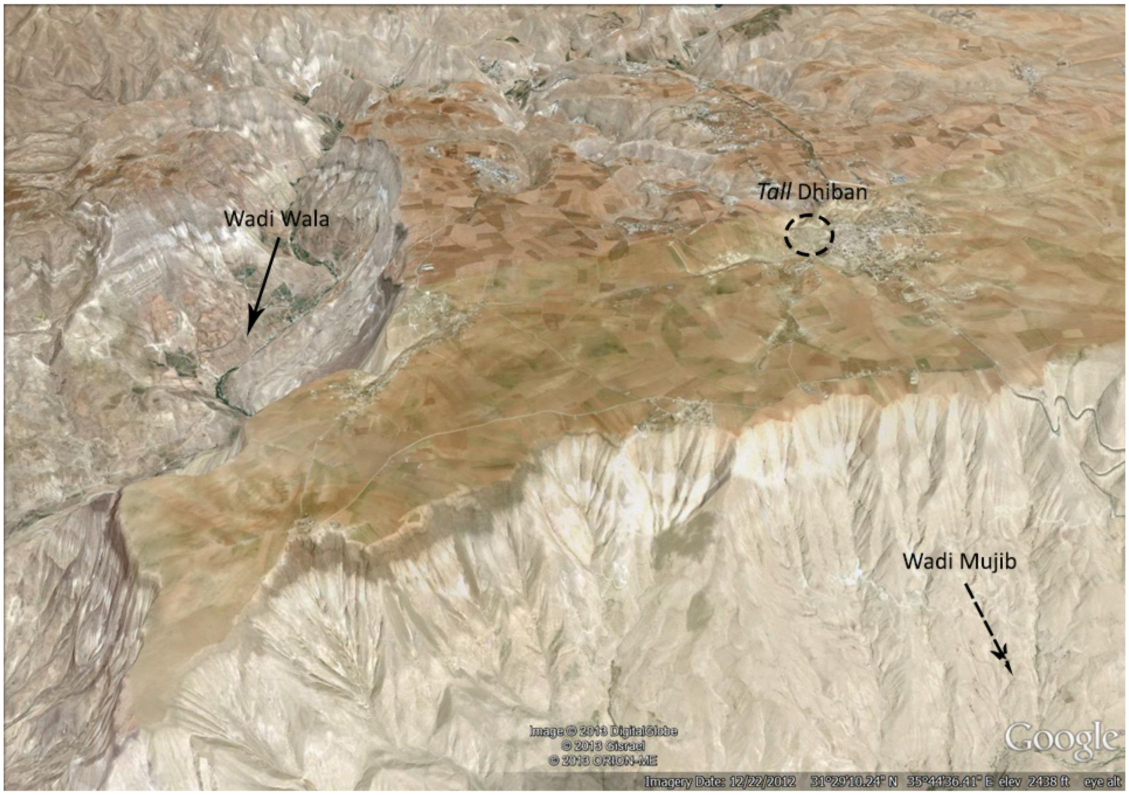

Figure 3.5: Exaggerated topography of Dhiban Plateau, image courtesy of Google Earth (2012).

genetic diversity of *Hordeum spontaneum* (wild barley), an important competitor in agricultural fields with desired agricultural crops, is highest among Jordanian populations in areas stressed by drought and high temperatures. The genetic diversity of Stipa (feather-grass), another prevalent agricultural weed, is also correlated to many, if not all, of the other environmental variables that influence the other major weeds, especially temperature and precipitation, where diversity is highest in semi-arid climates (Hamasha et al. 2012). The intense selection pressures of these low precipitation stress-inducing Mediterranean micro-climates in Jordan thus encourage substantial genetic diversity among plants.

Another critical non-human factor affecting Dhiban's long-term historical ecology is its geographic and topographic location. Dhiban is located on a plateau named after the settlement between the Wadi al-Wala to the north and the Wadi al-Mujib to the south. The deep escarpments cut by these seasonally recharged rivers demarcate the water catchment area of the Dhiban plateau (El-Naqa 1993). As a result, the site lies approximately 6km from water perennially available at the bottoms of the wadis to the north and the south, increasing the importance of water transportation and storage (**Figure 3.5**). The physical barrier created by the plateaus that surround Dhiban distanced it from nearby rural or urban centers (Porter et al. 2007: 316), especially the Wadi al-Mujib to the south of the site with an imposing, 400m sheer escarpment in some places (El-Naqa 1993: 258) that would have

Figure 3.6: Wadi al-Mujib as seen from the southern edge of the Dhiban Plateau (Photo Alan Farahani, 2011).

had to be traversed by foot (**Figure 3.6**). The self-proclaimed Iron Age king of Dhiban, Mesha (ca. 850 BCE), considered the construction of a road across the Mujib (known in the inscription and in the Hebrew Bible as the *Arnon*) such a significant achievement that it was included in the inscription found on the stele named after him (line 26; Routledge 2004: 136; 2013). Apart from its sheer topography, the Cretaceous uplift of the Mujib (Abed 1984) created conditions favorable for the formation of "Red Mediterranean Soils" (Cordova 2005: 31-32), which typically form in areas that receive around 300mm of precipitation and are part of a xeric moisture regime of moisture-free Mediterranean summers drying out the root zone of plants (Yaalon 1997). As a result, these soils are well-drained and ideal for agriculture, although they are also susceptible to erosion (Zalidis et al. 2002: 139). Most of the Dhiban plateau is, and has been, arable even with minimal irrigation, despite low and highly variable precipitation, unlike the areas immediately to the east and the west (Cordova 1999: 190-191).

Recent aerial photography and survey of the Dhiban plateau by the author illustrates that most of the area is dominated by agriculture (**Figure 3.8**). Contemporary agriculture alternates between the intensive cropping of major globalized and native crops (e.g. tomatoes, potatoes, watermelon, and barley; Abu-Sharar and Battikhi 2002: 371-372) and fallow periods during which the communities on the Dhiban plateau allow their sheep and goat herds to graze (**Figure 3.7**). The area around Dhiban is almost treeless, and is part of the large swath of Mediterranean-climate areas argued to have been heavily deforested

Figure 3.7: Sheep and Goat grazing on a recently harvested free-threshing wheat (*Triticum aestivum/durum*) field near the Wadi Mujib (Photo Alan Farahani, 2011).

at least since the Chalcolithic, that is around 4000 BCE (Cordova 2010: 117-118). Earlier vegetation surveys on the plateau by geoarchaeologist Carlos Cordova could only identify relict stands of *Pistacia atlantica* (Cordova 2007: 73), an indicator species of Mediterranean forests (Zohary 1973: 135). In 2013, the present author could also only identify one area in the northern section of the Dhiban plateau adjacent to the Wadi Wala in which the taxon could be found (**Figure 3.9**).

Isolated stands of *Acacia raddiana* are also found dispersed on hillslopes around the Dhiban plateau, which is a taxon indicative of a Sudanian bioclimate, as well as many stands of *Zizyphus spina-christi*,[8] a spiny tree originally from Western and Equatorial Africa and which also arrived in the southern Levant during the Chalcolithic (Ronel and Lev-Yadun 2009: 759). The heterogeneous distribution of plants, especially woody plants (i.e. trees) from different vegetation types around contemporary Dhiban is indicative of the long-term effects of environmental constraints and human agency through a 3,000 year history of agriculture and grazing. Human practices have become a critical element in Mediterranean ecosystem functioning and disturbance (Carmel and Kadmon 1999). The most prominent ecological discourses in this area, however, have revolved around environmental degradation (Cordova 2005; 2008), though the definition of what that degradation constitutes has often been left unstated (Hill 2006: 23). If a general loss of vegetative diversity is assumed,

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[8] Contra Cordova 2007 where he identifies them as *Zizyphus lotus*, but identified earlier as *spina-christi* in Cordova et al. 2005: 30.

Figure 3.8: An aerial photograph of *tall* Dhiban taken in 1994 (Kennedy and Bewley 2004: 103, Figure 7.2A).

Figure 3.9: Sole *Pistacia atlantica* on north-western hillslope escarpment of Dhiban Plateau (Photo Nicholas Ames, 2013; Alan Farahani (L) and Erik Nelson (R) pictured; coordinates: N: 31°31'26.32" E: 035°43'16.24").

Figure 3.10: Northern Escarpment of Dhiban Plateau dominated entirely by *Retaema ratam* (Photo Nicholas Ames, 2013).

then the contemporary landscape around Dhiban is degraded, as it is contains less plant biodiversity than in the past. The disturbance caused by the diversion of water for small-scale agriculture and the long-term harvesting of woody taxa for fuel and construction have created a landscape of largely homogenous vegetation: many areas of the Dhiban plateau escarpment are dominated by one taxon, *Retama raetam* (**Figure 3.10**), a leguminous brush. Yet as Blondel notes (2006: 725):

> the main consequences of traditional [Mediterranean] landscape design and management by humans have not been so much a decrease in overall species richness at a regional scale as in creating a tremendous proportional advantage for species adapted to drylands and shrublands at the expense of forest dwelling species.

The latter is visible in the abundance of plants on the plateau today which are highly adapted to Dhiban's dry climate and which are also resistant to frequent goat grazing. This includes various species from the families of Chenopodiaceae (Goosefoot) and Amaranthaceae (Amaranth), not to mention the extensive Poaceae (grasses) that commonly occur as field weeds. A floristic study of the area of Hesban, less than 30km north of the Dhiban plateau, records the same suite of taxa in similar ecological zones (Crawford 1986). Thus, the contemporary vegetative landscape of the Dhiban plateau is not only the result of the aforementioned environmental variables, but is also intertwined with human landscape practices. To understand what unmanaged vegetation might appear to have looked like in the past, it is necessary to venture to the riparian areas of the Wadi al-Wala to the north of the

Figure 3.11: Riparian Vegetation in the Wadi al-Wala during July (Photo Credit Alan Farahani 2013).

site (**Figure 3.11**). The escarpment of the Wadi al-Wala is considerably less sheer than that of the Wadi al-Mujib, and can be approached from a narrow point where the Dhiban plateau meets the "Eastern Desert". A number of woody plants are found in the Wadi al-Wala which are no longer extant on the plateau itself, these include Willow/Poplar (Salicaceae), Wild Fig (*Ficus carica sylvestris*), Mt. Atlas Mastic Tree (*Pistacia atlantica*), and numerous flowering plants of many different families.

In summary, the available AMS radiocarbon data collected from 2009 to 2012 illustrate the longevity of human occupation at Dhiban, from ca. 1000 BCE in the Iron Age to the Ottoman period in 1650 CE. Almost the entirety of the habitation of the tall occurs during the "historical period", or, periods of time in which there are sometimes abundant sources of written data available to nuance the understanding of the trajectory of agriculture in this area. Nevertheless, contemporary environmental and ecological data indicate the instability of precipitation and the effects of cumulative landscape practices by successive communities on the plateau. Due to high variability in precipitation, farmers today cannot rely on rain-fed agriculture to reliably maintain the plants in their fields.[9] The effects of thousands of years of

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[9] In contemporary Jordan, farmers are not allowed to cultivate vegetable crops in the Jordan Valley if the winter season is dry (Abu Sharar and Battikhi 2002: 369), although the area of irrigated agriculture in the "highland and desert areas" is estimated to be 42,000 hectares. In 2001, 67.7% of all water in Jordan

agro-pastoral grazing and shifting agricultural practices have also depleted almost all of the woody tree taxa; nearly all tree stands found on the Dhiban plateau today are anthropogenic in origin (cf. Cordova et al. 2005: 30), usually for arboriculture, as wind-breaks for fields, and even for shade. The vegetation that does exist on the plateau has grown in response to and taken advantage of the presence of cultivated fields and managed tree stands, and vegetation growing independent of human disturbance is rare to find (Cordova 1999: 191). The contemporary plateau is clearly the result of historically concatenated human practices, and it is necessary to turn to the available paleoenvironmental and paleoclimatic proxies to identify both the magnitude of these changes as well as their timing in the past. These proxies are also critical in understanding whether the vegetative landscapes encountered by past Byzantine and Middle Islamic period communities would have been different from that observed today. The latter is important for a historical ecological approach to the landscape as a "total" phenomenon as mentioned in the introduction, wherein the activities of people, uneven across time and space, are as much a part of the landscape as non-human processes such as the climate or geology. The identification of shifts in different vegetation-types in the paleoecological record is a crucial piece of evidence in the reconstruction of the historical ecology of the Dhiban plateau.

3.3 Paleoclimatic and Paleoecological Data of the Southern Levant

There is abundant paleoclimatic, paleoecological, and paleoenvironmental data available for the late Holocene southern Levant and the Eastern Mediterranean, more broadly. For the southern Levant specifically, these proxy data are collected from cave speleothems (Bar Matthews et al. 1997), pollen cores (Leroy 2009; Neumann et al. 2007b, 2010), Dead Sea level variations (Enzel et al. 2003), lacustrine sediments (Schwab et al. 2004), and multi-prong studies which combine all of these data (Neumann et al. 2007a).[10] Each of these data sets provides independent but complementary sources of information on changes in the landscape attributable to past communities. For the last 5,000 years in particular, it is recognized that "it becomes increasingly difficult to separate the respective influences of climate variations and human activity on environmental change" (Rambeau 2010: 5228-9). The latter is influenced by the large scale of agricultural production undertaken by some of the historical empires, such as the Achaemenian, Hellenistic, and Byzantine empires, which occupied this area. Despite the difficulty of resolving human versus climatic influence on past vegetation in the last 5,000 years around the Dead Sea area, many researchers *still* wish to attribute climatic changes *alone* to increases in the relative frequency of pollen of certain economically important plant taxa, such as *Olea* sp. (olive) and *Vitis* sp. (grape). In

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was diverted toward irrigation (Nortcliff et al. 2011: 407).

[10] For the most comprehensive overview of the current state of paleoenvironmental data in the southern Levant, see Rambeau 2010, with bibliography. The citations in the text above should not be taken as complete but representative.

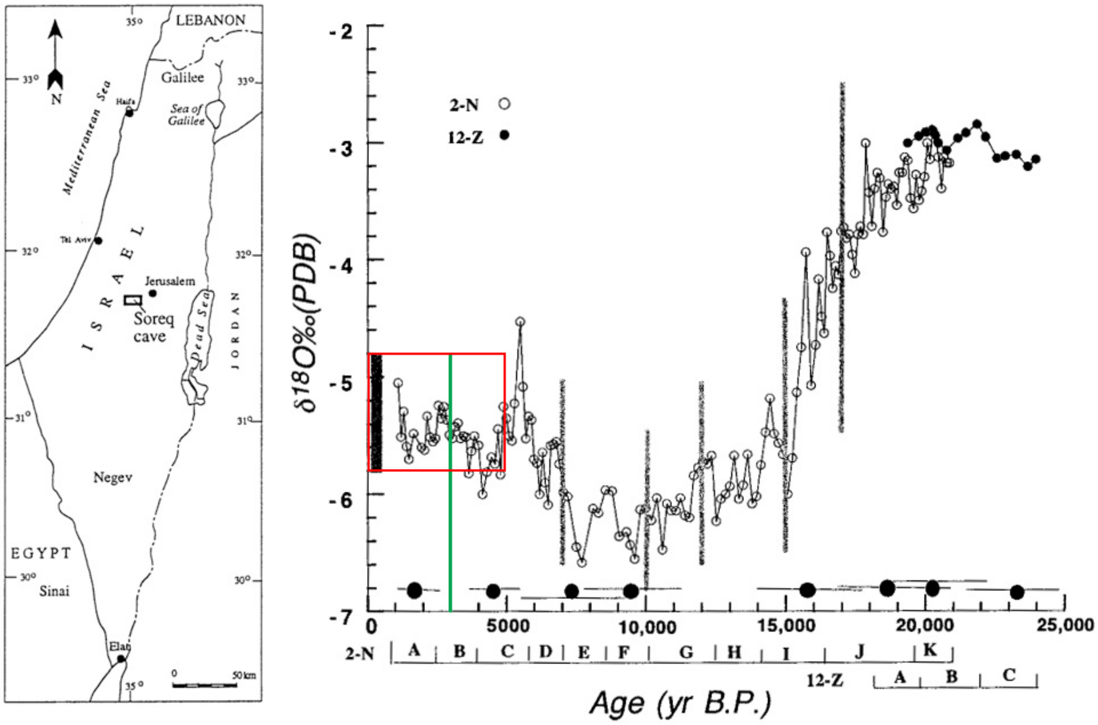

Figure 3.12: Speleothem data from Soreq Cave, Israel. The image to the left is the location of the study site, and the right (Bar Matthews et al. 1997: 156, 159: Fig. 4) image represents the δ^{18}O variations of stalactite 2-N and 12-Z. The black bar represents the contemporary δ^{18}O values that correspond to observed precipitation ranges at the Soreq site, 300 - 800 mm. The green line is placed at the 3,000 year BP mark, while a red rectangle is superimposed over the range of precipitation variation observed today.

addition, they seek to correlate major socio-political changes in these periods to hypothesized episodes of climatic change. Increased precipitation in the Early Bronze Age (ca. 4000 BP) triggers a decline in settlements, cooler and more humid temperatures in the Hellenistic and Roman/Byzantine period (2250 - 1300 BP) lead to an expansion of grape and olive cultivation, and more arid climates from 1000 BP, during the Islamic period onward, lead to a contraction of agricultural production (Rambeau 2010: 5229). Naturally these are all hypotheses reliant on the quality, reliability, and reproducibility (in other proxies) of the available proxy data, and all are subject to a number of biases that result from differential preservation, taphonomy, and secure dating (Rambeau 2010: 5230-5233). Nonetheless, what is common to all of these hypotheses is that they crucially exclude human practices as the origins of many of the increases in certain pollen (with some reservations, illustraed below).

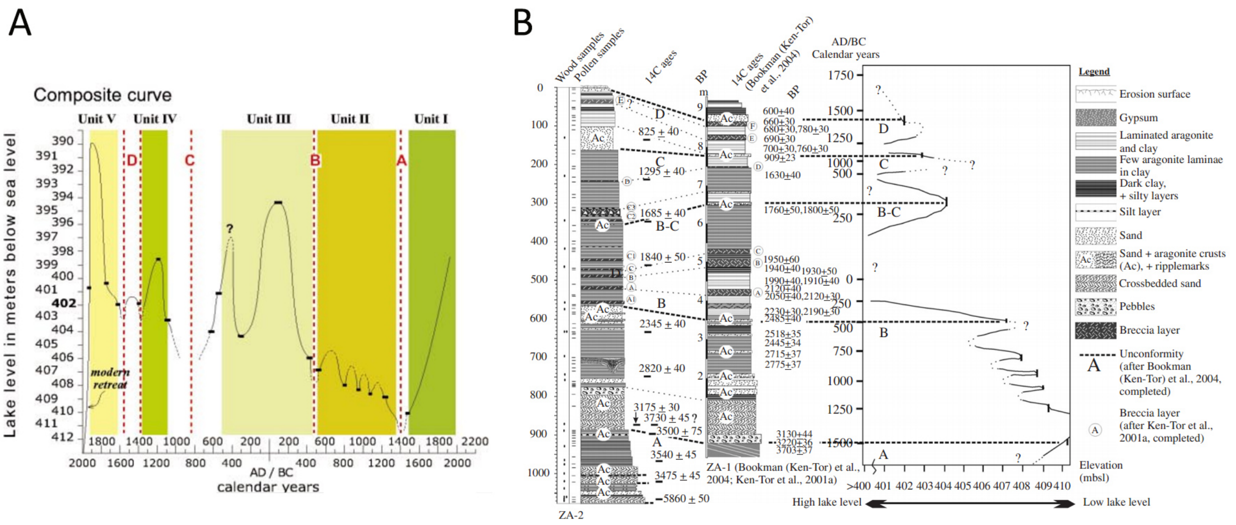

Figure 3.13: Past Dead Sea lake levels as inferred from limnological and sedimentological analyses. The left image (Bookman [Ken Tor] et al. 2004: 563, Figure 7) represents a composite curve based on lake level information from the Ze'elim and David sites. The right image (Neumann et al. 2007a: 1480, Figure 3) includes the ZA-1 core and another core, ZA-2, to the left, with corresponding ^{14}C ages and lithology for both sequences.

Past Precipitation and Dead Sea Lake Levels

The most reliable and closest proxy for a variable perhaps least influenced by human action is the past precipitation regime around the archaeological site of Dhiban – knowledge of this derives from speleothem data collected in the Soreq cave in the state of Israel (**Figure 3.12**). The Soreq cave is nearly parallel to the Dhiban plateau on the opposite, western side of the Dead Sea. The laminae of seven fossil speleothems were sampled by the authors and analyzed for their δ^{18}O and δ^{13}C values (Bar Matthews et al. 1997: 157-148). For the δ^{18}O values the authors assumed that present day relationships between the variations in average annual rainfall and the variations of δ^{18}O in rain and cave water remained constant since the Pleistocene (Bar Matthews et al. 1997: 161). The results of the analysis indicate (**Figure 3.12**) that for the past 5,000 years, the range of δ^{18}O values and by proxy, precipitation, occur within a constrained range of variation similar to the present. The δ^{18}O values are most similar to the present (relatively unenriched with the isotope, at -6 to -5 ppm) from 3,000 BP onward (demarcated with a green line in **Figure 3.12**). Past communities in this area, including Dhiban, would have had to manage a similar precipitation system of high inter-annual variation from 3,000 uncal BP to the present, albeit experiencing short climatic variations (Bar Matthews et al. 1997: 166). The influence of these "short climatic variations" in the yearly lived lives of Iron Age to Middle Islamic communities at Dhiban is difficult to estimate in the annual or decadal scale, but other proxies might provide insight into centennial scales of time.

One potential source of data for understanding these intra-period climatic variations is the reconstruction of the past lake levels of the Dead Sea. The analyses of the past height of the lake depend on models of the pre-1960 correlations of the upper water levels of the Dead Sea (because of the diversion of the Yarmuk and the upper Jordan Rivers) and the annual discharge of water from the surrounding wadis due to fluctuations in annual precipitation (Enzel et al. 2003: 264-66,269). In order to reconstruct lake levels in the past, a deep core is cut or an exposure is made and the diagnostic lithology of depth-sensitive environments in each deposit is compared to lateral and contemporaneous deposits. These are then directly associated with lake-level elevations (Bookman [Ken-Tor] et al. 2004: 558). When pollen cores are collected from adjacent deposits that can be directly correlated using ^{14}C dates, it is possible to ascertain a conjoined paleohydrological and palynological sequence (Neumann et al. 2007a; **Figure 3.13:B**). The combination of four cores and over 50 radiocarbon dates from various test sites on the western shores of the Dead Sea reveal several periods of particularly high lake levels (**Figure 3.13: A**). While some of the lowest levels of the Dead Sea correspond to the Iron Age, the highest corresponds to the turn of the first millennium CE. Another highstand seems to date to CE 340 - 470 (Bookman [Ken Tor] et al. 2004: 566), that is, during the Early Byzantine period, but insufficient exposure in the Ze'elim A sediments somewhat limits this interpretation. Nonetheless, it is clear that by the 6th century CE, lake levels began to drop and did not rise again until the 9th century CE (Bookman [Ken Tor] et al. 2004: 567; **Figure 3.13: B**). While these researchers argue that changes in precipitation might be responsible for the adjustments in the lake levels, the latter might also be due to large-scale changes in the hydrology of the area due to intensive agriculture and water diversion. Nevertheless, while the lake level data point to local changes in hydrology, neither the data from the Soreq cave nor the Dead Sea lake level data point to *extreme* changes in the Mediterranean precipitation system of the area.

Palynology of Dead Sea Area and Birkat Ram Crater

As a result of the relatively stable range of variation of precipitation for the past 3,000 years, it is more likely that palynological, or pollen evidence, during this period and in this region reflects historically specific and contingent changes in the *agricultural practices* of people, rather than climatic fluctuations alone (echoing Rambeau 2010: 5228-9 and Jalut et al. 2009: 10 where the latter note that from 3,000 BP there was a "strengthening of the Mediterranean climate conditions" in the Western Mediterrenean). Thankfully, there are numerous pollen cores from two distinct zones that provide complementary insight into long-term ecological and human entanglements: one set derives from the northern Golan (Birket Ram; Schwab et al. 2004; Neumann et al. 2007b), and the other from the western shore of the Dead Sea (En Gedi; Neumann et al. 2007a, 2010; Leroy 2010). The pollen cores extracted from the western shore of the Dead Sea form the closest available proxy for past vegetation in the area of the Dhiban plateau. They constitute six separate pollen cores (Neumann et al. 2010: 757), each published at varying levels of resolution. In each of the pollen cores, the limiting factor in the reliability of the pollen sequence is the number of radiocarbon dates extracted from each

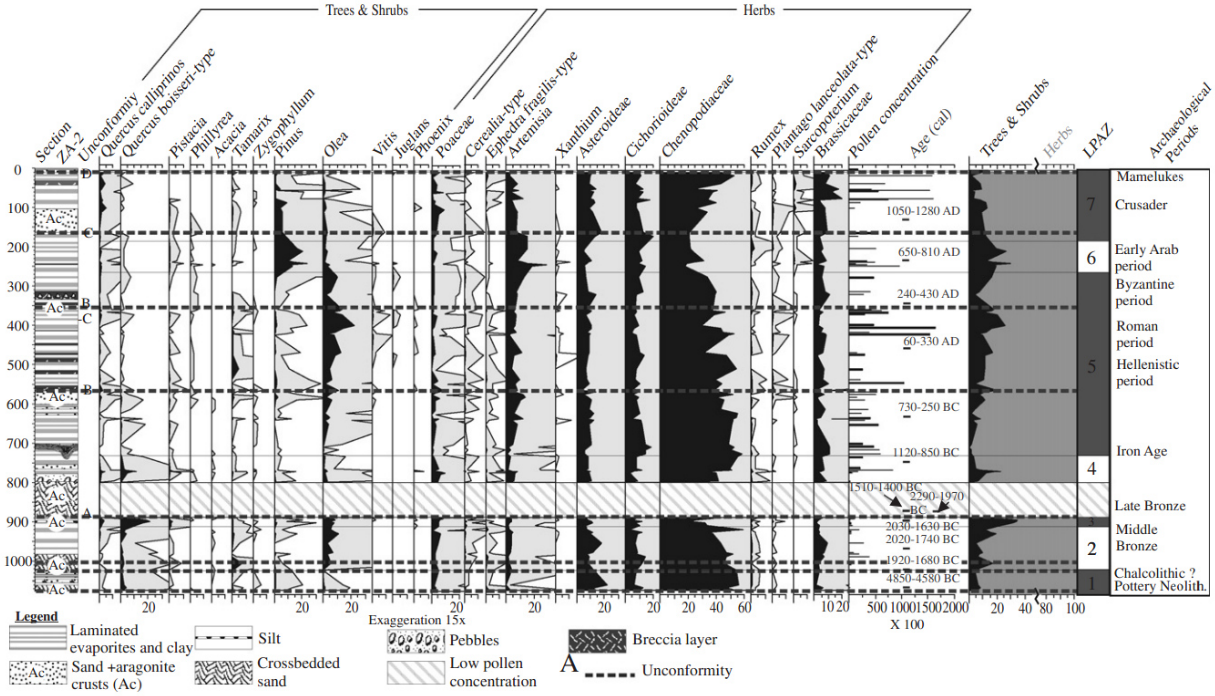

Figure 3.14: Nahal Ze'elim A-2 Pollen Core (from Neumann et al. 2007a: 1488, Fig 6).

core. The two cores discussed here are the Nahal Ze'elim A-2 (**Figure 3.14**) and Ein Feshka (**Figure 3.15**) cores, due to the quality and number of radiocarbon samples procured from each (12 from Nahal Ze'elim-2, and 9 from Ein Feshka: Neumann et al. 2007a : Table 3 and Table 4). These cores were also cross-correlated with each other due to complementary dating in similar lithostratigraphic layers (Neumann et al. 2010; **Figure 3.16**). Another recently published pollen core, DS7-1SC (Leroy 2010), will be referenced sparingly due to the fact that only four radiocarbon dates were procured from within a 50 centimeter section of the core, thereby providing a limited scope of temporal interpretation. The other dates that the author proposes for the lithological units depends on shaky assumptions of deposit formation.[11]

Here, four operationalized classes of plant taxa inform the potential broad landscape changes that might have occurred around the Dhiban plateau: woody taxa, economic crops, drought-adapted plants, and irrigated plants. Each indicates a different aspect of landscape and agricultural practice. For instance, weedy, drought-adapted taxa (undesirable plants found in agricultural fields: Vieyra-Odilon and Vibrans 2001), are strong indicators of changes in agro-ecosystems (Jones et al. 2010). Relatively large proportions of leguminous

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[11] The author notes (Leroy 2010: 308-9) that the dates for the other ranges of the core were based on calculated sedimentation rates predicated on laminite counting. The author admits the rate of sedimentation "might be underestimated due to missing layers caused for example by lack of winter floods and erosion due to earthquakes and flash floods".

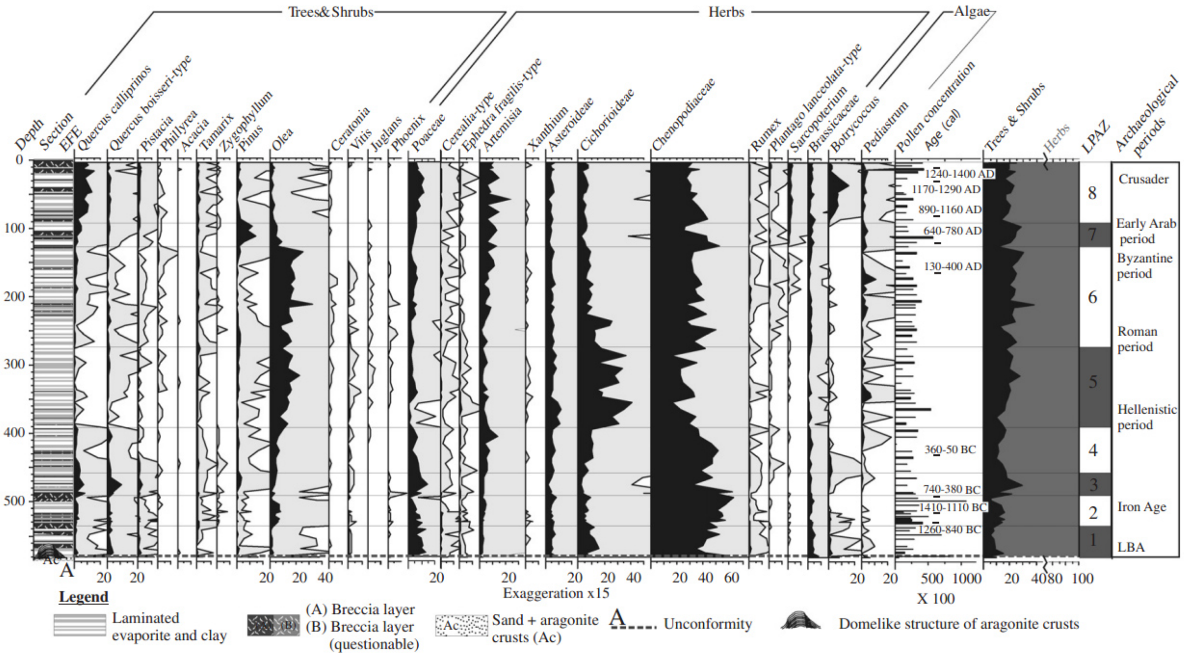

Figure 3.15: Ein Feshkha Pollen Core (from Neumann et al. 2007a: 1489, Fig 7).

plants might indicate agricultural practices that encourage fallow periods for replenishing depleted nitrogen in the soil, while sedges, rushes, and certain grasses indicate irrigated fields (Charles et al. 2003). The selected taxa are the only ones that are also present in the Birkat Ram crater, and therefore inter-regional trends can be inferred. The representatives of the drought-adapted plants are Chenopodiaceae (goosefoot) and *Artemisia* (sagebrush), and the proxy for weedy taxa as a result of irrigation is *Rumex* (dock), while Poaceae (grasses) represent weedy taxa more generally. The major economic crop of focus is *Olea* (olive), due to the amount of pollen that this plant produces (Cordova 2010: 103), and the two woody taxa under investigation are *Pinus* (pine) and *Quercus calliprinos* (Palestine oak).

The cores from both Nahal Ze'elim A-2 (**Figure 3.14**) and Ein Feshkha (**Figure 3.15**) illustrate that vegetation change, understood as the moments of the relatively most and least frequent abundances of pollen for each taxon, occurs in three distinct temporal ranges: one that is roughly from 60 - 430 cal CE, another from 650 - 810 cal CE, and the last from 890 - 1290 CE. These three ranges also correlate to the Roman / Byzantine, Umayyad, and Ayyubid / Mamluk periods of imperial intervention in the region. For instance, both cores contain the greatest concentration of *Pinus* from roughly 640 - 1160 CE. *Quercus calliprinos* pollen, represented in the Ein Feshkha core, disappears at some point between 740 and 50 BCE, but then resurfaces between 890 - 1160 CE, during the Middle Islamic I period. It seems that from the Iron Age until the Umayyad and Middle Islamic I and II periods, these plants were being actively exploited and were unable to propagate due to human intervention.

Intriguingly, the proportion of pollen of drought-adapted weedy plants, such as Chenopo-

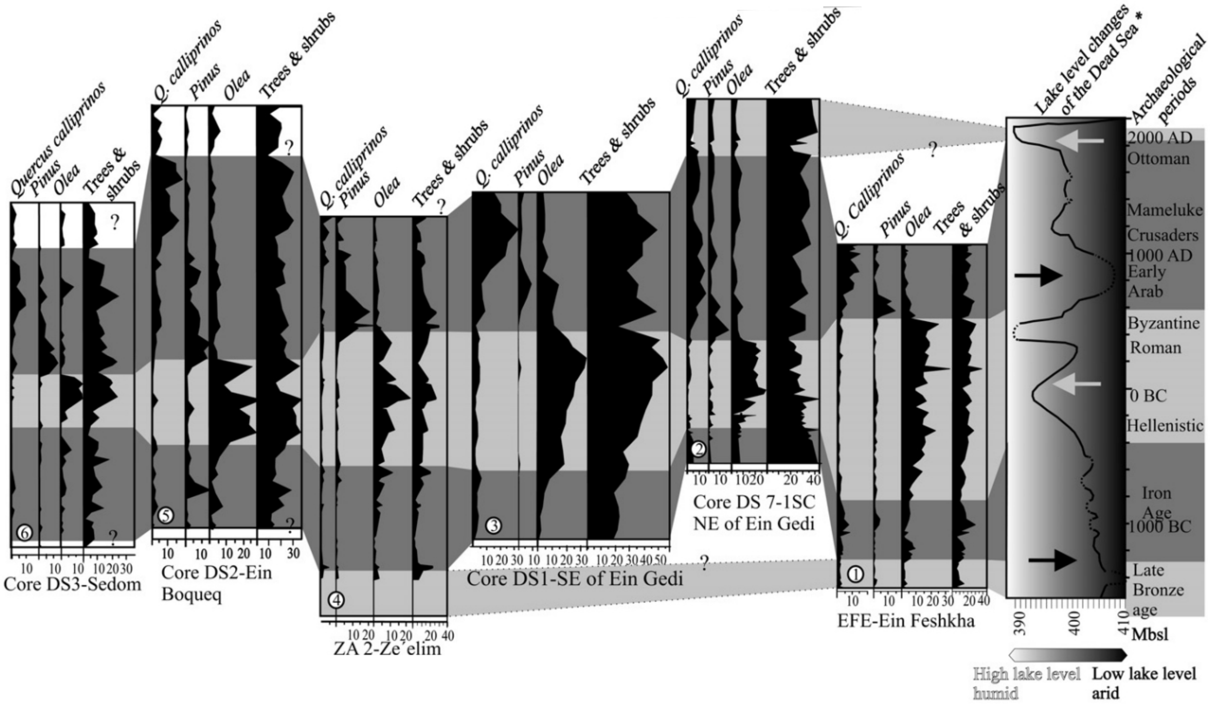

Figure 3.16: Cross correlated pollen sequence from six Dead Sea cores (from Neumann et al. 2010: 761, Fig 2)

diaceae and *Artemisia*, are also highest in both cores between 640 - 810 CE, except that in the Ein Feshkha core *Artemisia* pollen is relatively frequent in equal proportions except for a spike in 1170 - 1290 CE. That is to say, at the same time that pine and oak pollen become relatively abundant, drought adapted plants also return as well. The significance of this correlation is that whereas deforestation may have ceased in this period, so too did management of large tracts of land, which may have type-converted back to drought-adapted vegetation. The period of the least relatively abundant Chenopodiaceae pollen in the Ein Feshkha core is 360 BCE - 400 CE, again during the period of the least frequent woody taxa pollen.

The evidence for irrigation is found only in the period of 1050 - 1280 CE, and only in the Nahal Ze'elim A-2 core. Poaceae likewise became relatively more frequent in the same interval. It is clear, then, that if these pollen cores are recording agricultural and not climatic fluctuations, then a series of new, interlocking landscape practices in the Middle Islamic I and II periods had a series of cascade effects on the landscape, with increasing amounts of drought-adapted plants, grasses, and irrigation weeds becoming relatively more abundant. In turn, large amounts of woody taxa also seem to be present, perhaps due to relaxed pressure on the harvesting of these populations.

Indeed, the evidence for this might be evident in the spike of *Olea* (olive) pollen that both the Nahal Ze'elim A-2 and Ein Feshkha cores record as at some point between 60 and 640 CE, during the Roman and Byzantine period. The DS7-1SC also contains the greatest

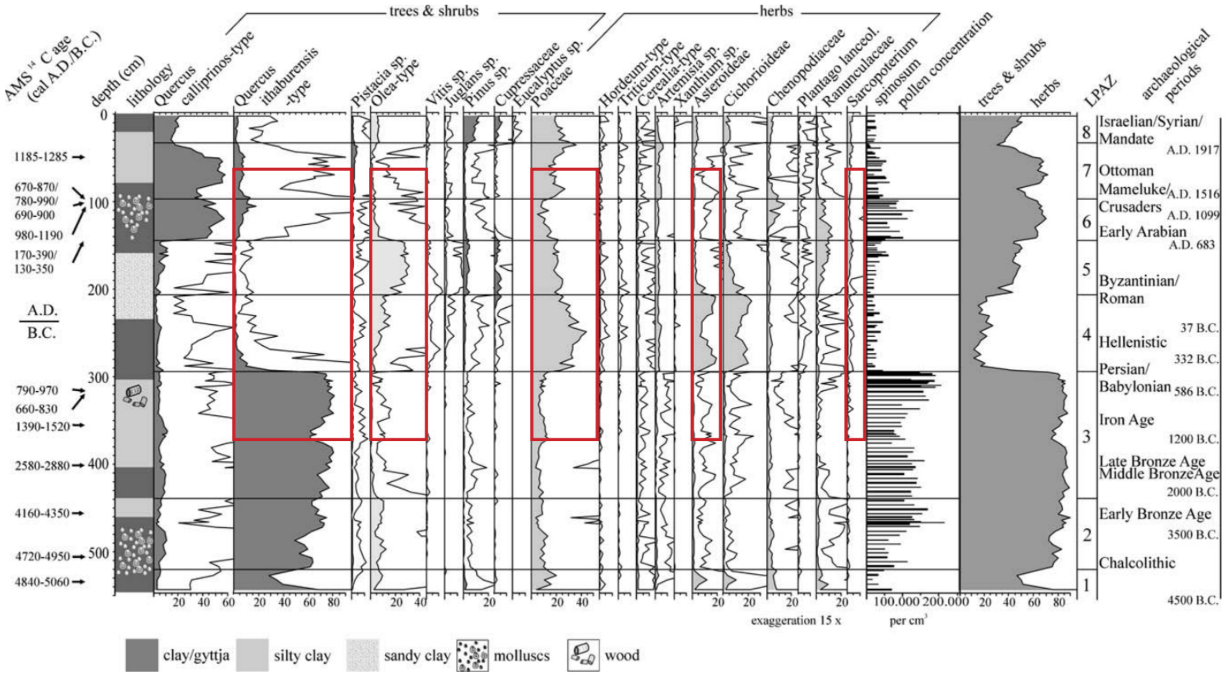

Figure 3.17: Pollen core from Birkat Ram crater lake (Neumann et al. 2007b: 337, Fig 5). Red lines indicate temporal extents of this study.

concentration of olive pollen near the 50 cm range which was directly dated (376 BCE - 420 CE). It is clear that the decline in the relative frequency of this pollen, insofar as it can be inferred from the available radiocarbon dates, begins immediately after this period. The cross-correlation of the laminae from these cores across all six of the field sites also support these conclusions (**Figure 3.16**). Nevertheless, all of these authors attribute the decline in *Olea* pollen (e.g. Leroy 2010: 313-314) to a 6th century CE aridification event. Using circular reasoning, these authors claim that the evidence of site abandonment vindicates the pollen data, but then argue that the pollen data explain the evidence of site abandonment (Hirschfeld 2004; Neumann et al. 2007a:1492, 2010: 762). Alone among these voices has Steve Rosen argued that the contraction of olive in these periods is more likely due to changes in *human* economic configurations and plant meanings that enabled the expansion of Mediterrean type crops in arid zones, rather than climate change alone (2000: 54-56). It is argued here that land that was set aside for what was probably extensive arboriculture, a defining feature of Byzantine period land management as shall be seen below, returned to an unmanaged state in the several hundred years after the end of the Byzantine period due to changing economic priorities and landscape practices.

In contrast to the Dead Sea pollen cores, the Birkat Ram core (**Figure 3.17**) near the Lake Kinneret in the very north of Jordan provides complementary data that complicates these more local assumptions around the Dead Sea. For instance, in the Birkat Ram core, the

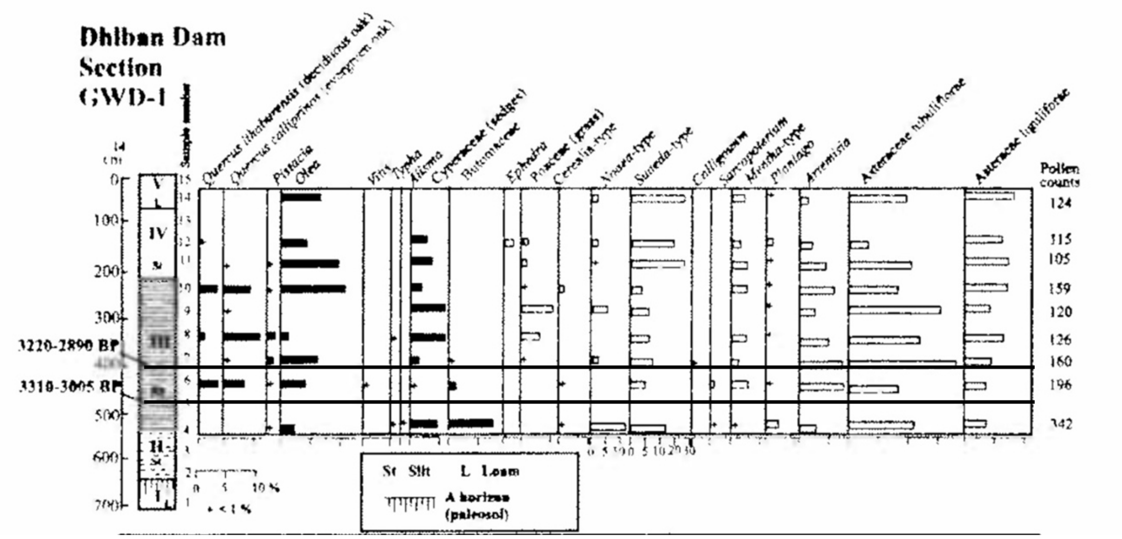

Figure 3.18: Pollen Core from Tall Dhiban dam, with black lines added to indicate temporal boundaries based on provided ^{14}C data (from Cordova 2010).

relative frequency of grasses (Poaceae) explode at the end or near the end of the Achaemenian Persian period (ca. 500 BCE) and persist with relatively minor fluctuations well into the British Mandate period. Likewise, the frequency of goosefoot (Chenopodiaceae), sagebrush (*Artemisia*), and catch-fly (Caryophyllaceae) pollen also remain relatively stable, i.e. abundant, through time. Again, the most dramatic vegetational shift seems to occur in the Byzantine period and is visible in the sudden relative increase of olive (*Olea*). Yet the quantitative proportional increase of this taxon only intensifies an earlier trend, one that seems to have started in the Hellenistic period or earlier. The core from Birkat Ram therefore both correlates to, and departs from, the series of samples from along the west coast of the Dead Sea (Leroy et al. 2010; Neumann et al. 2010). The relative persistence of some pollen types might in fact point to the ways in which the ecological and environmental conditions of certain areas direct the development of certain plants - a wetter environment in the zone near Lake Kinneret precludes the growth of drought-adapted taxa whereas the semi-arid zone around the Dead Sea is more sensitive to changes both in precipitation and in practice, and therefore drought-adapted taxa respond to these changes more variably.

Finally, close examination of pollen cores from the site of Dhiban itself provide higher resolution insight into landscape interaction on the level of the settlement (**Figure 3.18**). A pollen core taken from a now-bulldozed dam 200m east of Tall Dhiban clarifies some of the large-scale trends seen in the Dead Sea core and in the Birkat Ram core (Cordova 2010). Despite some issues with dating (Cordova 2010: 112), the ^{14}C evidence illustrates an expansion of *Olea* pollen after 3220-2890 uncal BP, which corresponds to the transition between the Late Bronze Age and the Iron Age. Surprisingly, the same pollen core shows almost no grape (*Vitis vinifera* ssp.). The evidence presented in Chapter 5 and Chapter 6 will illustrate the limitations of the use of pollen evidence alone in vegetation reconstruction (argued by Birks and Birks 2000), as Byzantine period deposits on the *tall* itself are *filled* with grape remains (pips, pedicels, etc.). Finally, there is little local variation in weedy taxa, except for grasses (Poaceae), which are more concentrated in the periods immediately after the Iron IIb, and then diminish through time, although never wholly disappear.

3.4 Summary

The available AMS ^{14}C data and associated archaeological evidence show that sedentary human communities have occupied the Dhiban plateau, and more specifically the *tall* of Dhiban, since at least 1000 cal BCE. The occupation of the site also fits within the span of time in which written language becomes ever-more available and prominent, not just to archaeologists, but perhaps in the worlds of these communities as well. The longevity of occupation on the plateau, and the agricultural practices which would have sustained them, have had visible consequences on the vegetation on the landscape. Today, almost the entirety of the plateau is dedicated to agriculture, and all of the woody vegetation on it is anthropogenic in origin, that is, managed and placed by human hands. The only unmanaged vegetation lies on the bottom of the wadi al-Wala, but even that has been influenced by the recent effects of riparian agriculture, water pumping, and fertilizer wash-outs (C(TE)).

In contrast to the contemporary vegetation on the Dhiban plateau, the paleoclimatic and paleoecological evidence indicates that past vegetation would have been different than today. The paleoclimate (speleothem) data from the Soreq cave in particular, illustrates that for the last 5,000 years, and more specifically the last 3,000 years, the range of variation in precipitation would have been roughly equivalent to the contemporary precipitation regime. Rainfall has been, and continues to be, too unreliable (256 mm per annum) for rain-fed agriculture by farmers on the Dhiban plateau. While the speleothem data sets absolute limits on past rainfall minima and maxima, it still does not speak to the lived yearly experiences of considerable inter-annual differences in precipitation by past communities on the plateau. Yet the stability of these minima and maxima also indicate that the paleoecological evidence (the palynological or pollen data), record more the changes of the agricultural practices of past communities in the area rather than climatic shifts.

The two periods in which changes in the relative frequencies of economically important plant pollen are most salient are in the Byzantine (ca. 320 - 650 CE) and Middle Islamic periods (1250 - 1450 CE). The chapter began by illustrating that not only are these two moments of imperial intervention, but they are also represented at the archaeological site of Dhiban through the absolute dating evidence presented in this chapter, as well as archaeological evidence discussed over the next two chapters. The changes in relative pollen frequencies for these different economically important plants are recorded not only in the Dead Sea area, but also near Lake Kinneret, which implies wide-scale changes in agricultural practice and "synanthropic vegetation", that is, vegetation affected by, but not dependent on, anthropogenic inputs (Cordova 2011: 97-8), across what is now central and northern

Jordan. In the Byzantine period, it was noted that the plant pollen that increases the most dramatically is that of *Olea* (olive), with a corresponding decrease in *Quercus calliprinos* (Palestine oak) and *Pinus* (pine). As Cordova (2011: 115) notes in a survey of all of the available palynological indicators from the eastern area of the State of Israel in combination with Jordanian pollen cores, the expansion of olive "shows the highest values ever recorded in all of the Levantine sequences". Nevertheless, Cordova also indicates, as do the pollen cores presented in this chapter, that this increase in olive production seems to have begun much earlier, in the Hellenistic and Roman periods, and that the subsequent intensification of olive pollen, and hence intensification of olive production, only expanded upon an earlier trend.

In contrast the pollen evidence for the Middle Islamic period 600 years later, revealed an increase in *Pinus* and *Quercus* pollen, a decrease in *Olea*, and an increase in Poaceae, or grasses. The changes in these relative plant pollen frequencies, it was argued, are associated with shifts in land management practices, and not changes in precipitation, humidity, or other climatic phenomena. The specific predicted shifts in practice were away from large-scale arboriculture, which facilitated the regrowth of previously suppressed oak and pine stands, alongside an increase in grasses. It has been noted in the Mediterranean basin that grasses are often removed from areas of potential arboriculture, especially of olive, in order to prevent competition for water resources by grasses and facilitate infiltration (Barker et al 1996: 269-270). Therefore less, albeit not absent, arboriculture might have permitted more Poaceae to return, as well as large-scale cultivation of cereal-crops which would encourage weedy grasses to grow in both active and fallow fields. The evidence of both of these periods emphasizes the role of Historical Ecology in understanding these changes – the entwined plant and human practices that are represented in these pollen cores are both exemplary of the landscape as a total phenomenon, as well as the shifts that accompanied the unique political and economic configurations of the Byzantine and Middle Islamic periods.

The chapter began by thinking about the binding aspect of agriculture – how were these Byzantine and Middle Islamic period societies bound together through time and in space through their production of particular plants at particular times, to the extent that large scale changes are visible in the relative frequencies of some plant taxa and not others in the pollen record? The paleocological data begins to address that question by illustrating that changes in these periods are connected to coordinated labor organization at a scale that could dramatically change the amount of ambient air pollen for plants such as olive, oak, pine, and grasses. Moreover, these plants changed in *different* ways in these two periods: more olive and less pine in the Byzantine period, and more oak and grasses in the Middle Islamic. The "large scale" component of this putative plant production still does not address how that scale was organized; it has still not yet been established whether these were loosely coordinated individual endeavors, state supervised ventures, or represent other kinds of self-organized community interactions. In the next chapter, the historical and imperial narratives of the Byzantine and Mamluk (Middle Islamic period) empires will be discussed in detail to offer answers to this fundamental inquiry. That is, these narratives (Chapter 4) will reveal precisely how the interaction between imperial desires and community negotiations produced large scale changes in the vegetative and agricultural landscape, and the subsequent chapters (Chapter 5 and 6) will illustrate how these large scale changes were manifested in particular ways through the agricultural production of the communities inhabiting Dhiban during these periods.

Chapter 4

Narratives of Intensification, Narratives of Empire

> I drew on both history and political economy in order to locate the peoples studied by anthropology in the larger fields of force generated by systems of power exercised over social labor. These systems are not timeless; they develop and change. It is thus important to understand how they unfold and expand their reach over people in both time and space. Although I wrote as an anthropologist rather than as a professional historian, I think history matters[...] Although I am not an economist, I think a grasp of a historically grounded political economy is imperative in understanding the structures that determine and circumscribe people's lives. Contrary to the opinion that this does not tell us much about "real people doing real things," I think it has a lot to do with just that. There may be "pie in the sky when you die," but how the pie is dished out on the ground has considerable existential relevance.
> - Wolf (2010: xix-xx)

The convergence of AMS radiocarbon dates and palynological evidence near and in Dhiban show that some of the most intensive agricultural landscape use occurred during two distinct periods of time. The first segment encompasses the Early and Late Byzantine period in the Levant, spanning roughly 320 to 650 CE. The second segment corresponds to the Middle Islamic period in Levantine cultural chronology which stretches from 800 to 1500 CE in some formulations (Walmsley 2008: 443-444), but which for the purposes of this research project, is coterminous with what political narratives designate as the Mamluk empire (Middle Islamic II: ca. 1260 - 1450). Yet it was also shown that in the case of the Byzantine period, some of the increases in pollen of some plants (e.g. *Olea*) were following earlier intensifications in the Hellenistic and Roman period. Neither the Byzantine nor the Mamluk empires encountered an "empty land" devoid of its own history and potentially self-awareness – by the time of the Byzantine empire, which itself was an extension of the earlier Roman empire, sedentary communities had been established at Dhiban for at least 1,000 years (Porter et al. 2007). As far as it can be attested archaeologically through the extensive remains of architecture found on the north *tall* of Dhiban, the periods with the most salient presence before the Byzantine empire, were the Iron Age (ca. 1000 - 700 BCE) and the Nabataean and Roman period (100 BCE - 300 CE). Previous excavations on the site located what the excavators described as an Iron Age Moabite palace 42.9 by 21.1 meters in size (Morton 1989: 245), the extensive remains of the foundation of a 17.5 by 14.5 meter Nabataean temple (Tushingham 1972: 27-8), and two Roman-period inscriptions (Tushingham 1972: 56). The continual, visible occupation of large structures that were often re-purposed (e.g. Tushingham 1972: 61) might have meant that Dhiban was probably old in the eyes of its inhabitants. It may have been even a place of special meaning, as its continued occupation, albeit with occasional interruption, attests (Porter et al. 2007: 316). Indeed, the Byzantine author and Church scholar Eusebius (ca. 260 - 339 CE) notes that although Dhiban was a "station in the wilderness" (ϵπὶ τῆς ϵϱήμου...σταθμὸς) during his life in the early 4th century CE (Euseb. *Onom* 3.11-12), it was a place of considerable antiquity, as "it was anciently the possession of the sons of Moab" (‘ἣν τὸ πάλαιον οὖσαν τῶν υιῶν Μωὰβ; Euseb. *Onom* 3.14-15). Of course, Eusebius had reason to be interested in the history of Dhiban given the importance of the settlement in the Hebrew Bible (see Chapter 1.1), as well as the fact that Eusebius was probably from the province of Palaestina Prima (around Caesarea) himself (Wolf 1964: 58). Yet even given Eusebius' religiously motivated interest, his acknowledgment of the "antiquity" of the site illustrates the possibility for awareness of these later Byzantine and Middle Islamic period communities to the history of settlement in these locales which they had now come into more direct contact.

There are two established narratives that have framed a considerable portion of the archaeological and historical investigation of the Byzantine and Mamluk empires in the Levant: agricultural intensification, and the consequences of the intervention of empires in formerly politically independent communities (e.g. Anderson 1998). In both cases, archaeological evidence has contributed to the exploration of these issues, although its utilization has been patchy (see Kingsley and Decker 2001; Walmsley 2008; McPhillips and Walmsley 2012). In this chapter, both of these narratives will be interrogated with respect to the theoretical literature which they draw upon, and certain aspects of these narratives will be problematized and then recombined. In doing so, this chapter also fulfills the second part of the agriculturally focused narrative begun in the preceding chapter, in that it highlights the unique social, political, and economic configurations which characterized the political interventions of each period. As Dietler (2010: 185) cogently avers, "...issues of entanglement and exploitation should mandate that the articulation of production and consumption should be an ever present concern", and while this recombined narrative does not *necessarily* ascribe an exploitative relationship of these empires to the communities at Dhiban, it nonetheless attempts to highlight the entanglement of interests seen in the desire of imperial polities for communities to grow particular plants. Moreover, while Dietler (following Sahlins) is also right to note that it is ultimately consumption that drives production, one of the "consequences of consumption" (Dietler 2010: 188) is a change in the manner of production itself. This chapter will admittedly not undertake an analysis of the specific forms and kinds of culinary preferences that may or may not have motivated Byzantine and Mamluk imperial elites in pursuit of particular agricultural goods (cf. Gumerman 1997); instead, it will view the plants themselves as the tokenized and valued items of exchange (cf. Appadurai 1986), and underline the politics which structured these exchanges. In the end, it will be shown that though similar kinds of plants were the objects of desire of both empires, the configurations of social relationships established within them to acquire these valued crops were, in fact, different. Several hypotheses are then offered as to the expectations of what the corresponding paleoethnobotanical evidence might be for each of these imperially desired plants, and these are then identified in the renewed excavations in Dhiban discussed over the next two chapters.

To begin, the concept of the intensification of agricultural production is a powerful narrative operating both within Byzantine period research (Decker 2009b) as well as Mamluk period research (Walker 2011). While there are many definitions of intensification, here the original and most widely disseminated definition is employed, that is the "addition of inputs up to the economic margin" against some constant of land in order to "gain more production from a given area, use it more frequently, and hence make possible a greater concentration of production" (Brookfield 1972: 31). Though this characterization of intensification emphasizes its more abstract and economic properties, the social and political contexts that underpin the actual trajectories of intensification often have more influence on their course than their supposedly universal qualities (Leach 1999; Brookfield 1972, 1984, 2001; Kirch 1994, 2006; Morrison 1994, 1996, 2006, 2007). As agricultural intensification is a process formed by the practices of people in specific places and spaces to concentrate agricultural production, and not a singular "moment", it is more productive to track the sequences of social and biological phenomena that enable it than to narrowly pursue causality and consequentiality.[1] Causation in particular is often difficult to ascertain in historical instances, given the at times ambiguous and fragmentary state of archaeological data (Morrison 2007: 238-239). Moreover, Erickson (2006: 348) cautions archaeologists pursuing the material traces of agricultural intensification to realize the biases inherent to a site-based approach, as "most activities of farm life that are pertinent to intensive agriculture are not settlement based; rather they occurred in that elusive gray zone imperceptible to archaeologists focusing primarily on sites". Though this study is entirely site based, it cannot be sufficiently stressed that the "elusive gray zone" of the area of the Dhiban plateau off the *tall* itself was, and still is, the primary arena for agricultural practice and production. One way to tackle the issue that Erickson has offered in lieu of the necessary "gray zone" research that he posits is to compare multiple sites and then infer the kinds of practices that must have by necessity existed in the intervening landscape. Another strategy, provided by the historical data assembled below, is to draw analogies from nearby sites to Dhiban that have recorded their off-site activities. While both contain their own biases and methodological issues, they nevertheless attempt to bridge this critical interpretive chasm.

Numerous studies of agricultural intensification focus on the effects of political economies, and yet few highlight the fundamental importance of plants (as agricultural crops and weeds)

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[1] Or, as framed by C. Erickson (2006: 334), the importance of "social organization, land tenure, labor organization, and rural lifeways."

in these networks (but see Hastorf 1993; Hastorf and Johanssen 1993). Plants played a critical role in many of the institutions which relied on or precipitated the intensification of agricultural goods, as seen in the variations in the the relative frequencies of the pollen evidence correlative to the time periods discussed here. These plants were in turn redistributed as food, currency, and tribute (Hastorf 1990, 1999; Smith and Montiel 2001: 249). In the case of the two polities under investigation, there are two particular ideologies that surround the facilitation of agriculture. In the Byzantine period, the "Mediterranean suite" of crops which includes grapes, olives, and wheat (or what Decker 2009a calls the Mediterranean "triad" more narrowly), extended into areas of the Eastern Mediterranean which were environmentally unsuitable for the reliable production of those crops (Bruins 2012). One such example is the arrival of these three plants in the hyper-arid regions of the Negev desert in the State of Israel (Rosen 2000). Settlements have been found in this region during the Byzantine period alone with subsequent abandonment (Rosen 2000; Ramsay and Tepper 2010), and the arrival of these plants within these settlements is often celebrated in mosaics across the area (Bowersock 2006). The expansion of Mediterranean origin crops was not a novel occurrence, however. It was preceded by an earlier shift in cultigen selection (and hence motivated by different culinary practices; Bray 2003) during the Iron Age, when southwest Asian communities seem to have chosen to grow free-threshing wheat varieties (*Triticum aestivum*, *Triticum durum*) rather than emmer (*Triticum dicoccum*) (Riehl and Nesbitt 2003: 306). The continued proliferation of this Mediterranean suite of desired and undesirable plants (weeds) through time in spite of other potential cultigens such as common millet (*Panium miliaceum*), which also entered into southwest Asian foodways at this time, attests to both the demand for, and strong ideologies around, these particular agricultural goods.

While the Mediterranean suite of wheat, olive and grape has dominated discussion of the Byzantine period in the Eastern Mediterranean, in the later Middle Islamic period some scholars have argued (Watson 1974, 1983) that the initial unification of the Mediterranean basin by successive Muslim empires beginning in the Umayyad period (c. 700 CE) to Africa through conquest, and South and southeast Asia through trade, engendered an unprecedented exchange of plants outside of their native biogeographic range. Some of these transplants include tropical plants such as mangos, sugarcane, and bananas (Walker 2004: 128 n. 33). In Jordan these crops were grown in areas with perennially available water, such as in the wadis of the Jordan valley. This is visible in the archaeological landscape through a large number of sugar mills dating to the 15th and 16th centuries (Walker 1999: 204). Aside from their economic importance to the elites of the Middle Islamic period, there were probably also newfound meanings given to many of these plant products, as their arrival was closely linked to changes in people's tastes and culinary experiences in all dimensions of the sensorium (Levanoni 2005).

Although the hypothesis of increased plant circulation through territorial unification is an attractive one for the Middle Islamic period, Decker (2009a) and Samuel (2001: 418-423) have refuted some of Watson's claims through thorough examination of the archaeological, archaeobotanical, and literary evidence. Decker cites evidence of cotton (2009a: 197-201), one of the plants Watson (1974: 9) claims enters between 700 and 1100 CE, earlier than Waton's late date using evidence such as papyri that mention the plant as being requisitioned for Roman troops stationed at Dura-Europos (Syria). Recent paleoethnobotanical research has also confirmed the presence of cotton in western Uzbekistan (Brite and Marston 2013) and southwestern Turkmenistan (Nesbitt 1993), each radiocarbon dated to 300-500 CE and 500 - 700 CE, far further to the north than the biogeographic range which Watson has proposed. Finally, Riehl and Nesbitt (2003: 306) note that *Triticum durum*, one of the crops that Watson (1983) claimed was instrumental to greater yields during the Umayyad, Abbassid, and Mamluk empires, is archaeobotanically attested in securely dated levels from 6000 BCE, and becomes one of the two dominant forms of wheat in southwest Asia from the Iron Age forward. Therefore paleoethnobotanical remains are key evidence in understanding the timing and direction of historical flows of organic goods, and it remains to be seen what, if any, plants were of special value, meaning, or importance to Middle Islamic communities, and in this sense paleoethnobotanical research, some of it presented here, are instrumental in determining the presence and absence of new kinds of plants during this period (cf. Samuel 2001: 423).

In addition to the narratives of intensification that exist for each of these periods, there are also "narratives of empire" which purport to highlight the impacts of elite imperial ideology on many of the communities and settlements far from official centers of authority. While each of these narratives of empire will be covered in greater detail below, it is important to note that by focusing on the question of empire, this study implicitly reifies this typological construct (Morrison 2001: 1-3). There is already sufficient and extended attention within archaeological research to the "definition" of what material and other correlates constitute an empire (e.g. Sinopoli 1994, 2001: 444:447; Morrison 2001: 1-10; Goldstone and Haldon 2009: 3-29). Included in the definition of empire is the thorny question of the relationship of so-called "peripheries" to imperial "centers"; the latter includes the perspectives of world-systems theory (Chase Dunn and Manning 2002), center and periphery models (Rowlands 1987), and more recently creolizing (Webster 2001) and postcolonial perspectives (Liebmann and Rizvi 2008). Since the capitals of the Byzantine and Mamluk empire were located in Constantinopole and Cairo, respectively, their relationship to Central Jordan, and hence Dhiban, falls within this schematic conceptualization. The narratives of empire used in the subsequent sections focus more on the material repercussions of the intervention of the Byzantine and Mamluk empires into the lifeways of communities far from the centers of social and political prestige (Lightfoot et al. 1998). The ways in which communities, or even individuals, negotiated these interventions through their decisions to support, resist, or restructure the new material inflows of these empires, remains relatively less understood (Dietler 2010). This study purports to escape the confines of typologizing by attempting to trace the consequences of these material exchanges rather than assigning groups *a priori*(cf. Latour 2004: 1-10). Plant remains in this sense provide a unique source of data as they represent the intersection of domestic activities and imperial demands (Sinopoli 1994: 162-164; Morrison 1996: 586; Hastorf and D'Altroy 2002).

The perspective that is taken on the "impact" of the Byzantine and Mamluk empires on Dhiban is largely indebted to the work of Dietler (2010), although it also incorporates ideas drawn from Giddens (1984), Bourdieu (1990), and others. Dietler, however, points considerable attention to

> the particular *things* that were actually consumed and the *ways* they were consumed; that is we must examine the specific properties and contexts of these objects and practices and try to understand the social and cultural logic of the desire for them and the social, economic, and political roles that their consumption played (Dietler 2010: 57).

In many respects it is possible to replace "consumption", with "production" and thereby arrive at the overarching narrative aim of this chapter; yet the latter is not necessary considering that production itself stems from and creates further consumption (Dietler 2010: 60). Therefore, the analysis below of the social, economic, and political roles that production played in the Byzantine and Mamluk periods is instrumental in identifying the "structures that determine and circumscribe people's lives", as Wolf (2010: xix) noted in the 1997 preface to his seminal *Europe and the People Without History.* Empires, as a chain of interconnected practices, establish and reproduce new kinds of political, social, and economic networks that are then negotiated by the individuals within it (Sinopoli 2001: 450). That is to say, while empires might create new or novel economic and political conditions through bringing together previously disconnected communities, it is ultimately the decision (the "agency") of those communities themselves to determine how they will negotiate these newfound connections. While the question of agency still continues to be a thorny issue in archaeological research (Dornan 2002; Joyce and Lopiparo 2005, among many), the kind of agency envisioned in this chapter is not a romanticized notion of utterly unique and idiosyncratic individuals who more often resemble the academics who write about them than those actually affected by the structures of the everyday (de Certeau 1984: 91-119; Clark 2000). Instead, agency is attributed to individuals who do not passively and helplessly "absorb" the new material inflows stemming from the novel networks afforded by empires, but selectively incorporate them into pre-established worlds of local meaning (Stein 2002). Nonetheless, coercion and violence stemming from these imperial encounters can not be denied, and there exist a spectrum of possibilities from acceptance, to resistance, to negotiation (Dietler 2010: 55). By focusing on the interplay between the communities at Dhiban and what is known about these larger political arrangements, it is hoped that such a spectrum of possibilities will be made clear within the domain of agricultural production. Moreover, through the recognition of these manifold social entanglements with agricultural production, the narrative shifts from one of subsistence (Jones 1985) or resource extraction by communities, to a historical ecology of their practices that highlights the interaction between human actors and non-human ecology.

Therefore, given the complexities of both narratives and the abundance of historical data available for each, it is necessary to examine each period of intervention separately. Through the latter, it will be possible to situate the cultural and historical variation that affected the process of intensification (that is, the historical ecological attention to unevennesses), the institutions that maintained or supported agriculture, and the various ways in which these empires would have intervened in people's local lifeways. Naturally it is impossible to provide an exhaustive summary of any given facet of the phenomena under investigation, or of these empires as a whole. These tasks have been accomplished elsewhere (for the Byzantine period: Cameron 1993; for the Middle Islamic period: Walker 2011). As a result, only those elements of the existing narratives directly pertinent to the entangled nature of agricultural production with social, political, and economic issues will be emphasized, where appropriate.

4.1 The Late Antique Apogee in the Southern Levant

A growing number of archaeologists and historians have realized that in the Byzantine Eastern Mediterranean, and the southern Levant in particular, considerable and diverse archaeological evidence points to a noted increase in a number of proxies of economic exchange between communities (King and Decker 2001) as well as an increase in settlement density.[2] The archaeological evidence of this intensification is manifold and has recently benefited from a surge of research since the 1960s, especially settlement surveys and excavation (Chavarria and Lewit 2004). The data for the latter are visible in the

1. simultaneous expansion and density of rural (i.e. non-urban or primarily producer) and urban settlements (Wilkinson et al. 2004: 20), in the Northern Levant (Casana 2007; Wilkinson 2003: 134), in the corridor between the Taurus mountains and the upper Euphrates river (Decker 2007), and above all, in the southern Levant (Banning 1987; Hirschfeld 1997; Bar 2004)
2. number of new constructions of buildings, specifically churches (Di Segni 1999)
3. scale of the exchange of agricultural goods identified through ceramic evidence such as amphorae (Pieri 2012) and shipwrecks (Parker 1992),
4. number and density of agricultural installations such as olive (Frankel 1997) and wine (Mayerson 1985) presses

In addition to archaeological evidence, many historical texts and inscriptions make it clear that many Roman institutions survived, albeit changed, in the Eastern Mediterranean. These institutions had been supplanted on the Italian peninsula and in the Western Mediterranean broadly by the arrival of Germanic-speaking groups, with the deposition of the last Roman emperor in Rome (Augustulus Romulus) by Odoacer in 476 CE (Cameron 1993: 33-36). Though the region was beset by numerous external pressures, such as several devastating invasions in the early 7th century by the Sasanian Persians (Foss 2003; including an occupation of two decades) and various Arab groups (Kaegi 1992), as well as internal pressure

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[2] Piccirillo (1985:257) notes, "[i]t is clear to archaeologists working in the region that Jordan was intensively settled in the Byzantine period."

from the effects of earthquakes (Ken Tor et al. 2001: 2228), plagues, and occasional social unrest (Hirschfeld 2006), many archaeologists have argued that the Byzantine period marks a high point of intensified agriculture in the Levant not surpassed until the introduction of mechanized agriculture after World War I (Watson 2008; Laiou and Morrisson 2007: 25-28; Meir et al. 2005). Many scholars have also argued that the impetus of this intensity of settlement and agricultural production "was strongly influenced by external factors, i.e. by the Roman-Byzantine empire, its civilization, and its institutions" (Rubin 1996: 50), a claim that echoes approaches to empire mentioned above, where communities are passive recipients of the material trappings and ideologies of a superior "civilization" (Webster 2001: 211-2).

Here the designation of "Byzantine" is largely, although not entirely, arbitrary as there was considerable political, institutional, and linguistic continuity between the Roman and Byzantine empires (Watson 2008: 443). The late third / early fourth century CE is nevertheless seen as a watershed and the beginning of the Byzantine period, as the emperor Diocletian initiated empire-wide infrastructural changes, whose more local effects included the split of the province of Arabia (Millar 1993; Anderson 1998; **Figure 4.1**). The successive Roman and Byzantine occupation of the Levant spanned a 600 year period beginning in 31 BCE and terminating with the arrival of the Umayyad Empire in 641 CE (Bowersock 1983; Millar 1993; Butcher 2003; Sartre 2005).[3] The enfolding of the Levant by the Romans into the Roman Empire was piecemeal and potentially unsystematic, and it was not until 106 CE that the territory coterminous with the political boundaries of the Hashemite Kingdom of Jordan was annexed and organized as a Roman province, the province of Arabia (Freeman 1996).[4] Nevertheless this event seems to have had significant local meaning, as communities such as that of Umm el-Rassas on the Dhiban plateau in Central Jordan, continued to use 106 CE, the date of the officially recognized incorporation of the area into the Roman Empire, as the basis for their calendar system even after the arrival of Umayyad armies 600 years later (Bowersock 2006: 11-13). Not long after this acquisition, the province of Arabia remained the southeastern-most frontier of Roman, and eventually Byzantine, authority, and a system of military encampments and fortresses were constructed across the western edge of the Jordanian "Eastern Desert" such as at Qasr el-Azraq, Udruh, al-Lejjun, and Umm al-Rassas.(Parker 1987, 2006; Kennedy 2004).

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[3] Even before the arrival of the armies of Pompey in the 1st century BCE, the 4th century BCE conquests of Alexander the Great thrust the region into ever greater contact with Hellenic culture (Smith 1990; Berlin 1997). The effect of these cultural interactions can not be understated; when local groups, such as the Nabataeans, gained political control they often re-purposed aspects of Hellenistic material culture, such as coinage, architecture, and portraiture, with new meanings (Schmid 2008).

[4] Despite spotty written evidence for Nabataean resistance to Roman political domination, there is still little consensus on the nature of the transfer of power to the Romans (Kennedy 2004: 39). Explanations for the abrupt absorption of the province of Arabia include the opportunistic ability for Roman elites to gain control of valuable luxury trade routes that connected the Red Sea to Roman provincial capitals in Philadelphia (contemporary Amman) and Bostra (Parker 1986: 123; Young 2001).

While many scholars have now accepted that settlement density seems to be at its highest in the Byzantine period,[5] alongside an explosion of agricultural intensification, the most pertinent and controversial questions are now the timing of that intensification and the locus of decision-making among the communities who sustained it (Morrison and Sodini 2002: 179-181).[6] In response to the search for the "locus of decision making", three main causative catalysts, or mechanisms, are offered as to why communities in the region began to intensify agricultural production: urbanization, the army, and the role of religion.

The food demands of massive cities such as Constantinople, Alexandria, and to some extent Antioch, encouraged if not dictated that rural communities supply foodstuffs to non-producing urban dwellers (Morrison and Sodini 2002). The extent to which this was overseen by the Byzantine state in the form of the *annona civica* is still debated (Kingsley and Decker 2001; Laoiu and Morrison 2007: 31-33). In contemporary Jordan, the hypothesis of the impacts of large urban centers has resulted in more attention paid to the urban north of the country, where researchers have disproportionately focused on a group of cities known as the Decapolis among the total range of available excavated settlements in Jordan (Chancey and Porter 2001). Much like the massive centers of Constantinople and Alexandria, some archaeologists assert that the material demands of Decapolis cities spurred the growth of supply-oriented rural centers in Central Jordan as they attempted to support the expanding populations of the North (Watson 2008: 445). The evidence of the consequences of this intensification is in the shift from the use of forest species as fuel at sites such as Pella and Deir 'Alla, to the almost exclusive use of wadi plants (Willcox 1992: 356). Less attention has been given to other, predominately rural, areas, such as at Hesban, Karak, Madaba, and Dhiban, and the excavation of these single, village settlements is nascent and has not yet kept pace with survey archaeology or excavation of these northerly sites (el-Khouri 2008; McQuitty 2005).[7]

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[5] The quantitative measures used to establish these settlement densities are subject to multiple competing intepretations due to the method of site quantification. The area around each of the southern Levantine Byzantine period settlements, so far only available for the Negev (see summary in Hirschfeld 1997: 39), are dependent on the criteria of the researcher for what is considered intra versus extra mural. Thus the *polis* of Elusa in the Negev can cover an area of 35 or 60.1 hectares (Hirschfeld 1997: 49) when one considers only architecture or also includes ceramic scatter. Alan Walmsley (2007: 513-515) has also drawn attention to the fact that these settlement surveys, especially in Jordan, utilize the presence of diagnostic ceramic remains to establish the evidence of occupation of a given area, and often do not publish the typologies which form the basis of these ceramic chronologies.

[6] Despite the abundance of archaeological data now growing, the role of archaeology in the interpretation of this phenomenon has not been straightforward, as some look with eagerness to an expansion of (Kingsley and Decker 2001: 8) "remote sensing techniques, soil flotation, quantitative pottery studies, and even landscape archaeology", while others claim that "[a]rchaeological evidence is...very difficult to interpret in ways that are useful for the writing of social history"(Sarris 2005:118).

[7] Nevertheless not all share the commitment to the investigation of these sites, as noted Byzantine historian Peter Sarris complains; the most investigated areas are in "relatively marginal areas or in areas where agriculture is difficult" (2005: 117) which, in his eyes, is a great loss as "these are precisely the sorts of areas where aristocratic dominance of land-ownership...would have been weakest".

The second major catalyst is the institution of the Late Roman, and then Byzantine, army. Like the demands of the urban centers, the army, which was stationed around the eastern borders of the southern Levant, also required food from the local community (Rubin 1997: 63-67). The payment of this food, the *annona militaris*, has also been seen as a mechanism which promoted intensified agriculture (Kingsley and Decker 2001: 5-9). While this no doubt partially explains the phenomenon, both papyrological evidence (the Nessana papyri, discussed below) and archaeobotanical evidence converge to show that the soldiers who were permanently garrisoned in their host communities were active participants in the daily lives of their host communities. For instance, at Nessana, a city in the Negev desert, soldiers married, divorced, owned bakeries, guest-houses, partitioned property, and managed a diversity of agricultural fields (Rubin 1997: 67). As the papyri further show, "former soldiers remained with their families in the Negev, and continued to harvest the crop of their fields and vineyards, for approximately another hundred years until the region was abandoned by the majority of its population" (Rubin 1997: 68). The archaeobotanical evidence from el-Lejjun, discussed in greater length in Chapter 6, a Roman and then Byzantine army barracks (Parker 2006: 111-122) in central Jordan, also illustrates this phenomenon. Both wheat and barley rachises (chaff) and the remains of field weeds - the evidence of crop processing - are found in deposits ranging from the Late Roman to the Late Byzantine period (Crawford 2006: 460). These data indicate that crop production was local and that crop processing was occurring on-site or at a nearby off-barracks installation. In either scenario, it implies that the soldiers who were stationed at Lejjun, or the families of the soldiers, were engaged in these local agricultural activities (Crawford 2006: 461).

Finally, the role of religion has also been seen as a major mechanism in the settlement of the southern Levant. This remains a highly contested interpretation of the available evidence. The underlying logic of the position states that Constantine's conversion to Christianity in 310 CE and the edict of Milan in 313 CE transformed the Levant from an area peripheral to the major political and social centers of authority, to a landscape imbued with significant spiritual meaning, or a "Holy Land" (Rubin 1996: 55-56; Bar 2004). Religious pilgrims began to visit the southern Levant with increasing frequency after an end to the persecution of the Christian Church, and eventually, its elevation to the sole authorized religion of the Byzantine Empire in 380 CE by Theodosius I (Sivan 2008: 10-18). As a result, churches as institutions gained considerable political clout and prestige among many of the communities of the Levant, especially since the area had been the original incubator of Christianity (Morrison and Sodini 2002: 182). A corollary of this prestige was financial gain; numerous papyri indicate that by the 6th century CE, ecclesiastic institutions owned vast tracts of land in the provinces of Palestine and Arabia, to the extent that some scholars speak of "ecclesiastical production and exchange" as a separate analytic category (Kingsley and Decker 2001: 25). Many scholars, however, such as Doron Bar, have called this model into question by claiming that the chain of causation has been reversed. It is not that the sanctification of this landscape caused economic intensification; rather it is that economic intensification caused an increase in the buildings of churches and monasteries, which have long been the proxies for the influence of religion in this area (Bar 2004: 315-316).

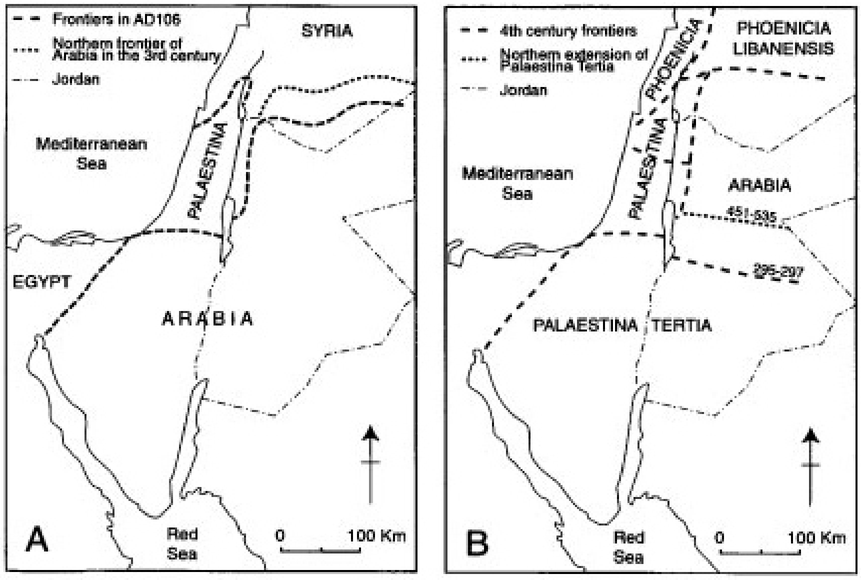

Figure 4.1: Boundary map of Roman and Byzantine Arabia indicating shifting provincial borders through time as dotted lines (Kennedy 2004: 41).

Even if any of these hypotheses were found to have more explanatory validity than the others, they address the what, when, and where of the process of this intensification, and yet only partially address the how (e.g. following Morrison 2006). The question of *how* these communities maintained and supported themselves during this period can be re-framed into several sub-investigations: what those communities grew, how they grew them, and how they divided labor to achieve this end. Almost all of these questions crucially depend on our ability to understand the changing relationships of people and plants during this period of time – both domesticated plants as crops, the field weeds they would have managed, and wild plants of value on the landscape used for fuel and fodder. The experience of the Dhiban community in the Byzantine period, and its relationship to agriculture through the questions just framed, can be achieved through a consideration of the available archaeological and papyrological evidence from the region of Palaestina broadly.

Dhiban in the Byzantine Landscape

The Byzantine period community of Dhiban was at first located in the province of Arabia (**Figure 4.2**). Nevertheless, the boundaries of the province of Arabia were constantly shifting, and in 358 CE, the boundaries of Palaestina Salutaris (later Tertia; see **Figure 4.1**) were advanced to a point nearly perpendicular to the northern tip of the Dead Sea.[8] The

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[8] Understandings of these administrative changes rely on remarks scattered throughout the works of Eusebius as well as the letters of Libanius to Clematius, the governor of the province of Palestine (Mayerson 1984: 224-227). Therefore attempts to correlate changes seen in the archaeological material with supposed

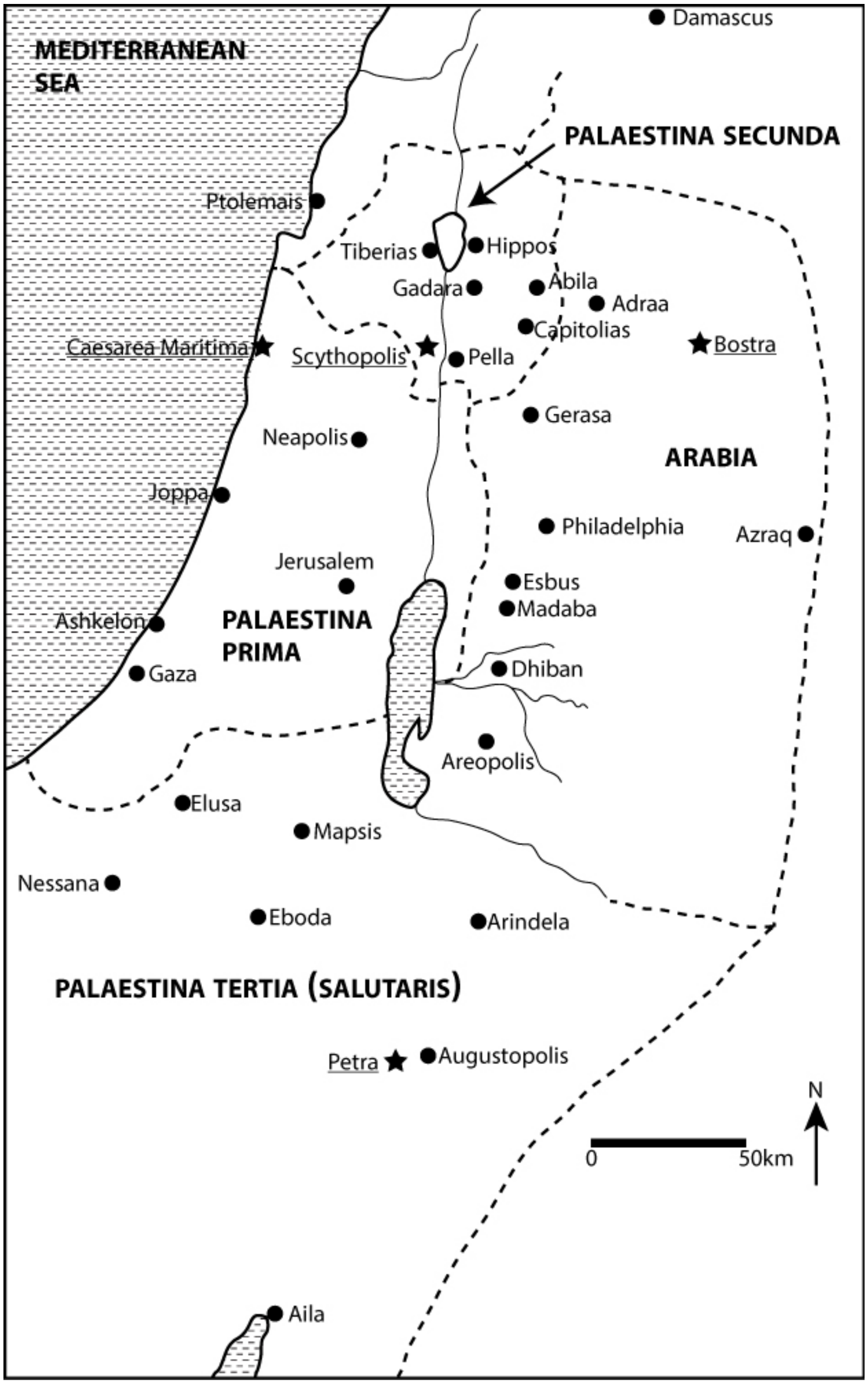

Figure 4.2: The position of Dhiban in the early Byzantine period, ca 350 (adapted from Walmsley 1999: 328).

Byzantine army, as with the Roman army before it, was deployed on the margins of these shifting boundaries and for southern Jordan: "forts were constructed, rebuilt, re-garrisoned, and abandoned throughout the Byzantine period, presumably with regard to a constantly changing political and economic environment, and neither a fully linear, nor a defense-in-depth system, were ever established" (Fiema 2007: 314). As Dhiban was close to the territorial border of the Byzantine empire (Kennedy 2004: 135-6), a potential military presence close to the community might have affected the social and economic exchanges between the representatives of the imperial state and the community of Dhiban itself.[9]

The general patterns of increased settlement throughout the southern Levant in the Byzantine period are also reflected more locally in and around the Dhiban plateau – archaeological survey records the majority of sites (>50%) are occupied during this time, the most out of any of the recorded periods (Ji and 'Attiyat 1997; Ji and Lee 1998, 2000). Complementary data from the Hesban regional survey (labeled as Esbus in **Figure 4.2**; LaBianca 1990) also illustrate that there is recorded Byzantine period occupation in 85% of the 148 total identified archaeological sites.[10] As the Byzantine period stretches over several centuries, however, the timing of the intensification of settlement was highly variable during that time and in the region. In settlement surveys around Petra, the capital of Palaestina Tertia, the number of settlements both in the Jabal ash-Sharah and in the western periphery decrease from the 3rd century CE (28 and 5 sites, respectively) to the early 7th century CE (13 and 1, respectively; Kouki 2009: 35-36). Although the number of settlements may have decreased in the Petra area, the occupation of Petra itself, as attested both in the remains of architecture (Fiema 1992) and the Petra papryi (Kouki 2009: 46-48), continued well into the 7th century CE. Yet as Kouki notes (2009: 41), "the western and central parts of the Petra region alone do not give the whole picture of settlement", because an expansion of

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administrative reforms should be considered with hesitation.

[9] Some earlier scholarship had argued that the concentration of the Byzantine military in this area was a response to the possibility of Sasanian military incursions, which did not occur until the beginning of the 7^{th} century CE. Instead, it has been convincingly shown that this system of fortification was more likely a response to the various semi-nomadic groups that increasingly played a more prominent role in the social fabric of society in this time (Parker 1986; Kennedy 2004: 51-52), as the Nessana and Petra papyri reveal larger numbers of Arabic names in proportion to Christian Greek names (Rubin 1996: 57). The relationship of the Byzantine authority to these groups is extremely complex, and cannot be covered in sufficient detail here (see Haiman 1995; Rosen 1987; Shahid 1984; 1989, 1995). It is sufficient to note that the Byzantine state apparatus headed by the emperor increasingly began to acknowledge and incorporate these groups into the defense of the area, to the extent that the emperor Justinian granted the phylarchate (e.g. military protection sphere) to the Ghassanid Abu Karib in 529 CE (Shahid 1984). For instance, a text known as the *diegemata* or "*narrationes* of Neilos the Ascetic", purportedly dating to the 5th century CE, recounts how an isolated Christian monk was captured by an Arab raid in the area around Mount Sinai (along with other monastic settlements; Mayerson 1963: 162). Even if the historicity of this event is questionable, it nonetheless provides a glimpse into the Byzantine imaginary of the Arabian social and environmental landscape during this period of time. From the archaeological data it is clear that these groups were clearly interdependent with sedentary communities, as both ceramic and other artifacts originating from them have been found in temporary camps in the Negev desert (in Nahal Ela) associated with past agro-pastoral groups (Haiman 1995: 32-33).

[10] Yet see Walmsley 2005 for important caveats regarding these data.

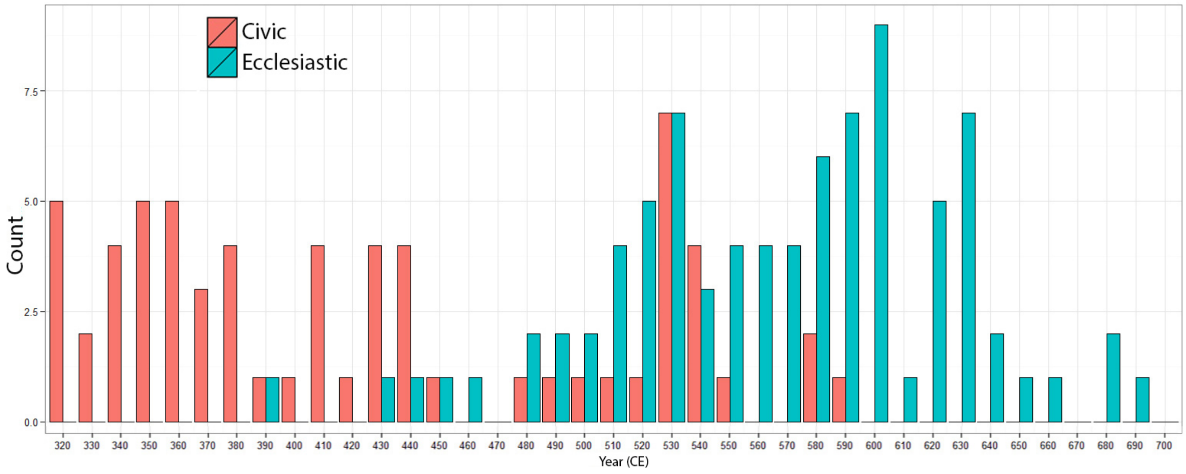

Figure 4.3: Building construction by year in Byzantine Jordan from CE 320 to 700. The graph represents the number of dedicatory building inscriptions by count each year, with the colors indicating civic versus ecclesiastic buildings (all data from Di Segni 1999).

agricultural activity took place in the area of Augustopolis (see **Figure 4.2**) at this exact same time, and it appears to be "not a state controlled enterprise but arose from the local economic dynamics". The timing of these changes through specific proxies is critical to understanding regional trends in settlement.

A quantitative assessment of these changes is possible thanks to a collation by Di Segni of the number of buildings that contain identifiable dates of construction in the Byzantine period in what are now the national boundaries of Jordan (1999: 159-163).[11] A plot of the comparison of the frequency of construction of civic and religious buildings by year (**Figure 4.3**) illustrates that the majority of the construction of civic buildings occurred between the early 4th to mid-6th centuries CE, and that an increase in ecclesiastic building took place at first simultaneously in the early 6th century CE, but rose considerably thereafter in the mid 6th to early 7th centuries CE. The latter dates of building construction are particularly important as the three AMS ^{14}C dates of the currently excavated Byzantine area of the site of Dhiban, which is discussed in the next chapter, identify the dates of occupation there at some point between 430 and 686 cal CE (uppermost and lowermost date, 2σ). Those dates overlap with the aforementioned simultaneous increase in the number of inscriptions marking ecclesiastic and civic construction at sites throughout the region, and these changes are reflected at the site of Dhiban itself at this time. In the southeast corner of the *tall*, initial excavations located a Byzantine church (Tushingham 1972: 59) complete with altar (**Figure 4.4: A**) and baptistery (**Figure 4.4: A**). Moreover, these same excavations uncovered architectural flourishes such as Corinthian capitals and stylized lintels similar to

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[11] Although these data are excellent indicators of construction activity, Walmsley 2009: 516-517 has shown that these indices reflect specific building activities under particular emperors rather than indicators of larger macroeconomic trends.

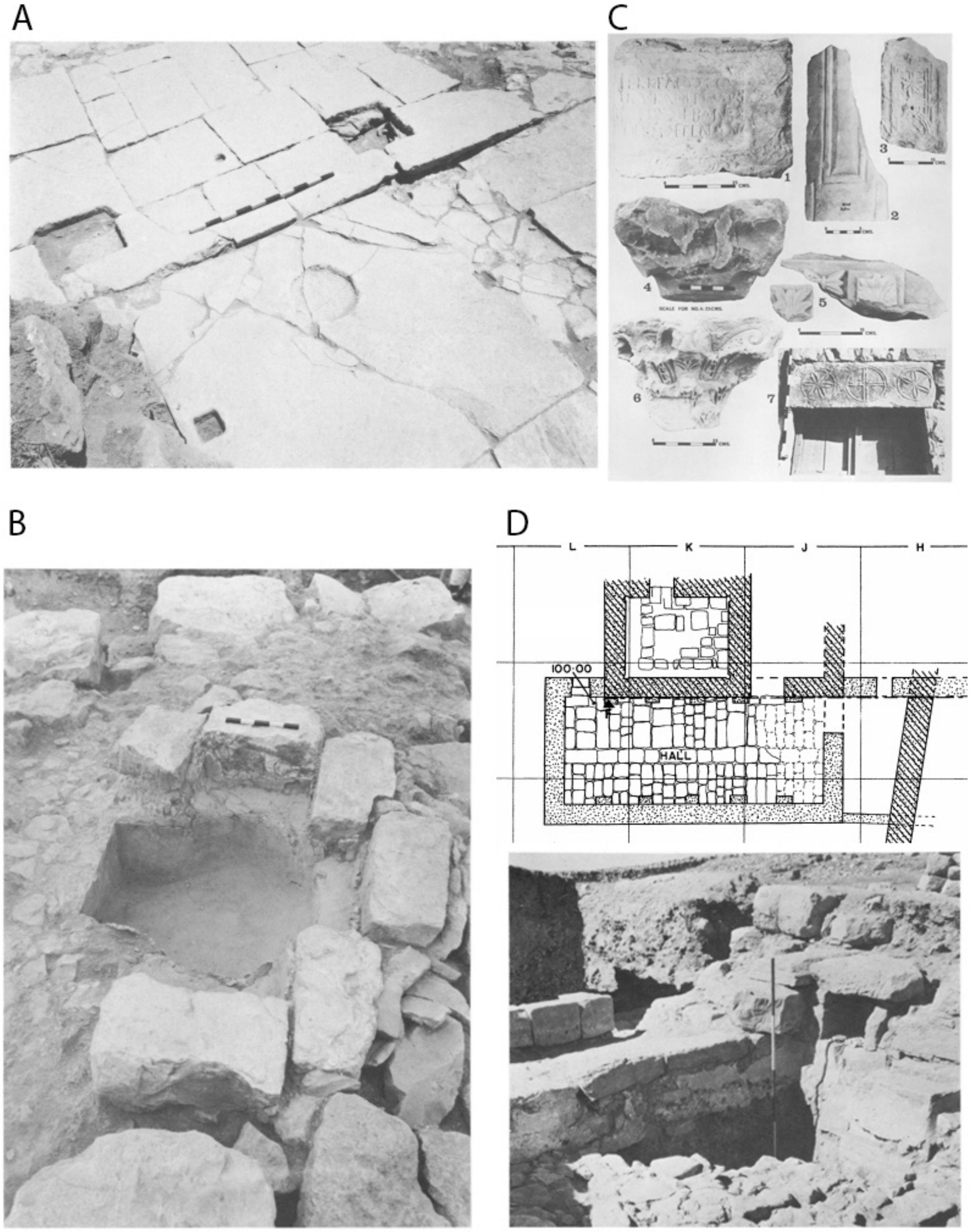

Figure 4.4: Byzantine period structures and architecture at Dhiban, where (A) is an image of the cuttings for the altar of the church (Tushingham 1972: Plate XVI.1), (B) is the baptistery of the church (Tushingham 1972: Plate XVII.2), (C) are the architectural flourishes of the structure, including Corinthian capitals (Tushingham 1972: Plate XL), and (D) is an architectural drawing of the Byzantine period bath, with an image of the once-plastered cobble floor of the bath (Tushingham 1972: Plate XII.1, and adapted)

the architecture of larger urban centers (**Figure 4.4: C**). Considering the presentation of paleoclimatic data in the previous chapter that ascertained the longevity of an unstable precipitation regime for reliable rain-fed farming, it is all the more surprising that the same excavations revealed a Byzantine period bath in this area (Winnett and Reed 1964: 17-18; **Figure 4.4: C**). The bath in particular indicates that the Dhiban community at this time was involved in considerable and coordinated water management beyond incidental capture, in order to supply enough water to the baths, the fields, the people, and the non-human animals which also depended on it. Coins of Justinian dating to 563/4 CE, discovered in the bedding of the flagstone floor of the church, allowed the excavators to propose a general date of the mid to late 6th century CE (and with evidence of an early/mid 7th century CE occupation as well) for the construction activities which produced the structures they uncovered (Tushingham 1972: 62-63). These dates align with the aforementioned absolute dating evidence produced from recent excavations at the site, and the architectural and object evidence underscore that during the Byzantine period, the community of Dhiban was actively engaging in, and involved with, the specific religious and prestige networks that have been discussed up to this point. It is likely that the Dhiban community *itself* chose to engage in these expressions of material solidarity with neighboring communities, as almost all Byzantine-period churches and baths in this area were largely funded and constructed through the initiative of individuals and communities, and not the "Byzantine state" (Di Segni 1999), although governors could sometimes serve as benefactors (MacAdam 1983).

The explosion of settlement and the subsequent connection of spaces of aggregated inhabitation (e.g. town, city, village, etc) had an effect on these communities' self-perception as well within this settled landscape. The archaeological evidence of the similarity of architectural styles and even features, such as baths, at Dhiban, to larger urban centers attests to the relationships between many of these settlements. Accordingly, some people in the province of Arabia (some parts of which later became Palaestina Tertia), imagined themselves explicitly to be part of a larger urban fabric, if the mosaics of the Byzantine churches at Madaba and Umm er-Rasas are illustrative of a larger sentiment (Bowersock 2006). The mosaic at the Church of Saint Stephen at Umm el-Rasas on the Dhiban plateau is particularly illustrative of these community imaginaries; the mosaic dates to 756 CE[12] and includes the names of each of the major cities of the area (such as Neapolis [Nablus] and Madaba: **Figure 4.5**) above stylized depictions of them. On the interior of this frame are also representations of hunting, fishing, sailing, and agricultural activities, which underscore the celebration of this community of the entangled urban - rural - agricultural nature of settlement in this area. Importantly, the mosaic does not include Dhiban. The lack of the mention of Dhiban in this mosaic, although the site of Dhiban was only 10 kilometers away from the community at Umm el-Rassas, highlights that each of the communities in this area was also accorded specific nomenclature within a hierarchy of settlement. Some cities received the title of *polis*

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[12] Although admittedly after the Byzantine period, and clearly in the Umayyad period, the date was predicated on the *Roman* date of annexation, 106 CE, even after the official absorption of this area into the Umayyad polity (Piccirillo 1988).

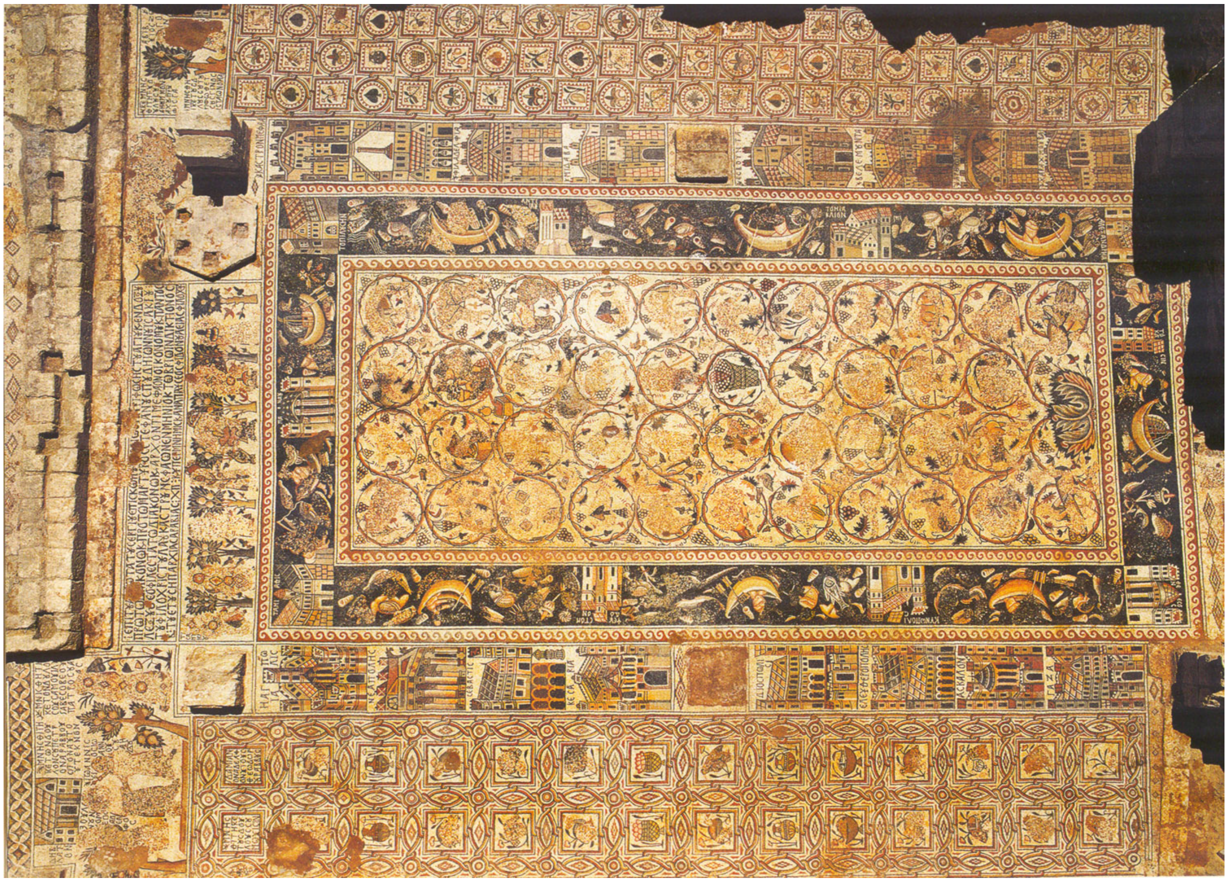

Figure 4.5: Mosaic of the Church of St. Stephen at Umm el Rassas (Bowersock 2006: 12).

("city": $\pi o\lambda\iota\varsigma$), and others *kome* ("village": $\kappa o\mu\eta$).[13] It appears that Dhiban was a *kome* during this period, as Eusebius lists it as a *kome pammagethes* ($\kappa o\mu\eta\ \pi\alpha\mu\mu\epsilon\gamma\epsilon\theta\eta\varsigma\ \pi\alpha\varrho\alpha\ \tau o\nu\ A\rho\nu\omega\nu\alpha\nu$), that is, a "large village astride the Arnon (Wadi Mujib)".[14] Despite the shared practices at Dhiban with nearby communities of conspicuous bathing structures, ornate architectural decorations, and religious practices, the fact that Dhiban is not considered a *polis* is indicative of the ways in which these political hierarchies could affect communities' imaginings of these inter-settlement relationships.

Although Dhiban was most certainly not a *polis* but a *kome* in this period, the farming communities (*komai*) dotting the landscape of these three provinces are critically important for understanding the nature of settlement in the area. Hirschfeld's (1997) nearly exhaustive study of the best published archaeological remains of *komai* in Byzantine Palestine (for him, corresponding to the State of Israel only), reveals several trends in architecture and archaeological features across all of the these settlements. Among the most important of these

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[13] For a detailed discussion of these distinctions, see Safrai 1994: 10-57 and Hirschfeld 1997: 34-39.

[14] Unfortunately the only surviving inscription from Dhiban, dating to the mid-3rd century CE (Tushingham 1955), does not list the settlement nomenclature used of Dhiban.

findings is that the layout of these villages does not seem to be due to institutional oversight, as there is a great deal of diversity in street plans and the absence of "coherent" (viz. orthogonal and rectilinear) street networks (Hirschfeld 1997: 61-62). The layout of Shivta (Soubeita) is exemplary of the lack of centralized planning in these villages – many streets and alleys terminate in "dead-ends" (**Figure 4.6: A**), and this organic layout is salient when compared to the rectilinear organization of the settlement of Shahba near Damascus, which Ball (1995: 204) inexplicably calls a "small country town", although it almost four times as large as Shivta/Soubeita (**Figure 4.6: B**).[15] In addition, the architecture of the farmhouses attached to these *komai* occur in a variety and range of styles and sizes, and do not appear to be standardized (1997: 67). As Hirschfeld has argued (2006: 64), an "[a]bsence of planning indicates both organic growth and a high level of autonomy. Apparently provincial authorities did not intervene in village affairs and organization". Therefore the well-preserved and well-researched "desert cities" in the Negev (Elusa, Rehovot, Nessana, Soubeita, Mampsis, and Sa'adon) can be used as an analogical microcosm of the phenomenon of near-autonomous agricultural life in Byzantine Palestine, when direct evidence from Dhiban itself is not available.

As it was noted, most of these *komai* contain multiple farmsteads, and in addition to these structures, almost all of the villages contain wine presses, oil presses, and large cisterns (Hirschfeld 1997: 50-53). Of these agricultural installations, those for olive (Frankel 1997) and wine (Mayerson 1985) are the most abundant. In contrast to Roman and Byzantine North Africa or southern France, there was a diversity of different olive oil and wine pressing technologies in the Byzantine period southern Levant that co-existed contemporaneously: lever and weights, lever and drum, and lever and screw (see Frankel 1997: 75). Moreover, the distribution of these different solutions to pressing grapes and olives did not overlap between regions, and seem to have indicated specific local traditions of manufacture (**4.7**). Indeed other archaeological evidence also points to increasing regionalism, such as the production of lamps, which da Costa (2007: 43) notes "from the mid-fifth throughout the sixth century in the southern Levant is the period of...the greatest number of [lamp] workshops distributing over relatively small areas". Although regionalism in craft and agricultural production seems to have been pronounced, the lengths to which these communities went in order to produce wine can be used as a proxy for the strong ideologies and desires that surrounded it. For instance, the wine produced in this region, and from the environs of Gaza in particular, became so well known that a poem by Sidonius Apollinaris (ca. 460 CE) laments that he has neither "Gazan" nor "Sareptan" wine available to his refined palate.[16] In an elegy of Justin II at the emperor Justinian's funerary banquet, the poet Flavius Cresconius Corripus praised the wines of "Sarepta...Gaza..and Ashkelon" for their "very fair snow white color and agreeable taste".[17]

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[15] As Segal (1985: 326) notes, "[i]n dealing with a town such as Shivta, it is difficult to speak of clear [street] axes. This terminology, appropriate for the planned networks of streets in Greek or Roman cities, does not apply to the complex of winding streets and alleys in Shivta."

[16] Vina mihi non sunt Gazetica, Chia, Falerna — Quaeque Sarepteno palmite missa bibas (Pieri 2012: 36)

[17] dulcia Bacchi — munera, quae Sarepta ferax, quae Gaza crearet, — Ascalon et laetis dederat quae grata

Figure 4.6: (A) A street plan of the *kome* of Shivta (Segal 1985: 320), where the scale is 50 meters, and (B) is a street plan of the settlement of Shahba, in Syria (Ball 1995: 205, Fig. 45), where the scale is 200 meters.

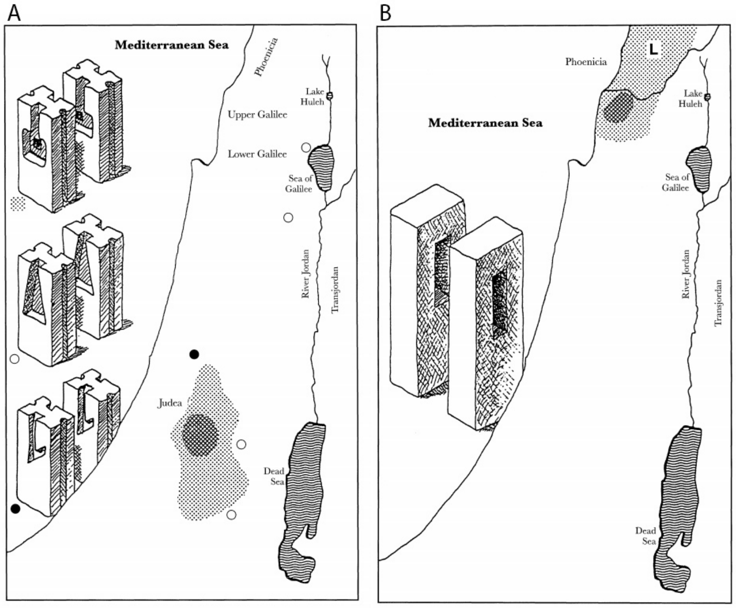

Figure 4.7: Differences in designs in olive oil press piers, where (A) represents slotted piers (Frankel 1997: Fig 4) and (B) represents Judean grooved pier press (Frankel 1997: Fig 7). Stippling represents extent of attested presence.

Figure 4.8: A Byzantine (576 - 578 CE) mosaic from a church in Kissufim, Israel, depicting a camel driver leading a camel loaded with amphorae presumably filled with wine (McCormick 2010: Fig 3.9).

Wine seems to have been so valued that enormous wine pressing installations are found in the aforementioned "desert cities" of the hyper-arid regions of the Nevev: nine wine presses alone have been located through excavation (Mayerson 1985: 74-75). Less than a kilometer outside the *polis* of Elusa (see **Figure 4.2**), a wine treading floor was uncovered associated with a wine press whose size was 33m^2, and the volume of the retaining vats ranged from 2.60m^3 to 8.80m^3, that is between 590 and 2000 gallons (Mayerson 1985: 77). The quantity of wine that these vats represented would have required an equally enormous number of grapes to be pressed, and yet these grapes would have had to be cultivated in an area with little precipitation (<100mm). As Mayerson (1985: 78) remarks "[i]t is certainly possible to speak of these presses, if not as industrial operations, then as corporate or cooperative ventures." The venturistic aspect of this widespread wine enterprise in the southern Levant is apparent considering the distance of the communities of the Negev, as well as the Dhiban and Karak plateaus, from the Mediterranean Sea (**Figure 4.2**). The Mediterranean sea was the primary conduit of exchange for communities in the area (McCormick 2012), as maritime transportation was the preferred mode of trade (Morrison and Sodini 2002: 207-9). Nonetheless, a mosaic from the site of Kissifum, five kilometers from the road connecting the Negev to Gaza, in the State of Israel, illustrates how communities distant from the sea, such as Dhiban and Elusa, could have managed such transportation. The church mosaic dating to 576-578 CE (McCormick 2012: 65) depicts a trader named *Orbikon* clutching what appear to be grapes in his (?) right hand, and pulling a camel laden with amphorae with his left (**Figure 4.8**). Therefore while regionalism in craft and trade production was high, the mosaic of *Orbikon* illustrates how community and imperial pursuit of certain plant and plant products bound communities together in their production and, as the mosaic indicates, their distribution.

The evidence of wine and oil presses, farmsteads, the organic arrangements of villages, and camel caravans, all point to a thriving and interconnected network of agricultural com-

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colonis...— prisca Palaestini miscentur dona Lyaei,— alba colore nivis blandoque levissima gusto (Corripus, *In Laudem Isutini Augusti Minoris* 3.85-97) munities in which Dhiban was embedded during the late Byzantine period. Nevertheless, these data do not indicate how these communities achieved the production of the plants that maintained and sustained these communities during this flowering of activity among the *komai*. Although reconstruction of the agricultural practices and specific production of cultigens of the Dhiban community at this time is one of the results of this project, there are two other complementary data-sets that can aid in the reconstruction of these practices, as well as establish expectations for the most recent paleoethnobotanical research at Dhiban itself: archaeobotanical and papyrological. The archaeobotanical evidence, although slim, will be discussed in detail in Chapter 6 within the context of the remains recovered from Dhiban during the most recent excavations. Until that point, it is noted that excavations at Hesban (Gililand 1986), Lejjun (Crawford 2006), Khirbet Faris (Hoppé 1999), Pella (Willcox 1992) and more recently Petra (Ramsay and Smith 2013), have all collected paleoethnobotanical material with varying degrees of representativeness (due to sample size and sampling strategy), that can be used to understand shifts in agricultural production during the Byzantine period. All of these sites, as it is shown in Chapter 6, record the presence of olive and grape in particular abundance, but also of wheat and barley (e.g. Lejjun: Crawford 2006). Importantly, much as in the evidence of the street layout of these *komai*, differences in the relative frequency of crops betweens sites seems to point to varying levels of autonomy in the production of agricultural goods. Considering the incomplete state of these data, the papyrological evidence from the Negev community of Nessana, serves as an exceptional complementary resource for understanding the nature of agricultural practice in the area.

The Nessana papyri, discovered in the course of the excavation of Nessana in 1935-37 (Colt 1962), are a unique source of information about Byzantine-period agricultural practice and production in the southern Levant as they date predominately to the late 6th through the late 7th centuries CE (Kraemer 1958)), and are a record of the minutiae of agricultural life recorded by members of the community of Nessana itself. Though the community of Nessana is almost 150km kilometers from Dhiban, the papyri provide a potential analog for the institutions that would have equally affected agricultural production and life at both settlements. Moreover, the papyri address three aspects of life for these communities that are difficult to detect using archaeological evidence alone: the specifics of taxes (Papyrus 39), agricultural yield (Papyri 40, 80, 82), and the role of irrigation, property, and the meaning-laden qualities of the land itself (Papyri 16 and 31). Thus far, this section has stressed that all of the archaeological data seem to indicate that the Byzantine period *komai* were relatively autonomous and self-organizing. Nevertheless, the way that that autonomy was achieved has not yet been made clear, especially since it is known that communities were taxed in agricultural products by the imperial elite to sustain large urban centers as well as the army (Kingsley and Decker 2001: 6-8). The Nessana papyri directly address the question of the imposition of taxes among these communities, as Papyrus 39 provides a list of several *poleis* in the mid 6th century CE, including Eboda and Mampsis, from whom taxes are extracted are in fractions and "carats" of *solidii* (Kraemer 1958: 120-121). Importantly, the assessment of taxes here is in coin (*solidii*), and not in kind (crops), although the latter may have been a valuation of these crops in cash. As Kraemer (1958: 123) points out through a correlation of the content of this papyrus with four related inscriptions from Beer Sheba (SEG 8.282 and Alt 1921: 5-12), the two groups of persons under taxation would have been the *limitanei* (border forces) and critically here, the *suntelstai*, or "the association of citizens responsible for seeing that tax quotas were met". That is to say, apart from the importance of tax being assessed *in coin* during this period, the taxes themselves would have been collected by an association of *citizens* in each of these communities, and not official representatives of the province. The fact that the Byzantine tax collection apparatus entrusted tax collection to a group of locals is one indication of how these communities may have retained a relative degree of autonomy in the internal organization of their communal affairs.

Although taxes may have been assessed and even collected in coin, Papyrus 40, dating to the early 7th century CE, indicates that wheat was often used as a form of salary (in the language of Papyrus 40: *eis trophia sitou*) and was also for sale (*eis prasin sitou*) to individuals, with varying weights used as a form of price (Kraemer 1958: 127: l.14 where wheat is sold to Patrikos at the weight of 1 modius, but 22 *modii* to Khallaf Allāh). From these disbursements, Kraemer (1958: 127) makes the additional argument that "wheat was the property of the community and that its disposition was in the hands of the officials in charge of the public granary". The crux of this argument is formed from the fact that the book-keeper is a local (*Patrikos*), and that all disbursements of wheat are in-community. If the official in charge of the granary is one of the members of the *suntelstai*, or local community, then it highlights the degree of control that this community maintained over its own production. In addition, Papyrus 80 records that wheat alone could serve as a donative to the local church. The multivalent uses of wheat, a cereal crop, attest to its significance both as an item of consumption but also as an item of imbued meaning. That these communities probably had direct control over its production and its distribution is doubly indicative of the importance of this plant to them. For instance, Papyrus 82 provides some of the most important evidence of the level of care and attention Byzantine farmers paid to their land, as it comprises an account of the wheat, barley and a legume (*arakos*) sown in various fields outside of Nessana. Based on the *modii* of wheat sown, Kraemer (1958: 237) has calculated about 5.36 to 24.12 acres per group of fields. In three of those fields, the amount of wheat sown was 40 *modii*, and the crop return was equal to or greater than 270 *modii* – almost 7 times the weight of the crop sown. A *modius* is about 8.7 liters, and therefore the return was nearly 2,400 liters of wheat seed on an initial investment of just under 350 liters of wheat seed. The very large returns on this wheat investment are evidence of the intensification of agriculture that researchers have sought to understand through proxy data, and which is elusive in the paleoethnobotanical record, as it will be shown in Chapter 6. This level of attention of the farmers around Nessana to these fields is further indicated by a papyrus dated to 512 that records a division of property (Papyrus 16); the farmers refer to fields *with personal names*, such as Alon and Airegla.

Finally, these papryi also indicate the extent of the land that was cultivated by the Nessana community. Papyrus 31 is a contract marking the resolution of a boundary dispute of adjoining plots of land dating to the 6th century CE. In it, the disputants refer to a "House of Abu Joseph son of Ḋubāb", which contains "ninety-six beds" as well as an upper story (see Kraemer 1958: 95-99: B/33-36). The ninety-six beds are probably for an as-yet undiscovered caravan-sarai of the kind that would have served groups of traders moving up and down the Negev in their transport of organic and inorganic goods. These are exactly the kind of traders depicted in the mosaic of Kissufim, where camel and other animal-pack caravans would have required places to rest in the desert heat. The papyrus also mentions the parceling of vineyards in plots with water channels that are overseen by specific individuals. The non-vineyard plots were located in a "dry garden" (*ξηροχηπιον*, xerokhepion) to the south of the town. Kraemer asserts that (1958: 101 n. 20) the latter might denote fallow land near the banks of wadis, in distinction to the land within the dry garden that is *θαχβισα* (thakhbisa), probably from the Arabic verbal noun takbisa "a filling up of earth" (Kraemer 1958: 101 n.28), referring to land repeatedly flooded and silted. The attention to both the quality and types of soil, the irrigation of vineyards specifically, as well as the fact that individual channels were owned by particular individuals who managed them directly, indicate that even in the absence of direct imperial involvement, the community at Nessana went to great lengths to ensure the intensive production of particular cultigens. From these papyri, it is expected that the irrigation of certain valued crops, especially wheat and grape, would be encountered at a similar and not-too-distant settlement like Dhiban.

In sum, the image of the Dhiban plateau and the area immediately around it in the Byzantine period, based on the cumulative evidence of building inscriptions, *kome* architecture, agricultural installations, mosaics, and papyri, is of a place of considerable movement across the landscape, wheat, grape and olive cultivation, potential autonomy in local village operation, and a high degree of care for agricultural fields. From the evidence compiled, it appears that the extent to which communities chose to engage in larger economic and prestige networks was ultimately at the discretion of the community, even while their involvement in these networks was predicated on their very existence. As Morrison and Sodini (2012: 181) note

> there seems to have been significant exploitation of agricultural potential, with an active rural population that worked the land with consummate skill refined by ancestral knowledge of nature [sic] and by the realization that the unceasing maintenance of these fields (clearing, terracing, rock removal, irrigation) was the precondition of the community's survival and the source of its well-being.

This is an important point to consider when the paleoethnobotanical evidence from Dhiban is presented in **Chapters 5 and 6**.

4.2 The Middle Islamic Boom and Bust

Much like the Late Antique period, the Middle Islamic period was also a pivotal time of agricultural florescence and increasingly prominent archaeological indicators of more intense inter-regional trade, especially long-distance sea-going trade, above all in the 14th century CE (Regourd 2004). In this respect, the Byzantine period and the Middle Islamic period are similar. In comparison to the Byzantine period in the Levant, however, the Middle Islamic period has been drastically under-investigated from the perspective of archaeology (see especially Walmsley 2008). As Bethany Walker indicates, until recently archaeological excavation of the Middle Islamic period has "been little more than an appendix in research that has traditionally focused on earlier cultures" (Walker 1999: 207). Despite the many material lacunae that would bedevil a coherent narrative constructed from archaeological evidence alone (Whitcomb 1997), the period spanning 1260 - 1550 CE is particularly rich in historical documents,[18] such as chronicles and annalistic sources of contemporary historians (Massoud 2007) as well as extremely detailed economic documents of charitable endowments (*waqf*, plural *waqfiyyāt*) and later Ottoman period economic and agricultural registers (*defter*, plural *defterler*, Bauden 2005).

There are several distinct periodizations of the span of time represented by the term "Middle Islamic" owing to the particularly turbulent political history of this period – Crusaders, Mongols, Turkic tribes, Circassian slaves, and local Arab groups all contributed, controlled, and commingled in the area stretching between contemporary southern Syria to the state of Egypt. In Levantine archaeological chronologies, the stretch of time associated with the Middle Islamic period lasts from 800 CE until 1550 CE (Walmsley 2008). Political histories often identify the Mamluk empire as beginning (Walker 1999: 203) when the last Ayyubid ruler of Egypt, al-Salih Ayyub, died during the Frankish invasion of Damietta in 1249 CE. His client military force, the *Bahriyya*, assumed power through a bloodless coup and established the Mamluk sultanate in Cairo (Walker 1999). This mercenary military force that assisted in this coup were called "mamluk" (from the Arabic root *mlk*), meaning "those who are ruled". The Mamluk elite who would later dominate Egyptian and Syrian politics as a virtual "ethnic caste", were the descendants of Kipchak and Cuman Turkic-speaking groups captured in raids from the steppe above the Ural and Caspian seas, who were enslaved, raised as Muslims, and then sold in Cairo (Haarmann 1988). The success of this slave-turned-soldier elite who later included enslaved people from the Balkans and the Caucasus mountains (Circassians), has been characterized as a "Mamluk phenomenon" (Ayalon 1979).

Despite the vicissitudes of its political inception, the Mamluk empire comprised the longest living autonomous state in Egypt after the Ottoman state. Shortly after the establishment of Mamluk political control in 1250 CE, the Mamluks secured their political hold over the area of "Transjordan" (Arabic *Bilād as-Shām*) after the battle of 'Ain Jalut against the Mongols in 1260 CE. The Mamluk Sultan Baybars absorbed this area after his subsequent campaign and victory against the remaining Ayyubid states and Crusader cities (Walker 1999). According to contemporary Western historians and then-contemporary Egyptian sources, it appeared that Baybars wished to secure interior caravan routes to Dam-

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[18] Somewhat tongue-in-cheek Carl Petry (1998: 51) provides the following quote from Stephen Humpreys' *Islamic History: A Framework for Inquiry* as an indication of this abundance: "Islamists like to complain about the state of their sources, but in fact what they have is extraordinarily rich and varied, far surpassing the miserable fragments which challenge the student of the late Roman Empire or early medieval Europe. The real problem is to use this patrimony effectively."

ascus from Cairo, as well as the important Muslim pilgrimage route (*Hajj*) to Mecca through the fortification of existing centers, such as Karak (Walker 2003: 243). While this periodization is expedient for the purposes of political history, Walker (1999: 207) emphasizes that "it does not do justice to the complex nuances of the region's social history" (Walker 1999: 207). The Mamluk elite were intensely and often personally involved in the economic operation as well as artistic development of the empire (Lapidus 1969: 1) – the physical remains of this extensive involvement can be seen in the tiles on the Dome of the Rock in Jerusalem, mosques across all of the cities within its territory, art, textiles, and the refurbishing of castles across Transjordan, such as Kerak (Walker 1999; Millwright 2008; Walmsley 2008).

The 14th century CE in particular is considered to be the most prosperous period in terms of agricultural production (Walker 2008: 80-1), and a virtual "golden age", based on a combination of documentary sources and building inscriptions (Walker 2003: 243-246). In contrast, the subsequent 15th century CE is associated with a series of decline narratives, much like the Byzantine period before it, centered around earthquakes, plagues, invasions, and bureaucratic land mismanagement (Walker 1999: 205; 2004: 119-120). The characterization of economic life in this period has been of a "boom and bust" (Walker 2004), especially in Transjordan, where different state-led initiatives and Mamluk regional officials precipitated dramatic changes in the agricultural landscape. An example of just such changes in economic fortune come from the site of Hisban (**Figure 4.9**), which was severely depopulated by the end of the 16th century, even though *waqf* documents indicate that it was thriving by the end of the 14th (Walker 2004: 133). Walker cites evidence from an Ottoman *defter* that indicates that by the early 16th century Hisban was a small village, by 1538 it was listed as the *only* small village in its district, and by 1596 it was listed as containing no permanently sedentary occupation (*khali*) at all.

The *waqf*, or charitable endowment documents, are a particularly important source of information in lieu of high-resolution archaeological data (of which, it must be emphasized, very little exists) to understand the larger political changes in which local farmers would have found themselves (Petry 1998). These endowments were often purchases of agricultural land and tracts held in perpetuity so that the profits derived from agricultural production could be used toward religious and social causes by the Mamluk elite (Walker 2011: 8-15). Cairo was the primary beneficiary of these endowments, and it has been shown from these documents that agriculture in the area of Transjordan largely financed most of the *madrasas*, or schools, in Cairo in the 14th century CE (Walker 2003: 244). By the 14th century CE, in fact, entire villages in Jordan were purchased by the *Bayt al-Mal* (the state treasury) to be used as *iqta'at* (tax farms, Walker 2007: 181). A synthesis of published *waqfiyat* in the work of Carl Petry as well as a monograph on late Mamluk land tenure by Imad Badr al-Din Abu Ghazi of Cairo University (Walker 2008: 87), indicates that despite their charitable intentions, most *waqfiyyat* were primarily profit driven rather than security-driven. Indeed the capital of Cairo was lavished with significant financial attention, and correspondingly consumed a great deal of the wheat, barley, and legumes produced by surrounding agricultural communities in Egypt and in Transjordan (Lapidus 1969).

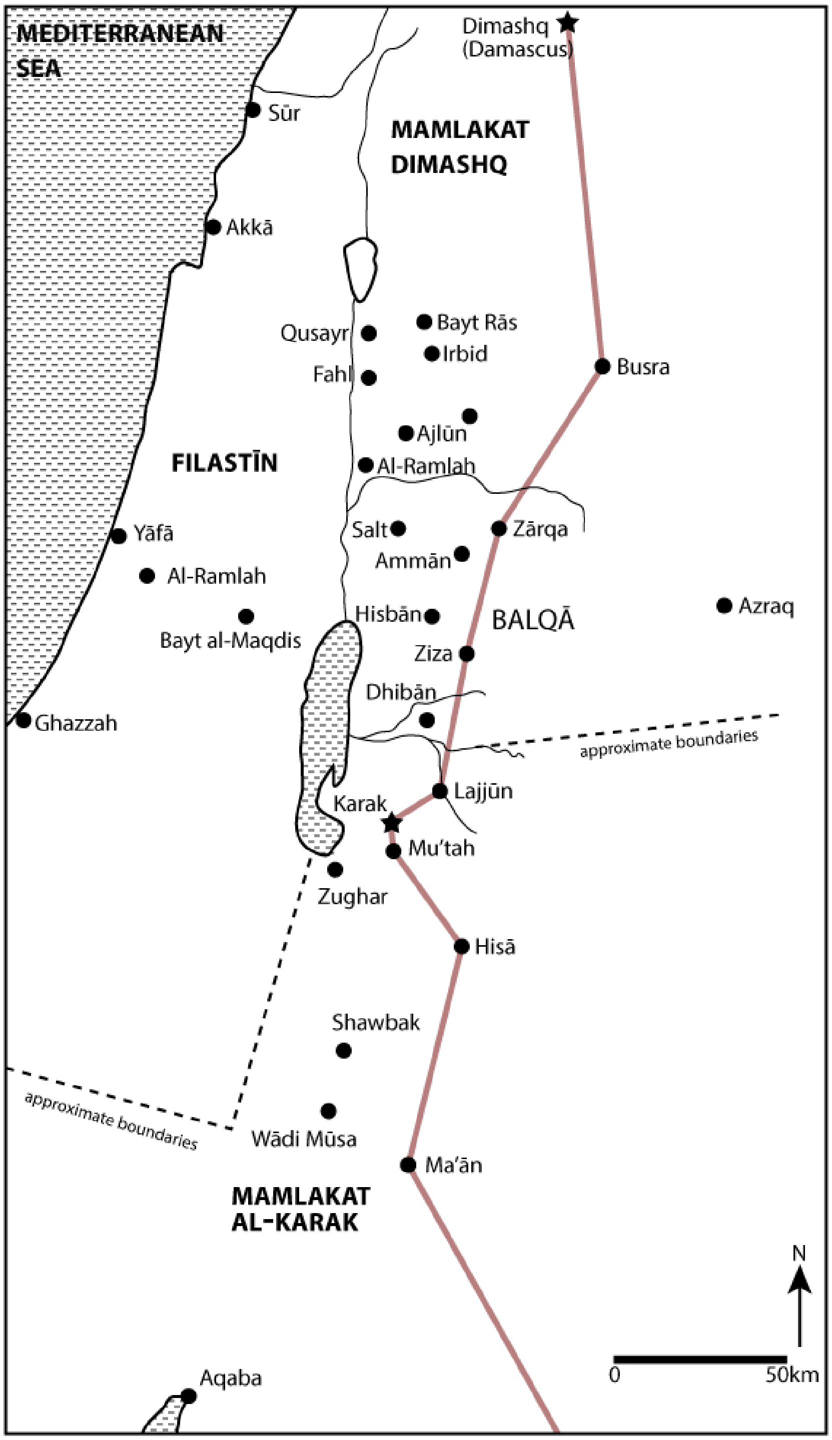

Figure 4.9: Dhiban in the Middle Islamic political landscape. The red line indicates the *Hajj* route, and stars indicate the capitals of the *mamlaka*, or provinces in bold, upper-case letters (adapted from Walmsley 2008).

Dhiban in the Middle Islamic Landscape

Thus, much like the earlier Byzantine period, the community inhabiting Dhiban found itself in a landscape and political climate that favored the intensification of agricultural production, particularly in the 14th century. Knowledge of the economic landscape of Transjordan in this period is indebted above all to the pioneering work of the historian Bethany Walker, who has tirelessly sifted through the Mamluk *waqfiyyat* and Ottoman *defterler* to provide an image of the agricultural changes that accompanied provincial redistricting, new managerial oversight, and shifts in land surveys (Walker 2011). Through her research, it has been possible to identify and understand how Dhiban's location in the Middle Islamic agricultural landscape was markedly different than in the earlier Byzantine period.

To begin, the area of contemporary Jordan was divided into two different administrative regions the *Mamlakat Karak* and the southern *safaqa* (district) of *Mamlakat Dimashq* in the north (Walker 2008: 79). The political and economic organization of Greater Syria (Walker 2003: 242) entailed the *mamlaka* (province), *safaqa* (district), and *'amal* (district). The capital of the smallest district would have been a *wilaya* or *niyaba* depending on the rank of its military governor. For example, the capital of the Balqā (a *wilayat*, or district) was Hisban, from 1300 to 1356 CE. As Dhiban was located on the boundary of these two *mamlakat*, control over this area by regional elites changed considerably as the southern border of the *Mamlakat Dimashq* shifted (Walker 2003: 242). Moreover, these new changes in the political and religious landscape meant that Dhiban now sat astride a major artery of communication between Damascus and Cairo, represented by the Hajj route (**Figure 4.9**). This combination of geographic and political factors had an impact on tax collection, discussed below, which in turn affected the daily lives of the farmers in this period.

The district of the Balqā, in which Dhiban was located, was famous for its wheat production among the Mamluk elite. For example, the historian al-Qalqashandi transmits a letter of an official who demands, in the early 15th century CE, that the leader of the *'ushran*, the local agricultural committee, of the Balqā, return it to the prosperity of former years (presumably the 14th century CE, Walker 2012:169). The area of Karak in particular commanded considerable political clout; the people of this region could bring sultans to power (Walker 2008: 79) through their support of some individuals over others, and thus it was a highly strategic area (Walker 2004: 132). Dhiban, on the border of this highly strategic area, would have been equally contested and desired by those Mamluk elite based in Kerak, who would have sought the support of this and other local agricultural communities.

Based on the accounts of agricultural land management in Egypt by then-contemporary historians, agricultural districts in the early years of the empire (the late-13th to mid-14th century) seem to have had the following general characteristics (Walker 2008: 80-82). First, they were overseen by a *muqtā* who was responsible for water management (irrigation, canals, dams, etc.) and had the legal right to use any labor source necessary. Nevertheless, the *muqtā* rarely interfered in the operations of planting and harvests, but left this to the *fellahun*, or local farmers. He relied on his agents (*wakils*) to collect taxes on these estates. In this respect, the *muqtā* served as an indirect liason between the imperial administrators based in

Cairo and the local communities which he oversaw, but with whom he did not often directly interact. That is to say, for the communities in Transjordan, taxation may have appeared to be an indifferent, distant, and obscure obligation. In contrast, some industries were subject to extremely tight state oversight, such as the sugar industry based in the Jordan valley, which was a state monopoly.

Most importantly, there was a tax on grains (*kharaj al-zira'ah*) that was paid in kind to Egypt by the communities around Dhiban, probably including Dhiban itself, and the resulting grain surplus could be used in times of need. The latter was a significant source of friction, especially in the area of the Balqā; part of the "bust" portion of the "boom and bust" economy, emerged when the state forced purchases of grain from communities in this area (known as *tarh*), even if communities did not wish to acquiesce. The result of this policy was several devastating grain riots both in Cairo who sought the grain (Shoshan 1980) and in many of the areas of Transjordan who did not want to yield (Walker 2003: 85-86), to the extent that local communities would often petition the governor of a *safaqa* to replace a *muqtā* or *mushadd* who was seen as egregiously abusing this practice (Walker 2003: 92-95).

Although agricultural oversight by the Mamluk elite in the latter half of the empire seems to have been indirect, and ultimately up to the local Transjordanian farmers, the situation began to change in the 14th century CE. This re-evaluation of agricultural land practices would have invariably affected Dhiban as well. Part of this agricultural re-evaluation was a cadastral land survey in 1313 CE (*rawk*) in the *Mamlakat Dimashq* used to reallocate land directly to the sultan, amirs (nobles), and members of the elite (Walker 2007: 178-179; Walker 2008: 81). As little documentation exists for these changes on the local level, that is, the specific changes that occurred to particular agricultural plots in the Balqā and surrounding areas, it is has been a longstanding question as to how this *rawk* affected agricultural production in Transjordan, particularly as the state came to control the territories within it more directly. As Walker notes, land owners would have been less autonomous in planting decisions, and the decisions of production would have been increasingly concentrated in the hands of the elite, leading to large estates based on the production of specialized cash crops (Walker 2008: 84). The concern of these managers for agricultural land is apparent from one late 14th century *waqf* document (796 AH/1393 CE) for the village of "Hay Malka" in the territory of Ajlun in northern Jordan; the register on the scroll records the topography, water sources, and taxable agricultural production of the village, as well as what fields, buildings, and olive oil installations had fallen into disuse, and their possibility for repair. It was noted that this village in particular was a major exporter of olive oil and wine (Walker 2008: 89).

In terms of crops and cultigens, communities in the Middle Islamic period seem to have been less concerned with the "Mediterranean suite" of cereal crops which prevailed in the Byzantine period, although they were heavily taxed as the *kharaj al zira'ah* and the food derived from the latter did comprise the majority of the diet of the population during this period. Increasing contact with Africa and South and southeast Asia through trade on the Red Sea led to a whole host of new cultigens which had previously never been grown in the region, and yet which became desired and gained new meanings for many of the communities in Transjordan (Walker 2004: 120-121). One of the most pronounced changes was the arrival of sugar (*Saccharum* sp.) in the Jordan Valley, which would have required intense labor to maintain, and which spawned a ceramic industry specifically for the storage of these items (the "sugar jars"; Walker 2003: 258-259). While the paleoethnobotanical data for Middle Islamic period sites in Transjordan is frustratingly limited, the port city of Quseir al-Qadim in Egypt (van der Veen 2011) might serve as a proxy for the magnitude and kinds of changes that accompanied new human and biotic networks during this time. At the site, it has been noted that there was a significant shift in foodways from the Roman to the Middle Islamic period (Cox and van der Veen 2008), where analyses of the sizes of recovered watermelon (*Citrullus lanatus*) seeds as well as distinct breakage patterns on them indicated that the latter were actually *eaten* during the Middle Islamic period and not in the earlier Roman and Byzantine period. As the authors note (2008: S186), the mention of watermelon as a desired food in contemporary documents occurs only from roughly the 13th century CE onward. Therefore changes in the kinds and the manner of foods and culinary preparations had considerable social and political implications (Levanoni 2005), and there are even documents which indicate that over time there was a preference for locally produced bread, or *al-khubz al-baytūtī* (Levanoni 2005: 210). From the 14th century onward, the community at Dhiban would have found itself in a position where the Mamluk elite increasingly sought specialized cash crops, above all cereals, from the community, but it was also a period in which new kinds of foods and plants would have been made accessible to it due to these new political, economic, and religious networks.

4.3 Hypotheses, Expectations, and Summary

Thus it is evident that there were both similarities and differences in the organization and plant management techniques and ideologies of these two empires, even though they occupied roughly the same area of the intersection of southwest Asia and the Eastern Mediterranean: the Levant. A comparison of the major features of these polities discussed above is provided to more easily identify these major variables (**Table 4.1**). In summary, while the elites of both empires seem to have sought to increase agricultural production, the mechanism of that production, that is the institutions that facilitated and oversaw it, seem to have been very different. In the Byzantine period, there is little evidence for direct top-down coercion of communities in the Levant to produce the plants desired by imperial elites, at least in the 5th through 7th centuries CE. Tax collection was at the level of the local community, and the variation in village architecture, street layouts, farmsteads, and even olive and wine press design attest to this autonomy. In contrast, in the Middle Islamic period, 14th and 15th century CE Mamluk elites directly oversaw and sometimes personally intervened both in the planting and harvesting decisions of local communities, as well as the collection of taxes in kind. State coercion could lead to friction between the communities and the bureaucratic elite, resulting in riots. While the large, urban centers of both empires (Constantinople in the Byzantine period, and Cairo in the Middle Islamic period), needed external sources of food, primarily grain, the available evidence indicates that the kinds of crops grown

Table 4.1: Comparison of Major Features of Imperial Interventions in Levant

	Byzantine	**Mamluk (Middle Islamic)**
Duration	320 - 650 CE	1260 - 1500 CE
Capital	Constantinople	Cairo
Agricultural Intensification?	Yes	Yes
Marginal Areas Farmed?	Yes	Yes
Crop Concentration	Grape, Olive, Wheat	Wheat, Barley, Olive
State Taxation	Province-level	Province-level
Agro-pastoralism?	No (?)	Yes
State Religion	Christianity	Islam
Settlement in Levant	Intensive	Patchy
Bath Complexes?	Settlement-wide in Levant	Elite residences only

were different between these two periods. There is no evidence of Negev-like settlements in the Middle Islamic period, where communities occupy environmentally challenging zones to produce a limited range of plant derived goods (in the case of the Negev cities, it is wine and olive oil). Instead, there was probably a wider range of foodstuffs available to Middle Islamic period communities due to newfound trade and economic networks, confirmed by the hitherto unseen consumption of watermelon seeds in the Middle Islamic periods.

Considering these similarities and differences, the insights from the above narratives can be combined with the paleoecological information from Chapter 3 to explicitly set out hypotheses for the kinds of archaeological data that would be expected to be found in the site of Dhiban during these two periods. For example, given that the palecological proxies indicate an expansion of *Olea* (olive) during the Byzantine period in the southern Levant, and that archaeological research in same region has located an explosion of olive presses at the same time, it can be hypothesized that such remains should be found at the site of Dhiban as well.

To reiterate, the two research questions are:

1. Were the depositional practices of successive communities on the *tall* of Dhiban qualitatively and/or quantitatively different from each other?
2. Do the presence and quantity of specific agricultural crops in temporally distinct archaeological deposits correlate to any given imperial intervention?

To address these research questions, multiple working hypotheses can be offered (*sensu* Chamberlin 1965). The first research question raises the issue posed by historical ecology (in Chapter 2) of the *unevenness* of impacts of subsequent communities, but at the resolution of local practice. It is hypothesized (Hypothesis 1) that due to ultimately similar goals by both of these communities separated by time (an increase in agricultural production), the depositional practices of successive communities will be similar. The archaeological data to determine this are the physical residues of the outcomes of the agricultural practices themselves: carbonized crop, weeds, and chaff remains. Although the specific expectations for the significance of each will be covered in the following chapter, it might be expected that, given that the available archaeological and historical data indicate that both the Byzantine period and Middle Islamic period communities were concerned with cereal production, archaeological evidence of that cereal production in the form of relatively high proportions of chaff remains, will be found in both periods. If, in contrast, high proportions of crop or weed remains are found, a) crop remains might point to more consumption on the site or a greater scale of production (avoiding, for the moment, the vexed question of identifying production and consumption in paleoethnobotanical remains), while b) more weed remains might point to more agro-pastoralism through animal grazing (discussed in the next Chapter) or through crop processing.

The second research question seeks to assess the influence of these individual empires on the local community at Dhiban, and the ways in which each community negotiated the now well-established demands of each imperial polity. It is hypothesized (Hypothesis 2) that the communities at Dhiban will resemble the archaeological sites or historical data for nearby areas, such as the communities of the Negev in the Byzantine period. In particular, it is hypothesized that in the Byzantine period, more paleoethnobotanical remains of a) olive (*Olea* sp.), grape (*Vitis vinifera*), and wheat (*Tricium* sp.) seeds will be uncovered, considering the proliferation of evidence indicating the existence of institutions and installations, based on the procurement and processing of these crops during this period. In contrast, in the Middle Islamic period, it is hypothesized that more remains of a) wheat (*Tricium* sp.), b) barley (*Hordeum vulgare*), and perhaps olive pits will be found. While the first two items (a-b) are expected given the evidence supplied by the *waqf* endowments for the grain-producing reputation of the Balqā as well as the tax in kind on grains, the final item (c) is motivated by the fact that olive production in the Middle Islamic period is noted both in Hisban and in cities in northern Jordan.

With these hypotheses now established, it is possible to turn to current excavations at the archaeological site of Dhiban, and the methodologies and quantitative frameworks needed to extract the paleoethnobotanical data used to address these research questions.

Chapter 5

Depositional Histories and Formation Processes of Archaeological Contexts at Dhiban

> Everyday life consists of the little things one hardly notices in time and space. The more we reduce the focus of vision, the more likely we are to find ourselves in the environment of material life: the broad sweep usually corresponds to History with a capital letter, to distant trade routes, and the networks of national or urban economies. If we reduce the length of the time observed, we either have the event, or the everyday happening. The event is, or is taken to be, unique; the everyday happening is repeated, and the more often it is repeated the more likely it is to become a generality or rather a structure. It pervades society at all levels, and characterises ways of being and behaving which are perpetuated through endless ages.
> - Braudel 1981: 29

To generate the data needed to confirm the hypotheses set forth in Chapter 4, or at least eliminate alternatives, the elements of a threefold approach to the archaeological material recovered at Dhiban are presented in considerable detail in this chapter. This approach, while not necessarily novel in its individual components, is a synthesis of a number of different recommended approaches to paleoethnobotanical field research. First, systematic sampling of archaeological deposits is needed in order to recover the quantifiable paleoethnobotanical remains that will be able to address the hypotheses generated by the combined historical narratives surrounding the Byzantine and Magmluk empires (Chapter 4), as well as what is known about the paleoclimate and paleoecology of the Dhiban plateau (Chapter 3). The archaeological contexts that form the sampled areas from which paleoethnobotanical remains were recovered at Dhiban, are therefore discussed in detail. The sampling strategy of any paleoethnobotanical study is argued to be the core of the methodological apparatus that allows for inferences to be made (e.g. Jones 1991). The second step of this three-fold methodology is the identification of the formation processes of the carbonized botanical remains in order to assess whether the contents of different samples from different archaeological periods are comparable. The latter will constitute the majority of the work of this chapter, as the processes that led to the formation of the sampled deposits are *as informative* about cultural practices as the paleoethnobotanical contents of these deposits themselves. In doing so, it advances the comprehensive argument of this chapter – that is, to consider depositional history as a kind of history of daily practice, especially since the botanical contents of these samples are filtered through routine agricultural practice.

The simple, yet challenging, question that paleoethnobotanists must first answer when undertaking any analysis is: why are the archaeological botanical remains carbonized (Minnis 1981; Miksicek 1987; Fuller and Weber 2005; van der Veen 2007)? The second and following interrelated question is: how did they become deposited in the area in which they are encountered (i.e. sampled)? For instance, if a deposit's contents are formed through the burning of dung fuel of domesticated ruminants, then the contents of that sample reflect the dietary habits of non-human animals (Miller 1984; Reddy 1998). That sample, therefore, can not be directly compared to a hypothetical sample collected from a burned storeroom – the contents of such a sample (or samples) would represent human food. The two samples are thus fundamentally incompatible; they can not be compared to determine if differences in sample contents (i.e. botanical remains) reflect differences in human food consumption practices (Miller and Smart 1984; Jones 1987). In analyses of change in agricultural practice through time, the problem is particularly acute as *depositional practices* might change both in *content* and in *context*. Both are intimately associated with the specific historical and cultural dispositions attendant to the individuals populating those communities - or *habitus*, which Bourdieu formalized as "principles which generate and organize practices and representations that can be objectively adapted to their outcomes *without presupposing a conscious aiming at ends* or an express mastery of the operations necessary in order to attain them." (Bourdieu 1992: 53, italics added).

The "principles" which organize these practices are not necessarily salient to the conscious experience of the people engaging in them. They represent the embodied dispositions and socialized ways-of-being (bundled together under "culture") that are the objects of study of many in the social sciences. Some analyses of stratigraphy, by extension, are beginning to recognize the inherently "social" aspect of deposit formation – that is a recognition that "deep stratigraphic deposits...are the materialization of repeated practice, their repetition the evidence of human dispositions and intentions" (Joyce 2008: 36).[1] It is unsurprising, then, that in Eurasia, judging by the number of publications and the research contents of them, a focus both on site formation processes (*sensu* Schiffer 1987) and people's practices (*sensu* Bourdieu 1972) have come to the fore. There has been an increasing recognition that archaeological deposits are formed through practices situated in particular places, times, and *habitus*. In Mesoamerica, paleoethnobotanists are also beginning to consider "archaeobotan-

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[1] The latter is clearly echoed by McAnany and Hodder (2009) who also explicitly call for a "social stratigraphy" - that is a deposit-focused approach to archaeological contexts focused on the historical and contingent practices of past people embedded in their cultural *habitus*. Nevertheless, the authors consider geological models unproductive, and see the Harris Matrix as "loosen[ing] the chains of codependency". It is not readily apparent why different disciplines can not be collaborative, and must be adversarial.

ical remains as connected to social practices situated in time and space, rather than only as broad trends that generalize a people's economy or ecology" (Morehart and Morell-Hart 2013: 5). As these deposits are sequentially overlain through the "Law of Superposition" (ignoring for the moment N-transforms which might disturb this arrangement; Miksicek 1987: 230-233), they therefore encode a *historical sequence* of practices. Thus, as the *habitus* that is structured and reproduced through the deposition of carbonized botanical remains is a "product of history" (Bourdieu 1990: 54), in that these remains represent specific ways of filtering practices and deposition taught to particular individuals at specific moments in time, so then does the untangling of depositional origins provide a *history* of its own: namely a history of botanical practice. The importance of the recognition of viewing formation processes as a history of practice has only begun to be embraced by the wider paleoethnobotanical community (e.g. van der Veen 2007; Fuller et al. 2008).

As a result of the practice-based origin of deposition, paleoethnobotanists have illustrated, in several areas of the world, that researchers employing environmental archaeological data sets can not uncritically assume that the botanical remains found in a given archaeological deposit directly correlate to the past surrounding vegetative landscape from which they were obtained (e.g. for wood charcoal: Asouti and Austin 2005:4) That is to say, a dense concentration of wheat (*Triticum* sp.) seeds in a given sample does not indicate the *frequency of occurrence* of wheat plants in the past living landscape. This is because aforementioned human agency and intentionality mediate the original living assemblage used by past people, and the patterned deposits which archaeologists uncover (**Figure 5.1**). Thus archaeological deposits sampled by paleoethnobotanists and archaeologists more broadly are not static repositories of inert environmental (or other) data altered by human agency *post hoc*, but are the byproducts of continuous interaction of past communities with the site, through the cultural practices of sifting, sorting, moving, digging, burning, dumping, and countless other routine activities. Therefore the goal of this chapter is to illustrate how paleoethnobotanical data can record such changes in practice, and why a rigorous sampling strategy is needed to detect this at the level of the archaeological site.

5.1 Identification of Depositional Practices - Competing Models

It is then the task of the paleoethnobotanist to disentangle the potential depositional origins of the carbonized botanical assemblage that is sampled and under analysis, both in order to assess the fundamental comparability of samples, as well as to provide insight into the deposition of these historical products. In southwest Asia, indeed almost across the whole of Eurasia, the empirical side of this issue has come under intense scrutiny by archaeobotanists since Gordon Hillman's pioneering ethnographic study of agricultural production at the Turkish village of Aşvan in the 1970s (Hillman 1973a, 1973b). In his ethnography, Hillman recognized that each stage of crop processing produced discrete associations of different

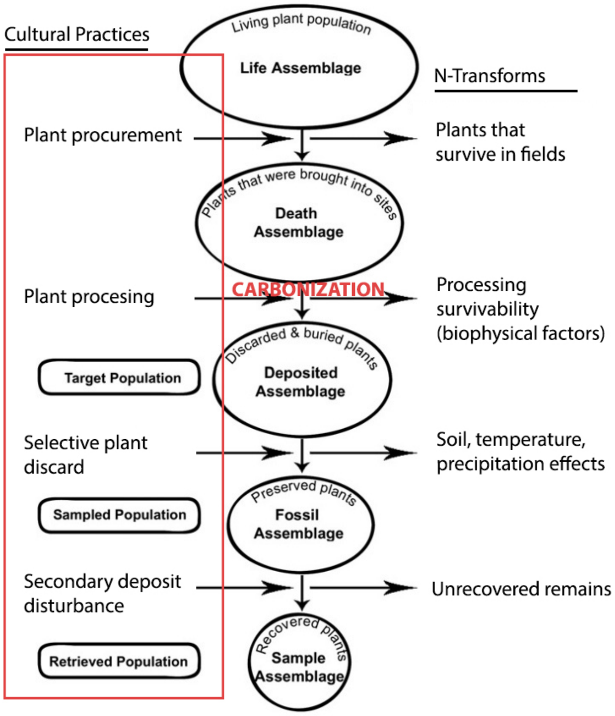

Figure 5.1: Schematic overview of the cultural filtering processes involved between the living plants once present in the landscape, and those remains found in archaeological deposits (adapted from Lee 2012: 652, Fig 2).

kinds of crops, weeds, and chaff remains, and that these associations could in part be used to reconstruct prehistoric and past agricultural activities from the archaeobotanical remains recovered on archaeological sites (Hillman 1981,1984). This approach, the "external" model, was then verified statistically (using linear discriminant analysis and hierarchical clustering) by Glynis Jones in her own ethnographic investigation of crop processing by the communities living on Amorgos, Greece (Jones 1987; Jones and Halstead 1995).

The use of ethnographic, or ethnoarchaeological, analogy was an alternative to the "internal" model advocated by Dennell (1974, 1976), who sought to identify the origins of archaeological plant remains in their archaeological context, i.e. plant remains found inside of a pit were *ipso facto* evidence of the kinds of plants stored in pits, and were indicative of their economic importance (Dennell 1976: 235). While Dennell's perspective was foundational in encouraging paleoethnobotanists to move beyond subsistence reconstruction (Jones 1985), more recent considerations of the formation processes that affect paleoethnobotanical remains (Miksicek 1987: 226) illustrate the danger of such assumptions using the distinctions of primary and secondary refuse developed by Michael Schiffer (1971, 1987: 58-9). As Miksicek illustrates, plant remains can enter into a pit that was once used as a storage receptacle, but has been re-purposed as a trash-dump or midden. To provide a more concrete regional example, a paleoethnobotanical analysis of material recovered from Tel Kedesh in the state of Israel, showed that the botanical contents of a trefoil jug uncovered at the site contained seeds that dated to 158 - 134 BCE (for two *Vicia*-type seeds) and 435 - 492 CE (for the biogenic carbonate pericarp of a Boraginaceae achene, Borojevic 2011: 837-838). Nevertheless, the vessel itself dated stylistically to the 3rd and 2nd centuries BCE. Using these dates and the presence of archaeological land-snail shells, it was argued that some form of bioturbation had happened *in the past* during which botanical elements from the 5th century CE landscape entered into a deposit formed six hundred years earlier. Therefore a mechanistic interpretation of the presence of Boraginaceae "inside of a trefoil jug" would have missed both the human and non-human formation processes that led to the intrusion of these temporally later materials.

The evolution of these frameworks continues in the two predominant models of identifying depositional practices in this geographic area: the *context* model and the *content* model. In the *context* model, the archaeological context of archaeobotanical remains aids the identification of the depositional origin of each sample. This model has been most recently advocated by Lennstrom and Hastorf (1995), who used the archaeological site of Pancán in Peru to illustrate that in order to understand whether the botanical remains found in archaeological hearths were *in situ*, it was necessary to extensively sample the surrounding deposits. While it may appear to be an extension of the "internal" model of Dennell, the authors are very careful not to assume that the botanical remains found in each context necessarily correlate to the *de facto* discard of botanical remains. For example, they note in the case of a pit with a unique artifact assemblage that "the pit [plant] contents are most similar to the plant remains recovered from the fill below", and thus point attention to the fact that "correlations or interpretations of the plants from the pits alone can be spurious" (Lennstrom and Hastorf 1995: 709-710). Although the archaeological context was useful in calibrating expectations of the kinds of plant material that *might* be present, it was ultimately the comparison of the content of the two adjacent samples (fill and pit) that illustrated that the pit contents did not likely represent *in situ* or *de facto* discard of them.

The latter is the primary argument of the second model, the *content* model, advocated by Fuller, Stevens, and McClatchie (2008), who "question why we should assume any relationship between context and archaeobotanical assemblage at all". In the *content* model, associations of different taxa *within* each sample as well as their relative proportions serve as indications of their ultimate origins (Stevens 2003; Bogaard 2004). Although not to this same extreme, but in a similar vein, Marijke van der Veen has recently (2007: 968) called for "[a] detailed understanding of the formation processes of each sample and assemblage", where interpretation must occur at the level of the sample since "the complexity of the archaeobotanical record is such that only an analysis that takes account of this complexity can hope to succeed" (van der Veen and Jones 2006: 222). The impetus for a higher-resolution approach to formation processes via the analysis of singular samples is motivated by a comprehensive meta-analysis of archaeological sites in North Africa that contain *both* dessicated and carbonized remains. Using this singularly unique situation, it was possible for van der Veen to compare the relative proportions of dessicated versus carbonized remains within each archaeobotanical sample, as well as to asses what kinds of botanical remains (and taxa) are more likely to become carbonized versus dessicated (van der Veen and Tabinor 2007; van der Veen 2007, 2010). The latter provides an observational counterpart to experimental research which has identified which plant parts from southwest Asian cereals (mainly *Tricitum* sp. and *Hordeum* sp.) are more likely to survive various burning regimes and different combinations of temperatures, exposure (oxidizing versus reducing), and heating times (Boardman and Jones 1990; Braadbaart 2008)

One of the most relevant findings of van der Veen's meta-analysis to this study is that in the five North African sites that contained both dessicated and carbonized remains within the same sample, the median proportion of cereals that were carbonized out of the total recovered botanical assemblage was 55%.[2] As Fuller and Stevens have noted (2009: 40), the majority of carbonized paleoethnobotanical assemblages found at archaeological sites across Eurasia are very similar in the kinds of plant parts that are preserved. The latter is reflected in the proportions of carbonized to dessicated remains at North African sites (van der Veen 2007: 978). The most commonly carbonized remains are grains, chaff, pulses (legumes), and wild plants (or agricultural field weeds). In these North African sites (van der Veen 2007: 987), the more delimited range of carbonized remains among the total range of botanical remains that *could* be recovered (and which are preserved for comparison in a dessicated state), indicates that these remains were used as a fuel first, and that the others were burnt both in accidental and deliberate fires. Experimental research on charring modern *Triticum* plant parts has shown that grains, for instance, exhibit the widest survival conditions within fires albeit with different states of distortion (Braadbart 2008). Yet in thinking about the effects of carbonization on which plant remains survive the carbonization process, bread wheat (*Triticum aestivum*) and barley (*Hordeum vulgare*) are the first to become carbonized, and the first to be destroyed at 350°C (Boardman and Jones 1990: 4-5). Both straw (culms and grass stems) and the rachis remains of free-threshing wheats disintegrate at 300°C after five hours, especially under oxidizing conditions (Boardman and Jones 1990: 4-5). Reducing conditions, however, delay both carbonization and destruction considerably, with most cereal plant parts surviving up to 550°C. In short, the kinds of remains that might be more illustrative of food and culinary practices, such as fruits, oil rich seeds, herbs, parenchymous plant parts (corms, tubers, etc.), edible leaves, and thin-shelled nuts are less likely to survive carbonization (Miksicek 1987: 220), unless the method, duration, and temperature of carbonization is favorable.

Therefore the formation processes that affect the recovery of remains involve characteristics inherent to the biology of the plant remains, in that different plant parts react to different oxidizing and reducing carbonization regimes, and extrinsic to the biology of them, in that different cultural practices selectively filter certain byproducts which are then deposited. The cultural practices that considerably skew the distribution of kinds of plant parts encountered

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[2] It is difficult to calculate the exact proportion of cereals as van der Veen only provides a table of the raw data, and not of the operationalized data which leads from the raw data to the graph presented. Nonetheless the four data points of the proportion of carbonized *Hordeum vulgare* are indicative: 92, 57, 53, and 20% of the total *Hordeum* assemblage.

in paleoethnobotanical assemblages in southwest Asia are the effects of crop processing and foddering practices. With respect to the former, it has long been established in studies of Eurasian agricultural production that the crop-processing sequence dramatically effects the recovery of very specific kinds of remains, such as cereal rachises, as it filters plant components based on their physical attributes. Numerous authors have proposed a relatively stable sequence of crop-processing (Hillman 1981; 1984) stages with expectations as to the outcomes of archaeobotanical material produced during each stage, using different measures and abundances of archaeobotanical material. The most commonly employed metrics are the presence and absence of different sizes of weed remains (Jones 1987, 1990; Stevens 2003), the association of certain kinds of crops due to impurities in field sowing and threshing (Jones and Halstead 1995), and the relative proportions of these items (e.g. weed seeds to cereals; van der Veen and Jones 2006). Each metric further reinforces the observation that the deposits that paleoethnobotanists encounter in Eurasia (and indeed, globally) can *not* be simply assumed to contain carbon-copy records of past practices, but are themselves filtered by these practices, and by the differential preservation of seeds and other parts of these plants through carbonization. Thus the assemblages that paleoethnobotanists encounter in their analyses of past agricultural societies in Eurasia, if not everywhere, represent a highly filtered subset of the total range of plants that would have been in circulation, and are more representative of some activities and not others. The fact that most archaeobotanical remains are filtered by events leading from and involving agricultural production, moreover, in turn means that they are excellent indicators of “agricultural practices, including the role of animals in the farming system, animal diet, and the use of crop by-products as fodder, bedding, temper, etc.” (van der Veen 2007: 978).

The last major entangled biological and cultural formation process that significantly affects paleoethnobotanical material in southwest Asia in particular is the aforementioned “animal diet and role of animals”. The role of animal diets in generating paleoethnobotanical assemblages only arose with Naomi Miller’s (1984a, 1984b) seminal recognition through ethnographic observation that dung was often used a fuel source by communities living in semi-arid areas with limited access to woody plants remains, especially in South and Southwest Asia. The undigested plant remains eaten by ruminants such as sheep, goat, cattle, and donkey could be carbonized if incorporated into “dung cakes” used as fuel, which is still a common and at many times a preferred source of fuel in India (1998) and Turkey (Anderson and Ertug-Yaras 1998). In Central Anatolia, for instance, each variant of dung fuel from different animals, and intended toward different fueling ends, receives its own name (Anderson and Ertug-Yaras 1998: 100). A voluminous literature has emerged to track this potential source of botanical material using paleoethnobotanical material alone (Charles 1998; Jones 1998; Derreumaux 2005) and also through experimental work (Valamoti and Charles 2005). An entire fascicle of the 2013 *Journal of Environmental Archaeology* has been devoted to the issue of the identifiability of dung fuel and species identification of dung remains. Among the most important studies is a recent experimental study of Valamoti and Charles (2005: 531), which has illustrated that glume wheats such as einkorn (*Triticum monococcum*) are completely broken down in the digestive system of caprids, whereas fig

(*Ficus carica*) seeds and chaff survive without distortion. A thorough study of the same issue through comparison of almost all published experiments involving sheep and goat seed digestability arrived at a similar set of taxa that survive the guts of ruminants (Wallace and Charles 2013), and yet these studies have not yet included systematic investigation of the survivability of free-threshing wheats. It is still not empirically verified as to whether these remains could survive the digestive system of a ruminant, and if so, in what condition.

Distinguishing animal fodder from fuel is therefore a crucial issue to determine whether the remains under investigation were used for food, fodder, or fuel, and there are two primary methods for achieving this. The first is a four-fold checklist proposed by Miller and Smart (1984) who assess the feasibility of botanical remains being the result of dung fuel through 1) assessing the availability of wood in the archaeological landscape, 2) determining if there were dung producing animals from which dung might be easily collected, 3) finding pellets of burnt dung, and 4) the recovering samples from hearth contexts containing such items. While the latter assumption might be challenged due to the fact that the contents of hearths might be secondary or tertiary refuse, the first two items are important baseline considerations in any paleoethnobotanical study. In Dhiban, for instance, both of these criteria are satisfied. While the plateau probably contained more woody vegetation in the past than is visible in the landscape today (Chapter 3), it still would not have been as abundant as similar Mediterranean areas with more precipitation. Second, there have been several different kinds of domesticated animals that produce an abundance of dung and which have been present at many points in Dhiban's history, such as sheep, goat, donkey, and camel. Other ways of distinguishing fodder from fuel include whether or not the non-crop species are consistent with what is known from the crop-processing model (Charles 2003: 115), whether the grain to chaff ratio is low (based on the ethnography of Anderson and Ertug Yaras who record more quantities of chaff than cereal in dung), and the biology and ecology of the plants themselves (Charles 2003: 121).

Given the many intersecting factors that affect deposit formation, the following is a synthesis of this research for the identification of different potential inputs of crop processing, dung fuel, and other routes of entry into the paleoethnobotanical assemblage. While not every single index will be used in this study, it is important to consider the full range of the potential inputs into a paleoethnobotanical assemblage (**Table 5.1**): As can be seen in **Table 5.1**, the four primary routes of entry which generate paleoethnobotanical remains in southwest Asian archaeological sites are labeled items "A" through "D". Each contains a subset of that particular process which provides a more detailed stage in the sequence of the origin of a sample (e.g. C-1 represents "Early Processing" within the "Crop Processing Byproduct"). Each of the formation processes also contains corresponding paleoethnobotanical expectations such as the density of seeds, the specific ratios of recoverable plant parts associated with each, and the proportions of the kinds of remains expected (e.g. "weedy" taxa versus rachis remains). The authors whose contributions from which these specific ratios are derived are also listed. The sequence of activities and archaeological contexts which are represented by these indices is displayed in **Figure 5.2**. This diagram schematically displays the exact sequence of the four primary routes through which a particular

Table 5.1: Models of Routes of Entry of Carbonized Botanical Remains and Paleoethnobotanical Expectations

	Formation Process		**Seed Density**	**Deposit Formation**	**Associated Ratio**	**%Crops**	**%Weeds**	**%Rachis**	**%Straw**	**Reference**
A	Direct Food Remains		Very High	Rapid	(#) Seeds / Liter (l)	Very High	Low	Low	Low	
B	Accidental Food Spillage		Low	Slow	(#) Seeds / Liter (l)	High - Med	Low	Low	Low	van der Veen and Jones 2006: 223; van der Veen 2007: 987
C	Crop Processing Byproduct									
C-1		Early Processing	Variable	Variable	Culm nodes to grain	Low			High	van der Veen and Jones 2006: 223; van der Veen 2007: 987
C-2		Early Processing	Variable	Variable	Free-threshing rachis to grains	Low		High		Stevens 2003: 68; van der Veen and Jones 2006: 223; van der Veen 2007: 987
C-3		Sieving	Variable	Variable	Small to Large Seeds		High			van der Veen and Jones 2006: 223; van der Veen 2007: 987
C-4		Late Processing	Variable	Variable	Weed Seeds to Cereal	Low	High			van der Veen and Jones 2006: 223; van der Veen 2007: 987
D	Dung or Fodder Byproduct									
D-1		Dung Fuel	Variable	Variable	Seed to Charcoal (# / #, #/ g)	Low	High			Miller 1984, Miller and Smart 1984
D-1		Dung Fuel	Variable	Variable	Grains to culm nodes	Low			High	Charles 2003
D-2		Foddering Intensity	Variable	Variable	Weed (Wild) Seeds to Cereal	Low	High			Marston 2011: 199

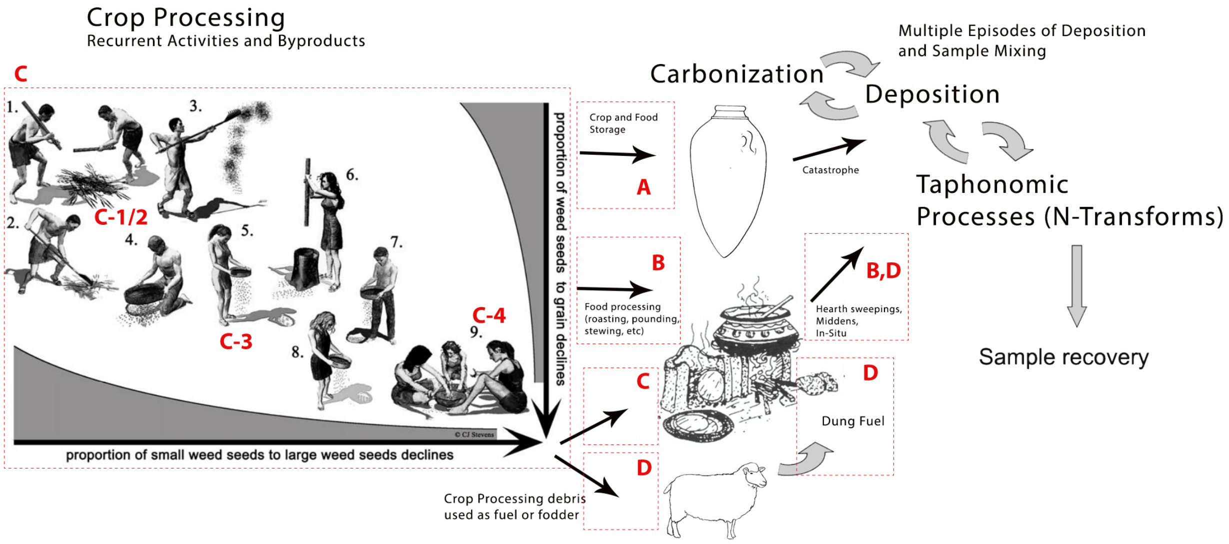

Figure 5.2: Pathways of entry of archaeobotanical remains, with associated Table 5.1 indices (red letter-number combinations) superimposed (adapted from Stevens 2003, Fuller, Stevens and McClatchie 2008, and Reddy 1984).

paleoethnobotanical item comes to be recovered through the sampling process.

5.2 Integrating Context and Content to Identify Depositional Origins

As **Table 5.1** illustrates, researchers have proposed different quantitative measures for distinguishing the potential depositional origins of a givenm paleoethnobotanical sample. Ternary diagrams (Jones 1985), the individual ratios of select plant parts per sample (van der Veen and Jones 2006), and the comparison of the ratios of these parameters (Fuller and Stevens 2009), have all been proposed to identify either crop processing or the influence of dung fuel. While some of these indices have been argued to be “overly mechanical” (as van der Veen and Jones (2006: 222) complain of Jones 1985), the approach advocated and employed in this project is instead focused on an *integrated analysis* which considers both *content* and *context*. As has been shown, the paleoethnobotanical expectations of the *content* model are already well-established through ethnographic and archaeological research, and so many of the ratios proposed, such as straw nodes to grain, or seeds to charcoal, are utilized below to understand the depositional origin of the samples collected at the site of Dhiban.

Moreover, the *context* of these paleoethnobotanical remains in this project is emphasized to the same extent as the content. As indicated, some practitioners consider the analysis of “context” to be irrelevant (Fuller et al. 2008), since most paleoethnobotanical remains are not found either in their primary place of use or discard, both *de facto* and primary

Table 5.2: Relationship of Depositional Activities to Locus of Deposition

Activity	Type	Locus of Deposition	Hubbard and Clapham 1992	Schiffer 1976,1987
In Situ Plant Remains	Discrete Burning Event	De Facto	A	De facto Refuse
Single Activity	Discrete Burning Event	Primary	A	Primary Refuse
Multiple Activities	Discrete Burning Event	Secondary	B	Secondary Refuse
Multiple Activities	Different Charing Events	Secondary and Tertiary	C	Secondary Refuse

refuse in the terminology of Schiffer (1987; see **Table 5.2**). Despite these reservations, many of the archaeobotanists discussed above have primarily conceived of context as an abstract designation of archaeological function (e.g. pit, fill, surface), and not as a *spatial location.* In fact, one of the many important insights of Lennstrom and Hastorf's (1995) pivotal study is that it is the *spatial associations and locations* of paleoethnobotanical samples that provide meaningful information related to deposition and depositional practices, rather than the *a posteriori* designations of functional context-types alone. It is possible that a cause for the disjunct in the paleoethnobotanical conception of *context*, and the spatial definition of context as a physical place where samples are collected, is that paleoethnobotanists in this geographic area traditionally are not present in the field at the time of excavation to oversee sampling (as van der Veen bemoans in an analysis of paleoethnobotanical remains from Libya (van der Veen et al. 1996: 230)).

The solution, therefore, is to combine a systematic sampling strategy to identify *spatial* variation in deposition, along with a content based model that distinguishes the particular formation processes that led to that sample's creation, which may or may not be independent of its context. It is only through an analysis of both simultaneously and in a feedback relationship that the two can be distinguished, and that either the dependence or independence of *context* and *content* can be ascertained. Having established this, and keeping in mind these potential routes through which remains can become carbonized, it is possible to turn to the Dhiban Excavation and Development Project from which the paleoethnobotanical materials that form the subject of this study were sampled.

5.3 The Dhiban Excavation and Development Project

There are two distinct periods of excavation of the *tall* of Dhiban, those that occurred before the year 2000, and all since. The excavations of Dhiban that occurred before 2000 were under the aegis of the *American Schools of Oriental Research*, led in 1950-2 by Fred. V. Winnett and William L. Reed (Winnett and Reed 1964), with the participation of William Morton and A. Douglas Tushingham. Tushingham would later publish the results of the excavations conducted in 1952-3 (Tushingham 1972), and Morton also re-visited Dhiban and excavated it for three separate years, in 1955, 1956, 1965 (Morton 1989) again under the auspices of ASOR. Nevertheless, Morton's results have not yet been published, and it is the subject of ongoing work by Bruce Routledge of the University Liverpool to publish Morton's archived data (e.g. Porter et al. 2010). The majority of the efforts of these early excavations were concentrated on the southeast corner of the site, where they exposed an Iron Age fortification system, a Nabataean temple, a Byzantine church, and dwellings dated from the Umayyad period to the Middle Islamic (Winnett and Reed 1964; Tushingham 1972). Morton, in contrast, focused on the acropolis of the site, and uncovered a large, probably Iron Age, structure that he characterized as a "Moabite palace" (Morton 1989: 245; Porter et al. 2007).

In 2004, a pilot season of excavation led by Benjamin Porter, Bruce Routledge, and Danielle Steen-Fatkin forming the Dhiban Excavation and Development project (henceforth DEDP; and later including Katherine Adelsberger), re-visited the site to achieve four objectives: 1) to record a topographic map of the site, 2) establish a five meter grid system for excavation, 3) record previously excavated architectural units, and 4) map all extant unexcavated surface architecture, which was 85% complete at the time of the published report's writing (Porter et al. 2005: 203). A ground penetrating radar study was also conducted, but unfortunately due to the site's deep stratification and sequence of overlaying limestone architectural remains, the study attained limited results (Porter et. al 2010: 12). In 2005, excavation of Field L, the upper area of the acropolis (discussed below), continued, and more of a structure identified as a barrel-vaulted room was uncovered (Porter et al. 2010: 18). A Middle Islamic coin hoard was also identified from a Middle Islamic structure on the acropolis, and of the four definitive identifications made, all were Ayyubid (1171-1250 CE) in date (Porter et al. 2010: 25).

Since 2005, and as of the writing of this research, several seasons of excavation have taken place on the northern *tall* of Dhiban: in 2009, 2010, 2012, and 2013. As the results from the 2009 season have only been published in part (Fatkin et al. 2011), some of the material uncovered in the course of the 2010, 2012, and 2013 excavation seasons will not be able to be verified through external publication, but will be presented here for the first time. Since the 2005 season, a 5x5 meter grid system aligned to true north has been superimposed over the 12.5 hectare *tall* of Dhiban to facilitate excavation and create a GIS-capable map. Within this grid system, the site has been divided into four primary areas of excavations (referred to as fields by the directors): 1) Field W, 2) Field L, 3) Field L-W(est), and 4) Field S(outh) (**Figure 5.3**).

The excavation areas are aggregations of individual units. For instance Field S is the combination of six units in the south-eastern portion of the tall (**Figure 5.3**). Within the larger 5x5 meter grid system, an additional 1x1 sub-grid system was also employed to locate remains with more accuracy and precision in general recording. For designated "special finds" (a subjective assessment of infrequently occurring objects of cultural importance), as well as for all flotation samples collected from 2012 to 2013, a Total Station was employed to record the exact coordinates of each object or sample. Site surveyor and analyst Dr. Andrew Wilson also conducted an extensive survey of the tall in 2010, recording 6,787 points in order to create an accurate digital elevation model of the *tall.* The location of each of these excavation areas was chosen through a combination of ground-penetrating radar, surface ceramic surveys, and test excavation (Porter et al. 2004; 2005).

Each of these excavation areas constitutes the sole areas of sampling for paleoethnobotan-

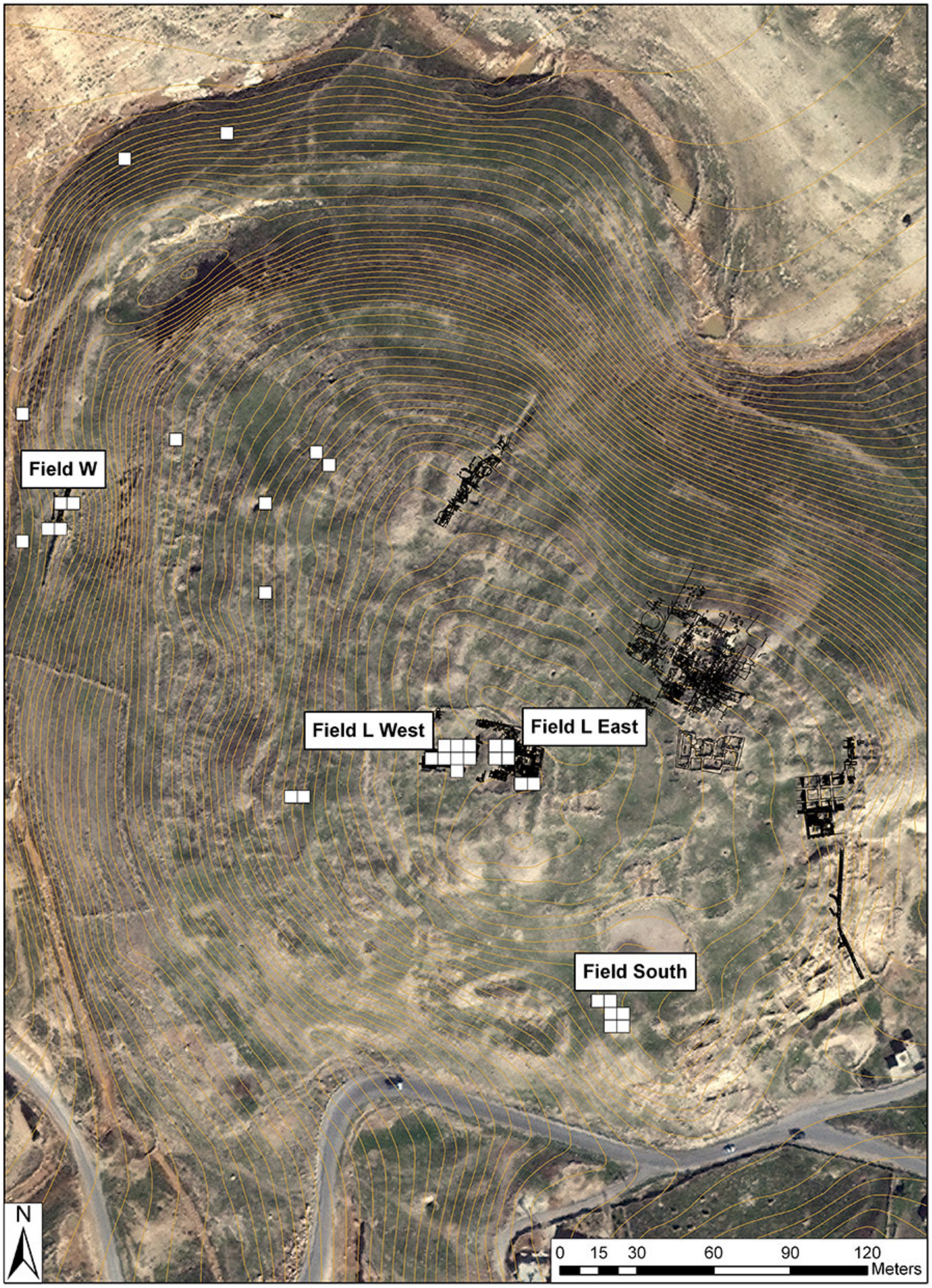

Figure 5.3: Topographic map of Tall Dhiban with areas of excavations (Fields), and units outlined in white.

ical remains on the *tall* of Dhiban. As such, one of the distinguishing features of occupation on *tall* Dhiban is the seemingly "single-period" occupation of many areas, such as the acropolis or Field L. For example, as of 2005, no evidence of any occupation other than the Middle Islamic period has been found in Field L (Porter et al. 2010: 13-19). Although some areas of the *tall* appear to be occupied in distinct periods of time, there are other areas that record multiple phases of temporally distinct occupation. For instance, a 2.7 meter exposure in the portion of the site originally excavated by William Morton (Porter et al. 2010: 28-29, named "L-Section"), contains evidence of occupation spanning the Iron II period, up to the Byzantine period. While the available ^{14}C data indicates the longevity of occupation on the entirety of the *tall*, many of the other sampled excavation areas nonetheless appear to be largely single-occupation as reconstructible through the combination of radiocarbon evidence, "diagnostic" objects, and architectural phasing. An overview of the major phases in each of these areas is presented below.

Excavation

Excavation of each 5x5m unit employed a modified open-context method (Roskams: 2001: 137-140). Each identifiable context (such as an enclosed space in a structure) was excavated as an integrated phenomenon, although the recording of the material contained therein was according to the unit in which the material was located. Thus some structures, although a unitary whole, could extend across four or five excavation units (such as the Barrel Vaulted Room in Field LW). Each unit was subdivided into loci (sg. locus) which represent a culturally mediated deposition-event of sediment (Stein 1987; Warburton 2003). The boundaries of loci were recorded using a Total Station, both in their upper-most and lower-most location within the 3-dimensional matrix of the unit stratigraphy. Loci were related using the Harris Matrix System, which facilitates the understanding of depositional histories, and therefore, the activities that led to their deposition (Harris 1989). All of the excavated sediment was passed through a 2mm screen.

Field W

Field W is an area of considerable stratigraphic and geomorphic complexity, currently overseen by Dr. Katherine Adelsberger of Knox College. The major research questions of this excavation area relate to the ways in which past communities at Dhiban managed both hydrologic resources and topographic features (Fatkin et al. 2011: 249-251). Thus excavations in this area are particularly important as they have uncovered what appears to be a water reservoir system composed of a series of large walls and a potential form of plaster found bonded to the interior of them which may have served as water sealant. The results of this research will directly speak to the water management employed by past communities necessary for agricultural production. Unfortunately these data have not been made readily available to the current author, and therefore will not be discussed within the context of this study. Future research directions include the timing of the construction of this reservoir, as well as its use, reuse, and modifications of it by subsequent communities.

Field L Introduction

As mentioned previously, Field L West and L (East) are located directly on the "acropolis", or the highest point of the tall. The location of these two excavation areas was initiated by the large abscess left by William H. Morton during his excavations in 1955, 1956, and 1965 (Morton 1989: 244-245). Morton's major interest was in the Moabite occupation of the tall, in which he was seeking the evidence of a large structure mentioned in the Mesha stele, where Mesha claims that he "made a high place for Kemosh in *Qrhh*". Morton did uncover, in fact, a structure 42.9 meters long and 21.10 meters wide at the bottom of the excavation areas now designated Field L West and L East (Morton 1989: Figure 13). To reach the "Moabite palace complex", Morton, on his own admission, removed a domed Umayyad structure (without documenting it; Morton 1989: 245), and using extant stratigraphy it is possible to estimate that Morton excavated more than three meters in depth. From the dimensions of the abscess, it is estimated that Morton removed approximately 2,700 m^3 of sediment. Morton did not backfill this very large area, and left the excavation unit side-walls open to the elements, with significant erosion of stratigraphy and unit sidewalls (**Figure 5.4: A**).

Since 2004, area supervisors Benjamin Porter and Bruce Routledge have begun the re-excavation of this area with the intent of bringing adjacent unexcavated areas to the west and east of this large depression into phase. Another motivation for the excavation of this area is improved preservation of the extant stratigraphy. The area has suffered exposure to a half-century of wet-dry cycles, which has posed a threat not only to the archaeology, but also to the local community in the event these walls collapse on the shepherds who currently use the tall as a place to graze their flocks of sheep and goat. Bruce Routledge has cleaned a section of Morton's exposed trench to reveal a stratigraphic profile that contains evidence occupation from the Iron II period to the Middle Islamic period (**Figure 5.4: B**).

L-Sect: This exposure, and the exposure immediately to the right of it (**Figure 5.4: A**), has been labeled "L-Sect". All of the samples used throughout this study dating to the Iron II or Nabataean and Roman periods through ^{14}C dating derive from this very large exposure. As can be seen in **Figure 5.4: B**, the excavation of this exposure has yielded a well-preserved sequence of floors and intervening fills. Preliminary publication of the stratigraphy and associated ceramic evidence of this area has already occurred (Porter et al. 2010), and excavation will continue in this area in order to preserve and understand the sequence of occupation within the exposed section.

L West: The excavation area known as "L-West" comprises three structures to the west of Morton's depression, which for the purposes of this project have been labeled Structures 1, 3, and 4 (**Figure 5.5**). All of the structures date to either the Middle Islamic I or Middle Islamic II periods, based on the AMS radiocarbon dates presented below. Structures 3 and 4 were excavated over the 2004, 2005, and 2009 seasons, and will not be discussed in detail. Since 2009, the primary focus of excavation in this large area has been on a large,

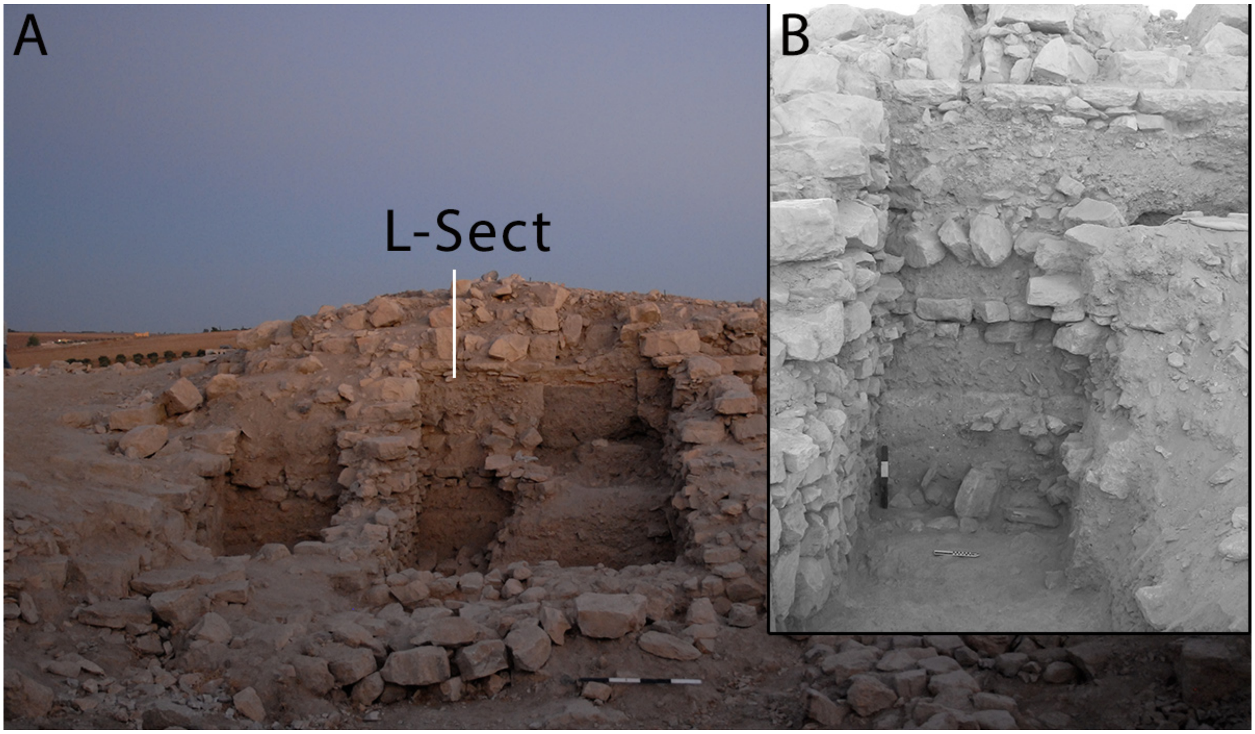

Figure 5.4: (A) is a photograph (facing west) of what remains of Morton's large trench, with L-Sect highlighted, and (B) is a close-up of the stratigraphic column labeled L-Sect (Photo C. Morgan, 2009).

barrel-vaulted room measuring 3 x 7.5 meters. The barrel-vaulted room (henceforth the "BVR") is especially important as it records a well-preserved sequence of several phases of construction and reuse, represented by Phases 2B through 2E in the internal chronology of the area (**Figure 5.6**). The AMS radiocarbon evidence illustrates that these four phases of re-surfacing, pits, bins, and tabuns (hearths) all probably date to within a 100 year time period in the 14th century CE (see **Table 5.3**). Concomitantly, the room has very complex stratigraphy (see **Appendix F** for the Harris matrices). It is still an object of ongoing research to determine if the structure(s) served any particular function. Most of the samples presented in this study that date to the Middle Islamic II period derive from this structure, although there are also samples from structures 3 and 4 as well (**Figure 5.17**).

L-East: The eastern half of the acropolis is labeled Field L-East, and comprises two structures, Structures 5 and 6 (**Figure 5.5**). The flotation samples collected in Structure 5 have not yet been analyzed. Several samples have been analyzed from Structure 2, however, and AMS radiocarbon dating has shown that this room is almost exclusively Middle Islamic I in date, and serves as the sole representative of that period in this study.

Beyond LW and LE: Beyond these two excavation areas, two different test excavation units noted by their unit numbers, CE27 (excavated by the author in 2010) and B027 were both dated to the Middle Islamic period based on diagnostic ceramic remains. Although

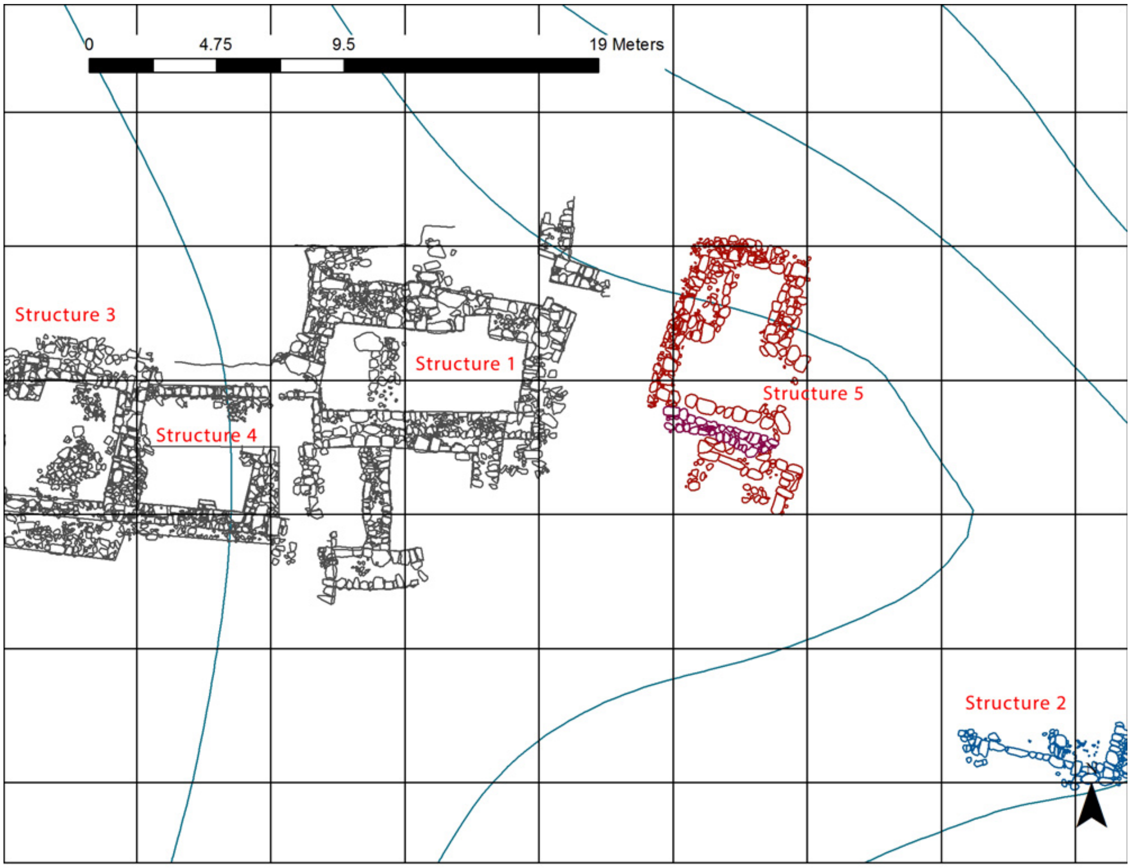

Figure 5.5: Field L architecture with structure (room) numbers superimposed.

they are far west of Field LW, they provide important Middle Islamic contexts outside of the acropolis that can be used to corroborate trends seen on it. Although will not be discussed at length in this study, samples collected from them are also among those designated as Middle Islamic period, and were used for the statistical analyses presented below.

Field S

Field S comprises the excavation area in the south-east corner of the *tall*, almost at the *tall*'s edge (**Figure 5.3**). In 2009 and 2010, Dr. Danielle Steen Fatkin conducted a surface ceramic survey of the tall for the remains of Roman and Byzantine pottery, in order to locate an area suitable for more extensive excavation in order to understand the nature of Roman and Byzantine occupation on the tall. The results of the survey showed that three areas emerged as containing the most dense concentrations of Roman and Byzantine ceramics, and in 2009 and 2010, nine 2.5 x 2.5m test excavation units were established in these areas. The ceramic evidence from these test units indicated that only one test unit, AX54, could be unequivocally associated with the Roman and Byzantine period of occupation (later confirmed by an AMS

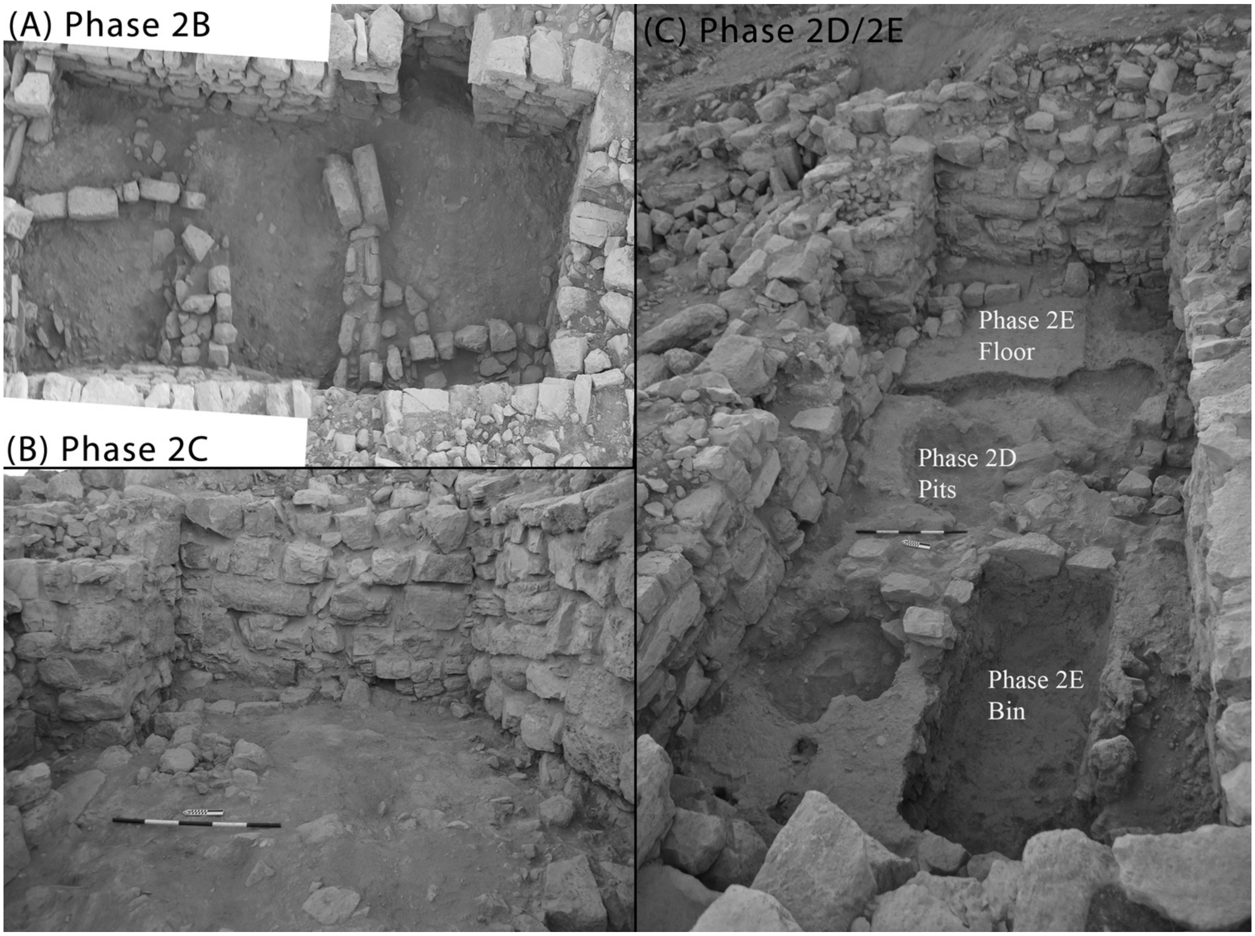

Figure 5.6: Occupation and Rebuilding Phases of the Barrel Vaulted Room, where (A) is the youngest (i.e. latest) phase, and (C) are the oldest (i.e. earliest) phases (Photo Credit DEDP).

^{14}C date procured from this unit during the 2009 excavation). In 2012 the current author, with generous support from the National Science Foundation (BCS #1135042), collaborated with Dr. Steen Fatkin to expand the area around AX54 to include five other excavation units, although only three were excavated in more detail (AW54, AW55, AX55: **Figure 5.7**). In 2013 excavation resumed in this area, and did not extend the horizontal extent of investigation, but continued vertical excavation. The architecture of the area is composed of three north-south walls enclosing two potential room-interiors (**Figure 5.7**), and four springer bases for two arches. The room interiors are for an as-yet unknown purpose, and the north-south room that straddles AX55 and AW55 contained a recycled architrave and basalt grinder that may have served as a drain (**Figure 5.9: B**).

Thus far two distinct phases of occupation have been identified for this area. The labeling of these phases is independent of the larger research project (DEDP), and is presented here as a binary for convenience only. The latest of the two is Phase 2, which was uncovered in the

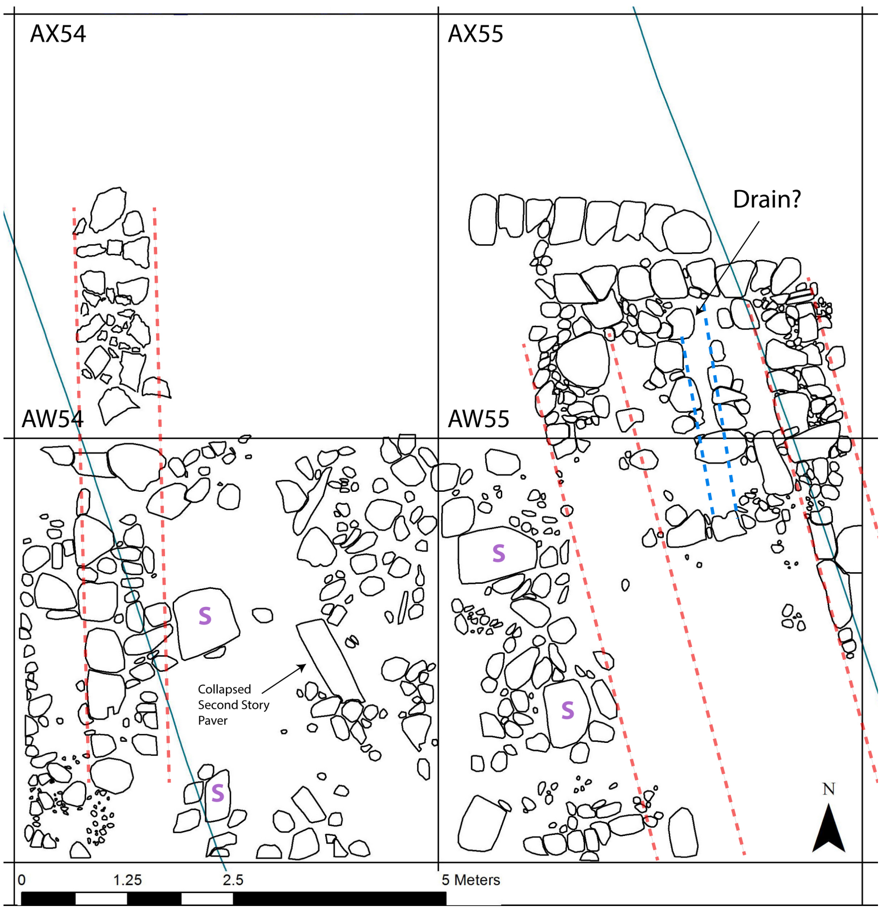

Figure 5.7: Field S Architecture - red lines indicate north-south walls, blue lines indicate a potential drain, purple S's indicate the locations of the springer bases for arch. Unit labels are in the upper left.

2012 season (**Figure 5.9: A**). Three AMS radiocarbon dates have dated occupation of this area to between 577-686 cal CE (**Table 5.3**). The deposits of Phase 2 are mostly composed of undifferentiated fill, although there were some *tabuns* and pits present. Moreover, this phase contains a reused basalt-grinder "drain" (**Figure 5.9: B**), of unknown purpose, as it appears to have been blocked shortly after its construction. The earlier phase, Phase 1, represents the collapse of the second story of a room that was supported by the four arch springers. Phase 1 is only represented in this study by the excavation unit AW54 (**Figure 5.7, Figure 5.8: A**). The phase is characterized by enormous quantities of visible charcoal (**Figure 5.8: C**), intact and burned small vessels (**Figure 5.8: B**), and the remains of destroyed *pithoi*, or storage vessels (**Figure 5.8: A**). As it will be shown below, Phase 1 represents an exceptional context as it is probably a storeroom that was enveloped by a conflagration that subsequently collapsed, and has preserved nearly all of the contents of the second story *in situ*. In summary, Phase 1 represents a collapsed storeroom, and Phase

Figure 5.8: Phase 1 of Late Byzantine Field S, which contains (A) a large number of *pitoi* fragments scattered in unit AW54, (B) an intact burnt juglet, and (C) large pieces of wood charcoal (Photo John Webley, 2013)

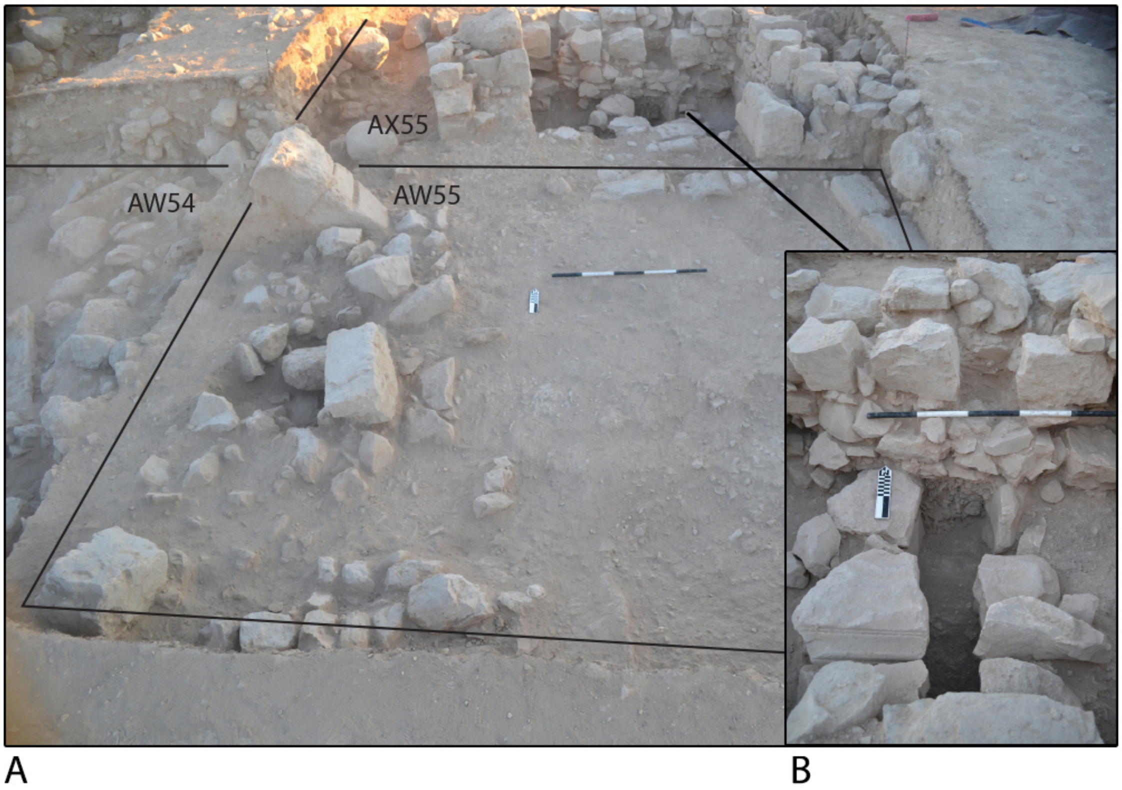

Figure 5.9: Phase 2 of Late Byzantine Field S, which contains (A) general architecture of the post-collapse occupation and (B) a “drain” with a basalt grinder reused as the drain opening in the foreground of the photograph (Photo Martin Weber, 2012).

2 represents the post-collapse occupation above it. None of the Phase 2 AMS radiocarbon dates date later than 700 CE (the latest upper bound of the calibrated 2σ date is 686 CE, and the 1σ is 665 CE) and so this phase does not likely represent a post-Byzantine, Umayyad occupation. It is more likely that Phase 2 represents the very end of the Byzantine period (Late Byzantine) in the 630s and 640s, given the available evidence. Thus Phase 2 serves as a *terminus ante quem* which, by association, dates all of the material below it. Phase 1, therefore, can not date to any period later than 686 CE (and moreover probably earlier, given the 1σ ranges), and is also more likely a Late Byzantine structure, as will be argued in the next chapter.

Absolute Dating and Phasing

As mentioned briefly in Chapter 3, the chronology of the occupation of these contexts is anchored by a series of absolute dates. As the phasing and timing of agricultural production is dependent on the methods for assessing that timing, this section will discuss the dating in some detail. Thus far 23 absolute dates have been sent to the Oxford Radiocarbon

Accelerator Unit and the University of Arizona Radiocarbon Laboratory, and the full report for the uncalibrated and calibrated dates can be found in **Appendix G**. As one sample was accidentally split by the Oxford Radiocarbon Accelerator Unit (OxA-23485 and OxA-23486), there are now 24 samples, but only 23 are reported below. All calibrated calendar dates are reported at the 2σ level, and were calibrated in Oxcal 4.2.1 using the IntCal09 curve (Ramsey 2006; Reimer et al. 2009).[3]

For the purposes of this study, the major groupings of dates are:

The Iron Age Two Iron I dates have been obtained from L-Sect and the adjacent exposure, but both are anomalous given their stratigraphic positions. One date yielded 2906 BP±26, 1209 - 1010 cal BCE, although it was directly below an Iron II ^{14}C date (reported below). Another yielded 2837 BP±41, 1128 - 899 cal BCE, even though it was adjacent to a Nabatean-Roman deposit, also ^{14}C dated. The sole Iron II date for Dhiban derives from L-Sect, and securely pins the deposit to 2511 BP±30, 789 - 538 BCE. The wide date range occupied by this sample is due to the effects of the Hallstat plateau.

The Nabataean-Roman period Two Nabataean-Roman dates were obtained from the extension of the L-sect exposure just to the north of the primary L-Sect stratigraphic sequence. These two dates were from deposits directly overlaying each other, and the bottom-most dated to 1963 BP±39, 45 cal BCE - 125 cal CE. The deposit directly above this dated to 1918 BP±45, 35 cal BCE - 219 cal BCE. These two dates show substantial overlap and are stratigraphically contiguous. The ceramic evidence also correlates to the absolute radiocarbon evidence, and provides some of the first absolute dating evidence for the Nabataean and early Roman period in this area.

The Byzantine Period All three ^{14}C dates were taken in samples collected from Phase 2 of the Byzantine period occupation in Field South. One sample derived from a drain deposit uncovered in 2012, and is the earliest, at 1524 BP±38, 430 - 610 cal CE. As the latter context may in fact be a midden based on evidence that will be presented in Chapter 6, the date might be recording secondary or even tertiary refuse dating to an earlier period upon which the contemporary community was living. Two samples from nearby fill deposits indicate tightly matching dates; one from 2009 yields 1404 BP±39, 571 - 675 CE, and the other from 2012 yields 1391 BP±39, 577 - 686 CE. The close similarity between these two dates thereby establishes the phasing of the Byzantine period in this area, which is Late Byzantine, or transitional Umayyad.

The Middle Islamic period The Middle Islamic period is divided into sub-periods I and II, given the results of the AMS radiocarbon evidence. Middle Islamic I dates are derived from one sample in 2009 from Structure 2 which yielded 832 BP±24, 1165 - 1260 cal CE. The latter matches a date collected from 2005, in Structure 3, which dated to 884 BP±23, 1045 - 1215 CE. The other Middle Islamic I date is from inside of Structure 1 (the BVR), and the evidence below will illustrate that it is probably due to secondary deposition.

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[3] As of the publication of this dissertation, the IntCal14 curve became available, but was unfortunately too recent to fully incorporate into this study. Re-analyses of the uncalibrated dates will indicate whether the new calibration increases the precision of the reported calendar dates

Table 5.3: Phasing Schema Used throughout this Study

^{14}C-OP	Phasing	Period	UncalBP	Calendar Calibrated Date (2σ)
1	2A	Ottoman	306	1494-1649 CE
2-1	2B	Middle Islamic II	605	1298 - 1405 CE
2-2	2B/2C	Middle Islamic II		
2-3	2C	Middle Islamic II	1167	772 - 976 CE
2-4	2D	Middle Islamic II	690	1261 - 1392 CE
2-5	2E	Middle Islamic II	573	1299 - 1426 CE
3		Middle Islamic I	832	1165 - 1260 CE
4		Byzantine	1391	577 - 686 CE
5		Nabataean - Roman	1918	35 BCE - 219 CE
6		Iron II	2511	789 - 538 BCE
7		Iron I-II	2837	1128 - 899 BCE

All of the Middle Islamic II dates are almost entirely obtained from a sequence of stratified surfaces and intervening features in the BVR. The lowermost deposit within this structure yielded a date of 573 BP±38, 1299 - 1426 cal CE. The uppermost deposit yielded a date of 626 BP±23, 1290 - 1397 cal CE. All four of the intervening dates fall within this range except for one sample, from Phase 2C, which dates to 1167 BP±38, 772 - 976 CE. As the latter date is in-between five other dates that all date to the 14th century cal CE, it probably represents older material that was purposely packed into the structure in between building episodes.

The results of excavation and these AMS radiocarbon dates derived from them have led to the following phasing schema used throughout this study (**Table 5.3**). Some phases represent the uppermost and lowermost bounds of all of the ^{14}C samples available for that period (e.g. the Byzantine period), while others only represent the 2σ range (e.g. Phase 2E of the Middle Islamic II).

Sampling Strategy Rationale

Experimental and observational studies have illustrated that the partition and sampling of the excavation space affects the kinds and frequencies of objects and organic remains recovered across a range of different types of archaeological sites, such as shell mounds, campsites, and sites with large standing architecture (Hole 1980; Rhode 1988; Meltzer et al. 1992; Plog and Hegman 1993; O'Neil 1993; Lyman and Ames 2007). Furthermore, paleoecologists, paleontologists and contemporary ecologists have established through the use of rarefaction curves (Tipper 1979; Foote 1992; Gotelli and Colwell 2001; Ugland et al. 2003; Koellner et al. 2004; Chiarucci et al. 2008) that sample size and species diversity (or richness) are often correlated. For paleoethnobotanists concerned with detection of the potential range of plants used by people in the past (and zooarchaeologists, as well), sample size is an issue (e.g. van der Veen and Fieller 1982; Jones 1991; Lee 2012). Based on these studies, it is clear that very large samples are necessary to detect the presence of rare taxa

(Cannon 2001). Therefore, if an archaeological argument relies on the presumed absence of a taxon (such as inferring trade networks through the presence or absence of certain key agricultural crops, i.e. Chapter 6), it would need to be demonstrated that the absence of that taxon was not due to insufficient sample size necessary for item detection. The latter is an unmistakable issue in the recovery of environmental archaeological remains, which are sampled from "non-random, concentrated, patterned depositional contexts" (Kirch 2005: 414), as was argued above. That is to say, these deposits are "non-random" as they are the result of repeated and singular, accidental and intentional, activities of human agents.[4] As a result, the non-random origins and processes that led to the creation of these remains within their sediment matrices are critical for the interpretation of the remains themselves.

Based on the considerations presented above in **Identification of Depositional Practices**, a systematic, judgmental, bulk sampling strategy of paleoethnobotanical remains was chosen. A bulk sample is a single, spatially bounded sediment sample taken from a discrete stratigraphic archaeological context (a locus). In a scatter sample, the entire deposit is sampled at equal intervals and all of the sub-samples are aggregated, providing a composite image of the remains found in a particular context. Bulk, versus scatter, sampling strategies are ideal for cases where "botanical remains are not distributed randomly nor evenly throughout the site" (Lennstrom and Hastorf 1992: 207). At sites such as Dhiban, there are clear episodes of deposition within and around architecturally enclosed spaces. Culturally mediated stratigraphy is correspondingly much easier to detect due to differences in sediment texture, compactness, color, and intervening architectural features (floors, pits, hearths, etc). Lennstrom and Hastorf (1992) have conducted the only empirical investigation of the comparison and effects of bulk versus scatter sampling within the same deposit, at an archaeological site with discrete horizontal archaeological contexts. The authors collected 654 flotation samples (or two sample pairs in 327 loci) at the site of Pancán, and the subsequent analysis revealed that 56.7% of the scatter samples in the two pairs contained the greater number of taxa (Lennstrom and Hastorf 1992: 211). Based on the published data, however, the magnitude of the effect size seems very small (the mean is 9.9 taxa per bulk sample, and 11.0 for scatter).[5]

Nonetheless although it is apparent that scatter samples might generate a greater number of taxa, the average densities of botanical remains recovered is almost identical (Lennstrom and Hastorf 1992: 208), as are the ubiquities of the major taxa of interest (Lennstrom and Hastorf 1992: 222). Therefore, bulk samples are almost as representative as scatter samples

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[4] The "non-randomness" of these depositional contexts violates some important assumptions of many statistical tests, in particular *iid* (independent and identically distributed random variables). Nevertheless, some ecologists working with analogously similar datasets encourage tests that relax some of these assumptions, and have promoted the use of multivariate statistics such as Principal Components Analysis (PCA) for precisely that reason (e.g. Zuur et al. 2007: 194-5).

[5] While the authors claim that a t-test confirms that these two strategies generate statistically significant differences in the number of taxa, it is also clear that the distributions are positively skewed (the means are larger than the medians in both cases, reflecting the "pull" of larger values on the right side of the tail). Although there might be an effect, its size (*sensu* Cohen 1988) can not be calculated from the available data.

in recovering the same number and diversity of remains. Moreover, the authors illustrate through a density analysis that for areas with standing architecture, bulk samples are better able to capture spatial variation in discrete deposits. Scatter sampling physically aggregates all of the sub-samples taken from a given deposit, and any spatial variation intra-context is irretrievably lost through this mixing. Unfortunately, this study has not yet been replicated by other archaeologists, and so the generalizability of its premises has not yet been tested. One of the goals of the sampling strategy at Dhiban in 2012-2013 was to replicate this outcome using a point-provenienced spatially disaggregated bulk sampling strategy.

Apart from where and how archaeological sediments should be sampled, the *amount* of sediment to be sampled for processing (i.e. flotation) out of the total sediment matrix is also a concern for the representativeness of the sample. Many in-field processing strategies have been proposed to make efficient use of time and money, yet it is acknowledged that systematic sampling, that is the sampling of all identifiable archaeological deposits, is the most representative, although the most time and cost intensive (Jones 1991). Indeed as Lennstrom and Hastorf (1995) have shown, without systematic sampling of all and adjacent archaeological deposits, it is impossible to infer the *spatial* variation within and around these deposits, and identify the extent to which remains are *in situ* or the result of secondary or tertiary refuse (Miksicek 1987). Therefore, since 2009 systematic sampling of all archaeological deposits at Dhiban for sediment (flotation) samples has taken place.

Due to the potentially large volume of a given archaeological deposit, even a systematic sampling strategy only samples a portion of any given deposit. Therefore, several considerations informed the choice of flotation sample volume and the utilization of different components of the flotation sample toward analysis (light versus heavy fraction) at Dhiban from 2009 to 2013. Many of these considerations hinge on a greater discussion within paleoethnobotany concerned with the number of archaeobotanical remains needed in order to produce reliable estimates of sampled taxa, a discussion which continues into the present (Pearsall 2000: 114-6; Lee 2012). Several parameter estimates, based on Wald's exact test of the binomial distribution (van der Veen and Fieller 1988: 295-6), have been proposed to assess the number of botanical remains needed (i.e. to be recovered) per sample to estimate the confidence interval of any given taxon's proportional presence. Although Wald's exact test is problematic and replacements such as Wilson's or Jeffrey's interval provide better estimations of proportion intervals (Agresti and Coull 1998; Brown et al. 2001), it nonetheless underscores the need to consider the number of remains needed for sample-to-sample or intra-sample taxon comparison. In paleontological simulations of benthic foraminifera assemblages using the binomial distribution, it has been shown using size-species proportions curves that for a taxon whose "true proportion" in a population is 1%, at least 50 items need to be counted in order to have 95% confidence in detection (Fatela and Taborda 2002: 171). In assessing abundance, however, for items that theoretically constitute 10% of a sample total, at least 100 items will need to be examined (Fatela and Taborda 2002: 172-173), with between 200 and 300 specimens needed to increase the precision of confidence by shortening the confidence interval range (Buzas 1990; Bennington and Rutherford 1999).[6] Therefore the number of remains recovered permit certain kinds of inferences to be made, and not others, and low counts make it difficult to be confident about whether differences in observed taxon abundances are a reflection of their abundances in the "true" (i.e. deposited), population (cf. Lee 2012). The paleontological simulations illustrate, on the other hand, that even given at least 100 items, relatively accurate, although not precise, estimates of the differences between taxon abundances can be ascertained. Further research in binomial interval estimation of paleoethnobotanical data is necessary in order to address the question of the confidence of proportional taxon estimation.

In order to test the effect of a positive linear relationship between sample size (as volume) on the number of remains recovered (as absolute count) given the previous discussion of the importance of increasing sample (i.e. remains recovered) size, a regression test was performed on flotation sample volumes collected from 2009 through 2013 at Dhiban (see section 5.5 below). Unfortunately, paleoethnobotanical practice does not yet require explicit analyses in published reports of the relationships of flotation volume size to the number of remains recovered. Using 194 samples (again, see section 5.5) collected across all current excavation seasons, a linear regression of log-transformed flotation volume and absolute numbers of seeds reveals that for every 1% increase in flotation volume, there is a corresponding 16% increase in the number of seeds.[7] Therefore, it is clear that the larger the flotation volume, the more seeds, and hence, the more taxa that can be detected and the more confidence given to estimates of taxon abundance. With the realization that a larger sample volume would lead to more absolute numbers of seeds recovered, in the 2009 season, the author recommended and oversaw a 30 L bulk sediment sampling strategy from every archaeological deposit.

5.4 Sampling and Laboratory Methodology

The sampling strategy employed at Dhiban therefore can be divided into three distinct phases of sampling, the years of 2004 and 2005, the years of 2009 and 2010 (Phase A; **Figure 5.10: A**), and the years of 2012 to 2013 (Phase B; see **Figure 5.10: B**). The period of sampling from 2009 until 2013 was overseen by the present author, while sample collection in the period before 2009 was at the discretion of the site directors. Across all four years overseen by the author, archaeological deposits were sampled systematically. Excavators

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[6] For instance, using the Wilson's interval (R.3.0.2 package 'Hmisc', function 'binconf') estimate, a count of 10 items in 100 yields a confidence interval from .05-.17, whereas for 30 and 300 (an identical proportion, 10%), it yields .07-.14. If 10 and 20 items were compared in the 100 item total sample, the confidence intervals overlap (10: .05-.17, 20: .13-.28) and while the relative abundance is indicated, a precise estimate of abundance can not be made. In contrast, by increasing the total count to 300 and maintaining the same relative proportion (30 and 60 items), the intervals fail to overlap, and indicate that the two items are abundant in different underlying frequencies (30: .07-.14, 60: .15-.24).

[7] The linear model specifications are as follows: Log Number of Seeds = -.0595 + 1.615 (Log Flotation Volume). The adjusted r^2 is .4511, F=157.1, *df*=189, $p<2.2e\text{-}16$. Three outliers were removed, flotation numbers 204, 363, and combined 208-405.

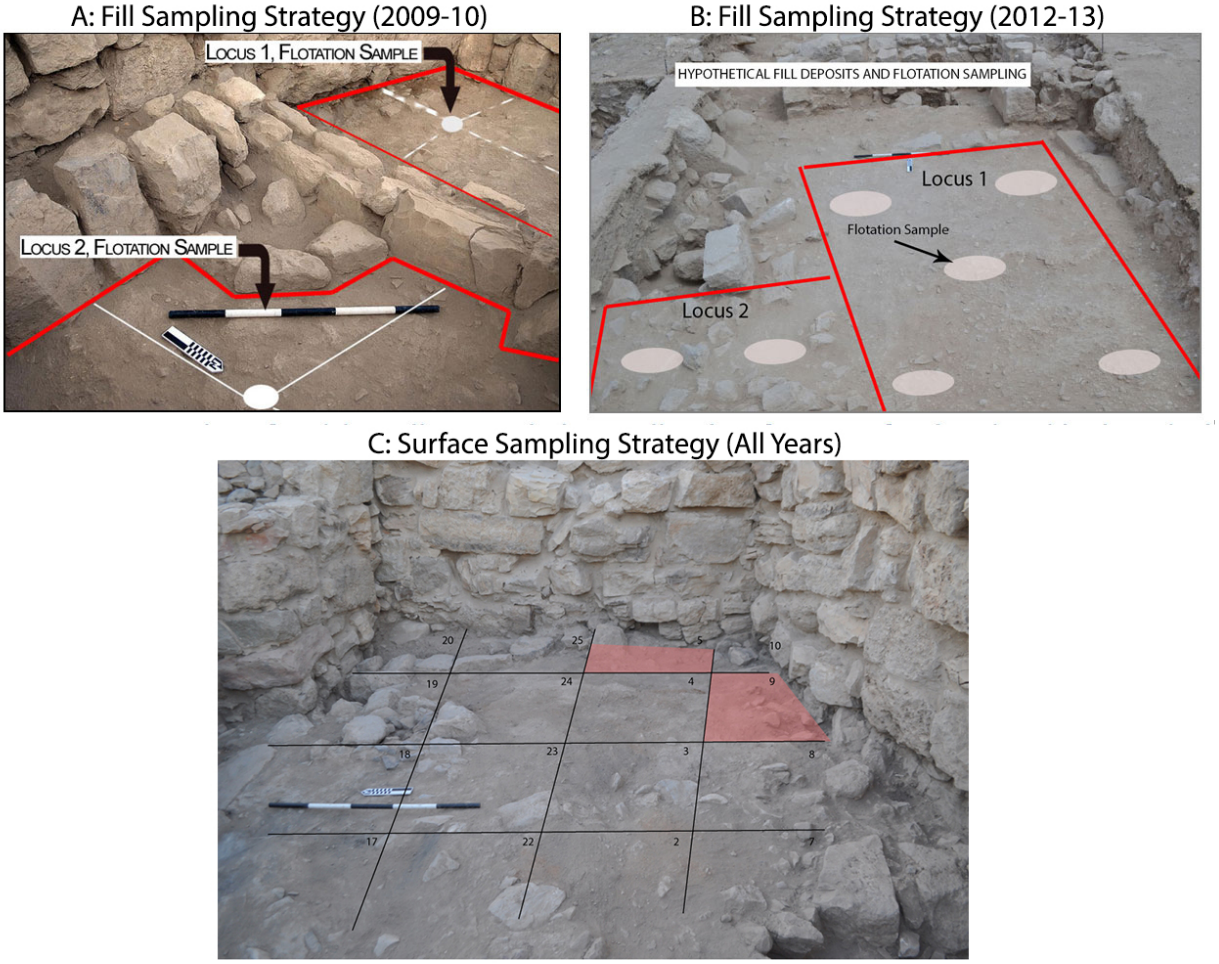

Figure 5.10: The comparison of sampling strategies by year, where (A) was the bulk sampling strategy of 2009 and 2010, of one large bulk sample collected from the center of an archaeological deposit. (B) is the sampling strategy of 2012 and 2013, where multiple, smaller samples were collected per deposit, but not aggregated physically. (C) is the sampling strategy of 1x1m gridded surfaces, across all years. Red grids highlight the potential for uneven geometry from the subgrid system.

were instructed to collect flotation samples regardless as to whether each deposit appeared to be rich in botanical remains or not. Therefore, all archaeological deposits that contained enough sediment to be sampled, were collected for flotation. Moreover the collection of these remains was judgmental, in that excavators used site architecture to guide spatial sampling locations. Rather than utilize the arbitrary sub-grid (that is, 1x1m grids within the 5x5m grids, aligned to the grids themselves and not architecture) to guide sampling locations, which could generate irregular geometry (e.g. 3/4th's of a subgrid might be found on the corner of the wall, leaving only the sediment in that corner available for sampling, **Figure 5.10: C**), excavators were encouraged to sample within discrete architecturally bounded areas, when possible.

In 2009 and 2010 the relative position of each flotation sample was recorded on a "Daily Top Plan", or a drawing of the extant architecture at the beginning of each day of excavation. While a Total Station was utilized to record the absolute coordinates of architectural and other features, it was nevertheless not employed to record the absolute location of each flotation sample. Nonetheless, because other "points" were recorded in proximity to flotation samples, and because each excavation unit was contained exactly within a 5 x 5m space, it was possible to georeference the drawing of each excavation square in GIS (ESRI ArcMap 10.1.2), and mark the absolute coordinates of each sample. As a result, it is possible that the location of flotation samples from the 2009 and 2010 seasons might be several centimeters off from their actual positions, as the accuracy of each drawing was dependent on the excavator. In contrast to 2009 and 2010, in 2012 and 2013 each flotation sample was recorded using a Total Station – in 2013 this procedure was extended to samples with a spatial extent greater than an idealized circular 50cm radius; e.g. for samples collected along the extent of a feature, the beginning, middle, and endpoint were recorded. Excavators were also instructed to collect at least 50g of sediment from the same area of each flotation sample for microbotanical (phytolith and starch) analysis. Each of the microbotanical samples was thus also point-provenienced from 2012 onward, although they have been collected since 2009.

The principal difference in these phases in sampling is the approach that informed the spatial collection of each sample. In 2009 and 2010, one, and only one, flotation sample was collected from each identifiable culturally mediated archaeological deposit, or locus. The location of each sample was from the geometric center of each locus, given the idealized shape of a square, as excavation occurred in 5x5 meter grids (see **Figure 5.10: A**). Although this is in principle a bulk sample, due to the large volume of sediment collected from a spatially contiguous area, the bulk sample approximated a scatter sample in both the numbers of remains that it collected (see below) and the homogenization of the deposit contents. In contrast, samples collected from deposits identified as surfaces during the course of excavation were collected in 1x1 meter square grids (**Figure 5.10: C**). These 1x1 meter square grids, or sub-grids, were aligned to the site-wide 5x5 meter grid. The entirety of the deposit that was contained inside of these grids was then collected for subsequent flotation. Prior to sediment extraction, however, the spatial location of artifacts visible to the excavators were recorded using a Total Station and then the artifacts were removed from the sediment matrix. The potential biases introduced by this method will also be discussed below.

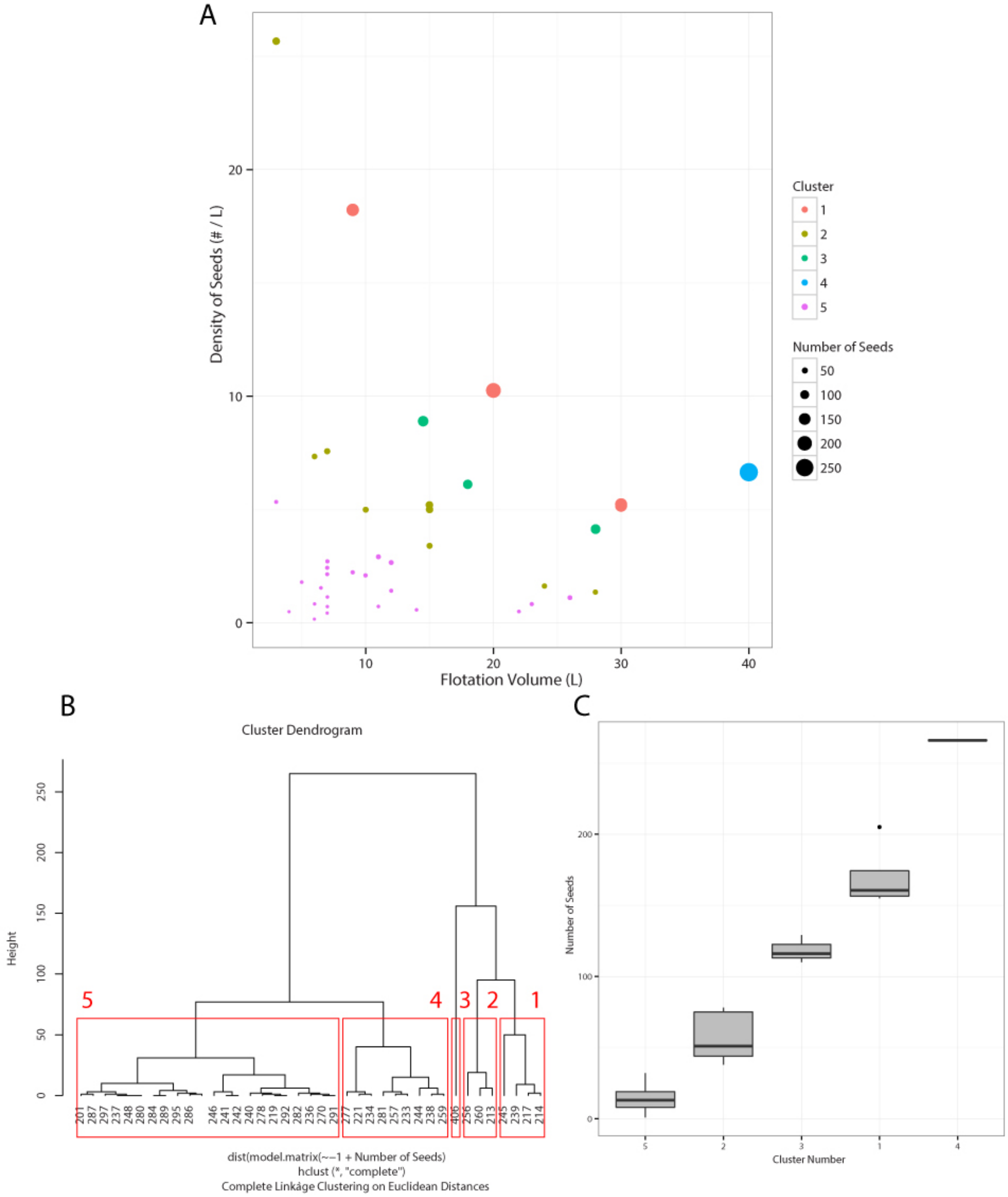

Figure 5.11: Relationship of flotation volume to density for 2009 and 2010 seasons. In (A) the colors represent the clusters produced by the complete linkage clustering, and the size of points symbolizes absolute numbers of seed remains. (B) is the dendrogram for a complete-linkage clustering product of Euclidian distance on the absolute (count) number of seeds. The rectangles correspond to $k = 5$ cluster solutions. (C) is a boxplot of the range of the number of seeds in each cluster.

Although the multi-year outcomes of the sampling strategy are presented below (**Sampling Results**), as predicted by Lennstrom and Hastorf the sampling strategy in 2009 and 2010 masked substantial intra-deposit variation through the collection of one large flotation from the geometric center of each locus. In a scatterplot of the relationship of flotation volume and seed density (number of seeds per liter) for 40 aggregated flotation samples from 2009 and 2010 from "fill" contexts (**Figure 5.11: A**), it is clear that for a select group of samples with high densities, there is a negative correlation between the flotation volume in liters and the density of seed remains per liter. As the volume of sediment collected increases, the density of remains decreases. Quixotically, the absolute number of seeds for less dense samples can often be *greater* than samples with a higher density.

In order to explore underlying groupings that might be present among the selected fill samples from 2009, complete linkage cluster analysis was employed using the absolute number of seeds as the solitary variable (for the resultant dendrogram, see: **Figure 5.11: B**).[8] The latter variable was chosen since it was clear that for some samples, the absolute number of seeds did not affect the overall density of the sample. From the resultant dendrogram, five clusters were chosen and these were symbolized in the scatterplot as colors. A boxplot of the clusters (**Figure 5.11: C**) illustrates the degree of separation between them. Clusters 2 and 1, for instance, contain vastly different numbers of seeds as an absolute count (a mean of 56.1 and 170.25, respectively). Using these clusters it is possible to see that for samples with larger numbers of seeds (Clusters 1, 3 and 4), as flotation volume *increases* the density of seeds *decreases*. As an example, the point in the upper left of the scatterplot (Cluster 2) is almost twice as dense as the point in the lower right (Cluster 4), even though it contains as much as *five times fewer seeds as an absolute count*.

The reason for this effect, it is argued, is that paleoethnobotanical remains at the site of Dhiban are *not* homogeneously distributed, especially in fill contexts, but are spatially hetereogenous. The hetereogeneity of the botanical "patterning" means that as the size of a collected sediment sample increases, so too does the likelihood of sampling a space which contains relatively fewer botanical remains (**Figure 5.12**). In contrast, a smaller flotation volume has a higher likelihood of landing upon an area with relatively little, or relatively many, remains, and therefore since the seeds fill the "sample space" evenly, the density is higher than a larger flotation sample, *even if the larger sample contains more seeds by count*.

With this observation, the sampling strategy in 2012 and 2013 was adjusted to maximize the identification of spatial heterogeneity in deposition, as well as the recovery of a diverse and representative range of taxa. Although surfaces were still subdivided into 1 x 1m grids aligned with the site grid (and occasionally, architecture), "fill" deposits were now sampled from as many locations as possible within the discrete boundaries of the deposit (**Figure 5.10: B**). Excavators were instructed that each collected sample of sediment was not to exceed 50 centimeters in diameter, and to be explicitly non-contiguous with other samples

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[8] Complete linkage cluster analysis is an agglomerative, hierarchical furthest-neighbor clustering technique (Legendre and Legendre 2012: 316-317), unlike single-linkage clustering which is a nearest neighbor technique (2010: 308-310). The advantage of complete linkage clustering is that it attempts to maximize the differences between groups in a continuous data-set (Legendre and Legendre 2012: 318).

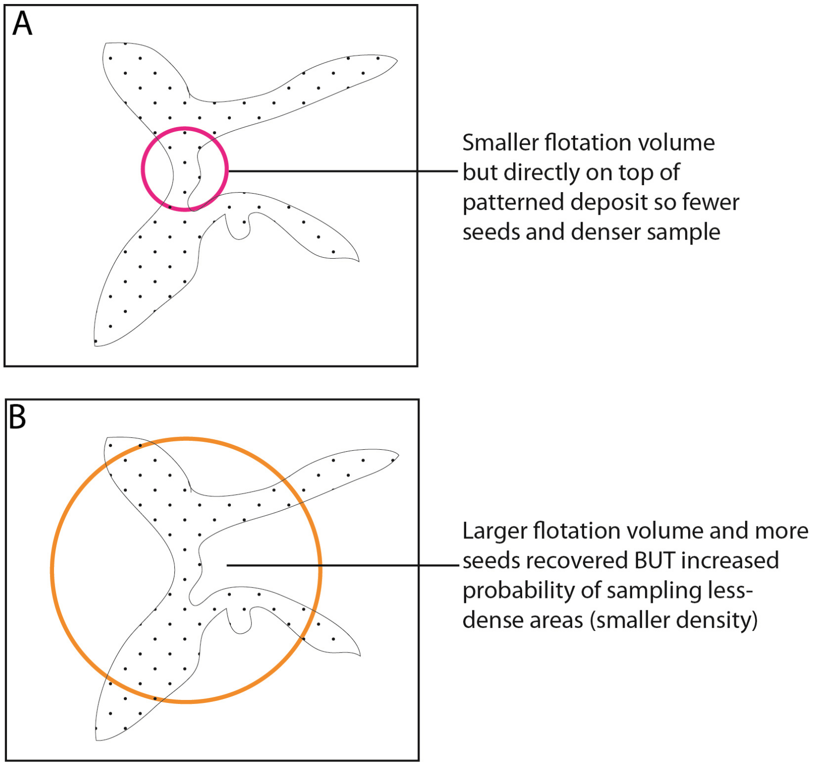

Figure 5.12: Two separate scenarios for the consequences of bulk sampling strategies with variable volumes. In (A) a smaller volume increases the probability of directly sampling an area rich in remains, while in (B) a larger volume recovers more remains as an absolute count, but increases the probability of sampling less-dense areas.

(**Figure 5.13**). Many deposits were not square in their geometric shape, and excavators were left to determine how to procure the greatest number of spatially segregated samples per identifiable archaeological deposit. To aid in this procedure, new handmade breathable cloth flotation bags were purchased from the community of Madaba, whose measured volume capacity ranged from 5 to 7 liters. The small size of the sample collection bag would ensure that samples would only be taken from more delimited spatial areas, and therefore avoid the problem of sampling "empty space" as seen in **Figure 5.12: B**. Therefore the ideal was to collect more, but smaller, and spatially disparate samples (**Figure 5.13**): a collection of five, 5L flotation samples, for a total of 25L of sediment per deposit, where possible. These samples were not processed together, however, but floted and analyzed individually. Therefore the sampling strategy remained a bulk sampling strategy, albeit one that took more, smaller, and spatially non-contiguous samples per archaeological deposit.

Moreover, excavators were also instructed not to remove any archaeological material during the course of collecting a flotation sample. The sediment of any given sample was to be placed into a sample collection bag exactly as it was found. The purpose of this procedure was to include other archaeological remains in the analysis of formation processes, such that

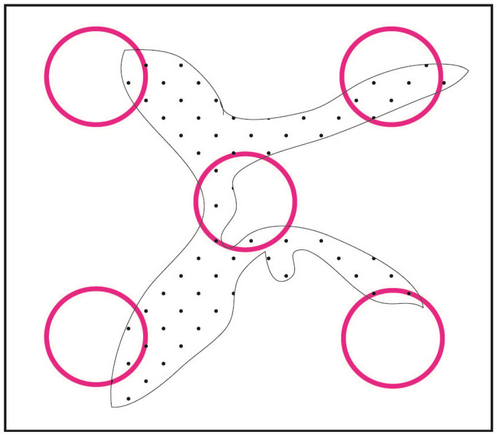

Figure 5.13: The ideal sampling scenario for paleoethnobotanical remains in fill deposits, where multiple, small samples (signified with the red circles) are collected across a singular deposit, especially when the underlying distribution of remains is not visible. These samples are not physically combined.

a flotation sample be considered a "whole" - that is containing conjoined macrobotanical and artifactual data. While the author did oversee this operation in Field S in 2012 and 2013, it was not possible to prevent the removal of visible artifacts for the "sub-gridded" surfaces elsewhere prior to sample collection. The decision to do this was to ensure comparability with earlier excavation seasons (2004, 2005, 2009, and 2010) during which these remains were routinely removed. In Field LW and LE, all archaeological remains embedded in surfaces and visible to the unaided eye were provenienced using a Total Station and then collected individually. Therefore, the contents of heavy fraction samples from sub-gridded surfaces in Field LW and Field LE are biased toward smaller remains missed by excavators.

It has been thus far shown that the size of a bulk sample, whether spatially large or small, has an effect on the density of remains recovered due to spatial heterogeneity of deposition. The data from 2009 and 2010 also illustrate that the size of the sub-grids used to sample surfaces, moreover, might also introduce a homogenizing effect within deposit contents. For instance, the excavation unit BP48 was divided into 1x1m sub-grids relative to its larger 5x5m grid in 2009, and each flotation sample was the entirety of the sub-grid, although impeded in some cases by the architecture (**Figure 5.14**). As seen on the accompanying scatterplot and in the accompanying table (**Table 5.4**) for the 2009 excavation of BP48,

Table 5.4: Volumetric and Seed Data from Sampled Surface Subgrids (BP48)

Flot Sample	4 (F0204)	1 (F0299)	3 (F0203)	5 (F0200)	2(F0205)
Flotation Volume (L)	5	11.5	17.5	22	25
Number of Seeds	199	371	78	326	134
Seed Density (#/L)	39.8	32.26	4.46	14.82	5.36

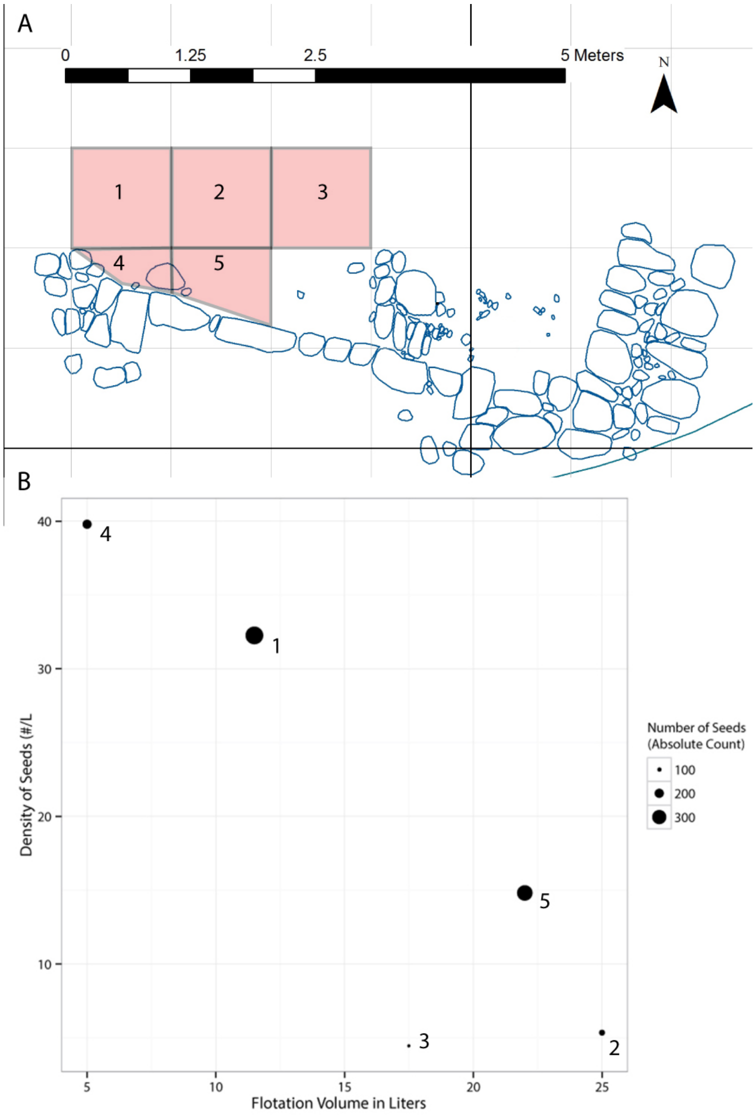

Figure 5.14: The effect of surface sub-grids on absolute number of seeds recovered and seed density. (A) is the spatial representation of the sampled 1x1 meter sub-grids (in red), with the corresponding sample number. The entirety of each grid in red was collected for flotation. (B) is the relationship of the flotation volume of the 1x1 meter subgrids in (A) to the number of seeds recovered per liter. The size of the points is the absolute number of seeds.

a 5L sample from the southwest corner of this structure contains 39.8 seeds per liter, with 199 seeds, while a 22L sample contains 14.82 seeds per liter, with 326 seeds. Although the 22L sample is larger in volume and the number of seeds as an absolute count is greater, its density is nonetheless *less* than the smaller sample by volume. Therefore much like the over-large bulk sampling strategy of fill deposits for 2009 and 2010, it is possible that the size of the "sub-grids" for excavated surfaces at Dhiban might also bias the identification of the spatial patterning of deposits. The latter must be kept in mind when considering any material presented from surfaces collected outside of Field S, as the removal of artifacts from subgrids extended into 2013, to ensure comparability with samples collected in previous excavation seasons.

Flotation

All sediment samples were processed using a modified Siraf-style flotation machine (Williams 1973), with a sediment processing tank decanting into a water collection tank (**Figure 5.15**). A machine water pump was used to transport the water from the collection tank back into the sediment processing tank. In order to prevent the contamination of samples, a water filter was placed over the hose drawing water from the water collection tank, and a "cleaning chiffon" was used in-between every sample to ensure that no residual remains were present. A 1mm mesh was placed inside the sediment processing tank for the collection of those remains with a specific gravity greater than water (the "heavy fraction"), and an extremely fine chiffon was placed in a ring at the end of the decanter to collect the material with a specific gravity less than water (the "light fraction"). The water was agitated both by the spigot inside of the tank, and also with gentle manual agitation.

To test the recovery rates of the flotation machine (Wagner 1982), *maftoul*, a form of processed wheat similar to couscous (between 1 and 3mm in size), which is morphologically unlike all of the potential taxa that could be encountered, was charred and entered into 10 samples at random (between 50 and 100 items in each sample) by an individual other than the one operating the machine. The result from 5 analyzed samples is that the machine recovered between 84 - 100% of the *maftoul* in the light fraction. One notable source of bias is that in one sample 20% of the recovered *maftoul* were fragmented (halved). The latter fragmentation due to exposure to water and perhaps mechanical agitation is another source of bias when considering the interpretation of fragmented archaeological plant remains from the years 2009 to 2013 at Dhiban (especially for the Fabaceae which are dicotyledonous and can rupture down the sagittal plane of the raphe). Despite the large size of these *maftoul*, the recovery rate of the flotation machine for archaeological seed remains between .5mm and 1mm in size was high, as it will be shown below. Many samples, especially those from Middle Islamic period deposits, contained small (>.5mm) weed seeds as more than half of the sample seeds, by count (e.g. F0353 contains 380 seeds, and 191, or 50%, are small >.5mm weed seeds). Therefore, the recovery rate of the machine for archaeological botanical remains across all fraction sizes was high.

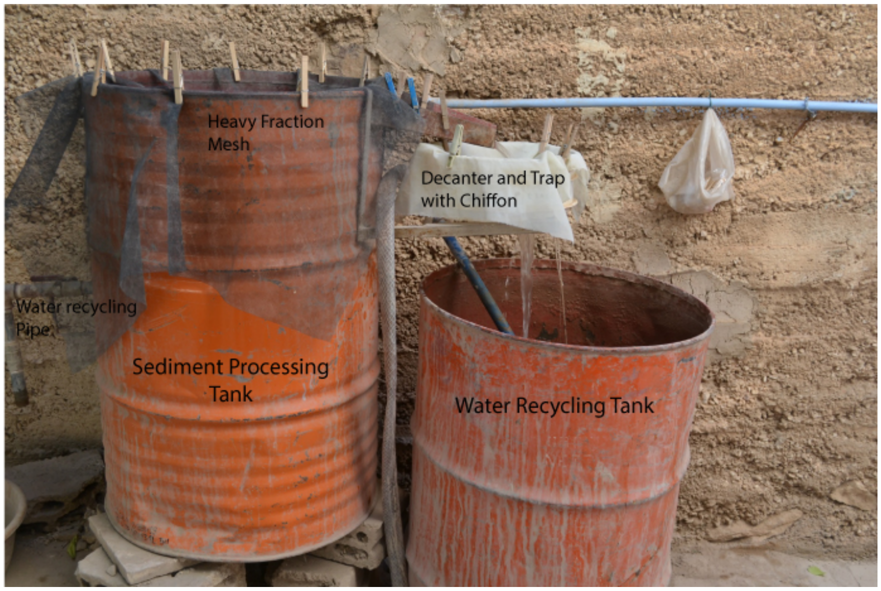

Figure 5.15: Modified Siraf-style flotation machine employed on the DEDP, with labeled component parts (Photo Martin Weber, 2012).

In-Field Processing

After the sediment of each sample was processed in the flotation machine, the heavy fraction and light fraction were left to dry in separate locations. The heavy fraction residues, upon drying, were then hand-sorted in the field laboratory in Madaba after having been passed through a series of nested copper geologic sieves; first through a stack of>25mm, >12.5, >8, and > 4mm sieves to remove the largest remains, and then >2mm and >1mm sieves to separate the smaller remains. The samples were hand-sorted down to >4mm in size, with the remaining sorted sediment (>2mm and >1mm) bagged in its entirety for inspection under a stereoscope at UC Berkeley. The light fraction remains, after drying, were bagged in their entirety, and shipped to UC Berkeley for analysis in the McCown Archaeobotany Laboratory.

Laboratory Methodology

In the laboratory, each light fraction sample to be analyzed was given its own identification number, or “flot number”, beginning at 0001 (e.g. F0220). The entirety of the residues of the light fraction sample was passed through a series of geologic meshes >2mm, >1mm, and >0.5mm in size, with each fraction size bagged separately. The weight of each entire sample was only recorded for only 120 samples, as it was determined that the total weight of the light fraction was highly correlated to the volume of sediment processed, and moreover was skewed by the presence of modern botanical material such as rootlets and cereal straw. Each of these size-sorted subsamples was then analyzed, except for the material <0.5mm in size. All identifiable archaeological plant remains were separated, quantified, and identified using a stereoscopic microscope to the most specific taxonomic level possible, e.g. to species - *Ficus carica* (fig), genus - *Galium* sp. (bedstraw), or family - Poaceae (grasses). Identifications were based on modern comparative collections housed at the University of Pennsylvania Museum of Anthropology and Archaeology curated by Naomi Miller, as well as in the McCown UC Berkeley Archaeobotany laboratory collected by the author (from the Sacramento USDA Agricultural Seed Bank) and by Christine Hastorf. Other invaluable sources of identification criteria included seed atlases (Martin and Barkley 2000; Nesbitt 2006), archaeobotanical identification literature (Jacomet 2006; Neef et al. 2011), a voluminous literature on archaeobotanical studies in southwest Asia with images, and contemporary ecological analyses of the range of vegetation expected in Central Jordan (Crawford 1986; Palmer 1998), including the *Flora Palaestina* (Zohary 1966).

Wood charcoal was counted and weighed at the >2mm mesh size, and only weighed, but not counted, at the 1mm mesh size. Both a stereoscopic and a high-power microscope (fitted with an objective lens up to 50x) were used for taxonomic identification. Taxon identification utilized the literature and comparative collections cited above, with the addition of wood-taxonomic specific identification literature (Schweingruber et al 2011). Identifiable and unidentifiable seed fragments were collected until the 1mm mesh level. When possible, seed fragments identifiable to some taxonomic level were recorded as fragments of that item (e.g. "Fabaceae frags"). The only taxa whose fragments were included into the count of whole seeds were Poaceae – in cases where a Poaceae seed was fragmented but the embryo / scutellum was visible (as Poaceae only contain one; Jones 1991: 65-6), that item was recorded as "Poaceae apex", but included in the count of whole Poaceae. Unidentifiable seed fragments were distinguished from "clinkered" remains, which were classified by severe distortion to the point of an inability of recognition (Hubbard and al Azm 1990). All archaeological plant remains, that is domesticates, non-domesticates, and rachis remains were separated, quantified, and identified down to the 0.5mm level. The quantification of rachis remains was predicated on the number of identifiable rachis internodes if found on a spike-chain (cf. Cappers and Neef 2012: 306). Non-botanical, organic remains such as shell, dung, and carbonized insect remains were also counted and identified down to the 0.5mm mesh size, although operationalized into larger categories (e.g. "shell"). Dung was both counted and weighed, although no volumes were taken as the volume is highly dependent on the three dimensional arrangement of individual dung pieces (Charles 1998: 113).

5.5 Sampling Results

The results of four years of sample collection have yielded 903 samples, for a total of 8,020.5 liters of processed archaeological sediment (**Figure 5.16:A; Table 5.5**).[9] As predicted from the change in sampling strategy from 2009-2010 to 2012-2013, the histograms of samples col-

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[9] Samples without flotation volumes were excluded from the analysis of the total. Including samples with no recorded volume, the number of total samples increases to 914.

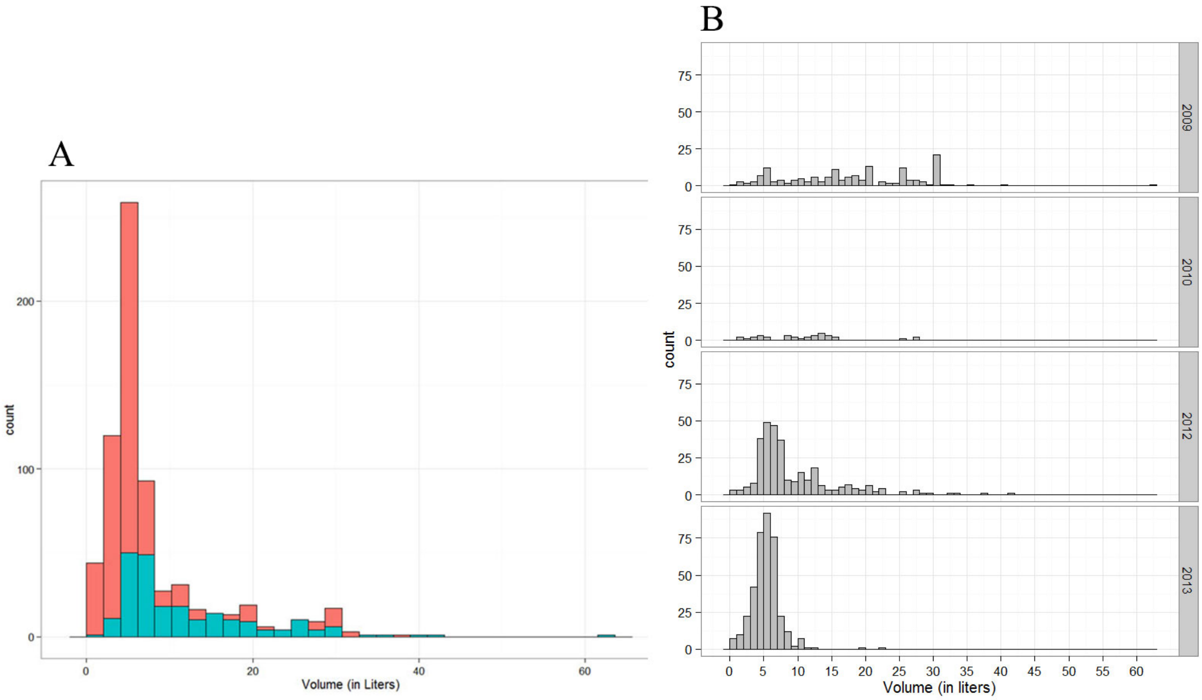

Figure 5.16: (A) is a histogram of the volume of flotation samples collected across all years of excavation (2009-2013), where blue-green signifies analyzed samples, and red signifies processed but not analyzed. (B) contains histograms of the volumes of collected flotation samples, by year.

lected by year (**Figure 5.16:B; Table 5.5**), show that the standard deviations of the sample volumes collected dramatically decreased in 2013 (from 6.2 to 2.2 liters), while the number of flotation samples as an absolute count rose considerably. The 2005 material (starred with an asterisk) is also presented here, although it was neither collected nor processed in the field by the author. The latter includes material from L-Sect (the Iron Age stratigraphic sequences), as well as important Middle Islamic I (i.e. Ayyubid ca. 1000 - 1200 CE) contexts. They have been included as they constitute part of the samples that have been analyzed in this study.

Of these 903 samples, 223 have been analyzed in the laboratory for the recovery and identification of paleoethnobotanical remains. The total volume of these samples is 2,671 liters, or 33.3% of the processed total. Among these 223 samples are samples that are from the same archaeological deposit, but that were collected over several days. For instance one 1x1m subgrid of a surface in the Barrel Vaulted Room in Field L (BR44 Locus 35 Subrid 3) was collected as three physically separate flotation samples, and although each of the three samples were processed and analyzed independently, they were combined for quantitative analysis (i.e. in spreadsheets) as they derive from the same sampling unit (i.e. they are sample duplicates from the 1x1 meter subgrid). In addition to samples that

Table 5.5: DEDP 2009-2013 Sampling Results: Volumetric Data

	All Samples	Analyzed Samples	2005*	2009	2010	2012	2013
N	903	223	22	166	34	306	375
Volume (L)	8020.5	2671	138.5	2897.5	358	2724	1902.5
$\bar{x}$	8.88	11.97	6.29	17.45	10.52	8.90	5.07
s	7.35	8.50	1.20	9.82	6.62	6.2	2.182
Skewness	2.00	1.88	.26	.51	.87	.1.98	1.99
Kurtosis	4.98	5.43	-.02	1.15	1.02	4.85	13.52

were aggregated, other samples have been removed from consideration in this study as they do not directly address the research questions presented thus far. These excluded samples include test units and geological terrace samples, as well as other samples with unclear archaeological provenience (due to insufficient notes from the excavator, e.g. BS47). The result of excluding and aggregating duplicate samples yields an analyzed sample count of 194 samples (from an original of 223), at 2,433 liters. The 194 samples are those used for the analysis of differences among the deposits dating to specific periods, and these are called the Operationalized Analyzed Samples. The original 223 from which these 194 derive are entitled the Total Analyzed Samples. For example, in the case of the Middle Islamic II contexts, the aggregation of duplicate samples changes the number of samples from 81 (TAS) to 66 (OAS), as there were 29 samples that, after aggregation, were reduced to 14 (see Middle Islamic Period Structure 1, **Figure 5.17**).

Analyzed Contexts

As discussed in the **Excavation** section, these samples derived from a number of unique archaeological contexts in each of the different excavation areas (fields). As each of these excavation fields is largely composed of a single period occupation, each occupation can be considered as representative of that field. As seen in the bar graph representing the comparison of sample counts by context (**Figure 5.18**) as well as the accompanying table (**Table 5.6**), the samples originate from several different archaeological contexts.

Table 5.6: Counts of Samples per Archaeological Context by Operationalized Cultural Period

	Iron II	Nab/Roman	Byzantine	M. Islamic I	M. Islamic II
Bin	0	0	0	0	1
Drain	0	0	6	0	0
Fill	15	5	55	4	18
Foundation Trench	0	2	0	0	0
Pit	0	0	3	0	5
Supra Surface	0	0	11	0	0
Surface	11	0	4	11	41
Tabun	0	0	1	0	1

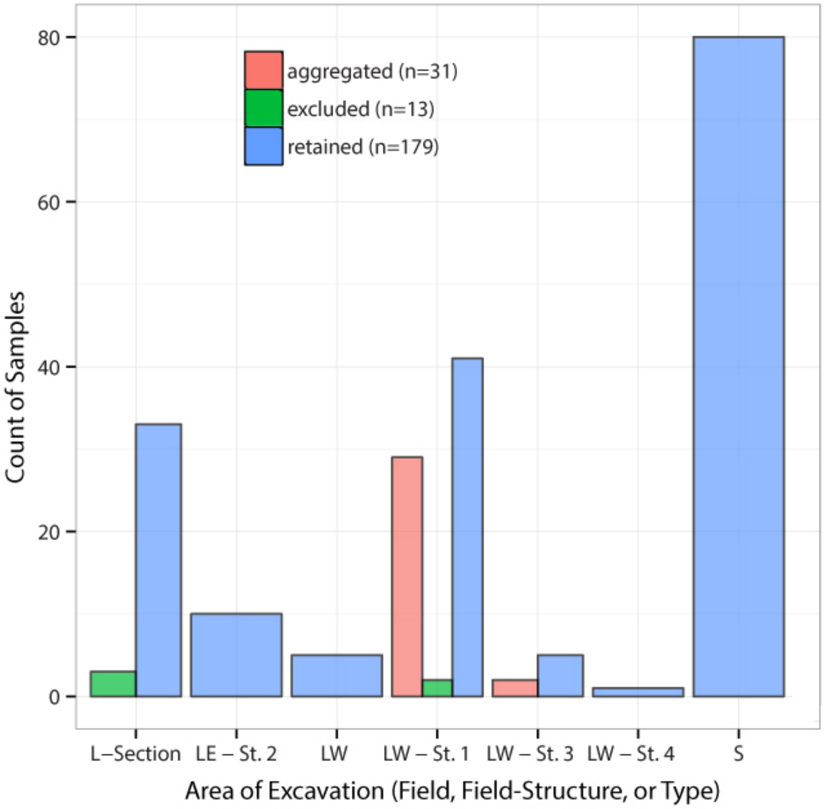

Figure 5.17: The counts of flotation samples that were aggregated, excluded, or retained. Aggregated indicates samples that were combined *post hoc* as they were multiple physical samples of the same deposit. Excluded indicates samples that were removed from statistical analysis. Retained indicates samples that were not adjusted *post hoc*. Bar width is not meaningful.

The most common contexts are "fills" among the Byantine period samples (55 - 68.7% of period total), and surfaces among the Middle Islamic II samples (41 - 62.1% of period total). There are other contexts as well, such as *tabuns*, pits, and bins, but they occur with less frequency. The relative abundance of each of these samples from each of these contexts is due to the nature of the excavated areas themselves.

Light Fraction Contents

Of the 223 total analyzed samples (2,671 liters of sediment), 68,295 items were identified (**Figure 5.19**). The majority of the total assemblage was constituted by (large) charcoal greater than 2mm in size (37.9%), followed by whole seeds (18.6%) and rachis remains (17.7%). The remaining 25.8% of the total analyzed assemblage was composed of unidentified fragmented seeds, shell, culm nodes, and other remains. The median proportion of identified seeds out of the 194 operationalized analyzed samples (after removal of test units and geologic soil samples) is 87.5%, whereas the mean is 83%. The distribution is negatively skewed

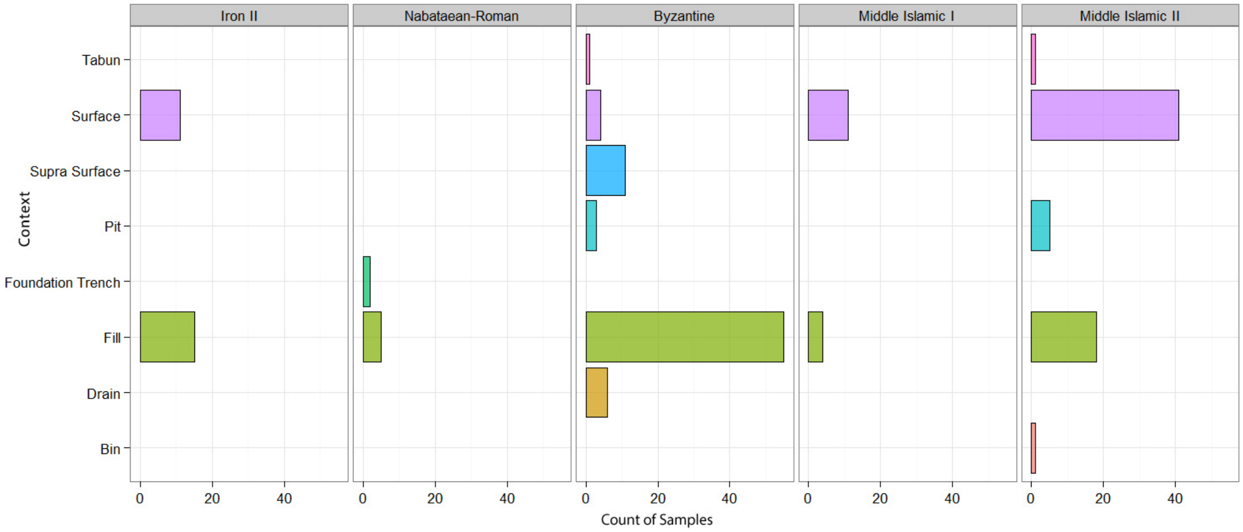

Figure 5.18: Counts of samples per archaeological context by period.

(smaller values have relatively less influence), and 75% of the samples are between 75.8% and 93% identified.

Heavy Fraction Contents

In addition to the light fraction, the corresponding heavy fraction of each flotation sample was also analyzed, when possible. In some cases, such as in the Iron II samples deriving from L-Sect excavated in 2005, heavy fraction samples were not available at the time of analysis. Thus far, 175 heavy fraction samples have been analyzed (representing 2,347.5 liters of sediment). Within these 175 samples, 27,183 different items were identified. The most proportionally abundant element of the assemblage (40.59%)is "chaff tempered clay". "Chaff tempered clay" is an as-yet functionally unknown class of material, which is identifiable on the basis of visible chaff impressions. After "chaff tempered clay", the next most abundant items as a total proportion of the assemblage are bone (27.82%) and ceramic sherds (21.92%). The remaining 9.67% is composed of shell, botanical items, glass, and other infreqeuent item classes (see **Figure 5.20**).

Potential Biases

There are several routes through which biases may have entered into both the light fraction and heavy fraction assemblages, in terms of the kinds of remains recovered, effects on the frequency of their recovery, effects on their frequency within a given sample, and the state (preservation conditions) of the recovered items. Thus far, the identified sources of potential bias have been spatial in origin: the first is through the collection of very large (30L) bulk sediment samples in 2009 and 2010, and the second has been the removal of artifacts in

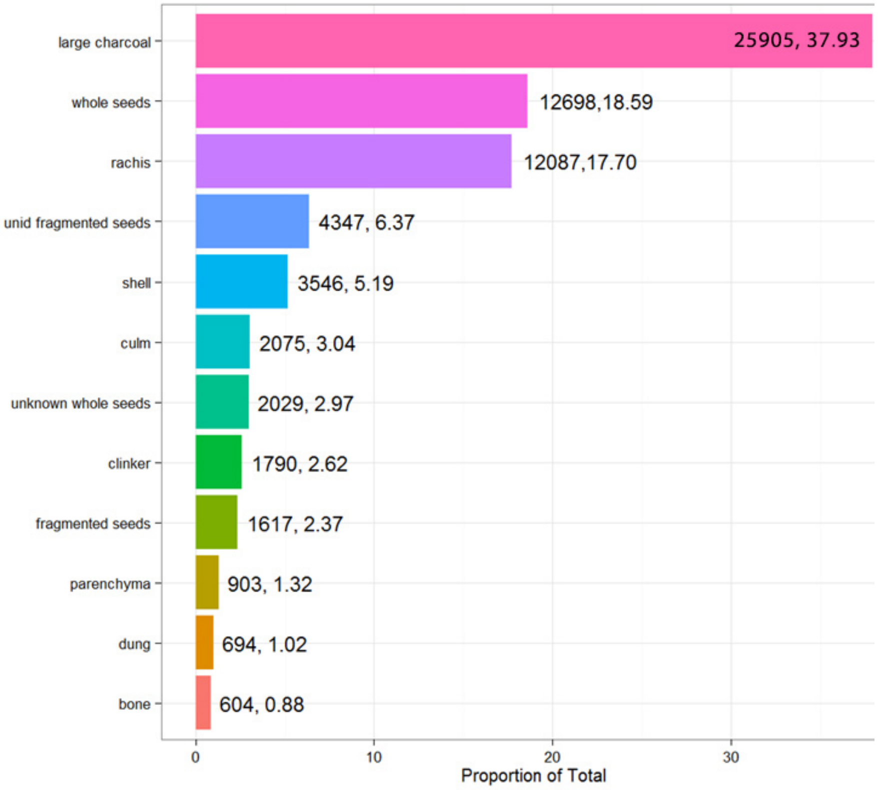

Figure 5.19: Overview of light fraction contents, with absolute count and proportion of total assemblage listed to right of bar (n=223 samples).

subgridded surfaces prior to their collection in flotation samples. Nevertheless, as discussed above (**Flotation**), the overall recovery of the flotation machine is high. As Wright (2005) has indicated, however, due to differences in sediment matrices among archaeological contexts in terms of buoyancy, material "trapping", and potential agitation (2005: 21), many botanical remains are unable to be released from their enveloping sediment matrix and may not be present in the light fraction (2005: 22-23). Again, while the latter is dependent on the quality and type of sediment found on archaeological sites, Wright (2005: 23) has also shown that certain botanical taxa such as nutshells (in this case, Bitternut hickory, *Carya cordiformis*) do not float because the specific gravity of these items is denser than the surrounding water. Therefore, in order to ensure that botanical remains might not be mis-represented through analysis of the light fraction alone, ten samples of >2mm heavy fraction (henceforth the "microdebris" or "MD") were analyzed, and compared to the >4mm of the heavy fraction ("HF"), as well as the >2mm of the light fraction ("LF"). Large charcoal (charcoal larger than >2mm in size) was quantified to compare recovery between these sample types, given its abundance and ubiquity in the light fraction. This analysis is important as this study only utilizes that material found in the light fraction, in order to maintain comparability

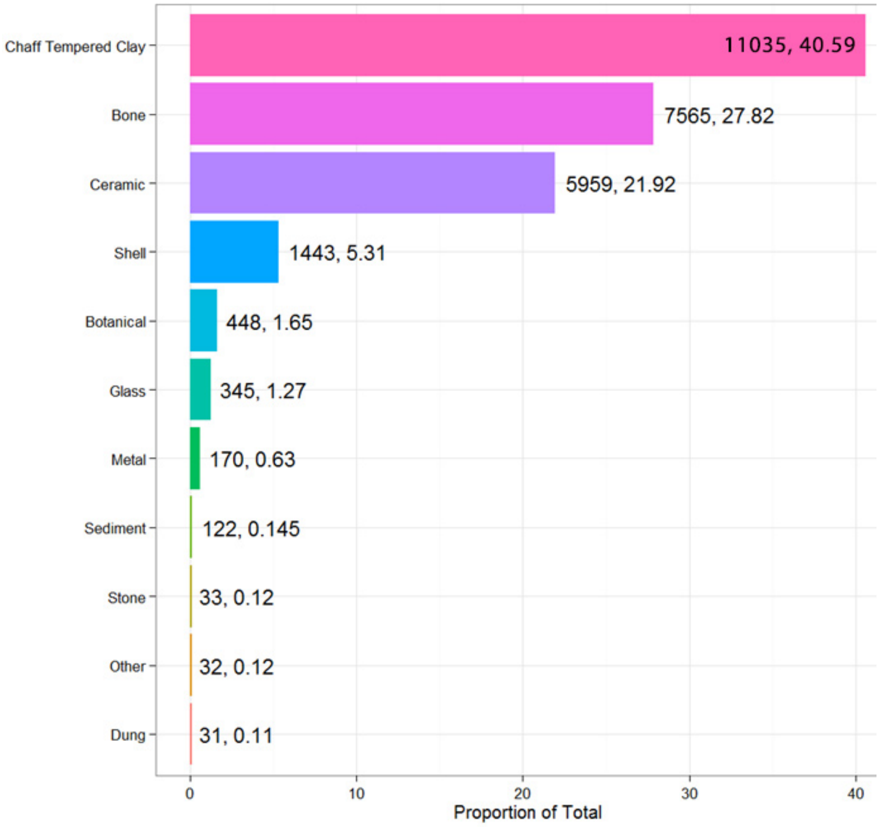

Figure 5.20: Overview of heavy fraction contents, with absolute count and proportion of total assemblage listed to the right of the bar (n=175 samples).

with earlier excavation seasons in which the heavy fraction was not retained.

Quantification of these biases is rarely reported in the paleoethnobotanical literature of this area and time (Hoppé 1999; Ramsay and Smith 2013), as most analysts anecdotally report the examination of "a few" heavy fraction samples to determine the lack of presence of remains, without explicit indication of the number of samples or the number of remains. Of the ten samples, five of the LF portions contained less than 75% of the large charcoal, by count. One sample (#309; see **Figure 5.21**), contained more than 50% of the charcoal count in the microdebris. Three samples (#'s 309, 334, and 377) contained only 33, 54, and 66% of the charcoal count in the light fraction. Weight is the parameter that is most often used in this study in the analysis of charcoal density (i.e. grams per liter) due to the potential for post-depositional fragmentation. Therefore, the proportion of the charcoal weight in each fraction out of the total combined sample was also calculated. While the light fraction contains the majority of charcoal weight (symbolized on the y-axis of **Figure 5.21**), some samples unsurprisingly contain the majority of the charcoal weight in the >4mm heavy fraction size, due to the larger size of those items. To illustrate, although the >4mm

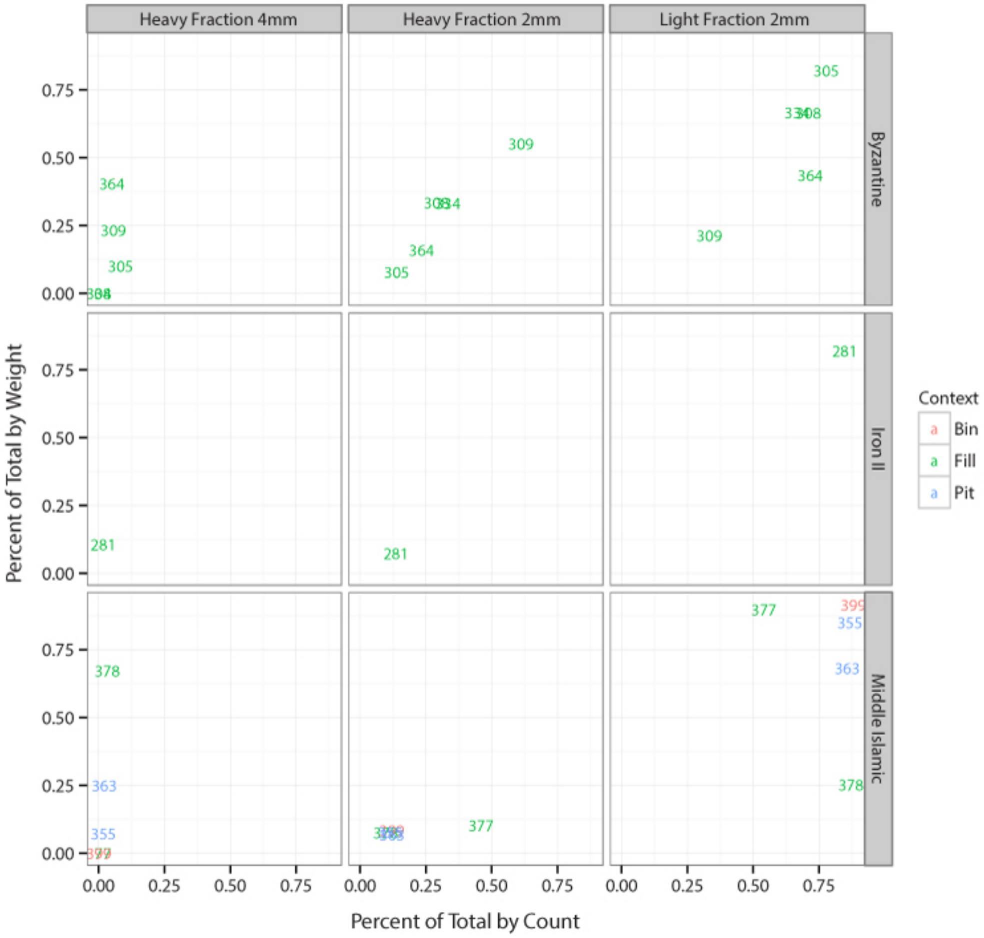

Figure 5.21: Proportion of total flotation sample represented by 4mm and 2mm heavy fraction sizes, and 2mm light fraction, for weight and count of charcoal. Each point is represented by its sample number, and the color indicates context, with key to the right.

heavy fraction mesh size of sample #378 comprises 3.2% (only 1 piece) of all of the charcoal recovered in that flotation sample by count, it constitutes 67.1% (.29 g) of the sample total by weight. Nevertheless, of the seven samples that contain charcoal in the >4mm heavy fraction, four contain the majority (68%-85%) of the charcoal weight in the light fraction.

If the >4mm charcoal pieces are excluded, however, the light fraction performs favorably as a proportion of the total charcoal weight of the combined microdebris and light fraction. Except for one sample (#309, again) that contains 72% of the charcoal by weight, the remaining 10 samples contain between 66.5% and 91.8% of the charcoal weight in the light fraction alone, with the mean proportion at 83%. Moreover, correlations of the contents of the fraction sizes to each other reveals that monotonic trends, or scalar relationships,

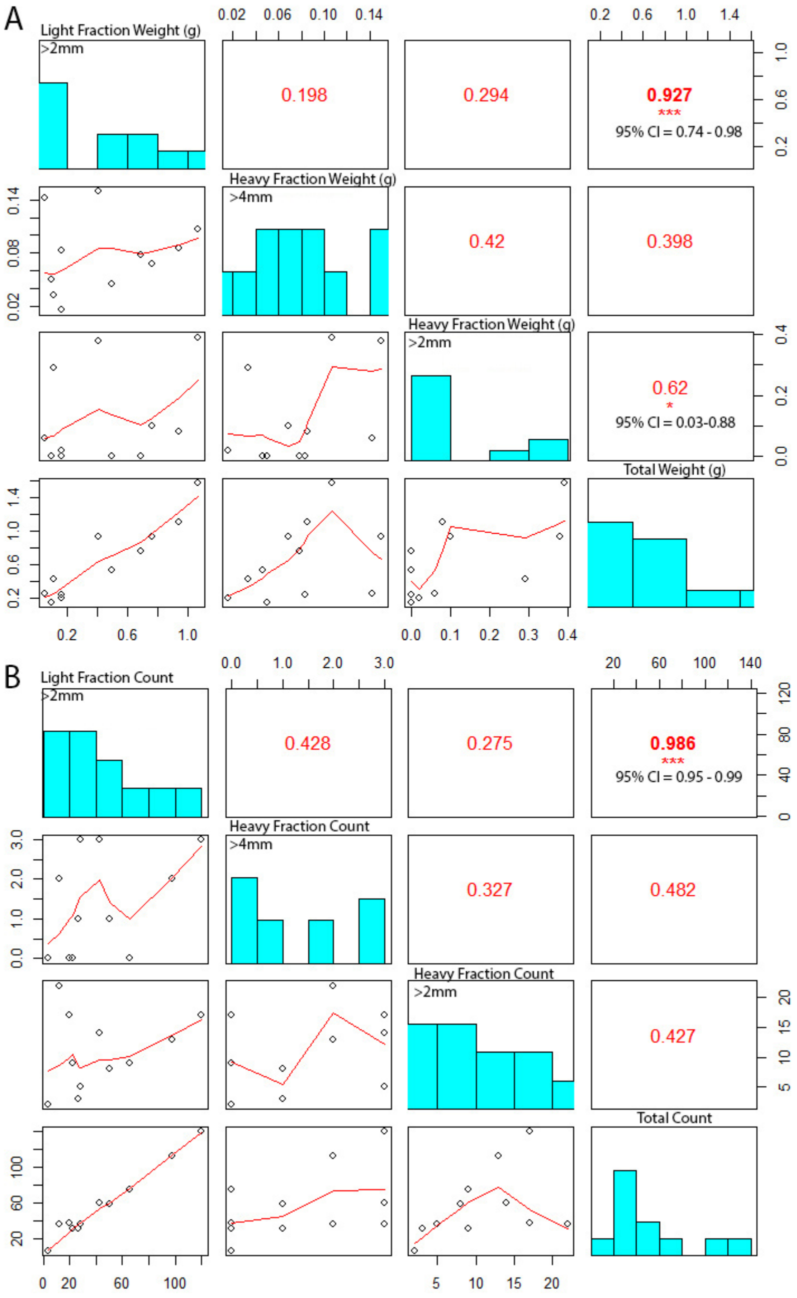

Figure 5.22: Pearson's r correlations of (A) charcoal by weight and (B) charcoal by count. Where the significance of the correlation is indicated ($* = p < .10, ** = p < .05, *** = p < .01$), the 95% confidence interval of the correlation is indicated below, in black. The histograms of the variables are in the middle panels, and a smoothing curve is added to the scatterplots in the lower panels.

between samples were preserved in the light fraction.[10] Correlations of the fraction sizes to each other and to the total, can reveal which of the fractions is the best estimator of the total weight or count due to autocorrelation. Autocorrelation is expected because the total weight or count of a sample is the sum of its individual fraction sizes. Therefore, all fraction sizes should be correlated with the total count or weight of a sample to some degree, if an equal distribution of charcoal remains occurs due to various reasons (e.g. mechanical reasons such as poor separation of remains in the flotation machine). In contrast to this hypothetical expectation, the greatest correlation between the total weight of any given sample and any of the individual fractions, is between the total weight and the light fraction (**Figure 5.22: A**), whose correlation is r=.927. The next most significant correlation is between the microdebris (the >2mm of the heavy fraction), but the corresponding confidence interval illustrates that the "true" correlation is anywhere between .03 and .88; it is therefore an unreliable estimator of the total charcoal weight. Similarly, the *only* significant correlation between total charcoal count and any of the fractions of the total, is in the light fraction, in which the correlation is r=.986. Therefore, these correlations reveal that there is not an equal distribution of charcoal among these fractions, and that the light fraction is a highly accurate, although not exactly precise, estimator of the charcoal in a sample. Moreover the light fraction preserves the monotonic trends of both the count and weight of the total assemblage, even if it underestimates the absolute magnitude.

The analysis of the proportion of domesticate (crop) remains in the light and heavy fractions (**Figure 5.23: A,B**) illustrates a parallel trend to the charcoal data. The proportion of the count of each taxon in each fraction size out of the total was calculated for nine samples, as were the means and standard deviations. Of nine samples, five contained almost 100% of the identifiable domesticate taxa in the light fraction alone. Four did not, and within these samples, three of the standard deviations of the mean proportion of counts overlapped (399, 309, and 305), indicating that there was substantial variability in the range of represented total counts of the taxa. The overlap in the variation in the mean proportion of taxa in the light fraction is due to the low counts of these samples, and the influence of infrequently occurring taxa. To provide one example, sample #339 contains 6 identified domesticates (**Figure 5.23: A**), and 4 are contained in the light fraction, that is 66%. Nevertheless the two specimens that are not present in the light fraction, are from two separate taxa (*Lens* and *Hordeum*), both of which are different from the taxon represented in the light fraction (*Vicia*). The light fraction therefore preserves the numerical trend of recovered taxa, although there are instances when it does not recover taxa that occur in low absolute counts, as was seen in the previous example. Therefore these data might not preserve the infrequent presence and absence of certain taxa, while simultaneously preserving their relative numerical abundance. While the >2mm of the heavy fraction was not incorporated into this analysis in order to ensure comparability with earlier research seasons where these remains were not collected, these analyses nonetheless indicate that the light fraction is a reliable

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[10] There is no correlation between the size of the flotation volume and the proportion of charcoal by weight in the light fraction (Pearson's r, corr=.005,p=.98,df=9)

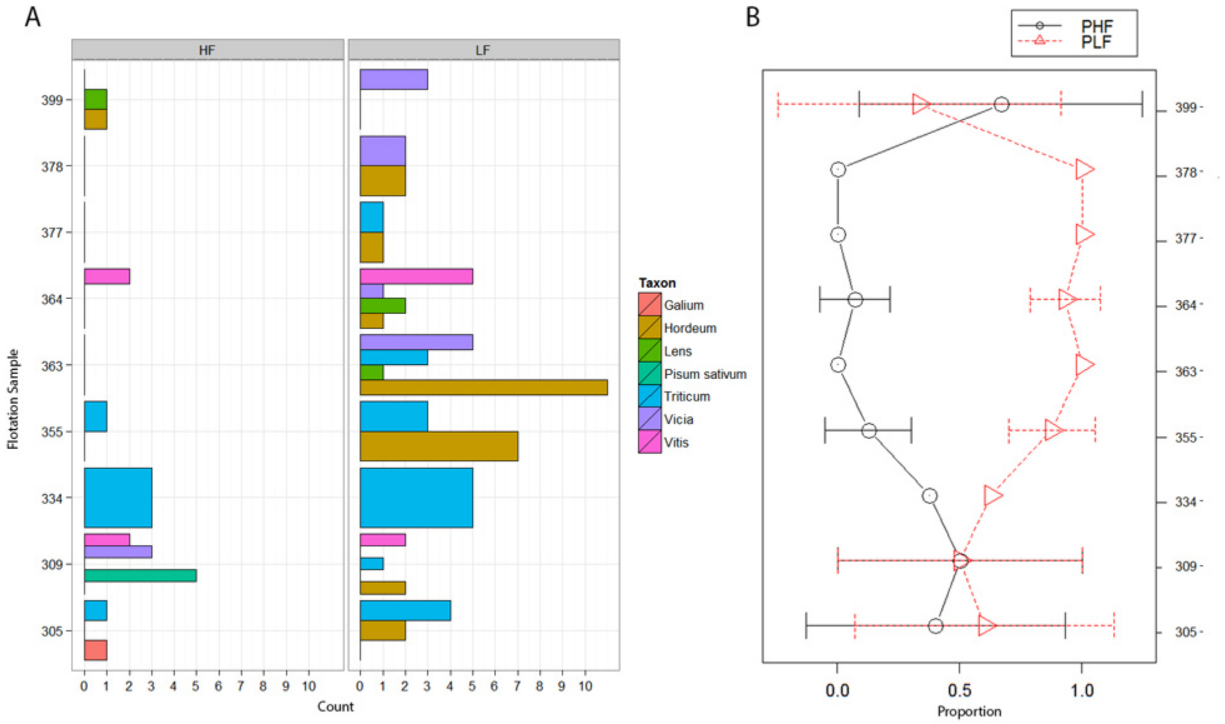

Figure 5.23: Comparison of domesticates recovered in heavy fraction and light fraction, where (A) contains a bar chart of counts of each taxon per sample, and (B) represents the mean of the proportions of the counts within each taxon in the light or heavy fraction, with standard deviation. In (A), the bar width is not meaningful.

indicator of flotation sample contents, and is a conservative estimator of the magnitude of the observed trends in recovered botanical remains, while accurately recording the trends between samples. Future analyses of these materials will include the >2mm heavy fraction remains, when possible.

5.6 Distinguishing Depositional Practices

As discussed above (**Identification of Depositional Practices - Competing Models**), there are several quantitative indices anchored in the paleoethnobotanical data used to determine the potential origins of each of the analyzed samples. To emphasize this point again, while van der Veen and Jones (2006) advocate the analysis of single samples to understand formation processes, with a rigorous, systematic sampling strategy similar to the one employed in this project, a sample-by-sample analysis should only be used for those samples that fall outside of the typical values of the parameter investigated. Therefore it is first necessary to identify general trends (averages, medians, ranges) in order to assess the distribution of the variables under study, and then to look to outliers to provide a more nuanced

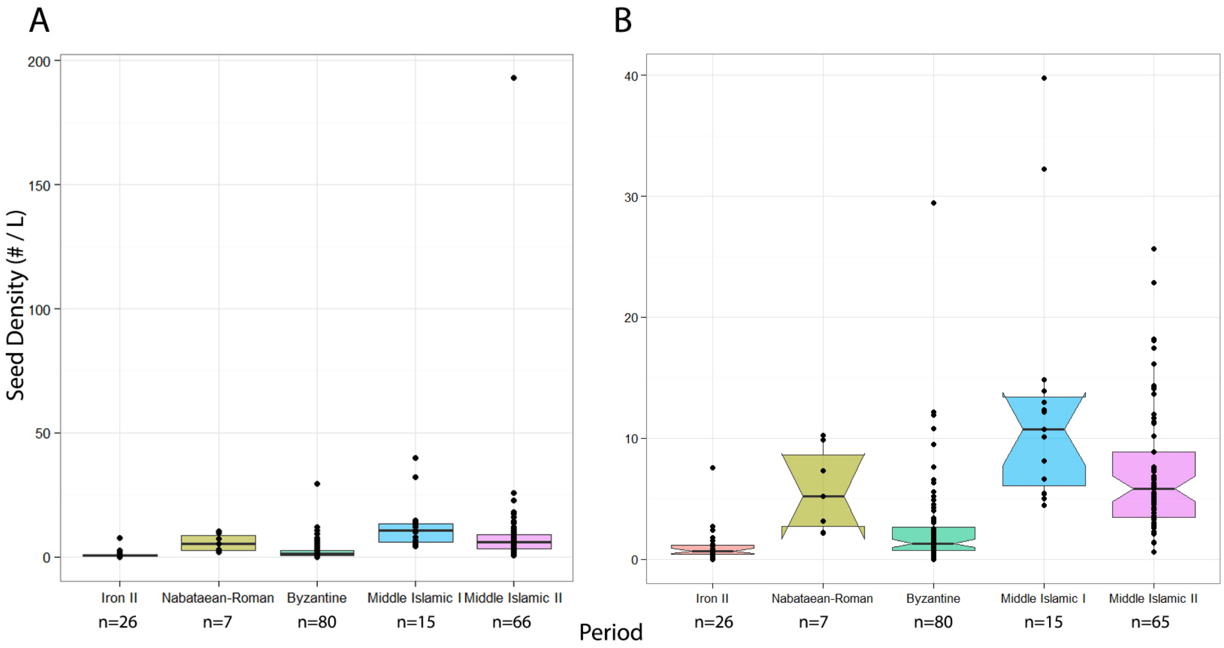

Figure 5.24: Overall density of seeds by period. (A) is a boxplot that contains a solitary extreme value in the Middle Islamic II period, and (B) is the same without the outlier, where the seed density is <150 seeds per liter (only 1 Middle Islamic II sample removed: Flot 363). Boxplot notches represent the 95% confidence interval of the median.

image of extremes in variation.

Individual Indices of Deposition

The indices of deposition that are presented in the following sections relate to those in **Table 5.1** used for assessing formation processes. The four indices are (1) the density of seed remains, (2) the distribution of the proportion of domesticates per sample, (3) the relationship of small weeds (<.5mm) to large (>2mm) domesticates, and (4) the amount of culm nodes (straw) in each sample, per period. First, the relative densities of these deposits by period underscores the nature of their deposition. A boxplot of the densities of seeds by period (**Figure 5.24: A**) illustrates that their distribution across these periodized samples is relatively equivalent except for one extreme value among the Middle Islamic II period samples. The latter sample is from a Pit in Phase 2D of Middle Islamic II period Structure 1 (BVR), which contains 192.8 seeds per liter (868 seeds in 4.5 liters). Although it will be discussed further in Chapter 6, the very high density value of the pit, and its small flotation volume, indicates that it represents the contents of one rapid carbonization and depositional event.

Excluding this unique sample, the resultant boxplot illustrates (**Figure 5.24: B**) that

Middle Islamic I and II period samples are generally denser than Byzantine period samples, that is, they contain a greater number of seed remains per liter of archaeological sediment. The mean and median number of seeds per liter in Byzantine period samples from Field S is 2.57 and 1.31, whereas it is 12.94 and 5.84 in the Middle Islamic period.[11] Although the median and mean of the density of seeds in Middle Islamic I and II period samples are higher than in Byzantine period samples, there is one very dense Byzantine period sample (29.4 seeds per liter) in the boxplot. The latter very high value will be discussed in Chapter 6, as it represents a unique depositional event of rapid carbonization. Apart from the density of all seed remains, an analysis of the density of the domesticates alone (that is the number of crops per liter, **Figure 5.25**) reveals that the greatest number of extreme values (i.e. those samples outside of the general trend of the data) occurs among Byzantine period samples (more than 10 crop seeds per liter, and almost 30 crop seeds per liter), although there are two particularly dense Middle Islamic II outliers as well. Each one of the very dense (>10 crop seeds per liter) samples among the Byzantine period outliers is from the Phase 1 collapsed store-room context, and therefore the distribution of domesticate densities is skewed by a few samples from a unique context that contain high densities of crop taxa. Removing these four outliers from the Byzantine period samples, and the sole outlier from the Middle Islamic period, reveals that the median number of crop seeds per liter for the remaining majority of Byzantine period samples is slightly lower than Middle Islamic II period samples (.45 crop seeds per liter versus .81 crop seeds per liter).

Despite the fact that Middle Islamic I and II period samples have denser concentrations of all seed remains as well as crop remains, the median proportion of identified macrobotanical remains that are domesticates (crop seeds) is higher (50%) within Byzantine period samples than within Middle Islamic II period samples (<25%, **Figure 5.26**). The boxplot of this difference illustrates, moreover, that the Byzantine samples with the greatest number of seeds (from Phase 1) are almost entirely composed of crop seeds. The Middle Islamic II period samples with the greatest number of seeds as an absolute count, in contrast, are those that are less likely to contain crop seeds as a proportion of the total number of identified seeds per sample. Therefore while Middle Islamic II period samples might contain denser concentrations of seeds, they are less likely to contain crop seeds within those samples. Indeed a comparison of the crop versus weed seed proportions using the ^{14}C anchored chronology indicates that while Byzantine period samples are roughly equal in the proportion of crop and weed seeds, Middle Islamic I and II samples are almost entirely composed of weedy taxa in each identified sample (**Figure 5.27**)). Thus while there may be fewer remains (i.e. less dense) in Byzantine period samples overall, even including crop seeds, those remains that *are* likely to be present have a higher probability of being a crop seed of some sort. In contrast, although Middle Islamic period I and II samples are denser in both total seeds and crop seeds, the internal proportions of each sample are more likely to be dominated by weed

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[11] The data are very strongly positively skewed, and that is most visible in the Middle Islamic samples, whose mean is strongly influenced by a few aforementioned samples that exert influence over the mean of the distribution.

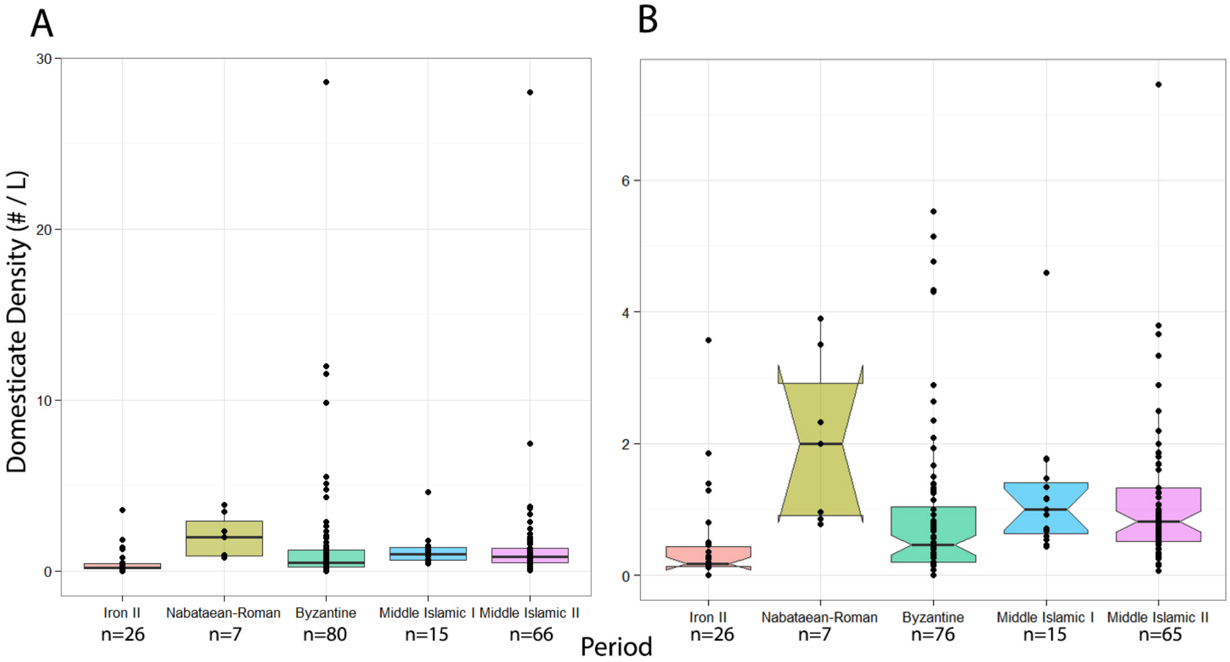

Figure 5.25: Density of domesticate seeds with (A) all data including outliers, and (B) where the number of domesticates per liter <9 (four Byzantine samples removed and 1 Middle Islamic II). Boxplot notches indicate the 95% confidence interval of the median.

seeds than crop seeds.

Moreover, the distributions of the sizes of the weed seeds themselves points to the specific activities from which these weed-seed dominated assemblages derive. A plot of the proportion of total weed seeds comprised by smaller (>.5mm) weed seeds by sample, per period, (**Figure 5.28: A**), illustrates that the median proportion of Middle Islamic II period samples that are composed of small weed seeds, is slightly higher than the earlier Byzantine period (for summary statistics, see **Table 5.7**). Furthermore, the absolute number of weed seeds is greater in Middle Islamic II period samples (symbolized by the point size in **Figure 5.28: A**), and this in turn means that numerically, close to 50% of high weed seed count Middle Islamic II period samples are composed of small weeds alone. As van der Veen and Jones (2006: 223; alongside Stevens 2003, Fuller and Stevens 2009), have noted from the long history of ethnographic work on crop-processing discussed above, the proportion of smaller to larger weed seeds implies by-products from sieving within the crop-processing sequence (item C-3 in **Table 5.1**). In addition, a comparison of the proportion of the number of small weed seeds (<.5mm) to the number of large domesticates (>2mm) out of the *total* number of identified seeds (**Figure 5.28: B**), illustrates that Middle Islamic II period samples are more likely (around 50%) to contain small weed seeds as the majority of the total count of identified seeds, than Byzantine period samples. In contrast, the range of variation is high for Byzantine period samples due to their low seed count, but with most samples trending toward

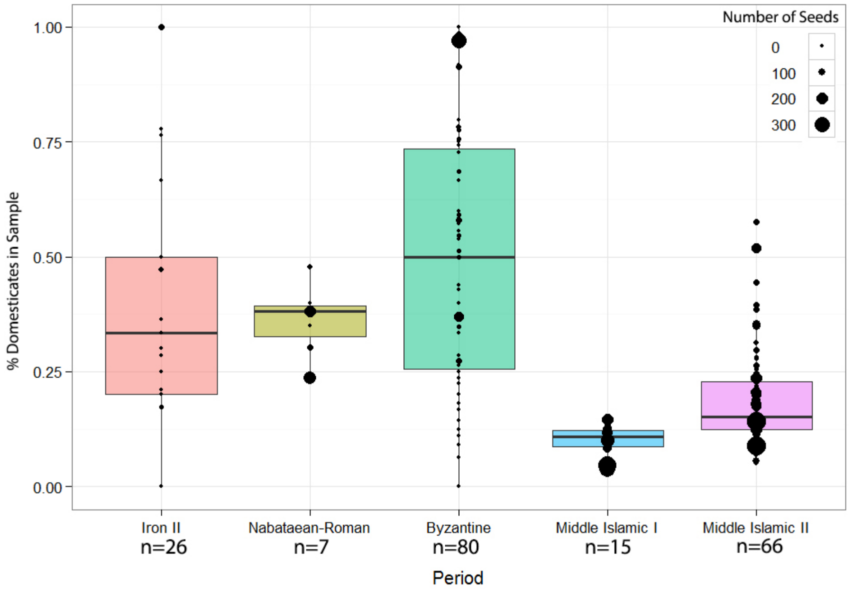

Figure 5.26: The proportion of seeds in each sample composed of domesticates, by time period, with each point sized to the number of seeds per sample as an absolute count.

a higher proportion of large domesticates per sample. Indeed, as **Figure 5.28: C** shows, the densest Middle Islamic II period samples (>20 seeds per liter), contain proportionally the greatest number of small weed seeds, while the densest Byzantine period samples, contain proportionally the greatest number of large domesticates. Therefore Middle Islamic II period samples are most likely the results of crop-processing debris from a late processing stage, whereas Byzantine period samples represent a greater range of other activities, but mainly those that include the handling of mostly clean crop seeds.

Table 5.7: Summary Statistics for Identified Small Weed Seeds (>.5mm - <1mm)

		>.5mm as a % of all weed seeds			>.5mm density (# \ l)			>.5mm absolute count		
	n	mean	sd	median	mean	sd	median	mean	sd	median
Iron II	26	0.68	0.39	0.83	0.43	0.51	0.27	3.69	4.4	2
Nabataean-Roman	7	0.64	0.11	0.64	2.31	1.47	1.72	41.14	41.52	21
Byzantine	80	0.47	0.11	0.5	0.46	0.55	0.33	4.2	9.15	2.5
Middle Islamic I	15	0.59	0.13	0.47	5.39	4.77	4	89.07	86.55	64
Middle Islamic II	66	0.59	0.13	0.58	4.42	12.99	2.4	50.24	63.21	38.5

Therefore the low densities of Byzantine period seed remains (except for Phase 1), but the high proportion of crops within them, points to items “A” and “B” within the model of potential formation processes (**Table 5.1**), that is, direct food remains (Phase 1) and culinary accidents (Phase 2). In contrast to the Byzantine period samples, the Middle Islamic I and II samples are much denser in seed remains overall, but are more likely to contain (small)

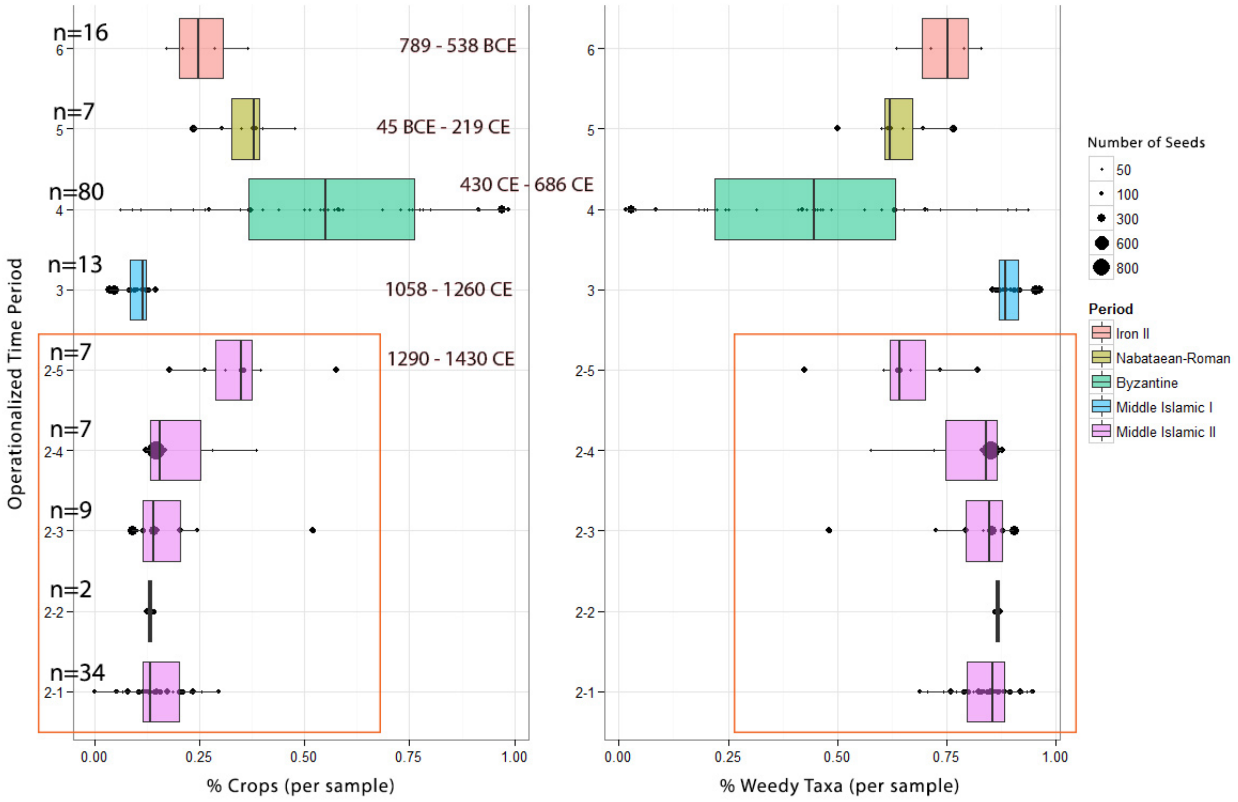

Figure 5.27: Change through time of the proportion of seeds composed by domesticates (A), and arable weed taxa (B), in each sample, with points sized to the number of seeds as an absolute count. Operationalized time period corresponds to the internal phasing of each political period (symbolized as the color of the boxplot), and the corresponding radiocarbon date is provided in-between both plots. The red box indicates that the provided radiocarbon date applies to all of the internal phases.

weedy taxa as a greater proportion of the total identified seeds in each sample. It is more likely, therefore, that Middle Islamic period II remains are the results of crop processing debris (and perhaps dung) burned as fuel. Indeed the density of large charcoal (>2mm) is much higher in Middle Islamic II period samples, whether analyzed by count or by weight (excluding extreme values: **Figure 5.29**)) than in the earlier Byzantine period samples. The charcoal weight of Byzantine period samples is exceptionally low: 75% of the values of Byzantine period charcoal remains as an absolute weight in grams, are between .004g and .167g. When adjusted for flotation volume, the values are even lower (.0008 and .022 g/L). In contrast 75% of the Middle Islamic II charcoal weight density values are between .016 g/L and .15 g/L. The contrast is even more extreme in charcoal density by count, where the upper 75% quartile is 3.6 charcoal pieces per liter in Byzantine period samples, and 15.5 in Middle Islamic period samples. These comparisons indicate that it is more likely that

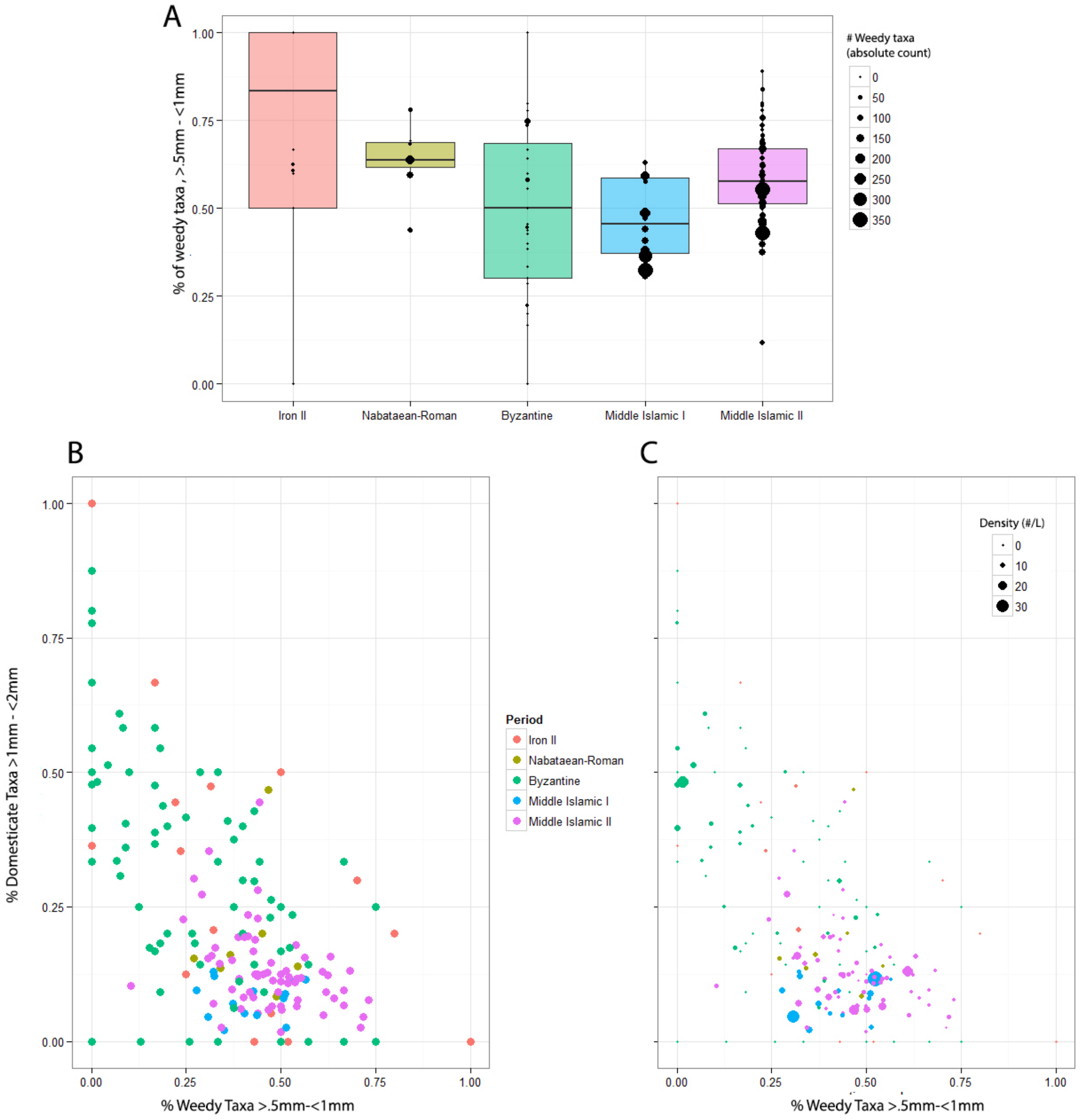

Figure 5.28: The contribution of small (>.5mm - <1mm) weed seeds to the total number of all seeds per sample, as well as the total number of weed seeds, per sample, by period. (A) is a boxplot of the proportion of weedy taxa that are small weeds, with point size representing the total count of identified weed seeds. (B) is a scatterplot of the relationship of the proportion of all identified seeds that are small weeds, to the proportion of all identified seeds that are large (>2mm) domesticates. (C) is the sample plot as (B), but where point size represents the number of seeds per liter.

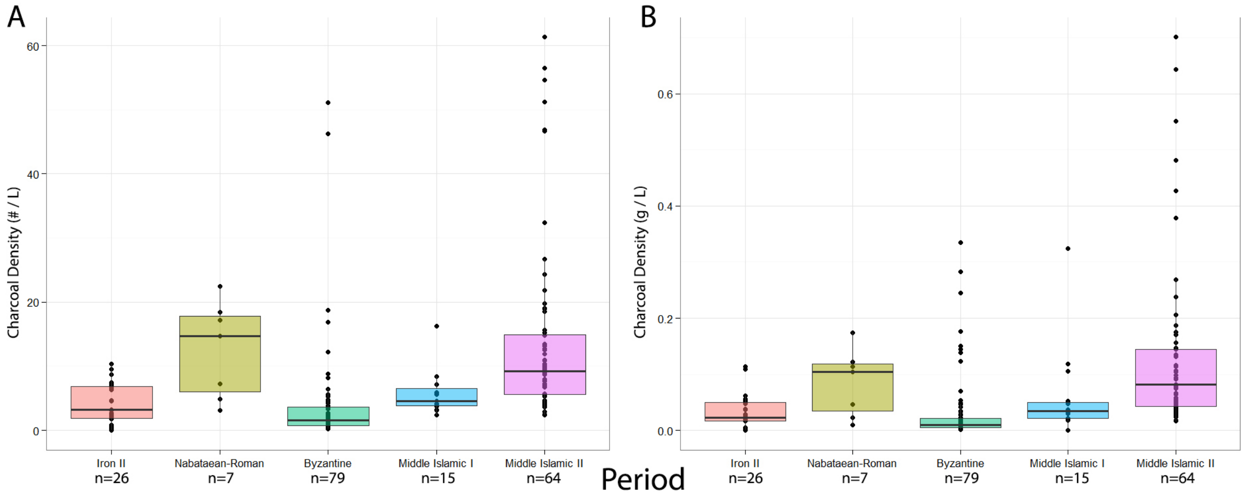

Figure 5.29: Density of charcoal, by period, where the weight of charcoal is less than 10g to remove three outliers (1 Byzantine, and 2 Middle Islamic II), where (A) charcoal density is calculated by count (#/L), and (B) where charcoal density is calculated by weight (g/L).

large amounts of charcoal by weight and by count will be found in Middle Islamic II, rather than Byzantine, samples. The abundance of charcoal is caused by the circumstances of its deposition as well as the amount of burning that was occurring on site. The amount of both charcoal *and* crop-processing debris such as weed seeds, however, points to inter-mixed crop processing debris, charcoal, and dung all burned simultaneously.

The Problem of Dung Fuel

To pursue the issue of dung fuel, it should be recalled that the ratio of culm nodes (straw) to grain is used to assess whether a particular sample is the result of crop processing debris (item C-1 in **Table 5.1**), but also can be used to assess the contribution of dung fuel in a sample. That index is not informative for the Byzantine period samples, as 57 samples, or 71% of the total number of analyzed samples (80), do not contain any culm nodes (straw) at all (**Figure 5.30: A**). In contrast, only one out of the 66 Middle Islamic II period samples did not contain straw remains. When only those samples that contain straw remains are compared across time periods, the median number of straw per liter in Byzantine period samples is 0.2, whereas it is 1.0 in the Middle Islamic period samples (**Figure 5.30: B**). It is therefore clear that there is a much greater amount of straw in Middle Islamic II period samples both in its ubiquity across samples, as well as in its density, that is counts per liter. As straw is an important component of the diet (fodder) of certain domesticated animals, such as sheep and goats, a greater ubiquity and density of straw in Middle Islamic II samples might indicate the importance of dung fuel (Anderson and Ertug-Yaras 1998) in Middle Islamic II period contexts. In contrast to the predictions of Miller (1984, 1988; and Miller and Smart 1984), however, the samples with the *most charcoal*, the Middle Islamic II

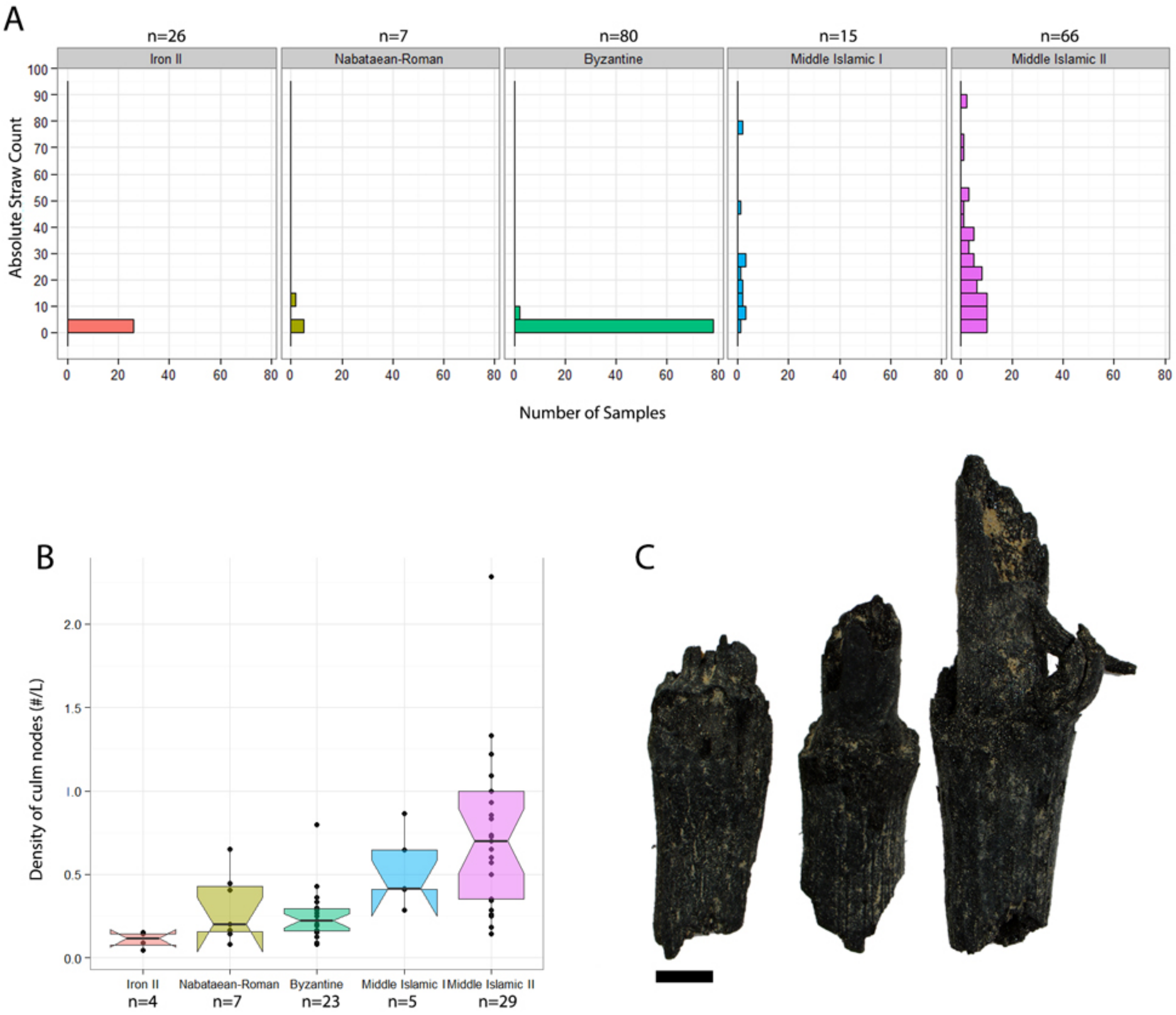

Figure 5.30: (A) Histogram of straw (culm nodes) as an absolute count, by period, and (B) density of straw (culm nodes) in samples where straw density is >0 but less than 15, and (C) straw remains (culm nodes) from a Middle Islamic II period sample (F0353). The scale is 1mm.

period samples, also contain the most straw and weeds.

Assessing the importance of dung fuel using the general "seed to charcoal" ratio (Miller 1985, 1988; Miller and Marston 2013: 98-99) is therefore not meaningful, because the amount of wood charcoal as measured in grams in Byzantine period samples is very low. For example, the sample with the highest seed to charcoal ratio is a Phase 1 Byzantine sample (F0417), with a ratio of 2,950 – a very high number. In comparison, a sample which was very likely formed through the burning of dung fuel (Middle Islamic II period F0363), due to the abundance of dung fragments (14, >2mm dung fragments per liter), fig, weed seeds, and barley with dung attached, contains a seed to charcoal ratio of 812 (868 seeds, 1.07 g of charcoal, in a 4.5 liter sample). The very high seed to charcoal ratio of the Byzantine period sample does not reflect a correspondingly large number of seeds: the total number of seeds is 41 (31 of which are crops, or 75% of the sample), but the denominator, the weight of charcoal, is very low, .0139 grams. This sample, moreover, derives from a known context, it is from the collapse of the Byzantine period storeroom (AW54 Phase 1), and therefore, its formation process is also known. These remains were found inside of the fragments of a *pithos*, or storage jar. What this sample represents, then, is a general paucity of remains, both of seed and charcoal, and not dung fuel. While weed seeds to charcoal might be a better estimator of the contribution of weed seeds to dung fuel through preservation of the seeds of grazed wild plants subsequently burnt in the dung, the same problem of low numerator/denominator sample counts still affects this ratio. In this way, a so-called "mechanistic" interpretation of the data might lead one to conclude that dung fuel was prevalent in Phase 1 of the Byzantine period storeroom based on this ratio alone, when the opposite is true. This should serve as a constant warning that ratios do much to mask the underlying distributions generating data, and that researchers should constantly try to analyze the raw data whenever possible (as advocated by Kadane 1988). The issue of dung fuel will be further explored in Chapter 6, when the correlations of specific weedy taxa (following Charles 2003) with particular domesticates are presented. Until that point, it is nonetheless important to note that the vast majority of straw (culm nodes) are found in Middle Islamic II period deposits, and almost absent in Byzantine period samples, and this might be indicative of dung fuel.

Principal Components Analysis of Heavy and Light Fraction

Given that each of these indices are pointing to different but complementary interpretations, multivariate statistics are necessary as they are well-suited to the analysis of $n\ x\ p$ arrangements of data which are typical of paleoethnobotanical analyses, where n is a site, or sample, and p is a parameter, or variable.The tradition of multivariate statistical methods to identify depositional practices is well established (Jones 1984; Jones 1987, van der Veen 1992; Charles et al. 2003). Nevertheless, these analyses utilize paleoethnobotanical remains *only*; this occurs even in discussions of the identification of deposition beyond those processes that lead to the presence of charred botanical material. Depending on the research question, the analysis of paleoethnobotanical data alone can be justified, considering that the aim of many of these studies is to identify the potential stage within the crop-processing sequence from which a given sample might be the result. Nevertheless, flotation samples do not contain only paleoethnobotanical remains, but include other organic remains such as bone, as well as non-organic cultural objects such as ceramic sherds, in the heavy fraction. Therefore the depositional practices that led to the presence of carbonized botanical remains can not be *assumed* to be independent of those same depositional practices that also generated non-organic cultural objects, such as pottery sherds. The correlation of these remains should provide additional insight into the formation processes which led to their co-incidental deposition.

One of the most underutilized and yet powerful techniques for the analysis of different kinds of remains in flotation samples is Principal Components Analysis (henceforth "PCA"). PCA is a dimensionality reduction technique that calculates a series of sequential axes, or principal components, that correspond to the successive dimensions of the maximum variance of the data (Zuur et al. 2007: 194-196; Legendre and Legendre 2012: 391-3).[12] The latter works by computing an association matrix based on the linear correlations ("standardized") or covariances ("unstandardized") of the variables under analysis. PCA has enjoyed widespread application within ceramic provenance studies (Baxter et al. 1990; Glascock et al. 2004), and yet has been under-applied in paleoethnobotanical research, as Correspondence Analysis (henceforth "CA"), has been the preferred technique, especially for compositional data (e.g. Smith et al. 2009).

One of the few paleoethnobotanical analyses to attempt the integration of multiple data sets using PCA is Amber VanDerwarker's (2010) investigation of the co-occurrence of plant and animal remains from La Joya, in Veracruz, Mexico (Peres et al. 2010). Although labeled as "complex statistics" (VanDerwarker 2010: 76), PCA has enjoyed wide application in many ecological studies. These more ecological applications are very similar to paleoethnobotanical research, in that PCA is often used in "the ordination of sites on the basis of...community composition data" (Borcard et al. 2011: 130). There are a number of important assumptions that must be met before using PCA, however, and although it is a heuristic technique (and **not** an inferential test), it should not be used uncritically. First, PCA must be computed on dimensionally homogeneous variables (Borcard et al. 2011: 130), that is to say, the variables in question must be in the same *physical units*.[13] Second, the data must be quantitative (i.e. not nominal or ordinal data; Legendre and Legendre 2012: 388; although presence-absence data can be used after an appropriate transformation). Third, the data matrix must be multivariate normal, although PCA is robust to departures from multivariate normality given that the skew is not exaggerated (Legendre and Legendre 2012: 411). Fourth, the sample size must be at least 100, although other studies have shown that the relationship of the number of observations (n) to the number of variables (or parameters, p), is more important than a minimum number of observations (Kocovsky et al. 2009: 491, who recommends an n:p greater than 3.5).

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[12] The following discussion of the principles of PCA are derived from the following sources: Hammer and Harper 2006: 84-87; Zuur et al. 2007: 194-196; Legendre and Legendre 2012: 391-3

[13] This is necessary since PCA creates components that attempt to capture the maximum variation, and that variation (the variance) must be in equivalent units to be meaningful

Of the total samples available for PCA, there were 116 samples which contained both analyzed light and heavy fraction, and the total number of identified items spread across these 116 samples was 29,169. From these two fraction types, seven variables were chosen that were the most abundant in terms of ubiquity as well as density. Four variables were selected from the light fraction (domesticates, large charcoal weight, weedy taxa, and rachis remains)[14] and three from the heavy fraction (ceramics, bone, and chaff tempered clay). Due to the biases inherent in the sampling strategy of subgrids (where excavators removed large artifacts and ecofacts), only the >8mm->12.5mm and >4mm->8mm fraction sizes were utilized, as this was assumed to represent the size of objects that potential excavators may have missed, and would standardize this against areas where such items were not removed during flotation sample collection, such as Field S. Finally, the natural log of the densities (# or g per liter) of the variables was calculated for each variable, in order to standardize the data, make them dimensionally homogeneous (i.e. unitless), and correct for skew by inducing normality (Bocard et al. 2001: 131). The log equation used was $log(x + 1)$ as proposed by Bocaard et al. (2011: 18), in order to ensure that absences remain as zeroes.

PCA was calculated using the "vegan" package of R (following equations in Legendre and Legendre 2010: 391-403), using an unrotated covariance matrix. The results of the analysis (**Table 5.8**) indicate that the first two principal components explain 68.2% of the data, while the first four principal components explain 86% of the data.[15] The resultant biplots are illustrative of the influence of each of these variables (**Figure 5.31: A, B**) as are the "variable scores", which indicate the directionality of the variable vectors. For instance the variable score for Large Charcoal Weight Density is -2.13 and that for Rachis Density is -2.35; that is both are negatively correlated with each other. The latter can be seen in the biplot of the second scaling (**Figure 5.31: B**) in which the angles between the variables reflect their correlations. Therefore, if two arrow vectors are at 90°, that is orthogonal to each other, then they are completely uncorrelated.

From the second scaling of the biplot it can be seen that density of large charcoal by weight (g/L), weed density, and rachis density are all highly correlated, and are orthogonal to (or largely independent from) the densities of domesticates, bone, ceramics, and chaff tempered clay. The relative influence of each of these factors can be seen in the biplot of the first scaling (**Figure 5.31: A**), where the corresponding circle contains a radius equal to $\sqrt{d/p}$, where d is the number of axes represented in the biplot, and p is the number of dimensions, or the number of variables, in this space (Boucard et al. 2001: 125). It thus represents a hypothetical variable that would contribute equally to all dimensions in this space – any variable arrow found outside of this "null" variable thus has a higher contribution than average.

The three variables that have a higher contribution than average are the densities of large charcoal (by weight), the density of rachis remains (by count), and the densities of

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[14] Here rachis remains constitute the nodes and internodes of both free-threshing wheats and barley.

[15] Both a Kaiser-Guttman test and a broken stick model both illustrated that the two principal components are the optimum number for the explanation of the structure of the data.

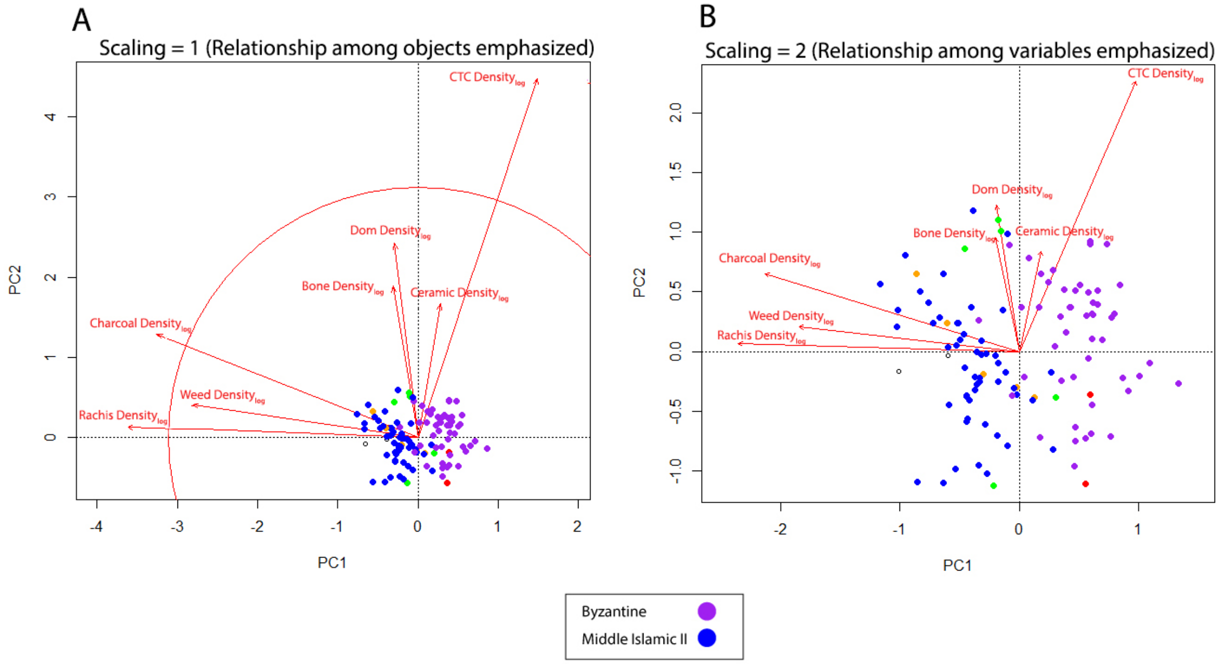

Figure 5.31: Biplots of the first two principal components from the PCA of the select classes of data from the light and heavy fraction. Panel (A) contains a biplot emphasizing the relationships between objects (i.e. samples), and panel (B) contains a biplot emphasizing the relationship between variables.

chaff tempered clay (by count). Given the correlations of these variables, what appears to be represented in the PCA are associations of samples that are the *byproducts of crop processing burnt as fuel as well as dung fuel*, notable for their relatively higher densities of rachis, weeds, and weight of charcoal, and those remains that are the result of *accidental routine cooking accidents*, as is represented by the dimension of the densities of domesticates, bone, ceramics, and chaff tempered clay.

Furthermore, when the first two principal components are extracted, and the periods from which these samples derive are overlain (**Figure 5.32: A**), it is clear that there is a strong temporal dimension to the structure of the data. Namely, it is that Middle Islamic samples are more likely to contain denser concentrations of large charcoal (by weight), rachis remains, and weedy taxa. Indeed, even when contexts are also superimposed (as colors, and the period as shapes: **Figure 5.32: B**), it is still apparent that temporality is important. As it was demonstrated in **Analyzed Contexts**, most Byzantine period samples are fills, and most Middle Islamic period samples are surfaces. It is not surprising, then, that the contexts (as colors) correlate to each period. Nonetheless, as seen in **Figure 5.32: B**, Byzantine period surfaces are found in closer association to Byzantine period fills than they are to Middle Islamic period surfaces. That is to say, it is the historically specific contingent practices that occurred in these contexts, rather than the contexts themselves, that determine the relative

Table 5.8: Eigenvalues of PCA and Cumulative Proportion of Variance Explained

Partioning of Variance							
	Inertia	Proportion					
Total	10.2	1					
Unconstrained	10.2	1					
Eigenvalues							
Eigenvalue	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Proportion Explained	0.4266	0.2558	0.1045	0.07312	0.06481	0.04199	0.03317
Cumulative Proportion	0.4266	0.6824	0.7869	0.86003	0.92484	0.96683	1
Variable Scores							
	PC1	PC2	PC3	PC4	PC5	PC6	
Bone Density (log)	-0.2043	0.95395	-0.6063	0.59409	-0.52102	-0.00368	
Ceramic Density (log)	0.1819	0.84202	-0.1661	1.17922	0.01121	0.275899	
CTC Density (log)	0.9743	2.26529	0.2433	-0.66567	-0.48474	-0.07299	
Domesticate Density (log)	0.1901	1.2237	0.7001	0.16097	1.14253	-0.02199	
Rachis Density (log)	2.3544	0.06851	0.9946	-0.03912	-0.4584	0.589998	
Weed Density (log)	1.8452	0.20561	0.2766	0.26199	-0.18332	-0.98232	
Charcoal Weight Density (log)	2.13	0.65358	-1.2462	-0.45884	0.39269	0.191276	

densities of the remains found on and in them.

Despite these apparent differences between periods, the importance of the individual contribution of each of these vectors (i.e. variables) is critical – a density histogram comparison of the $(log(x = 1))$ density estimates of each of the variables (**Figure 5.33: A**) illustrates that between periods, almost all of the means of the variables are equivalent. To test this, a multi-way ANOVA was employed with the formula $Density_{log} \sim Period * Variables$ to examine the interaction effect of these two factors. The resulting interaction effect was significant ($F(6, 693) = 46.608, p < 2e^{16}$), and the total variance captured by this model, including the main and interaction effects, was 71.3%.[16] A Tukey's post-hoc test of significance ("Honestly Significant Difference" or HSD) revealed that the only four variables with a significant difference in means are chaff tempered clay, rachis remains, weeds, and charcoal weight (**Table 5.9**). In the case of the latter three variables, the Byzantine period is defined by the fact that it *does not* have rachis remains, weeds, or charcoal in similar densities to the later Middle Islamic period samples. In fact both Byzantine and Middle Islamic period deposits seem to have equal amounts of bone, ceramic, and even domesticates (as a density) in these 116 samples, as is illustrated in the plot of means (see **Figure: 5.33: B**).

Therefore the differences in deposition between the Byzantine and Middle Islamic periods indicate that the major axis of difference lies in the fact that the Middle Islamic community at Dhiban was depositing the remains of crop processing debris at a *larger scale* than the Byzantine period community. The presence of greater densities of charcoal by weight sharpens this image, it implies that some Middle Islamic period denizens of Dhiban were *burning*

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[16] The main effects of Period ($F[1, 693] = 45.77, p = 2.83e^{11}$) and Variable ($F[6, 693] = 233.81, p =< 2.e^{16}$) were also significantly different. Yet they are not archaeologically meaningful, as the aggregation of all values across identified items between time periods (Period) is not informative, nor is the comparison of variables (Variable) of different classes (e.g. bone to ceramic) to each other.

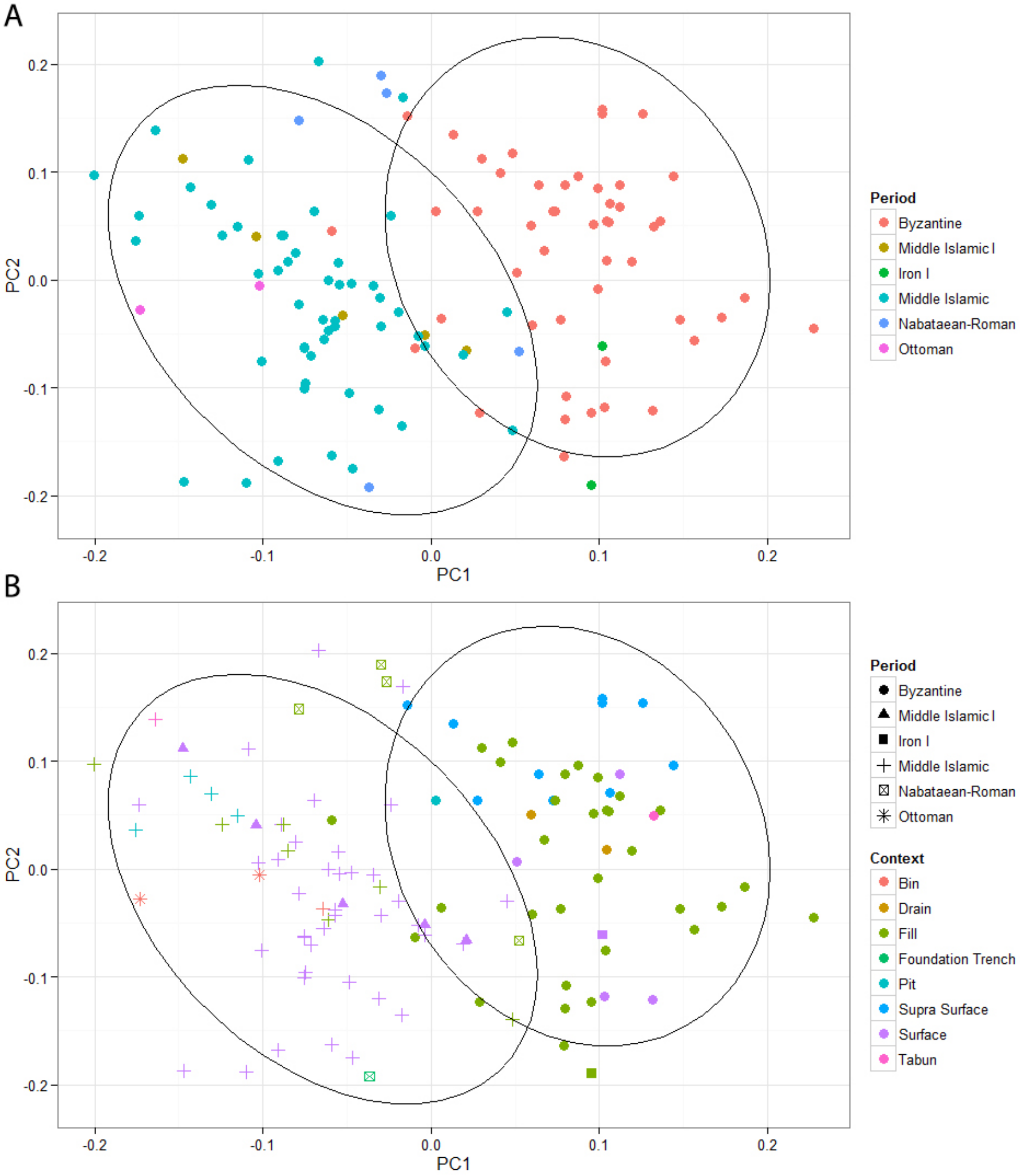

Figure 5.32: The extracted first and second principal components of the PCA with (A) the period overlain on each point as a color, and (B) the period represented as a shape, and the archaeological context as a color. The ellipses represent the 95% confidence ellipse for each period.

Table 5.9: Tukey's HSD (Honestly Significant Difference) Values of Pairwise Comparisons of Variables Used in PCA

Variable	Period	*n*	Mean	SD	Tukey Diff	95% CI Lower	95% CI Upper	P
Bone	Byzantine	49	0.88	0.85	0.05	-0.72	0.61	1
	Middle Islamic	52	0.83	0.82				
Ceramic	Byzantine	-	0.55	0.84	-0.03	-0.97	0.36	0.96
	Middle Islamic	-	0.25	0.89				
Charcoal	Byzantine	-	-4.15	1.51	1.69	2.35	2.35	0*
	Middle Islamic	-	-2.46	0.87				
Domesticates	Byzantine	-	0.11	1.2	-0.36	-1.02	0.3	0.86
	Middle Islamic	-	-0.25	0.77				
Rachis	Byzantine	-	-0.6	0.79	2.24	1.57	2.91	0*
	Middle Islamic	-	1.64	0.94				
Weeds	Byzantine	-	-0.34	0.82	1.66	0.99	2.33	0*
	Middle Islamic	-	1.32	0.65				
CTC	Byzantine	-	1.9	1.27	-1.34	-2.01	-0.68	0*
	Middle Islamic	-	0.55	1.26				

the byproducts of crop processing debris at a greater scale than the earlier Byzantine period community. The fact that Byzantine period deposits contain little to no crop processing debris indicate that the depositional practices that led to the formation of these deposits were mainly accidental in nature, and probably related to routine culinary activities. In contrast, Middle Islamic period deposits appear to have been the highly mixed residues of both routine cooking accidents and crop processing byproducts burnt as fuel, with dung fuel and charcoal burnt as well. The comparison of the contents of these samples in Chapter 6, will illustrate that the kinds of weeds being deposited indicate dung burnt as fuel, as well as their associations with well known fodder crops such as vetch and barley.

Correspondence Analysis of Paleoethnobotanical Compositional Data

To further reinforce this point, it is necessary to compare the proportions of crops, weeds, and rachis (or chaff) remains per sample. Unfortunately, PCA is not an acceptable technique in this instance as it provides too much weight to double zeroes (which is why the most proportionally abundant data were used).[17] Experimental replications of analogous situations in ecology (where relative relationships between variables are emphasized rather than absolute ones) have shown that correspondence analysis is very effective for compositional (i.e. proportion data; Jackson 1997) as the underlying chi-square distance (Legendre and Legendre 2012: 452) removes differences between data formats. More important is that experimental replications have shown there are no serious differences in eigenvalues calculated from the

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[17] The Euclidean distances calculated by PCA are not appropriate for species community composition containing zeroes (Legendre and Gallagher 2001: 272)

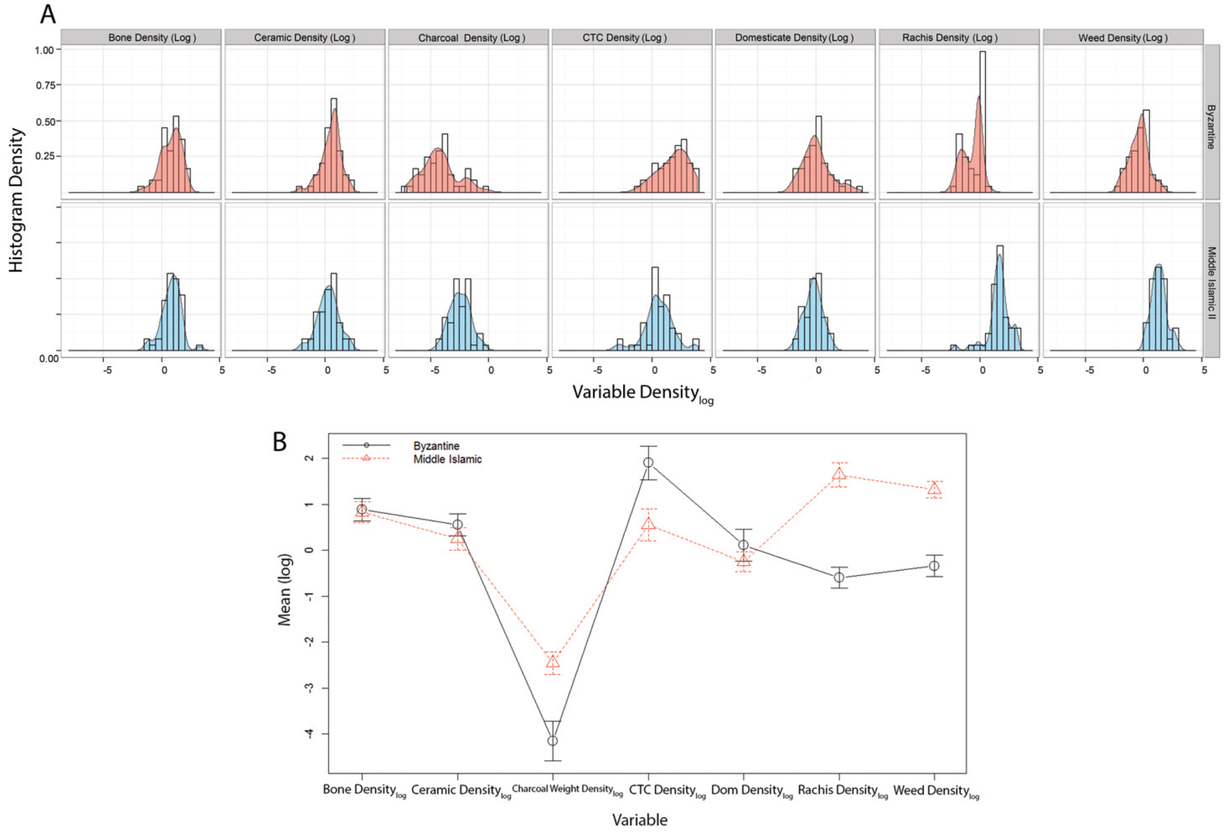

Figure 5.33: A comparison of the $\log(x+1)$ of the variables used in the PCA, by period, with (A) density distributions of each variable overlain on density histograms, separated by period and (B) a plot of the log-transformed density means with 95% confidence intervals of each period, by variables.

underlying data versus the compositional data derived therefrom (Jackson 1997: Legendre and Gallagher 2001: 274).

There are some limitations, however, to this technique for paleoethnobotanical applications, and these relate to the underlying assumptions of correspondence analysis. Correspondence analysis was initially designed for ecological applications (e.g. Ter Braak 1986). In particular, CA assumes a unimodal gradient of species distributions (Legendre and Gallagher 2001: 276), which might not be an accurate characterization of the data generating mechanism of paleoethnobotanical assemblages, given the contextual nature of deposition. Furthermore, the output of CA is often subject to several trend effects (reviewed in Legendre and Legendre 2012: 465-472), including the horseshoe and arch effect, which occur when values become reciprocally similar, as in a parabola. Nevertheless it is widely used in paleoethnobotanical analyses world-wide for its robustness to the problem of double zeros as well as its applicability for compositional data.

Using the relative proportions of crops, weeds, rachis, and culm nodes per sample (i.e.

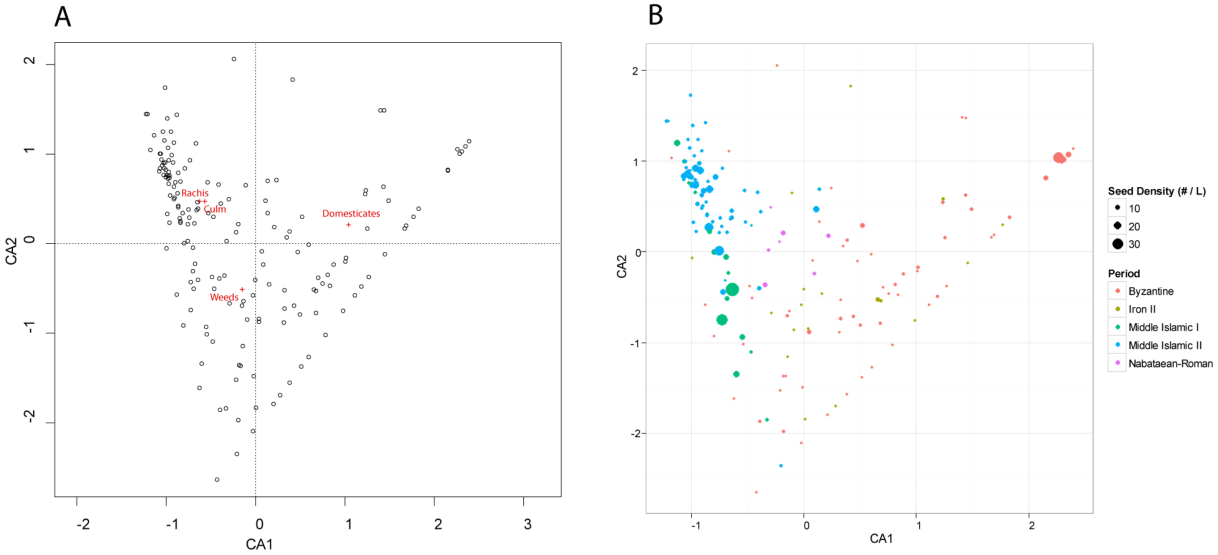

Figure 5.34: Biplots of the first two axes of the CA of the proportions of rachis, culm nodes, domesticates, and weeds per sample, where (A) is the CA variable biplot of the first two axes, and (B) contains the extracted axes, with point sizes reflecting the number of seeds per liter, and the colors of the points symbolizing the period.

the proportion of each by count, per sample), the resultant first two components of the correspondence analysis (**Table 5.10**) captured 92% of the variance.[18] The scores of the variables indicate that the proportions of rachis and culm remains per sample are more associated with each other than with domesticates, and slightly more related to weeds (**Figure 5.34: A**). Extracting the components and superimposing the periods from which the compositional data was calculated, indicates an identical trend to that computed by PCA and the individual variables – namely that Byzantine period samples are more likely to be composed of domesticates as a proportion of the total identified seed remains of each sample, than Middle Islamic I or II period remains (**Figure 5.34: B**). Indeed the second biplot also illustrates that not only are Middle Islamic I and II period samples more associated with greater proportions of rachis and culm node (straw) remains, but that these samples are also numerically dense. The latter further reinforces the notion that greater amounts of burnt crop-processing byproducts were being deposited on-site during these two periods.

Intra-Contextual and Spatial Analyses

Thus it has been established through univariate and multivariate analyses of the *content* of the assemblages that Byzantine period and Middle Islamic II period samples are con-

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[18] The latter is expected given that only four variables were used, and the number of components is a function of the degrees of freedom of the variables, namely N(variables)-1.

Table 5.10: Eigenvalues of Correspondence Analysis, Including the Partitioning of the Mean Squared Contingency Coefficient

Partitioning			
	Inertia	Proportion	
Total	0.6648	1	
Unconstrained	0.6648	1	
Eigenvalues			
	CA1	CA2	CA3
Eigenvalue	0.4208	0.1916	0.05241
Proportion Explained	0.6329	0.2882	0.07884
Cumulative Proportion	0.6329	0.9212	1
Variable Scores			
	CA1	CA2	CA3
Proportion Domesticate	1.0075	0.2175	-0.0064635
Proportion Straw (Culm)	-0.5975	0.4791	0.9180053
Proportion Weeds	-0.1775	-0.5064	0.0008159
Proportion Rachis	-0.6553	0.4819	-0.1790251

siderably different along a number of quantifiable paleoethnobotanical variates. The most important variates appear to be the densities of charcoal, rachis remains, and weedy taxa in distinguishing the formation processes that led to the origins of these samples. Yet it should be recalled that it is not only the *content* of these samples that is informative, but also the *context* in which they occur. As argued at the beginning of this chapter, it is the spatial variation of the relative contributions of these variables that can provide particular insight into whether the contents of the remains encountered are *de facto*, primary, or secondary refuse. That is to say, although Middle Islamic period II samples are clearly crop processing byproducts and perhaps dung burned as fuel, the location of these samples may not be in the places in which these crops were processed and burnt.

In order to identify the effect of specific depositional practices, a comparison of the structures of Phase 2 from Field S (the Byzantine period area), and Structure 1 (the BVR) of Field LW, illustrate the differences in the depositional *origins* of these samples. In particular, it will be seen that Byzantine period samples are more likely primary and secondary refuse, whereas Middle Islamic II period samples are secondary and maybe even tertiary refuse. The first analysis to illustrate this is the density of charcoal remains as the number of grams per liter. In the resultant spatial visualization, Field S (**Figure 5.35: A**) is compared to the three primary surface phases of the BVR (**Figure 5.35 B-D**). It can be seen in **Figure 5.35: A** that the distribution of charcoal (by weight) is uneven – there are places where there are less dense concentrations of charcoal, and places where there are much denser areas of charcoal. In the southwest quadrant of (**Figure 5.35: A**), there are two orange circles which represent particularly dense concentrations of charcoal. As it will be shown in the next chapter, these dense charcoal contexts are also associated with grape remains, and was probably the result of a cooking installation set up against the wall of this post-

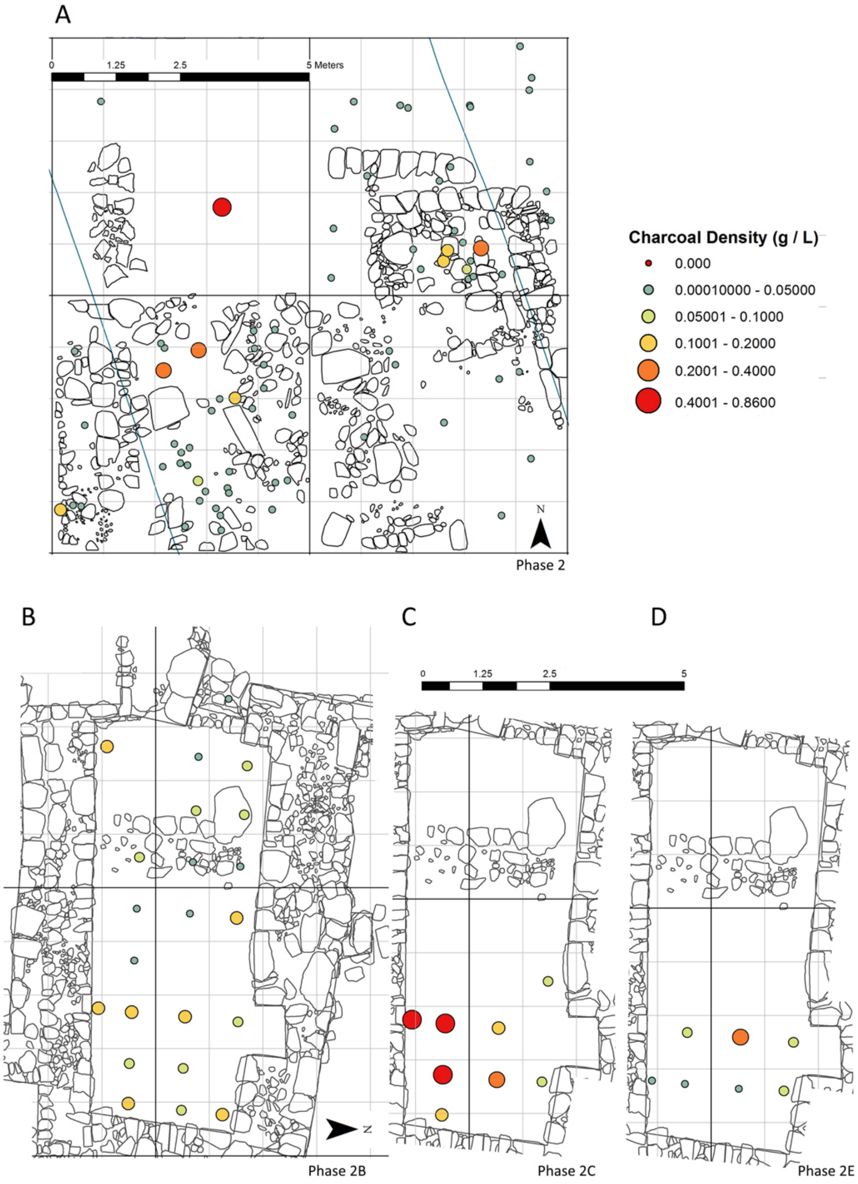

Figure 5.35: Visualizations of the location of the density of charcoal as grams per liter in (A) Phase 2 of Field S, (B-D) Phases 2B through 2E of the BVR.

collapse phase. In contrast, the distribution of charcoal densities is relatively homogeneous in the BVR across all phases, except for Phase 2C (**Figure 5.35: C**). Although there might be issues of bias considering the surface "sub-gridding" technique, it nevertheless implies that the burnt remains might have been intentionally and evenly dumped in this structure, in-between rebuilding phases.

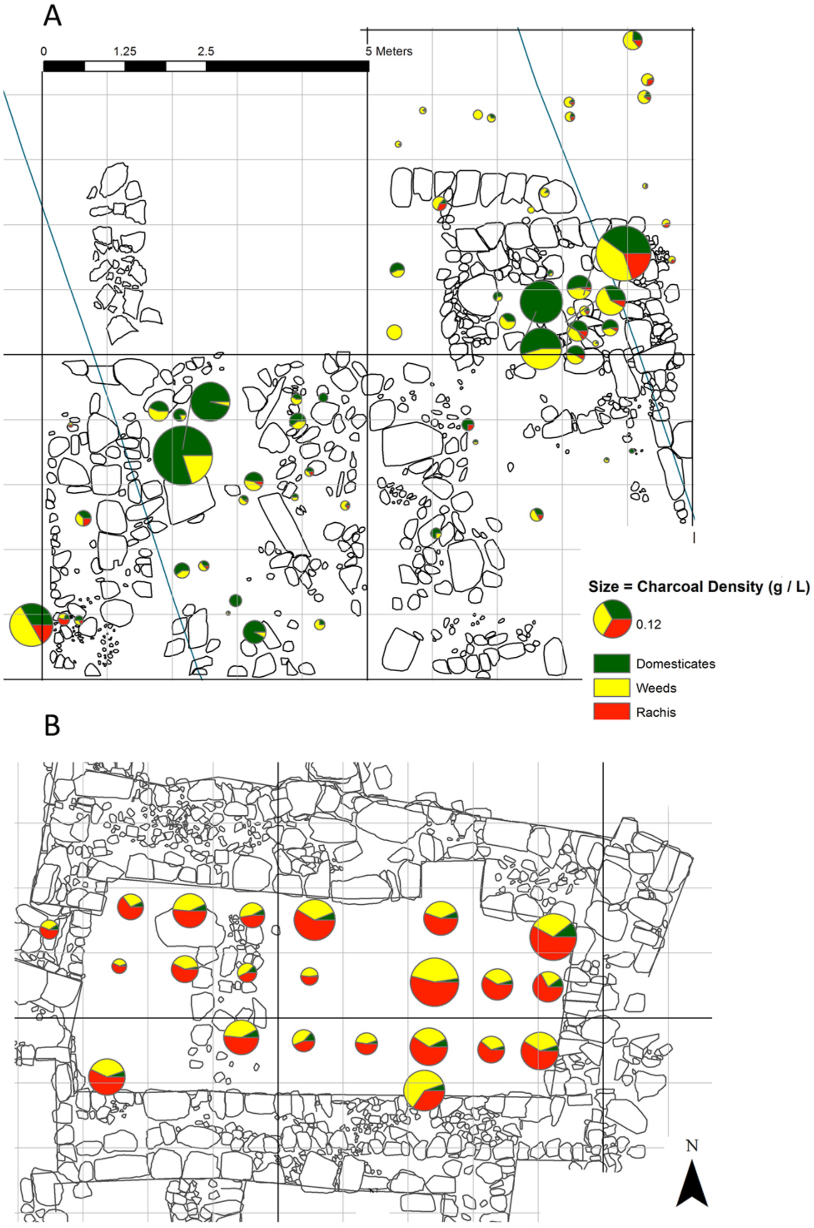

Figure 5.36: Visualization of the locations of the density of charcoal as grams per liter; the size of the pie chart reflects the relative density of charcoal weight, and pie charts illustrate the relative proportions of domesticates, weeds, and rachis remains, per sample, between Phase 2 of Field S (A) and Phase 2B of the BVR (B).

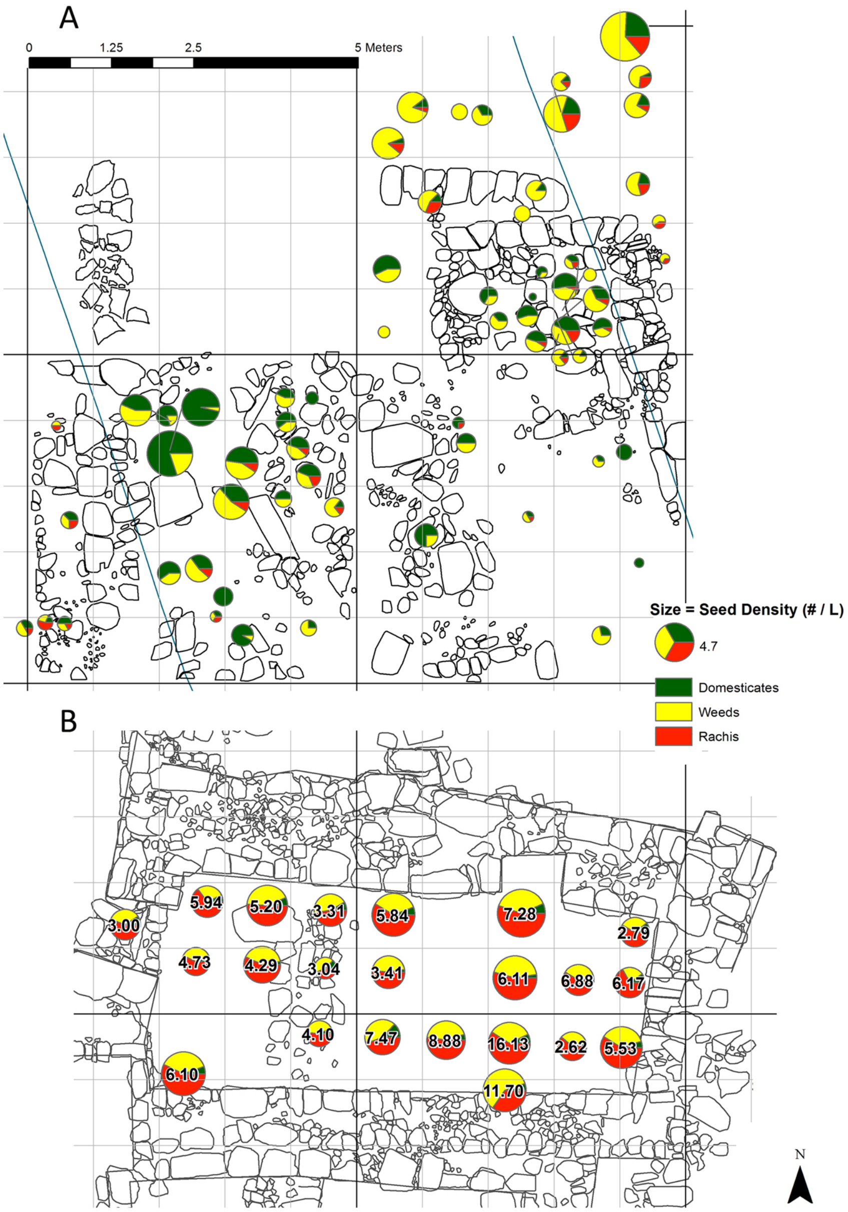

Figure 5.37: Visualization of the locations of the density of seeds as count per liter, with the relative size of the pie chart representing the number of seeds per liter, and the pie charts illustrating the relative proportions of domesticates, weeds, and rachis remains per sample, between Phase 2 of Field S (A) and Phase 2B of the BVR (B).

As further evidence, a comparison of the the relative proportions of domesticates, rachis, and weed remains between Phase 2 of Field S (**Figure 5.36: A**), and Phase 2B of the BVR (**Figure 5.36: B**), are emblematic of these differences. In the plot of these three plant remains, it can be seen in (A) that the areas with the most yellow, that is weed remains, are *outside of the structure walls*, particularly in the NE quadrant of the excavation area. The correlated charcoal densities indicate that most of the samples with denser concentrations of charcoal as grams per liter in Phase 2 of this area, also contain a large number of domesticates as a proportion of the total number of identified seeds. In contrast the distribution of both charcoal and plant remains is more homogeneous in Phase 2B of the BVR (**Figure 5.36: B**). The latter density of charcoal can be compared to the density of seeds per liter, to assess differences in trends between the two, where again the remains distributed in Phase 2B of the BVR are relatively homogeneous (**Figure 5.37: B**). Both the homogeneity of the samples, and their distribution *across space*, seems to indicate several secondary dumping events that homogenized these samples. In contrast, the Byzantine period remains with the densest number of spatially proximate seeds (**Figure 5.37: A**) also contain the most weed remains (in the NE quadrant in yellow). They might, therefore, indicate practices where crop-processing byproducts are dumped outside of structure walls.

5.7 Summary: Depositing History at Dhiban

In summary, it appears that the primary differences between samples are *temporal* in origin, rather than *contextual*. The identification of the formation processes of these samples, if conceived of as changes in practice, indicate that practices of crop processing and deposition were different for the communities living in Dhiban during the period of Byzantine and Mamluk political interventions. For example, in the latter spatial analysis of the Byzantine period area (Field S), some of the densest samples in Phase 2 also contained the most number of weeds – and yet these samples were located outside of the walls of the structure-complex. In contrast, the analyzed Middle Islamic I and II period structures seemed to be *filled* with dense concentrations of charcoal, rachis remains, and weedy taxa. The results of the PCA illustrated that in terms of densities, samples from Byzantine period surfaces were more similar to samples from Byzantine period fills, than they were to Middle Islamic II period surfaces. Therefore, the ways in which space was conceived as a place where burnt crop processing debris was deposited was different for the Byzantine period and Middle Islamic period communities. Concomitantly, this might signal a shift in the way in which taskscapes (*sensu* Ingold 1993) were organized between these two communities in these two distinct periods of time. It must be stressed that these changes in crop processing and depositional practices are probably connected to larger scale changes in labor strategies within these taskscapes. Although it is not the focus of this project, it is essential to note that there were probably a host of other factors such as the gendered division of labor, the organization of the household, and even conceptions of child labor, that must have changed between the Byzantine and Middle Islamic II periods as well.

Indeed, the density of these remains strengthens the argument that the changing nature of deposition was in fact a function of changes in labor associated with agricultural production. The large densities of charcoal by weight in the BVR in each one of the phases analyzed (keeping in mind that the life history of this building was only 100 years, and that is during the supposed agricultural florescence of the Middle Islamic period, the 14th century CE), as well as a large amount of crop processing debris, indicate large quantities of crop processing debris burnt as fuel. Considering the narrative presented in the last chapter, that is, of the importance of cereal production in the Balqā, changes in these crop processing and depositional practices might be connected to larger imperial initiatives to increase agricultural production of cereals, and perhaps other industries that relied on large amounts of fuel. Although future faunal analyses will be necessary, this crop processing was probably "in sync" with pastoral activities, especially of sheep and goat herding. The large quantities of straw found in these Middle Islamic contexts specifically highlight the likelihood that in addition to crop processing byproducts, a large number of these weed seeds and rachis remains were probably fodder that survived the gut of ruminants, whose faeces were later burned as fuel, either within or deposited within these structures.

In contrast, the very low densities of any remains in the Byzantine period samples, especially in Phase 2, the post-collapse occupation, in tandem with a high proportion of crops among these low absolute numbers, indicates mostly accidental deposition of routine cooking activities. The solitary context outside of Phase 2 which contains large numbers of seeds and proportionally more weeds, are among the few samples of that phase which could be the result of crop processing debris or dung fuel. Furthermore, the large densities of crop remains in Phase 1 Byzantine period samples points to the exceptional nature of the preservation of the burnt storeroom. The significance of the contents of these crops for reconstructing Byzantine period agricultural production will be explored in full in the next chapter. These depositional processes seem to point to an "autonomous" community in the Byzantine period, both in Phase 1 (the period just before the room collapse) and in Phase 2. In contrast, the large amounts of charcoal, weed seeds, and rachis remains, might indicate that Dhiban was an "industrial" farm, albeit at a small scale, where labor was pooled to expediently process cereal crops.

In conclusion, the formation processes that led to the deposition of these samples are again best understood as:

- Byzantine period deposits - the results of **direct food remains** (Phase 1) and **accidental deposition of routine culinary practices** (Phase 2).
- Middle Islamic period deposits (all phases) - the results of **accidental deposition of routine cooking practices**, **crop processing byproducts burned as fuel**, and **dung fuel**.

Therefore, in response to the first research question proposed in Chapter 3, namely: were the depositional practices of successive communities on the *tall* of Dhiban qualitatively and/or quantitatively different from each other?, the answer is yes. All of the indices, both spatial and content-based, indicate that each community differentially deposited different kinds of remains, albeit from the same suite of plants (cereals in particular). Indeed, without a simultaneous analysis of content and context, the differences in spatial heterogeneity and homogeneity of deposition between these periods, as well as the specific contents of the samples that were deposited, would have been missed. Yet up until this point, the specific taxa themselves have not been discussed, nor the strategies of production that can be inferred from them. Now that the depositional and formation process origins of these samples are established, it is time to turn to the specific taxa in the samples themselves to identify the ways in which these imperial polities may or may not have affected the *kinds* of desired cultigens produced and processed at Dhiban during these moments of intervention.

Chapter 6

Long-term Agroecosystems and Imperial Interventions

> What is a weed? A plant whose virtues have never been discovered.
> - Ralph Waldo Emerson

> [T]herefore we ask, most sacred emperor, that you aid us...lest the right be denied...to procurators...to increase the agricultural shares...against the interests of the tenants...as a poor rustic people tolerating a livelihood gained from the work of our own hands, we are unfairly matched with a lessee most influential.
> - Roman North African Farmers (ca. 2nd century CE) petitioning the Roman emperor Hadrian (Kehoe 1989: 67-68)

In the last chapter, univariate and multivariate analyses showed that the *kinds* (e.g. rachis, weeds, etc.) and *abundances* (densities, proportions, etc.) of paleoethnobotanical remains found in Byzantine period and Middle Islamic period deposits at Dhiban are strongly associated with each of those time periods. Specifically, Byzantine period samples, whether in Phase 1 or 2, contain low numbers of seeds per liter, a higher proportion of crops per sample on average, and low proportions of rachis, weed, and culm (straw) remains. These samples are evidence of dense and clean crop seed storage in Phase 1, and less dense but still crop-seed majority refuse in Phase 2. In contrast, Middle Islamic period samples (whether Middle Islamic I or II) are denser than Byzantine period samples (i.e. contain a greater amount of seeds per liter), but contain lower proportions of crop seed remains, on average, with much higher proportions of rachis (chaff), weed, and culm (straw) remains. Therefore, the Middle Islamic period samples are probably the evidence of dense, mixed crop processing byproducts and dung burnt as fuel. Though the *archaeological contexts* that constitute these samples (pit, drain, fill, etc.) still appear to be important in predicting the kind of paleoethnobotanical remains that might be contained in each, as was seen in the distinction between intra- and extra-mural deposition of charred plant remains in Phase 2 of the Byzantine period area (Field S), it is more likely that the *content* of each sample is itself a product of the unique agricultural and everyday depositional practices of the communities at

Dhiban during these major periods of imperial intervention. Moreover, differences in these quotidian depositional practices are illustrative of the new-found changes that accompanied the reorientation of political and economic networks in each of these periods. For instance, whereas the Byzantine period communities of the southern Levant seem to have been relatively autonomous in the late 5th to early 7th centuries CE with respect to agricultural tax collection as it was overseen by associations of the citizens themselves (the *suntelstai*), the late 13th to mid/late 14th century CE Balqā (central Jordan) was the "breadbasket" of the Mamluk empire, and agricultural production was closely overseen by a *muqtā* (agricultural supervisor) or *mushadd* (regional supervisor) (Walker 2008: 90-93). The abundance and density of crop processing debris intermixed with charcoal and dung dating to Middle Islamic I and II (Mamluk-period) deposits might be a consequence of new elite imperial initiatives that restructured daily practices at Dhiban involving labor and fuel production, whereby the increased necessity of expedient burning necessitated their immediate deposition on site.

In this chapter, the second research question raised in Chapter 4 will be addressed, namely: does the presence and quantity of specific agricultural crops correlate to any given political intervention?. The answer, as it will be illustrated fully below, is largely in the affirmative. Many of the specific crops identified with the agricultural narratives of each period, grape (*Vitis*) in the Byzantine period, and wheat (*Triticum* esp. *aestivum/durum*) and barley (*Hordeum cf. vulgare*) in the Middle Islamic, are present in those periods in proportional abundance. Their proportionally greater presence in each sample confirms the expected paleoethnobotanical correlates predicted by hypothesis (2). Nevertheless, it will be shown that the several sub-hypotheses raised in Chapter 4 of the specific paleoethnobotanical expectations of other taxa were not confirmed. For instance, despite the prevalence of olive presses throughout the southern Levant in the Byzantine period, as well as archaeobotanical remains of olive from adjacent sites, very few olive pits were found in the Byzantine period samples. This is only one of several potential examples that could be raised to illustrate this point. Thus it is argued that although the interventions of these empires placed new economic and political demands through taxation, they simultaneously established novel economic configurations, and opportunities ("structure"), and the local community at Dhiban in the Byzantine and Middle Islamic periods exerted some degree of influence ("agency"), as to how they would operate within these unique economic, political, and social configurations through their agricultural production. The presence of rare or difficult-to-obtain organic remains, presented below, is just such evidence of the capability of the community at Dhiban to participate in these larger networks of organic goods.

Several quantitative measures will be presented that will illustrate the degree to which the seeds of certain cultigens correlate to samples deriving from each of these periods of imperial intervention. First, a general overview of the most numerically abundant crop seeds, by count, in the aggregate of all of the samples of each period, is presented. In doing so, it is possible to assess the extent to which a few or several taxa influenced the total assemblages of each period. Then, evenness and diversity measures are presented that compare the dominance of these crop seeds on a per-sample basis, to identify whether certain crop seeds are more unevenly distributed in Byzantine period samples than their Middle

Islamic counterparts. These indices aid in determining whether the total range of available crops is restricted to the total assemblage, or is a trend represented in each sample. After this, ubiquity measures are discussed that indicate the number of times a taxon appears in each sample dating to each period (a presence/absence measure per sample), to assess its relative importance within the samples of that period, while keeping in mind the effects of formation processes on each sample. It will be shown that despite the greater ubiquity of grape seeds among Byzantine period samples, wheat and barley persist across all periods, and their continuous presence and relative ubiquity in each period is indicative of an earlier shift in the Iron Age towards free-threshing wheat cultivation. The thicknesses of the seeds of wheat and barley are then compared between the Byzantine and Middle Islamic period samples, to identify potential changes in field practice and / or cultivar selection. Then, the unique assemblage of Byzantine period Phase 1 is analyzed with respect to the density of its recovered crop seeds, as well as the spatial location of these densities, as it was argued in the last chapter that the phase was formed through unique taphonomic circumstances (a rapid conflagration) and can not be compared to other samples formed through everyday deposition and accumulation. After this, the weed seeds of each period are analyzed in order to understand whether changes in imperial intervention also led to changes in field practices. Finally, with these data, Dhiban is re-inserted into its regional context in both periods, and these assembled data are then compared to other sites with comparable data, in order to understand the site's place within these wider economic and imperial networks.

6.1 Imperial Plants: Desired Crops of the Byzantine and Mamluk Empires

As elaborated in Chapter 4, the narratives of agricultural production proposed for the Byzantine and Mamluk empires indicated that they were differentially invested in agricultural goods, and that each of the cultigens associated with these landscape investments (grape, olive, etc.) was closely linked to regional and macro-regional economic networks. Each of these cultigens was also associated with different taxes for crops that are known through the historical sources presented in Chapter 4 – in the Byzantine period, taxes seem to have been assessed in coin, although wheat was an important crop used in intra-community economic transactions (e.g. Papyrus 40 of the Nessana papyri). During the Mamluk empire, historical documents specifically mention a tax on grain (*kharaj al-zira'ah*) for communities in the region in which Dhiban was situated, the Balqā. Moreover, the distribution of these desired cultigens was constrained not just in time, but in space as well. The archaeological remains of enormous wine-pressing vats in hyper-arid areas of the Negev, as well as the Nessana and Petra papyri, illustrate that Byzantine period communities, for instance, were growing these desired (*Vitis vinifera*) plants in "extreme" environments through the careful irrigation and tending of vines. Yet in other parts of the Byzantine empire a vastly different array of crops were being grown: in the fortified *gsur* of Libya of the 4th to 6th centuries

CE, farms were both producing and trading economic crops from Central and Southern Africa, such as watermelon (*Citrullus lanatus*) and bitter gourd (*Citrullus colocynthus*, van der Veen et al. 1996: 235). This phenomenon was not restricted to the Byzantine period. In the Middle Islamic period, while the Balqā, the area of Central Jordan, was designated the grain-producing region for the Mamluk empire by imperial elites in the 14th century CE, the Jordan Valley was primarily devoted to sugar (*Saccharum* sp.) production (Walker 2003: 258-259). Therefore the identification of changes in those crops desired by imperial elites, or privileged with meaning in imperial exchanges, must take account of potential variations due to regional preference, selective investment, or the influence of the local community in agricultural production. Furthermore, in addition to the desires of imperial elites for specific plant products used as tax or even for social capital, the communities of Dhiban itself would have had their own desired cultigens, linked to community foodways (Gumerman 1997), that would have encouraged members of the community to find ways to acquire these valued items.

In this respect, one of the most salient aspects of the agricultural crop-seed assemblage at Dhiban is the restricted range of taxa (i.e. number of different kinds of crops) present in the samples of both periods. Neither the Byzantine nor the Middle Islamic period samples from Dhiban exhibit any major differences in the range and diversity of cultigens. Instead, communities in these periods seem to have adjusted the relative proportions of an existing, and delimited, range of crops. This is apparent when the absolute number of identified agricultural crop seeds is totaled for each period; the majority of each periodized assemblage (by count) is dominated by less than five domesticates - wheat (*Triticum*), barley (*Hordeum*), lentil (*Lens*), grape (*Vitis*), and fig (*Ficus*). For the sake of simplicity, all *Triticum* and *Hordeum*, here, are specific to the level of genus only, although there are important differences between the species of free-threshing wheat (*Triticum aestivum/durum/compactum*), and this will be discussed in detail below.

In order to make these periodized assemblages comparable, Phase 1 of the Byzantine period (in excavation Field S) was again excluded from the analysis (**Figure 6.1, Table 6.1, Table 6.2**), as it is a unique context preserving a specific moment in time (the moment just prior to the burning and collapse of the storeroom), and thus must be considered independently from the other samples formed as the result of routine activities over longer spans of time. The five crops above account for more than 90% of the total identified seed remains of agricultural crops by period, if all of the samples from each period are combined (**Figure 6.1: A, Table 6.1**). Although these five cultigens constitute a large number of the total identified seeds from each period, it is important to recognize that figs produce an enormous quantity of seeds per fruit, 700 to 2,200 seeds that are .5 - 1mm in size (Cappers and Neef 2012: 404). Unsurprisingly, therefore, the small size of these seeds and their numerical abundance per fruit increases the probability of their carbonization – accordingly, more than 30% of the combined samples by period are composed of fig seeds alone (**Figure 6.1: B, Table 6.2**). If fig seeds are excluded, the four remaining dominant cultigens (wheat, barley, lentil, grape) account for more than 40% of all identified domesticates in each period, with 61.4% of all Byzantine period crop seeds constituted by these four taxa alone (by count),

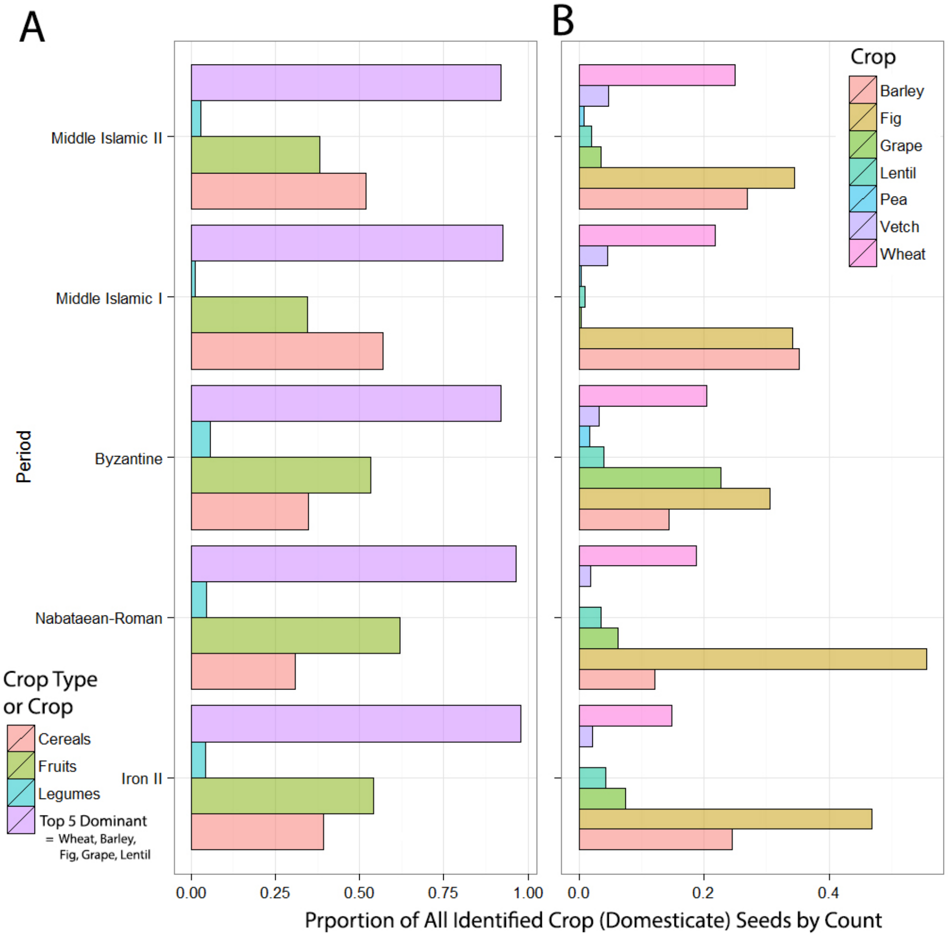

Figure 6.1: Proportion of total aggregated assemblages of crop seeds by count for each period. In (A) operationalized crop types are given, with the legend in the lower left. In (B), individual taxa are represented by colors, with the legend in the upper right.

as well as 57.3% of the recovered Middle Islamic II seed remains. All of the remaining crop seeds that are not the "dominant suite" constitute less than 10% of the total – only 8% of both the Byzantine and Middle Islamic assemblages by count are not composed of the four major domesticates listed above. The addition of vetch or vetchlings (*Vicia* / *Lathyrus*) to these four domesticate taxa then leaves only 3% of all identified Middle Islamic II period crop seeds as belonging to another cultigen. That is to say, almost 97% of the 1,219 Middle Islamic II period crop seeds spread across 66 samples belong to just six different kinds of crops.

While this broad characterization illustrates the constrained range of the kinds of cultigens available, there are several quantitative indices developed in ecology and biology (Magurran 2004; Hammer and Harper 2006) that can be used to identify the diversity or evenness of the aforementioned taxa in these assemblages beyond broad categorization alone. Indices

Table 6.1: Proportion of Total Assemblage By Period Comprised of Aggregated Crop Classes

Period	N	Total Volume	Cereals	Fruits	Legumes	Dominant	Domesticates
Iron II	26	236.5	37	51	4	92	94
Nabataean-Roman	7	106.5	69	138	10	215	223
Byzantine	65	530.5	140	214	23	370	402
Middle Islamic I	15	293.5	173	105	4	281	304
Middle Islamic II	66	1174.5	633	464	35	1120	1219

Table 6.2: Proportion of Total Assemblage Composed of Individual Domesticate Taxa by Period

Period	N	Total Volume	Barley	Fig	Grape	Lentil	Pea	Vetch	Wheat	Domesticates
Iron II	26	236.5	23	44	7	4	0	2	14	94
Nabataean-Roman	7	106.5	27	124	14	8	0	4	42	223
Byzantine	65	530.5	58	123	91	16	7	13	82	402
Middle Islamic I	15	293.5	107	104	1	3	1	14	66	304
Middle Islamic II	66	1174.5	328	421	42	24	10	58	305	1219

such as the Chao 2, Jackknife, and Shannon-Weaver (Hammer and Harper 2006: 184-7), have all been proposed to deal with the concepts of dominance and evenness, where the latter represents an equal distribution of counts across a set of species, here, crops. Yet the number of indices is so great that the comparison of the outcomes of each has resulted in an "excessively bewildering field" (Hammer and Harper 2006: 186). Archaeologists have used these diversity measures on artifact assemblages to varying effect (see review in Kaufman 1998), and some paleoethnobotanists have also incorporated some of these measures into their analyses of recovered archaeobotanical material (e.g. Popper 1988: 67-68; Lennstrom and Hastorf 1992; Marston 2010). For simplicity, the index that is chosen here is Simpson's (1949) index, which has been called "one of the most meaningful and robust diversity measures available" (Magurran 2004: 115). The equations for the indices that will be used in this analysis are given below, as they often vary between researcher (Hammer and Harper 2006: 187):

1. Simpson: $D_1 = 1 - \sum_{i=1}^{S} p_i^2$
2. Inverse Simpson: $D_2 = \frac{1}{\sum_{i=1}^{S} p_i^2}$
3. Evenness: $E = \frac{D_2}{S}$

The advantage of Simpson's index of diversity (D_1) is in its intuitive simplicity: it produces a range of values between 0 or 1 which correspond to less (0) or more (1) diversity (Magurran 2004: 114-116), measured as the relative contribution of a taxon across a set of species. Using the equation above, a hypothetical set of ten species with 100 counts of only one taxon, would yield a Simpson index of 0 ($1 - 1^2$), that is no diversity (maximum dominance). A critical advantage of the Simpson's diversity index is that it minimizes the effect of sample richness through consideration of the relative proportions of each taxon alone, a count of 1 or 100 of one taxon among ten species would still yield the same outcome of 0. Nonetheless the counts comprising taxon abundance are still subject to the general issue of confidence in proportion estimates and taxon detection given low numbers of observations (van der Veen and Fieller 1982). In addition to a diversity index, an evenness index can be also calculated from Simpson's diversity index (Magurran 2004: 115). The evenness index utilized here is the inverse of Simpson's index divided by the total number of species (again, domesticates). The latter index therefore directly compares the relative influence of each crop on the total range of domesticated crop seeds represented in the assemblage.

These indices were calculated on the 11 domesticates represented across all of the samples (*Triticum*, *Hordeum*, *Cicer*, *Vitis*, *Ficus*, *Vicia*, *Lens*, *Olea*, *Pisum*, Large Fabaceae, and Other Cereal[Poaceae]) to determine whether the samples in each period were more, or less, diverse with respect to the relative influence of the domesticates within them. The outcome of these analyses (**Figure 6.2, Table 6.3**) reveals that Middle Islamic II period samples are slightly more diverse than Byzantine period samples, although both are roughly equivalent in the evenness, or spread, of the number of seeds across these domesticates within the samples of each of these periods. In the case of the Simpson's index, it is clear from a histogram of the count of Simpson index values (**Figure 6.2: A**) that Middle Islamic II period samples contain more values closer to the "more diverse" range (∼.75), than the Byzantine period, regardless of context. These differences between the latter two periods are in fact statistically significant,[1] although the effect size is small (0.0334), that is the model explains just 3% of the variance in the data (**Table 6.3: Model 1**).

In contrast, it does not appear that there is a significant difference between the evenness of the domesticates of Byzantine and Middle Islamic Period II period samples. To reiterate, evenness provides a number between 0 and 1, where contributions of each crop are more evenly distributed (1) versus more dominated by one to a few crops (0). Although the means of the Evenness index are not statistically significant (**Table 6.3: Model 2**),[2] the histogram (**Figure 6.2: B**) reveals that there is a heavy skew to the data, insofar as there are more Byzantine samples with higher Evenness values. More Byzantine period samples contain a more even distribution of counts throughout the domesticates in each sample, although the effect of this difference is not large. Therefore these indices reinforce the results provided by the aggregate data, namely that while there are differences in the relative contributions of each crop as a count, the overall assemblages are roughly similar in

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[1] This computation was performed on samples that had a Simpson's index greater than 0, and less than 1, in order to remove samples with very low counts. As it was argued in the last chapter, low counts have a correspondingly lower likelihood of detecting taxa, and the inclusion of these samples would bias these diversity estimates. The number of samples retained is visible in the histogram.

[2] Like the Simpson index calculation, samples with low counts were removed (<10), so only those samples were calculated where the evenness was less than 1, and the richness, or number of identified species, was greater than 0.

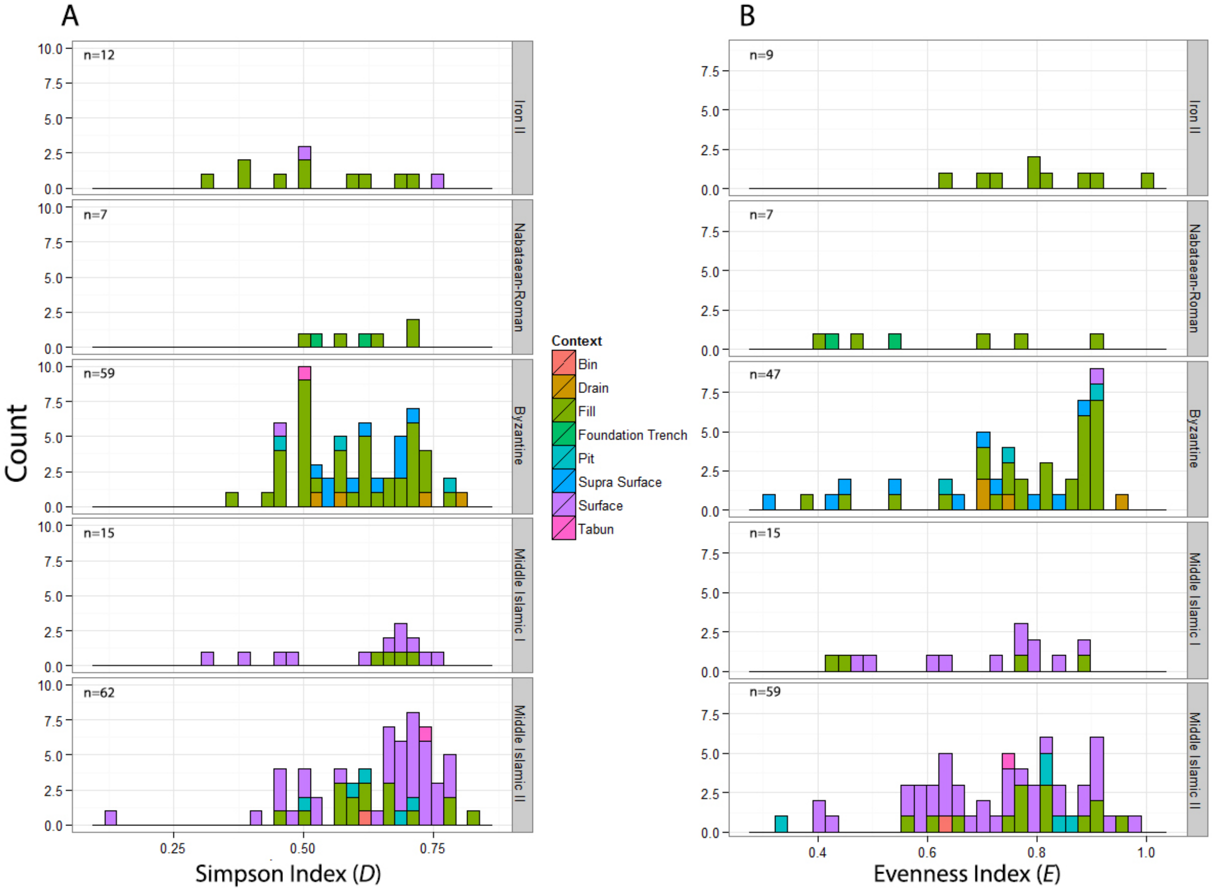

Figure 6.2: Comparison of diversity indices across time periods, where (A) is a histogram of the Simpson's diversity index (D_1) where $D_1 > 0, D_1 < 1$, and (B) is a histogram of the Evenness index (E), where $R > 0, E < 1$, R being the richness or the total number of distinct taxa represented in a sample. The counts of the number of samples in each histogram are given in the upper left, and the context of each of the histogram counts is superimposed as a color.

Table 6.3: ANOVA Results of Tests of Simpson and Evenness Indices

Model 1 ($D > 0, < 1$)					
	DF	Sum Sq	Mean Sq	F	Pr(F)
Period	1	0.056	0.05601	4.146	0.0439
Residuals	120	1.621	0.01351		
	Mean	SD	N		
Byzantine	0.5975531	0.1085121	59		
Middle Islamic II	0.6404281	0.123003	63		
Model 2 ($R > 0, E < 1$)					
	DF	Sum Sq	Mean Sq	F	Pr(F)
Period	1	0.0183	0.01826	0.787	0.377
Residuals	105	2.4372	0.02321		
	Mean	SD	N		
Byzantine	0.7592857	0.1611248	47		
Middle Islamic II	0.7329613	0.145147	60		

their diversity, i.e. in the range of the different kinds of crops available. The only observed difference between the Middle Islamic II and Byzantine period samples is in the Simpson diversity index, and the difference between these two periods is more likely an indication of the effect of formation processes. As Middle Islamic II period samples are probably secondary or tertiary in depositional origin, it is expected that there should be more diversity of crop remains due to the continuous mixing of different burning events. The concentration of lower evenness values of these samples is due to a greater influence of some domesticates (cereals, as it will be shown) over others, even if other domesticates are still represented in those samples, albeit in lower numbers.

The remaining infrequently occurring taxa not represented by the dominant cultigens discussed above are leguminous crops such as bitter vetch (*Vicia ervilia*) and pea (*Pisum sativum*), and other large (>2mm) cereals (Poaceae) that could not be determined to genus based on variable caryposis morphology.[3] Contrary to the prediction of Hypothesis 2 in Chapter 4, olive, a plant of economic importance for both the Byzantine and Mamluk empires, is almost entirely absent from either of these periods. Among the Byzantine period samples, the only whole olive remains (n=3) occur in the Phase 1 collapse of the storeroom, and only one of the three was recovered through flotation (the others were found while dry-screening). Among the Middle Islamic period samples, only one olive shell fragment has been identified in the heavy fraction (the >4mm of HF223, **Figure 6.17: C**), and none in the light fraction. These infrequently occurring taxa are present in numbers that are too low for any analysis of general trends, but they are briefly introduced now as they will be discussed at length toward the end of this chapter.

First, among the Phase 2 Byzantine period samples, one fragment of a *Pistacia atlantica* seed shell **Figure 6.17: A**) indicates that at least some *Pistacia* stands must have been in the vicinity of the plateau, perhaps more than were found today (it should be recalled

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[3] Large (>2mm) legumes (Fabaceae) were excluded from this analysis as it could not be determined whether they were wild or domesticated variants.

from Chapter 3 that only one *Pistacia atlantica* tree was found on the plateau in 2013). In addition, what is tentatively identified as a *Zizyphus spina-christi* (Christ's thorn) berry was also present in a different sample from the same phase. These two taxa would have been accessible to the community in the immediate vicinity of, or on, the Dhiban plateau. In contrast, the unique variety of less common cultigens in the Middle Islamic II period probably points to direct community procurement of these desired items from newfound plant-exchange networks, or perhaps even garden plot cultivation. For example, in the Middle Islamic II period samples, there is one entire well-preserved *Prunus domestica* cf. *cerasus* (a plum, or more likely a sour cherry) pit, and a *Sorghum* sp. seed in two separate Middle Islamic II samples. Although there is only one of each, they provide singularly important insight into changes in the engagement of the Middle Islamic community at Dhiban with garden plot cultivation (*Prunus*) or trade (*Sorghum*). The ramifications of the presence and low abundance of these items for both periods is explored further in section 6.3.

Assessing Relative Cultigen Importance

With the aggregates of absolute counts of crop seeds by period characterized, it is necessary to describe the distribution of these major agricultural crop seeds across the collected samples (i.e. considering the contribution of each sample), and within the actual physical space in which they were sampled. There are several ways of assessing the relative importance of a given taxon across a set of paleoethnobotanical samples. Among the most commonly used is the "ubiquity" measure (Miller 1988; Popper 1988), which is a presence-absence assessment of a given taxon within each sample. This has proven to be a popular technique for the comparison of samples with differing volumes, or with uncertain sampling regimens. Yet Kadane has shown that ubiquity is *still* dependent on background factors (Kadane 1988: 210) such as preservation and volume, assuming a Poisson distribution of λpv.[4] Moreover ecologists have devised statistical methods of association (Q-analysis) that calculate the similarity and dissimilarity of sampling sites (equivalent to a paleoethnobotanical flotation sample) for both quantitative (Bray-Curtis) and presence-absence data (Sorenson, Jaccard), without imputing overdue influence to double-zeros (an asymmetric coefficient; Hammer and Harper 2006; Zuur et al. 2007; Legendre and Legendre 2012). The latter is particularly important as two null presences of the same taxon (e.g. *Triticum*) in two different samples, do not make those two samples as similar to two other samples with two positive presences of the same taxon (e.g. *Hordeum*). Much more research must be done on simulations and real-world analyses of paleoethnobotanical material comparing the various similarity and dissimilarity measures, especially considering the univariate gradient assumptions of these measures (Legendre and Legendre 2012). Nevertheless, ubiquity is nevertheless a useful exploratory measure for understanding the major trends of cultigens across samples.

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[4] Where λ corresponds to the Poisson distribution parameter $e^{-\lambda}\lambda^x/x!$, p to the probability of survival, and v the volume of a sample. There are good reasons to assume that paleoethnobotanical samples are not Poisson-distributed, as λ posits a constant rate of deposition, and many samples can be formed, as it has been shown in Chapter 5, through disparate human practices at multiple scales of time.

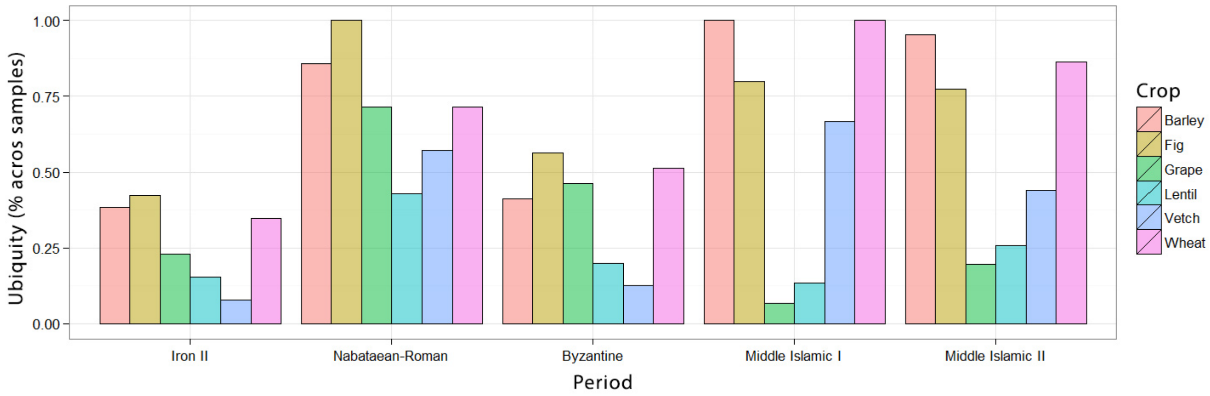

Figure 6.3: Ubiquities of select domesticate taxa, where the common name is given in the legend to the right. Bar height represents number of times where positive identification of that taxon was at least one, across samples. Bar color represents the domesticate (crop). Sample counts are given in Table 6.4.

Table 6.4: Ubiquities of Most Common Domesticates Across Periodized Samples

Period	Barley	Fig	Grape	Lentil	Vetch	Wheat	N
Iron II	10	11	6	4	2	9	26
Nabataean-Roman	6	7	5	3	4	5	7
Byzantine	33	45	37	16	10	41	80
Middle Islamic I	15	12	1	2	10	15	15
Middle Islamic II	63	51	13	17	29	57	66

As is predicted by the formation processes that generated the paleoethnobotanical assemblages of each sample, 86% and 95% of Middle Islamic II period samples contain at least one *Triticum* or *Hordeum* seed, while only 51% and 41% of the same cultigens occur across the Byzantine period samples (**Figure 6.3, Table 6.4**). The former ubiquity of cereal remains among Middle Islamic period II samples is to be expected if the deposits from which they derive were formed as the result of the burning of crop (i.e. cereal) processing debris and dung fuel, and if Byzantine period samples are largely the result of the deposition of routine cooking and culinary activities. The ubiquity estimates specifically confirm the hypothesis of the increased presence of grape (as grape, *Vitis vinifera*, seeds) across samples as presented at the end of Chapter 4. The Byzantine period assemblage, including Phase 1 and Phase 2, is more likely to contain the remains of at least one *Vitis vinifera* pip (seed) in each sample than any other period.[5] Assessing the reliability of these proportional parameter estimates is possible using a permutation test. Permutation tests are fairly well established for proportions (Hammer and Harper 2006: 33), and operate with the following logic: if one re-sampled, with replacement, at random from a dataset, and performed this

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[5] While technically the Nabataean-Roman samples contain the highest proportion at 71%, the number of samples from this period is low (n=7), and is not representative.

resampling iteratively a large number of times, what would be the mean proportion of these iterations? In the case of these taxon ubiquities, 50 samples were drawn at random, and the ubiquities of each major taxon was then calculated on this randomly drawn subset. The latter process was repeated 10,000 times, and the total mean of these random recombinations was computed. A permutation test for grape, for instance, using 10,000 iterations on a sample of 50,[6] produces a mean of 46%.[7] In contrast, a permutation test of the ubiquity of grape among the Middle Islamic II period samples using the same parameters generates a mean of 19.6%.[8] Considering that the upper and lower quartiles of both of the permutation tests of these two distributions do not overlap, it is possible to reject the hypothesis that the two periods contain equal ubiquities of grape remains across these samples. Therefore Byzantine period samples are significantly more likely to contain grape seeds than Middle Islamic II period samples, and this substantiates the claim that the economic configurations of the Byzantine empire, and perhaps not the empire itself, affected the local community at Dhiban in such a way as to encourage greater production and therefore deposition of this desired plant by them. What kinds of culinary experiences those grapes represented, either in Phase 1 or Phase 2, will be discussed below.

Cereals: A Shift in Long-Term Water Management

Up to this point, it has been established that the range of available cultigens was relatively restricted, and did not differ between the Byzantine period and Mamluk period communities at Dhiban. Nevertheless, the ubiquities of those crops indicate that Middle Islamic II (i.e. Mamluk) period samples were more likely to contain wheat and barley seeds, and Byzantine period samples were more like to contain grape seeds. Although Byzantine period samples are more likely to contain the seeds of *Vitis vinifera*, 51% of those samples also contain at least one *Triticum* (wheat) seed, and 41% of samples contain at least one *Hordeum* (barley) seed. In fact, wheat and barley seem to occur almost evenly throughout the analyzed samples through time in terms of the likelihood of their occurrence in each sample (**Figure 6.3**). In the Iron II period, for instance, wheat and barley are found in 35% and 38% of the total number of samples, that is in roughly equivalent proportions to each other, albeit in very low absolute numbers. As it will be discussed further in the **Weed Agroecology** section below, wheat and barley are significantly correlated both in the Phase 2 Byzantine samples ($n = 65, r = .363$; **Figure 6.13**) as well as in the Middle Islamic period II samples ($n = 65, r = .368$; **Figure 6.14**). These correlations indicate that the presence of the seed of one cereal (e.g. wheat) likely implies the presence of the seed of the other (e.g. barley). The longevity of this conjoined production of these two valued cereals, wheat and barley, irrespective of species or cultivar, is clear, especially when considering that the Byzantine period samples were *not* likely formed through crop-processing debris, and yet these cereals are still present.

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[6] As there are only 66 Middle Islamic samples, a “lowest common denominator” was necessary.

[7] $s = 4\%$, 75% of values were between 30 and 50%, upper bound was 64%.

[8] $s = 2.77\%$, 75% of values were between 8 and 22%, and 26% is the uppermost bound

Table 6.5: Presence / Absence of Economic Crops by Period

Scientific Name	Common Name		Iron II	Nab/Roman	Byzantine	M. Islamic I	M. Islamic II
Cicer arietinum	Chickpea			X			X
Ficus carica	Fig		X	X	X	X	X
Hordeum vulgare (distichon and vulgare ssp.)	Barley		X	X	X	X	X
Lens culinaris	Lentil		X	X	X	X	X
Olea europea (pit)	Olive				X		
Olea europea (shell)	Olive shell				X		X
Pistacia atlantica (shell)	Mt. Atlas Mastic Tree				X		
Pisum sativum	Pea				X	X	X
Prunus domestica	Plum						X
Triticum aestivum (rachis)	Bread wheat		X	X	X	X	X
Triticum durum (rachis)	Macaroni wheat		X	X	X	X	X
Triticum aestivum/durum (seed)	Free Threshing Wheat		X	X	X	X	X
Triticum dicoccum (caryopsis)	Emmer wheat		X	X	X	X	X
Vicia\Lathyrus sp.	Grass Pea		X	X	X	X	X
Vicia ervilia	Bitter Vetch		X	X	X	X	X
Vicia faba	Broadbean				X		X
Vitis vinifera	Grape		X	X	X	X	X

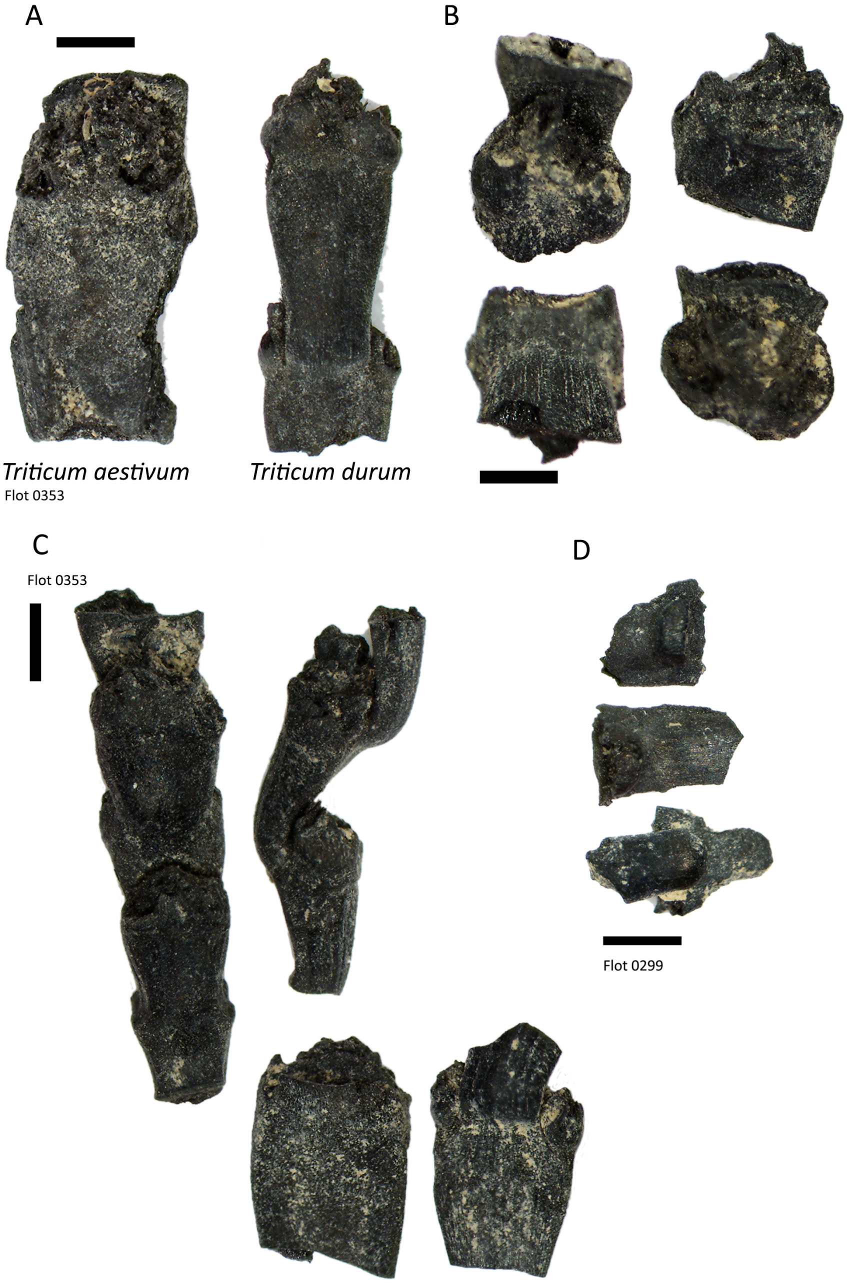

Figure 6.4: (A) contains *Triticum aestivum* and *durum* rachises, (B) contains *Tricitum aestivum/durum* nodes (unidentifiable to species), (C) contains *Triticum aestivum/durum* spike chains and whole rachis segments unidentifiable to species, and (D) contains *Hordeum vulgare* rachis nodes. All black bars represent 1mm and are scaled to equivalent sizes.

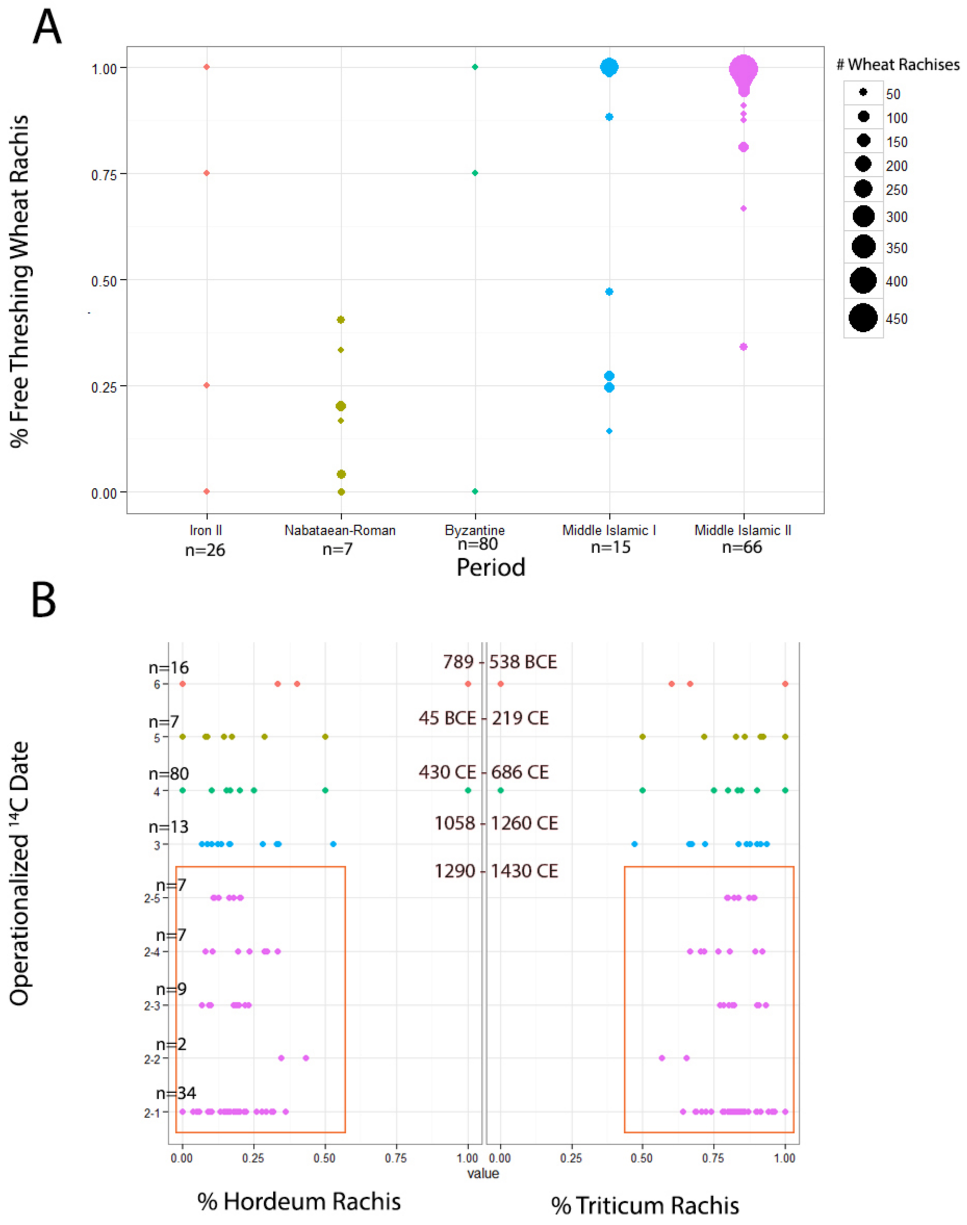

Figure 6.5: Rachis remains through time, where (A) is the proportion of free-threshing wheat rachises among all identified wheat rachises, and the point size represents the absolute number of wheat rachises, and (B) is the proportion of wheat or barley rachises in a given sample. The numbers on the y-axis in (B) correspond to internal phasing for each radiocarbon date provided. The color of (B) represents the period, and follows the color-period assignations in (A).

What is more telling about the desirability of these plants is the coordination of labor through irrigation that is necessary to maintain and encourage their growth. The varieties of wheat present in almost all of the samples are *Triticum aestivum*, *Triticum durum*, and *Triticum dicoccum* (**Table 6.5**), as identifiable through their rachis remains. All three taxa require a greater input of water than is a) available through precipitation alone, and b) than barley (which requires only 200-250 mm of rain per annum; Cappers and Neef 2012: 273). The free-threshing wheats in particular, *Triticum aestivum* and *Triticum durum*, require between 300 and 700mm of rainfall in order to achieve a reliable yield (Koohafkan and Stewart 2008: 27). Free-threshing wheats cannot be distinguished through seed morphology alone due to significant variability in the caryposes of these specific cultigens (Jacomet 2006; Cappers and Neef 2012: 304-5; **Figure 6.4**). They can be distinguished, however, using their rachis remains, as T. *aestivum* rachis internodes have a characteristic shield-shape (**Figure 6.4: A**), while T. durum rachis internodes taper in a straight line to the rachis node, and contain a conspicuous rounded lump beneath each glume insertion. The latter free-threshing wheat rachis remains should be contrasted with the glumed wheats, at Dhiban only represented by *Triticum dicoccum* (which is distinguishable to species based on seed morphology alone, preservation conditions permitting), whose rachis remains are diagnostic due to the presence of “spikelet forks”. In contrast, many of the rachis remains found in the samples at Dhiban can not be identified beyond “free-threshing wheat” (*Triticum aestivum / durum / compactum*), either as nodes (**Figure 6.4: B**), or on spike chains (**Figure 6.4: C**).

Using these identification criteria, it is possible to see that these higher-water requirement free-threshing wheats have been grown at Dhiban since the Iron II period (**Figure 6.5: B; Table 6.5**), that is since at least 789 cal BCE, but more likely earlier. As a proportion of all identified *Triticum* rachis remains, wheat rachises of a free-threshing variety often comprise more than 50% of the identified assemblage of each period, whether in the form of whole rachises, spikes, or nodes (**Figure 6.5: A**). The sole exception is the Nabataean-Roman period, where the majority of the rachises were only identified as *Triticum*, and yet diagnostically they were not of a glumed wheat variety. Therefore it is likely that since the Iron II period (**Figure 6.5: B**), the majority of *Triticum* rachises are in fact of free-threshing wheat varieties.

The latter abundance of free-threshing wheat confirms Riehl and Nesbitt’s survey of archaeobotanical reports in the Near East, where they note that in contrast to the Aegean, free-threshing wheats begin to become *the* dominant cultivar of wheat across the region (2003: 306-307). Indeed in all of the radiocarbon dated archaeological sediments at Dhiban (**Figure 6.5: B**), wheat rachises comprise the majority of all of the rachis remains recovered. Nevertheless, emmer wheat (*Triticum dicoccum*) does not seem to be totally supplanted but is present in very low quantities (<10 identified specimens) in each identifiable time period. The latter low, but consistent, presence of T. *dicoccum* might be a result of the longevity of “maslin” field practices, where farmers intentionally sow multiple cultivars of desired cereals in the same plot, or at least tolerate the presence of other cultivars as “impurities” which might hedge against crop failure (Halstead and Jones 1995). The very low presence of the rachis remains of emmer and glumed wheats in general (of 194 samples, only 23 contain these remains), seem to imply maslin production, as the large-scale processing of glumed wheats would have led to a greater number of rachis remains accidentally or intentionally deposited and therefore recovered through sampling (cf. van der Veen and Jones 2006: 219). Nonetheless both the relative frequencies of free-threshing rachises among all wheats (**Figure 6.5: A**) as well as the frequencies of wheat rachises among all cereals (**Figure 6.5: C**), indicate that by the Middle Islamic I and especially the Middle Islamic II period, wheats, and free-threshing wheat (*Triticum aestivum/durum*) in particular, were the cereal plants that emerged as the most dominant. Indeed this slow but pronounced shift toward wheat production, specifically of free-threshing wheat varieties, illustrates the ways in which the choices of prior communities, such as the shift to free-threshing wheat in the Iron II period, could influence successive communities in the same area through inherited knowledge of, or changes to, the larger agro-ecological landscape.

Quality or Quantity? Morphometric Studies of Wheat and Barley

Despite a clear shift to cereal production and processing in the Middle Islamic I and II period at Dhiban, there does not appear to be a concomitant shift in the “quality” of the grain produced. The thickness of the caryopses of domesticated cereals (Poaceae) can be used as a proxy for field and cultivation practices, as among cereals larger seed size is often positively selected for by cultivators (Fuller 2007: 908, 2012: 116-117). The selection for larger seed size is due to the fact that it is the caryopsis itself that is used as food, or the basis of food through further processing (Samuel 1983). Moreover the caryopses of wheat and barley are sensitive to environmental conditions such as soil quality and moisture during the grain-filling process, and therefore their morphology is influenced by both biophysical as well cultivation factors (Bruns and Croy 1983: 413). Morphometric analyses of seed thicknesses indicate that Byzantine *Hordeum* caryopses are significantly thicker (ANOVA F=8.549, *df*=1, *p*=.0048) than Middle Islamic period caryopses, although the effect of this difference is not large (a .3mm difference, on average; **Figure 6.6: A**). In contrast, Byzantine period *Triticum* seeds are not significantly thicker (ANOVA F=.295, *df*=1, *p*=.59) than their later Middle Islamic (I and II) period varieties, although the sample sizes are small (29 and 15 seeds, respectively), and many more seeds need to be measured in order to be confident in the reliability of these results.

There are two potential interpretations of these data. One interpretation is that differences in the thickness of these economic plants indicate changes in aforementioned field practices such as tilling, manuring, soil nutrient replenishment, irrigation, and careful cultigen selection (Fuller 2012). As was seen in the Nessana papyri, Byzantine period farmers in the area carefully assessed the amount of wheat seed sown and the amount returned, as well as paid close attention to the types of soils found in each of their plots. It is nonetheless surprising that it is *Hordeum* that is larger in the Byzantine period samples, and *not Triticum*, as it might be expected that *Triticum* seeds would be larger given what is known from the written evidence (i.e. wheat was so important that it was given as donation to

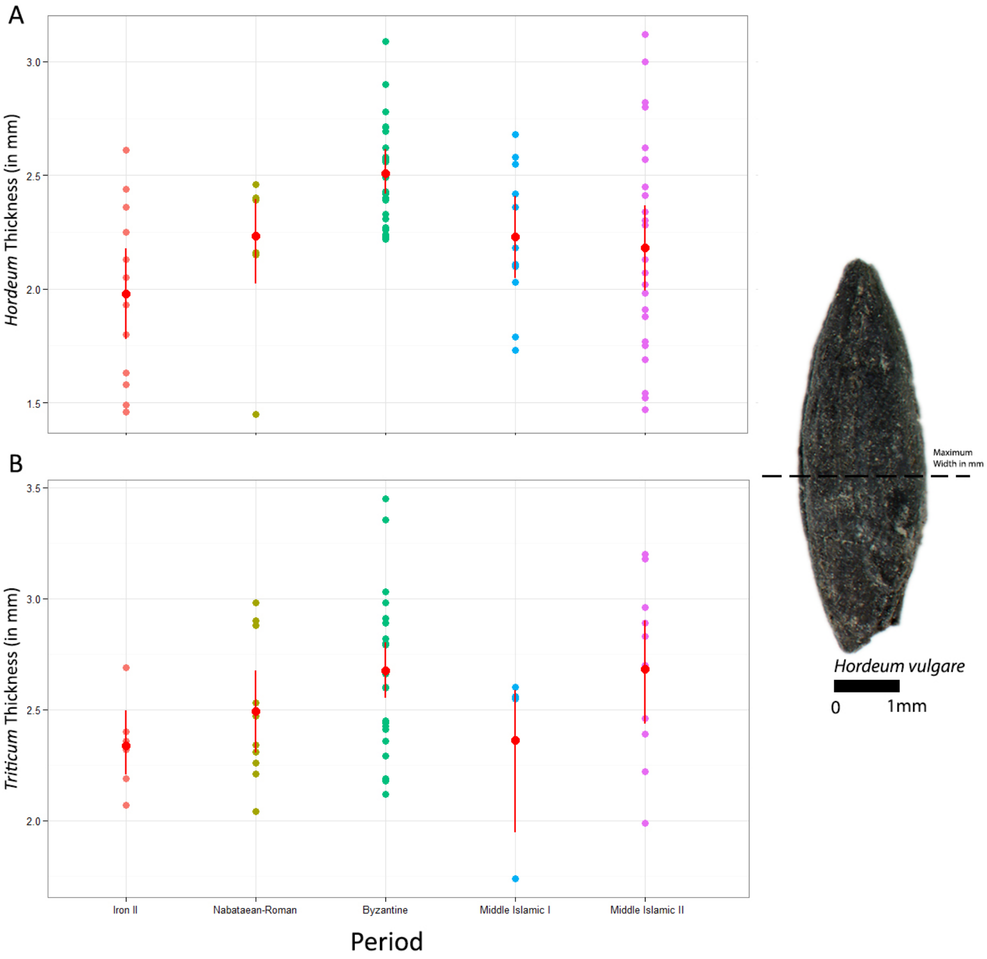

Figure 6.6: Measurements of *Hordeum* (A) and *Triticum* (B) seed thickness by period. Thickness is measured as the maximum width on the lateral side of a caryopsis, in mm (see image on right). On the plots, the red dot represents the mean, and the red lines are the 95% confidence interval.

churches). Another interpretation is that differences in *Hordeum* seed sizes between these periods reflects differences in the formation processes of these samples. As Glynis Jones (1996: 172-173) has shown through measuring the effect of sieving on grain size selection during routine crop (i.e. cereal) processing in her ethnographic research in Amorgos, Greece, *Hordeum* grains that are the byproducts of sieving are about 1mm less thick on average than the final, cleaned product.

Therefore it is possible that the difference in size between Byzantine period barley caryopses and Middle Islamic period barley caryopses is that Middle Islamic samples are more likely the result of crop processing debris and dung burnt as fuel. As a result, the smaller Middle Islamic II *Hordeum* seeds are crop processing by-products themselves, and not cleaned grain. Yet Jones also illustrates that the same magnitude of difference (about 1mm on aver-

Table 6.6: Morphometric Data of Cereal Taxa by Period

	Taxon	N	Thickness mean(mm)	Thickness sd(mm)
Iron II				
	Hordeum	11	1.96	0.41
	Triticum	6	2.33	0.21
Nabataean-Roman				
	Hordeum	10	2.22	0.3
	Triticum	11	2.49	0.33
Byzantine				
	Hordeum	23	2.51	0.23
	Triticum	29	2.66	0.34
Middle Islamic I				
	Hordeum	11	2.23	0.32
	Triticum	4	2.36	0.42
Middle Islamic II				
	Hordeum	27	2.2	0.49
	Triticum	11	2.68	0.41
Middle Islamic (All)				
	Hordeum	38	2.21	0.45
	Triticum	15	2.59	0.42

age) in thickness should be present in the measured *Triticum* seeds as well. Thus *Triticum* seed sizes are also reduced in size through the sieving process. Although the sample sizes are small and should not be taken as representative, there is little difference in the means of the thickness of *Triticum* seeds between these two periods (**Figure 6.6: B**). The only difference is in their variance – while the variance of Byzantine period *Hordeum* seed thickness is significantly different from Middle Islamic seeds (F-test, F=.2792, df_{num}=21, df_{denom}=37, p=.0028), the same is not true for the variance of the thickness of *Triticum seeds* (F-test, F=.2792, df_{num}=21, df_{denom}=37, p=.0028). That is to say, there is less variability in seed sizes between periods within wheat seeds, than barley seeds. Since it is expected that grain-sieving would have reduced the size of *Hordeum* and *Triticum* caryopses simultaneously, it is striking that Byzantine period *Hordeum* caryopses are larger than Middle Islamic period caryopses, but the same is *not* true for the *Triticum* grains. This might indicate that wheat and barley entered into the Middle Islamic samples through separate pathways, namely that barley entered as crop processing byproducts and dung fuel, while wheat entered as nearly cleaned grain – but more samples (i.e. seeds) will be necessary in order to confirm this suggestive trend.

Therefore differences in the thickness of these seeds, and *Hordeum* seeds in particular, further substantiate the notion that changes in practice, whether in crop processing or in the fields themselves, accompanied the reorientation of agricultural production with the intervention of these empires. Whereas the grain that was handled in Phase 2 of Byzantine period Dhiban represented carefully selected barley product charred accidentally, the deposition of a barley byproduct with a large range of variation in thickness demonstrates attention to quantity rather than quality in Middle Islamic period Dhiban. Given that the density of crop processing remains is greater in these same samples than in all other periods, the combination of these lines of evidence is indicative of the effects of an expedient crop production strategy where these crop-processing remains were then recycled as fuel.

A Taste for Grape, Wine, and Peas in Late Antique Dhiban

As it was noted above, Phase 1 of the Byzantine period samples from Field S was excluded from the analysis of general trends among the major agricultural crops as it represents an exceptional context. The density of nearly-pure agricultural crop seeds in one of these samples alone is the highest thus far uncovered at Dhiban: of the 7 samples out of 194 that contained more than 300 seeds as an absolute count, 97% of this sample's 309 seeds were all crop seeds of some variety. In contrast, the other samples, all from Middle Islamic I and II period contexts, contained just 3%(n=326), 4% (n=371), 8% (n=380), 10% (n=805), and 14% (n=396 and n=868) of crop seeds within each sample. Therefore this phase provides unparalleled insight into food storage and agricultural production in the moments just before the collapse of the building. Each phase of occupation, moreover, provides a different snapshot of agricultural production and processing in this same area. It is important to note again that the formation processes of these samples also indicate different scales of time in the deposition of these remains. For example, Phase 1 was formed through a catastrophic fire and building collapse, and it therefore represents a very narrow window of time: the fleeting moments just before the room's untimely destruction. Phase 2 samples, on the other hand, are more likely the result of repeated, routine activities due to the very low numbers of seed remains recovered and the proportional abundance of crop seeds within the assemblage. With the recognition of these different intra-area temporal scales, grape, one of the more ubiquitous seed remains among Byzantine period samples, persists through both phases, but was also used in distinct ways. As it will be shown, in Phase 1 the *Vitis vinifera* pips that have been found are more likely the result of wine dregs, whereas in Phase 2, grapes were probably consumed "as grapes", which can be inferred from their spatial heterogeneity and low numbers (i.e. more likely the result of an individual fruit being casually tossed into a fire).

To begin, Phase 1 is only represented by 15 samples, with 10 samples comprising "supra-surface" deposits (those deposits that overlaid the original second story plaster surface), and 5 samples comprising the actual surface material of the second story (**Figure 6.7**). Within the supra-surface remains, the densest items are, in descending order of density, wheat, peas, and grape (**Figure 6.7**). Indeed given the large numbers of destroyed *pithos* jars in this context, the quantity of wheat and peas inside of the destroyed vessel fragments indicates storage of those items specifically. Many of the *Pisum* remains were found either halved ($n_{samples}$=4), or fragmented ($n_{samples}$=7), and yet still identifiable due to surface morphology and diagnostic features such as the presence of the hilum. Although the surface morphology and distinct associations of the hilium and chalaza permitted identification to the level of the genus *Pisum* (Renfrew 1973: 105; Fuller and Harvey 2006: 223), it is possible that these identified *Pisum* remains are in fact *Vicia sativa*, as both possess nearly indistinguishable

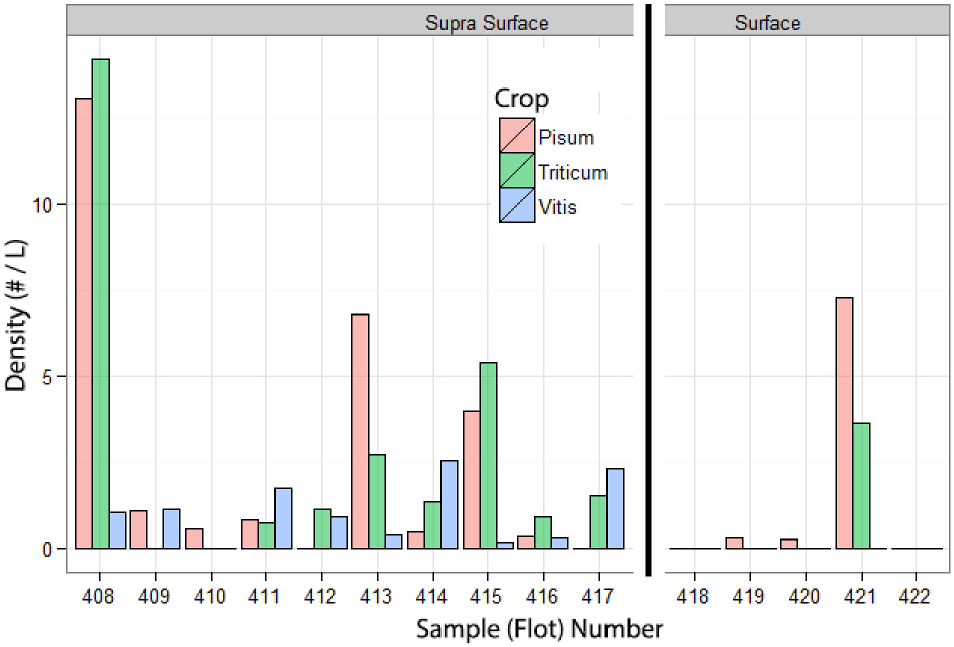

Figure 6.7: The densities of three domesticate taxa by flotation sample in Phase 1 of Field S (Byzantine period), divided between the surface and supra-surface deposits. Colors represent the differing taxa as seen in the legend.

seed morphologies. There do appear to be at least a few *Vicia* seeds interspersed with these putative *Pisum* remains. While both are legumes, the identifiability of *Pisum* versus *Vicia sativa* changes the interpretation of this area in subtle but important ways, which will be addressed below. Nonetheless, the operating identification used throughout this section and in this analysis will be of *Pisum* for these recovered remains.

Using the weight of seven samples that contained 121 whole and identifiable pea seeds, it was possible to calculate a regression equation ($Pisum\ count$=1.5701+(32.82 $*$ $fragment\ weight$)) to estimate the number of whole *Pisum* seeds that the aggregated fragment weight must have represented. The regression equation calculated that the sample with the most number of remains contained an estimated 137 *Pisum* seeds (total weight = 4.1285g), or 13 *Pisum* seeds per liter (**Figure 6.7: F0408**). The next most dense sample (F0421) contains an estimated 40 peas, or 7.2 peas per liter. In fact, the context from which these remains derived was considered by the excavator to be part of the "plaster" surface, and yet the densities of botanical material for this sample illustrate that it is more similar to the "supra-surface" deposits than the "surface" deposits, which contain few to no remains. The sample that contains 137 *Pisum* seeds also contains 149 *Triticum* seeds, at an estimated 14 wheat seeds per liter. Over 253 *Triticum* remains were found in total, probably of a free-threshing wheat cultivar.

The locations of the densest samples of *Triticum*, *Pisum*, and *Vitis* (**Figure 6.8**) reveal

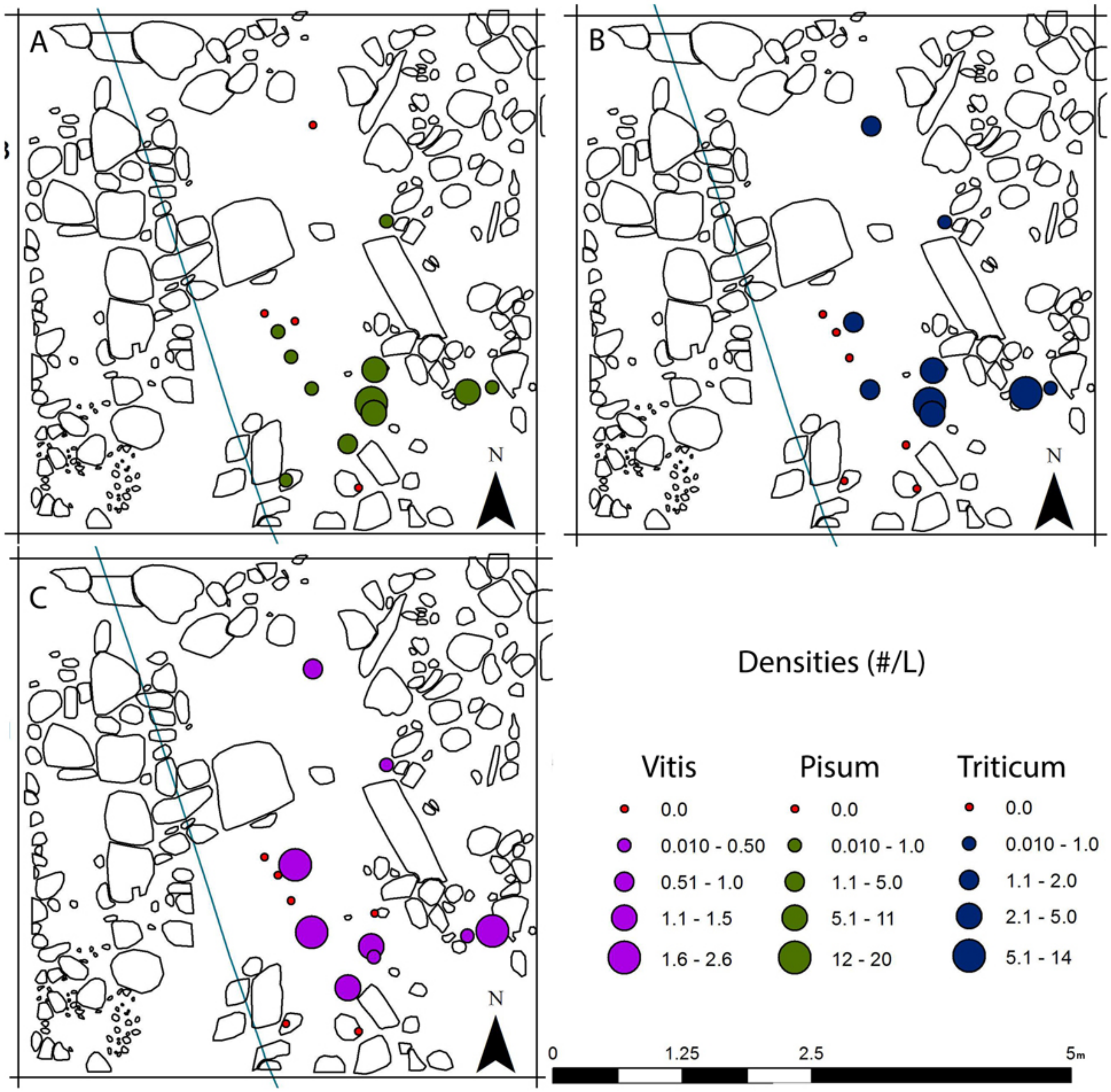

Figure 6.8: The location of the densities of the seeds of the major crops in AW54 of Field S Phase 1, with sizes representing taxon density. Each square represents the same excavation unit. Size of point represents the relative density, and the color indicates the taxon, which is provided in the legend.

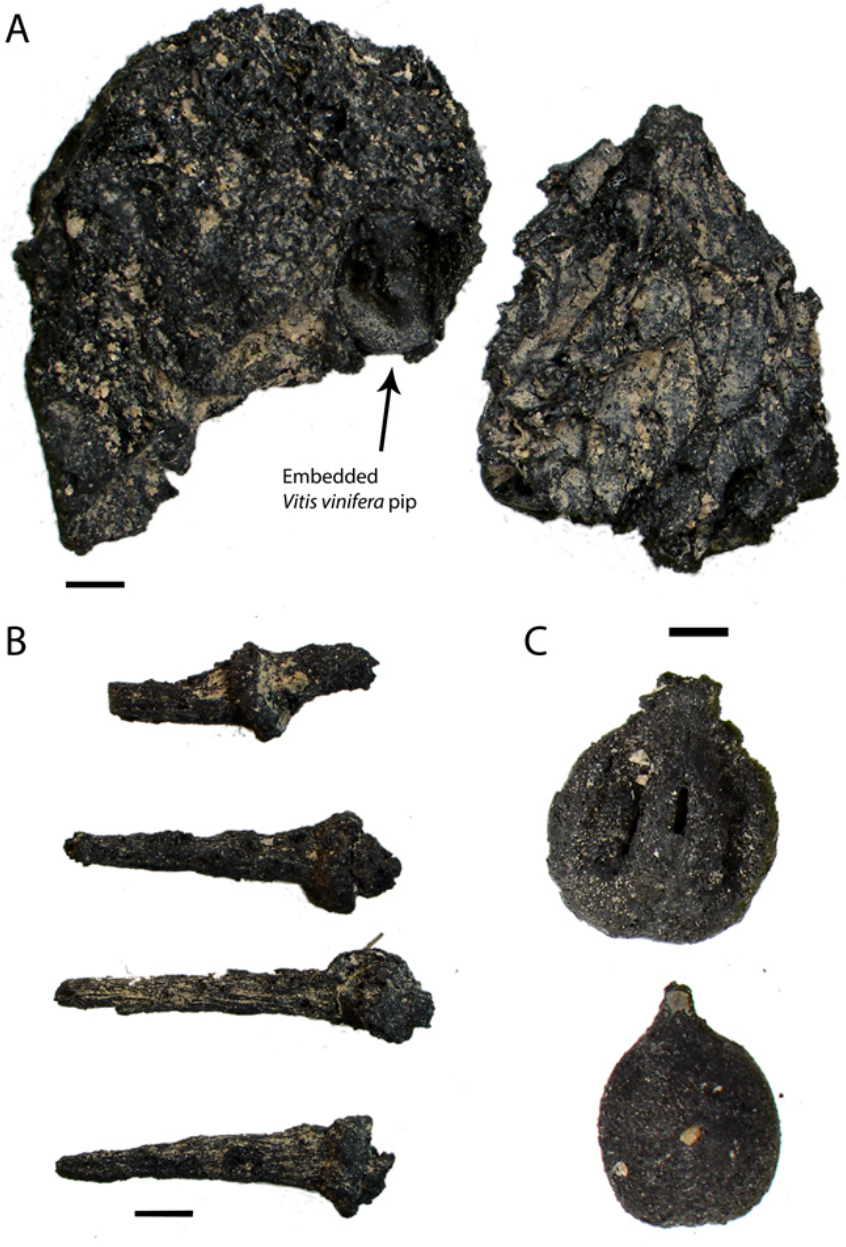

Figure 6.9: *Vitis* remains from Phase 1, including (A) *Vitis* mesocarps with embedded pips, (B) long pedicels, and (C) pips (A-B: Photo Rudi Vanzin 2013, C Alan Farahani 2013)

that wheat and pea are non-contiguous with grape (**Figure 6.8: C**) , and yet seem to spatially covary with each other (**Figure 6.8: A-B**). Therefore they are probably from two or more separate *pithoi*. The contents of the destroyed *pithos* that contained the most *Vitis vinifera* pips (**Figure 6.9: C**) also contained pressed *Vitis vinifera* mesocarps with seeds still embedded (**Figure 6.9: A**) and very long pedicels (**Figure 6.9: B**). Margaritis and Jones (2006) have argued that the combination of these kinds of *Vitis* remains are evidence of wine storage. They base this assertion on the comparison of ethnoarchaeological observations of "traditional" wine-making techniques in Greece with experimental charring conditions of *Vitis vinifera* mesocarps and pips, to the Hellenistic archaeological site of Komboloi in west-central Greece. In fact, they argue that if all of these remains are found together in a whole or fragmented *pithos*, "they can represent wine dregs of any kind of wine stored in the vessel. Grape pips may escape during the sieving processes before the must enters the vessel for fermentation" (Margaritis and Jones 2006: 798). The authors indicate that the remains found in this state might indicate white wine specifically (Margaritis and Jones 2006: 799), which is a tempting conclusion to draw for this material as it was shown in Chapter 4 that Flavius Cresconius Corripus, a poet of the 6th century CE, praised the wine of Byzantine Palestine for its "very fair snow white color" (*alba colore nivis...levissima*). Upcoming analyses of the ceramic remains will identify whether these storage vessels were of local manufacture or of non-local origin, and therefore shed considerable light on the nature of wine consumption and production in the late Byzantine and Late Antique southern Levant.

The implications of these associations in terms of the hypotheses set forth in Chapter 4 are doubly informative: while wheat is expected given the information supplied by the Nessana and Petra papyri, as well as other historical data, *Pisum sativum* is not expected. Yet the triple-cropping of wheat-legume-grape is known from historical texts, inscriptions, and some papyri, especially Nessana Papyrus 82, which explicitly mentions wheat (*sitos*) and a legume (*arakos*), grown in adjacent plots. It appears that the remains from the Phase 1 collapse of the structure constitute the physical paleoethnobotanical evidence of the widespread occurrence of this practice beyond the Negev. If the identified remains are *Vicia sativa* rather than *Pisum sativum* as was noted above, however, it might indicate that both human food (wheat and wine) were stored in adjacent areas to potential animal fodder (common vetch). In the case of either identification, it does not undermine the existence of this triple-cropping strategy beyond the confines of the Negev, and indeed places Dhiban within the agricultural "network" of these communities. Therefore it might not be remiss to say that there were regional knowledges of agricultural production which circulated among the Late Antique communities around the Dead Sea, specifically oriented to the challenges of plant growth in a semi-arid landscape. As opposed to the abundance of these plant remains, olive (*Olea*) is practically non-existent among the Phase 1 samples. The unique taphonomic circumstances of Phase 1 *should have* preserved much of the botanical material present inside of the collapsed structure. And yet only one flotation sample yielded one entire *Olea* seed (Flot 0415), while olive shell fragments were interspersed in very low densities (<50mg in four samples) throughout the plaster surface.

The ramifications of this low abundance of olive for the Late Byzantine period, and the

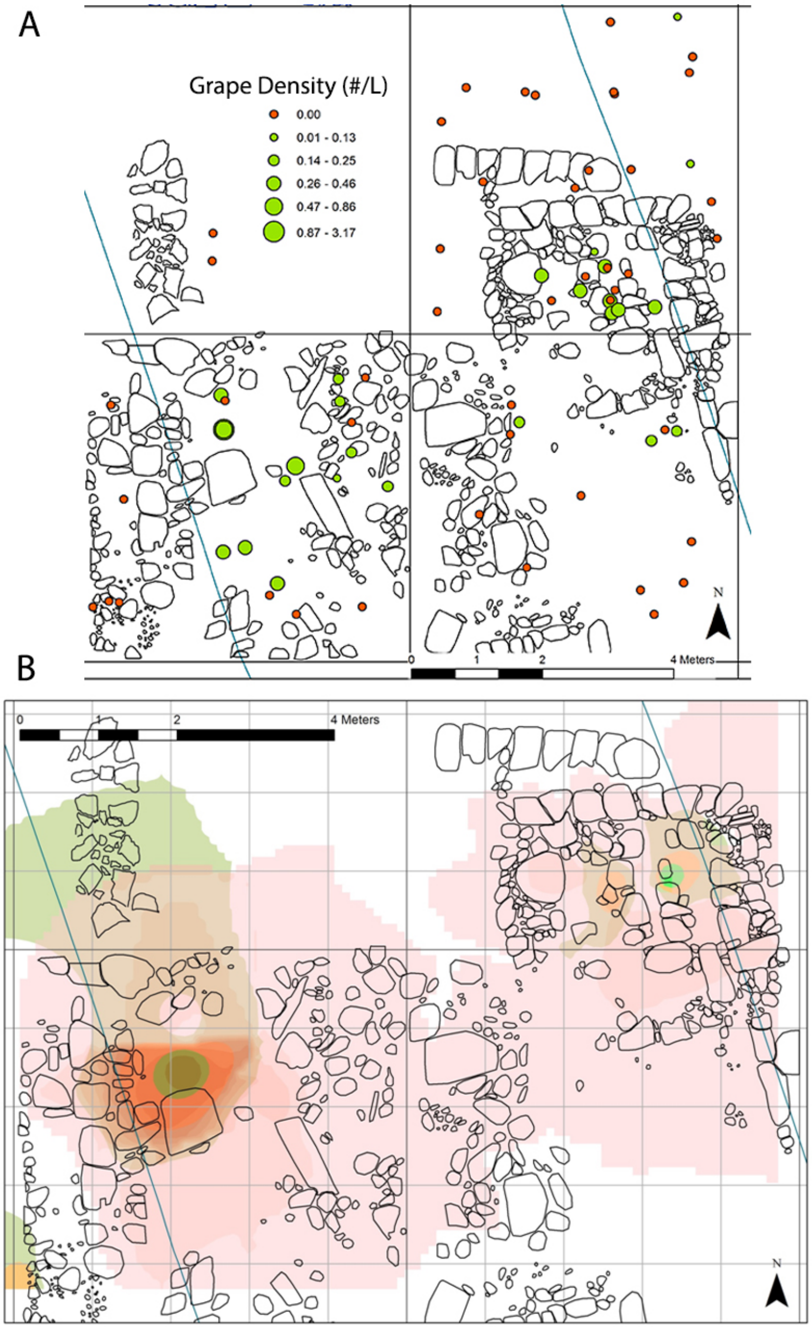

Figure 6.10: Phase 2 *Vitis* pip (seed) density, where (A) is the density of grape seed remains, with null values symbolized in red, and (B) is a kernel density (radius = 1m, cell size = .05m) of grape seed density (in green) and large charcoal (>2mm) density (of any taxon) by weight, in red.

Late Antique southern Levant, are historically profound: the rarity of olive either implies that olive was not grown in the vicinity of Dhiban, or seeds of this crop are to be found in another areas of the *tall*. One hypothesis is that olive consumption was perhaps not as widespread as previously assumed, even within the same settlement. The latter is substantiated by Kouki (1999: 47), who observes that the 6th century CE Petra Papyri rarely mention oleoculture, and that an account of the use of an olive press is only found in one papyrus out of the very large collection. Another hypothesis is seasonality: as olive trees were typically harvested in the ancient Mediterannean between November and December (Foxhall 2007: 6-9), the contents of this storeroom might represent the harvest of wheat and pea/common vetch only, which occurs between the months of April and June (Palmer 1998: 150). Therefore the building may have collapsed at a point prior to the harvest of olive, yet at some point after the harvest and processing of the cereals and legumes. Given the convergence of these factors, the 551 regional earthquake (Ken-Tor et al. 2001: 2228) seems to be an attractive explanation for dating the collapse of the building, given the absolute radiocarbon evidence from the deposits of the post-collapse occupation; 577 cal CE is the lowermost calibrated date, and 686 cal CE is the uppermost (1391±39 uncal BP; 2σ: 577 - 686 cal CE, 1σ: 616 - 665 cal CE). Furthermore most historical texts place its occurrence on the 9th of July, precisely after the harvest of wheat and legumes, but before the olive harvest (Rucker and Niemi 2010). The latter is only a tentative hypothesis, however, as there are serious problems with circular reasoning surrounding the archaeoseismological evidence, and Rucker and Niemi (2010: 102) also indicate that there is an inscription in Areopolis (just south of Dhiban) dedicated to the community for the rebuilding of a structure in 597-598 CE after an earthquake not attested in the archaeoseismological proxies. It is possible that there are, therefore, archaeoseismologically unattested earthquakes which may have equally contributed to the collapse of the Phase 1 structure, although they would have all likely occurred in the very late 6th century CE given the current ^{14}C evidence. Of these earthquakes, the 597 - 598 CE “Areopolis” earthquake seems to be an equally viable hypothesis.

In contrast to Phase 1, the post-collapse occupation of Phase 2 is less amenable to discrete interpretation. Whatever the cause of the conflagration that enveloped the building, it is clear that grape was still being handled “on the vine” afterward, albeit at a much reduced scale. First, the median density of grape remains in this phase in samples that contain at least one grape seed (n=28 of 65), is .38 grape seeds per liter, and the mean is .63. Second, the absolute number of recovered *Vitis* pedicels is 27, and they occur in 20% of samples, in contrast to all of the other Middle Islamic II period samples (n=66), where they are only present in 9%. Third, the taxa recovered from this phase are very similar to those below it, with the exception of peas/common vetch, which are not present, nor is olive, in 65 samples and 530.5 liters of processed sediment. It is likely that given that the formation processes of these samples, again, mainly the result of routine cooking and culinary accidents as well as food waste dumping, that these remains comprise a composite reflection of the kinds of crops the Dhiban community was producing and processing after the collapse of the building. That peas and olive disappear, but grape (and wheat) continues, is notable. The Petra papryi illustrate that in the mid 6th century CE, abandoned agricultural land was given over to vineyard cultivation (Kouki 2009: 46). It might have also been the case at Dhiban that whatever the ultimate cause of the conflagration and collapse of this structure, grapes were still being handled and processed within the remains of the fallen architecture. Indeed spatial analyses show that grape remains are *only* found within the confines of the architecture of this phase (except for two samples, **Figure 6.10: A**). The location of these *Vitis* pips is also spatially correlated to dense charcoal and low ceramic counts in the heavy fraction (**Figure 6.10: B**). The combination of denser numbers of grape pips and large charcoal by weight might represent "hastily assembled" tabuns or at least cooking places which were then left in-situ. The location of the greatest density of these two remains is in between a wall and a springer may even indicate an "activity area" where the wall was used as a wind-break for culinary preparation.

The next densest area of *Vitis* pip concentration is inside a drain visible in the upper right of **Figure 6.10: B**. This feature was filled with numerous bone (4.44 per liter) and ceramic (4.63 per liter) fragments, as well as a human tooth, metal jewelery, and an as yet-identified coin. In addition, a sample directly inside of the "drain" contained a perfectly preserved barley caryposis still inside of its rachis (**Figure 6.11**), implying that these deposits may have been intentionally deposited refuse, a very small proportion of which (<2%) included crop-processing remains. The AMS ^{14}C dates procured from a *Triticum* seed inside of this drain are also much earlier than the other two from the same area (1524±38 uncal BP; 2σ: 430 - 610 cal CE, 1σ: 442 - 597 cal CE); the 2σ ranges of this sample only overlap by thirty years with the lowermost 2σ ranges of the other AMS radiocarbon dates of this area (1391±39 uncal BP; 2σ: 577 - 686 cal CE, 1σ: 616 - 665 cal CE). Given the density of grape pip remains, ceramics, and assorted small refuse, as well as the much earlier date, it might be that this area represents a midden where materials were continuously redeposited, including material that dated to the period before the collapse of the room. In this respect it should be noted that the uppermost date of the 1σ range is 597 CE – precisely the moment of the earthquake recorded in the Areopolis inscription. Therefore even though this phase represents a post-collapse occupation most likely during the turbulent time of the early 7th century CE, it sheds considerable light on the responses of the Late Byzantine Dhiban community to the changes that accompanied the events that led to the conflagration of this building through their agricultural production.

6.2 Weed Agroecology, Fodder, and Field Maintenance

Another indicator of changes in agricultural production that would have accompanied these imperial interventions is in field weeds – that is the undesirable plants that compete with agricultural crops in fields for soil nutrients, water, and sunlight (Vieyra-Odilon and Vibrans 2001). The management of field weeds is an ever-present and costly concern that occupies a considerable portion of contemporary discourse around the sustainable management of agri-

Figure 6.11: Byzantine period barley (*Hordeum vulgare*) in its rachis, located inside of the Phase 2 drain (F0346).

cultural fields (Tilman et al. 2002). Moreover the analysis of the composition, abundance, and identification of field weeds is highly instructive about the kinds of field practices used in these different strategies of agricultural production, as field weeds are sensitive to changes in field practice such as manuring, irrigation, and soil nutrition (Jones et al. 2010). Therefore the following analyses will attempt to understand how the Byzantine period and Middle Islamic period communities at Dhiban were producing, at the level of field practice, the crops whose seeds, such as wheat, barley, and grape, have been discussed above. Within the archaeological literature, a large amount of experimental work bundled under the "FIBS", or "Functional Interpretation of Botanical Surveys", approach has connected various diagnostic attributes of whole-plant morphology to ecological variables in experimental plots in order to understand the effect of changes in field practices (tilling, hoeing, manuring, etc.) on the kinds of weedy taxa that are attracted to certain ecological conditions (Charles et al. 1997, 2003; Jones et al. 2010). The technique, however, makes strong uniformitarian assumptions about the kinds of weed associations, linked through the theory of phytosociology, that should persist through time (Bogaard 2004: 138-140). The FIBS approach is not explicitly used in this study due to the considerable contemporary experimental research needed in the Dhiban area to ascertain the effect of local environmental variables on whole plant morphology. Yet it is still acknowledged that the "most useful archaeological evidence of crop husbandry is provided by the seeds of arable weeds found in association with crop material in archaeological deposits" (Bogaard 2004: 5), and therefore the following analyses will compare arable weeds with crop seeds, when possible.

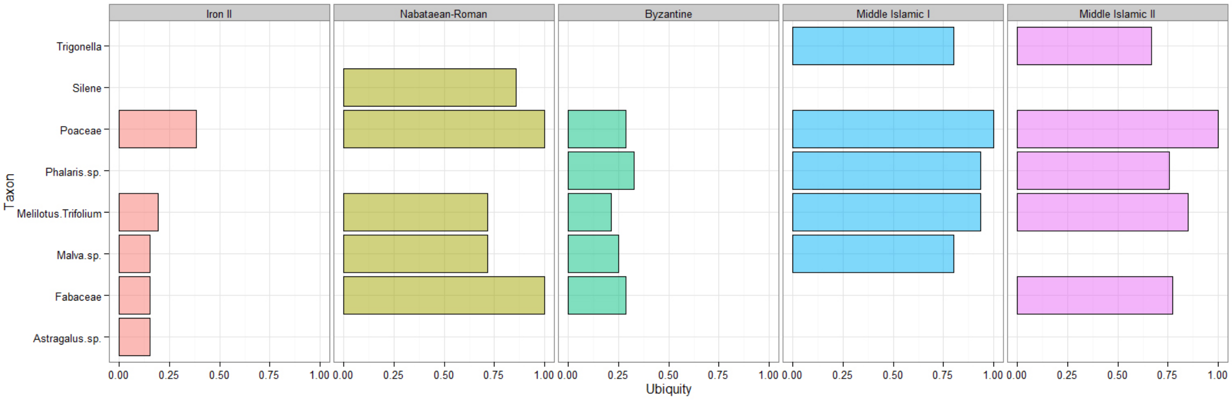

Figure 6.12: Ubiquities of the top five most ubiquitous weedy taxa, by time period.

It should be recalled that the proportion of weeds in any given Byzantine sample is relatively low. The sample with the greatest number of weed seeds out of the 80 analyzed Byzantine period samples, contains 59 weed seeds of 84 total identified seeds, in an 11 liter sample, that is, 70% (F0366). In contrast, the Middle Islamic II sample that contains the greatest number of weed seeds possesses 739 out of 858 identified seeds in a 4.5 liter sample, that is 86% (F0363). While the latter sample is unusually dense in terms of the number of remains recovered, as the last chapter illustrated large absolute numbers of weed seeds are present in Middle Islamic period samples (whether I or II) on average, and not Byzantine period samples. Accurately characterizing the weed associations among Byzantine period samples is therefore difficult, as there are only two samples of the 80 analyzed that contain more than 30 weed seeds.

Of the weedy taxa that are present, even despite their low abundances in Byzantine period samples, several broad characterizations can be made. First, the three most ubiquitous weedy taxa shared by all periods of time are either unidentified (but identifiable) Poaceae (grasses), or leguminous weeds (Fabaceae) (**Figure 6.12**). Though *Phalaris* sp. (canarygrass) only occurs in 32.5% of Byzantine period samples, it is nonetheless the most ubiquitous weed among them. Likewise, in the Middle Islamic II samples, grass weeds of some form or another are found in 100% of identified samples, with Melilotus/Trifolium (clover) occurring in 84% of them. What these ubiquitious weeds show is that similar, but by no means identical, field conditions must have prevailed in these periods of intervention. The grasses (Poaceae) in particular are abundant in agricultural plots primarily devoted to cereal production, as they have become adapted to agricultural field conditions and readily mimic the whole plant morphology of domesticates (Barrett 1983; Willcox 2012). Therefore the ubiquity and density of Poaceae weeds further strengthens the notion of continued and persistent cereal production in both the Byzantine and Middle Islamic periods. The presence of Fabaceae, or leguminous, weeds, is indicative of fodder or animal grazing (Palmer 1998: 3-4).

In order to identify the associations between these ubiquitious weeds, Spearman-rank correlations (Spearman's ρ) of the log of the densities of these weedy taxa were calculated to substantiate the trends seen in the ubiquities. Here Spearman's ρ, a non-parametric correlation coefficient, is chosen because many of the taxon densities, even after transformation (log $(x+1)$), are not normally distributed. Nevertheless Spearman's ρ performs well at identifying non-linear monotonic relationships (Borcard et al. 2011: 48), as it is the linear correlation coefficient (Pearson's r) of the ranks of the two variables (taxa) under consideration (Hammer and Harper 2006: 46). The use of correlations *within* a given assemblage is known as R-mode analysis within ecology, and is used to explore the relationships between *variables* or *descriptors*, and not samples (Legendre and Legendre 2012: 288). These relationships are then indicative of larger associations either of depositional practice, or here, field maintenance and harvesting. As a result, it is possible to analyze the Phase 2 Byzantine-period samples, even despite their low absolute numbers, although assessing that a correlation is significantly different from zero is only possible when $n > 10$ (Hammer and Harper 2006: 46).

The first set of correlations (**Figure 6.13**) show that the most positively correlated weeds among the Phase 2 Byzantine Period samples are Fabaceae and *Malva* (Panel A), as well as Cyperaceae and *Fumaria* (Panel B). The latter high positive correlation is probably indicative of weeds of irrigation that are growing in similar plots, and this is substantiated by the low, albeit significant, correlation of *Triticum* with *Fumaria* ($\rho = .263$, Panel C). Therefore it is likely that irrigation of fields was occurring in the Byzantine period, and perhaps in fields in which wheat (*Triticum*) was being grown, in particular. The association of Fabaceae (weedy legumes) and *Malva* is harder to interpret. The correlation of these two weeds might be due to samples that had previously unidentified dung-fuel admixed, as both of these plants are frequently grazed upon by ruminants.

The second set of correlations (**Figure 6.14**) shows that the most positively correlated weeds and select crops among the Middle Islamic II samples are Fabaceae and Poaceae (Panel A) and *Hordeum* and Poaceae (Panel B). As there are considerably more weeds as an absolute count in each of these samples, the inferences that can be drawn from these correlations are more robust. The correlation of Fabaceae and Poaceae (Panel A), and in turn the high and significant correlation with *Hordeum* (Panel B), imply that barley (*Hordeum*) seeds found in Middle Islamic II contexts are more likely fodder remains than human food. The genera among the identified Fabaceae are all attested leguminous forage plants, including *Trigonella*, *Astragalus*, and *Coronilla*, and point to their incorporation into the paleoethnobotanical record through the burning of dung fuel. Other sheep and goat fodder foods are also correlated, such as *Ficus* and *Vicia* (Panel C), which are, as in the case of *Vicia*, almost uncorrelated with wheat (Panel D). Indeed this seems to be the case as the only correlation of wheat (*Triticum*) with any other weed is with *Malva* (Panel E), or cheeseweed, a plant associated with cultivated, disturbed soils (Crawford 1986: 93). The correlation of *Malva* with Poaceae (Panel F), in turn, indicates that at least some Poaceae must have been the result of processed non-domesticated grasses growing among the desired crops, in this case cereals. The correlation of Poaceae and Fabaceae emphasizes again that these samples are highly mixed. If in fact Poaceae were largely entering as field weeds through routine cereal processing (and later burnt), and Fabaceae as the forage of ruminants that

Figure 6.13: Multiple correlation plots of select taxa from Byzantine period samples ($n = 65$) with smoothed correlation in lower panel, histograms in middle panels, and correlations in upper panels. If a positive correlation is significantly different from zero, it is bolded in red, with the number of stars assessing the level of significance ($* = p < .10, ** = p < .05, *** = p < .01$)

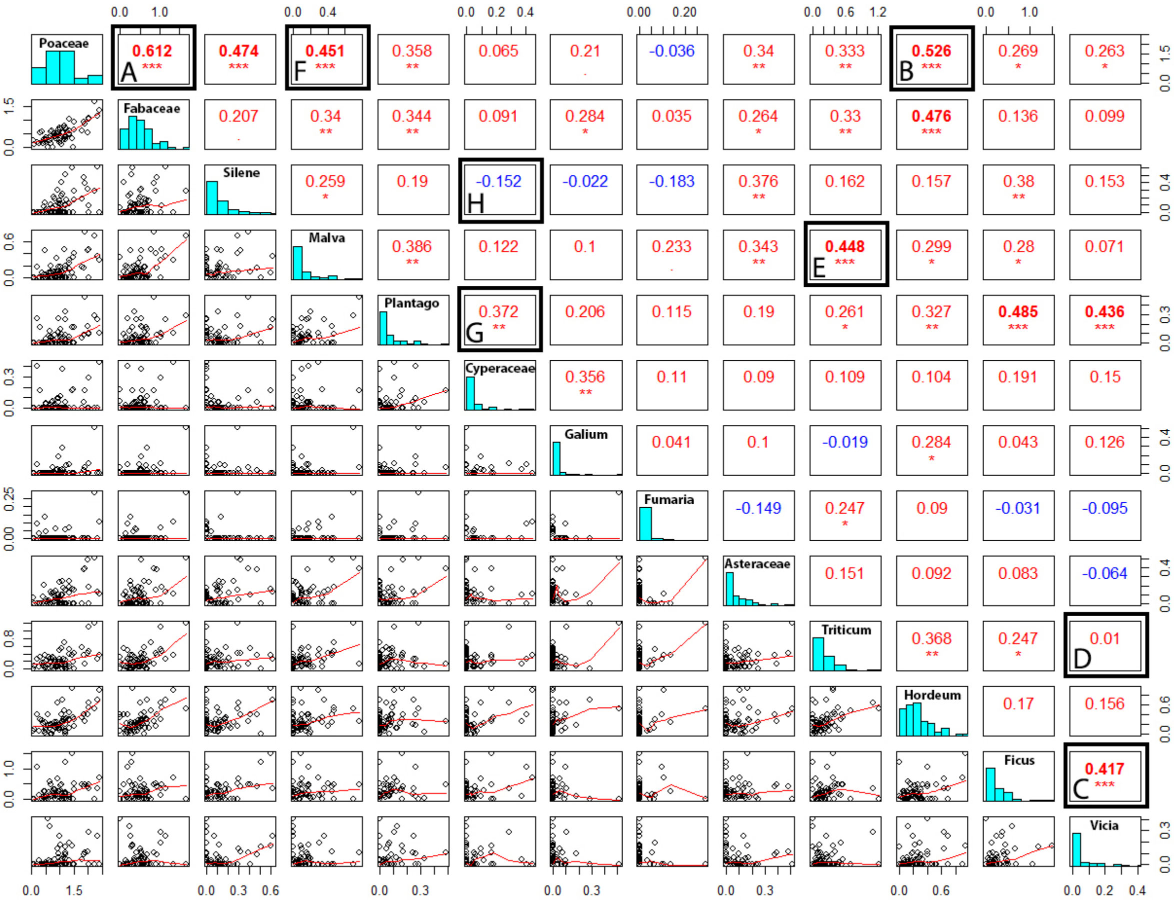

Figure 6.14: Multiple correlation plots of select taxa from Middle Islamic period samples ($n = 65$) with smoothed correlation in lower panel, histograms in middle panels, and correlations in upper panels. If a positive correlation is significantly different from zero, it is bolded in red, with the number of stars assessing the level of significance ($* = p < .10, ** = p < .05, *** = p < .01$)

was later burnt as dung fuel, they represent multiple burning episodes of plants of different human and non-human origins. Some of these samples also appear to indicate that irrigation was occurring in at least a few fields – Cyperaceae is correlated to *Plantago* (Panel G), both weeds commonly found in irrigated plots (Miller 2010: 60; Miller and Marston 2012: 101). It is therefore telling that there is no, almost a negative, correlation between Cyperaceae and *Silene* (catch-fly) (Panel H), which is an arable field weed of dry-farmed plots. The lack of correlation between these two implies that some plots were irrigated, while others were not, and that the outcomes of both strategies are present in these samples.

In order to confirm the above correlational trends seen in the Middle Islamic II period variables, correspondence analysis on the compositional data (proportional data) was performed on only those samples that had more than 40 weed remains, in order to minimize the issue of the inability to detect infrequent but important taxa due to small sample size (Fatela and Taborda 2002). In order to create more generalizable inferences, only Middle Islamic I and II period samples were chosen for analysis, which left 56 candidate samples available for correspondence analysis. The taxa chosen were those that were more ubiquitious and correlated in the last analysis, and therefore representative of different field practices. For instance, the weeds of *Cyperaceae*, *Plantago*, and *Fumaria* were considered to be indicators of irrigation, given their preference for moist, damp soils (Marston 2011: 201). The aforementioned Poaceae as well as *Galium* (bedstraw), *Silene* (catchfly), and *Asteraceae* (daisy family) are indicative of field-edges, particularly cereal fields, and other areas with highly disturbed soils (Crawford 1986).

Table 6.7: Eigenvalues of Middle Islamic Weed Seed Compositional Data CA

Partioning									
	Inertia	Proportion							
Total	0.3536	1							
Unconstrained	0.3536	1							
Eigenvalues									
	CA1	CA2	CA3	CA4	CA5	CA6	CA7	CA8	CA9
Eigenvalue	0.1537	0.04733	0.03881	0.02945	0.02733	0.02255	0.01653	0.009637	0.00825
Proportion Explained	0.4347	0.13386	0.10975	0.08327	0.0773	0.06378	0.04675	0.02725	0.02333
Cumulative Proportion	0.4347	0.56857	0.67831	0.76159	0.83889	0.90267	0.94942	0.97667	1
Variable Scores									
	CA1	CA2	CA3	CA4	CA5	CA6			
Poaceae	0.1313	0.18821	0.006783	-0.030529	0.02742	-0.004208			
Fabaceae	-0.6812	-0.09906	-0.003743	0.001422	-0.01983	0.015812			
Silene	0.4952	-0.46606	0.341187	-0.682927	-0.32951	0.18467			
Malva	0.3946	-0.13674	-0.035651	0.412308	-0.08538	0.598575			
Plantago	0.5149	-0.22012	-0.229385	0.278059	-0.57289	0.165067			
Cyperaceae	0.4386	-0.48518	-1.679016	-0.479987	0.36675	0.040488			
Galium	0.2137	-0.23779	-0.618645	0.213352	0.09458	0.131709			
Fumaria	0.021	0.02812	-0.379162	1.645852	-0.47356	-0.625633			
Asteraceae	0.3843	-0.57209	0.399217	0.093138	0.82561	0.115186			
Other	0.3223	-0.26098	0.025553	0.132381	-0.07628	-0.251269			

The results of the correspondence analysis indicate that the model explained 56% of the variance of these samples (**Figure 6.15: A**). When the axes are extracted, and the structures from which these samples were taken, their period of origin (Middle Islamic I or II), and the

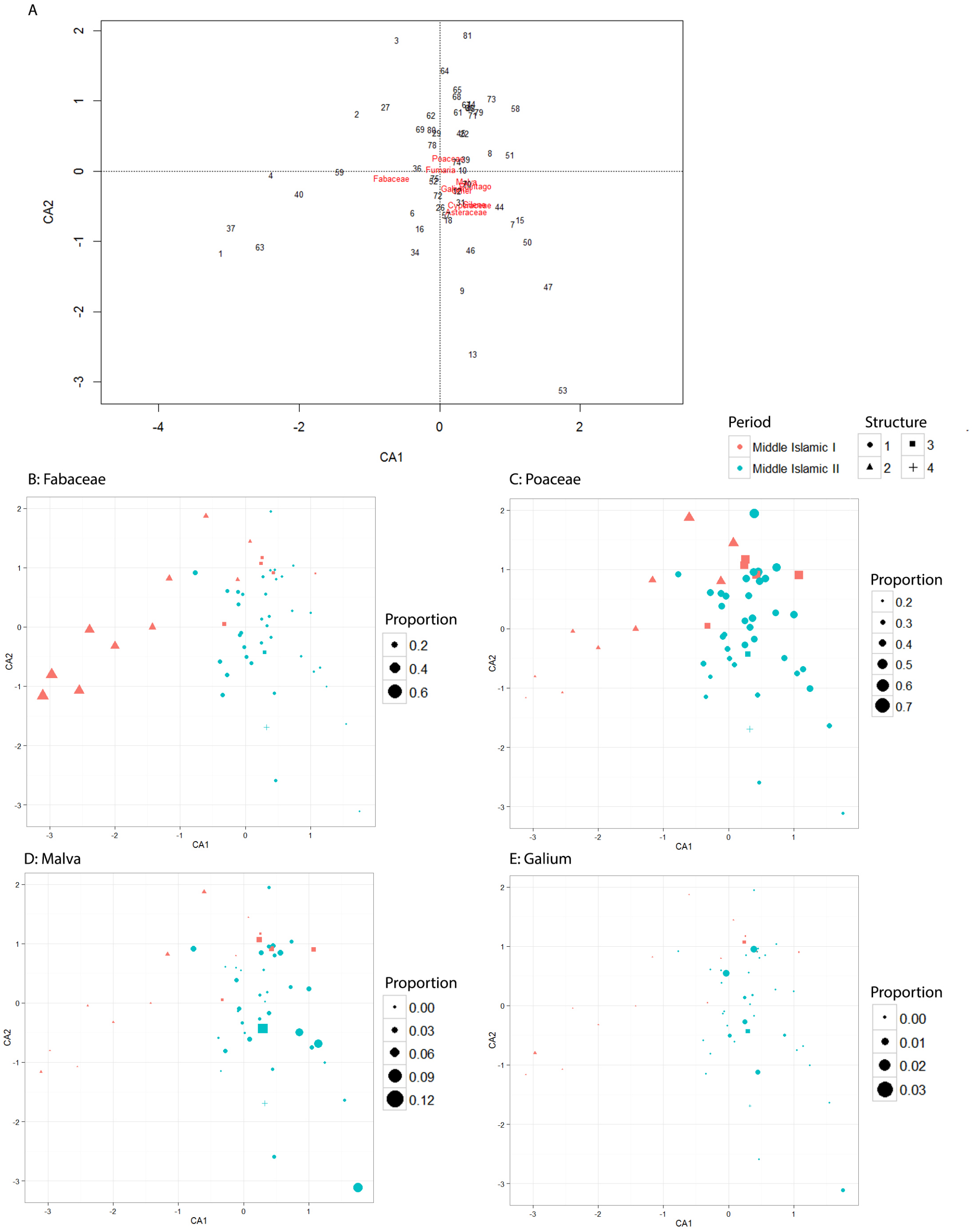

Figure 6.15: Biplots of the CA of major weedy taxa found in 56 Middle Islamic I and II samples. (A) represents the relative influence of each taxa, and (B-E) contain the extracted axes, with the structure number as shape, the period as color, and the proportion composed by that taxon as point size.

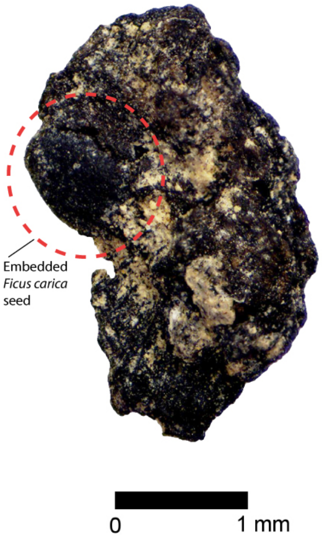

Figure 6.16: Fig (*Ficus carica*) seed embedded in a flattened dung fragment from a Middle Islamic II period context (a Phase 2D pit in the Phase 2E surface of the BVR, F0351).

relative proportions of select weedy taxa overlain on the scatterplot points, there are two clear observations. First, Middle Islamic period I samples contain far more Fabaceae seeds as a proportion of the weedy taxa total, but especially Melilotus/Trifolium (**Figure 6.15: B**). Second, the Poaceae, or grasses, are more characteristic of Middle Islamic II deposits (and some Middle Islamic I), almost regardless of the structure from which they were sampled. Those samples that are not composed of grass weeds by a majority, moreover, are more likely to contain greater proportions of *Malva*, or cheeseweed, remains (**Figure 6.15: C**).

The correspondence analysis reveals that Middle Islamic samples are certainly composite images of multiple harvests that have been mixed, and represent different stages of the crop-processing continuum due to the frequent co-occurrence of weedy taxa from different potential plot types, especially the weeds of irrigation. The mixing of the weeds of these multiple harvests directly relates to on-site activities, especially of waste discard. Second, Middle Islamic I deposits are more likely the remains of dung fuel, as the majority of weed seeds from these deposits are Melilotus / Trifolium (cf. **Figure 6.12**), which along with fig seeds, can survive the gut of ruminants almost unscathed (Valamoti and Charles 2005: 531). As it was shown above, fig seeds are ubiquitous in Middle Islamic I and II period samples, where they are present in more than 75% of samples. Moreover, one fig seed was found embedded inside a piece of dung from a sample procured from a surface inside of the Middle Islamic II period BVR (barrel-vaulted room, **Figure 6.16**), which is indicative of the potential of these crop seeds to be, in fact, proxies of animal dung.

Therefore it is highly likely that many of these Middle Islamic I and II period samples reflect the grazing habits of sheep and goats in this period. While the presence of the genera of many of the Fabaceae are usually indicators of healthy steppe growth (e.g. *Astragalus* and *Coronilla*, Marston 2011), they should above all signal the differences in the practices that led to the deposition of the Byzantine period and Middle Islamic period samples. In short, the evidence of weed agroecology reinforces the notion that changes in landscape practices such as increased sheep and goat rearing in the Middle Islamic period, also involved new and different ways of interacting with existing fields. The combination of agricultural field weeds and probably grazed legiminous taxa from the plateau point to an integrated agro-pastoral process, whereby these animals may have grazed on fallow cereal fields, and their dung was then burnt as fuel. The latter is a marked contrast from the Byzantine period samples, where very little evidence of this strategy is present. While future faunal data from these contexts will identify these combined and mutually influential changes in field practice, the botanical data are nonetheless indicative of the concatenated and connected effects of changes in agricultural production attendant upon the shifts in social relations sedimented in the institutional effects of the empires in each of these periods.

6.3 Dhiban in Regional Context: Snapshots of Shifting Economic Networks and Landscape Knowledge

While the characterization of the frequencies and distributions of the crops represented by these crop seeds highlighted large-scale trends in agricultural production, field maintenance, and agropastoralism, the paleoethnobotanical and heavy fraction outliers, that is, the less common or rare plants, can provide snapshots or at least indices of some of the range of desired cultigens that must have existed in the worlds of all of the communities at Dhiban. The presence or absence of particular rare plants indicate changes in economic and personal networks (in terms of the potential and manner of acquisition), changes in field practices, and shifts in knowledge of the landscape and perhaps new methods of cultivation. Comparisons with paleoethnobotanical data from other sites is necessary in order to situate and understand the plants of each of these periods which might be uncommon at Dhiban, but might have been abundant at other sites. The three closest sites with paleoethnobotanical information published are Hesban (Gililand 1986), Lejjun (Crawford 2006), and Khirbet Faris (Hoppé 1999). Within contemporary Jordan, Pella (Willcox 1992) and more recently Petra (Ramsay 2013) are also reported upon, although none of the tabulated quantitative data has yet been published for Pella, Lejjun, or Petra. Hesban is located to the north-east of the Dhiban plateau, while Khirbet Faris and el-Lejjun are located just to the south, on the Karak plateau (**Figure 6.18**). These sites illustrate the potential routes through which those individuals carrying plants or knowledge about their cultivation may have traveled.

Comparisons with these sites show that Dhiban is unique in the botanical landscape in both the Byzantine and Middle Islamic periods, and though it is clear that imperial demands existed for certain plants, and that the communities inhabiting Dhiban in some sense responded by changing in agricultural production, there are indications that they nonetheless exerted some forms of agency in their acquisition of other desired plants. Yet where that agency was located and organized (i.e. individuals, institutions, etc.) is a matter for further research. The available data offer some suggestive indications as to how these exchanges might have occurred, and through what medium of agency.

Specialization and Localization in Byzantine Dhiban

The first recognition that can be made when comparing the Dhiban assemblage to other sites, is that the Byzantine period botanical remains of both phases are comparatively homogeneous with few outliers outside of the "dominant suite". In Phase 1, the most numerically abundant taxon which lies outside of the typical major four cultigens (wheat, barley, grape, fig) is *Pisum sativum / Vicia sativa*, which has already been noted as part of a potential wheat-legume-grape triple-cropping strategy. In Phase 2, the only taxa outside of the range of the dominant Mediterranean cultigens are *Pistacia atlantica*, which is indicative of at least a few *Pistacia* stands available on the landscape to Byzantine period communities, as well as a *Zizyphus spina-christi* berry, which is a large, spiny tree from equatorial Africa but had been established in the area since the Chalcolithic (Ronel and Yev-Ladun 2009: 759). Furthermore, both of these fruits, the *Pisacia* and the *Zizyphus*, would have been locally available on or around the Dhiban plateau. Yet what does this restricted range of plants mean in terms of the Byzantine Dhiban community's relationship to the outside world? The remains of olive provide one such avenue for insight into this matter. As can be seen in **Figure 6.18**, olive is present in 41% of Hesban samples (Gililand 1986), 9% of the Late Byzantine period samples in Lejjun (Crawford 2006: 462), and in 20% of the samples from Khirbet Faris (Hoppé 1999). Thus it is present at these sites, albeit in lower quantities than anticipated, and yet it is almost entirely absent from Dhiban. In contrast, Dhiban has the highest ubiquity of grape seeds of any of these sites (46% of 65 Phase 2 samples, 60% of 15 Phase 1 samples). Given the much larger sample size and volume of sediment processed at Dhiban versus these other sites, the generalization of a greater grape abundance is numerically more reliable (Hesban has 15 Byzantine period samples, Khirbet Faris has 5, and Lejjun has 34 Late Byzantine). There is little evidence for olive, but abundant evidence for grape in both phases, and this may imply a degree of agricultural specialization among the communities of the area. Similarly, Lejjun, the site with the next greatest number of samples and therefore the next most generalizable, contains barley (*Hordeum*) in nearly 75% of its samples. Indeed even though the two sites closest to Dhiban, Hesban and Lejjun, were growing and harvesting cereals, the relative proportions of the recovered crop seeds differed considerably.

It is possible that given the similarity of taxa between sites, but their differing proportions, that communities in the Late Byzantine period in this small area of the southern Levant around the Dead Sea were specializing in the production of different agricultural goods and distributing them between communities. As an indication of this exchange, wheat and barley rachises, that is evidence of crop processing, are found in Lejjun and Khirbet Faris (Hesban

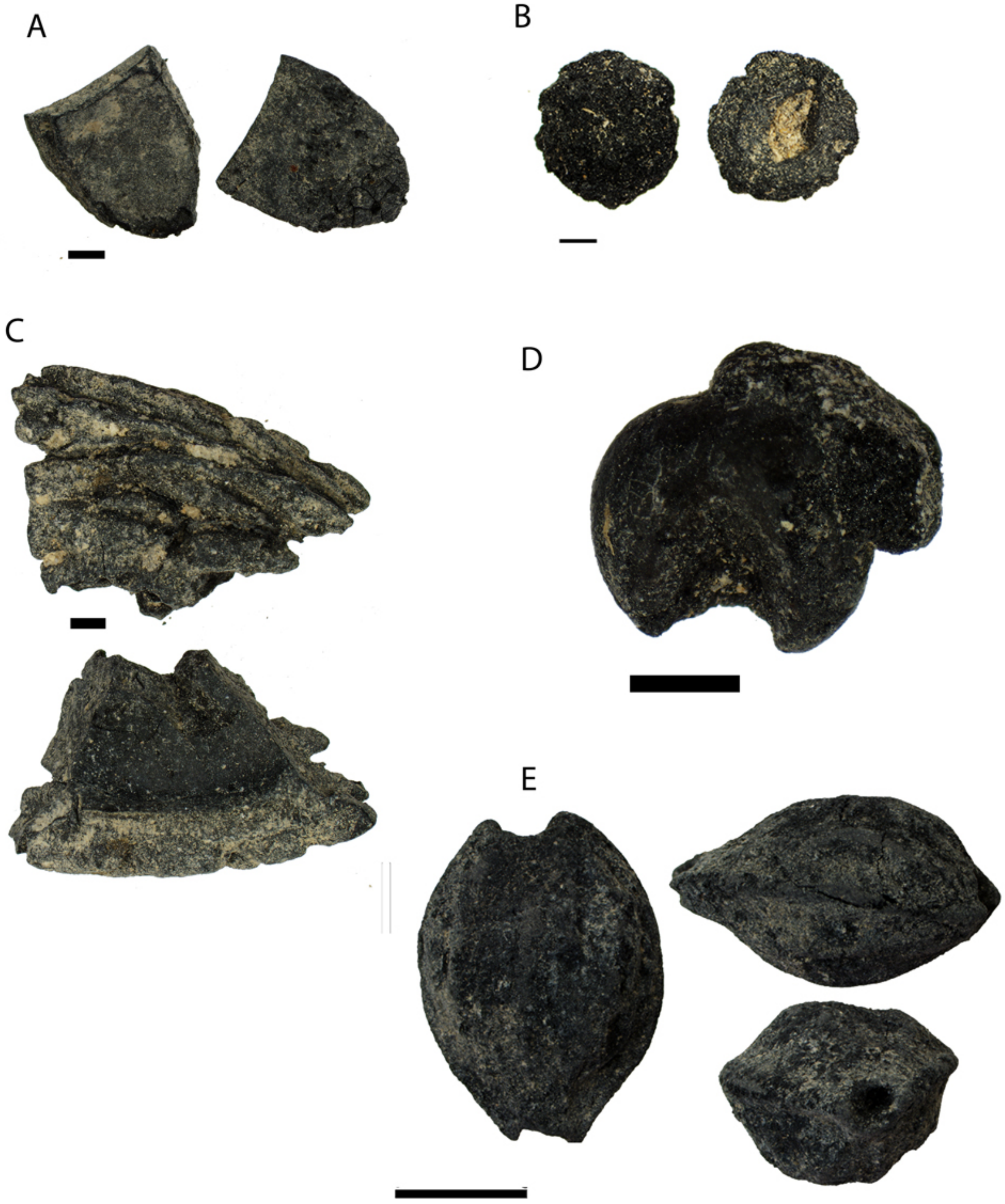

Figure 6.17: Rare domesticate taxa found at Dhiban, including (A) *Pistacia atlantica*, (B) *Zizyphus spina-christi*, (C) *Olea sp.*, (D) *Sorghum* sp., and (E) *Prunus domestica* cf. *cerasus*. All scales are 1mm, except for (E), which is 5mm.

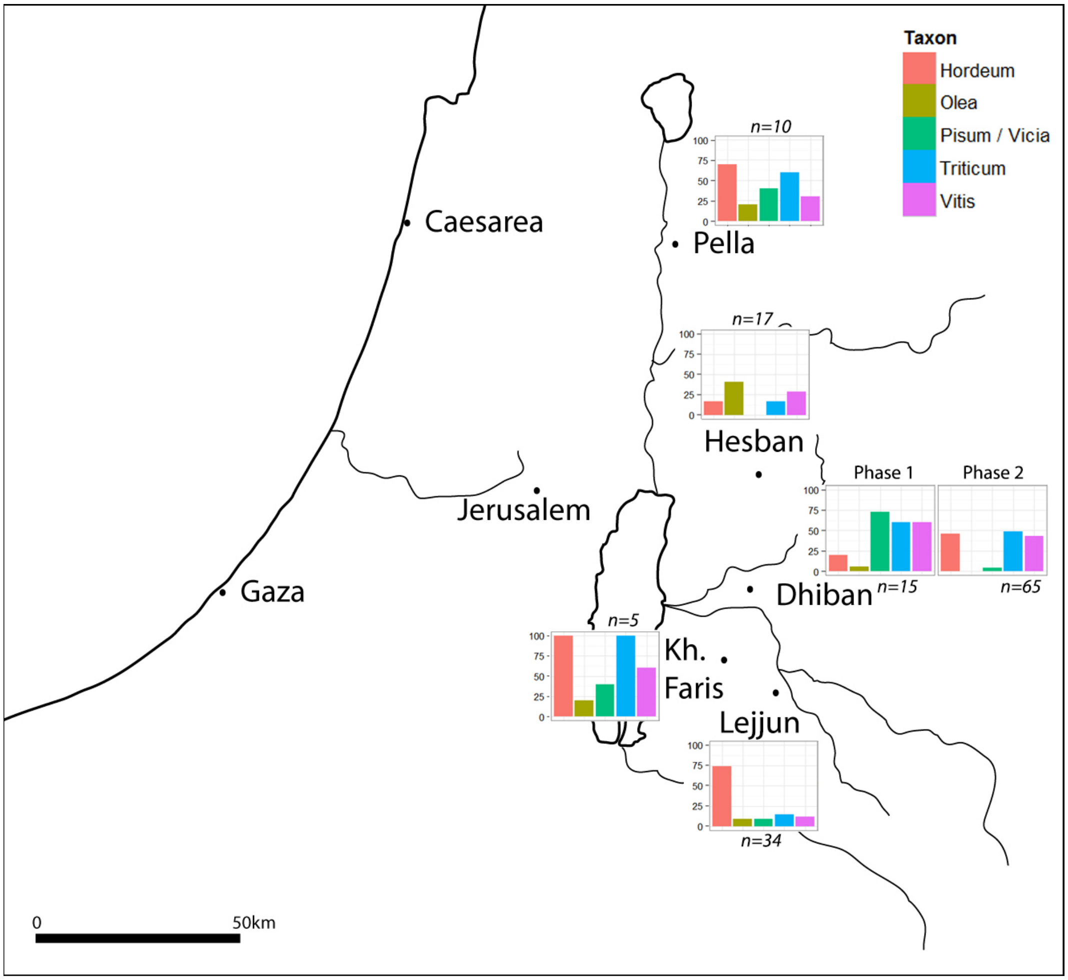

Figure 6.18: Comparison of ubiquities of select domesticate taxa across Byzantine-period sites, where data is available. The number of samples is provided either above or below each graph. (image adapted from Walker 1999).

does not report this), in rather modestly high ubiquities (41% barley and 50% wheat in Late Byzantine Lejjun, 100% wheat at Khirbet Faris). An analysis of only the ubiquities for Dhiban would under-serve the available data. Of 80 samples representing 622.6 liters of sediment, only 74 free threshing (*Triticum aestivum / durum*) and 11 barley (*Hordeum vulgare*) rachis nodes were identified. Out of these 80 samples, 33 samples had neither wheat nor barley rachises (41% absence), while 36 did not have wheat (45%), and 55 (69%) did not have barley. The current evidence therefore points to little cereal processing on the *tall* of Dhiban itself in the Byzantine period, but considerable processing occurring at other contemporaneous sites.

It might be possible that the discrepancy between these sites is due to the archaeological contexts that have been excavated. Thus far, only one identified Byzantine-period structure complex has been uncovered at Dhiban, and it might therefore only represent a fraction of the full range of plants used by the past community. While future research will qualify this assertion, it is still clear that differences in excavation areas alone can not account for the discrepancies between the presence and absence of major taxa. Both dates (*Phoenix dactylifera*) and peach pits (*Prunus persica*) are found at Lejjun, but only dates are found at Khirbet Faris, and neither thus far at Dhiban. The site of Lejjun, it must be emphasized, was a military barracks, and one of the largest in Jordan (Kennedy 2004: 154-159). What the differential distribution of these botanical remains might illustrate are the ways in which plants were associated with certain communities in the Byzantine period, certain practices, and perhaps even certain privileges. It is tempting to associate a greater diversity of plant remains at Lejjun specifically with the military garrison there. Yet the ubiquity of barley grains and also wheat and barley chaff indicate that the community was engaged in direct crop cultivation. Whatever the case, it is nonetheless clear that a highly romanticized image of a timeless agricultural landscape of highly conservative farmers in this period is not warranted (Rubin 1996), and the communities in this area, as predicted in Chapters 3 and 4, were actively negotiating and reinforcing political relationships through these strategies of agricultural production.

Fish and Fruit in the Middle Islamic Dhiban Plateau

The most stark contrasts with the Byzantine period, in this respect, come not from other sites, but from the use of the same site at a different time. The Middle Islamic community at Dhiban, especially the Middle Islamic II community (ca. 1350 CE), seems to have been able to come into possession of a vastly different array of crops closely linked to larger biotic networks established through trade and new kinds of knowledge about agricultural production (Walker 2011). Though the crop remains in the paleoethnobotanical samples from this period are dominated by cereals, new and different kinds of crops appear that attest to changes in knowledge of the landscape. These include a *Prunus domestica* cf. *cerasus* (sour cherry) pit (**Figure 6.17: E**), and a *Sorghum* sp. seed (**Figure 6.17: D**). While there is only one example of both of these rare taxa, they individually attest to a different and larger networks of human relationships mediated by these plant remains, and with people in the landscape more specifically.

For instance the presence of what is cautiously identified as *Prunus domestica* (plum), but is more likely a *cerasus* (sour cherry), was found in the barrel vaulted room in the uppermost sequence of the four episodes of room rebuilding. As such, it dates to the 14th century CE, the precise and only time during which "plum" is also attested at Khirbet Faris immediately to the south of Dhiban (Hoppe 1999: 128). The reason "plum" is placed in quotation marks is that due to considerable morphological variability from species hybridization, identification of specimens to the species level from pits alone even today is difficult (Depypere et al. 2007). Yet no matter the species, the presence of domesticated "plum" is important when it is recognized that this plant does not grow natively in this region (Zohary et al. 2010: 141-4) , and so it must have been acquired through trade or through garden plot arboriculture of a transplanted tree. Beyond the southern Levant, plum is attested in southern Syria only as early as the 12th century CE (Samuel 2001: 358). The connection of Khirbet Faris and Dhiban at the same chronological moment through “plums” is manifestly part of new linkages between communities in search of different kinds of consumable fruits.

In this respect the presence of *Sorghum cf. bicolor*, also indicates such changes. Khirbet Faris again records the presence of sorghum in the 12th and 13th centuries CE, and the plant is one of those proposed by Watson (1974) to have been responsible for the Islamic “green revolution” due to the fact that it is a summer crop. Sorghum is planted in the summer, and harvested in the winter, unlike native Mediterranean plants, which are mainly harvested in the early spring (although there are winter varieties of many wheats). The growth regime of *Sorghum* therefore permits nearly year-round cropping. Although 20% of Khirbet Faris samples contain at least one sorghum seed, there is only 1 Middle Islamic II sample at Dhiban which contains it (F0356). The possession of this plant seems to have been regional – no sorghum is attested in contemporaneous sites of the Syrian Middle Euphrates Valley (Samuel 2001), or Anatolia (Miller 1998). It therefore represents a more circumscribed and local experiment into different kinds of plant cultivation, and the presence of just one *Sorghum* seed at Dhiban indicates infrequent cultivation at best. Nonetheless, the rare sorghum seed is part of larger changes in deposition visible at the level of the barrel vaulted room itself. A visualization with select taxa superimposed in the room from which the sorghum derives (**Figure 6.19**), illustrates that the sorghum seed, located in subgrid 19, is surrounded by a relatively homogeneous assemblage of other domesticate taxa. Yet the density of grape remains in subgrid 9, directly against the room’s walls, probably represent the sweepings of a meal, whereas the adjacent subgrid (18) to the sorghum seed contains very low counts of fish vertebrae and scales. The pit (Locus 90) adjacent to this sorghum seed contains extremely high densities of fig remains, as well as barley, and is in fact the densest sample yet recovered at Dhiban. Within this sample is one germinating *Malva* seed, which together with the high densities of fig and barley, indicates a pit used to burn dung fuel, within which the seed was subject to a reducing carbonization environment that caused it to begin germination (Cappers and Neef 2013). Therefore the co-occurrence of all of these different “activity” areas indicates how life changed for the Middle Islamic II community at the level of the structure, with dung fuel, fish remains, and new crops all inhabiting the same physical space, as well as the activities that they both represented and of which they were a part.

Finally, these outliers also indicate changing relationships with local hydrology. The preliminary wood charcoal evidence (**Figure 6.20**) reveals that the only period when Willow or Popular (Salicaceae), woody taxa that are riparian and thus bound to fresh water, begin to be burnt in any quantity, is during the Middle Islamic II period. The latter should be connected to an abundance of fish remains that appear in the heavy fraction, of 94 samples, 34% contain at least one fish skeleton remain, and these include vertebrae, ribs, spines, scales, and even otoliths (**Figure 6.21**). The diversity of these fish parts and their small size (>2mm but <8mm) points to repeated wadi visits to procure these items, with occasional wood harvests (Salicaceae). These are very different landscape practices than engaged in by

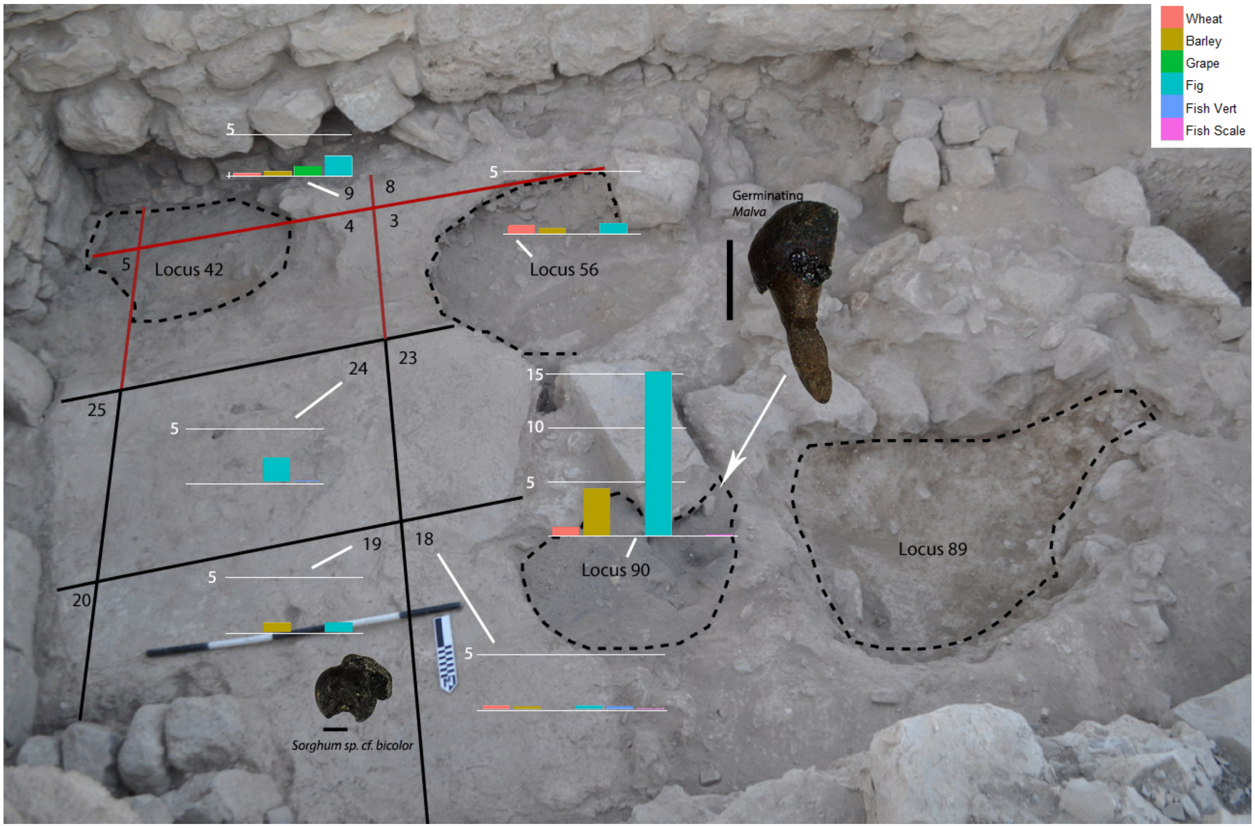

Figure 6.19: A visualization of Phase 2D and 2E of the Barrel Vaulted Room. The dotted lines indicate pits, and the straight lines are the sampled sub-grids of one floor deposit (locus). The key to the taxa is located in the upper right, and the bars represent density (counts per liter). The white lines leading from the densities indicate the grid or pit from which the samples originate (adapted from photo, Martin Weber, 2012).

the earlier Byzantine community.

Finally, this "taste for fish" might have also been enabled by newfound trade networks in the Middle Islamic II period (van der Veen 2011: 8-10) – two Scaridae (parrotfish) pharyngeal grinding mills (**Figure 6.21: C**) from Middle Islamic II contexts, hint at the kinds of long-distance networks in which even Dhiban was immersed, as Scaridae are Indo-Pacific fish that would have had to be traded over considerably long distances (van Neer et al. 2004: 105). These fish are probably connected to burgeoning trade in the Red Sea area at this time, where large scale fishing voyages are mentioned in contemporaneous documents from Egypt (Regourd 2005: 279), and which began bringing in new kinds of organic goods. The fact that Dhiban contains even just two of these remains, and their low number should not be unappreciated, indicates the extent to which the *Hajj* route to the area of the Red Sea may have facilitated occasional commerce or even more sustained interaction of the community with areas beyond the plateau, especially to the south.

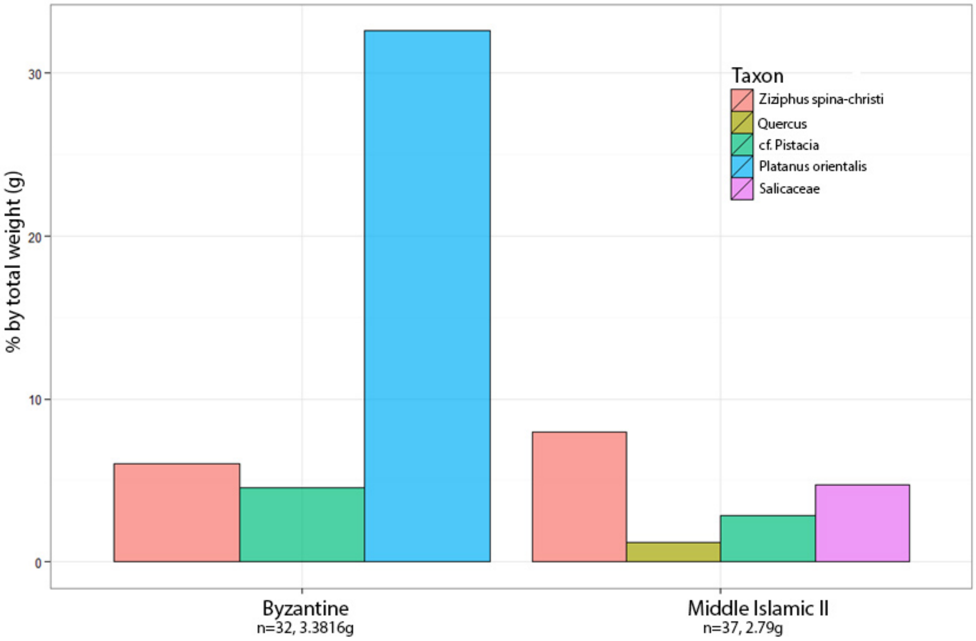

Figure 6.20: Preliminary results of wood charcoal analysis, with proportion of assemblage constituted by each taxon as weight in grams for each period. Color of bar indicates taxon.

6.4 Summary: Agriculture and Practice in Dhiban's Imperial History

From the analyses of the available paleoethnobotanical data, it is clear that there was both continuity and change in agricultural production between the Byzantine and the Middle Islamic communities. To summarize the available evidence, this chapter has illustrated that:

- There was a limited range of cultigens available and grown across all periods of time.
- Byzantine period deposits are more likely to contain *Vitis vinifera* (grape) remains, irrespective of phase. The latter is probably connected to the intensity of grape cultivation in the area, probably for wine.
- Middle Islamic period deposits are more likely to contain *Triticum* sp. (wheat) and *Hordeum* sp. (barley) remains, which is expected if they are the product of crop processing debris and dung burnt as fuel.
- Byzantine period *Hordeum* sp. (barley) seeds are thicker (in mm) than Middle Islamic II period seeds, and this might be related either to the context of deposition, or to differences in field practices.
- Weeds from the Fabaceae (legume) and Poaceae (grass) families are strongly associated with Middle Islamic II period deposits.

Figure 6.21: Fish remains from Middle Islamic II period deposits at Dhiban, where (A) is a fish vertebra, (B) are fish scales, and (C) is a pharyngeal grinding mill of a Scaridae (parrotfish).

- The importance of cereals in the Middle Islamic period is probably due to taxes, but also points to an increase in foddering, in turn related to an increase in agro-pastoralism, and therefore of a greater availability of dung fuel.
- Fish remains are abundant in Middle Islamic II samples, and from diverse parts of the fish skeleton.
- New kinds of plant taxa appear in the Middle Islamic II period, such as sorghum and a kind of plum (perhaps sour cherry), indicating new plant trade and cultivation pathways.

Therefore these data do much to highlight the tensions of new economic possibilities created by imperial networks, and the responses of local communities to them. To choose but two examples from the above discussion, it is clear from the associated archaeological, paleoecological, and historical evidence that olive production was widespread in the Byzantine period. It is evident that some demand for consumption, whether through imperial taxation or the culinary preferences of individuals, motivated the construction of large and yet idiosyncratic olive presses throughout the area around the Dead Sea. In this respect, new kinds of relationships were thus made available, centered around the distribution and growth of these woody plants. Yet the fact that little to no olives are found at Dhiban (or in the Petra papyri, for that matter), highlight the probability that these communities possessed some degree of agency to *decide* whether they would participate in those networks, and if so, in what manner. Nevertheless, the Dhiban community in the Late Byzantine period, with no explicit indications of direct coercion, seems to have participated in the agricultural practices common to the area, through the cultivation of wheat, legumes, and grapes.

In contrast, the Middle Islamic period remains illustrate the power and consequences of potential coercion at the level of the community. In Chapter 4 the shift in land management in Jordan in the 14th century was noted, where increasingly more land was transferred to direct control by the state. The barrel vaulted room found at Dhiban, dating to precisely this period, thus encodes a high-resolution record of the changes that would have been attendant. As expected, large amounts of cereal grain were produced, both of wheat and barley, but their size (i.e. thickness) indicates expedient production rather than careful management. Indeed the sudden appearance of a proliferation of fish remains and hitherto unseen plants such as plums and sorghum, might all point to attempts by the local community to move "beyond" the reach of imperial production, while at the same time engaging in it. Increasing engagement with the wadi through fishing and riparian wood harvesting also implies new kinds of experiences and perceptions of the landscape from which these desired organisms were obtained.

In conclusion, these data illustrate the power of the "Corrupting Seed" in Dhiban's long imperial history. Neither full-blown resistance nor acceptance can easily be read in the paleoethnobotanical material dating to the Byzantine or the Middle Islamic periods (even considering taphonomic and other formation process issues). Communities in both of these periods, on the other hand, seem to have selectively engaged in, taken advantage of, and were constrained by, the new opportunities created by the intervention of these imperial powers. It is also apparent that the supposed "timeless" agricultural practices that seem to underlie most assumptions of agricultural change in this region must be emphatically rejected. While the range of cultigens was restricted largely to crops of Mediterranean origin, shifts in relative proportions indicate how communities manipulated these pre-existing and valued plants. Nevertheless, it must also be recognized that changes that seem dramatic and exciting to the analyst, by virtue of having all of the data assembled in one place and canvassed with the aid of computerized technology, may have appeared slow, ponderous, even undesirable to the actual individuals who were engaged in this production (cf. Dietler 2010: 55). The changes which accompanied these imperial interventions may have even been undetectable or unnoticed to these communities, who in turn "naturalized" these practices into their everyday lives. The data presented above therefore represent one step toward the construction of a new narrative informed by historical ecology, that highlights the profound entanglements between human beings and non-human ecology through plants, and the ways in which human social relations were mediated through the propagation and maintenance of certain plants.

Chapter 7

Conclusion: Planting the Corrupting Seed

This project began by considering the incidental uncovering of a seed cache inside of a storage vessel found in the southeast corner of the archaeological site of Dhiban in 1951-2 (Winnettt and Reed 1967: 43), located in southwest Central Jordan east of the Dead Sea. Although the excavators stated in their report that the seed cache was a piece of evidence used to explain their larger historical interest in the Iron IIb inhabitants of the Dhiban plateau 3,000 years earlier (ca. 850 BCE; Reed 1957: 10), archaeological thought at the time of their excavation did not yet provide a theoretical or methodological apparatus that connected these seeds to the history that they sought. The question was then presented: how does one connect seeds to history? The latter question also masks but involves an even more encompassing inquiry: do seeds matter to history? Up to this point, the four intervening chapters have explicitly attempted to demonstrate the importance of seeds to history, using the insight afforded by renewed excavations at the archaeological site of Dhiban (2004-2013). The paleoethnobotanical remains, that is the archaeological plant remains, recovered through rigorous and systematic on-site sampling of archaeological deposits, are evidence of the entangled relationship between the everyday practices of people, their cultural, political, and economic organization, and non-human ecology. The bridging apparatus of this study, however, was informed specifically by the framework of historical ecology, which views non-human ecology (i.e. seeds) not as separate from the cultural and social variation of human life through time (i.e. history), but forming a cyclical and mutually constitutive whole with it.

The goal of this chapter is to recapitulate each of the major findings of the previous chapters, and illustrate how each has informs or addresses the major postulates of historical ecology that have inspired and guided the paleothnobotanical research conducted during the most recent excavations at Dhiban (2009 - 2013). The two postulates in question are the uneven impacts of successive societies on their landscapes (Balée 2006: 83), and the "total phenomenon" of human environments (Balée 2006: 2-3). Each of these postulates directly established testable expectations that were then addressed by the archaeological data through research questions and their attendant hypotheses. To reiterate, the research questions presented in Chapter 3 are:

1. Were the depositional practices of successive communities on the *tall* of Dhiban qualitatively and/or quantitatively different from each other?
2. Do the presence and quantity of specific agricultural crops in temporally distinct archaeological deposits correlate to any given imperial intervention?

The ramifications of these research questions to issues of regional historical importance in the Byzantine and Middle Islamic periods, the two periods which receive the greatest attention in this study, are discussed in this chapter. These research questions and historical implications, in turn, also nuance theories and perspectives in the archaeological, anthropological, historical, and ecological literature. More specifically, these latter perspectives include agricultural intensification and the "impacts" of empire, which are presented at length in Chapters 3 and 4. The outcome of the presentation of the results of these various argumentative threads will be to illustrate the fundamental utility of plant remains in understanding long-term changes in people's lifeways, not at the level of subsistence, but at the level of social relations. In short, it will follow Crumley's (1994: 9) call to realize "the ongoing dialectical relations between human acts and acts of nature, made manifest in the landscape", that is, the way in which humans shape non-human ecology, but are in turn shaped by the ecologies that they modify (Balee and Erickson 2006: 2).

To begin, Chapter 2 argues at length that during those periods of time in which written language is available in southwest Asia and the Eastern Mediterranean, the number of studies of archaeological plant remains decreases substantially (e.g. Miller 1991; Neef 1997). The situation since Winnet and Reed's initial interest in agriculture in the 1950's at Dhiban through unsystematic investigation of the archaeological evidence of past agricultural practices has surprisingly only slightly improved for historic-period societies. The collection of archaeological plant remains in these periods still lags considerably behind the explosion of continued interest, and paleoethnobotanical research, in the Neolithic (Fuller 2012) and Chalcolithic periods. The core of this tangible disinterest in the study of archaeological plant remains (and this should include, by extension, most organic remains uncovered at archaeological sites, including faunal; Crabtree 1990; deFrance 2009), has been a nature/culture binary that has implicitly structured research not only in this geographic area, but in many places across the world (e.g. Morehart and Morell-Hart 2013). In short, it is argued that plants are often construed as solely "natural", and therefore not relevant data to answering specifically cultural questions. In turn, in periods in which supposed "cultural" evidence is overwhelming (i.e. in periods in which writing is available), plant remains are no longer seen as informative windows into past human lives. The solution proposed to resolve this tension of an imposed dichotomy between nature and culture, is the perspective of Historical Ecology (Crumley 1994; Balée and Erickson 2006; Balée 1998, 2006). Historical Ecology acknowledges the shifting and yet concatenated practices of different communities through time and the heterogeneous landscapes and practices they engender (cf. Fisher and Feinman 2005).

The empirical study of the entanglement of people and their biotic world therefore generates data to confront and test conceptions of "timeless" landscapes or landscape practices (Balée 2006: 79). In this regard, it is argued that agriculture is a particularly fruitful domain of historical ecological research, as it is a fundamentally social enterprise aimed at coordinating human labor to manage the reproduction of desired plants (Fuller and Stevens 2009). As Vandermeer (2011: 26) has aptly noted, "agriculture is not planting a seed and harvesting a crop. Agriculture is making a contract among people to provide for one another, using seeds and harvests to do so."

Historical Ecology *is not* the only way to approach or understand the past lifeways of people, nor should it be. There is a plurality of theoretical perspectives and methodologies that address many facets of the lives of human beings in the past, such as what is broadly construed as "the social" (Meskell and Preucel 2007; Preucel and Mrozowski 2010;), object agency (Knappet 2011), gender (Hastorf 1991; Joyce 2000), theories of the state (Smith 2003), identity (Casella and Fowler 2004), as well as the materiality of the everyday (Miller 2005), as much as there are avenues of research that treat non-human ecology that are equally as critical during these periods of time (Bradley 1999). The focus on Historical Ecology is an important reminder that human beings are not detached from the world in which they are embedded, and which, through evolution, they form a corporeal part and relation to all other living organisms (Ingold 2000: 77-88), and yet nor are they mindless automatons at the direction of a "wild nature" upon which their actions unfold (Ingold 2000: 13-26). The recognition of the relationship of people to non-human ecologies has methodological repercussions – for instance, none of the plant remains used in this project would have been collected at the archaeological site of Dhiban, unless the *a priori* realization had been made that human destinies and the plants that they carefully propagated, and which in turn propagated them, were intertwined.

In Chapter 3 the archaeological site of Dhiban is introduced, and the AMS ^{14}C evidence procured from the site illustrates that human communities at Dhiban have been present since the Iron IIb (ca. 900 BCE) period, with occasional episodes of settlement abandonment, such as during the Achaemenian period ca. 500 BCE. The absolute dating evidence thus highlights that almost all of the communities that have inhabited Dhiban also lived during periods in which written language was increasingly becoming abundant, or was abundant, in the form of stelae, inscriptions, papyri, and even historical texts (Zimansky 2005; Matthews 2013). These written sources supply an additional and complementary source of information about the specific actors and networks of social relations in these periods, especially when used in conjunction with archaeological evidence (cf. Matthews 2003). The two periods chosen out of the 2,500 years of community life at Dhiban were the Byzantine and Middle Islamic II periods, the latter period overlapping with the historical Mamluk empire (Walker 1999). As argued in Chapters 3 and 4, these moments in time in Dhiban's history involved the intervention of people organized in the form of human social relations known as "empire" (Morrison 2001; Sinopoli 1996, 2011). Both the Byzantine and Mamluk empires intervened in the lives of the communities at Dhiban, and the elites of both empires sought to increase the quantitative and concentrated production of agricultural goods within their respective territories (Walker 2004; Kingsley and Decker 2001). Therefore, both of these polities provide insight into the ways in which local communities at Dhiban negotiated, through their agricultural production, the interventions of these non-local polities in pursuit of agricultural intensification. Furthermore, although the imperial elite in both of these polities pursued the concentrated increase of particular cultigens, their differing economic, political, and social configurations, separated by 600 years, illustrate how these differences affected local strategies of agricultural production.

In addition, it is shown that the contemporary landscape of the Dhiban plateau is almost entirely anthropogenic in origin – all of the present vegetation is the result of human land management (Cordova et al. 2005; Cordova 2007, 2010). The historical ecological postulate of the unevenness of societal impacts, however, predicts that societies' interactions with the landscape, and the vegetation upon it, vary through time and space, and are temporally cumulative (Balèe and Erickson 2006: 2). In pursuit of these long-term practices, the paleoclimatic and paleoecological data presented in Chapter 3 provides direct evidence of the ways in which past communities on the Dhiban plateau might have successively affected or changed the kinds and frequencies of different types of vegetation. The speleothem data from the Soreq cave in Israel also illustrates that the contemporary regime of highly variable precipitation constrained within a bounded range (at the field site, 300 - 800mm) seems to have been a feature of the Dead Sea region for at least the past 5,000 years, and certainly for the past 3,000 years (Bar Matthews et al. 1997). Dhiban is not located immediately near Soreq Cave, however, and today receives only 256mm of rainfall a year, an average that masks high interannual variability (100 - 400mm). The farming communities at Dhiban from 1000 BCE to 1500 CE would have faced roughly the same climatic conditions as today, that is, an environment with precipitation too unreliable for sustainable rain-fed cultivation. The changes in the relative frequencies of pollen visible in the palynological record from the Dead Sea cores and the Birkat Ram crater are more likely recording large scale changes in past agricultural practices *and not* shifts in local climatology (Rambeau 2010). This is not to say that perturbations in local temperature, precipitation, and humidity could not have occurred at a scale significant enough to be perceived at the level of yearly lived life (Barker and Gilbertson 2000). Rather, these data illustrate that, in the area of the Dead Sea much like in the rest of the Mediterranean basin, "human activity should be considered as an integral ecological feature of the region" (Blondel et al. 2010: 202).

Specifically, the pollen data from several field sites at the Dead Sea and Birkat Ram crater (Neumann et al. 2007a, 2007b, 2010; Leroy 2009) converge in their indication of several large scale trends. In the Byzantine period (ca. 320 - 650 CE), large amounts of *Olea* (olive) pollen were released into the atmosphere, while relatively less *Pinus* (pine) and *Quercus calliprinos* (Palestine oak) were present. Therefore, it was hypothesized that large scale cultivation of olive was occurring, and perhaps subsequent removal of other woody plant taxa for fuel use, or clear-cutting for arboriculture. In contrast, in the Middle Islamic (ca. 1260 - 1500 CE) period, relatively more Poaceae (grasses) appear in the pollen record, as well as an increasing abundance of *Pinus* and *Quercus* pollen, in addition to some drought tolerant plants such as those in the goosefoot (Chenopodiaceae) family. Through the analysis of related archaeological and historical data in Chapter 4, the increase in the relative frequency of the pollen of these plants closely accords to what is known about the desired plants of these polities. For reasons that will be detailed below, elites and communities in the Byzantine period Levant seem to have focused on olive, grape, and wheat production (Decker 2009b), whereas communities in the Middle Islamic period Levant focused on barley, wheat, and olive production, within a system of animal pasturage (Walker 2004: 126-128).

The narratives presented for each of these polities in Chapter 4 substantially nuance the understandings of the social and political relations that categorized these periods, during which large-scale changes in vegetation took place. In particular, it is noted that tracing the process of agricultural intensification reveals more about its functioning than pursuit of causality (Leach 1999; Brookfield 1972, 1984, 2001; Kirch 1994, 2006; Morrison 1994, 1996, 2006, 2007), while considerable care is needed in understanding the effects of large territorial empires in southwest Asia and the Mediterranean on communities on the edges of their territories (Matthews 2003: 127-153; Dietler 2010: 27-55). In the 5th through 7th century CE Byzantine period, substantial archaeological evidence indicates that an intensification of settlement, economic exchange, and agriculture, occurred in the southern Levant (Kingsley and Decker 2001; Morrison and Sodini 2002; Bar 2004). The mechanism of that intensification, whether it was due to the presence of large urban centers, the army, or the gradual Christianization of this area, is still debated (Rubin 1997; Bar 2004). Nonetheless, a variety of archaeological evidence, such as wine and olive presses (Mayerson 1984; Frankel 1997), as well as papyri (Kraemer 1958), illustrate a specific demand for, and production of, wheat, olive and grape. Moreover, it was illustrated that taxes, the method by which imperial elites came to possess these desired plants, were indirectly collected through assemblies of the members of the local communities in the provinces ringing the Dead Sea. Indeed, the idiosyncratic arrangement of farmsteads, villages, and even variability in olive and wine press design in these "village" sites, or *komai*, all point to a form of local autonomy (Hirschfeld 1997).

In contrast, the social and political configurations of the Middle Islamic (II) period, here coterminous with the Mamluk empire in the late 13th through early 15th centuries CE (Walmsley 2008), were decidedly different. Though Mamluk imperial elites also sought to increase the production of desired cultigens, unlike the earlier Byzantine period, by the 14th century CE, the elite often directly intervened into the lives of non-local communities in their management of these plants (Walker 2004). Yet much like the Byzantine period, large urban centers consumed a great deal of the crops produced elsewhere (Lapidus 1969). As a result, documentary evidence often indicated considerable friction between the desires of the elite to acquire the wheat, barley, and olive crops they sought (Walker 2008), and the resistant communities who required them for their own sustenance (Walker 2003: 85-86). Yet because of newfound human and biotic networks hitherto unestablished, above all with Africa and southeast Asia, new kinds of plants came into people's lives, such as sugar cane and bananas (Watson 1983; Walker 2003), which complemented the earlier Mediterranean suite of wheat, olive, and grape, so prominent in the Byzantine period.

It might not be remiss to claim that the Byzantine and Mamluk empires, and perhaps most historical empires in this area, were "plant (and animal) states" (cf. Braudel 1981: 107). The elites of these polities depended on non-local plant management, and sedimented this dependency in ideologies that facilitated the acquisition of specific cultigens (for the Byzantine period especially: Decker 2009b). Moreover through the control and redistribution of food in times of crisis, elites could also draw upon considerable social capital (Dietler and Herbich 2001; Bray 2003; Porter 2011: 37-8). One example of this practice is the Mamluk use of *tarh* discussed in Chapter 4, where Mamluk elites forced purchases of grain from non-local communities, especially those in the Levant, in order to feed urban centers such as Cairo that were not agricultural producers themselves (Shoshan 1980). Yet at the same time, these elites also mystified the inequality of this relationship between themselves and the farmers upon whom they depended by portraying the relationship as fundamentally extractive through various legitimizing ideologies (Bourdieu 1972: 192). Unsurprisingly, in both the Byzantine and Middle Islamic periods, great care was taken to ensure that desired cultigens were channeled to the respective elites. In the Byzantine period, this channeling was formalized as the *annonna civica* and the *annona militaris* (Laiou and Morrison 2007: 33), two forms of crop tax that drew plants to large urban (consumer) settlements and to the army.

Concomitantly, in Chapter 5 it is hypothesized that differences in social, political, and economic configurations in the Byzantine and Middle Islamic periods are manifested in the deposition of plant remains by the communities engaging with the *tall* of Dhiban. It is argued that the act of deposition is a record of everyday practice (*sensu* Bourdieu 1972; de Certeau 1984; cf. van der Veen 2007), and that the sequential layering of this deposition in the form of recoverable stratigraphy therefore provides a sequence of a history of the deposition of past agricultural practices (Joyce 2008). To identify these past practices, a systematic sampling of archaeological sediments was employed at the site of Dhiban from 2009 until 2013, and more than 8,000 liters of archaeological sediment were processed, with 223 flotation samples analyzed. Without an adequate sampling strategy, generalizable inferences about past site activities can not be formed (Jones 1991), and anthropological and historical questions can not be answered. For instance, if an argument relies on the presence or absence of a certain botanical item, but only five samples are taken from the entirety of a 20 hectare site, then those samples can not form a reliable basis to claim the presence or absence of it. Therefore it is shown that through careful attention to both the content of the archaeobotanical remains in a sample (van der veen and Jones 2006), as well as to their precise spatial location (Lennstrom and Hastorf 1995), considerable information can be gleaned on the past practices of the communities that deposited those remains.

While the exact totals of sediment processed and the remains recovered and identified can be reviewed in Chapters 5 and 6, the following discussion will only present the relevant results of these analyses. First, the analyses of paleoethnobotanical remains at Dhiban directly confirm the first research question, in that the depositional practices of the two primary communities of interest - the Byzantine and Middle Islamic period communities - were depositing different kinds of plant remains in varying abundances, as well as in different areas of similar structures. The different areas in which these structures were located represented multiple phases of differential site use in the Byzantine and Middle Islamic periods, and each phase was represented by a different kind of archaeological context. For instance, Byzantine period occupation uncovered in 2012 and 2013 was centered on a structure complex that included a collapsed storeroom in one phase, and a post collapse occupation in the next, dating to the early 7th century CE. The Middle Islamic II period is also characterized by a number of rebuilding phases inside of each of its structures, especially within a barrel vaulted room, which occur in a fairly narrow range of time ($\sim$100 years) in the 14th century CE.

The first phase of Byzantine occupation identified, that is, the earliest excavated occupation, is most likely the second story of a collapsed storeroom based on the evidence presented in Chapter 5 and 6. The archaeobotanical indices associated with the flotation samples recovered from this area (**Figure 7.1: A**) reveal a high density of botanical remains almost entirely composed of crop seeds, located within the scattered and yet patterned fragments of storage vessels. Moreover, the crop seeds found in these destroyed vessels were of domesticated pea or common vetch (*Pisum sativum / Vicia sativa*), a free-threshing wheat (*Triticum aestivum/durum*), and grape (*Vitis vinifera*) remains that are probably the dregs of wine storage-vessels. The deposits of the subsequent phase of occupation (**Figure 7.1: B**), Phase 2, represent the use of this area after the conflagration and collapse of the building. The AMS ^{14}C dates from this phase confirm that it was probably occupied in the early to early-mid 7th century (1391$\pm$39 uncal BP; 2σ: 577 - 686 cal CE, 1σ: 616 - 665 cal CE), and in Chapter 6 some of the contemporary earthquakes known through archaeoseismological research are reviewed that may have been responsible for the collapse of this structure complex. The deposits from this second phase of occupation contain relatively few seeds of any kind, and almost no crop processing byproducts. Nevertheless, the seeds that are present are more likely to be crop seeds than weed seeds. Moreover, the heterogeneous spatial distribution of these remains implies specific activity areas – in one corner of the structure complex is a concentration of charcoal and grape remains denser than any surrounding deposits, and the latter might indicate a place where cooking was occurring with occasional food remains accidentally lost. The presence of specific activity areas implies that Dhiban was not totally abandoned even after the events that caused the catastrophic destruction of the storeroom, but was a lived space used in new and different ways.

In contrast, the Middle Islamic II period deposits 600 years later contain a vastly different array and proportion of crop and weed seeds, as well as crop processing byproducts (**Figure 7.1: C**). The density of these remains in all of these deposits is very high. In fact, the density of crop seeds is higher in Middle Islamic II period deposits than in Byzantine period deposits, and yet the proportion of total identified seeds that are crop seeds is correspondingly much lower. The densities and proportions of weed seeds and rachis (chaff) remains are also very high in these deposits, and among the crop seeds, barley (*Hordeum vulgare*), free-threshing wheat (*Triticum aestivum/durum*), and bitter vetch (*Vicia ervilia*) are dominant and ubiquitous. Thus it is argued in Chapter 5, with the aid of established paleoethnobotanical indices as well as multivariate and spatial statistics, that these deposits probably represent the highly mixed outcomes of crop processing byproducts and dung burned as fuel. Some indications of the dung-origins of these samples include the associations of the seeds of vetch,

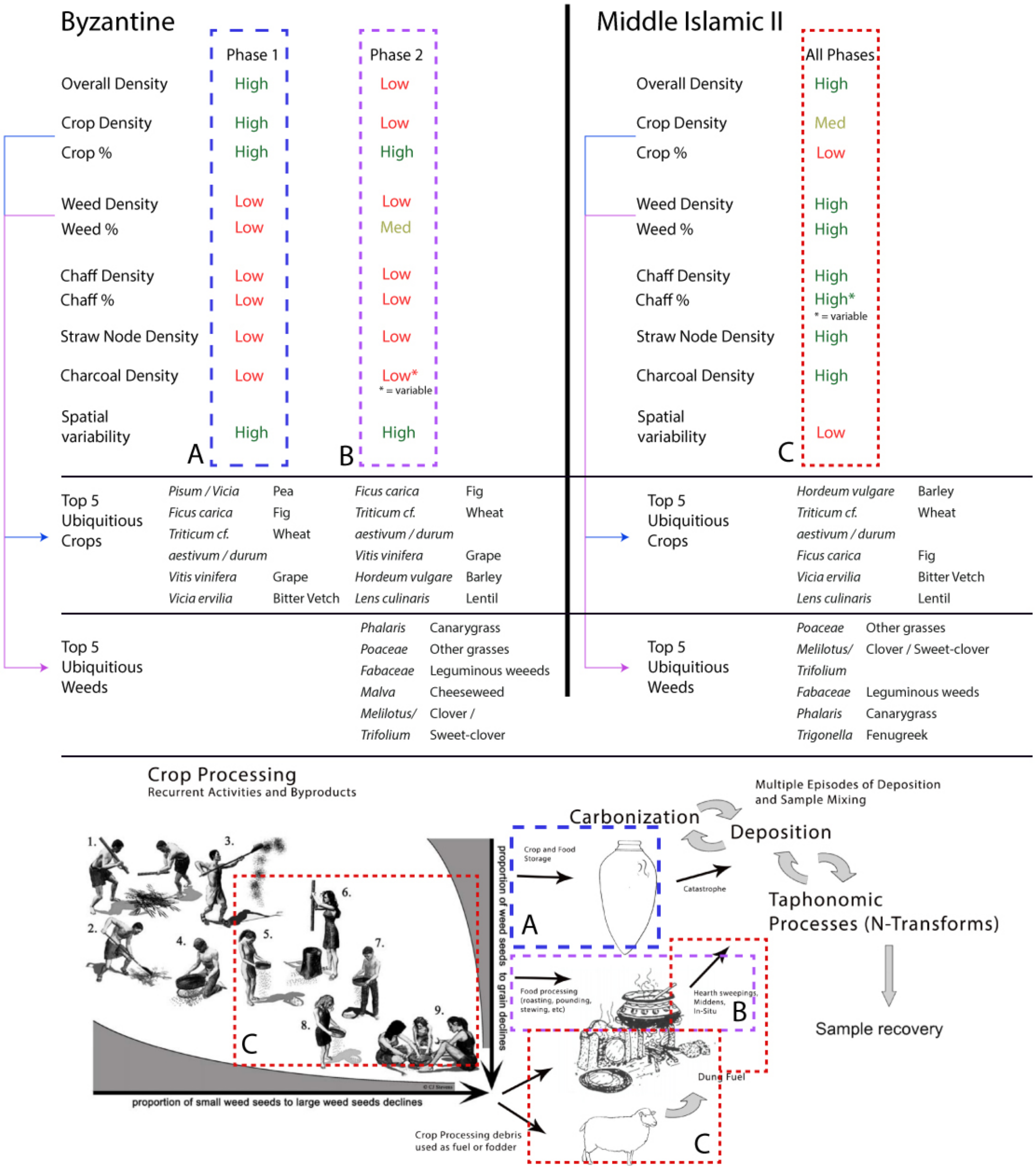

Figure 7.1: Comparison of the taphonomic pathways between the Byzantine and Middle Islamic II periods, with each of the major indices from previous chapters presented. The dashed, colored outlines in the image above correspond to the same in the image of the formation processes below.

barley, fig, and leguminous weeds (Fabaceae), as well as crop processing byproducts such as straw (culm) nodes simultaneously used as fodder (Anderson and Ertug-Yaras 1998), that may have been carbonized through their presence in dung used as fuel. Surprisingly, the densities of charcoal in these deposits are also very high, which complicates the findings of some regional paleoethnobotanical research where increased dung-fuel use necessarily results in decreased wood-fuel use (Miller and Marston 2012: 97-98). Furthermore, all of these burnt crop processing and dung fuel remains were found inside the uncovered structures, and indicate that burning was happening inside of these structures, or that in between each rebuilding phase, the refuse of cooking and other burning activities was being redeposited. The AMS ^{14}C dates associated with all of this redeposited material are in the 14th century CE (605±24 uncal BP; 2σ: 1298 - 1405 cal CE, 1σ: 1306 - 1396 cal CE), that is during the supposed agricultural florescence of the area of central Jordan, or the Balqā (Walker 2011: 67-79).

The results of these analyses directly illustrate that the depositional practices of botanical remains by these two communities were unique and historically contingent. Late Byzantine period samples were more similar to other samples from the same time, than to the much later Middle Islamic II period samples. With this knowledge, Chapter 6 utilizes the confluence of associated archaeobotanical, archaeological, and historical research, to interweave the historically contingent differences in the deposition of agricultural remains found on the site of Dhiban, with the political and economic configurations in those periods in which Dhiban was embedded. Yet given the wide historical canvas of the Byzantine and Middle Islamic periods, and the number of historically known actors present within them, it is impossible to situate the events at Dhiban with any exact precision down to the edict of a given emperor or the action of a solitary individual. The latter reduction to individuals is manifestly not the goal of this project (cf. Clark 2000). Instead, a schematic characterization is useful to disentangle the manifold influences stemming from these political interventions that occurred in a region that had already seen at least 1,000 years of previous settled agricultural life (**Figure 7.2**). Using this characterization, it is possible to trace the ways in which the production of various agricultural goods simultaneously structured relationships between these communities, as well as between these communities and their agroecosystemic landscape (Vandermeer 2011). Moreover, the agroecosystems maintained by Byzantine and Mamluk period farmers also structured their own (social) relationships, and therefore led to the unique and historically situated deposition of archaeological remains in these two periods.

The combination of these results in Chapter 6 answers the second of the two research questions: does the presence and quantity of specific agricultural crops in temporally distinct archaeological deposits correlate to any given imperial intervention? The answer, based on the combination of these data, is decidedly yes. There are proportionally more kinds of certain crops in the samples of some of these periods of imperial history, such as a greater ubiquity of grape seeds in Byzantine period samples, than in Middle Islamic II period samples. Nevertheless, there are important caveats to the strength of the assertion of the confirmation of the latter research question. First, it is emphasized again that the elite in the

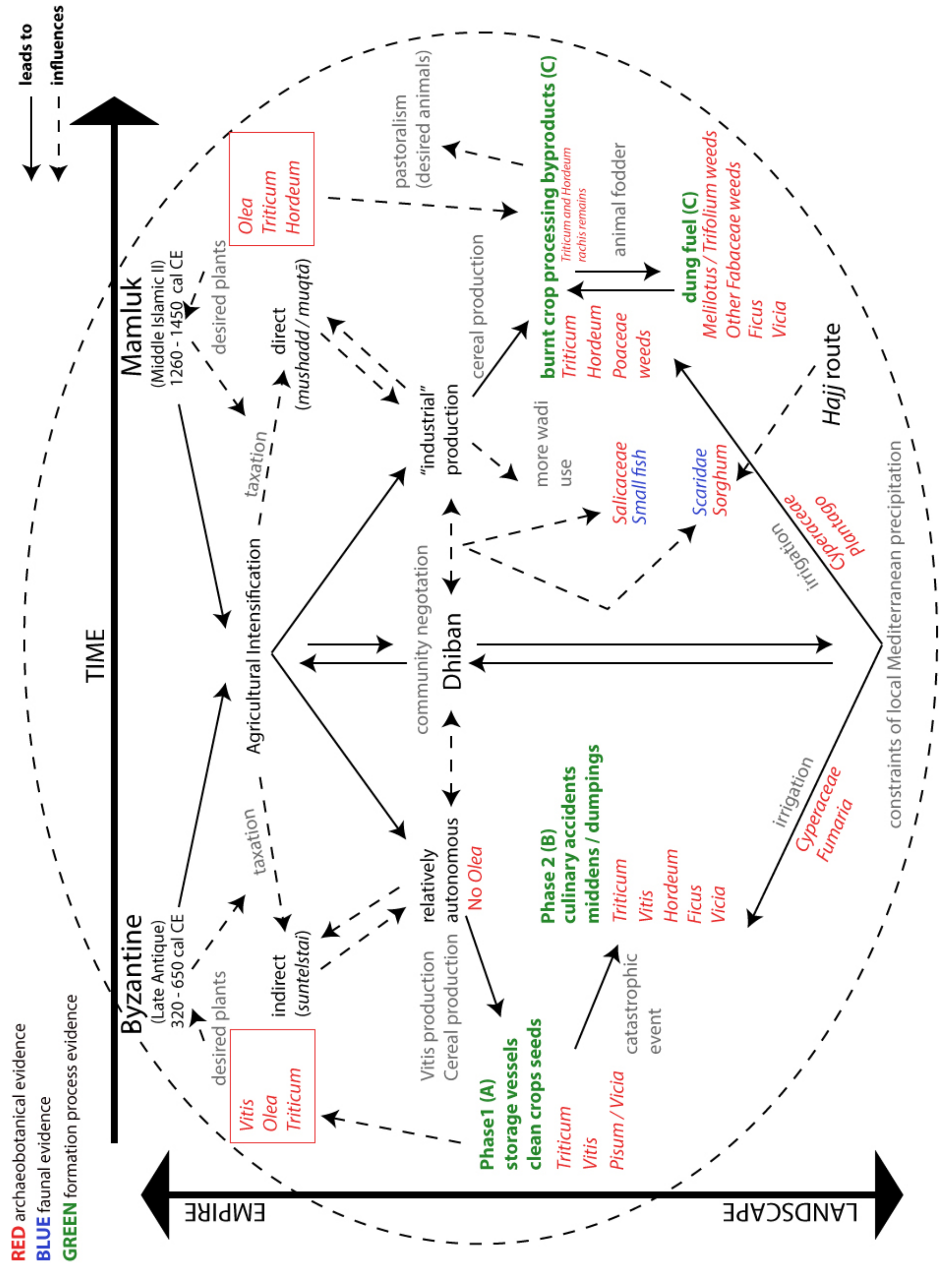

Figure 7.2: A schematic representation of the influences and entanglements of plants and people in the Byzantine and Middle Islamic II periods. Solid lines indicate a directional cause, whereas dashed lines indicate influence but not necessarily causation. Gray letters are the hypothesized phenomenon which a line represents. Items in red are archaeobotanical evidence of that phenomenon, while blue represents faunal evidence, and green the evidence of formation processes.

Byzantine and Mamluk empires sought to intensify agricultural production in certain parts of their territories (**Figure 7.2**), and that this intensification of agriculture included the area of Dhiban, which, it is noted, is in an area too low for reliable rain fed agriculture. Importantly, the intensification of agriculture, operationalized as “overproduction”, is not detectable in paleoethnobotanical remains alone (Marston 2011: 196) because of the human practices that selectively filter the material which is later uncovered by paleoethnobotanists and archaeobotanists (Fuller et al. 2008). Moreover, the strategies employed by these two polities toward intensification differed with respect to the social relations that encouraged (or demanded) that communities facilitate the growth of these plants. In the southern Levant, the 5th and 6th century CE Byzantine empire collected crop taxes from villages through assemblies of the local community, therefore leaving it to these small village communities, or *komai*, to decide how best to pay the mandatory taxes in crops and perhaps coin. In the 14th century CE Mamluk empire, in contrast, elites appointed non-local officials who were direct representatives of the state to oversee the production of particular crops. The specific water and soil requirements of these plants needed to grow in a semi-arid Mediterranean precipitation regime (Araus 2004) also exerted a considerable degree of influence on these communities, as the water and soil needs of these plants facilitated the coordinated social effort to maintain irrigation infrastructures to provide water to them. Finally, throughout these entangled negotiations between the desires of these imperial elites and the biological needs of the plants, the human communities at Dhiban mediated these relationships through their own knowledge of the growth of these cultigens (see the place of Dhiban in **Figure 7.2**). As the flowchart illustrates, each of these two imperial approaches to crop tax collection, and therefore to the kind of relationship of Dhiban with these imperial elites, whether autonomous or subject to direct oversight, changed the ways in which the Dhiban community in those two periods chose to orient its agricultural production.

The word “choose” is appropriate here, as the available archaeobotanical evidence from nearby sites around Dhiban in the Byzantine period, such as Hesban, Lejjun, and Khirbet Faris, illustrate that each of these large settlements was producing, and potentially receiving, different kinds of crops. For instance, almost no olive pits have been found at Dhiban in either of the two excavated phases, despite the proliferation of olive pollen (as Cordova 2010 noted, the highest in the palynological record). Moreover the presence of olive pits archaeobotanically attested at sites immediately to the north (Hesban) and south (Lejjun), as well as the extensive finds of olive presses across the southern Levant (Frankel 1997), also indicate large-scale olive production. Yet the extremely infrequent occurrence of olive at Dhiban might indicate community specialization in some cultigens and not others; the community might have taken advantage of the lack of direct involvement by the Byzantine imperial elite, as well as of regional economic opportunities (viz. local exchange and trade), to grow these crops. Regardless of whether it is hypothesized that the act of taxation itself in the Byzantine period might have spurred communities to intensify agriculture in response (Hopkins 1980), a “taxes-and-trade” model still does not explain the ways in which these communities would have sustained this production of desired crops.

Therefore, what did the Dhiban community specialize in? The evidence from the collapsed Phase 1 storage room indicates wheat, a legume such as pea (*Pisum sativum*) or common vetch (*Vicia sativa*), and wine. If the *Vitis vinifera* endocarps and pips can be positively associated with the collapsed storage vessels, McCormick (2010: 64) has noted that only wine intended for trade was put into amphorae, while documentary evidence suggests that local wine consumption was placed into transportable skins. If Phase 1 is near-contemporaneous with the church (563 - 4 CE) discovered at the site in earlier excavations, this evidence nevertheless places Dhiban within the greater orbit of sites known through the Nessana papyri in the latter half of the 6th century (Kraemer 1958) that were engaging in what might be called "communities of agricultural practice", through the cultivation of wheat, a legume, and grape for wine production. Future research will determine whether the wine that was stored in these amphorae was imported by the Dhiban community, or perhaps intended for export to the larger wine markets that existed during this time. If so, it might disentangle the degree to which this wine and wheat were intended as taxes for provincial capitals or large cities such as the capital of Constantinople, given Dhiban's distance from major urban centers during this period.

The contrast with the Dhiban community's use of the site 600 years later in the Middle Islamic period is pronounced. As it is illustrated in Chapter 4, although the Mamluk elite based in Cairo initially allowed the local *fellahun*, or farmers, of the southern Levant to direct management of their own agricultural fields as long as they paid taxes to an imperial intermediary (Walker 2008: 80-82), from the early 14th century onward Mamluk elites increasingly became involved in the production of specific cultigens (Walker 2008: 84). The papyrological evidence of *waqf* or land endowments on *iqta'at* fields points to increasing consolidation of land, resulting in entire villages being purchased by the Mamluk *Bayt al-Mal*, or imperial treasury, to engage in what might be considered monocropping of desired plants (Walker 2007: 181). The paleoethnobotanical evidence from Dhiban reflects the local scale of these inter-connected changes in political organization, economic tensions, and local community desire in the 14th century.

Almost all of the Middle Islamic period deposits at Dhiban are the result of burnt crop processing byproducts or dung burnt as fuel. The large quantity of crop processing byproducts points to the specific production of cereals, and unsurprisingly most of the crop seeds found are either of a free-threshing wheat or barley. Yet many of these deposits also seem to have been formed due to the burning of dung fuel, not only because of the presence of dung itself, but also because of large amounts of leguminous weeds, figs, and vetch, all of which Chapter 6 illustrates are highly correlated, and that are often indicators of grazing by, and foddering of, ruminants. Therefore, as it is shown in the schema in **Figure 7.2**, it is likely that there was considerable animal husbandry overseen by the 14th century CE community at Dhiban, probably of sheep and goat. The available evidence seems to point to a system of cereal production perhaps more accurately described as monocropping, which was probably not used for local consumption in its entirety. These cereals may have been, in part, payment as taxes to the local Mamluk imperial tax collector, as well as fodder for their animals. Where these crops-as-taxes would have gone, whether to regional settlements with an imperial presence in Transjordan, or large cities such as the Mamluk capital at Cairo, requires future research. Nevertheless, these analyses show that direct institutional oversight as well as the ecological possibilities of the plateau itself substantially affected the Dhiban community's production of these agricultural goods.

Yet the same unique economic networks established by the Mamluk elite that partially structured the interactions of the community of Dhiban with them, also allowed the community at Dhiban to make new kinds of decisions about their procurement of desired plants. For instance, Dhiban's place within the larger network of settlements changed in the Middle Islamic period, as it now found itself astride the *Hajj* pilgrimage route, as well as imperial roads leading from Cairo to Damascus. Large-scale human traffic through the *Hajj* route to Mecca in the direction of the Red Sea (Walker 2011: 106-7), as well as Mamluk interest in Red Sea trade more generally, provided new avenues of agricultural experimentation through the establishment of physical pathways to new communities and their plants (van der Veen 2011). In support of this, one sorghum *Sorghum cf. bicolor* seed, a plant of African origin (DeWet and Harlan 1971), has been found thus far in the Middle Islamic period deposits at Dhiban. It is noted in Chapter 6 that related archaeobotanical evidence from other sites seems to indicate that sorghum was a local experiment in the southern Levant into new forms of plant cultivation. Moreover, the presence of one plum (*Prunus domestica*, cf. *cerasus*) or sour cherry pit exclusively in the Middle Islamic period, also correlates to similar finds at that time (cf. Hoppé 1999: 128). These changes in agricultural production and animal husbandry may have encouraged new uses and modifications of the landscape, as the evidence of Willow/Poplar (Salicaceae) wood among the wood charcoal, and numerous small fish remains, indicate more trips to the wadis around the site, especially to the north (the Wadi al-Wala).

Both the Byzantine and Middle Islamic (Mamluk) examples illustrate how community agency was manifested in different ways in these periods, and specifically entangled with plants. The nexus of this agency in both of these periods was in agricultural production and practice. The latter focus on agriculture, called "the corrupting seed" in Chapters 3 and 4, highlights the ways in which the social contracts used to propagate plants also bind communities together in unpredictable ways. Once these communities planted these "corrupting" seeds, they affected their relationships not only to their own, and other, communities, in this case imperial elites that sought them, but also to the landscape itself in attention to soil, water management, the climate, and critically, the plants themselves. The paleoethnobotanical data illustrated that decision-making through agricultural production was achieved in different ways in each of these periods; in the Byzantine period, the community at Dhiban seems to have chosen some crops such as grape, and not others, such as olive, out of a long-established Mediterranean suite (cf. Decker 2009a). Despite the palynological evidence of widespread olive cultivation across numerous field sites in the region, the remains of olive are rare at Dhiban.

In contrast, the same pollen data revealed an increase in grasses, which was reflected at Dhiban in the Middle Islamic period through the abundance of domesticated cereal crops, and also the weeds of wild grasses, recovered in these archaeological deposits. The correlation of the pollen and paleoethnobotanical data in the Middle Islamic period at Dhiban implies that the community may have been directly overseen to produce what might be characterized as a monocropped cereal strategy alongside increased animal husbandry. Yet through the pursuit and probable experimentation with new plants such as plum, as well as with the incorporation of fish from the nearby wadi, the Dhiban community was able to incorporate different kinds of foods that probably contained new meanings. At least a few members of this community also seem to have co-opted the new economic and political linkages in the Mamluk empire to incorporate plants from Africa (sorghum) and fish from the Indo-Pacific (parrotfish). In both cases there is evidence of neither full blown resistance to the pressures of imperial elites, nor passive acceptance, but negotiation within the constraints and opportunities brought on by these imperial polities. As Hastorf and Johannessen (1993: 133) likewise noticed for the role of maize in the Andes, these data "demonstrate the need to temper consideration of economic production with questions about the meanings and political uses of a certain crop".

A historical ecological perspective of these relations avoided viewing the Byzantine and Middle Islamic communities as merely acting on an inert environment (cf. Ingold 2000: 46). The constraints of local precipitation, soil geochemistry, and the prior long-term domestication of a specific range of Mediterranean plants all influenced the subsequent strategies of the Byzantine and Middle Islamic period communities at Dhiban (cf. Barton et al. 2004; Haaland 2007). The conception of timeless agriculture in the region is manifestly not tenable, and instead the changes between the Byzantine and Middle Islamic period reveal the dynamic nature and shifts that occurred with the availability of some plants and not others (plum/sorghum), and the focus on the assisted reproduction of some plants and not others (grape versus wheat). Yet dynamic does not mean rapid, and it is likely that many of these changes in agricultural practice would have been virtually unnoticed by these communities, even if the cumulative effect has become more apparent through its inscription into the landscape, and in archaeological deposits, through hundreds of years of repeated, everyday practice.

Future analyses will provide additional and important data to draw out more concretely some of the tentative conclusions that have been offered here. First, more radiocarbon dates will be necessary to determine the timing of many of these changes in agricultural practice between and within periods, as well as correlations between these absolute dates and numismatic evidence. The latter chronological resolution will be important for the collapsed Late Byzantine storeroom and directly dating the crop seeds that were stored in the vessels, which will indicate whether there was a gap in occupation between its active use and the subsequent post-collapse occupation. Upcoming excavations will also provide critical evidence of the activities transpiring on the first floor of this structure, which has not yet been reached at the time of the writing of this project, and which will supply insight into the nature of this structure complex within the Late Byzantine world. Continuing analysis of the macrobotanical material from more structures in the Middle Islamic II period, moreover, will indicate whether the phenomenon of redepositing burnt crop processing debris inside of structure walls was a widespread practice on the *tall*, or only restricted to a few areas. Increasing the sample size of the measurements of cereal grains, especially wheat

(*Triticum*), will ascertain whether the observed differences between the thicknesses of these grains between the Byzantine and Middle Islamic II periods, are evidence of larger changes in field or depositional practice. While the wood charcoal evidence presented thus far has been preliminary, future and upcoming analyses of the wood charcoal will identify whether fuel harvesting strategies shifted between both periods, and whether certain taxa were less available through time due to over-harvesting. Finally, although not addressed explicitly in this project, it is nonetheless important to emphasize that changes in practices and performances of gender must be considered in tandem with the evidence of large-scale changes in cultivation, crop-processing, and depositional practices presented thus far (Hastorf 1991). These shifts in agricultural production would have been closely linked to the organization of the household used to turn crops into meals, which in turn, implies that conceptions of gender, labor, and perhaps even childhood, changed as well. Future research will do more to understand the fabric of the communities at Dhiban carrying out the labor associated with the sowing, field management, harvest, and processing of these crops.

The dissertation opened by considering how Amartya Sen's revision of his own views on food risk led him to view it as an issue in the relations between people and food. In this vein, this study utilized the perspective of Historical Ecology to make the same argument, to broaden it, and to use the unique capacity of agriculture as the nexus of human and non-human ecology to explore the relations between people, and between people and plants. As the project did not conceive of an *a priori* separation between nature and culture, but the inextricable interweaving of the two, it therefore led to the subsequent incorporation of rigorous field methodologies for archaeological plant remains that facilitated all of the data presented in this project. Without sampling every archaeological deposit on the site, using fine meshes to recover the smallest remains, and point-proveniencing every sample, most of these data would be irretrievably lost. The relevance of this research extends beyond the site itself, to the regional, disciplinary, and inter-disciplinary level. In a regional perspective, these data are another step toward answering large-scale questions about shifts in cultivation that swept across the Middle East well after the Neolithic period, although the studies of which rarely include archaeobotanical material from periods after the Iron Age, ca. 1000 BCE (Riel et al. 2008; Riehl 2008, 2009). The data collected at Dhiban will form a crucial node in larger analyses of regional trends, especially the data that has been collected on the 2,500 years of occupation at Dhiban, after the Iron Age.

Moreover, the data and results from this research at Dhiban directly address the concerns of archaeologists working in other places of the world, and in other periods. First, it has already been observed that the phenomenon of not collecting botanical remains, or not using them to answer questions about human relationships, is an issue in other places in the world, such as Mesoamerica (Morehart and Morell-Hart 2013). This project therefore provides an example of the continued analytic potential and unique insights afforded through paleoethnobotany. Second, the results of this research also inform archaeologists working in other places and times that are concerned with issues such as agricultural intensification and the effects of non-local political intervention. Much of the archaeological conversation on agricultural intensification has been framed in the Pacific (Brookfield 1972; 1984; 2001;

Leach 1999; Minnegal and Dwyer 1998; Kirch 1994; 2006) and south Asia (Morrison 1994; 1996; 2006; 2007). Therefore these data contribute to and enhance a growing interest in the region with human-environmental relationships (Altaweel 2008; Riehl 2008; Alizadeh et al. 2004; Wilkinson 2004). The data from this project can thus refine current models about how communities intensify agricultural production, even in semi-arid areas that require significant investments of labor.

Finally, this project directly contributes to neighboring natural science disciplines such as ecology and environmental science, as the data sets generated in this study are representative of historical cycles of time greater than that observable by modern agroecologists, ecologists, or environmental scientists (van der Leeuw and Redman 2002). Some projects in ecology (Dambrine et al. 2007; Ross 2011) and agroecology (Vandermeer 2011) are turning to environmental archaeology specifically to provide novel data in the identification of the inputs and influences of past practices on contemporary landscapes and ecosystems (Briggs et al. 2006; Lightfoot et al. 2013). Archaeology looks to a future in which it is increasingly involved in affecting the public's opinion of the past (Constanza et al. 2007), as well as positively affecting future policy (Guttman-Bond 2010). This study is another step toward a recognition of the necessity and continued importance of multi-disciplinary archaeological research to inform contemporary perspectives on the historical richness and complexity of human-ecological interactions, as well as the ways in which past communities' entanglements might encourage contemporary communities to reflect on their own sustainable, or unsustainable, practices.

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Appendix A

Light Fraction Data (Total Analyzed Samples)

Unit	BP48	BR47	BR47	BP48	BP48	BP48	BR44	BR/BS43	BR41	BR43	BR44	BS44	BS43	BS43	BR42	BR47	BR44	AX54	BR44	BR47	BR47
Locus	18	16	18	18	18	18	35	48	45	48	36	58	18	19	10	10	36	6	36	17	9
SG	18			14	17	13	8					23	18	18							
Bag	213	126	135	208		196	415	215	208	214	400	186	234		173	80	400	93	400	127	92
FlotNum	**200**	**201**	**202**	**203**	**204**	**205**	**206**	**207**	**208**	**209**	**210**	**211**	**212**	**213**	**214**	**215**	**216**	**217**	**218**	**219**	**220**
Flotvol (l)	22	22	25	17.5	5	25	16	8	62	30	26	18	28	18	30	24.5	19	30	22	23	25
TotWt (g)	4.7621	15.582	12.7416	19.039	4.6054	14.8784	22.5844	3.928	19.9034	21.1165	33.3957	18.4472	22.698	21.118	17.253	16.944	25.2484	99.69	16.4682	6.3959	5.829
>2mm # seeds	7	4	0	9	23	7	6	2	20	16	14	5	10	12	18	20	41	36	12	1	11
>1mm # seeds	202	7	4	25	72	68	31	5	143	49	87	25	36	39	41	67	141	27	3	6	12
>.5mm # seeds	117	0	10	44	104	59	53	19	205	80	80	80	46	55	96	155	114	94	0	12	56
>2mm charcoal ct	86	228	52	79	81	77	310	108	291	260	418	340	247	342	210	359	307	2558	362	171	181
>2mm charcoal wt	0.4652	2.4996	0.5504	0.6456	0.5283	0.4606	3.5435	0.657	5.7938	1.5644	2.8296	3.3717	1.6929	2.6397	1.2546	2.7828	2.5762	25.7378	2.8702	1.1795	1.1597
>1mm charcoal wt	0.6834	1.7719	0.4335	0.7978	0.6501	0.6384		0.4888	2.1459	1.5353	2.6318	2.6318	1.5809	1.5809		2.8673	2.0226			0.9989	1.1801
DOMESTICATES																					
Cicer arietinum (2mm)																					
Hordeum vulgare (2mm)	3			2	15	4	2	1	12	4	6	1	4	3	5	9	10	10	1		3
Lens culinaris (2mm)											2		1	1	2			3	2		1
Pisum sativum (2mm)												2						4			
Prunus sp.cf. cerasus (2mm)																					
Secale cereale (2mm)																					
Triticum aestivum/durum (2mm)				4				1	2	1	3	1			2	6	17	5			2
Triticum sp. (2mm)	2	1		2	7	2	3		3	5			4	2	8	2	13	7	5	1	4
Triticum dio (2mm)																					
Triticum mono (2mm)																					
Triticum mono/di (2mm)	1																				
Triticum spelta (2mm)																					
Vitis vinifera (2mm)		2								1						2			1		1
Vitis sp. (2mm) pedicel																					
Vitis sp. (2mm) frag																					
Vicia faba (2mm)																					
Vicia ervilia (2mm)	1	1			1						1	1		2		1		4			
Ficus carica (1mm)																		1	1		
Hordeum sp. (1mm)	1										1		1				2	1	1		
Hordeum distichon (1mm)																					
Lathyrus sativa (1mm)																					
Lens culinaris (1mm)	1										1										
Punica granatum (1mm)																					
Secale cereale (1mm)											1										
Triticum sp. (1mm)													2	1			2	1	1		
Vicia sp. (1mm)																					
Vitis vinifera (1mm)										1								1			
Vitis sp. (1mm) pedicel																					
Vitis sp. (1mm) frag																					
Ficus carica (.5mm)	3		4			5			23	2	7	1	4	3	12	37	3	20		3	13
Punica granatum (.5mm)																					
Vitis vinifera (.5mm)																					
Vitis sp. (.5mm) pedicel																					
GENERAL FAMILIES																					
Fabaceae (2mm)										5			1	3			1	1	2		
Poaceae (2mm)				1		1	1		1												
Asteraceae (1mm)												1			1		2				
Amaranthaceae (1mm)																					
Boraginaceae (1mm)											1						2	4			
Brassicaceae (1mm)																					
Caryophyllaceae (1mm)									3												
Chenopodiaceae (1mm)															1	1					
Cyperaceae (1mm)														1	1	1					
Dipsacaceae (1mm)																	1				
Fabaceae (1mm)	2								27	3	3	2	1	2	4			1			
Lamiaceae (1mm)																	1				
Malvaceae (1mm)														1							
Polygonaceae (1mm)																					
Poaceae (1mm)	20			8	35	11	18	4	81	23	51	2	14	17	13	12	94	1		1	
Poaceae Frags (1mm)		7	5	7		7			7	10	15	12	33	9	11	21	48	11		6	3

FlotNum	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
Amaranthaceae (.5mm)															2			1			
Apiaceae (.5mm)												1									
Asteraceae (.5mm)									1	8	2	1	2				5	1		1	
Boraginaceae (.5mm)																					
Brassicaceae (.5mm)											1	1			1						
Caryophyllaceae (.5mm)									3					4							
Chenopodiaceae (.5mm)									2		2	1			3	4				1	2
Cyperaceae (.5mm)	2															1	2				
Fabaceae (.5mm)									23	3	2	2			1	1		2			8
Lamiaceae (.5mm)																					
Malvaceae (.5mm)																					
Papaveraceae (.5mm)						1						1						2			
Poaceae (.5mm)	27			17	52	18	27	10	72	27	34	32	23	20	14		55	1			2
Poaceae Frags (.5mm)	60	3		6	10	16	29	2	112	34	21	26	7	18	23		45				
Polygonaceae (.5mm)	1													1							
Portulaceae (.5mm)									9							3					
Rubiaceae (.5mm)											2										
Scrophulariaceae (.5mm)																		2			
Solanaceae (.5mm)	1									1											
WILD OR WEEDY																					
Arnebia sp (2mm)																		1			
Avena sp. (2mm)																					
Bromus sp. (2mm)																					
Convolvulus (2mm)																					
Galium sp.(2mm)									1												
Hippocrepis (2mm)																					
Hordeum murinum/boeticum (2mm)																					
Malva sp. (2mm)									1												
Phalaris sp. (2mm)															1						
Adonis (1mm)																					
Agrostemma / Cerastium (1mm)																					
Ajuga sp. (1mm)																					
Amaranthus (1mm)																	1				
Androsace maxima (1mm)																					
Anthemis (1mm)																	1				
Asparagus (1mm)																					
Asphodelus (1mm)																					
Astragalus sp. (1mm)	3						1			2	1	1	3	1	3	1	4	1			
Atriplex sp. (1mm)																	1				
Avena sp. (1mm)												3									
Bellevalia (1mm)																					
Brassica (1mm)																					
Bupleurum sp. (1mm)																					
Camelina (1mm)																					
Carex (1mm)																					
Centaurea-type (1mm)												1									
Cephalaria syriaca (1mm)										2											
cf. Asparagus (1mm)																	1				
cf. Setaria (1mm)																	1				
Convolvulus (1mm)																					
Coronilla sp. (1mm)											1	1									
Eleocharis (1mm)												1	1								
Eremo/Agropyron (1mm)																					
Euphorbia (1mm)																					
Fumaria (1mm)											1			1				2			1
Galium sp. (1mm)		1							1		1					1					
Glaucium (1mm)													1								
Heliotropium (1mm)																					
Hippocrepis sp. (1mm)	1									1					1						
Hordeum murinum / boeticum (1mm)												1									
Hyoscyamus (1mm)																					
L. usitatissimum (1mm)											1										
Lavatera (1mm)																					

FlotNum	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
Lolium sp. (1mm)												1						1			
Malva sp. (1mm)	2			1	4	1	2		14		2	1		2	1	26	4	1			1
Medicago-type (1mm)																	2	1			
Melilotus/Trifolium (1mm)	163	2	1	12	23	44	2			10	9	2	6	5	4	1	4				2
Onopordum / Eleusine (1mm)														1							
Ornithogalum-type (1mm)												1			1						
Papaver sp. (1mm)						1					1		2								
Peganum harmala (1mm)																					
Phalaris sp. (1mm)	7			1	7	1	1	1			1	1	1	1		3	4	3			
Plantago sp. (1mm)																					
Polygonum sp. (1mm)																		1			
Portulaca (1mm)											1				1			1			
Rumex (1mm)																					
Salsola (1mm)																					
Scirpus (1mm)																					
Scorpiurus (1mm)											1		2	1	1		1				
Silene sp (1mm)											1				1						
Stipa (1mm)																		1			
Teucrium sp. (1mm)																	1				
Thymelaea sp. (1mm)				1			1														
Trigonella (1mm)							4					1			3	1					
Trigonella coele-syriaca (1mm)																					
Vaccaria (1mm)																					
Veronica (1mm)																					
Aizoon sp. (.5mm)																					
Agrostemma (.5mm)																					
Ajuga sp. (.5mm)															1						
Amaranthus sp. (.5mm)																					
Androsace maxima (.5mm)														1				1			
Anthemis (.5mm)																					
Artemisia (.5mm)																					
Asparagus (.5mm)																					
Astragalus sp. (.5mm)	3							2			2	1			3		1	3		1	
Atriplex (.5mm)										2											
Avena (.5mm)																					
Bellevalia (.5mm)																					
Brassica (.5mm)																					
Bupleurum (.5mm)															1		1				
Calendula (.5mm)																					
Carex / Scirpus (.5mm)																					
Centaurea (.5mm)															3						
Cerastium (.5mm)																					
cf. Berberis (.5mm)																					
cf. Camelina (.5mm)												2		1							
Chenopodium album (.5mm)																					
Convolvulus (.5mm)										1								1			
Coronilla sp. (.5mm)													1					2			
Eleocharis (.5mm)																					
Eragrostis sp. (.5mm)																					
Eremo/Agropyron (.5mm)												1									
Erodium cicutarium awn (.5mm)																					
Erodium sp (.5mm)															1			1			
Euphorbia (.5mm)																					
Fumaria sp. (.5mm)																					
Glaucium sp. (.5mm)																					
Heliotropium (.5mm)												2						1			
Hippocrepis sp. (.5mm)	2								9				1	2	2		1				
Hordeum murinum / boeticum (.5mm)												1									
Hyoscyamus (.5mm)																					
Lavatera (.5mm)									1	1											
Malva sp. (.5mm)	2			1	1		1		3	1		3		1	2	57	1	1		2	2
Medicago (.5mm)																					
Melilotus/Trifolium (.5mm)	60		1	10	13	20	1	2		9	6		7		2	5	5			1	

FlotNum	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
Melilotus/Trifolium punctate (.5mm)					4																
Ornithogalum (.5mm)									2			1		1				1			
Papaver sp. (.5mm)														1							
Peganum harmala (.5mm)																					
Phalaris sp. (.5mm)	1			1		5			9	1	5	1	1	3	7		4	9			2
Phleum (.5mm)																					
Plantago sp. (.5mm)	1								6			7		5	1		1				
Polygonum sp. (.5mm)																	2				
Portulaca (.5mm)	1													1		3					
Rumex (.5mm)																					
Salsola (.5mm)																					
Schinus (.5mm)	1										1			1							
Scirpus (.5mm)																					
Scorpiurus (.5mm)																					
Silene sp. (.5mm)			1	1	1		1	2		5	1	2			6	6		7			5
Stellaria (.5mm)																					
Suaeda (.5mm)												1		1							
Teucrium sp. (.5mm)												2			1						
Thymelaea sp (.5mm)												1									
Trifolium cf. repens (.5mm)																					
Trigonella astroites (.5mm)																	2				
Trigonella sp. (.5mm)	3				1		1			1					3					3	
Vaccaria (.5mm)									1		1					1					
Verbascum (.5mm)																					
Veronica (.5mm)																					
Ziziphora (.5mm)																					
UNKS OR FRAGS																					
Cerealia frags (2mm)			8	13								7	5	11	20	29	20	94	5	3	7
Hordeum frags (2mm)																					
Nutshell frag (2mm)																					
Unidentifiable Poaceae frag (2mm)	15								23	1	14										
Unidentifiable seed frag (2mm)				2	17	14								4	8	33			20		13
Unk non-Poac (2mm)											2							1			
Fabaceae frags (2mm)																					3
Indeterminate cereal (2mm)														1					1		
Indeterminate rachis (1mm)	10				15						8			15	10						
Fabaceae Frags (1mm)																					
Unidentifiable Seed Fragments (1mm)	14	7	11	27	25	12				13		18	10	13	12	76	33	18		5	
Cerealia frags (1mm)																					
Hordeum frags (1mm)																					
Nutshell frag (1mm)																					
Intedeterminate cereal (1mm)															1						
Unks non-Poaceae (1mm)	2	4	3	2	3	10	2		17	7	8	5	2	5	5	20	12	5		5	8
Unidentifiable seed fragments (.5mm)	35	18			5	12			24	10			11	4	11		20				
Unks non-Poaceae (.5mm)	9		4	14	32	10	22	3	41	18	14	15	7	9	30	37	31	38			22
Fabaceae frags (.5mm)																					
Indeterminate rachis (.5mm)										14		6		4	16						
CLINKER AND PARENCHYMA																					
Clinker (2mm)																					
Clinker (1mm)																	136				
Clinker (.5mm)																	7				
Parenchyma (2mm)																		8			
Parenchyma (1mm)																		60			
RACHIS FRAGMENTS																					
H. vul. rach (2mm)															1						
T. aest rach (2mm)												1			1		4		1		
T. aest/dur rach (2mm)							2														
T. dur rach (2mm)															1						
Trit aest/dur node (2mm)				1																	
Trit sp. rach (2mm)																	5		3		
Wild rachis (2mm)																	12				
Frag rachis (1mm)																					
Hordeum sp. rachis (1mm)	9			2	8	1				10	25	6	1	5	16	2	15				

FlotNum	**200**	**201**	**202**	**203**	**204**	**205**	**206**	**207**	**208**	**209**	**210**	**211**	**212**	**213**	**214**	**215**	**216**	**217**	**218**	**219**	**220**
T. aest rach (1mm)				3	13	2				4	50	4	35	4	1						
T. aest/dur rach (1mm)	11									8		13		12	27		206				1
T. aest/dur rach node (1mm)	9									83	87	56	103	42	49		302	8			
T. aest/dur rach internode (1mm)	27			7		10				5											
T. dur rach (1mm)				1	8					2		7		1				1			
T. mono/di rach (1mm)		1	1														2			1	2
T. sp node (1mm)			2	2	51											67					22
T. sp rach (1mm)				4	13	2					1		2			8				2	
Wild Rachis (1mm)	2									10	24	11	23	8	2		53	4			
Hordeum sp. rach (.5mm)	16								68	13	21	15	12	11	20	6	14	1		2	4
Hordeum sp. Rach internode (.5mm)										14		11			6						
Triticum aest rach (.5mm)									3												
Triticum aest/dur rach (.5mm)										3				2	3		2				
Triticum aest/dur rach node (.5mm)	4											5		3	9	19	14			1	16
Triticum sp. node (.5mm)																					
Triticum mono/di rach (.5mm)										1							2				1
Triticum sp. internode (.5mm)									19	6	3		3			5					
Wild rachis (.5mm)									11	9	7	1	5	3	1		8	2			
CULMS AND ROOTS																					
Grass Culms (2mm)	2			1	15				10				7	7	10	1	4	7	4		
Grass Culms (1mm)	13	2		4	14					20	44	5	20	20	20	9	43	2		1	2
Grass Culm (.5mm)	5									3	5	4	5				4				
Poaceae root (2mm)					9																
Poaceae root (1mm)																					
BONE																					
Bone (2mm)															1		1	7	10		
Bone (1mm)		21	2							8		1		2			4			17	
Bone (.5mm)		12										1		2			1	6			
SHELL																					
Shell (2mm)					3				17					4			8	2	2		
Shell (1mm)	4	18	1	1	10							6		35	29		17	5		21	
Shell Burnt (1mm)																					
Shell (.5mm)	6		3									1		88	117		25	12			
OTHER																					
Carbonized insect (2mm)																					
Carbonized insect (1mm)																					
Carbonized insect (.5mm)																					
Dung (2mm)					2													5			
Dung (1mm)																		1			
Fish Scale (1mm)																					

Unit	BR47	BS44	BS43	BS43	BS41	BS43	BS44	BR44	BR44	BR44	BR44	BS43	B027	CE27	CE27	CE27	B027	AX54	CE27	B027	B027
Locus	8	58	18	18	58	18	58	35	35	35	35	26	9	6	12	9	13	4	8	13	9
SG		18	18	17/22	19	20	24	5	4	2	8	23,24,25		18	18						
Bag	58	178	234	260	182	223	191	411	410	414	415	265	61/62	82	147	137	80	53	108	74	55,56,57
FlotNum	**221**	**222**	**223**	**224**	**225**	**226**	**227**	**228**	**229**	**230**	**231**	**232**	**233**	**234**	**235**	**236**	**237**	**238**	**239**	**240**	**241**
Flotvol (l)	15	25	6.5	11	20	35	17	15	29	18	14	18	15	3	5	3	14	24	9	10	11
TotWt (g)	10.3917	18.47	1.7752	6.2178	10.9374	15.2261	9.04744	14.8957	27.2565	14.4831	23.367	11.56	18.264	3.415	1.775	7.2638	15.5531	23.493	19.397	8.8918	30.115
>2mm # seeds	12	22	3	2	13	41	3	9	5	4	8	9	7	10	6	2	1	16	26	2	9
>1mm # seeds	32	80	4	15	44	30	26	31	30	24	54	10	20	20	8	7	3	6	82	5	9
>.5mm # seeds	34	80	10	16	47	45	20	43	41	64	23	50	21	47	24	7	4	17	56	14	14
>2mm charcoal ct	337	238	28	58	237	236	152	191	166	124	134	170	68	97	36	184	176	86	420	43	40
>2mm charcoal wt	2.6116	2.3277	0.1702	0.3221	1.86	1.743	1.0655	1.7035	1.654	0.5932	0.4941	1.4459	0.4367	0.7132	0.453	2.1046	1.84	1.1776	5.7969	0.4723	0.361
>1mm charcoal wt	1.9313		0.21	0.285	1.1041	1.9518	0.881	1.184	1.3234	0.45	0.6327	0.9735	0.586	0.8722	0.195	1.1246	1.159	0.6316	3.1927	0.2811	0.2901
DOMESTICATES																					
Cicer arietinum (2mm)					1																
Hordeum vulgare (2mm)	4	11		2	6		2	4		1	2	3	2	2	2	2	1	1	6	1	4
Lens culinaris (2mm)					1			2		1										1	
Pisum sativum (2mm)																					
Prunus sp.cf. cerasus (2mm)																					
Secale cereale (2mm)																					
Triticum aestivum/durum (2mm)		5			3	3				2		1	2	7	1				8		1
Triticum sp. (2mm)	2	5	1			2	1	1	5		1	4	2		3			2			3
Triticum dio (2mm)																		1	3		
Triticum mono (2mm)	1																	2			
Triticum mono/di (2mm)																					
Triticum spelta (2mm)																			5		
Vitis vinifera (2mm)	3	1						1										10			
Vitis sp. (2mm) pedicel																					
Vitis sp. (2mm) frag																					
Vicia faba (2mm)																					
Vicia ervilia (2mm)	1				1						1								3		
Ficus carica (1mm)	1			1		1		1			1										
Hordeum sp. (1mm)	1	3	1	1		2		1		1		1			1	1			2		
Hordeum distichon (1mm)																					
Lathyrus sativa (1mm)																					
Lens culinaris (1mm)																					
Punica granatum (1mm)																					
Secale cereale (1mm)																					
Triticum sp. (1mm)	2	2				1			1			1			1				2	1	
Vicia sp. (1mm)																					
Vitis vinifera (1mm)	2																	1			
Vitis sp. (1mm) pedicel																					
Vitis sp. (1mm) frag																					
Ficus carica (.5mm)	12		1	3	2	9	1		3	4	3	3						3	4		
Punica granatum (.5mm)																					
Vitis vinifera (.5mm)	1																				
Vitis sp. (.5mm) pedicel																					
GENERAL FAMILIES																					
Fabaceae (2mm)			2								1	1		1							1
Poaceae (2mm)								1			2										
Asteraceae (1mm)		1			1						4										
Amaranthaceae (1mm)		1																			
Boraginaceae (1mm)	3								1												
Brassicaceae (1mm)						1															
Caryophyllaceae (1mm)																			4		
Chenopodiaceae (1mm)																					
Cyperaceae (1mm)	2				9																2
Dipsacaceae (1mm)																					
Fabaceae (1mm)	3	2			1		2	1		2		1	1	2					3	1	
Lamiaceae (1mm)																					
Malvaceae (1mm)																					
Polygonaceae (1mm)																					1
Poaceae (1mm)	5	32	1	6	20	6	11	13	9	13	30		11	7	1		1		34		1
Poaceae Frags (1mm)		17		4	4	5	5	4	5		40		2	9	3	3		13	29	7	4

FlotNum	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241
Amaranthaceae (.5mm)	2							2	1		1										
Apiaceae (.5mm)																					
Asteraceae (.5mm)		4			1	2			3					2							
Boraginaceae (.5mm)																					
Brassicaceae (.5mm)				1		2	1					1								2	
Caryophyllaceae (.5mm)			1		1				4					1							
Chenopodiaceae (.5mm)	1	2		1		1	2				1	1							1	2	
Cyperaceae (.5mm)																			3		
Fabaceae (.5mm)	1	1			5					4	1		2	4							1
Lamiaceae (.5mm)																					
Malvaceae (.5mm)																					
Papaveraceae (.5mm)																					
Poaceae (.5mm)	3	30	4	1	20	11	9	22	13	40	4	17	9	18	8	5			20	1	3
Poaceae Frags (.5mm)		13	7		4	15	2	4	18	26	7	26	2	19	2	4	8		29	1	5
Polygonaceae (.5mm)					1									1						1	
Portulaceae (.5mm)																					
Rubiaceae (.5mm)																					
Scrophulariaceae (.5mm)																	1				
Solanaceae (.5mm)		3									1	1							1	1	
WILD OR WEEDY																					
Arnebia sp (2mm)																					
Avena sp. (2mm)																			1		
Bromus sp. (2mm)																					
Convolvulus (2mm)																					
Galium sp.(2mm)	1				1						1										
Hippocrepis (2mm)																					
Hordeum murinum/boeticum (2mm)																					
Malva sp. (2mm)																					
Phalaris sp. (2mm)																					
Adonis (1mm)																					
Agrostemma / Cerastium (1mm)																					
Ajuga sp. (1mm)																					
Amaranthus (1mm)																					
Androsace maxima (1mm)																					
Anthemis (1mm)																					
Asparagus (1mm)																					
Asphodelus (1mm)																					
Astragalus sp. (1mm)		5	1					1	1	2		2	1	3				1	3	1	
Atriplex sp. (1mm)				1		3									1						
Avena sp. (1mm)							1												1		
Bellevalia (1mm)																					
Brassica (1mm)																					
Bupleurum sp. (1mm)																					
Camelina (1mm)																					
Carex (1mm)																					
Centaurea-type (1mm)		1		1		2	1		1												
Cephalaria syriaca (1mm)																					
cf. Asparagus (1mm)																					
cf. Setaria (1mm)																					
Convolvulus (1mm)																			1		
Coronilla sp. (1mm)						1										1					
Eleocharis (1mm)																					
Eremo/Agropyron (1mm)																		1			
Euphorbia (1mm)																					
Fumaria (1mm)																					
Galium sp. (1mm)											2			2		1			1		
Glaucium (1mm)					1																
Heliotropium (1mm)																					
Hippocrepis sp. (1mm)																					
Hordeum murinum / boeticum (1mm)																					
Hyoscyamus (1mm)																					
L. usitatissimum (1mm)																					
Lavatera (1mm)																					

FlotNum	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241
Lolium sp. (1mm)									2												
Malva sp. (1mm)					2	2	1	2	3	2	2	2	1	2							
Medicago-type (1mm)				1				2	1		2										
Melilotus/Trifolium (1mm)	1	5		2	7	7	3	4	1		5	2	2	1	1		2		3		4
Onopordum / Eleusine (1mm)																					
Ornithogalum-type (1mm)		1		1							1										
Papaver sp. (1mm)		1														1					
Peganum harmala (1mm)																					
Phalaris sp. (1mm)	2	5		1				5	2	1	1				1	1		1	4		
Plantago sp. (1mm)																					
Polygonum sp. (1mm)																					
Portulaca (1mm)						1													1		
Rumex (1mm)																					
Salsola (1mm)																					
Scirpus (1mm)																					
Scorpiurus (1mm)		2								2									2		1
Silene sp (1mm)		1				2		1		1	1										
Stipa (1mm)									1												
Teucrium sp. (1mm)						1					1										
Thymelaea sp. (1mm)																			1		
Trigonella (1mm)		2									1			1	2	2			5		
Trigonella coele-syriaca (1mm)																					
Vaccaria (1mm)									2		1										
Veronica (1mm)																					
Aizoon sp. (.5mm)																					
Agrostemma (.5mm)																					
Ajuga sp. (.5mm)																					
Amaranthus sp. (.5mm)																	1				
Androsace maxima (.5mm)																					
Anthemis (.5mm)						2						1			1				3		
Artemisia (.5mm)					1																
Asparagus (.5mm)																					
Astragalus sp. (.5mm)		6					1					1									
Atriplex (.5mm)										1											
Avena (.5mm)																					
Bellevalia (.5mm)																					
Brassica (.5mm)															3						
Bupleurum (.5mm)																					1
Calendula (.5mm)																					
Carex / Scirpus (.5mm)																					
Centaurea (.5mm)		1				4	1	3													
Cerastium (.5mm)																					
cf. Berberis (.5mm)																					
cf. Camelina (.5mm)																					
Chenopodium album (.5mm)																					
Convolvulus (.5mm)																					
Coronilla sp. (.5mm)		3							1		1	3									1
Eleocharis (.5mm)																					
Eragrostis sp. (.5mm)									1												
Eremo/Agropyron (.5mm)				1																	
Erodium cicutarium awn (.5mm)																		1			
Erodium sp (.5mm)																					
Euphorbia (.5mm)																					
Fumaria sp. (.5mm)													1	1							
Glaucium sp. (.5mm)													1								
Heliotropium (.5mm)								1				2									
Hippocrepis sp. (.5mm)							1								1				2		
Hordeum murinum / boeticum (.5mm)																			1		
Hyoscyamus (.5mm)																					
Lavatera (.5mm)																					
Malva sp. (.5mm)							1	2	3					1	3			4			
Medicago (.5mm)																					
Melilotus/Trifolium (.5mm)		7	1	2		2			1			4	2		2			1			1

FlotNum	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241
Melilotus/Trifolium punctate (.5mm)																	2				
Ornithogalum (.5mm)		1							2		1			3					1		
Papaver sp. (.5mm)													2	2							
Peganum harmala (.5mm)																					
Phalaris sp. (.5mm)	1	4	1	5		2		2	1	4		1			1			1			
Phleum (.5mm)																					
Plantago sp. (.5mm)				1					2		1	1		1					1		2
Polygonum sp. (.5mm)																					
Portulaca (.5mm)							1												1		
Rumex (.5mm)																					
Salsola (.5mm)																					
Schinus (.5mm)						1															
Scirpus (.5mm)									1												
Scorpiurus (.5mm)																					
Silene sp. (.5mm)	3	2				1	1	1		1	2	2		1							
Stellaria (.5mm)																					
Suaeda (.5mm)				1																	
Teucrium sp. (.5mm)																					
Thymelaea sp (.5mm)																		1			
Trifolium cf. repens (.5mm)																		1			
Trigonella astroites (.5mm)																					
Trigonella sp. (.5mm)		1	1		1	1	1	2				3		4					3		
Vaccaria (.5mm)													1		1						
Verbascum (.5mm)																					
Veronica (.5mm)																					
Ziziphora (.5mm)																					
UNKS OR FRAGS																					
Cerealia frags (2mm)	7	6		7	5	14	4	3	7	7		2			7	1		5	28		
Hordeum frags (2mm)																					
Nutshell frag (2mm)																					
Unidentifiable Poaceae frag (2mm)			1																		
Unidentifiable seed frag (2mm)	14	3				3		4				3	3					10			55,56,57
Unk non-Poac (2mm)						34				0											
Fabaceae frags (2mm)																					
Indeterminate cereal (2mm)						2							1								
Indeterminate rachis (1mm)		15	5	13	24			15	14		24		28		3		1		18	4	
Fabaceae Frags (1mm)																					
Unidentifiable Seed Fragments (1mm)	68	14		5		4	4	15	17		9	5	14		5	1	13		44	8	26
Cerealia frags (1mm)																					
Hordeum frags (1mm)																					
Nutshell frag (1mm)																					
Intedeterminate cereal (1mm)							1					1						1	3		
Unks non-Poaceae (1mm)	10	16	1		3		7		5		2	1	4	2				2	15	2	
Unidentifiable seed fragments (.5mm)		10		1	2	13					7	14									
Unks non-Poaceae (.5mm)	10	15	1		15	7		8	5	10	7	9	3	8	4	2		5	15	7	5
Fabaceae frags (.5mm)																					
Indeterminate rachis (.5mm)		13					4		5		8						1		21	2	
CLINKER AND PARENCHYMA																					
Clinker (2mm)																					
Clinker (1mm)																					
Clinker (.5mm)																					
Parenchyma (2mm)																					
Parenchyma (1mm)				6		5			25			11								3	35
RACHIS FRAGMENTS																					
H. vul. rach (2mm)																					
T. aest rach (2mm)		5			4																
T. aest/dur rach (2mm)													1								
T. dur rach (2mm)																					
Trit aest/dur node (2mm)																					
Trit sp. rach (2mm)						1		4			6						2				
Wild rachis (2mm)																					
Frag rachis (1mm)					24																
Hordeum sp. rachis (1mm)		21		2	5	5	6	7	10	6	24	8	6	2	2				10	3	2

FlotNum	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241
T. aest rach (1mm)					1				3	19	11	2	4	5		4		1			
T. aest/dur rach (1mm)		26		6		15	13	16	17		12	16	5				3		35	3	11
T. aest/dur rach node (1mm)		111	16	27	55	58	34	66	48	33	25	64	28		9	3	11		77	13	32
T. aest/dur rach internode (1mm)					14				2												
T. dur rach (1mm)					5				5				3	5							
T. mono/di rach (1mm)					1																
T. sp node (1mm)	24													22	1						
T. sp rach (1mm)														2							
Wild Rachis (1mm)		26	2	4		10	8	12	10	6	7	10				1	2	1	25	3	3
Hordeum sp. rach (.5mm)		30	2	3		10	4	8	12	12	4	7	5	17	3	2	4	1	22	6	3
Hordeum sp. Rach internode (.5mm)									5										8		
Triticum aest rach (.5mm)																					
Triticum aest/dur rach (.5mm)		4						2	2	4		1		4						2	
Triticum aest/dur rach node (.5mm)						4	3	2	1			3			1	1			5	2	6
Triticum sp. node (.5mm)														3							
Triticum mono/di rach (.5mm)																					
Triticum sp. internode (.5mm)									3	5											
Wild rachis (.5mm)		1					2	1	2	8	1	1	3	2			1		9	2	2
CULMS AND ROOTS																					
Grass Culms (2mm)		18		1	5	4	1	2	1	9	9	4	4						2		11
Grass Culms (1mm)	3	16	7	7	11	5	12	19	27	13	12	24	5	1	3	4	3		35	5	1
Grass Culm (.5mm)		4							2	4			2	2			1		3		
Poaceae root (2mm)																					
Poaceae root (1mm)																					
BONE																					
Bone (2mm)	2	2			1		2	3	1	1			1								1
Bone (1mm)				1			2	22	4				2								2
Bone (.5mm)			7	2			4	41	4		1									1	7
SHELL																					
Shell (2mm)	15	5		3	3	4	1	2	4	3	2		10	3	1	2	2	5			6
Shell (1mm)		17		14		16	4	9	12		2	11	22	6	26		3				43
Shell Burnt (1mm)																					
Shell (.5mm)		48	30	26		53	6	17	19		3	14			36		24			46	98
OTHER																					
Carbonized insect (2mm)																					
Carbonized insect (1mm)																					
Carbonized insect (.5mm)																					
Dung (2mm)				1		1															1
Dung (1mm)									5												
Fish Scale (1mm)																					

Unit	B027	BR43	BR47	BR47	BR47	BR47	BR47	BS47	BS47	BS47	BS44	BR44	BR44	BR44	BR43	BR43	BR43	BR43	BR41	BR43	BR44
Locus	9	48	8	6	3	13	5	17	16	6	58	35	35	35	58	58	48	58	41	48	35
SG		5	1,2,6				11	12,17,22	16	16	16	1	1	3	23	21	8	17		5	3
Bag	58,59,60	226	58	33	20	108	104	214	187	94	200	381	401	385	203	201	218	202	174	214	381
FlotNum	**242**	**243**	**244**	**245**	**246**	**247**	**248**	**249**	**250**	**251**	**252**	**253**	**254**	**255**	**256**	**257**	**258**	**259**	**260**	**261**	**262**
Flotvol (l)	12	25.5	6	20	26	6	7	15	19	30	25	25	30	9	14.5	10	10.5	28	28	20	14
TotWt (g)	15.5214	13.6464	5.0467	28.2608	6.7354	1.7428	0.9475	18.9713	16.5719	8.9796	23.7834	16.4279	37.9645	32.9598							
>2mm # seeds	5	9	6	33	0	1	2	12	21	12	17	4	32	9	25	6	8	1	6	3	10
>1mm # seeds	9	16	7	56	10	1	0	13	56	30	65	9	68	23	52	17	27	8	54	5	28
>.5mm # seeds	18	49	31	116	19	2	6	16	41	26	65	28	75	35	52	27	29	29	56	16	51
>2mm charcoal ct	28	309	103	368	177	5	32	188	195	104	547	117	135	74	286	152	80	69	120	98	208
>2mm charcoal wt	0.2193	3.583	0.6234	2.4432	1.2174	0.032	0.1489	1.1474	1.349	0.6834	3.33962	0.8996	1.3104	0.5192	2.2632	1.4384	1.1227	0.4629	1.2115	0.8626	1.9853
>1mm charcoal wt	0.4204	1.7803	0.7102	2.9687	0.8106	0.0707	0.1044	1.4571	1.9083	0.9391	3.0584	1.1056	1.3868	0.5071	1.4064	1.0165	0.6181	0.5531	1.7115	0.5777	1.4268
DOMESTICATES																					
Cicer arietinum (2mm)																					
Hordeum vulgare (2mm)	2	5	1	5		1	1	4	8	3	6	1	3	3	5	2	2		4	1	5
Lens culinaris (2mm)				5				2	3	3					1						
Pisum sativum (2mm)														1	1		3				1
Prunus sp.cf. cerasus (2mm)															1						
Secale cereale (2mm)																					
Triticum aestivum/durum (2mm)	1	2	3	4					4		1		2	1	3						3
Triticum sp. (2mm)	1	1		12				4		2	3	2	24	4	5	1			2		
Triticum dio (2mm)									1				2		2			1			
Triticum mono (2mm)																					
Triticum mono/di (2mm)																					
Triticum spelta (2mm)																					
Vitis vinifera (2mm)			1	3			1	1	3	2					2		1				
Vitis sp. (2mm) pedicel																					
Vitis sp. (2mm) frag																					
Vicia faba (2mm)																					
Vicia ervilia (2mm)				1								1			3	1				1	1
Ficus carica (1mm)									3												
Hordeum sp. (1mm)	2			2									1	1			2	1	4		2
Hordeum distichon (1mm)																					
Lathyrus sativa (1mm)																					
Lens culinaris (1mm)				1																	
Punica granatum (1mm)																					
Secale cereale (1mm)																					
Triticum sp. (1mm)				4					1				4								2
Vicia sp. (1mm)											1										
Vitis vinifera (1mm)					1			1													
Vitis sp. (1mm) pedicel																					
Vitis sp. (1mm) frag																					
Ficus carica (.5mm)		1	15	41	4				3	3	8	2	9	2	2	1		2	5	3	
Punica granatum (.5mm)																					
Vitis vinifera (.5mm)			1																		
Vitis sp. (.5mm) pedicel																					
GENERAL FAMILIES																					
Fabaceae (2mm)	1	1						1	1		3				2	1					
Poaceae (2mm)										1											
Asteraceae (1mm)														2							
Amaranthaceae (1mm)																					
Boraginaceae (1mm)				1									1			1			1		
Brassicaceae (1mm)																					
Caryophyllaceae (1mm)																			2		
Chenopodiaceae (1mm)						1		1													
Cyperaceae (1mm)											2										
Dipsacaceae (1mm)														1							
Fabaceae (1mm)	1		2	11	4			1	12		3			1	11			1	1		
Lamiaceae (1mm)																					
Malvaceae (1mm)																					
Polygonaceae (1mm)														1							
Poaceae (1mm)		3		6	1				7	11	26	6	34	8	18	6	11	0	14	1	5
Poaceae Frags (1mm)	17	12		26	4			12	7	3	38	3	22	17	7	7	1	6	15		

FlotNum	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262
Amaranthaceae (.5mm)				2						2			1			1					
Apiaceae (.5mm)																					
Asteraceae (.5mm)					1						1	1	3	1		1			1		3
Boraginaceae (.5mm)																					
Brassicaceae (.5mm)	1										2		5	1							
Caryophyllaceae (.5mm)															1				4		
Chenopodiaceae (.5mm)				4				3						1		1	1				3
Cyperaceae (.5mm)											1										
Fabaceae (.5mm)				5	1				5			1					1	1			
Lamiaceae (.5mm)																					
Malvaceae (.5mm)																					
Papaveraceae (.5mm)				1																	
Poaceae (.5mm)	4	17	1	3					12	1	16	13	30	11	19	9	14	14	24	4	24
Poaceae Frags (.5mm)	6	14							2	5	32	29	32	16	36	18	8	8	27	3	22
Polygonaceae (.5mm)											1									1	
Portulaceae (.5mm)				2		1				1			1								
Rubiaceae (.5mm)																					
Scrophulariaceae (.5mm)											1										
Solanaceae (.5mm)	1	1									3		2								
WILD OR WEEDY																					
Arnebia sp (2mm)																					
Avena sp. (2mm)																					
Bromus sp. (2mm)																					
Convolvulus (2mm)																					
Galium sp.(2mm)				2					1	1						1					
Hippocrepis (2mm)																					
Hordeum murinum/boeticum (2mm)																					
Malva sp. (2mm)																					
Phalaris sp. (2mm)																					
Adonis (1mm)																					
Agrostemma / Cerastium (1mm)																					
Ajuga sp. (1mm)																					
Amaranthus (1mm)																					
Androsace maxima (1mm)																					
Anthemis (1mm)																					
Asparagus (1mm)																					
Asphodelus (1mm)																					
Astragalus sp. (1mm)		2		2					1	1	4	1	5	1			3		4		4
Atriplex sp. (1mm)																					
Avena sp. (1mm)																				1	1
Bellevalia (1mm)																					
Brassica (1mm)																					
Bupleurum sp. (1mm)																					
Camelina (1mm)																					
Carex (1mm)																					
Centaurea-type (1mm)																					
Cephalaria syriaca (1mm)																					
cf. Asparagus (1mm)																					
cf. Setaria (1mm)																					
Convolvulus (1mm)																1					
Coronilla sp. (1mm)		1		1							1				1						
Eleocharis (1mm)																					
Eremo/Agropyron (1mm)															2						
Euphorbia (1mm)																					
Fumaria (1mm)																					
Galium sp. (1mm)				2				1			1					1	1		1		1
Glaucium (1mm)					2																
Heliotropium (1mm)																		1			
Hippocrepis sp. (1mm)								1		1	2										
Hordeum murinum / boeticum (1mm)																					
Hyoscyamus (1mm)																					
L. usitatissimum (1mm)																					
Lavatera (1mm)																					

FlotNum	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262
Lolium sp. (1mm)			1											1							
Malva sp. (1mm)		1	1	4				1	1	1	1		4		5	1			6		2
Medicago-type (1mm)											4										
Melilotus/Trifolium (1mm)	3	5						4		8	6	2	3	3	3	4	3	1	6		4
Onopordum / Eleusine (1mm)				6																	
Ornithogalum-type (1mm)															1				2		
Papaver sp. (1mm)																					
Peganum harmala (1mm)																					
Phalaris sp. (1mm)		2		1				1	5	3			4		1	1				2	3
Plantago sp. (1mm)															1						
Polygonum sp. (1mm)																					
Portulaca (1mm)									1												
Rumex (1mm)																					
Salsola (1mm)																					
Scirpus (1mm)																					
Scorpiurus (1mm)											5		2								
Silene sp (1mm)											1		1				1				
Stipa (1mm)																					
Teucrium sp. (1mm)		1													1						
Thymelaea sp. (1mm)				1															1		
Trigonella (1mm)											1				1	1	2		5		1
Trigonella coele-syriaca (1mm)																					
Vaccaria (1mm)													1								
Veronica (1mm)																					
Aizoon sp. (.5mm)																					
Agrostemma (.5mm)																					
Ajuga sp. (.5mm)																					
Amaranthus sp. (.5mm)																					
Androsace maxima (.5mm)														1							
Anthemis (.5mm)																					
Artemisia (.5mm)																					
Asparagus (.5mm)																					
Astragalus sp. (.5mm)	1			3	3				1		1		2				1		1	1	1
Atriplex (.5mm)																					
Avena (.5mm)																					
Bellevalia (.5mm)											1										
Brassica (.5mm)													1								
Bupleurum (.5mm)																					
Calendula (.5mm)																					
Carex / Scirpus (.5mm)																					
Centaurea (.5mm)		1																	1		
Cerastium (.5mm)																					
cf. Berberis (.5mm)																					
cf. Camelina (.5mm)																			1		
Chenopodium album (.5mm)																					
Convolvulus (.5mm)																1					
Coronilla sp. (.5mm)				3					2					1	2	1			1		
Eleocharis (.5mm)																1				2	
Eragrostis sp. (.5mm)																					
Eremo/Agropyron (.5mm)																					
Erodium cicutarium awn (.5mm)																					
Erodium sp (.5mm)																					
Euphorbia (.5mm)																					
Fumaria sp. (.5mm)															1						
Glaucium sp. (.5mm)							1														
Heliotropium (.5mm)														1							1
Hippocrepis sp. (.5mm)				1				1			3		3				1	1	1		1
Hordeum murinum / boeticum (.5mm)																					
Hyoscyamus (.5mm)																					
Lavatera (.5mm)																					
Malva sp. (.5mm)	1	1	1	4		1	1		6			1							5		1
Medicago (.5mm)												1									
Melilotus/Trifolium (.5mm)	2	5	2	4				2	4	6	1	1			4		3	1	2		2

FlotNum	**242**	**243**	**244**	**245**	**246**	**247**	**248**	**249**	**250**	**251**	**252**	**253**	**254**	**255**	**256**	**257**	**258**	**259**	**260**	**261**	**262**
Melilotus/Trifolium punctate (.5mm)																					
Ornithogalum (.5mm)																					
Papaver sp. (.5mm)																			1		
Peganum harmala (.5mm)																					
Phalaris sp. (.5mm)	1	1		1				1	4		3	2	3				1	2	2		4
Phleum (.5mm)																					
Plantago sp. (.5mm)		1									4		1	1		3				1	1
Polygonum sp. (.5mm)																	1				
Portulaca (.5mm)																					
Rumex (.5mm)																					
Salsola (.5mm)																					
Schinus (.5mm)																1					
Scirpus (.5mm)																					
Scorpiurus (.5mm)																					
Silene sp. (.5mm)		2	2	5	1			1	2	1							1				
Stellaria (.5mm)																					
Suaeda (.5mm)		2																			
Teucrium sp. (.5mm)																					
Thymelaea sp (.5mm)																					
Trifolium cf. repens (.5mm)																					2
Trigonella astroites (.5mm)		3											1								
Trigonella sp. (.5mm)	2	1	1	2			1		2		1			2	2			1	2		2
Vaccaria (.5mm)																			1		
Verbascum (.5mm)																					
Veronica (.5mm)																					
Ziziphora (.5mm)																1					
UNKS OR FRAGS																					
Cerealia frags (2mm)	1	8		53				17	42	7	11	5	11	3	9	1	2	3	10		5
Hordeum frags (2mm)																					
Nutshell frag (2mm)																					
Unidentifiable Poaceae frag (2mm)																					
Unidentifiable seed frag (2mm)	1	6	17	26		12			20		18	1		3					7	3	2
Unk non-Poac (2mm)				1							2						1				
Fabaceae frags (2mm)																					
Indeterminate cereal (2mm)			1								2		1				1			1	
Indeterminate rachis (1mm)	10	12									34	8	11	22	17	10	2		35		14
Fabaceae Frags (1mm)																					
Unidentifiable Seed Fragments (1mm)	32	8	79	127	28		3	138	184	55	39	10		5	22	16		18	62		12
Cerealia frags (1mm)																					
Hordeum frags (1mm)																					
Nutshell frag (1mm)																					
Intedeterminate cereal (1mm)	1										1		2					2			
Unks non-Poaceae (1mm)	3	1	3	14	2			2	25	5	7		8	4	7	1	4	4	7	1	3
Unidentifiable seed fragments (.5mm)		3									19								9		5
Unks non-Poaceae (.5mm)	5	13	8	35	9		3	8		12	18	6	13	13	21	6	5	7	4	4	6
Fabaceae frags (.5mm)																					
Indeterminate rachis (.5mm)		12									18	10	7	2	35	8	6		23	3	9
CLINKER AND PARENCHYMA																					
Clinker (2mm)																					
Clinker (1mm)																	11	5			
Clinker (.5mm)																					
Parenchyma (2mm)														2	7				1		
Parenchyma (1mm)											44			23					73		20
RACHIS FRAGMENTS																					
H. vul. rach (2mm)																					
T. aest rach (2mm)															1		1				
T. aest/dur rach (2mm)											5	1	6	6							
T. dur rach (2mm)									1						1						
Trit aest/dur node (2mm)											2				4						
Trit sp. rach (2mm)													1								
Wild rachis (2mm)	1																				
Frag rachis (1mm)																					
Hordeum sp. rachis (1mm)	3	2							9	3	26	4	28	6	3	13	1		41	2	14

FlotNum	**242**	**243**	**244**	**245**	**246**	**247**	**248**	**249**	**250**	**251**	**252**	**253**	**254**	**255**	**256**	**257**	**258**	**259**	**260**	**261**	**262**
T. aest rach (1mm)				3						10					5		1				2
T. aest/dur rach (1mm)	8	17									28	9	8	12	26	7	18	9	22	6	25
T. aest/dur rach node (1mm)	27	46									90	26	41	44	62	29	46	9	82	7	73
T. aest/dur rach internode (1mm)															5						
T. dur rach (1mm)									4												
T. mono/di rach (1mm)																					
T. sp node (1mm)			10	64			2		44	51											
T. sp rach (1mm)				4					1												
Wild Rachis (1mm)	8	3									15	2	6	10	37	6	3	1	14	5	12
Hordeum sp. rach (.5mm)	7	9	4	15	1				11	17	10	12	14	6	22	10	7	1	20	2	7
Hordeum sp. Rach internode (.5mm)											6										
Triticum aest rach (.5mm)															2						
Triticum aest/dur rach (.5mm)											1	2			6	2	5	1	3		1
Triticum aest/dur rach node (.5mm)	3	4									3	2	1		4	3		1	3		
Triticum sp. node (.5mm)				1					1												
Triticum mono/di rach (.5mm)																					
Triticum sp. internode (.5mm)			3	26					7	0	13										
Wild rachis (.5mm)	8										4		6	2	10	1	2		5		1
CULMS AND ROOTS																					
Grass Culms (2mm)	1	5	1	2				1	3		18	2	7	7	11	3	4		5		11
Grass Culms (1mm)	11	13		9					18	13	20	12	23	9	33	18	12	3	40	7	30
Grass Culm (.5mm)		1		2					2		1	2			6	3	1	1	7		3
Poaceae root (2mm)																					
Poaceae root (1mm)																					
BONE																					
Bone (2mm)																			3	1	1
Bone (1mm)		4	1								1		3	2			2		3		2
Bone (.5mm)		45							5		1			2			10				
SHELL																					
Shell (2mm)	7			13											5			2	95		1
Shell (1mm)	49	7	13								19		6	5		3	9	5		2	4
Shell Burnt (1mm)																					
Shell (.5mm)	136	30									38			9		7	31	15		10	5
OTHER																					
Carbonized insect (2mm)																					
Carbonized insect (1mm)																		1			
Carbonized insect (.5mm)																					
Dung (2mm)																				1	
Dung (1mm)																					
Fish Scale (1mm)																					

Unit	C19	BS44	BR44	BR44	BS44	BS44	BS44	BS43	BS44	BS43	BS43	BS43	BS43	BS43	BR41	L-Sect	L-Sect	L-Sect	L-Sect	L-Sect	L-Sect
Locus	4	58	35	35	58	58	58	23	58	18	18	18	18	18	43	10	12	11	29	7	20
SG		20	3	2	25	25	24	1,6,11	21	23-1	23-2	24	25	25							4.1
Bag	27	193	416	414	192	192	191	262	201	256	256	261	263	263	182	43	77	61	211	81/41	127
FlotNum	**263**	**264**	**265**	**266**	**267**	**268**	**269**	**270**	**271**	**272**	**273**	**274**	**275**	**276**	**277**	**278**	**279**	**280**	**281**	**282**	**283**
Flotvol (l)	27	14	9	8.5	15	10	3	12	17	7	15	3.5	15	14	15	9	5	11	7	7	6
TotWt (g)																					
>2mm # seeds	1	7	2	2	5	9	2	4	1	1	4	1	3	2	6	4	4	1	11	7	1
>1mm # seeds	1	7	2	12	10	12	2	5	26	4	12	4	5	9	28	3	1	2	13	0	2
>.5mm # seeds	8	25	17	18	22	16	8	8	31	9	25	10	13	12	41	13	1	5	29	8	2
>2mm charcoal ct	0	167	121	60	64	110	42	44	50	22	30	35	52	61	88	28	33	2	50	34	52
>2mm charcoal wt	0	2.4454	1.1199	0.4408	0.448	1.4049	0.4989	0.2867	0.4185	0.1902	0.1899	0.2041	0.3633	0.4976	0.4815	0.08959	0.116	0.0059	0.7651	0.1599	0.224
>1mm charcoal wt	0.001	0.8101	0.6102	0.5455	0.5981	0.6097	0.2665	0.2853	0.567	0.1857	0.3705	0.1808	0.3116	0.43	0.837	0.233	0.1264	0.0384	0.5525	0.3706	0.1724
DOMESTICATES																					
Cicer arietinum (2mm)																2					
Hordeum vulgare (2mm)	1	1			1	3	1	3		1		1		1	2		1		6	2	1
Lens culinaris (2mm)																1	1				
Pisum sativum (2mm)						1							1		1						
Prunus sp.cf. cerasus (2mm)																					
Secale cereale (2mm)																					
Triticum aestivum/durum (2mm)		2			1	3					2		1		2						
Triticum sp. (2mm)		2			1	1		1	1		1						1	1	4		
Triticum dio (2mm)		1		2										1	1						
Triticum mono (2mm)																					
Triticum mono/di (2mm)					1						1										
Triticum spelta (2mm)																					
Vitis vinifera (2mm)			1														1				
Vitis sp. (2mm) pedicel																					
Vitis sp. (2mm) frag																					
Vicia faba (2mm)																					
Vicia ervilia (2mm)			1		1								1						1	1	
Ficus carica (1mm)																			2		
Hordeum sp. (1mm)						1				1				1							
Hordeum distichon (1mm)																					
Lathyrus sativa (1mm)																					
Lens culinaris (1mm)																					
Punica granatum (1mm)																					
Secale cereale (1mm)																					
Triticum sp. (1mm)					1	1				1											
Vicia sp. (1mm)																					
Vitis vinifera (1mm)																					
Vitis sp. (1mm) pedicel																					
Vitis sp. (1mm) frag																					
Ficus carica (.5mm)		4	3	2	5	1	1	1	2				1	3	3	4		3	12	1	
Punica granatum (.5mm)																					
Vitis vinifera (.5mm)																					
Vitis sp. (.5mm) pedicel																					
GENERAL FAMILIES																					
Fabaceae (2mm)							1													2	
Poaceae (2mm)																				1	
Asteraceae (1mm)					1				1												
Amaranthaceae (1mm)																					
Boraginaceae (1mm)				1					3					1	1				1		
Brassicaceae (1mm)													1								
Caryophyllaceae (1mm)																					
Chenopodiaceae (1mm)					1																
Cyperaceae (1mm)																					
Dipsacaceae (1mm)																					
Fabaceae (1mm)					3	1			1		1			2					3		
Lamiaceae (1mm)																					
Malvaceae (1mm)																					
Polygonaceae (1mm)																					
Poaceae (1mm)			2		1		2	2	4	1	5	2	2	1	13	2	1		2		1
Poaceae Frags (1mm)		3	5		4	7			9	7	9	4	2	4	10	1			17		

FlotNum	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283
Amaranthaceae (.5mm)	7			1					1						1						
Apiaceae (.5mm)																					
Asteraceae (.5mm)							1	1	1	1		1			1	1			1		
Boraginaceae (.5mm)																					
Brassicaceae (.5mm)	1										1		1								
Caryophyllaceae (.5mm)			1												1						
Chenopodiaceae (.5mm)			2	1							1			1						1	
Cyperaceae (.5mm)											1										
Fabaceae (.5mm)			1						2		3				1	1					
Lamiaceae (.5mm)																					
Malvaceae (.5mm)																					
Papaveraceae (.5mm)																					
Poaceae (.5mm)		13	7	1	9	10	3	3	10	3	5	5	2	3	12						1
Poaceae Frags (.5mm)		7		27	25	19	5	5	15	6	20		7	7	20						
Polygonaceae (.5mm)							1	1			1										
Portulaceae (.5mm)																					
Rubiaceae (.5mm)																					
Scrophulariaceae (.5mm)													1								
Solanaceae (.5mm)																					
WILD OR WEEDY																					
Arnebia sp (2mm)																					
Avena sp. (2mm)																					
Bromus sp. (2mm)		1																			
Convolvulus (2mm)																					
Galium sp.(2mm)																1				1	
Hippocrepis (2mm)																					
Hordeum murinum/boeticum (2mm)																					
Malva sp. (2mm)																					
Phalaris sp. (2mm)																					
Adonis (1mm)																					
Agrostemma / Cerastium (1mm)																					
Ajuga sp. (1mm)																					
Amaranthus (1mm)																					
Androsace maxima (1mm)																					
Anthemis (1mm)																					
Asparagus (1mm)																					
Asphodelus (1mm)																					
Astragalus sp. (1mm)				2				1	1		1		1	1	1						
Atriplex sp. (1mm)																					
Avena sp. (1mm)																					
Bellevalia (1mm)																					
Brassica (1mm)																					
Bupleurum sp. (1mm)		1																			
Camelina (1mm)		1																			
Carex (1mm)																					
Centaurea-type (1mm)																					
Cephalaria syriaca (1mm)																					
cf. Asparagus (1mm)																					
cf. Setaria (1mm)																					
Convolvulus (1mm)																					
Coronilla sp. (1mm)																					
Eleocharis (1mm)																					
Eremo/Agropyron (1mm)																					
Euphorbia (1mm)																					
Fumaria (1mm)										1											
Galium sp. (1mm)		1																			
Glaucium (1mm)																					
Heliotropium (1mm)									1												
Hippocrepis sp. (1mm)											1										
Hordeum murinum / boeticum (1mm)				1																	
Hyoscyamus (1mm)																					
L. usitatissimum (1mm)																					
Lavatera (1mm)																					

FlotNum	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283
Lolium sp. (1mm)																					
Malva sp. (1mm)	1			1	1	1									1			2			
Medicago-type (1mm)									1		1				1						
Melilotus/Trifolium (1mm)				4	1	2		1	6				1		3						
Onopordum / Eleusine (1mm)																					
Ornithogalum-type (1mm)									1		1	1			1						
Papaver sp. (1mm)									1												
Peganum harmala (1mm)																					
Phalaris sp. (1mm)									1												
Plantago sp. (1mm)																					
Polygonum sp. (1mm)																					
Portulaca (1mm)																					
Rumex (1mm)																					
Salsola (1mm)																					
Scirpus (1mm)																					
Scorpiurus (1mm)								1						1							
Silene sp (1mm)		1			1							1									
Stipa (1mm)																					
Teucrium sp. (1mm)		1									1				1						
Thymelaea sp. (1mm)						1															
Trigonella (1mm)						1			1					1	4						
Trigonella coele-syriaca (1mm)																					
Vaccaria (1mm)																					
Veronica (1mm)																					
Aizoon sp. (.5mm)																					
Agrostemma (.5mm)																					
Ajuga sp. (.5mm)																					
Amaranthus sp. (.5mm)																					
Androsace maxima (.5mm)																					
Anthemis (.5mm)																					
Artemisia (.5mm)																					
Asparagus (.5mm)																					
Astragalus sp. (.5mm)			1	1	1	1							1			1			1		
Atriplex (.5mm)																					
Avena (.5mm)																					
Bellevalia (.5mm)															1						
Brassica (.5mm)																					
Bupleurum (.5mm)		1								1	1										
Calendula (.5mm)																					
Carex / Scirpus (.5mm)																					
Centaurea (.5mm)																					
Cerastium (.5mm)																					
cf. Berberis (.5mm)																					
cf. Camelina (.5mm)		1							1												
Chenopodium album (.5mm)																					
Convolvulus (.5mm)																					
Coronilla sp. (.5mm)											1				1				1		
Eleocharis (.5mm)		1							1												
Eragrostis sp. (.5mm)																					
Eremo/Agropyron (.5mm)																					
Erodium cicutarium awn (.5mm)																					
Erodium sp (.5mm)											1										
Euphorbia (.5mm)																					
Fumaria sp. (.5mm)													1		1						
Glaucium sp. (.5mm)																					
Heliotropium (.5mm)						1					1										
Hippocrepis sp. (.5mm)				3	1						1								1		
Hordeum murinum / boeticum (.5mm)																					
Hyoscyamus (.5mm)																					
Lavatera (.5mm)																					
Malva sp. (.5mm)				1																1	
Medicago (.5mm)																					
Melilotus/Trifolium (.5mm)				1					2	1		1			3				3		

FlotNum	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283
Melilotus/Trifolium punctate (.5mm)																					
Ornithogalum (.5mm)		1													3						
Papaver sp. (.5mm)															1						
Peganum harmala (.5mm)																					
Phalaris sp. (.5mm)		2				1		1	3					1	3						
Phleum (.5mm)				2																	
Plantago sp. (.5mm)				1	1	1															
Polygonum sp. (.5mm)																					
Portulaca (.5mm)																					
Rumex (.5mm)																					
Salsola (.5mm)																					
Schinus (.5mm)																					
Scirpus (.5mm)																					
Scorpiurus (.5mm)														1							
Silene sp. (.5mm)				1			1				1									1	
Stellaria (.5mm)																					
Suaeda (.5mm)				1																	
Teucrium sp. (.5mm)				1									1								
Thymelaea sp (.5mm)																					
Trifolium cf. repens (.5mm)																					
Trigonella astroites (.5mm)																					
Trigonella sp. (.5mm)			2		1	1		1	1						3		1				
Vaccaria (.5mm)									2	1											
Verbascum (.5mm)																					
Veronica (.5mm)																					
Ziziphora (.5mm)																					
UNKS OR FRAGS																					
Cerealia frags (2mm)				9	4	3	2			3					3	14			6		
Hordeum frags (2mm)																					
Nutshell frag (2mm)																					
Unidentifiable Poaceae frag (2mm)																				1	
Unidentifiable seed frag (2mm)			1	1				1	2						1	23	5				
Unk non-Poac (2mm)																					
Fabaceae frags (2mm)																					
Indeterminate cereal (2mm)						1															
Indeterminate rachis (1mm)			2	9	9	14	3		7		10	4		3							
Fabaceae Frags (1mm)																					
Unidentifiable Seed Fragments (1mm)	5	11	5	9	11	4		9	6	5	9	1	1	6	3	5			7		
Cerealia frags (1mm)																					
Hordeum frags (1mm)																					
Nutshell frag (1mm)																					
Intedeterminate cereal (1mm)																					
Unks non-Poaceae (1mm)		2		1		4			4		1			1	2	1			5		1
Unidentifiable seed fragments (.5mm)				6	6	23			2				1		2	2			4	1	
Unks non-Poaceae (.5mm)		2		1	4		1		5	2	7	3	5	3	6	6		2	10	4	1
Fabaceae frags (.5mm)																					
Indeterminate rachis (.5mm)				8	8	13			10	1				4							
CLINKER AND PARENCHYMA																					
Clinker (2mm)																					
Clinker (1mm)																					
Clinker (.5mm)																					
Parenchyma (2mm)			10		2						3		3	6							
Parenchyma (1mm)			14	13	65			6	16	32	32	4	11	13	30						
RACHIS FRAGMENTS																					
H. vul. rach (2mm)																					
T. aest rach (2mm)																					
T. aest/dur rach (2mm)															2						
T. dur rach (2mm)																					
Trit aest/dur node (2mm)																					
Trit sp. rach (2mm)																					
Wild rachis (2mm)		1													1						
Frag rachis (1mm)																					
Hordeum sp. rachis (1mm)		3	6	2	5	2			1	1	1	1			9				1		

FlotNum	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283
T. aest rach (1mm)			1		2	1															
T. aest/dur rach (1mm)		8	5	8	8	12	3		8		8	2	11		7						
T. aest/dur rach node (1mm)		19	14	15	40	28	7	8	34	14	26	8	11		28	1			3		
T. aest/dur rach internode (1mm)															5	4					
T. dur rach (1mm)																					
T. mono/di rach (1mm)		1																	1		
T. sp node (1mm)								1													
T. sp rach (1mm)																					
Wild Rachis (1mm)		8	3	5	5	10	3		3		9			5	12						
Hordeum sp. rach (.5mm)		9	6	3	14	6	2	2	10	3	5	4	1		11	1			1	3	
Hordeum sp. Rach internode (.5mm)															8						
Triticum aest rach (.5mm)																				1	
Triticum aest/dur rach (.5mm)					5	3			2	1			1								
Triticum aest/dur rach node (.5mm)		1		2	6	4			4		1	3	3		8						
Triticum sp. node (.5mm)																1				2	
Triticum mono/di rach (.5mm)															1						
Triticum sp. internode (.5mm)				6												1		2		5	1
Wild rachis (.5mm)		4		3			2				4	2	1	1	8						
CULMS AND ROOTS																					
Grass Culms (2mm)		3	1		1	1			1				2		3	4				1	
Grass Culms (1mm)		20	7	7	16	14	1	3	5	15		6	4	3	5						
Grass Culm (.5mm)		1		4	2	4				1	2	2	1		5						
Poaceae root (2mm)																					
Poaceae root (1mm)																					
BONE																					
Bone (2mm)		3													1					1	
Bone (1mm)			5	1	7	4		13					1	5	3	1					
Bone (.5mm)		8	5		6	3		1	1				4		6			1			
SHELL																					
Shell (2mm)		6	1	2	1	2		9			2				12					4	
Shell (1mm)	36	13	5	4	8	12		129	6		7		4	3	40						
Shell Burnt (1mm)																					
Shell (.5mm)	47	36	10	7	12	21		216	12	2	25		5	18	46						
OTHER																					
Carbonized insect (2mm)																					
Carbonized insect (1mm)																					
Carbonized insect (.5mm)																					
Dung (2mm)																					
Dung (1mm)																					
Fish Scale (1mm)																					

Unit	L-Sect	L-Sect	L-Sect	L-Sect	L-Sect	L-Sect	L-Sect	L-Sect	L-Sect	L-Sect	L-Sect	L-Sect	L-Sect	L-Sect	L-Sect	L-Sect	CI9	BP48	CQ21	CS13	AX55
Locus	16	20	23	15	24	21	20	27	28	24	24	18	24	25	13	20	5	18	5	43	14
SG		4.2			4.3		4.4			4.1	4.2		4.4					12			5
Bag	96	125	162	87	172	151	133	209	202	174	170	106	171	183	82	136	30	191	42	10	136
FlotNum	**284**	**285**	**286**	**287**	**288**	**289**	**290**	**291**	**292**	**293**	**294**	**295**	**296**	**297**	**281-2**	**280-2**	**298**	**299**	**300**	**301**	**302**
Flotvol (l)	7	5	7	6.5	5	6	8	7	7	5	8	6	6	5	4	6	25	11.5	5	4	5
TotWt (g)																	43.58	13.3111	2.439	127.804	1.6388
>2mm # seeds	0	0	1	3	0	0	1	6	5	1	0	0	0	4	2	0	0	17	6	1	2
>1mm # seeds	1	0	0	0	0	0	0	1	4	0	0	0	0	2	0	0	3	237	0	0	4
>.5mm # seeds	4	1	2	7	1	5	3	10	10	1	1	1	0	3	0	1	3	117	0	0	4
>2mm charcoal ct	44	9	19	20	0	28	26	17	14	2	5	57	2	34	38	13	0	66	1	2	8
>2mm charcoal wt	0.3878	0.0231	0.172	0.1342	0	0.1382	0.2282	0.1385	0.1566	0.0067	0.297	0.3302	0.0047	0.3094	0.2146	0.0976	0	0.3352	0.01	0.01	0.0673
>1mm charcoal wt	0.3484	0.0252	0.1021	0.3186	0	0.2608	0.1206	0.1678	0.1271	0.0097	0.0225	0.2134	0.0313	0.2241	0.0849	0.0505	0.0122	0.4397	0.045	0.0278	0.0305
DOMESTICATES																					
Cicer arietinum (2mm)																					
Hordeum vulgare (2mm)				1				6	2	1				2				8	2	1	1
Lens culinaris (2mm)			1						1					1							
Pisum sativum (2mm)																					
Prunus sp.cf. cerasus (2mm)																					
Secale cereale (2mm)																					
Triticum aestivum/durum (2mm)																		3	1		1
Triticum sp. (2mm)				1			1								2			1	1		
Triticum dio (2mm)									1												
Triticum mono (2mm)																					
Triticum mono/di (2mm)				1																	
Triticum spelta (2mm)																					
Vitis vinifera (2mm)									1					1							
Vitis sp. (2mm) pedicel																					
Vitis sp. (2mm) frag																					
Vicia faba (2mm)																					
Vicia ervilia (2mm)																		2	1		
Ficus carica (1mm)														2							
Hordeum sp. (1mm)								1													
Hordeum distichon (1mm)																					
Lathyrus sativa (1mm)																					
Lens culinaris (1mm)																					
Punica granatum (1mm)																					
Secale cereale (1mm)																					
Triticum sp. (1mm)																					
Vicia sp. (1mm)																					
Vitis vinifera (1mm)																					
Vitis sp. (1mm) pedicel																					
Vitis sp. (1mm) frag																					
Ficus carica (.5mm)							1	6	4		1	1		1				3			
Punica granatum (.5mm)																					
Vitis vinifera (.5mm)																					
Vitis sp. (.5mm) pedicel																					
GENERAL FAMILIES																					
Fabaceae (2mm)																			1		
Poaceae (2mm)																					
Asteraceae (1mm)																					
Amaranthaceae (1mm)																	1				
Boraginaceae (1mm)																					
Brassicaceae (1mm)																					
Caryophyllaceae (1mm)																					
Chenopodiaceae (1mm)																					
Cyperaceae (1mm)																					
Dipsacaceae (1mm)																					
Fabaceae (1mm)																		2			
Lamiaceae (1mm)																					
Malvaceae (1mm)																					
Polygonaceae (1mm)																					
Poaceae (1mm)																		41			
Poaceae Frags (1mm)														3				26			

FlotNum	**284**	**285**	**286**	**287**	**288**	**289**	**290**	**291**	**292**	**293**	**294**	**295**	**296**	**297**	**281-2**	**280-2**	**298**	**299**	**300**	**301**	**302**
Amaranthaceae (.5mm)																					
Apiaceae (.5mm)																					
Asteraceae (.5mm)						1															
Boraginaceae (.5mm)					1	1															
Brassicaceae (.5mm)																					
Caryophyllaceae (.5mm)																					
Chenopodiaceae (.5mm)																		1			
Cyperaceae (.5mm)																					
Fabaceae (.5mm)	1							1													
Lamiaceae (.5mm)																					
Malvaceae (.5mm)																					
Papaveraceae (.5mm)				1																	
Poaceae (.5mm)			1	4		2	1			1								33			
Poaceae Frags (.5mm)	1			3		2												27			
Polygonaceae (.5mm)																		1			
Portulaceae (.5mm)																					
Rubiaceae (.5mm)																					
Scrophulariaceae (.5mm)																					
Solanaceae (.5mm)																		1			
WILD OR WEEDY																					
Arnebia sp (2mm)																					
Avena sp. (2mm)																					
Bromus sp. (2mm)																					
Convolvulus (2mm)																					
Galium sp.(2mm)																		2			
Hippocrepis (2mm)																					
Hordeum murinum/boeticum (2mm)																					
Malva sp. (2mm)																					
Phalaris sp. (2mm)																					
Adonis (1mm)																					
Agrostemma / Cerastium (1mm)																					
Ajuga sp. (1mm)																					
Amaranthus (1mm)																					
Androsace maxima (1mm)																					
Anthemis (1mm)																					
Asparagus (1mm)																					
Asphodelus (1mm)																					
Astragalus sp. (1mm)																		1			
Atriplex sp. (1mm)																					
Avena sp. (1mm)																					
Bellevalia (1mm)																					
Brassica (1mm)																					
Bupleurum sp. (1mm)																					
Camelina (1mm)																					
Carex (1mm)																					
Centaurea-type (1mm)																					
Cephalaria syriaca (1mm)																					
cf. Asparagus (1mm)																					
cf. Setaria (1mm)																					
Convolvulus (1mm)																					
Coronilla sp. (1mm)																					
Eleocharis (1mm)																					
Eremo/Agropyron (1mm)																					
Euphorbia (1mm)																					
Fumaria (1mm)																					
Galium sp. (1mm)																					
Glaucium (1mm)																					
Heliotropium (1mm)																					
Hippocrepis sp. (1mm)																					
Hordeum murinum / boeticum (1mm)																					
Hyoscyamus (1mm)																					
L. usitatissimum (1mm)																					
Lavatera (1mm)																					

FlotNum	284	285	286	287	288	289	290	291	292	293	294	295	296	297	281-2	280-2	298	299	300	301	302
Lolium sp. (1mm)																					
Malva sp. (1mm)																	2	1			2
Medicago-type (1mm)																					
Melilotus/Trifolium (1mm)																		184			
Onopordum / Eleusine (1mm)																					
Ornithogalum-type (1mm)																					
Papaver sp. (1mm)																					
Peganum harmala (1mm)																					
Phalaris sp. (1mm)																					2
Plantago sp. (1mm)																					
Polygonum sp. (1mm)																					
Portulaca (1mm)																					
Rumex (1mm)																					
Salsola (1mm)																					
Scirpus (1mm)																					
Scorpiurus (1mm)																					
Silene sp (1mm)																					
Stipa (1mm)																					
Teucrium sp. (1mm)																					
Thymelaea sp. (1mm)																					
Trigonella (1mm)																		1			
Trigonella coele-syriaca (1mm)																					
Vaccaria (1mm)																					
Veronica (1mm)																					
Aizoon sp. (.5mm)																					
Agrostemma (.5mm)																					
Ajuga sp. (.5mm)																					
Amaranthus sp. (.5mm)																		1			1
Androsace maxima (.5mm)																					
Anthemis (.5mm)																					
Artemisia (.5mm)																					
Asparagus (.5mm)																					
Astragalus sp. (.5mm)				1																	
Atriplex (.5mm)																					
Avena (.5mm)																					
Bellevalia (.5mm)																					
Brassica (.5mm)																					
Bupleurum (.5mm)																					
Calendula (.5mm)																					
Carex / Scirpus (.5mm)																					
Centaurea (.5mm)																					
Cerastium (.5mm)																					
cf. Berberis (.5mm)																					
cf. Camelina (.5mm)																					
Chenopodium album (.5mm)																					
Convolvulus (.5mm)																					
Coronilla sp. (.5mm)																					
Eleocharis (.5mm)																					
Eragrostis sp. (.5mm)																					
Eremo/Agropyron (.5mm)																					
Erodium cicutarium awn (.5mm)																					
Erodium sp (.5mm)																					
Euphorbia (.5mm)																					
Fumaria sp. (.5mm)																					
Glaucium sp. (.5mm)																					
Heliotropium (.5mm)																					
Hippocrepis sp. (.5mm)																		1			
Hordeum murinum / boeticum (.5mm)																					
Hyoscyamus (.5mm)																					
Lavatera (.5mm)																					
Malva sp. (.5mm)																	2				
Medicago (.5mm)																					
Melilotus/Trifolium (.5mm)									6									45			1

FlotNum	284	285	286	287	288	289	290	291	292	293	294	295	296	297	281-2	280-2	298	299	300	301	302
Melilotus/Trifolium punctate (.5mm)																					
Ornithogalum (.5mm)																					
Papaver sp. (.5mm)																					
Peganum harmala (.5mm)																					
Phalaris sp. (.5mm)																					
Phleum (.5mm)																					
Plantago sp. (.5mm)														1				2			
Polygonum sp. (.5mm)																					
Portulaca (.5mm)																					
Rumex (.5mm)																					
Salsola (.5mm)																					
Schinus (.5mm)																					
Scirpus (.5mm)																					
Scorpiurus (.5mm)																					
Silene sp. (.5mm)																					
Stellaria (.5mm)																					
Suaeda (.5mm)																	1	1			
Teucrium sp. (.5mm)																					
Thymelaea sp (.5mm)																					
Trifolium cf. repens (.5mm)																					
Trigonella astroites (.5mm)																					1
Trigonella sp. (.5mm)				1																	
Vaccaria (.5mm)																					
Verbascum (.5mm)																					
Veronica (.5mm)																					
Ziziphora (.5mm)																					
UNKS OR FRAGS																					
Cerealia frags (2mm)				1				7	12					1	4			24			2
Hordeum frags (2mm)																					
Nutshell frag (2mm)																					
Unidentifiable Poaceae frag (2mm)									4												
Unidentifiable seed frag (2mm)		2		1														32			1
Unk non-Poac (2mm)																		1			
Fabaceae frags (2mm)																					
Indeterminate cereal (2mm)																					
Indeterminate rachis (1mm)																		31			
Fabaceae Frags (1mm)																					
Unidentifiable Seed Fragments (1mm)																1		29			13
Cerealia frags (1mm)																					
Hordeum frags (1mm)																					
Nutshell frag (1mm)																					
Intedeterminate cereal (1mm)																					
Unks non-Poaceae (1mm)	1								4									7			
Unidentifiable seed fragments (.5mm)	2							3										16			3
Unks non-Poaceae (.5mm)	3	1	1			1	1	3						1		1		28			1
Fabaceae frags (.5mm)																					
Indeterminate rachis (.5mm)																					1
CLINKER AND PARENCHYMA																					
Clinker (2mm)																					
Clinker (1mm)																					
Clinker (.5mm)																					
Parenchyma (2mm)																					
Parenchyma (1mm)																					
RACHIS FRAGMENTS																					
H. vul. rach (2mm)																					
T. aest rach (2mm)																					
T. aest/dur rach (2mm)																					
T. dur rach (2mm)																					
Trit aest/dur node (2mm)																		1			
Trit sp. rach (2mm)																					
Wild rachis (2mm)																					
Frag rachis (1mm)																					
Hordeum sp. rachis (1mm)																		5			

FlotNum	284	285	286	287	288	289	290	291	292	293	294	295	296	297	281-2	280-2	298	299	300	301	302
T. aest rach (1mm)																					
T. aest/dur rach (1mm)		1																15			
T. aest/dur rach node (1mm)																		99			
T. aest/dur rach internode (1mm)																					1
T. dur rach (1mm)																					
T. mono/di rach (1mm)																					
T. sp node (1mm)															1						
T. sp rach (1mm)																					
Wild Rachis (1mm)																		26			
Hordeum sp. rach (.5mm)	2			1					1									12			
Hordeum sp. Rach internode (.5mm)																					
Triticum aest rach (.5mm)	3																				
Triticum aest/dur rach (.5mm)																					
Triticum aest/dur rach node (.5mm)																		4			
Triticum sp. node (.5mm)																					
Triticum mono/di rach (.5mm)																		1			
Triticum sp. internode (.5mm)			1	1			3														
Wild rachis (.5mm)																		5			
CULMS AND ROOTS																					
Grass Culms (2mm)																		8			
Grass Culms (1mm)																		20			
Grass Culm (.5mm)				1					1												
Poaceae root (2mm)																					
Poaceae root (1mm)																					
BONE																					
Bone (2mm)																					
Bone (1mm)																1					
Bone (.5mm)	3		1																		
SHELL																					
Shell (2mm)																					
Shell (1mm)																	14				
Shell Burnt (1mm)																					
Shell (.5mm)	6		4														40			3	
OTHER																					
Carbonized insect (2mm)																					
Carbonized insect (1mm)																					
Carbonized insect (.5mm)																					
Dung (2mm)																					
Dung (1mm)																					
Fish Scale (1mm)																					

Unit	AX55	AW54	AW54	AW54	BR44	AW54	AW54	AW54	AX55	AX55	BR44	BR44	BR44	BR44	BR44	BP49	CL13	CL13	CL13	CL13	AX55
Locus	12	10	10	10	51	10	10	10	8	18	51	65	65	65	65	13	13	10	9	12	20
SG	23/24	15	3	8	4		18	10	24		3	4	4	3	3	21	21/16	14	14	21/16	24
Bag	139	232	228	148	483	230	231	149	92	200	488	570	570	565	568	129	126	111	108	124	250
FlotNum	**303**	**304**	**305**	**306**	**307**	**308**	**309**	**310**	**311**	**312**	**313**	**314**	**315**	**316**	**317**	**318**	**319**	**320**	**321**	**322**	**323**
Flotvol (l)	12	6	5	6	5	6	6.5	7	13	7.5	33	19.5	17.5	14.5	1.5	12	3	13	10	18.5	10.5
TotWt (g)	4.3197	23.2839	3.7451	6.7364	9.3109	4.3469	5.8901	5.7781	7.8065	3.6244	61.91	21.2322	7.4184	21.6987	0.7716	9.8751	1.6888	22.07	11.4225	16.4106	5.0065
>2mm # seeds	1	3	7	21	3	8	3	4	2	0	38	14	8	9	1	9	0	0	1	0	5
>1mm # seeds	3	1	6	2	23	5	6	5	1	1	196	30	12	17	1	72	1	5	4	9	3
>.5mm # seeds	3	3	3	4	3	7	6	4	5	3	162	38	24	40	8	48	0	0	0	0	4
>2mm charcoal ct	5	7	28	101	273	22	12	12	114	8	2029	118	54	126	17	29	1		2	14	28
>2mm charcoal wt	0.0326	0.0404	0.1635	0.7376	2.4076	0.1653	0.055	0.0437	3.1839	0.0349	15.7271	0.9936	0.3383	0.9095	0.1159		0.0182		0.0153	0.1049	0.22
>1mm charcoal wt	0.0705	0.0409	0.0812	0.8085	1.7955	0.1899	0.1432	0.0862	0.2873	0.0872	10.6458				0.0906			0.0022		0.0366	
DOMESTICATES																					
Cicer arietinum (2mm)																					
Hordeum vulgare (2mm)			2	2	2				1		13	5	2	4		7					2
Lens culinaris (2mm)											1	1									
Pisum sativum (2mm)																					
Prunus sp.cf. cerasus (2mm)																					
Secale cereale (2mm)														1							
Triticum aestivum/durum (2mm)							1				7	4	1								1
Triticum sp. (2mm)			2	1	1	3		2			7				1	1					
Triticum dio (2mm)			2	1									1								
Triticum mono (2mm)																					
Triticum mono/di (2mm)																					
Triticum spelta (2mm)																					
Vitis vinifera (2mm)		1		16		4	2	1				2	2	1							2
Vitis sp. (2mm) pedicel			1								1										
Vitis sp. (2mm) frag						1								1							
Vicia faba (2mm)								1													
Vicia ervilia (2mm)											3	1		3		1			1		
Ficus carica (1mm)	1										2	1	1								
Hordeum sp. (1mm)											3					2					
Hordeum distichon (1mm)																					
Lathyrus sativa (1mm)																					
Lens culinaris (1mm)																					
Punica granatum (1mm)																					
Secale cereale (1mm)											2										
Triticum sp. (1mm)														1							
Vicia sp. (1mm)																					
Vitis vinifera (1mm)				2			1						1								1
Vitis sp. (1mm) pedicel						9	2														
Vitis sp. (1mm) frag						1	1							1							
Ficus carica (.5mm)				3		3	2	3	2		15	12	9	7	2						1
Punica granatum (.5mm)																					
Vitis vinifera (.5mm)				1																	
Vitis sp. (.5mm) pedicel											1										
GENERAL FAMILIES																					
Fabaceae (2mm)		1	1						1		3	1									
Poaceae (2mm)											2										
Asteraceae (1mm)																					
Amaranthaceae (1mm)											1										
Boraginaceae (1mm)								2		1		1	1				1	5	4	8	
Brassicaceae (1mm)																					
Caryophyllaceae (1mm)																					
Chenopodiaceae (1mm)																					
Cyperaceae (1mm)					1																
Dipsacaceae (1mm)											3										
Fabaceae (1mm)							1				12	2		1							
Lamiaceae (1mm)											1										
Malvaceae (1mm)											1										
Polygonaceae (1mm)											1										
Poaceae (1mm)					14						88	10	4	7		12					1
Poaceae Frags (1mm)	1		1		7					1	57	12	8	10		15					1

FlotNum	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323
Amaranthaceae (.5mm)																					
Apiaceae (.5mm)																					
Asteraceae (.5mm)																					
Boraginaceae (.5mm)																					1
Brassicaceae (.5mm)			1								3			1							
Caryophyllaceae (.5mm)																					
Chenopodiaceae (.5mm)																2					
Cyperaceae (.5mm)											2										
Fabaceae (.5mm)											1										1
Lamiaceae (.5mm)																					
Malvaceae (.5mm)																1					
Papaveraceae (.5mm)																					
Poaceae (.5mm)	1				2						78	16	7	14	5	25					
Poaceae Frags (.5mm)	1				3		1	1			71	10	12	9							
Polygonaceae (.5mm)																					
Portulaceae (.5mm)																					
Rubiaceae (.5mm)																					
Scrophulariaceae (.5mm)																					
Solanaceae (.5mm)																					
WILD OR WEEDY																					
Arnebia sp (2mm)																					
Avena sp. (2mm)																					
Bromus sp. (2mm)																					
Convolvulus (2mm)																					
Galium sp.(2mm)																					
Hippocrepis (2mm)																					
Hordeum murinum/boeticum (2mm)																					
Malva sp. (2mm)																					
Phalaris sp. (2mm)																					
Adonis (1mm)												1				1					
Agrostemma / Cerastium (1mm)																					
Ajuga sp. (1mm)																					
Amaranthus (1mm)																					
Androsace maxima (1mm)																					
Anthemis (1mm)																					
Asparagus (1mm)																					
Asphodelus (1mm)																					
Astragalus sp. (1mm)											4	1									1
Atriplex sp. (1mm)																					
Avena sp. (1mm)					1																
Bellevalia (1mm)																					
Brassica (1mm)																					
Bupleurum sp. (1mm)																					
Camelina (1mm)																					
Carex (1mm)																					
Centaurea-type (1mm)											13										
Cephalaria syriaca (1mm)																					
cf. Asparagus (1mm)																					
cf. Setaria (1mm)																					
Convolvulus (1mm)																					
Coronilla sp. (1mm)											4										
Eleocharis (1mm)			1			1															
Eremo/Agropyron (1mm)																					
Euphorbia (1mm)																					
Fumaria (1mm)			1			1														1	
Galium sp. (1mm)											1										
Glaucium (1mm)																					
Heliotropium (1mm)						1															
Hippocrepis sp. (1mm)											3										
Hordeum murinum / boeticum (1mm)					2											1					
Hyoscyamus (1mm)											1										
L. usitatissimum (1mm)																					
Lavatera (1mm)																					

FlotNum	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323
Lolium sp. (1mm)																					
Malva sp. (1mm)		1			2		1				5	1		2							
Medicago-type (1mm)								1													
Melilotus/Trifolium (1mm)	1										16	8	1	2		53					
Onopordum / Eleusine (1mm)																					
Ornithogalum-type (1mm)												1									
Papaver sp. (1mm)																					
Peganum harmala (1mm)																					
Phalaris sp. (1mm)	1		1			1	1	1	1		4			2							
Plantago sp. (1mm)																					
Polygonum sp. (1mm)											1										
Portulaca (1mm)			1		1																
Rumex (1mm)																					
Salsola (1mm)																					
Scirpus (1mm)																					
Scorpiurus (1mm)																					
Silene sp (1mm)											11	1									
Stipa (1mm)																					
Teucrium sp. (1mm)																					
Thymelaea sp. (1mm)																					
Trigonella (1mm)																1					
Trigonella coele-syriaca (1mm)																					
Vaccaria (1mm)																					
Veronica (1mm)																					
Aizoon sp. (.5mm)																					
Agrostemma (.5mm)																					
Ajuga sp. (.5mm)																1					
Amaranthus sp. (.5mm)																					
Androsace maxima (.5mm)																					
Anthemis (.5mm)												1		2							
Artemisia (.5mm)																					
Asparagus (.5mm)																					
Astragalus sp. (.5mm)						1		1			1										
Atriplex (.5mm)																					
Avena (.5mm)																					
Bellevalia (.5mm)																					
Brassica (.5mm)																					
Bupleurum (.5mm)											1										
Calendula (.5mm)																					
Carex / Scirpus (.5mm)																					
Centaurea (.5mm)											2										
Cerastium (.5mm)																					
cf. Berberis (.5mm)																					
cf. Camelina (.5mm)																2					
Chenopodium album (.5mm)																					
Convolvulus (.5mm)																					
Coronilla sp. (.5mm)											2		1	3							
Eleocharis (.5mm)																					
Eragrostis sp. (.5mm)																					
Eremo/Agropyron (.5mm)																					
Erodium cicutarium awn (.5mm)																					
Erodium sp (.5mm)																					
Euphorbia (.5mm)																					
Fumaria sp. (.5mm)																					
Glaucium sp. (.5mm)																					
Heliotropium (.5mm)																					
Hippocrepis sp. (.5mm)											8										
Hordeum murinum / boeticum (.5mm)																					
Hyoscyamus (.5mm)											1			2							
Lavatera (.5mm)																					
Malva sp. (.5mm)											1	1	1		1	1					
Medicago (.5mm)																					
Melilotus/Trifolium (.5mm)											1	1	2			8					

FlotNum	**303**	**304**	**305**	**306**	**307**	**308**	**309**	**310**	**311**	**312**	**313**	**314**	**315**	**316**	**317**	**318**	**319**	**320**	**321**	**322**	**323**
Melilotus/Trifolium punctate (.5mm)																					
Ornithogalum (.5mm)																					
Papaver sp. (.5mm)											1										
Peganum harmala (.5mm)																					
Phalaris sp. (.5mm)							2			2	6					1					1
Phleum (.5mm)											3										
Plantago sp. (.5mm)		1									3	1		1							
Polygonum sp. (.5mm)																					
Portulaca (.5mm)																					
Rumex (.5mm)																					
Salsola (.5mm)																					
Schinus (.5mm)																					
Scirpus (.5mm)																					
Scorpiurus (.5mm)																					
Silene sp. (.5mm)										1	9	3		2		1					
Stellaria (.5mm)																					
Suaeda (.5mm)											1										
Teucrium sp. (.5mm)																					
Thymelaea sp (.5mm)																					
Trifolium cf. repens (.5mm)																					
Trigonella astroites (.5mm)																					
Trigonella sp. (.5mm)													1								
Vaccaria (.5mm)																					
Verbascum (.5mm)																					
Veronica (.5mm)																					
Ziziphora (.5mm)																					
UNKS OR FRAGS																					
Cerealia frags (2mm)				3	3	1		2			16			5		4					
Hordeum frags (2mm)																					
Nutshell frag (2mm)																					
Unidentifiable Poaceae frag (2mm)																					
Unidentifiable seed frag (2mm)			7		2	1	9	5	2	3	13	15									
Unk non-Poac (2mm)				1									1								
Fabaceae frags (2mm)																					
Indeterminate cereal (2mm)	1	1				1					2		1								
Indeterminate rachis (1mm)					16						87	24			2	10					
Fabaceae Frags (1mm)																					
Unidentifiable Seed Fragments (1mm)	3	3	17		5	10	16	10	5	7	152	13		9	1	19			1		9
Cerealia frags (1mm)						1	1														
Hordeum frags (1mm)																					
Nutshell frag (1mm)																					
Intedeterminate cereal (1mm)		1									2										
Unks non-Poaceae (1mm)			2		2	1	2	1			19	3	4	2	1	2					
Unidentifiable seed fragments (.5mm)	2	18			4	5	3	1	1	9				24		9					
Unks non-Poaceae (.5mm)	2	2	2		1	3	2		3		23	3	3	8		6					
Fabaceae frags (.5mm)																					
Indeterminate rachis (.5mm)									1			10									
CLINKER AND PARENCHYMA									7												
Clinker (2mm)						5	1				21		5		2	8			1		2
Clinker (1mm)						41	28	5			152	52		31	11	46					19
Clinker (.5mm)																					
Parenchyma (2mm)						3															
Parenchyma (1mm)	1					40	21	10		2											
RACHIS FRAGMENTS																					
H. vul. rach (2mm)																					
T. aest rach (2mm)														1							
T. aest/dur rach (2mm)					4						24	1				1					
T. dur rach (2mm)																					
Trit aest/dur node (2mm)											3		1	2							
Trit sp. rach (2mm)													1								
Wild rachis (2mm)											7										
Frag rachis (1mm)																					
Hordeum sp. rachis (1mm)					6						54	6	3	4		27					

FlotNum	**303**	**304**	**305**	**306**	**307**	**308**	**309**	**310**	**311**	**312**	**313**	**314**	**315**	**316**	**317**	**318**	**319**	**320**	**321**	**322**	**323**
T. aest rach (1mm)											2		19								
T. aest/dur rach (1mm)					23						137	15		27		17					1
T. aest/dur rach node (1mm)					28	2		3			199	27	18	30	1	6					
T. aest/dur rach internode (1mm)																		1			
T. dur rach (1mm)											1										
T. mono/di rach (1mm)											1										
T. sp node (1mm)																					
T. sp rach (1mm)																					
Wild Rachis (1mm)		1			19		2				52	5	6	5		8					
Hordeum sp. rach (.5mm)									1		50	7	6	11	2						
Hordeum sp. Rach internode (.5mm)																					
Triticum aest rach (.5mm)																					
Triticum aest/dur rach (.5mm)											6	1		1							
Triticum aest/dur rach node (.5mm)					4							1	2	6							
Triticum sp. node (.5mm)																					
Triticum mono/di rach (.5mm)											1										
Triticum sp. internode (.5mm)																					
Wild rachis (.5mm)									1		15	1	2	2							
CULMS AND ROOTS																					
Grass Culms (2mm)					2						29	1		5		5					
Grass Culms (1mm)		2	1		14						56	6	5	14		13					
Grass Culm (.5mm)	1										3		1	1							
Poaceae root (2mm)																4					
Poaceae root (1mm)																					
BONE																					
Bone (2mm)							1					1									1
Bone (1mm)	2				1						1		1	1		1					
Bone (.5mm)							1		5			2	1								3
SHELL																					
Shell (2mm)					1		1	1				6	2	2			3	5	12	34	
Shell (1mm)	1		10			3	1		3	6	6	9	2	6		6	1	20	32		5
Shell Burnt (1mm)																					
Shell (.5mm)							5	1		3							6	11			12
OTHER									7												
Carbonized insect (2mm)																					
Carbonized insect (1mm)																					
Carbonized insect (.5mm)																					
Dung (2mm)											2	3		5							1
Dung (1mm)											1			3							
Fish Scale (1mm)																					

Unit	AW55	AW55	AW55	AW55	AW55	AX55	AX55	AX55	AX55	AX55	AX55	AX55	AX55	AW54	AW54	AW54	AW54	AW54	AW54	AX55	AX55
Locus	3	3	3	3	3	27	14	14	14	13	28	28	17	6	20	9	12	21	9	18	18
SG	24	13/14	20	5/10	2/7	20	5/10	9	8	6	16	13	23						24	18/19/23/24	
Bag	107	111	108	109	110	242	243	244	245	246	247	248	249	129	210	188	205	248	122	251	198
FlotNum	**324**	**325**	**326**	**327**	**328**	**329**	**330**	**331**	**332**	**333**	**334**	**335**	**336**	**337**	**338**	**339**	**340**	**341**	**342**	**343**	**344**
Flotvol (l)	6.5	13	7.5	6.5	7	6	7	6.5	5	5	6	5	11.5	7	6	6	6	6.5	8	11	7
TotWt (g)	5.5705	2.5053	4.1629	1.6618	3.9933	4.5634	5.4328	3.1111	2.1029	5.4512	2.5361	2.4282	8.6316	3.0887	5.2113	5.6509	5.3445	2.9493	9.3006	9.2023	2.0329
>2mm # seeds	0	2	1	4	2	0	1	1	0	1	7	0	2	0	2	5	1	3	7	4	1
>1mm # seeds	2	1	0	1	0	0	5	2	2	9	2	1	4	0	1	3	2	1	3	5	2
>.5mm # seeds	5	2	1	0	1	2	5	4	2	6	5	3	5	2	2	2	4	2	2	14	3
>2mm charcoal ct	4	28	2	3	15	4	8	6	4	4	4	3	23	2	73	22	2	11	31	71	13
>2mm charcoal wt	0.0316	0.1742	0.007	0.0119	0.0824	0.0249	0.0808	0.0539	0.0346	0.0145	0.1001	0.0165	0.2412	0.0118	0.899	0.1107	0.0575	0.1271	0.3334	0.77	0.0526
>1mm charcoal wt	0.0117	0.1713	0.105	0.0507	0.0697	0.0165	0.0269	0.0607	0.0194	0.0648	0.0473	0.0261	0.1152	0.0111	0.1646	0.1835	0.0204	0.0605		0.2845	0.0837
DOMESTICATES																					
Cicer arietinum (2mm)																					
Hordeum vulgare (2mm)		1	1	3				1			2							2	2		1
Lens culinaris (2mm)		1			1								1		1			1			
Pisum sativum (2mm)																					
Prunus sp.cf. cerasus (2mm)																					
Secale cereale (2mm)																					
Triticum aestivum/durum (2mm)															1						
Triticum sp. (2mm)											3								4	1	
Triticum dio (2mm)										1											
Triticum mono (2mm)																					
Triticum mono/di (2mm)											2										
Triticum spelta (2mm)																					
Vitis vinifera (2mm)				1												2	1			3	
Vitis sp. (2mm) pedicel																					
Vitis sp. (2mm) frag																					
Vicia faba (2mm)																					
Vicia ervilia (2mm)																2			1		
Ficus carica (1mm)	1																		2		
Hordeum sp. (1mm)																					
Hordeum distichon (1mm)																					
Lathyrus sativa (1mm)																					
Lens culinaris (1mm)				1																	
Punica granatum (1mm)																					
Secale cereale (1mm)																					
Triticum sp. (1mm)																					
Vicia sp. (1mm)																			1		
Vitis vinifera (1mm)																				2	
Vitis sp. (1mm) pedicel		1		1													1				
Vitis sp. (1mm) frag																				2	1
Ficus carica (.5mm)	1		1		1						1		3			1	2		1	2	
Punica granatum (.5mm)																					
Vitis vinifera (.5mm)																					
Vitis sp. (.5mm) pedicel																					
GENERAL FAMILIES																					
Fabaceae (2mm)					1		1						1			1					
Poaceae (2mm)																					
Asteraceae (1mm)							1														
Amaranthaceae (1mm)																	1				
Boraginaceae (1mm)															1					1	1
Brassicaceae (1mm)																					
Caryophyllaceae (1mm)																					
Chenopodiaceae (1mm)																					
Cyperaceae (1mm)																					
Dipsacaceae (1mm)																					
Fabaceae (1mm)									1				1					1			
Lamiaceae (1mm)																					
Malvaceae (1mm)																					
Polygonaceae (1mm)																					
Poaceae (1mm)	1									3			1			1					
Poaceae Frags (1mm)					1		1	3				1						1	5		

FlotNum	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344
Amaranthaceae (.5mm)							1														
Apiaceae (.5mm)																					
Asteraceae (.5mm)																					
Boraginaceae (.5mm)																					
Brassicaceae (.5mm)																					1
Caryophyllaceae (.5mm)																					
Chenopodiaceae (.5mm)																					
Cyperaceae (.5mm)																					
Fabaceae (.5mm)												1									
Lamiaceae (.5mm)																					
Malvaceae (.5mm)										1											
Papaveraceae (.5mm)																					
Poaceae (.5mm)											1										1
Poaceae Frags (.5mm)							1	2			1							1			
Polygonaceae (.5mm)																					
Portulaceae (.5mm)																					
Rubiaceae (.5mm)																					
Scrophulariaceae (.5mm)																					
Solanaceae (.5mm)	1																				
WILD OR WEEDY																					
Arnebia sp (2mm)																					
Avena sp. (2mm)																					
Bromus sp. (2mm)																					
Convolvulus (2mm)																					
Galium sp.(2mm)																					
Hippocrepis (2mm)																					
Hordeum murinum/boeticum (2mm)																					
Malva sp. (2mm)																					
Phalaris sp. (2mm)																					
Adonis (1mm)																					
Agrostemma / Cerastium (1mm)																					
Ajuga sp. (1mm)																					
Amaranthus (1mm)																					
Androsace maxima (1mm)																					
Anthemis (1mm)																					
Asparagus (1mm)																					
Asphodelus (1mm)																					
Astragalus sp. (1mm)											1										
Atriplex sp. (1mm)																					
Avena sp. (1mm)																					
Bellevalia (1mm)																					
Brassica (1mm)																					
Bupleurum sp. (1mm)																					
Camelina (1mm)																					
Carex (1mm)																					
Centaurea-type (1mm)																					
Cephalaria syriaca (1mm)																					
cf. Asparagus (1mm)																					
cf. Setaria (1mm)																					
Convolvulus (1mm)																					
Coronilla sp. (1mm)																1					
Eleocharis (1mm)																					
Eremo/Agropyron (1mm)																					
Euphorbia (1mm)																					
Fumaria (1mm)										1							1				
Galium sp. (1mm)																					
Glaucium (1mm)																					
Heliotropium (1mm)																					
Hippocrepis sp. (1mm)																					
Hordeum murinum / boeticum (1mm)													1								
Hyoscyamus (1mm)																					
L. usitatissimum (1mm)																					
Lavatera (1mm)																					

FlotNum	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344
Lolium sp. (1mm)																					
Malva sp. (1mm)		1					1	1		3											
Medicago-type (1mm)																					
Melilotus/Trifolium (1mm)											1										
Onopordum / Eleusine (1mm)																					
Ornithogalum-type (1mm)																					
Papaver sp. (1mm)																					
Peganum harmala (1mm)																					
Phalaris sp. (1mm)																				1	1
Plantago sp. (1mm)																					
Polygonum sp. (1mm)																					
Portulaca (1mm)																					
Rumex (1mm)																					
Salsola (1mm)																					
Scirpus (1mm)																					
Scorpiurus (1mm)																					
Silene sp (1mm)																					
Stipa (1mm)																					
Teucrium sp. (1mm)																					
Thymelaea sp. (1mm)																				1	
Trigonella (1mm)																					
Trigonella coele-syriaca (1mm)																					
Vaccaria (1mm)									1												
Veronica (1mm)																					
Aizoon sp. (.5mm)																					
Agrostemma (.5mm)																					
Ajuga sp. (.5mm)																					
Amaranthus sp. (.5mm)																					
Androsace maxima (.5mm)																					
Anthemis (.5mm)																					
Artemisia (.5mm)																					
Asparagus (.5mm)																					
Astragalus sp. (.5mm)																			1		
Atriplex (.5mm)																					
Avena (.5mm)											1										
Bellevalia (.5mm)																					
Brassica (.5mm)																					
Bupleurum (.5mm)																					
Calendula (.5mm)																					
Carex / Scirpus (.5mm)																					
Centaurea (.5mm)																					
Cerastium (.5mm)																					
cf. Berberis (.5mm)																					
cf. Camelina (.5mm)																					
Chenopodium album (.5mm)																					
Convolvulus (.5mm)																					
Coronilla sp. (.5mm)																					
Eleocharis (.5mm)																					
Eragrostis sp. (.5mm)																					
Eremo/Agropyron (.5mm)																					
Erodium cicutarium awn (.5mm)																					
Erodium sp (.5mm)																					
Euphorbia (.5mm)																					
Fumaria sp. (.5mm)																					
Glaucium sp. (.5mm)									1												
Heliotropium (.5mm)																1					
Hippocrepis sp. (.5mm)								1													
Hordeum murinum / boeticum (.5mm)																					
Hyoscyamus (.5mm)																					
Lavatera (.5mm)																					
Malva sp. (.5mm)							1	1		3	1										
Medicago (.5mm)																					
Melilotus/Trifolium (.5mm)		1				1															

FlotNum	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344
Melilotus/Trifolium punctate (.5mm)																					
Ornithogalum (.5mm)									1					1							
Papaver sp. (.5mm)																					
Peganum harmala (.5mm)																					
Phalaris sp. (.5mm)																				1	1
Phleum (.5mm)																					
Plantago sp. (.5mm)																					
Polygonum sp. (.5mm)																					
Portulaca (.5mm)																					
Rumex (.5mm)																					
Salsola (.5mm)																					
Schinus (.5mm)																					
Scirpus (.5mm)																					
Scorpiurus (.5mm)																					
Silene sp. (.5mm)										1										3	
Stellaria (.5mm)																					
Suaeda (.5mm)																					
Teucrium sp. (.5mm)												1									
Thymelaea sp (.5mm)																					
Trifolium cf. repens (.5mm)																					
Trigonella astroites (.5mm)																					
Trigonella sp. (.5mm)													1								
Vaccaria (.5mm)							1														
Verbascum (.5mm)																					
Veronica (.5mm)																					
Ziziphora (.5mm)																					
UNKS OR FRAGS																					
Cerealia frags (2mm)							5				3	1				1	1		8	2	1
Hordeum frags (2mm)																					
Nutshell frag (2mm)																					
Unidentifiable Poaceae frag (2mm)																					
Unidentifiable seed frag (2mm)		2					8		1	1			2			58	6	6	17	3	2
Unk non-Poac (2mm)																					
Fabaceae frags (2mm)																			27		
Indeterminate cereal (2mm)																					
Indeterminate rachis (1mm)							1	1	1												1
Fabaceae Frags (1mm)																					
Unidentifiable Seed Fragments (1mm)	1	8		4	16	3	24	7	3	12	24	4			3	120	12	8		10	5
Cerealia frags (1mm)											1										
Hordeum frags (1mm)																					
Nutshell frag (1mm)																					
Intedeterminate cereal (1mm)																					
Unks non-Poaceae (1mm)							3	1		2		1	1			1					
Unidentifiable seed fragments (.5mm)			1	3	5	3								5			1				
Unks non-Poaceae (.5mm)	3	1				1	2	2		1	1	1	1	1	2		2	2		8	
Fabaceae frags (.5mm)																					
Indeterminate rachis (.5mm)																					
CLINKER AND PARENCHYMA																					
Clinker (2mm)						1													1	3	
Clinker (1mm)		13	1		1	1	12	5		2	1		10	1	4	15	5	5		23	5
Clinker (.5mm)					1												2				
Parenchyma (2mm)																3					
Parenchyma (1mm)		1	1		1		5	1		2					1	154					6
RACHIS FRAGMENTS																					
H. vul. rach (2mm)																					
T. aest rach (2mm)																					
T. aest/dur rach (2mm)																					
T. dur rach (2mm)																					
Trit aest/dur node (2mm)																					
Trit sp. rach (2mm)																					
Wild rachis (2mm)																					
Frag rachis (1mm)																					
Hordeum sp. rachis (1mm)																					

FlotNum	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344
T. aest rach (1mm)																					
T. aest/dur rach (1mm)							1								1			1			
T. aest/dur rach node (1mm)		1			1	1	2	1		1				1							1
T. aest/dur rach internode (1mm)							1														
T. dur rach (1mm)																				2	
T. mono/di rach (1mm)																					
T. sp node (1mm)																					
T. sp rach (1mm)																					
Wild Rachis (1mm)														1				1			
Hordeum sp. rach (.5mm)										1											
Hordeum sp. Rach internode (.5mm)																					
Triticum aest rach (.5mm)																					
Triticum aest/dur rach (.5mm)																					
Triticum aest/dur rach node (.5mm)																					
Triticum sp. node (.5mm)																					
Triticum mono/di rach (.5mm)																					
Triticum sp. internode (.5mm)																					
Wild rachis (.5mm)																					
CULMS AND ROOTS																					
Grass Culms (2mm)																					
Grass Culms (1mm)									1					2	1					1	
Grass Culm (.5mm)														1							
Poaceae root (2mm)																					
Poaceae root (1mm)																					
BONE																					
Bone (2mm)																		1			
Bone (1mm)				1	1								2					6		3	5
Bone (.5mm)				1									1			4				2	3
SHELL																					
Shell (2mm)		3	1									1	1	3				2	4	3	
Shell (1mm)	1	2	2	1	3	4	1	2				29	8	21	6			10		3	7
Shell Burnt (1mm)																					
Shell (.5mm)	14	2	1	1		20							3				1				
OTHER																					
Carbonized insect (2mm)																					
Carbonized insect (1mm)																					
Carbonized insect (.5mm)																					
Dung (2mm)									1						1				19		
Dung (1mm)											1							27	2		
Fish Scale (1mm)																					

Unit	AX55	AX55	AW54	AW54	BS44	BS44	BR44	BR44	BS44	BR44	BR44	BS44	BS44	BR44	BS44	BR44	BR44	BS44	BS44	AX55	AX55
Locus	18	18	3	3	82	80	56	65	80	56	46	82	80	51	82	51	42	82	90	31	19
SG			8	18/23	18	18	2	9	24	3	2	19	17	8	23	5	4/5	24	17/22	8,19,23,24	
Bag	195	191	87	105	480	308	545	578	285	537	468	463	301	499	473	507	513	435	445	290	189
FlotNum	**345**	**346**	**347**	**348**	**349**	**350**	**351**	**352**	**353**	**354**	**355**	**356**	**357**	**358**	**359**	**360**	**361**	**362**	**363**	**364**	**365**
Flotvol (l)	7	8	7	7	14	22	6	10	27	5	9	20	10	7	6	11	16	41	4.5	12	3
TotWt (g)	2.7528	4.003	10.9633	4.4535	17.2453	0.1784	5.4576	3.5672	52.0367	2.0889	7.7717	12.9484	7.8878	12.7186	7.0877	18.0089	28.05		14.4492		
>2mm # seeds	5	7	8	7	11	0	4	15	22	3	12	24	11	8	1	43	18	20	27	11	1
>1mm # seeds	4	5	6	0	12	0	24	18	151	4	90	31	29	46	10	37	106	71	292	10	0
>.5mm # seeds	1	6	32	1	25	0	33	33	207	9	104	69	33	68	27	78	95	58	549	9	2
>2mm charcoal ct	32	38	324	10	153		111	44	1130	67	98	139	56	328	62	163	904	224	120	43	4
>2mm charcoal wt	0.1875	0.3743	1.9779	0.0795	1.108		1.2331	0.413	10.08	0.62	0.94	1.49	0.52	2.99	1.61	1.27	8.8196	1.601	1.0685	0.4091	0.0194
>1mm charcoal wt	0.2369	0.4235	2.8215					0.4073		0.3024			0.8009	2.7464			4.933				0.0074
DOMESTICATES																					
Cicer arietinum (2mm)																					
Hordeum vulgare (2mm)	1				3		1	3	8	2	7	16	3	2		17	7	8	11	1	
Lens culinaris (2mm)	1		1					1				1				5		1	1	2	
Pisum sativum (2mm)																					
Prunus sp.cf. cerasus (2mm)																					
Secale cereale (2mm)																					
Triticum aestivum/durum (2mm)							1		4		3		6	2			3	7	2		
Triticum sp. (2mm)		1		2	3		2					1				5	4		1		
Triticum dio (2mm)		1																			
Triticum mono (2mm)								2													
Triticum mono/di (2mm)								1													
Triticum spelta (2mm)																					
Vitis vinifera (2mm)	3	3	6	2				8								14				5	1
Vitis sp. (2mm) pedicel			1								1										
Vitis sp. (2mm) frag			1																		
Vicia faba (2mm)																					
Vicia ervilia (2mm)				3	4				3	1		3		2	1	2	2	2	5	1	
Ficus carica (1mm)			4					2	1		1			1		7	1	1	1		
Hordeum sp. (1mm)								2			6	2	2	5			1	3	9	1	
Hordeum distichon (1mm)																			22		
Lathyrus sativa (1mm)																				1	
Lens culinaris (1mm)												1							1		
Punica granatum (1mm)																			2		
Secale cereale (1mm)																					
Triticum sp. (1mm)					1						1		1				1	1	1		
Vicia sp. (1mm)																					
Vitis vinifera (1mm)								2									1				
Vitis sp. (1mm) pedicel			4					2	1					1						1	
Vitis sp. (1mm) frag			2	1				13												1	
Ficus carica (.5mm)		3	25	1	4		4	17	16	1	8	19	6	2	14	31	7	8	68	4	1
Punica granatum (.5mm)																			2		
Vitis vinifera (.5mm)																1					
Vitis sp. (.5mm) pedicel																					
GENERAL FAMILIES																					
Fabaceae (2mm)		2							2			1						2			
Poaceae (2mm)																					
Asteraceae (1mm)													1								
Amaranthaceae (1mm)																					
Boraginaceae (1mm)	1		1						1		1		4	2			1	1	1		
Brassicaceae (1mm)									2								4				
Caryophyllaceae (1mm)																					
Chenopodiaceae (1mm)																					
Cyperaceae (1mm)								3													
Dipsacaceae (1mm)																					
Fabaceae (1mm)		2					2	1	10		2	2		1	1	1			8		
Lamiaceae (1mm)																					
Malvaceae (1mm)			1																		
Polygonaceae (1mm)																					
Poaceae (1mm)	1				7		13		64	2	46	9	11	25	5	7	54	29	56	2	
Poaceae Frags (1mm)	1	3			6			6	28	4	19	32	14	15	1		12	12	119	9	

FlotNum	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365
Amaranthaceae (.5mm)					2																
Apiaceae (.5mm)																					
Asteraceae (.5mm)									1					1				1			
Boraginaceae (.5mm)																					
Brassicaceae (.5mm)							1		1		2					1	1		21		
Caryophyllaceae (.5mm)																					
Chenopodiaceae (.5mm)									1				2				1	3			
Cyperaceae (.5mm)																					
Fabaceae (.5mm)					2														1		
Lamiaceae (.5mm)																			3		
Malvaceae (.5mm)																					
Papaveraceae (.5mm)																					
Poaceae (.5mm)	1	1			16		8	1	85	5	44	15	5	38	8	19	47	23	87		
Poaceae Frags (.5mm)			1		2				43		31	11	10	17		6	24	12	37		
Polygonaceae (.5mm)								1													
Portulaceae (.5mm)																					
Rubiaceae (.5mm)																					
Scrophulariaceae (.5mm)																					
Solanaceae (.5mm)									1												
WILD OR WEEDY																					
Arnebia sp (2mm)																					
Avena sp. (2mm)																					
Bromus sp. (2mm)																					
Convolvulus (2mm)																			1		
Galium sp.(2mm)									1											1	
Hippocrepis (2mm)												1									
Hordeum murinum/boeticum (2mm)											2										
Malva sp. (2mm)																					
Phalaris sp. (2mm)																					
Adonis (1mm)											1							1			
Agrostemma / Cerastium (1mm)																					
Ajuga sp. (1mm)													1								
Amaranthus (1mm)																2			4		
Androsace maxima (1mm)																					
Anthemis (1mm)											2										
Asparagus (1mm)																			1		
Asphodelus (1mm)																			1		
Astragalus sp. (1mm)											1		1					2	3		
Atriplex sp. (1mm)																					
Avena sp. (1mm)																					
Bellevalia (1mm)												1							3		
Brassica (1mm)												2									
Bupleurum sp. (1mm)																					
Camelina (1mm)												1									
Carex (1mm)											3								1		
Centaurea-type (1mm)									10		1						10		2		
Cephalaria syriaca (1mm)																					
cf. Asparagus (1mm)																					
cf. Setaria (1mm)																					
Convolvulus (1mm)																			6		
Coronilla sp. (1mm)							1		1	2			1						2		
Eleocharis (1mm)																					
Eremo/Agropyron (1mm)																					
Euphorbia (1mm)																		1			
Fumaria (1mm)								1			1								1		
Galium sp. (1mm)		1						1	1			1							5		
Glaucium (1mm)																					
Heliotropium (1mm)																	1				
Hippocrepis sp. (1mm)											1			1		1		2			
Hordeum murinum / boeticum (1mm)																			1		
Hyoscyamus (1mm)																			1		
L. usitatissimum (1mm)																			5		
Lavatera (1mm)																					

FlotNum	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365
Lolium sp. (1mm)																					
Malva sp. (1mm)							1	1	20		3		1			1	5	1	45		
Medicago-type (1mm)	1	1																			
Melilotus/Trifolium (1mm)					2		1	1	14		5	3		6			6	15		1	
Onopordum / Eleusine (1mm)																					
Ornithogalum-type (1mm)									3								2	2			
Papaver sp. (1mm)																					
Peganum harmala (1mm)																			21		
Phalaris sp. (1mm)									3		2	2				6	2	1	2	3	
Plantago sp. (1mm)								1	3									1	5		
Polygonum sp. (1mm)																					
Portulaca (1mm)									1		1			1							
Rumex (1mm)																1					
Salsola (1mm)																					
Scirpus (1mm)									1												
Scorpiurus (1mm)																3	4				
Silene sp (1mm)					1		1		2			1	1	2	1		3	3	28		
Stipa (1mm)																					
Teucrium sp. (1mm)					1														1		
Thymelaea sp. (1mm)														1							
Trigonella (1mm)							1		3		4					1		3	2		
Trigonella coele-syriaca (1mm)							1														
Vaccaria (1mm)																					
Veronica (1mm)									1												
Aizoon sp. (.5mm)												1									
Agrostemma (.5mm)																					
Ajuga sp. (.5mm)																					
Amaranthus sp. (.5mm)							1					1							7		
Androsace maxima (.5mm)																					
Anthemis (.5mm)							2		4		7	1					2		9		
Artemisia (.5mm)																					
Asparagus (.5mm)																			4		
Astragalus sp. (.5mm)									5		2	1					3	1			
Atriplex (.5mm)																					
Avena (.5mm)												4									
Bellevalia (.5mm)																					
Brassica (.5mm)																					
Bupleurum (.5mm)														1							
Calendula (.5mm)					1																
Carex / Scirpus (.5mm)								1			1	1							7		
Centaurea (.5mm)									2										6		
Cerastium (.5mm)		1									1								2		
cf. Berberis (.5mm)													3						8		
cf. Camelina (.5mm)									1												
Chenopodium album (.5mm)												3	1						1		
Convolvulus (.5mm)																					
Coronilla sp. (.5mm)									3	1	6			1			4		6		
Eleocharis (.5mm)																			3		
Eragrostis sp. (.5mm)																					
Eremo/Agropyron (.5mm)																					
Erodium cicutarium awn (.5mm)																					
Erodium sp (.5mm)																1			1		
Euphorbia (.5mm)																			1		
Fumaria sp. (.5mm)																					
Glaucium sp. (.5mm)																			2		
Heliotropium (.5mm)							1														
Hippocrepis sp. (.5mm)												3		4	1					1	
Hordeum murinum / boeticum (.5mm)																			1		
Hyoscyamus (.5mm)									2					1			2		10		
Lavatera (.5mm)																	1				
Malva sp. (.5mm)							2	1	11			2		3			4		14		
Medicago (.5mm)																					
Melilotus/Trifolium (.5mm)										1	1	3		1				3			

FlotNum	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365
Melilotus/Trifolium punctate (.5mm)																					
Ornithogalum (.5mm)									2		2					3	1		6		
Papaver sp. (.5mm)													1	2					1		
Peganum harmala (.5mm)																			3		
Phalaris sp. (.5mm)								1	1			1	3	3	1	3			4	1	
Phleum (.5mm)																					
Plantago sp. (.5mm)								2	14		1	1	1	2		2	3		25		
Polygonum sp. (.5mm)											1			1				1			
Portulaca (.5mm)											1								6		
Rumex (.5mm)									2										11		
Salsola (.5mm)																					
Schinus (.5mm)																					
Scirpus (.5mm)									2							1					
Scorpiurus (.5mm)																					
Silene sp. (.5mm)		1					1		11			6	4	4	3	9	3	5	20		
Stellaria (.5mm)																			1		
Suaeda (.5mm)									3										9		
Teucrium sp. (.5mm)																					
Thymelaea sp (.5mm)																					
Trifolium cf. repens (.5mm)																					
Trigonella astroites (.5mm)											1			1							
Trigonella sp. (.5mm)							3		4		6					1	1	1	1		
Vaccaria (.5mm)											3					1			6		
Verbascum (.5mm)									2										5		
Veronica (.5mm)																		1			
Ziziphora (.5mm)																					
UNKS OR FRAGS																					
Cerealia frags (2mm)	4		5	3			3		15			2				22		4	10	10	
Hordeum frags (2mm)									6			8									
Nutshell frag (2mm)																					
Unidentifiable Poaceae frag (2mm)																					
Unidentifiable seed frag (2mm)	2	3		2	6		1	5	12		2	1	3			11		6	5	8	
Unk non-Poac (2mm)									1					1			2		3		
Fabaceae frags (2mm)				36														4		6	
Indeterminate cereal (2mm)			1		1				3			1	2	1					3	1	
Indeterminate rachis (1mm)					3		8					3	5							1	
Fabaceae Frags (1mm)																1		2			
Unidentifiable Seed Fragments (1mm)	3	3	5		8		10	36	60	7	37	59	61						52	51	
Cerealia frags (1mm)			4									2				1				1	
Hordeum frags (1mm)																			8		
Nutshell frag (1mm)																		2			
Intedeterminate cereal (1mm)								1						7							
Unks non-Poaceae (1mm)	1	1					3	3	11		8	6	5	1	3	7	10	4	51	2	
Unidentifiable seed fragments (.5mm)																					
Unks non-Poaceae (.5mm)			7				10	9	33	1	17	7	7	3		5	15	11	187	3	1
Fabaceae frags (.5mm)																1					
Indeterminate rachis (.5mm)							2						4								
CLINKER AND PARENCHYMA																					
Clinker (2mm)			1	1			1	8		2	21	5		2	3	7	10		7		
Clinker (1mm)	13	11	21		14		19	34	80	12	84	36	17	15			46	16	52	45	
Clinker (.5mm)																					
Parenchyma (2mm)				1																	
Parenchyma (1mm)																				4	
RACHIS FRAGMENTS																					
H. vul. rach (2mm)																					
T. aest rach (2mm)									2												
T. aest/dur rach (2mm)					2		3		24			1		11			6	1	3		
T. dur rach (2mm)									1												
Trit aest/dur node (2mm)							1		9			1				2					
Trit sp. rach (2mm)																					
Wild rachis (2mm)									2		1						19				
Frag rachis (1mm)																					
Hordeum sp. rachis (1mm)		1			3		8	2	40		29	5	2	6	1	3	34	10	6		

FlotNum	**345**	**346**	**347**	**348**	**349**	**350**	**351**	**352**	**353**	**354**	**355**	**356**	**357**	**358**	**359**	**360**	**361**	**362**	**363**	**364**	**365**
T. aest rach (1mm)					1				6		2			2					2		
T. aest/dur rach (1mm)					8		16	2	161		45	21	8	52	18	12	98	23	61	1	
T. aest/dur rach node (1mm)					33		32	18	213	8	67	41	43	80	6	38	124	85	236	5	
T. aest/dur rach internode (1mm)																					
T. dur rach (1mm)									1					1					4		
T. mono/di rach (1mm)									1									1			
T. sp node (1mm)																					
T. sp rach (1mm)																					
Wild Rachis (1mm)					1		4	2	48	2	14	4	5	5	2	2	21	9	30		
Hordeum sp. rach (.5mm)	1				4		14	1	64	8	35	9	4	29	2	10	24	16	32		
Hordeum sp. Rach internode (.5mm)																					
Triticum aest rach (.5mm)																	10				
Triticum aest/dur rach (.5mm)								2	11		3	5	2	3		1		5	7		
Triticum aest/dur rach node (.5mm)					4			2	21	3	4	3	2	11	1		1	4	12		
Triticum sp. node (.5mm)																					
Triticum mono/di rach (.5mm)									1												
Triticum sp. internode (.5mm)																					
Wild rachis (.5mm)					2		9	3	15		13		1	3	2	3	2	6	20		
CULMS AND ROOTS																					
Grass Culms (2mm)					2		11	1	24		11		2	6	1	8	5	7	13		
Grass Culms (1mm)					7		9	9	63	1		11	5	13	3	10	48	18	57	4	
Grass Culm (.5mm)		1			3					2		2		3	1		1	2	3		
Poaceae root (2mm)							1							1			5	1	3		
Poaceae root (1mm)							1		6	2			2	5			2	3		2	
BONE																					
Bone (2mm)		1					1			1		1				3					
Bone (1mm)		1	2					2	8	3	1		1	1		5	2	3	1	3	1
Bone (.5mm)	4		9					3	4	2		1	1			19	2	3			
SHELL			4																		
Shell (2mm)	12	5						1	1	1		1	1	1	1	2	1	4			
Shell (1mm)	10	15	3		3			2	11	1	3	11	5	3			10	16	1	3	1
Shell Burnt (1mm)									1										5		
Shell (.5mm)																					
OTHER																					
Carbonized insect (2mm)																					
Carbonized insect (1mm)																					
Carbonized insect (.5mm)																					
Dung (2mm)		2	3				7		4		27		1	3	31	6		2	64		
Dung (1mm)			1				61		44		143	12	2	12			12	2			
Fish Scale (1mm)																					

Unit	AX55	AX55	AX55	AX55	AX55	AW54	AW54	AW54	AW54	AW54	BR43	BS43	BS43	BS44	BS44	BR41	AW54	AW54	AX55	AW55	AW54
Locus	16	15	12	15	14	3	3	3	3	3	53	27	27	80	80	46	3	3	8	5	3
SG	4	14	23	7,8	9	16	14	21,16	25	4,5,9,10	3	3	24	23	19		10	8,19,23,24	23	11,16	
Bag	179	178	159	134	135	104	106	55	57	107	277	280	279	299	270	235	58	56	57	83	27
FlotNum	**366**	**367**	**368**	**369**	**370**	**371**	**372**	**373**	**374**	**375**	**376**	**377**	**378**	**379**	**380**	**381**	**382**	**383**	**384**	**385**	**386**
Flotvol (l)	11	11	16	7	4	7	8	7.5	5	6	5.5	7	4	10	16	19	5	5	12	7	8
TotWt (g)																					
>2mm # seeds	25	5	2	3	4	2	8	1	1	1	4	2	4	12	6	4	0	1	1	7	3
>1mm # seeds	22	5	11	2	3	1	14	2	0	0	12	5	1	56	25	58	0	1	0	3	1
>.5mm # seeds	37	9	9	4	10	2	10	2	3	2	20	18	4	41	48	92	8	0	1	2	6
>2mm charcoal ct	36	5	85	9	6	8	15	7	7	2	72	20	27	248	128	74	1	1	51	7	13
>2mm charcoal wt	0.3191	0.022	2.2187	0.0368	0.029	0.0806	0.0535	0.0477	0.043	0.0388	0.5026	0.6882	0.1089	1.744	1.0585	0.4093	0.004	0.0067	1.7384	0.0624	0.1657
>1mm charcoal wt																				0.0657	
DOMESTICATES																					
Cicer arietinum (2mm)																					
Hordeum vulgare (2mm)	7	1	1	1	1	1	1				2	1	2	2	1	2			1	3	
Lens culinaris (2mm)											1										
Pisum sativum (2mm)	2																				
Prunus sp.cf. cerasus (2mm)																					
Secale cereale (2mm)																					
Triticum aestivum/durum (2mm)	4	2			2	1	1	1		1		1		8	3	1				2	
Triticum sp. (2mm)	4						2		1									1		2	1
Triticum dio (2mm)		1		2																	
Triticum mono (2mm)																					
Triticum mono/di (2mm)																					
Triticum spelta (2mm)																					
Vitis vinifera (2mm)	1	1					2								1						2
Vitis sp. (2mm) pedicel																			1		
Vitis sp. (2mm) frag																					
Vicia faba (2mm)																					
Vicia ervilia (2mm)			1										2		1						
Ficus carica (1mm)								1								1					
Hordeum sp. (1mm)												1		1	1	2				1	1
Hordeum distichon (1mm)																					
Lathyrus sativa (1mm)																					
Lens culinaris (1mm)																				1	
Punica granatum (1mm)																					
Secale cereale (1mm)																					
Triticum sp. (1mm)												2									
Vicia sp. (1mm)																					
Vitis vinifera (1mm)			5																		
Vitis sp. (1mm) pedicel							1							1			1				
Vitis sp. (1mm) frag			1								3						5				
Ficus carica (.5mm)	1		5		1		6	1		2	2	2		6	5	13	4		1		2
Punica granatum (.5mm)																					
Vitis vinifera (.5mm)																					
Vitis sp. (.5mm) pedicel																					
GENERAL FAMILIES																					
Fabaceae (2mm)	4																				
Poaceae (2mm)														1							
Asteraceae (1mm)																					
Amaranthaceae (1mm)																					
Boraginaceae (1mm)	2		1				14				1			1		1					
Brassicaceae (1mm)																					
Caryophyllaceae (1mm)																					
Chenopodiaceae (1mm)																					
Cyperaceae (1mm)																					
Dipsacaceae (1mm)																					
Fabaceae (1mm)			1								1			1							
Lamiaceae (1mm)																					
Malvaceae (1mm)																					
Polygonaceae (1mm)																					
Poaceae (1mm)	7				1			1			7		1	35	3	31					
Poaceae Frags (1mm)	18			3	4			3			5	9	1	33		19					1

FlotNum	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386
Amaranthaceae (.5mm)														1		1					
Apiaceae (.5mm)		1																			
Asteraceae (.5mm)																					
Boraginaceae (.5mm)		2																			
Brassicaceae (.5mm)									1						1						
Caryophyllaceae (.5mm)																					
Chenopodiaceae (.5mm)												1				2					
Cyperaceae (.5mm)						1															
Fabaceae (.5mm)	1			1	1						1				3						1
Lamiaceae (.5mm)																1					
Malvaceae (.5mm)																					
Papaveraceae (.5mm)																					
Poaceae (.5mm)	14		1		1						11	4	2	22	22	40					
Poaceae Frags (.5mm)	12	7		2	1					1	8	8	7	14	4	34					
Polygonaceae (.5mm)								1													
Portulaceae (.5mm)																					
Rubiaceae (.5mm)																					
Scrophulariaceae (.5mm)																					
Solanaceae (.5mm)																					
WILD OR WEEDY																					
Arnebia sp (2mm)																					
Avena sp. (2mm)														1							
Bromus sp. (2mm)																					
Convolvulus (2mm)																					
Galium sp.(2mm)																					
Hippocrepis (2mm)																					
Hordeum murinum/boeticum (2mm)																					
Malva sp. (2mm)																					
Phalaris sp. (2mm)																					
Adonis (1mm)																					
Agrostemma / Cerastium (1mm)																					
Ajuga sp. (1mm)																					
Amaranthus (1mm)																					
Androsace maxima (1mm)																1					
Anthemis (1mm)																					
Asparagus (1mm)																					
Asphodelus (1mm)																					
Astragalus sp. (1mm)			1												4			1			
Atriplex sp. (1mm)																					
Avena sp. (1mm)																					
Bellevalia (1mm)																					
Brassica (1mm)																					
Bupleurum sp. (1mm)																					
Camelina (1mm)																1					
Carex (1mm)																					
Centaurea-type (1mm)																					
Cephalaria syriaca (1mm)																					
cf. Asparagus (1mm)																					
cf. Setaria (1mm)																					
Convolvulus (1mm)																					
Coronilla sp. (1mm)																1					
Eleocharis (1mm)																					
Eremo/Agropyron (1mm)																					
Euphorbia (1mm)																					
Fumaria (1mm)												1									
Galium sp. (1mm)																					
Glaucium (1mm)																					
Heliotropium (1mm)																1					
Hippocrepis sp. (1mm)														2							
Hordeum murinum / boeticum (1mm)														1							
Hyoscyamus (1mm)																					
L. usitatissimum (1mm)																					
Lavatera (1mm)																1					

FlotNum	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386
Lolium sp. (1mm)																					
Malva sp. (1mm)	7	3	1		1	1						1		3	3	4					
Medicago-type (1mm)																1					
Melilotus/Trifolium (1mm)			1	1	1						1			2	9						
Onopordum / Eleusine (1mm)																					
Ornithogalum-type (1mm)															1	4					
Papaver sp. (1mm)																					
Peganum harmala (1mm)														1							
Phalaris sp. (1mm)	2		1								1			4		4					
Plantago sp. (1mm)																					
Polygonum sp. (1mm)																					
Portulaca (1mm)																					
Rumex (1mm)																					
Salsola (1mm)																					
Scirpus (1mm)																					
Scorpiurus (1mm)															1						
Silene sp (1mm)	1										1										
Stipa (1mm)																					
Teucrium sp. (1mm)																					
Thymelaea sp. (1mm)																					
Trigonella (1mm)														1		1					
Trigonella coele-syriaca (1mm)																					
Vaccaria (1mm)																					
Veronica (1mm)																					
Aizoon sp. (.5mm)																					
Agrostemma (.5mm)																					
Ajuga sp. (.5mm)																					
Amaranthus sp. (.5mm)	1					1	1								1	1	2				
Androsace maxima (.5mm)																					
Anthemis (.5mm)														1							
Artemisia (.5mm)																					
Asparagus (.5mm)																					
Astragalus sp. (.5mm)	1											1			1						
Atriplex (.5mm)												1									
Avena (.5mm)																					
Bellevalia (.5mm)																					
Brassica (.5mm)																					
Bupleurum (.5mm)																					
Calendula (.5mm)																					
Carex / Scirpus (.5mm)																1					
Centaurea (.5mm)																					
Cerastium (.5mm)																					
cf. Berberis (.5mm)																					
cf. Camelina (.5mm)													1			2					
Chenopodium album (.5mm)																					1
Convolvulus (.5mm)																					
Coronilla sp. (.5mm)	1											1				1					
Eleocharis (.5mm)																					
Eragrostis sp. (.5mm)																					
Eremo/Agropyron (.5mm)																					
Erodium cicutarium awn (.5mm)																					
Erodium sp (.5mm)																					
Euphorbia (.5mm)																					
Fumaria sp. (.5mm)																					
Glaucium sp. (.5mm)																					
Heliotropium (.5mm)	1																				
Hippocrepis sp. (.5mm)	1													2	1						
Hordeum murinum / boeticum (.5mm)																					
Hyoscyamus (.5mm)	1	1										1									
Lavatera (.5mm)																					
Malva sp. (.5mm)	1	1	1	2	1							3				1					
Medicago (.5mm)																					
Melilotus/Trifolium (.5mm)	3	1		1							1	1									

FlotNum	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386
Melilotus/Trifolium punctate (.5mm)																					
Ornithogalum (.5mm)	1												1			3					
Papaver sp. (.5mm)					1																
Peganum harmala (.5mm)																					
Phalaris sp. (.5mm)	2	1					2								1	3	2				2
Phleum (.5mm)																					
Plantago sp. (.5mm)											1			1	2	3					
Polygonum sp. (.5mm)																					
Portulaca (.5mm)															1						
Rumex (.5mm)																					
Salsola (.5mm)																					
Schinus (.5mm)																					
Scirpus (.5mm)															1						
Scorpiurus (.5mm)																					
Silene sp. (.5mm)	2	1										1		4	2	3					
Stellaria (.5mm)																					
Suaeda (.5mm)	1															1					
Teucrium sp. (.5mm)																					
Thymelaea sp (.5mm)																					
Trifolium cf. repens (.5mm)																					
Trigonella astroites (.5mm)											1										
Trigonella sp. (.5mm)					1									2	1	1					
Vaccaria (.5mm)		1					1														
Verbascum (.5mm)																					
Veronica (.5mm)																					
Ziziphora (.5mm)																					
UNKS OR FRAGS																					
Cerealia frags (2mm)	16	6			3	1	2		6	2				2		5	1	2		11	2
Hordeum frags (2mm)																					
Nutshell frag (2mm)		1	1																		
Unidentifiable Poaceae frag (2mm)																					
Unidentifiable seed frag (2mm)	19				3		1		2	2		12		9			4			6	5
Unk non-Poac (2mm)	1																				
Fabaceae frags (2mm)																1					
Indeterminate cereal (2mm)	2				1		2				1					1					
Indeterminate rachis (1mm)	1									1		1				14					1
Fabaceae Frags (1mm)																2					
Unidentifiable Seed Fragments (1mm)	96		2	5	14		16	4	22	6	18		14	46	22	30	18	6	2	67	7
Cerealia frags (1mm)	1																			28	
Hordeum frags (1mm)																					
Nutshell frag (1mm)																					
Intedeterminate cereal (1mm)														1							
Unks non-Poaceae (1mm)	3	2		1										4	3	4				1	
Unidentifiable seed fragments (.5mm)			14																		
Unks non-Poaceae (.5mm)	5		2		4				2		3	2		2	6	15				2	
Fabaceae frags (.5mm)																					
Indeterminate rachis (.5mm)																					
CLINKER AND PARENCHYMA																					
Clinker (2mm)	6	2				1	1	1		2				2	3			1			1
Clinker (1mm)	55	8	7	5	13	5	11	4	14	7	22	15	8	38	32	6	3	3		18	4
Clinker (.5mm)																					
Parenchyma (2mm)							2														
Parenchyma (1mm)		4				1	12		3								20				
RACHIS FRAGMENTS																					
H. vul. rach (2mm)																					
T. aest rach (2mm)																2					
T. aest/dur rach (2mm)		1												1	1	1					
T. dur rach (2mm)																					
Trit aest/dur node (2mm)																					
Trit sp. rach (2mm)																					
Wild rachis (2mm)																					
Frag rachis (1mm)																					
Hordeum sp. rachis (1mm)	1	1				1					4		1	5	5	23					

FlotNum	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386
T. aest rach (1mm)														2							
T. aest/dur rach (1mm)		1									9	5	7	31	16	51		1			
T. aest/dur rach node (1mm)	11	2			3	3	3	1			19	8	14	83	51	87	1				
T. aest/dur rach internode (1mm)																					
T. dur rach (1mm)																					
T. mono/di rach (1mm)																					
T. sp node (1mm)																					
T. sp rach (1mm)																					
Wild Rachis (1mm)												1	2		6	17					
Hordeum sp. rach (.5mm)	1										5	4	1	21		59					
Hordeum sp. Rach internode (.5mm)																					
Triticum aest rach (.5mm)																					
Triticum aest/dur rach (.5mm)											2		2			2					
Triticum aest/dur rach node (.5mm)					1	2								2		18					
Triticum sp. node (.5mm)																					
Triticum mono/di rach (.5mm)																					
Triticum sp. internode (.5mm)																					
Wild rachis (.5mm)											2			5		15					
CULMS AND ROOTS																					
Grass Culms (2mm)	4					2		1						5	1	4					
Grass Culms (1mm)		1			1			1		1		4	4	11	6	37					
Grass Culm (.5mm)											1				1	5					
Poaceae root (2mm)	1			1									1								
Poaceae root (1mm)	3												1	6	1	4					
BONE																					
Bone (2mm)											2	3	1			1					
Bone (1mm)			1										1	2							
Bone (.5mm)		1	3								2			1					3		
SHELL																					
Shell (2mm)	1	2				2	6			1		9		1	1	2				1	4
Shell (1mm)	4	62	6	1		3	11	2			1	30	2	3	15	37	1		1	12	6
Shell Burnt (1mm)																					
Shell (.5mm)	12																				
OTHER																					
Carbonized insect (2mm)																					
Carbonized insect (1mm)																					
Carbonized insect (.5mm)																					
Dung (2mm)	3		2					1			1		2	5	1	6				1	
Dung (1mm)	4		3					1			7	5		50	18	10				1	
Fish Scale (1mm)																					

Unit	BP49	AX55	AX55	AX55	AX55	AX55	AX55	AW55	AW54	AW54	AW55	BR44	BS44	BS44	BS44	BP49	BP49	BP49	BR41	BR41	BR41
Locus	13	13	12	9	48	9	9	3	3	3	3	56	72	80	84	11	13	13	45	43	26
SG	16	6	23	15	11	21	13	2			4,5	3	20	23	18/19		17	20			
Bag	151	133	113	50	48	44	49	65	28	26	64	526	238	283	326	85	143	160		190	132
FlotNum	**387**	**388**	**389**	**390**	**391**	**392**	**393**	**394**	**395**	**396**	**397**	**398**	**399**	**400**	**401**	**402**	**403**	**404**	**405**	**406**	**407**
Flotvol (l)	17	6	15	5.5	6.5	7	6	8.5	9	8	7	6	7.5	10	10	9.5	12	17	62	40	9
TotWt (g)																					
>2mm # seeds	25	2	1	0	2	0	2	3	3	6	1	3	4	14	10	9	14	12	29	13	11
>1mm # seeds	109	9	2	2	6	1	2	2	2	0	0	20	8	28	81	45	92	49	186	122	45
>.5mm # seeds	73	7	3	1	3	2	4	5	3	5	2	26	14	30	52	42	42	32	222	131	69
>2mm charcoal ct	64	3	6	3	12	17	6	4	5	18	2	105	66	238	512	39	67	54	230	287	146
>2mm charcoal wt	0.5854	0.0216	0.0437	0.027	0.1025	0.1223	0.0403	0.0145	0.035	0.1003	0.0139	1.2503	0.4934	2.006	3.7893	0.4488	0.4112	0.2946	1.5113	2.0634	2.9231
>1mm charcoal wt																					
DOMESTICATES																					
Cicer arietinum (2mm)																					
Hordeum vulgare (2mm)	10	1						1		1				5	4	4	7	5	8	4	5
Lens culinaris (2mm)							1												2		
Pisum sativum (2mm)								1													
Prunus sp.cf. cerasus (2mm)																					
Secale cereale (2mm)																					
Triticum aestivum/durum (2mm)	6								2	1		3		7	5	2	3	4	3	2	3
Triticum sp. (2mm)	5	1														1			2	2	1
Triticum dio (2mm)					2																
Triticum mono (2mm)																					
Triticum mono/di (2mm)																					
Triticum spelta (2mm)																					
Vitis vinifera (2mm)			1					1		3	1				1					1	
Vitis sp. (2mm) pedicel																					
Vitis sp. (2mm) frag																					
Vicia faba (2mm)																					
Vicia ervilia (2mm)	2												3	1			2	1	1	1	1
Ficus carica (1mm)														2							1
Hordeum sp. (1mm)												2	1		3	1			2	1	
Hordeum distichon (1mm)																					
Lathyrus sativa (1mm)																					
Lens culinaris (1mm)			1																		
Punica granatum (1mm)																					
Secale cereale (1mm)																					
Triticum sp. (1mm)															1						
Vicia sp. (1mm)	1																				
Vitis vinifera (1mm)								1	1												
Vitis sp. (1mm) pedicel										3									1		
Vitis sp. (1mm) frag						1				11											
Ficus carica (.5mm)	6		2					1		3		2	6	4	6	1	1	2	22	15	5
Punica granatum (.5mm)																					
Vitis vinifera (.5mm)																					
Vitis sp. (.5mm) pedicel																					
GENERAL FAMILIES																					
Fabaceae (2mm)									1					1		2	1		3	1	
Poaceae (2mm)																		2	2	1	
Asteraceae (1mm)																					
Amaranthaceae (1mm)																					
Boraginaceae (1mm)						1									1				2	2	1
Brassicaceae (1mm)															1						1
Caryophyllaceae (1mm)																					
Chenopodiaceae (1mm)																					
Cyperaceae (1mm)																					
Dipsacaceae (1mm)																					
Fabaceae (1mm)	1				1		1	1				1	1	1	1			1	3	2	
Lamiaceae (1mm)																					
Malvaceae (1mm)					1												2				
Polygonaceae (1mm)																					
Poaceae (1mm)	37				1							6	2	16	37	25	15	31	101	73	29
Poaceae Frags (1mm)	33					1	3			4		2	2	8	15	8	26	8	29	27	14

FlotNum	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407
Amaranthaceae (.5mm)																					
Apiaceae (.5mm)																					
Asteraceae (.5mm)	2																				
Boraginaceae (.5mm)																					
Brassicaceae (.5mm)	1						1	1	1			1			1	1		4	5	6	
Caryophyllaceae (.5mm)																					
Chenopodiaceae (.5mm)												1					2		8	3	2
Cyperaceae (.5mm)																			1		2
Fabaceae (.5mm)	1				2		1					1							1		
Lamiaceae (.5mm)																					
Malvaceae (.5mm)																					
Papaveraceae (.5mm)																					
Poaceae (.5mm)	27										1	11	5	19	28	19	12	11	116	63	31
Poaceae Frags (.5mm)	23	10			1		1					9	2	6	12	18	15	11	59	35	3
Polygonaceae (.5mm)																					
Portulaceae (.5mm)																					
Rubiaceae (.5mm)																					
Scrophulariaceae (.5mm)																					
Solanaceae (.5mm)	1																				
WILD OR WEEDY																					
Arnebia sp (2mm)																					
Avena sp. (2mm)																					
Bromus sp. (2mm)																					
Convolvulus (2mm)	2																				
Galium sp.(2mm)																			2		
Hippocrepis (2mm)																					
Hordeum murinum/boeticum (2mm)																					
Malva sp. (2mm)																					
Phalaris sp. (2mm)																					
Adonis (1mm)																			1		
Agrostemma / Cerastium (1mm)									1												
Ajuga sp. (1mm)																1			1		
Amaranthus (1mm)																					
Androsace maxima (1mm)												1		1					1	1	
Anthemis (1mm)																					
Asparagus (1mm)																					
Asphodelus (1mm)																					
Astragalus sp. (1mm)				1											2		1		2	1	
Atriplex sp. (1mm)																			3		
Avena sp. (1mm)														1							
Bellevalia (1mm)																			1		
Brassica (1mm)												3									
Bupleurum sp. (1mm)																					
Camelina (1mm)													1								
Carex (1mm)																				1	
Centaurea-type (1mm)															2						
Cephalaria syriaca (1mm)																					
cf. Asparagus (1mm)																					
cf. Setaria (1mm)																					
Convolvulus (1mm)																					
Coronilla sp. (1mm)	1														4						
Eleocharis (1mm)																					
Eremo/Agropyron (1mm)																					
Euphorbia (1mm)																					
Fumaria (1mm)																					
Galium sp. (1mm)																			1		
Glaucium (1mm)																					
Heliotropium (1mm)	1																				
Hippocrepis sp. (1mm)												1			4				3		
Hordeum murinum / boeticum (1mm)																					
Hyoscyamus (1mm)																			1		
L. usitatissimum (1mm)																					
Lavatera (1mm)															1						

FlotNum	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407
Lolium sp. (1mm)																					
Malva sp. (1mm)	1				1										3				15	2	1
Medicago-type (1mm)																					
Melilotus/Trifolium (1mm)	55	8		1								1		2	8	10	69	8	6	14	6
Onopordum / Eleusine (1mm)																					
Ornithogalum-type (1mm)														1	1		1		5	1	
Papaver sp. (1mm)																					
Peganum harmala (1mm)															1						
Phalaris sp. (1mm)	7		1				1					1			1	2	1	4	1	1	
Plantago sp. (1mm)																		1	7		1
Polygonum sp. (1mm)																					
Portulaca (1mm)															1						
Rumex (1mm)																				1	
Salsola (1mm)																1					
Scirpus (1mm)																					
Scorpiurus (1mm)		1			2										1						
Silene sp (1mm)												1								2	1
Stipa (1mm)																					
Teucrium sp. (1mm)																					
Thymelaea sp. (1mm)																					
Trigonella (1mm)	1											1				1		1	17	9	2
Trigonella coele-syriaca (1mm)	1																				
Vaccaria (1mm)																1		1	1	1	1
Veronica (1mm)																					
Aizoon sp. (.5mm)	1																				
Agrostemma (.5mm)				1																	
Ajuga sp. (.5mm)																					
Amaranthus sp. (.5mm)	3															1	1			1	
Androsace maxima (.5mm)										1									3		
Anthemis (.5mm)														1	1			1		1	
Artemisia (.5mm)																					
Asparagus (.5mm)																					
Astragalus sp. (.5mm)																2	1				
Atriplex (.5mm)																					
Avena (.5mm)																					
Bellevalia (.5mm)																					
Brassica (.5mm)																					
Bupleurum (.5mm)																					
Calendula (.5mm)																					
Carex / Scirpus (.5mm)																1					
Centaurea (.5mm)																					1
Cerastium (.5mm)																					
cf. Berberis (.5mm)																					
cf. Camelina (.5mm)	1																				3
Chenopodium album (.5mm)																					
Convolvulus (.5mm)																					
Coronilla sp. (.5mm)																		2			
Eleocharis (.5mm)																					
Eragrostis sp. (.5mm)																					
Eremo/Agropyron (.5mm)																					
Erodium cicutarium awn (.5mm)																					
Erodium sp (.5mm)	2																				
Euphorbia (.5mm)																					
Fumaria sp. (.5mm)																					
Glaucium sp. (.5mm)																					
Heliotropium (.5mm)																					
Hippocrepis sp. (.5mm)	2														1			1	5	3	2
Hordeum murinum / boeticum (.5mm)																					
Hyoscyamus (.5mm)		1	1					1									1	1			1
Lavatera (.5mm)																1					
Malva sp. (.5mm)		1					1							1	3				4		4
Medicago (.5mm)																					
Melilotus/Trifolium (.5mm)	14	2				2						2		1		4	11		2		2

FlotNum	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407
Melilotus/Trifolium punctate (.5mm)																					
Ornithogalum (.5mm)															1	1		2	1	1	
Papaver sp. (.5mm)																					
Peganum harmala (.5mm)																					
Phalaris sp. (.5mm)	1				1						1	1			1	1	1	1	8	2	4
Phleum (.5mm)																					
Plantago sp. (.5mm)	1								1			1	1		1	1		1		7	1
Polygonum sp. (.5mm)								1													
Portulaca (.5mm)																					
Rumex (.5mm)	1																				
Salsola (.5mm)												1				1					
Schinus (.5mm)																					
Scirpus (.5mm)								1													
Scorpiurus (.5mm)																					
Silene sp. (.5mm)															1		2		13	5	1
Stellaria (.5mm)																					
Suaeda (.5mm)															1						1
Teucrium sp. (.5mm)																					
Thymelaea sp (.5mm)																					
Trifolium cf. repens (.5mm)																					
Trigonella astroites (.5mm)																					
Trigonella sp. (.5mm)		1											1	2	1	1		1	12	7	3
Vaccaria (.5mm)																					
Verbascum (.5mm)															1						
Veronica (.5mm)																					
Ziziphora (.5mm)		1																			
UNKS OR FRAGS																					
Cerealia frags (2mm)	23				5			1		1				3	6	3	5		14	6	4
Hordeum frags (2mm)																			3	1	
Nutshell frag (2mm)																					
Unidentifiable Poaceae frag (2mm)																					
Unidentifiable seed frag (2mm)	11		1	1			1	7						1	4			2	8		1
Unk non-Poac (2mm)																	1			1	
Fabaceae frags (2mm)	5							1										2			1
Indeterminate cereal (2mm)							1			1			1						6		1
Indeterminate rachis (1mm)	9			1	1								3			2		5			
Fabaceae Frags (1mm)																					
Unidentifiable Seed Fragments (1mm)	60	11	6	4	12		13		6	28	3	12	15			16		18			
Cerealia frags (1mm)	2	5										3								1	
Hordeum frags (1mm)														1				2			
Nutshell frag (1mm)																					
Intedeterminate cereal (1mm)														1	1						
Unks non-Poaceae (1mm)	3											2	3	4	8	3	3	2	12	10	1
Unidentifiable seed fragments (.5mm)																					
Unks non-Poaceae (.5mm)	9	1					1		1	1		5	1	2	5	7	10	5	21	17	6
Fabaceae frags (.5mm)																					
Indeterminate rachis (.5mm)	2																				
CLINKER AND PARENCHYMA																					
Clinker (2mm)			1		2				1						1		2	1	9	1	
Clinker (1mm)	18	5	4			3	10			48		4	8			13	18	12			
Clinker (.5mm)																					
Parenchyma (2mm)																					
Parenchyma (1mm)	2																				
RACHIS FRAGMENTS																					
H. vul. rach (2mm)																					
T. aest rach (2mm)																					
T. aest/dur rach (2mm)	5													2	2			2	4	2	1
T. dur rach (2mm)																					
Trit aest/dur node (2mm)	9														1			3	1	7	1
Trit sp. rach (2mm)																					
Wild rachis (2mm)															1						
Frag rachis (1mm)																					
Hordeum sp. rachis (1mm)	7											8	3	3	33		3	1	48	53	8

FlotNum	**387**	**388**	**389**	**390**	**391**	**392**	**393**	**394**	**395**	**396**	**397**	**398**	**399**	**400**	**401**	**402**	**403**	**404**	**405**	**406**	**407**
T. aest rach (1mm)					1										1		1		1		
T. aest/dur rach (1mm)	16											13	9	36	37	19	8	10	66	61	36
T. aest/dur rach node (1mm)	87	1		1	2							17	15	51	57	40	18	31	218	154	198
T. aest/dur rach internode (1mm)																					
T. dur rach (1mm)																					
T. mono/di rach (1mm)																			1		
T. sp node (1mm)																					
T. sp rach (1mm)																					
Wild Rachis (1mm)	14				1							7	3	9	7	4	5	1	19	21	7
Hordeum sp. rach (.5mm)	12				1							5	11	20	48	13	12	8	124	63	20
Hordeum sp. Rach internode (.5mm)																					
Triticum aest rach (.5mm)													2	5						3	
Triticum aest/dur rach (.5mm)												1							14		3
Triticum aest/dur rach node (.5mm)	4			1									9	4	8	7	3		27	10	11
Triticum sp. node (.5mm)																					
Triticum mono/di rach (.5mm)																			1		
Triticum sp. internode (.5mm)																					
Wild rachis (.5mm)												8		4	1	1	3	2	15	7	6
CULMS AND ROOTS																					
Grass Culms (2mm)	4											5	3	2	10	3	1	2	20	14	10
Grass Culms (1mm)	7				1							7	4	7	21	14	4	5	44	60	15
Grass Culm (.5mm)															1	1			2	3	
Poaceae root (2mm)	5						1								3		2		11	4	5
Poaceae root (1mm)	2												3	4	3	4		1	8	9	1
BONE																					
Bone (2mm)											1					1	1		4		
Bone (1mm)								1					2						4	4	5
Bone (.5mm)	1							1					1				5			4	
SHELL																					
Shell (2mm)		1	1		2			2						1	1	1	2		44		4
Shell (1mm)	1	3			4	2	2	2	1	6	1	2	13	1	6	4	30	17	140		
Shell Burnt (1mm)															2				2		
Shell (.5mm)																					
OTHER																					
Carbonized insect (2mm)																			1		
Carbonized insect (1mm)																					
Carbonized insect (.5mm)																			2		
Dung (2mm)	1										1	2	1	8	8	1			6		
Dung (1mm)	4						2					2		1		5	4		4		1
Fish Scale (1mm)																					

Unit	AW54	AW54	AW54	AW54	AW54	AW54	AW54	AW54	AW54	AW54	AW54	AW54	AW54	AW54	AW54
Locus	31	31	30	30	30	25	32	25	27	31	26	26	26	26	26
SG															
Bag	298	299	264	265	263	416	381	414	273	292	469	450	462	497	470
FlotNum	**408**	**409**	**410**	**411**	**412**	**413**	**414**	**415**	**416**	**417**	**418**	**419**	**420**	**421**	**422**
Flotvol (l)	10.5	4.5	6	4	4.5	5.5	7.5	6.5	6.5	6.5	5	5.5	7	5.5	7
TotWt (g)															
>2mm # seeds															
>1mm # seeds															
>.5mm # seeds															
>2mm charcoal ct	16	7	32	22	230	8	61	14	122	30	2	13	5	12	9
>2mm charcoal wt	0.1334	0.0267	0.1345	0.0912	1.5073	0.0735	0.4	0.0621	1.143	0.0139	0.0097	0.1072	0.0245	0.0533	0.0467
>1mm charcoal wt											0.0163	0.0902			
# seeds / liter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DOMESTICATES															
Hordeum vulgare (2mm)						1				2				1	
Lens culinaris (2mm)	1				2	1	4								
Olea sp. (2mm)						1									
Olea sp. wt (2mm)						0.1526									
Olea sp. shell frag (2mm)				1	4				2	1					
Olea sp. shell frag wt (2mm)				0.0292	0.0426				0.0472	0.0168					
Pisum sativum (2mm)	66		2			14	2	20	2					15	
Pisum sativum wt (2mm)	1.98		0.05			0.3792	0.0253	0.4785	0.0205					0.4184	
Pisum sativum halves (2mm)	52		1	3		21								13	
Pisum sativum halves wt (2mm)	0.8279		0.006	0.0507		0.3109								0.1997	
Pisum sativum frags (2mm)	130	2				70	6	34					1	84	
Pisum sativum frags wt (2mm)	1.0875	0.1013				0.4034	0.0312	0.2662					0.003	0.4383	
Pisum sativum whole distort (2mm)	11													7	
Pisum sativum whole distort wt (2mm)	0.2331													0.1153	
Triticum aestivum/durum (2mm)						3								4	
Triticum sp. (2mm)	135			3	5	10	10	35	6	10				13	
Triticum dicoccum (2mm)						2								3	
Triticum mono/di (2mm)															
Triticum sp. halves (2mm)														7	
Vitis vinifera (2mm)	11	5		4	4	2	19	1	2	13					
Vitis vinifera endocarp (2mm)	6				4	4	9	2	5	3	1				
Vitis vinifera endocarp wt (2mm)	0.141				0.0122		0.1161	0.0138	0.0636	0.0133	0.0058				
Vitis vinifera pedicel (2mm)	1	1				3	1								
Vitis vinifera frag (2mm)		6					2		4						
Vicia sp. (2mm)	2														
Vicia sp. wt (2mm)	0.0435														
Vicia faba (2mm)														4	
Vicia ervilia (2mm)					1	1									
Cereal indet						5									
Cereal frag (2mm)	129	1		16	3	25	14	33	1	16				15	
Cereal frag wt (2mm)	0.6383	0.0025		0.0678	0.0161	0.1165		0.1546		0.0695				0.0823	
Unk fruit (2mm)				2			1								
Ficus carica (1mm)					1		1		2						
Hordeum sp. (1mm)															
Hordeum distichon? (1mm)															
Lathyrus sativa (1mm)															
Lens culinaris (1mm)															
Pisum sativum frags (1mm)												2	3		

FlotNum	**408**	**409**	**410**	**411**	**412**	**413**	**414**	**415**	**416**	**417**	**418**	**419**	**420**	**421**	**422**
Pisum sativum frags wt (1mm)												0.005	0.0066		
Punica granatum (1mm)															
Secale cereale (1mm)															
Triticum sp. (1mm)	7														
Triticum sp. apex + embryo (1mm)	5														
Triticum sp. halves (1mm)	4														
Vicia sp. (1mm)															
Vitis vinifera pedicel (1mm)		6			5		20		2	14	1				1
Vitis vinifera (1mm)				3						2					
Vitis vinifera frag (1mm)	2	11		1	9	2	10		1	7		2			
Ficus carica (.5mm)		2		2			3	2	3	4	2		1	1	
Punica granatum (.5mm)															
Vitis vinifera (.5mm)															
Vitis vinifera frag (.5mm)							2								
GENERAL FAMILIES															
Fabaceae (2mm)															
Poaceae (2mm)															
Asteraceae (1mm)															
Amaranthaceae (1mm)															
Boraginaceae mineral (1mm)	1			1			2		1						
Boraginaceae burnt (1mm)	1						1								
Brassicaceae (1mm)															
Caryophyllaceae (1mm)															
Chenopodiaceae (1mm)							1								
Cyperaceae (1mm)															
Dipsacaceae (1mm)															
Fabaceae (1mm)					3										
Lamiaceae (1mm)															
Malvaceae (1mm)															
Polygonaceae (1mm)		1													
Poaceae (1mm)				1			1	1	1	2					
Poaceae Frags (1mm)												4			
Amaranthaceae (.5mm)															
Apiaceae (.5mm)															
Asteraceae (.5mm)															
Boraginaceae (.5mm)															
Brassicaceae (.5mm)								1							
Caryophyllaceae (.5mm)															
Chenopodiaceae (.5mm)															
Cyperaceae (.5mm)															
Fabaceae (.5mm)															
Lamiaceae (.5mm)															
Malvaceae (.5mm)															
Papaveraceae (.5mm)															
Poaceae (.5mm)							2								
Poaceae Frags (.5mm)							3	1	2	3					
Polygonaceae (.5mm)															
Portulaceae (.5mm)															
Rubiaceae (.5mm)															
Scrophulariaceae (.5mm)															
Solanaceae (.5mm)															
WILD OR WEEDY															

FlotNum	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422
Arnebia sp (2mm)															
Avena sp. (2mm)															
Bromus sp. (2mm)															
Convolvulus (2mm)															
Galium sp.(2mm)															
Hippocrepis (2mm)															
Hordeum murinum/boeticum (2mm)															
Malva sp. (2mm)															
Phalaris sp. (2mm)															
Adonis (1mm)															
Agrostemma / Cerastium (1mm)															
Ajuga sp. (1mm)															
Amaranthus (1mm)															
Androsace maxima (1mm)															
Anthemis (1mm)															
Asparagus (1mm)															
Asphodelus (1mm)															
Astragalus sp. (1mm)															
Atriplex sp. (1mm)															
Avena sp. (1mm)															
Bellevalia (1mm)															
Brassica (1mm)															
Bupleurum sp. (1mm)															
Camelina (1mm)															
Carex (1mm)															
Centaurea-type (1mm)															
Cephalaria syriaca (1mm)															
cf. Asparagus (1mm)															
cf. Setaria (1mm)															
Convolvulus (1mm)															
Coronilla sp. (1mm)					2		2								
Eleocharis (1mm)															
Eremo/Agropyron (1mm)															
Euphorbia (1mm)															
Fumaria (1mm)				1	1		1								
Galium sp. (1mm)					1										
Eragrostis sp. (.5mm)															
Eremo/Agropyron (.5mm)															
Erodium cicutarium awn (.5mm)															
Erodium sp (.5mm)															
Euphorbia (.5mm)															
Fumaria sp. (.5mm)															
Glaucium sp. (.5mm)															
Heliotropium (.5mm)															
Hippocrepis sp. (.5mm)															
Hordeum murinum / boeticum (.5mm)															
Hyoscyamus (.5mm)															
Lavatera (.5mm)															
Malva sp. (.5mm)							2								
Medicago (.5mm)															
Melilotus/Trifolium (.5mm)				1				1							
Melilotus/Trifolium punctate (.5mm)															
Ornithogalum (.5mm)															

FlotNum	**408**	**409**	**410**	**411**	**412**	**413**	**414**	**415**	**416**	**417**	**418**	**419**	**420**	**421**	**422**
Papaver sp. (.5mm)															
Peganum harmala (.5mm)															
Phalaris sp. (.5mm)	1														
Phleum (.5mm)															
Plantago sp. (.5mm)															
Polygonum sp. (.5mm)															
Portulaca (.5mm)															
Rumex (.5mm)															
Salsola (.5mm)															
Schinus (.5mm)															
Scirpus (.5mm)															
Scorpiurus (.5mm)															
Silene sp. (.5mm)							1								
Stellaria (.5mm)															
Suaeda (.5mm)												1			
Teucrium sp. (.5mm)															
Thymelaea sp (.5mm)															
Trifolium repens (.5mm)															
Trifolium cf. repens (.5mm)															
Trigonella astroites (.5mm)															
Trigonella sp. (.5mm)				1				1							
Vaccaria (.5mm)															
Verbascum (.5mm)															
Veronica (.5mm)															
Ziziphora (.5mm)															
UNKS OR FRAGS															
Clinker (2mm)	1			14	7					15					
Clinker wt (2mm)	0.0029			0.0496	0.0242					0.0369					
Unidentifiable Poac. Frag (2mm)		1													
Unidentifiable Poac. Frag wt (2mm)		0.0025													
Unidentifiable Seed Frag (2mm)	87				10	8	14	9	7	1			1	3	1
Unidentifiable Seed Frag wt (2mm)	0.3611				0.0615	0.0228	0.051	0.0335	0.0309	0.004			0.0032	0.0064	0.0051
Unk non-Poac (2mm)	1				1	2		1		2				1	
Fabaceae Frags (2mm)				2											
Fabaceae Frags wt (2mm)										0.0342					
Indeterminate Cereal (2mm)															
Indeterminate Rachis (1mm)															
Clinker (1mm)												2	8		
Clinker wt (1mm)												0.0016	0.0083		
Fabaceae Frags (1mm)															
Unidentifiable Seed Fragments (1mm)					4	4				14	23	18	4		
Unidentifiable Seed Fragments wt (1mm)					0.004					0.015	0.019	0.0198	0.0054		
Cerealia frags (1mm)															
Hordeum Frags (1mm)															
Nutshell frag (1mm)															
Intedeterminate Cereal (1mm)															
Unks non-Poaceae (1mm)					1		5		1			1			
Unidentifiable Seed Fragments (.5mm)															
Unks non-Poaceae (.5mm)	4						7		2	3			1		
Fabaceae Frags (.5mm)															
Indeterminate Rachis (.5mm)															
RACHIS FRAGMENTS															

FlotNum	**408**	**409**	**410**	**411**	**412**	**413**	**414**	**415**	**416**	**417**	**418**	**419**	**420**	**421**	**422**
H. vulgare rachis (2mm)															
T. aestivum rachis (2mm)															
T. aestivum/durum rachis (2mm)															
T. durum rachis (2mm)															
T. aestivum/durum rachis node (2mm)															
Triticum sp. rachis (2mm)															
Wild Rachis (2mm)															
Frag. Rachis (1mm)															
Hordeum sp. rachis (1mm)									1		1				
T. aestivum rachis (1mm)															
T. aestivum/durum rachis (1mm)							2			3					
T. aestivum/durum rachis node (1mm)							9		1	2	1				
T. durum rachis (1mm)															
T. mono/dicoccum rachis (1mm)															
Triticum sp. rachis node (1mm)											1				
Triticum sp. rachis (1mm)															
Wild Rachis (1mm)							1								
Cereal Internode (.5mm)															
Hordeum sp. rachis (.5mm)											1				
T. aestivum rachis (.5mm)															
T. aestivum/durum rachis (.5mm)															
T. aestivum/durum rachis node (.5mm)															
Triticum sp. rachis node (.5mm)															
T. mono/dicoccum rachis (.5mm)															
Wild Rachis (.5mm)															
ROOTS															
Poaceae Root (2mm)		1					1								
Poaceae Root (1mm)							1			1					
Poaceae Root (5mm)															
CULM															
Grass Culms (2mm)	1			1	1		4			1					
Grass Culms (1mm)	1	1					2								
Grass Culm (.5mm)															
BONE															
Bone (2mm)									1					1	
Bone (1mm)	1	1			2		4		1				5		
Bone (.5mm)	2	6					1			1					
SHELL															
Shell (2mm)	1	2					1		1	1				1	
Shell (1mm)	4	7			5	1	4		2				1		
Shell Burnt (1mm)															
Shell (.5mm)															
OTHER															
Dung (2mm)															
Dung (1mm)															
Parenchyma (2mm)		3			5				11						
Parenchyma wt (2mm)		0.0929			0.0172										
Parenchyma (1mm)															
Insect Pupae (1mm)															
Eggshell (2mm)							1								
Fish vertebra (2mm)		1									1				
Fish scale (1mm)													1		

Appendix B

Light Fraction Data (Operationalized Analyzed Samples)

Flot	Exc_Year	Unit	Locus	SG	Phasing	Context	Period	X-Coord	Y-Coord	Volume	2mmseeds	1mmseeds	5mmseeds	2mmcharcct	2mmcharcwt	1mmcharcwt	Seed Density	Seeds per Charc Gram	Number of Seeds	Triticum
200	2009	BP48	18	18		Surface	Middle Islamic I	237.5014038	206.7532959	22	7	202	117	86	0.47	0.6834	14.82	31.85	326	3
201	2009	BR47	16	0		Fill	Iron II			22	4	7	0	228	2.50	1.7719	0.50	0.20	11	1
202	2009	BR47	18	0		Surface	Iron II			25	0	4	10	52	0.55	0.4335	0.56	1.02	14	0
203	2009	BP48	18	14		Surface	Middle Islamic I	238.7285156	207.3812866	17.5	9	25	44	79	0.65	0.7978	4.46	6.90	78	6
204	2009	BP48	18	17		Surface	Middle Islamic I	236.6663818	206.8840942	5	23	72	104	81	0.53	0.6501	39.80	75.34	199	7
205	2009	BP48	18	13		Surface	Middle Islamic I	237.5006714	207.5067749	25	7	68	59	77	0.46	0.6384	5.36	11.64	134	2
207	2009	BR43	48	0	2B	Surface	Middle Islamic II			8	2	5	19	108	0.66	0.4888	3.25	4.95	26	1
209	2009	BR43	48	0	2B	Surface	Middle Islamic II			30	16	49	80	260	1.56	1.5353	4.83	3.09	145	6
211	2009	BS44	58	23	2B	Surface	Middle Islamic II	217.4052124	220.5515137	18	5	25	80	340	3.37	2.6318	6.11	1.81	110	1
213	2009	BS43	19	18	2A/2B	Fill	Middle Islamic II	212.7285156	221.7092896	18	16	39	55	342	2.64	1.5809	6.11	2.32	110	2
214	2009	BR42	10	0		Fill	Middle Islamic II	206.122	216.887	30	18	41	96	210	1.25	0	5.17	4.12	155	10
215	2009	BR47	10	0		Foundation Trench	Nabataean-Roman			24.5	20	67	155	359	2.78	2.8673	9.88	3.55	242	8
217	2009	AX54	6	0		Fill	Byzantine	273.2954712	116.7199097	30	36	27	94	2558	25.74	0	5.23	0.20	157	13
219	2009	BR47	17	0		Fill	Iron II			23	1	6	12	171	1.18	0.9989	0.83	0.70	19	1
220	2009	BR47	9	0		Foundation Trench	Nabataean-Roman	231.368986	217.87922	25	11	12	56	181	1.16	1.1801	3.16	2.72	79	6
221	2009	BR47	8	0		Fill	Nabataean-Roman	230.995402	218.738663	15	12	32	34	337	2.61	1.9313	5.20	1.99	78	5
222	2009	BS44	58	18	2B	Surface	Middle Islamic II	217.50177	221.5338745	25	22	80	80	238	2.33	0	7.28	3.13	182	12
224	2009	BS43	18	17/22	2B	Surface	Middle Islamic II	211.48	221.36	11	2	15	16	58	0.32	0.285	3.00	9.31	33	0
225	2009	BS41	58	19	2B	Surface	Middle Islamic II	213.640076	221.650208	20	13	44	47	237	1.86	1.1041	5.20	2.80	104	3
226	2009	BS43	18	20	2B	Surface	Middle Islamic II	214.6008301	221.5809937	35	41	30	45	236	1.74	1.9518	3.31	1.90	116	6
228	2009	BR44	35	5	2B	Surface	Middle Islamic II	219.0249023	219.4915771	15	9	31	43	191	1.70	1.184	5.53	3.25	83	1
229	2009	BR44	35	4	2B	Surface	Middle Islamic II	218.2756958	219.5112915	29	5	30	41	166	1.65	1.3234	2.62	1.58	76	6
232	2009	BS43	26	23,24,25	2B	Surface	Middle Islamic II			18	9	10	50	170	1.45	0.9735	3.83	2.65	69	6
233	2009	B027	9	0		Fill	Middle Islamic II	148.494105	203.932374	15	10	20	21	68	0.44	0.586	3.40	7.79	51	4
234	2009	CE27	6	18		Fill	Middle Islamic II	136.41	280.58	3	10	20	47	97	0.71	0.8722	25.67	35.99	77	7
235	2009	CE27	12	18		Surface	Middle Islamic II	136.991	280.99	5	6	8	24	36	0.45	0.195	7.60	16.78	38	5
236	2009	CE27	9	0		Fill	Middle Islamic II	136.5	281.3	3	2	7	7	184	2.10	1.1246	5.33	2.53	16	0
237	2009	B027	13	0		Fill	Middle Islamic II	147.49641	203.788078	14	1	3	4	176	1.84	1.159	0.57	0.31	8	0
238	2009	AX54	4	0		Fill	Byzantine	270.9448242	118.7700806	24	16	6	17	86	1.18	0.6316	1.63	1.38	39	5
239	2009	CE27	8	0		Fill	Middle Islamic II	136.4255981	282.0231934	9	26	82	56	420	5.80	3.1927	18.22	3.14	164	18
240	2009	B027	13	0		Fill	Middle Islamic II	146.79821	203.445347	10	2	5	14	43	0.47	0.2811	2.10	4.45	21	1
241	2009	B027	9	0		Fill	Middle Islamic II	148.494105	203.932374	11	9	9	14	40	0.36	0.2901	2.91	8.06	32	4
242	2009	B027	9	0		Fill	Middle Islamic II	148.494105	203.932374	12	5	9	18	28	0.22	0.4204	2.67	12.16	32	2
244	2009	BR47	8	1,2,6		Fill	Nabataean-Roman	230.995402	218.738663	6	6	7	31	103	0.62	0.7102	7.33	11.76	44	3
245	2009	BR47	6	0		Fill	Nabataean-Roman	230.496654	218.70924	20	33	56	116	368	2.44	2.9687	10.25	4.20	205	20
246	2009	BR47	3	0		Fill	Iron II	37.50923	-6.378594	26	0	10	19	177	1.22	0.8106	1.12	0.92	29	0
247	2009	BR47	13	0		Surface	Iron II			6	1	1	2	5	0.03	0.0707	0.67	20.83	4	0
248	2009	BR47	5	11		Fill	Iron II	37.908835	-62.88712	7	2	0	6	32	0.15	0.1044	1.14	7.68	8	0
252	2009	BS44	58	16	2B	Surface	Middle Islamic II	215.5609741	221.5100708	25	17	64	65	547	3.34	3.0584	5.84	1.75	146	4
256	2009	BR43	58	23	2B	Fill	Middle Islamic II	212.557007	220.799011	14.5	25	52	52	286	2.26	1.4064	8.90	3.93	129	10
257	2009	BR43	58	21	2B	Fill	Middle Islamic II	210.5	220.7	10	6	17	27	152	1.44	1.0165	5.00	3.48	50	1
258	2009	BR43	48	8	2B	Surface	Middle Islamic II	212.3668823	219.0919189	10.5	8	27	29	80	1.12	0.6181	6.10	5.43	64	0
259	2009	BR43	58	17	2B	Fill	Middle Islamic II	211.5	221.6	28	1	8	29	69	0.46	0.5531	1.36	2.93	38	1
260	2009	BR41	41	0		Fill	Middle Islamic II	202.859924	215.809507	28	6	54	56	120	1.21	1.7115	4.14	3.42	116	2
264	2009	BS44	58	20	2B	Surface	Middle Islamic II	219.2301025	221.246521	14	7	7	25	167	2.45	0.8101	2.79	1.14	39	5
270	2009	BS43	23	1,6,11	2A/2B	Fill	Middle Islamic II			12	4	5	8	44	0.29	0.2853	1.42	4.94	17	1
271	2009	BS44	58	21	2B	Surface	Middle Islamic II	215.4813843	220.6384277	17	1	26	31	50	0.42	0.567	3.41	8.15	58	1
274	2009	BS43	18	24	2B	Surface	Middle Islamic II	213.5646973	220.7525024	3.5	1	4	10	35	0.20	0.1808	4.29	21.00	15	0
277	2009	BR41	43	0		Fill	Middle Islamic I	202.591787	215.680917	15	6	28	41	88	0.48	0.837	5.00	10.38	75	3
278	2009	L-Sect	10	0		Fill	Nabataean-Roman			9	4	3	13	28	0.09	0.233	2.22	24.80	20	0
279	2009	L-Sect	12	0		Surface	Iron II			5	4	1	1	33	0.12	0.1264	1.20	10.34	6	1
280	2009	L-Sect	11	0		Fill	Iron II			11	1	2	5	2	0.01	0.0384	0.73	123.27	8	1
281	2009	L-Sect	29	0		Fill	Iron II			7	11	13	29	50	0.77	0.5525	7.57	9.90	53	4
282	2009	L-Sect	7	0		Fill	Nabataean-Roman			7	7	0	8	34	0.16	0.3706	2.14	13.40	15	0
283	2009	L-Sect	20	4.1		Surface	Iron II			6	1	2	2	52	0.22	0.1724	0.83	3.72	5	0
284	2009	L-Sect	16	0		Fill	Iron II			7	1	0	4	44	0.39	0.3484	0.71	1.84	5	0
285	2009	L-Sect	20	4.2		Surface	Iron II			5	0	0	1	9	0.02	0.0252	0.20	8.66	1	0
286	2009	L-Sect	23	0		Fill	Iron II			7	1	0	2	19	0.17	0.1021	0.43	2.49	3	0
287	2009	L-Sect	15	0		Fill	Iron II			6.5	3	0	7	20	0.13	0.3186	1.54	11.46	10	2
288	2009	L-Sect	24	4.3		Surface	Iron II			5	0	0	1	0	0.00	0	0.20	#DIV/0!	1	0
289	2009	L-Sect	21	0		Fill	Iron II			6	0	0	5	28	0.14	0.2608	0.83	6.03	5	0
290	2009	L-Sect	20	4.4		Surface	Iron II			8	1	0	3	26	0.23	0.1206	0.50	2.19	4	1
291	2009	L-Sect	27	0		Fill	Iron II			7	6	1	10	17	0.14	0.1678	2.43	17.53	17	0
292	2009	L-Sect	28	0		Fill	Iron II			7	9	0	10	14	0.16	0.1271	2.71	17.33	19	1
293	2009	L-Sect	24	4.1		Surface	Iron II			5	1	0	1	2	0.01	0.0097	0.40	59.70	2	0
294	2009	L-Sect	24	4.2		Surface	Iron II			8	0	0	1	5	0.30	0.0225	0.13	0.42	1	0
295	2009	L-Sect	18	0		Fill	Iron II			6	0	0	1	57	0.33	0.2134	0.17	0.50	1	0
296	2009	L-Sect	24	4.4		Surface	Iron II			6	0	0	0	2	0.00	0.0313	0.00	0.00	0	0
297	2009	L-Sect	25	0		Fill	Iron II			5	4	2	3	34	0.31	0.2241	1.80	5.82	9	0
299	2009	BP48	18	12		Surface	Middle Islamic I	236.7608032	207.4193115	11.5	17	237	117	66	0.34	0.4397	32.26	96.24	371	4
302	2012	AX55	14	5		Fill	Byzantine	279.257687	118.989771	5	2	4	4	8	0.07	0.0305	2.00	29.72	10	1
303	2012	AX55	12	23/24		Fill	Byzantine	278.052979	115.517998	12	1	3	3	5	0.03	0.0705	0.58	17.89	7	0

Flot	Exc_Year	Unit	Locus	SG	Phasing	Context	Period	X-Coord	Y-Coord	Volume	2mmseeds	1mmseeds	5mmseeds	2mmcharcct	2mmcharcwt	1mmcharcwt	Seed Density	Seeds per Charc Gram	Number of Seeds	Triticum
304	2012	AW54	10	15		Fill	Byzantine	274.65872	112.677112	6	3	1	3	7	0.04	0.0409	1.17	28.88	7	0
305	2012	AW54	10	3		Fill	Byzantine	272.177589	113.982558	5	7	6	3	28	0.16	0.0812	3.20	19.57	16	4
306	2012	AW54	10	8		Fill	Byzantine	272.160708	113.543906	6	21	2	4	101	0.74	0.8085	4.50	6.10	27	2
307	2012	BR44	51	4	2C	Surface	Middle Islamic II	218.2756958	219.5112915	5	3	23	3	273	2.41	1.7955	5.80	2.41	29	1
308	2012	AW54	10	0		Fill	Byzantine	273.253841	112.990648	6	8	5	7	22	0.17	0.1899	3.33	20.17	20	3
309	2012	AW54	10	18		Fill	Byzantine	272.485417	111.746981	6.5	3	6	6	12	0.06	0.1432	2.31	41.96	15	1
310	2012	AW54	10	10		Fill	Byzantine	274.106382	113.196279	7	4	5	4	12	0.04	0.0862	1.86	42.50	13	2
311	2012	AX55	8	24		Fill	Byzantine	278.325109	115.922825	13	2	1	5	114	3.18	0.2873	0.62	0.19	8	0
312	2012	AX55	18	0		Drain	Byzantine	278.124801	115.672819	7.5	0	1	3	8	0.03	0.0872	0.53	15.28	4	0
313	2012	BR44	51	3	2C	Surface	Middle Islamic II	217.3184204	219.5565186	33	38	196	162	2029	15.73	10.6458	12.00	0.76	396	14
318	2012	BP49	13	21		Surface	Middle Islamic I	240.599286	205.826246	12	9	72	48	29	0.00	0	10.75	#DIV/0!	129	1
323	2012	AX55	20	24		Fill	Byzantine	278.734076	115.41317	10.5	5	3	4	28	0.22	0	1.14	5.19	12	1
324	2012	AW55	3	24		Fill	Byzantine	278.720361	110.728314	6.5	0	2	5	4	0.03	0.0117	1.08	34.08	7	0
325	2012	AW55	3	13/14		Fill	Byzantine	277.606164	112.534621	13	2	1	2	28	0.17	0.1713	0.38	2.21	5	0
326	2012	AW55	3	20		Fill	Byzantine	279.292296	111.83292	7.5	1	0	1	2	0.01	0.105	0.27	38.10	2	0
327	2012	AW55	3	5/10		Fill	Byzantine	279.065756	113.518744	6.5	4	1	0	3	0.01	0.0507	0.77	64.64	5	0
328	2012	AW55	3	2/7		Fill	Byzantine	276.544892	113.923387	7	2	0	1	15	0.08	0.0697	0.43	5.20	3	0
329	2012	AX55	27	20		Fill	Byzantine	279.68218	116.458417	6	0	0	2	4	0.02	0.0165	0.33	13.39	2	0
330	2012	AX55	14	5/10		Fill	Byzantine	279.308322	119.2324	7	1	5	5	8	0.08	0.0269	1.57	19.45	11	0
331	2012	AX55	14	9		Fill	Byzantine	278.104344	118.692662	6.5	1	2	4	6	0.05	0.0607	1.08	19.98	7	0
332	2012	AX55	14	8		Fill	Byzantine	276.75351	118.694636	5	0	2	2	4	0.03	0.0194	0.80	23.12	4	0
333	2012	AX55	13	6		Fill	Byzantine	275.476866	118.240699	5	1	9	6	4	0.01	0.0648	3.20	220.69	16	1
334	2012	AX55	28	16		Fill	Byzantine	275.460097	116.305115	6	7	2	5	4	0.10	0.0473	2.33	23.31	14	5
335	2012	AX55	28	13		Fill	Byzantine	277.516642	117.228523	5	0	1	3	3	0.02	0.0261	0.80	48.48	4	0
336	2012	AX55	17	23		Fill	Byzantine	277.157051	115.511414	11.5	2	4	5	23	0.24	0.1152	0.96	3.97	11	0
337	2012	AW54	6	0		Fill	Byzantine	270.434813	113.918361	7	0	0	2	2	0.01	0.0111	0.29	24.21	2	0
338	2012	AW54	20	0		Fill	Byzantine	270.163539	110.839453	6	2	1	2	73	0.90	0.1646	0.83	0.93	5	1
339	2012	AW54	9	0		Fill	Byzantine	272.148448	111.676575	6	5	3	2	22	0.11	0.1835	1.67	15.06	10	0
340	2012	AW54	12	0		Fill	Byzantine	273.910804	114.315791	6	1	2	4	2	0.06	0.0204	1.17	20.29	7	0
341	2012	AW54	21	0		Fill	Byzantine	270.633414	112.480444	6.5	3	1	2	11	0.13	0.0605	0.92	7.26	6	0
342	2012	AW54	9	24		Fill	Byzantine	273.265769	110.729146	8	7	3	2	31	0.33	0	1.50	4.50	12	4
343	2012	AX55	18	18,19,23,24		Drain	Byzantine	278.047642	115.506833	11	4	5	14	71	0.77	0.2845	2.09	2.72	23	1
344	2012	AX55	18	0		Drain	Byzantine	278.0707	115.3114	7	1	2	3	13	0.05	0.0837	0.86	16.30	6	0
345	2012	AX55	18	0		Drain	Byzantine	278.080801	115.322435	7	5	4	1	32	0.19	0.2369	1.43	7.62	10	0
346	2012	AX55	18	0		Drain	Byzantine	277.971369	116.033704	8	7	5	6	38	0.37	0.4235	2.25	6.01	18	2
347	2012	AW54	3	8		Fill	Byzantine	272.161116	113.546393	7	8	6	32	324	1.98	2.8215	6.57	3.32	46	0
348	2012	AW54	3	18,23		Fill	Byzantine	272.97347	111.196356	7	7	0	1	10	0.08	0	1.14	14.38	8	2
349	2012	BS44	82	18	2E	Surface	Middle Islamic II	217.50177	221.5338745	14	11	12	25	153	1.11	0	3.43	3.09	48	4
351	2012	BR44	56	2	2D	Pit	Middle Islamic II	216.3588257	219.6027222	6	4	24	33	111	1.23	0	10.17	8.24	61	3
352	2012	BR44	65	9	2E	Surface	Middle Islamic II	218.2156982	218.9014893	10	15	18	33	44	0.41	0.4073	6.60	15.98	66	3
353	2012	BS44	80	24	2C	Surface	Middle Islamic II	218.3707275	220.5159302	27	22	151	207	1130	10.08	0	14.07	1.40	380	4
355	2012	BR44	46	2	2B/2C	Pit	Middle Islamic II	216.3588257	219.6027222	9	12	90	104	98	0.94	0	22.89	24.35	206	4
356	2012	BS44	82	19	2E	Surface	Middle Islamic II	218.4094238	221.3543091	20	24	31	69	139	1.49	0	6.20	4.16	124	1
357	2012	BS44	80	17	2C	Surface	Middle Islamic II	216.5325928	221.4708252	10	11	29	33	56	0.52	0.8009	7.30	14.04	73	7
358	2012	BR44	51	8	2C	Surface	Middle Islamic II	217.2478027	218.9375	7	8	46	68	328	2.99	2.7464	17.43	5.83	122	2
359	2012	BS44	82	23	2E	Surface	Middle Islamic II	217.4052124	220.5515137	6	1	10	27	62	1.61	0	6.33	3.93	38	0
360	2012	BR44	51	5	2C	Surface	Middle Islamic II	219.0249023	219.4915771	11	43	37	78	163	1.27	0	14.36	11.31	158	5
361	2012	BR44	42	4,5	2D	Tabun	Middle Islamic II	218.5	219.5	16	18	106	95	904	8.82	4.933	13.69	1.55	219	8
362	2012	BS44	82	24	2E	Surface	Middle Islamic II	218.3707275	220.5159302	41	56	71	58	224	1.60	0	4.51	2.82	185	8
363	2012	BS44	90	17/22	2D	Pit	Middle Islamic II	216.5326	221.0328674	4.5	27	292	549	120	1.07	0	192.89	180.52	868	4
364	2012	AX55	31	18,19,23,24		Drain	Byzantine	278.176641	115.367339	12	11	10	9	43	0.41	0	2.50	6.11	30	0
365	2012	AX55	19	0		Tabun	Byzantine	277.005465	115.894176	3	1	0	2	4	0.02	0.0074	1.00	51.55	3	0
366	2012	AX55	16	4		Pit	Byzantine	279.080489	119.840848	11	25	22	37	36	0.32	0	7.64	23.93	84	8
367	2012	AX55	15	14		Pit	Byzantine	279.273567	117.596564	11	5	5	9	5	0.02	0	1.73	78.51	19	3
368	2012	AX55	12	23		Fill	Byzantine	277.593421	115.664454	16	2	11	9	85	2.22	0	1.38	0.62	22	0
369	2012	AX55	15	7,8		Pit	Byzantine	276.907055	118.643971	7	3	2	4	9	0.04	0	1.29	34.94	9	2
370	2012	AX55	14	9		Fill	Byzantine	278.116866	118.663823	4	4	3	10	6	0.03	0	4.25	146.55	17	2
371	2012	AW54	3	16		Fill	Byzantine	270.406747	110.926749	7	2	1	2	8	0.08	0	0.71	8.86	5	1
372	2012	AW54	3	14		Fill	Byzantine	273.095373	112.762515	8	8	14	10	15	0.05	0	4.00	74.77	32	3
373	2012	AW54	3	21,16		Fill	Byzantine	270.564403	110.908942	7.5	1	2	2	7	0.05	0	0.67	13.98	5	1
374	2012	AW54	3	25		Fill	Byzantine	274.268124	110.842447	5	1	0	3	7	0.04	0	0.80	18.60	4	1
375	2012	AW54	3	4,5,9,10		Fill	Byzantine	274.321158	114.339021	6	1	0	2	2	0.04	0	0.50	12.89	3	1
376	2012	BR43	53	3	2C	Fill	Middle Islamic II	212.4105835	219.8098145	5.5	4	12	20	72	0.50	0	6.55	13.02	36	0
377	2012	BS43	27	3	2D	Fill	Middle Islamic II			7	2	5	18	20	0.69	0	3.57	5.19	25	3
378	2012	BS43	27	24	2D	Fill	Middle Islamic II	213.5646973	220.7525024	4	4	1	4	27	0.11	0	2.25	20.66	9	0
380	2012	BS44	80	19	2C	Surface	Middle Islamic II	218.4094238	221.3543091	16	6	25	48	128	1.06	0	4.94	4.66	79	3
381	2009	BR41	46	0		Surface	Middle Islamic I	9.662462	-6.618583	19	4	58	92	74	0.41	0	8.11	19.80	154	1
382	2012	AW54	3	10		Fill	Byzantine	274.107808	113.654872	5	0	0	8	1	0.00	0	1.60	400.00	8	0
383	2012	AW54	3	18,19,23,24		Fill	Byzantine	272.860018	111.017604	5	1	1	0	1	0.01	0	0.40	59.70	2	1
384	2012	AX55	8	23		Fill	Byzantine	277.675444	115.87956	12	1	0	1	51	1.74	0	0.17	0.10	2	0
385	2012	AW55	5	11,16		Fill	Byzantine	276.056473	112.250058	7	7	3	2	7	0.06	0.0657	1.71	27.47	12	4
386	2012	AW54	3	0		Fill	Byzantine	273.928587	113.973926	8	3	1	6	13	0.17	0	1.25	7.54	10	1

Flot	Exc_Year	Unit	Locus	SG	Phasing	Context	Period	X-Coord	Y-Coord	Volume	2mmseeds	1mmseeds	5mmseeds	2mmcharcct	2mmcharcwt	1mmcharcwt	Seed Density	Seeds per Charc Gram	Number of Seeds	Triticum
387	2012	BP49	13	16		Surface	Middle Islamic I	240.369952	206.388364	17	25	109	73	64	0.59	0	12.18	20.80	207	11
388	2012	AX55	13	6		Fill	Byzantine	275.852657	118.762038	6	2	9	7	3	0.02	0	3.00	138.89	18	1
389	2012	AX55	12	23		Fill	Byzantine	277.810265	116.255298	15	1	2	3	6	0.04	0	0.40	9.15	6	0
390	2012	AX55	9	15		Fill	Byzantine	279.595264	117.020848	5.5	0	2	1	3	0.03	0	0.55	20.20	3	0
391	2012	AX55	48	11		Fill	Byzantine	276.110355	117.325961	6.5	2	6	3	12	0.10	0	1.69	16.51	11	2
392	2012	AX55	9	21		Fill	Byzantine	275.415261	115.343585	7	0	1	2	17	0.12	0	0.43	3.50	3	0
393	2012	AX55	9	13		Fill	Byzantine	277.725804	117.49621	6	2	2	4	6	0.04	0	1.33	33.09	8	0
394	2012	AW55	3	2		Fill	Byzantine	276.663082	113.655016	8.5	3	2	5	4	0.01	0	1.18	81.14	10	0
395	2012	AW54	3	0		Fill	Byzantine	273.885933	112.805514	9	3	2	3	5	0.04	0	0.89	25.40	8	2
396	2012	AW54	3	0		Fill	Byzantine	272.11477	114.07098	8	6	0	5	18	0.10	0	1.38	13.71	11	1
397	2012	AW55	3	4,5		Fill	Byzantine	278.67822	113.376283	7	1	0	2	2	0.01	0	0.43	30.83	3	0
399	2012	BS44	72	20	2D	Bin	Middle Islamic II	219.2301025	221.246521	7.5	4	8	14	66	0.49	0	3.47	7.03	26	0
401	2012	BS44	84	18,19	2B/2C	Pit	Middle Islamic II	217.9555969	221.3543091	10	10	81	52	512	3.79	0	14.30	3.77	143	6
402	2012	BP49	11	0		Fill	Middle Islamic I	240.625849	205.980136	9.5	9	45	42	39	0.45	0	10.11	22.52	96	3
403	2012	BP49	13	17		Surface	Middle Islamic I	241.159956	206.432827	12	14	92	42	67	0.41	0	12.33	29.99	148	3
404	2012	BP49	13	20		Surface	Middle Islamic I	239.540115	206.320676	17	12	49	32	54	0.29	0	5.47	18.57	93	4
406	2009	BR41	43	0		Fill	Middle Islamic I	202.301609	216.15775	40	13	122	131	287	2.06	0	6.65	3.22	266	4
407	2009	BR41	26	0		Surface	Middle Islamic I	201.16	217.986	9	11	45	69	146	2.92	0	13.89	4.75	125	4
408	2013	AW54	31			Supra Surface	Byzantine	273.403	111.26	10.5				16	0.13	0	29.43		309.06747	149
409	2013	AW54	31			Supra Surface	Byzantine	273.176064	110.865163	4.5				7	0.03	0	3.31		14.894766	0
410	2013	AW54	30			Supra Surface	Byzantine	272.502212	111.946749	6				32	0.13	0	0.57		3.40802	0
411	2013	AW54	30			Supra Surface	Byzantine	274.569715	111.410606	4				22	0.09	0	5.56		22.234074	3
412	2013	AW54	30			Supra Surface	Byzantine	272.842922	113.938722	4.5				230	1.51	0	4.89		22	5
413	2013	AW54	25			Supra Surface	Byzantine	273.429	111.164	5.5				8	0.07	0	11.90		65.45877	15
414	2013	AW54	32			Supra Surface	Byzantine	272.831	111.399	7.5				61	0.40	0	9.52		71.42443	10
415	2013	AW54	25			Supra Surface	Byzantine	274.329	111.367	6.5				14	0.06	0	10.77		70.011154	35
416	2013	AW54	27			Supra Surface	Byzantine	273.549848	113.009581	6.5				122	1.14	0	3.42		22.24291	6
417	2013	AW54	31			Supra Surface	Byzantine	272.669	112.047	6.5				30	0.01	0	6.31		41	10
418	2013	AW54	26			Surface	Byzantine	273.281207	110.444772	5				2	0.01	0.0163	0.40		2	0
419	2013	AW54	26			Surface	Byzantine	272.629445	111.705789	5.5				13	0.11	0.0902	1.41		7.7342	0
420	2013	AW54	26			Surface	Byzantine	272.57999	110.515345	7				5	0.02	0	0.56		3.885172	0
421	2013	AW54	28			Supra Surface	Byzantine	273.436	111.579	5.5				12	0.05	0	12.19		67.025294	20
422	2013	AW54	26			Surface	Byzantine	272.374399	112.120232	7				9	0.05	0	0.00		0	0
206+231	2009	BR44	35	8	2B	Surface	Middle Islamic II	217.2478027	218.9375	30	16	83	76	444	4.04	0.6327	11.70	13.88	175	4
208+405	2009	BR41	45	0		Fill	Middle Islamic I	203.739588	215.274029	62	49	329	427	521	7.31	2.1459	12.98	5.69	805	10
212+223	2009	BS43	18	18	2B	Surface	Middle Islamic II	212.7285156	221.7092896	34.5	14	40	56	275	1.86	1.7909	5.94	17.33	110	7
227+269	2009	BS44	58	24	2B	Surface	Middle Islamic II	218.3707275	220.5159302	20	5	28	28	194	1.56	1.1475	6.88	10.72	61	1
230+266	2009	BR44	35	2	2B	Surface	Middle Islamic II	216.3588257	219.6027222	26.5	6	36	82	184	1.03	0.9955	8.88	17.16	124	4
243+261	2009	BR43	48	5	2B	Surface	Middle Islamic II	214.4321289	219.7015991	45.5	12	21	65	407	4.45	2.358	4.10	2.20	98	3
254+254	2009	BR44	35	1	2B	Surface	Middle Islamic II	215.3922119	219.6489868	55	36	77	103	252	2.21	2.4924	7.47	6.27	216	34
255+262+:	2009	BR44	35	3	2B	Surface	Middle Islamic II	217.3184204	219.5565186	32	21	53	103	403	3.62	2.5441	16.13	19.62	177	10
267+268	2009	BS44	58	25	2B	Surface	Middle Islamic II	219.1484985	220.4783936	25	14	22	38	174	1.85	1.2078	6.17	8.14	74	9
272+273	2009	BS43	18	23	2B	Surface	Middle Islamic II	212.5570068	220.7990112	22	5	16	34	52	0.38	0.5562	4.73	24.91	55	5
275+276	2009	BS43	18	25	2B	Surface	Middle Islamic II	214.5222778	220.6970825	29	5	14	25	113	0.86	0.7416	3.04	7.16	44	2
280-2	2009	L-Sect	20	0		Surface	Iron II			6	0	0	1	13	0.10	0.0505	0.17	1.71	1	0
281-2	2009	L-Sect	13	0		Fill	Iron II			4	2	0	0	38	0.21	0.0849	0.50	2.33	2	2
314+315	2012	BR44	65	4	2E	Surface	Middle Islamic II	218.2756958	219.5112915	37	22	42	62	172	1.33	0	6.72	11.66	126	6
316+317	2012	BR44	65	3	2E	Surface	Middle Islamic II	217.3184204	219.5565186	16	10	18	48	143	1.03	0.0906	11.22	62.53	76	2
354+398	2012	BR44	56	3	2D	Pit	Middle Islamic II	217.3184204	219.5565186	11	6	24	35	172	1.87	0.3024	11.37	11.69	65	3
379+400	2012	BS44	80	23	2C	Surface	Middle Islamic II	217.4052124	220.5515137	20	26	84	71	486	3.75	0	18.10	9.84	181	15

Flot	Hordeum	Cicer	Other Cereal	Vitis	Ficus	Vicia	Large Fabaceae	Lens	Olea	Pisum	Cereals	Legumes	Fruits	Domesticates	Dung	Straw	Weeds (+Unks)	Weeds (ID'ed)	All Rachis	Triticum Rachis	Hordeum Rachis	Wild Rachis	C14OP	AMSDate
200	4	0	0	0	3	1	0	1	0	0	7	1	3	12	0	20	314	303	78	51	25	2	3	1165 CE – 1260 CE
201	0	0	0	2	0	1	0	0	0	0	1	0	2	4	0	2	7	3	1	1	0	0	6	
202	0	0	0	0	4	0	0	0	0	0	0	0	4	4	0	0	10	3	3	3	0	0	6	
203	2	0	0	0	0	0	0	0	0	0	8	0	0	8	0	5	70	54	20	18	2	0	3	1165 CE – 1260 CE
204	15	0	0	0	0	1	0	0	0	0	22	0	0	23	2	29	176	141	93	85	8	0	3	1165 CE – 1260 CE
205	4	0	0	0	5	0	0	0	0	0	6	0	5	11	0	0	123	103	15	14	1	0	3	1165 CE – 1260 CE
207	1	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	24	21	0	0	0	0	2-1	
209	4	0	0	2	2	0	5	0	0	0	10	0	4	14	0	23	126	101	168	112	37	19	2-1	
211	1	0	0	0	1	1	0	0	0	2	2	2	1	6	0	9	104	84	130	86	32	12	2-1	1058 CE - 1275 CE
213	4	0	1	0	3	2	4	1	0	0	6	1	3	13	0	27	97	76	91	64	16	11	2-1	
214	5	0	0	0	12	0	0	2	0	0	15	2	12	29	0	30	126	91	137	91	43	3		
215	9	0	0	2	37	1	0	0	0	0	17	0	39	57	0	10	185	128	107	99	8	0	5	45 BCE - 125 CE
217	11	0	0	1	21	4	1	3	0	4	24	7	22	57	6	9	99	55	16	9	1	6	4	571 CE - 675 CE
219	0	0	0	0	3	0	0	0	0	0	1	0	3	4	0	1	15	10	6	4	2	0	6	
220	3	0	0	1	13	0	0	1	0	0	9	1	14	24	0	2	55	25	46	42	4	0	5	35 BCE - 219 CE
221	5	0	0	6	13	1	0	0	0	0	10	0	19	30	0	3	48	28	24	24	0	0	5	
222	14	0	0	1	0	0	0	0	0	0	26	0	1	27	0	38	155	124	224	146	51	27	2-1	1058 CE - 1275 CE
224	3	0	0	0	4	0	0	0	0	0	3	0	4	7	1	8	26	26	42	33	5	4	2-1	1290 CE – 1397 CE
225	6	1	0	0	2	1	0	1	0	0	9	2	2	14	0	16	90	72	109	80	5	0	2-1	1058 CE - 1275 CE
226	2	0	2	0	10	0	0	0	0	0	8	0	10	20	1	9	96	55	103	78	15	10	2-1	1290 CE – 1397 CE
228	5	0	0	1	1	0	0	2	0	0	6	2	2	10	0	21	73	65	118	90	15	13	2-1	1298 CE – 1405 CE
229	0	0	0	0	3	0	0	0	0	0	6	0	3	9	5	30	67	57	120	81	27	12	2-1	1298 CE – 1405 CE
232	4	0	0	0	3	0	1	0	0	0	10	0	3	13	0	28	55	45	112	86	15	11	2-1	
233	2	0	1	0	0	0	0	0	0	0	6	0	0	7	0	11	44	34	55	41	11	3		
234	2	0	0	0	0	0	1	0	0	0	9	0	0	9	0	3	67	57	64	43	19	2	2-1	
235	3	0	0	0	0	0	0	0	0	0	8	0	0	8	0	3	30	26	16	11	5	0	2-1	
236	3	0	0	0	0	0	0	0	0	0	3	0	0	3	0	4	13	11	11	8	2	1	2-1	
237	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	4	7	7	23	16	4	3		
238	1	0	0	11	3	0	0	0	0	0	6	0	14	20	0	0	19	12	3	1	1	1	4	
239	8	0	0	0	4	3	0	0	0	0	26	0	4	33	0	40	131	101	191	117	40	34	2-1	
240	1	0	0	0	0	0	0	1	0	0	2	1	0	3	0	5	18	9	34	20	9	5		
241	4	0	0	0	0	0	1	0	0	0	8	0	0	8	1	12	23	18	59	49	5	5		
242	4	0	0	0	0	0	1	0	0	0	6	0	0	6	0	12	25	17	65	38	10	17		
244	1	0	1	2	15	0	0	0	0	0	4	0	17	22	0	1	22	11	17	13	4	0	5	
245	7	0	0	3	41	1	0	6	0	0	27	6	44	78	0	13	127	77	113	98	15	0	5	1128 BCE - 899 BCE
246	0	0	0	1	4	0	0	0	0	0	0	0	5	5	0	0	24	13	1	0	1	0	6	
247	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	3	3	0	0	0	0	6	
248	1	0	0	1	0	0	0	0	0	0	1	0	1	2	0	0	6	3	2	2	0	0	6	
252	6	0	2	0	8	1	3		0	0	10	0	8	21	0	39	123	96	203	142	42	19	2-1	1058 CE - 1275 CE
256	5	0	0	2	2	3	2	1	0	1	15	2	5	24	0	50	102	74	188	116	25	47	2-1	
257	2	0	0	0	1	1	1	0	0	0	3	0	1	5	0	24	44	37	71	41	23	7	2-1	
258	4	0	1	1	0	0	0	0	0	3	4	3	1	9	0	17	55	45	84	71	8	5	2-1	
259	1	0	0	0	2	0	0	0	0	0	2	0	2	4	0	4	34	23	22	20	1	1	2-1	
260	8	0	0	0	5	0	0	0	0	0	10	0	5	15	0	52	101	90	190	110	61	19		
264	1	0	0	0	4	0	0	0	0	0	6	0	4	10	0	24	29	25	54	29	12	13	2-1	1058 CE - 1275 CE
270	3	0	0	0	1	0	0	0	0	0	4	0	1	5	0	3	12	12	11	9	2	0	2-1	
271	0	0	0	0	2	0	0	0	0	0	1	0	2	3	0	6	55	46	62	48	11	3	2-1	1058 CE - 1275 CE
274	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	8	14	11	20	13	5	2	2-1	1290 CE – 1397 CE
277	2	0	0	0	3	0	0	0	0	1	5	1	3	9	0	13	66	58	102	51	28	21	3	
278	0	2	0	0	4	0	0	1	0	0	0	3	4	7	0	4	13	6	8	7	1	0	5	
279	1	0	0	1	0	0	0	1	0	0	2	1	1	4	0	0	2	2	0	0	0	0	6	
280	0	0	0	0	3	0	0	0	0	0	1	0	3	4	0	0	4	2	2	2	0	0	6	
281	6	0	0	0	14	1	0	0	0	0	10	0	14	25	0	0	28	13	6	4	2	0	7	
282	2	0	0	0	1	1	2	0	0	0	2	0	1	4	0	1	9	5	11	8	3	0	5	
283	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	4	2	1	1	0	0	6	789 BCE - 538 BCE
284	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	5	3	2	0	6	
285	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	6	789 BCE - 538 BCE
286	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	2	1	1	1	0	0	7	
287	1	0	0	0	0	0	0	0	0	0	3	0	0	3	0	1	7	7	2	1	1	0	6	
288	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	7	1209 BCE – 1010 BCE
289	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	4	0	0	0	0	7	
290	0	0	0	0	1	0	0	0	0	0	1	0	1	2	0	0	2	1	3	3	0	0	6	789 BCE - 538 BCE
291	7	0	0	0	6	0	0	0	0	0	7	0	6	13	0	0	4	1	3	0	0	0	7	
292	2	0	0	1	4	0	0	1	0	0	3	1	5	9	0	1	10	6	1	0	1	0	7	
293	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	7	1209 BCE – 1010 BCE
294	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	7	1209 BCE – 1010 BCE
295	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	6	
296	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	1209 BCE – 1010 BCE
297	2	0	0	1	3	0	0	1	0	0	2	1	4	7	0	0	2	1	0	0	0	0	7	
299	8	0	0	0	3	2	0	0	0	0	12	0	3	17	0	28	354	318	168	120	17	31	3	1165 CE – 1260 CE
302	1	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	8	7	1	1	0	0	4	
303	0	0	1	0	1	0	0	0	0	0	0	0	1	2	0	1	5	3	0	0	0	0	4	

Flot	Hordeum	Cicer	Other Cereal	Vitis	Ficus	Vicia	Large Fabaceae	Lens	Olea	Pisum	Cereals	Legumes	Fruits	Domesticates	Dung	Straw	Weeds (+Unks)	Weeds (ID'ed)	All Rachis	Triticum Rachis	Hordeum Rachis	Wild Rachis	C14OP	AMSDate
304	0	0	1	1	0	0	1	0	0	0	0	0	1	2	0	2	5	2	1	0	0	1	4	
305	2	0	0	0	0	0	1	0	0	0	6	0	0	6	0	1	9	5	0	0	0	0	4	
306	2	0	0	19	3	0	0	0	0	0	4	0	22	26	0	0	1	0	0	0	0	0	4	
307	2	0	0	0	0	0	0	0	0	0	3	0	0	3	0	16	26	23	84	59	6	19	2-3	
308	0	0	1	4	3	0	0	0	0	0	3	0	7	11	0	0	9	5	2	2	0	0	4	
309	0	0	0	3	2	0	0	0	0	0	1	0	5	6	0	0	9	5	2	0	0	2	4	
310	0	0	0	1	3	0	1	0	0	0	2	0	4	6	0	0	6	5	3	3	0	0	4	
311	1	0	0	0	2	0	1	0	0	0	1	0	2	3	0	0	4	1	2	0	1	1	4	
312	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0	4	430 CE - 610 CE
313	16	0	4	0	17	3	3	1	0	0	30	1	17	55	3	88	338	296	552	374	104	74	2-3	
318	9	0	0	0	0	1	0	0	0	0	10	0	0	11	0	18	118	110	59	24	27	8	3	
323	2	0	0	3	1	0	0	0	0	0	3	0	4	7	1	0	5	5	1	1	0	0	4	
324	0	0	0	0	2	0	0	0	0	0	0	0	2	2	0	0	5	2	0	0	0	0	4	
325	1	0	0	0	0	0	0	1	0	0	1	1	0	2	0	0	3	2	1	1	0	0	4	
326	1	0	0	0	1	0	0	0	0	0	1	0	1	2	0	0	0	0	0	0	0	0	4	
327	3	0	0	1	0	0	0	1	0	0	3	1	1	5	0	0	0	0	0	0	0	0	4	
328	0	0	0	0	1	0	1	1	0	0	0	1	1	2	0	0	0	0	1	1	0	0	4	
329	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	1	0	0	4	
330	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	10	5	4	4	0	0	4	
331	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	6	3	1	1	0	0	4	
332	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	4	4	0	0	0	0	4	
333	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	15	12	2	1	1	0	4	
334	2	0	0	0	1	0	0	0	0	0	7	0	1	8	1	0	6	5	0	0	0	0	4	
335	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	0	4	
336	0	0	0	0	3	0	1	1	0	0	0	1	3	4	0	0	7	4	0	0	0	0	4	
337	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	1	2	1	0	1	4	
338	0	0	0	0	0	0	0	1	0	0	1	1	0	2	1	1	3	1	1	1	0	0	4	
339	0	0	0	2	1	2	1	0	0	0	0	0	3	5	0	0	4	3	0	0	0	0	4	
340	0	0	0	1	2	0	0	0	0	0	0	0	3	3	0	0	4	2	0	0	0	0	4	
341	2	0	0	0	0	0	0	1	0	0	2	1	0	3	27	0	3	1	2	1	0	1	4	
342	2	0	0	0	3	2	0	0	0	0	6	0	3	11	21	0	1	1	0	0	0	0	4	
343	0	0	0	5	2	0	0	0	0	0	1	0	7	8	0	1	15	7	2	2	0	0	4	430 CE - 610 CE
344	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	5	5	1	1	0	0	4	430 CE - 610 CE
345	1	0	0	3	0	0	0	1	0	0	1	1	3	5	0	0	5	4	1	0	1	0	4	430 CE - 610 CE
346	0	0	0	3	3	0	2	0	0	0	2	0	6	8	2	1	8	7	1	0	1	0	4	430 CE - 610 CE
347	0	0	1	6	29	0	0	1	0	0	0	1	35	37	4	0	9	2	0	0	0	0	4	
348	0	0	0	2	1	3	0	0	0	0	2	0	3	8	0	0	0	0	0	0	0	0	4	
349	3	0	1	0	4	4	0	0	0	0	7	0	4	16	0	12	32	32	58	48	7	3	2-5	1299 CE - 1426 CE
351	1	0	0	0	4	0	0	0	0	0	4	0	4	8	68	20	53	40	87	52	22	13	2-4	
352	5	0	0	10	19	0	0	1	0	0	8	1	29	38	0	10	28	16	32	24	3	5	2-5	
353	8	0	3	0	17	3	2	0	0	0	12	0	17	35	48	87	344	299	620	451	104	65	2-3	772 CE - 976 CE
355	13	0	0	0	9	0	0	0	0	0	17	0	9	26	170	11	180	155	213	121	64	28	2-2	
356	18	0	1	0	19	3	1	2	0	0	19	2	19	44	12	13	79	66	90	72	14	4	2-5	1299 CE - 1426 CE
357	5	0	2	0	6	0	0	0	0	0	12	0	6	20	3	7	53	41	67	55	6	6	2-3	772 CE - 976 CE
358	7	0	1	0	3	2	0	0	0	0	9	0	3	15	15	22	107	102	203	160	35	8	2-3	
359	0	0	0	0	14	1	0	0	0	0	0	0	14	15	31	5	23	20	32	25	3	4	2-5	1299 CE - 1426 CE
360	17	0	0	15	38	2	0	5	0	0	22	5	53	82	6	18	76	64	71	53	13	5	2-3	
361	8	0	0	1	8	2	0	0	0	0	16	0	9	27	12	54	192	165	339	239	58	42	2-4	1288 CE - 1436 CE
362	11	0	0	0	9	2	2	1	0	0	19	1	9	31	4	27	152	101	160	119	26	15	2-5	1299 CE - 1426 CE
363	20	0	3	0	69	5	0	2	0	0	24	2	69	103	64	73	739	498	413	325	38	50	2-4	1261 CE - 1392 CE
364	2	0	1	5	4	1	1	2	0	0	2	2	9	15	0	4	14	8	6	6	0	0	4	
365	0	0	0	1	1	0	0	0	0	0	0	0	2	2	0	0	1	0	0	0	0	0	4	
366	7	0	2	1	1	0	4	0	0	2	15	2	2	21	7	4	59	50	13	11	2	0	4	
367	1	0	0	1	0	0	0	0	0	0	4	0	1	5	0	1	14	12	5	4	1	0	4	
368	1	0	0	5	5	1	0	0	0	0	1	0	10	12	5	0	10	8	0	0	0	0	4	
369	1	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0	6	5	0	0	0	0	4	
370	1	0	1	0	1	0	0	0	0	0	3	0	1	5	0	1	12	8	4	4	0	0	4	
371	1	0	0	0	0	0	0	0	0	0	2	0	0	2	0	2	3	3	6	5	1	0	4	
372	1	0	2	2	6	0	0	0	0	0	4	0	8	14	0	0	18	18	3	3	0	0	4	
373	0	0	0	0	2	0	0	0	0	0	1	0	2	3	2	2	2	2	1	1	0	0	4	
374	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	3	1	0	0	0	0	4	
375	0	0	0	0	2	0	0	0	0	0	1	0	2	3	0	1	0	0	0	0	0	0	4	
376	2	0	1	0	2	0	0	1	0	0	2	1	2	6	8	1	30	27	41	30	9	2	2-3	
377	2	0	0	0	2	0	0	0	0	0	5	0	2	7	5	4	18	16	18	13	4	1	2-4	
378	2	0	0	0	0	2	0	0	0	0	2	0	0	4	2	4	5	5	27	23	2	2	2-4	
380	2	0	0	1	5	1	0	0	0	0	5	0	6	12	19	8	67	58	79	68	5	6	2-3	772 CE - 976 CE
381	4	0	1	0	14	0	0	0	0	0	5	0	14	20	16	46	134	115	275	161	82	32	3	1045 CE - 1215 CE
382	0	0	0	0	4	0	0	0	0	0	0	0	4	4	0	0	4	4	1	1	0	0	4	
383	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	1	1	0	0	4	
384	1	0	0	0	1	0	0	0	0	0	1	0	1	2	0	0	0	0	0	0	0	0	4	
385	4	0	0	0	0	0	0	1	0	0	8	1	0	9	2	0	3	0	0	0	0	0	4	
386	1	0	0	2	2	0	0	0	0	0	2	0	4	6	0	0	4	4	0	0	0	0	4	

Flot	Hordeum	Cicer	Other Cereal	Vitis	Ficus	Vicia	Large Fabaceae	Lens	Olea	Pisum	Cereals	Legumes	Fruits	Domesticates	Dung	Straw	Weeds (+Unks)	Weeds (ID'ed)	All Rachis	Triticum Rachis	Hordeum Rachis	Wild Rachis	C14OP	AMSDate
387	10	0	0	0	6	3	0	0	0	0	21	0	6	30	5	11	177	165	154	121	19	14	3	
388	1	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	16	15	1	1	0	0	4	
389	0	0	0	1	2	0	0	1	0	0	0	1	3	4	0	0	2	2	0	0	0	0	4	
390	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	2	2	0	0	4	
391	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	1	9	9	5	3	1	1	4	
392	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	4	
393	0	0	1	0	0	0	0	1	0	0	0	1	0	2	2	0	6	5	0	0	0	0	4	
394	1	0	0	2	1	0	0	0	0	1	1	1	3	5	0	0	5	5	0	0	0	0	4	
395	0	0	0	1	0	0	1	0	0	0	2	0	1	3	0	0	4	3	0	0	0	0	4	
396	1	0	1	3	3	0	0	0	0	0	2	0	6	9	0	0	2	1	0	0	0	0	4	
397	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	0	2	2	0	0	0	0	4	
399	1	0	1	0	6	3	0	0	0	0	1	0	6	11	1	7	15	11	52	35	14	3	2-4	
401	7	0	0	1	6	0	0	0	0	0	13	0	7	20	8	32	123	110	196	106	81	9	2-2	
402	5	0	0	0	1	0	2	0	0	0	8	0	1	9	6	18	85	75	84	66	13	5	3	
403	7	0	0	0	1	2	1	0	0	0	10	0	1	13	4	5	134	120	53	30	15	8	3	
404	5	0	0	0	2	1	0	0	0	0	9	0	2	12	0	7	81	74	58	46	9	3	3	
406	5	0	0	1	15	1	1	0	0	0	9	0	16	26	0	77	239	211	381	237	116	28	3	
407	5	0	1	0	6	1	0	0	0	0	9	0	6	17	1	25	108	101	291	250	28	13	3	
408	0	0	0	11	0	2	0	1	0	137.07	149	138.06747	11	300.06747	0	2	9	5	2	0	0	0	4	
409	0	0	0	5	2	0	0	0	0	4.89	0	4.894766	7	11.894766	0	1	3	3	1	0	0	0	4	
410	0	0	0	0	0	0	0	0	0	3.41	0	3.40802	0	3.40802	0	0	0	0	0	0	0	0	4	
411	0	0	0	7	2	0	0	0	0	3.23	3	3.234074	9	17.234074	0	1	5	5	1	0	0	0	4	
412	0	0	0	4	1	1	0	2	0	0	5	2	5	13	0	1	9	8	1	0	0	0	4	
413	1	0	5	2	0	1	0	1	1	37.46	16	38.45877	3	63.45877	0	0	2	2	0	0	0	0	4	
414	0	0	0	19	4	0	0	4	0	3.42	10	7.42443	23	41.42443	0	6	30	18	18	11	0	1	4	
415	0	0	0	1	2	0	0	0	0	26.01	35	26.011154	3	64.011154	0	0	6	6	0	0	0	0	4	
416	0	0	0	2	5	0	0	0	0	2.24	6	2.24291	7	15.24291	0	0	7	4	2	1	1	0	4	
417	2	0	0	15	4	0	0	0	0	0	12	0	19	31	0	1	10	7	6	5	0	0	4	
418	0	0	0	0	2	0	0	0	0	0	0	0	2	2	0	0	0	0	4	2	2	0	4	
419	0	0	0	0	0	0	0	0	0	1.73	0	1.7342	0	1.7342	0	0	6	5	0	0	0	0	4	
420	0	0	0	0	1	0	0	0	0	1.89	0	1.885172	1	2.885172	0	0	1	0	0	0	0	0	4	
421	1	0	0	0	1	4	0	0	0	40.03	21	40.025294	1	66.025294	0	0	1	1	0	0	0	0	4	
422	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	
206+231	4	0	0	0	4	1	1	0	0	0	8	0	4	13	0	21	161	128	92	56	28	8	2-1	1298 CE – 1405 CE
208+405	22	0	6	0	45	1	3	2	0	0	32	2	45	86	10	76	716	625	640	355	240	45	3	
212+223	7	0	0	0	5	0	2	1	0	0	14	1	5	20	0	39	88	76	204	159	15	30	2-1	1290 CE – 1397 CE
227+269	3	0	0	0	2	0	1	0	0	0	4	0	2	6	0	14	54	46	87	60	12	15	2-1	1058 CE - 1275 CE
230+266	2	0	0	0	6	0	0	1	0	0	6	1	6	13	0	37	111	99	137	92	23	22	2-1	1298 CE – 1405 CE
243+261	6	0	1	0	4	1	1	0	0	0	9	0	4	15	1	26	82	63	103	80	15	8	2-1	
254+254	5	0	1	0	11	1	0	0	0	0	39	0	11	52	0	46	164	137	169	97	58	14	2-1	1298 CE – 1405 CE
255+262+	11	0	0	1	5	2	0	0	0	2	21	2	6	31	0	68	146	120	256	183	45	28	2-1	1298 CE – 1405 CE
267+268	5	0	1	0	6	1	0	0	0	1	14	1	6	23	0	38	51	43	151	109	27	15	2-1	1058 CE - 1275 CE
272+273	2	0	0	0	0	0	0	0	0	0	7	0	0	7	0	18	48	38	73	50	10	13	2-1	1290 CE – 1397 CE
275+276	2	0	0	0	4	1	0	0	0	1	4	1	4	10	0	10	34	25	34	26	1	7	2-1	1290 CE – 1397 CE
280-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	6	789 BCE - 538 BCE
281-2	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	2	2	0	0	6	
314+315	7	0	1	5	23	1	1	1	0	0	13	1	28	44	3	13	81	67	122	86	22	14	2-5	
316+317	4	0	1	1	9	3	0	0	0	0	6	0	10	20	8	20	56	45	92	68	17	7	2-5	
354+398	4	0	0	0	3	1	0	0	0	0	7	0	3	11	4	15	54	46	80	42	21	17	2-4	
379+400	8	0	0	0	12	1	1	0	0	0	23	0	12	36	64	25	144	132	284	217	49	18	2-3	772 CE - 976 CE

Appendix C

Seed Measurement Data

ITEMNUM	FlotNum	Bag	Period	Unit	Locus	SG	Genus	Species	NakedHulled	Sphericity	Area	Perimeter	Elongation	DMH	DMW	Shape Factor	DScH	DScW	Si Sphericity	Si Area	Si Perimeter	Si Thickness	Si Elongation	SiScMax	SiScMin
1	200	213	Middle Islamic I	BP48	18	18	Hordeum	vulgare	hulled	0.19		17.28		5.18	2.31	0.40	0.72	0.53				1.73		1.06	0.62
2	200	213	Middle Islamic I	BP48	18	18	Triticum	diococcum		0.32		17.30		4.58	2.70	0.41	0.59	0.44				2.60		1.36	0.68
3	200	213	Middle Islamic I	BP48	18	18	Triticum	aestivum/durum		0.51		20.17		4.82	3.47	0.42						2.56		1.55	0.98
1	201	126	Iron II	BR47	16		Triticum			0.30		12.12		4.06	2.27	0.68	0.51	0.23				2.07		1.21	0.54
1	205	196	Middle Islamic I	BP48	18	13	Hordeum	vulgare		0.22		18.03		5.96	2.89	0.52	1.11	0.59				2.03		1.13	0.71
2	205	196	Middle Islamic I	BP48	18	13	Hordeum	vulgare	hulled	0.23		15.34		5.37	2.66	0.59						1.79		1.45	0.76
3	205	196	Middle Islamic I	BP48	18	13	Triticum							4.03	2.45		0.76	0.63				1.74			
4	205	196	Middle Islamic I	BP48	18	13	Hordeum	vulgare	hulled	0.28		19.28		6.95	3.73	0.70	1.15	0.41				2.58		2.18	0.87
1	210	400	Middle Islamic II	BR44	36		Hordeum	vulgare	naked	0.24		15.68		4.19	2.13	0.33	0.91	0.68				1.73		1.06	0.51
2	210	400	Middle Islamic II	BR44	36		Hordeum	vulgare	hulled	0.26		16.77		5.81	3.01	0.55	1.13	0.73				2.11		1.61	0.71
3	210	400	Middle Islamic II	BR44	36		Hordeum	vulgare	hulled	0.28		22.71		7.14	4.01	0.53						3.20		1.97	0.99
1	212	234	Middle Islamic II	BS43	18	18	Hordeum	vulgare	naked	0.42		16.96		4.48	3.29	0.53	0.78	0.38				2.57			
2	212	234	Middle Islamic II	BS43	18	18	Triticum	aestivum/durum		0.44		17.50		4.59	3.07	0.48	0.66	1.37				2.83		2.14	0.78
3	212	234	Middle Islamic II	BS43	18	18	Triticum			0.47		16.88		4.71	3.14	0.56	1.17	1.02				2.39		1.43	0.51
4	212	234	Middle Islamic II	BS43	18	18	Hordeum		naked	0.27		12.34		4.33	2.30	0.77						1.91			
5	212	234	Middle Islamic II	BS43	18	18	Triticum			0.35		17.39		5.52	3.27	0.62	0.93	1.05				2.96		2.18	0.80
1	215	80	Roman	BR47	10		Triticum	aestivum/durum		0.48		14.69		4.61	3.27	0.48	1.27	0.89				2.47		1.27	0.53
2	215	80	Roman	BR47	10		Triticum	aestivum/durum		0.48		14.60		4.60	3.29	0.74	0.59	0.32				2.90		1.86	0.84
3	215	80	Roman	BR47	10		Triticum	aestivum/durum		0.69		16.11		4.79	4.03	0.78	0.90	0.93				2.98		2.73	0.86
4	215	80	Roman	BR47	10		Triticum			0.38		15.53		4.73	2.96	0.62	0.55	0.47				2.53		1.53	0.58
5	215	80	Roman	BR47	10		Hordeum			0.61		16.97		4.94	3.91	0.69						2.46		1.63	0.77
6	215	80	Roman	BR47	10		Hordeum			0.46		18.09		5.29	3.64	0.60	0.46	0.42				2.39		1.33	0.75
7	215	80	Roman	BR47	10		Hordeum			0.43		22.21		5.57	3.79	0.46						2.46		1.62	0.77
8	215	80	Roman	BR47	10		Hordeum			0.28		23.73		6.45	3.63	0.42						2.15		1.62	0.73
9	215	80	Roman	BR47	10		Hordeum			0.24		17.98		6.13	3.11	0.60						2.39		1.77	0.69
10	215	80	Roman	BR47	10		Triticum	aestivum/durum		0.49		12.11		3.16	2.53	0.60									
11	215	80	Roman	BR47	10		Hordeum			0.30		15.00		5.24	2.87	0.64						2.16		1.28	0.52
12	215	80	Roman	BR47	10		Triticum			0.35		12.69		3.92	2.46	0.82						2.31		1.71	0.86
13	215	80	Roman	BR47	10		Hordeum	vulgare	hulled	0.41		11.73		4.26	2.74	0.84						2.40		1.33	0.64
14	215	80	Roman	BR47	10		Triticum	aestivum/durum		0.47		11.40		4.10	2.70	0.86						2.34		1.90	0.77
15	215	80	Roman	BR47	10		Hordeum			0.33		11.89		3.72	2.22	0.55	1.11	0.88				1.45		1.26	0.79
16	215	80	Roman	BR47	10		Triticum	aestivum/durum		0.51		11.38		3.49	2.51	0.68						2.04		1.81	0.98
1	217		Byzantine	AX54	6		Hordeum			0.32	12.89	15.88	1.77	5.19	3.02	0.64			0.20	9.68	15.80	2.40			
2	217		Byzantine	AX54	6		Hordeum			0.39	13.32	15.66	1.60	4.98	3.24	0.68			0.26	9.86	15.34	2.58			
3	217		Byzantine	AX54	6		Hordeum		hulled	0.29	18.13	17.06	1.87	6.55	3.81	0.78			0.20	13.58	22.66	2.90			
4	217		Byzantine	AX54	6		Hordeum			0.40	14.87	16.67	1.58	5.29	3.42	0.67			0.26	10.79	18.19	2.62			
5	217		Byzantine	AX54	6		Hordeum			0.40	16.21	17.72	1.58	5.50	3.61	0.65			0.31	13.11	18.97	3.09			
6	217		Byzantine	AX54	6		Hordeum			0.43	11.89	14.43	1.53	4.76	3.09	0.72			0.26	8.32	14.43	2.24			
7	217		Byzantine	AX54	6		Hordeum			0.33	14.78	15.35	1.75	5.85	3.19	0.79			0.23	12.23	21.12	2.78			
8	217		Byzantine	AX54	6		Hordeum			0.28	12.14	16.25	1.89	5.11	2.74	0.58			0.20	8.96	15.26	2.31			
9	217		Byzantine	AX54	6		Triticum	aestivum/durum		0.44	14.63	16.78	1.51	5.25	3.52	0.65			0.41	13.14	15.08	3.35			
10	217		Byzantine	AX54	6		Triticum	aestivum/durum		0.46	15.61	17.46	1.48	5.31	3.67	0.64			0.22	10.32	13.81	2.43			
11	217		Byzantine	AX54	6		Triticum	aestivum/durum		0.36	13.69	16.54	1.68	5.42	3.31	0.63			0.27	10.70	14.57	2.68			
12	217		Byzantine	AX54	6		Triticum	aestivum/durum		0.30	16.55	18.40	1.82	5.91	3.39	0.61			0.20	12.73	15.73	2.66			
13	217		Byzantine	AX54	6		Triticum	aestivum/durum		0.37	14.53	18.15	1.65	5.39	3.37	0.55			0.25	10.47	14.31	2.60			
14	217		Byzantine	AX54	6		Triticum	aestivum/durum		0.33	13.15	15.38	1.75	5.27	3.05	0.70			0.35	11.58	14.66	3.03			
15	217		Byzantine	AX54	6		Triticum	aestivum/durum		0.63	13.15	14.94	1.26	4.49	3.65	0.74			0.46	10.14	13.00	3.03			
16	217		Byzantine	AX54	6		Triticum	aestivum/durum		0.57	12.31	15.63	1.32	4.27	3.39	0.63			0.52	9.86	12.55	2.60			
17	217		Byzantine	AX54	6		Triticum	aestivum/durum			16.31	15.76		5.59	3.58							2.98			
18	217		Byzantine	AX54	6		Triticum	aestivum/durum							3.22							2.91			
19	217		Byzantine	AX54	6		Triticum	aestivum/durum						4.52	3.16							2.44			
20	217		Byzantine	AX54	6		Triticum	aestivum/durum			13.58	14.47		5.09	3.31				0.35	11.62	13.91	2.89			
21	217		Byzantine	AX54	6		Hordeum	vulgare		0.36	18.13	20.83	1.66	5.94	3.85	0.53			0.16	11.38	16.02	2.39	2.49		
22	217		Byzantine	AX54	6		Hordeum	vulgare	hulled					4.96	3.11							2.71			
1	219	127	Iron II	BR47	17		Triticum			0.41		18.58		5.44	3.63	0.56						2.32		1.44	0.53
1	225	182	Middle Islamic II	BS44	58	19	Hordeum	vulgare	hulled	0.24		23.71		6.66	3.04	0.33	1.98	0.66				2.02		1.20	0.43
2	225	182	Middle Islamic II	BS44	58	19	Hordeum	vulgare	hulled	0.34		15.85		5.93	3.48	0.81						2.28		1.52	0.41

ITEMNUM	FlotNum	Bag	Period	Unit	Locus	SG	Genus	Species	NakedHulled	Sphericity	Area	Perimeter	Elongation	DMH	DMW	Shape Factor	DScH	DScW	Si Sphericity	Si Area	Si Perimeter	Si Thickness	Si Elongation	SiScMax	SiScMin
3	225	182	Middle Islamic II	BS44	58	19	Triticum	aestivum/durum		0.48		11.49		3.55	2.42	0.63	0.60	0.67				2.22		1.85	0.93
5	225	182	Middle Islamic II	BS44	58	19	Triticum	aestivum/durum		0.45		14.54		3.94	2.85	0.48						2.70		1.70	0.64
6	225	182	Middle Islamic II	BS44	58	19	Hordeum	vulgare	hulled	0.31		20.84		6.08	3.41	0.48						2.34		1.74	0.82
7	225	182	Middle Islamic II	BS44	58	19	Hordeum	vulgare	hulled	0.32		26.03		6.38	3.65	0.41	1.37	0.81				3.12		1.31	0.61
8	225	182	Middle Islamic II	BS44	58	19	Triticum																		
1	230	414	Middle Islamic II	BR44	35	2	Hordeum	vulgare	hulled	0.31		15.86		4.57	2.62	0.48	0.84	0.62				1.98		1.05	0.51
2	230	414	Middle Islamic II	BR44	35	2	Triticum	aestivum/durum		0.59		19.02		4.43	3.42	0.41						2.89		1.94	1.03
3	230	414	Middle Islamic II	BR44	35	2	Triticum	aestivum/durum		0.49		18.16		5.08	3.54	0.54						3.20		2.16	0.65
1	244	58	Roman	BR47	8		Triticum	aestivum/durum		0.39		13.88		4.45	2.83	0.69						2.26		2.10	0.70
2	244	58	Roman	BR47	8		Triticum	aestivum/durum		0.37		12.67		4.05	2.51	0.66						2.21		2.16	1.02
3	244	58	Roman	BR47	8		Triticum	aestivum/durum		0.45		17.93		5.34	3.60	0.62						2.88		2.51	0.98
4	244	58	Roman	BR47	8		Hordeum	vulgare	hulled	0.31		17.92		5.76	3.33	0.63	0.74	0.47				2.23		1.84	0.51
1	247	108	Roman	BR47	13		Hordeum			0.27		16.25		5.53	2.83	0.57						2.13		1.24	0.66
1	281	211	Iron II	L-Sect	29		Triticum			0.36		15.72		4.74	2.85	0.57	1.27	0.86				2.36		2.21	0.71
2	281	211	Iron II	L-Sect	29		Triticum			0.33		15.73		4.94	2.86	0.57	1.48	1.14				2.40		2.17	0.81
3	281	211	Iron II	L-Sect	29		Triticum			0.25		15.65		5.64	2.89	0.65	1.88	1.10				2.69		2.64	0.88
4	281	211	Iron II	L-Sect	29		Triticum			0.32		14.11		4.57	2.64	0.64	1.37	0.75				2.19		1.90	0.88
5	281	211	Iron II	L-Sect	29		Hordeum	vulgare	hulled	0.25		13.01		4.06	2.14	0.52						1.49		0.97	0.51
6	281	211	Iron II	L-Sect	29		Hordeum	vulgare	hulled	0.31		11.85		3.90	2.22	0.57	0.64	0.49				1.46		1.27	0.62
7	281	211	Iron II	L-Sect	29		Hordeum	vulgare	hulled	0.17		16.41		5.72	2.51	0.52	1.30	1.10				1.93		1.28	0.71
8	281	211	Iron II	L-Sect	29		Hordeum	vulgare	hulled	0.28		16.39		5.75	2.94	0.59	1.36	1.21				2.25		1.57	0.83
9	281	211	Iron II	L-Sect	29		Hordeum	vulgare	hulled	0.24		15.48		5.38	2.70	0.59						2.05		1.17	0.63
10	281	211	Iron II	L-Sect	29		Hordeum	vulgare	hulled	0.26		16.79		5.82	3.05	0.60						2.44		1.22	0.71
1	291		Iron II	L-Sect	27		Hordeum	vulgare	hulled	0.21		25.04		6.30	2.94	0.29	1.24	0.66				1.80		1.41	0.55
2	291		Iron II	L-Sect	27		Hordeum	vulgare	hulled	0.15		24.07		6.60	2.55	0.28	1.72	0.67				1.58		1.11	0.51
3	291		Iron II	L-Sect	27		Hordeum	vulgare	hulled	0.24				5.82	2.73							1.63		1.05	0.49
4	291		Iron II	L-Sect	27		Hordeum	vulgare	hulled	0.32		25.96		5.84	3.39	0.29	1.14	1.04				2.61		1.75	0.67
5	291		Iron II	L-Sect	27		Hordeum	vulgare	hulled	0.39		19.98		4.76	3.00	0.33						2.36		1.86	0.82
1	305		Byzantine	AW54	10	3	Triticum			0.32	8.86	13.00	1.76	4.40	2.62	0.66			0.25	7.17	11.93	2.12	2.01		
2	305		Byzantine	AW54	10	3	Triticum	diococcum					1.55	5.66	3.56				0.37	13.93	17.47	3.45	1.64		
3	305		Byzantine	AW54	10	3	Hordeum	vulgare	hulled				2.06	6.03	3.10				0.16	10.47	15.66	2.42	2.51		
1	306		Byzantine	AW54	10	8	Hordeum							4.57	3.66					8.33	14.03	2.43			
2	306		Byzantine	AW54	10	8	Hordeum							6.11	3.19				0.18	10.75	15.02	2.56	2.36		
3	306		Byzantine	AW54	10	8	Triticum	diococcum						3.76	2.00					5.94	11.46	2.19			
4	306		Byzantine	AW54	10	8	Triticum	aestivum/durum						3.08	2.04				0.49	4.92	9.39	2.18	1.43		
1	308		Byzantine	AW54	10		Triticum	aestivum/durum		0.42	12.78	15.80	1.55	4.99	3.14	0.64			0.30	10.21	14.83	2.79	1.81		
2	308		Byzantine	AW54	10		Triticum	diococcum						4.64	3.07				0.22	11.85	16.44	2.80	2.14		
1	309		Byzantine	AW54	10	10	Triticum	aestivum/durum		0.57	11.93	16.88	1.32	4.16	3.37	0.53						2.67			
1	310		Byzantine	AW54	10	18	Triticum							4.08	2.78							2.29			
2	310		Byzantine	AW54	10	18	Triticum							4.98	3.03							2.60			
1	314		Middle Islamic II	BR44	65	4	Triticum			0.48	6.55	10.28	1.44	3.33	2.35	0.78			0.36	5.13	9.19	1.99	1.66		
2	314		Middle Islamic II	BR44	65	4	Triticum			0.50	10.89	14.51	1.41	4.33	3.20	0.65			0.51	10.48	13.39	3.18	1.40		
3	314		Middle Islamic II	BR44	65	4	Hordeum			0.25	13.15	16.71	1.98	5.80	2.94	0.59			0.17	9.51	15.23	2.45	2.45		
1	318		Middle Islamic I	BP49	13	21	Hordeum			0.30	11.39	16.18	1.84	5.31	2.85	0.55			0.20	6.91	12.91	2.10	2.24		
2	318		Middle Islamic I	BP49	13	21	Hordeum			0.37	13.79	16.01	1.64	5.48	3.31	0.68			0.18	7.38	12.72	2.11	2.36		
3	318		Middle Islamic I	BP49	13	21	Hordeum	vulgare	hulled	0.28	15.83	18.29	1.89	6.36	3.32	0.59	0.66	0.81	0.18	9.43	16.09	2.36	2.37	1.74	0.69
4	318		Middle Islamic I	BP49	13	21	Hordeum			0.39	8.02	11.69	1.61	4.02	2.51	0.74	0.68	0.62	0.36	7.34	11.61	2.42	1.66		
5	318		Middle Islamic I	BP49	13	21	Triticum			0.41	9.07	12.89	1.57	4.12	2.69	0.69	0.67	0.79	0.38	8.64	12.78	2.55	1.63		
6	318		Middle Islamic I	BP49	13	21	Hordeum			0.31	10.54	16.54	1.80	4.97	2.93	0.48			0.20	8.53	13.62	2.18	2.25		
7	318		Middle Islamic I	BP49	13	21	Hordeum			0.39	14.11	17.14	1.59	5.54	3.43	0.60	2.57	1.76	0.25	10.56	15.23	2.68	1.99		
8	318		Middle Islamic I	BP49	13	21	Hordeum			0.19	10.74	16.18	2.32	5.62	2.51	0.52	0.26	0.43	0.19	10.38	14.90	2.55	2.31		
1	323	250	Byzantine	AX55	20	24	Triticum	aestivum/durum		0.59	11.50	14.72	1.30	4.45	3.33	0.67	0.84	1.18						2.52	0.49
2	323	250	Byzantine	AX55	20	24	Hordeum			0.30	7.76	14.37	1.84	4.26	2.30	0.47	1.09	`1.03	0.27	7.25	13.85	2.26	1.93		
3	323	250	Byzantine	AX55	20	24	Hordeum			0.28	7.11	15.36	1.91	4.19	2.21	0.38									
1	331	244	Byzantine	AX55	14	9	Hordeum			0.48	7.75	13.92	1.44	3.77	2.71	0.50						2.23			
1	333	246	Byzantine	AX55	13	6	Triticum	diococcum		0.33	11.52	18.95	1.75	5.08	2.99	0.40	1.14	1.41	0.33	10.47	16.68	2.89	1.73	2.36	0.64
1	334		Byzantine	AX55	28	16	Hordeum			0.52	13.71	17.50	1.39	4.92		0.56			0.32	9.66	13.44	2.71	1.77		

ITEMNUM	FlotNum	Bag	Period	Unit	Locus	SG	Genus	Species	NakedHulled	Sphericity	Area	Perimeter	Elongation	DMH	DMW	Shape Factor	DScH	DScW	Si Sphericity	Si Area	Si Perimeter	Si Thickness	Si Elongation	SiScMax	SiScMin
2	334		Byzantine	AX55	28	16	Triticum			0.41	10.69	13.11	1.55	4.51		0.78			0.28	8.45	12.76	2.36	1.87		
3	334		Byzantine	AX55	28	16	Hordeum			0.29	14.81	16.97	1.87	5.54		0.65			0.21	12.16	16.15	2.69	2.20		
1	338	210	Byzantine	AW54	20		Triticum			0.57		18.71	1.33	5.20	4.02	0.57	0.93	0.92	0.32	10.57	14.83	2.82	1.78	2.52	0.73
2	341	248	Byzantine	AW54	21	0	Hordeum			0.32	10.31	15.39	11.77	5.03	2.61	0.55			0.21	9.08	13.72	2.27	2.21		
3	341	248	Byzantine	AW54	21	0	Hordeum			0.37	12.26	19.07	1.65	5.31	3.11	0.42			0.24	9.98	15.16	2.57	2.04		
1	343		Byzantine	AX55	18		Triticum			0.35	9.10	13.71	1.69	4.22	2.54	0.61			0.31	8.15	13.31	2.41	1.80		
1	344	198	Byzantine	AX55	18	0	Hordeum			0.49	9.32	12.80	1.42	4.17	2.85	0.72			0.33	7.86	11.97	2.33	1.74		
1	356		Middle Islamic II	BS44	82	19	Hordeum			0.22	16.03	17.77	2.15	6.50	3.09	0.64			0.11	10.01	15.40	2.13	3.06		
2	356		Middle Islamic II	BS44	82	19	Hordeum			0.18	13.46	15.78	2.34	6.12	2.71	0.68			0.09	7.72	14.05	1.77	3.42		
3	356		Middle Islamic II	BS44	82	19	Hordeum			0.27	9.45	12.91	1.93	4.75	2.51	0.71			0.10	5.54	11.55	1.54	3.12		
4	356		Middle Islamic II	BS44	82	19	Triticum	aestivum/durum		0.32	9.11	12.26	1.76	4.36	2.62	0.76			0.33	8.24	11.74	2.46	1.74		
5	356		Middle Islamic II	BS44	82	19	Hordeum			0.26	9.02	12.75	1.96	4.76	2.42	0.70			0.10	5.33	11.14	1.52	3.19		
6	356		Middle Islamic II	BS44	82	19	Hordeum			0.22	9.04	13.48	2.13	4.78	2.27	0.62			0.13	5.86	11.68	1.69	2.82		
7	356		Middle Islamic II	BS44	82	19	Hordeum			0.36	13.45	15.29	1.67	5.45	3.21	0.72			0.19	8.76	13.49	2.30	2.29		
8	356		Middle Islamic II	BS44	82	19	Hordeum			0.27	14.02	17.12	1.93	5.67	3.01	0.60			0.17	10.94	15.68	2.41	2.45		
9	356		Middle Islamic II	BS44	82	19	Hordeum			0.26	18.04	17.84	1.97	6.61	3.40	0.71			0.16	12.01	15.97	2.62	2.52		
10	356		Middle Islamic II	BS44	82	19	Hordeum			0.32	12.13	15.49	1.77	5.21	2.97	0.64			0.12	7.86	13.36	1.88	2.91		
11	356		Middle Islamic II	BS44	82	19	Hordeum			0.27	13.76	15.57	1.91	5.66	3.03	0.71			0.13	9.12	14.01	2.07	2.77		
1	360		Middle Islamic II	BR44	51	5	Hordeum		hulled	0.36	16.98	20.68	1.67	6.35	3.74	0.50	2.35	2.37	0.24	12.48	16.92	3.00	2.04	2.37	0.24
2	360		Middle Islamic II	BR44	51	5	Hordeum		hulled	0.39	17.29	19.47	1.60	6.12	3.80	0.57	1.59	1.52	0.23	12.22	15.96	2.82	2.10	2.59	0.69
3	360		Middle Islamic II	BR44	51	5	Hordeum		hulled	0.34	14.30	15.93	1.72	5.67	3.29	0.71			0.23	11.14	15.01	2.80	2.08	2.52	0.79
4	360		Middle Islamic II	BR44	51	5	Hordeum			0.22	9.05	13.88	2.12	5.05	2.40	0.59	1.66	1.13	0.08	5.49	12.42	1.47	3.47	1.33	0.32
5	360		Middle Islamic II	BR44	51	5	Hordeum			0.41	5.60	10.81	1.56	3.52	2.13	0.60	1.14	0.99	0.23	4.06	9.12	1.75	2.08	1.37	0.44
6	360		Middle Islamic II	BR44	51	5	Hordeum			0.20	7.78	12.32	2.21	4.76	2.18	0.64			0.14	5.83	12.97	1.91	2.69		
1	364		Byzantine	AX55	31		Hordeum	vulgare	hulled					5.62	2.49							2.49			
1	342		Byzantine	AW54	9	24	Hordeum			0.35	11.39	15.01	1.70	4.81	3.00	0.64			0.21	7.73	12.65	2.22	2.16		
3	342		Byzantine	AW54	9	24	Triticum			0.39	9.19	13.58	1.61	4.32	2.65	0.63			0.34	7.98	13.28	2.45	1.72		
4	342		Byzantine	AW54	9	24	Triticum			0.45	13.90	16.07	1.49	5.17	3.58	0.68			0.27	10.07	14.87	2.66	1.91		
6	342		Byzantine	AW54	9	24	Triticum			0.28	9.64	13.11	1.90	4.76	2.52	0.70			0.20	7.56	12.81	2.11	2.26		

Appendix D

Heavy Fraction Data

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
104	BR44	35	1		30	LW	Bone	Fragment			3.20	96		3	21	72	0.77	23.04		3.02	12.02	8
104	BR44	35	1		30	LW	Bone	Burnt			0.13	4			2	2	0.05	1.42			0.86	0.56
104	BR44	35	1		30	LW	Glass	Fragment			0.10	3		1		2	0.12	3.62		3.45		0.17
104	BR44	35	1		30	LW	Chaff Tempered Clay	Unburnt			0.80	24			3	21	0.18	5.44			2.48	2.96
104	BR44	35	1		30	LW	Bone	Whole	Vertebra	Fish	0.03	1			1		0.01	0.2			0.2	
104	BR44	35	1		30	LW	Bone	Whole	Scapula		0.03	1				1	0.00	0.02				0.02
104	BR44	35	1		30	LW	Chaff Tempered Clay	Burnt			0.23	7		1		6	0.29	8.77		7.9		0.87
104	BR44	35	1		30	LW	Shell	Eggshell			0.03	1				1	0.00	0.02				0.02
104	BR44	35	1		30	LW	Shell	Fragment		Terrestrial	0.03	1				1	0.00	0.03				0.03
104	BR44	35	1		30	LW	Botanical	Charcoal			0.10	3				3	0.01	0.21				0.21
104	BR44	35	1		30	LW	Metal				0.03	1		1			0.28	8.5		8.5		
104	BR44	35	1		30	LW	Ceramic	Body Sherd			1.07	32		9	10	13	1.12	33.63		23.09	7.99	2.55
104	BR44	35	1		30	LW	Ceramic	Diagnostic	Rim		0.07	2		1		1	0.18	5.33		2.26		3.07
105	BS44	58	18		25	L	Bone	Fragment			1.32	33		1	3	29	0.23	5.87		1.72	1.12	3.03
105	BS44	58	18		25	L	Bone	Burnt			0.08	2				2	0.01	0.29				0.29
105	BS44	58	18		25	L	Glass	Fragment			0.04	1				1	0.00	0.07				0.07
105	BS44	58	18		25	L	Shell	Fragment		Terrestrial	0.40	10			1	9	0.07	1.65			1.3	0.35
105	BS44	58	18		25	L	Bone	Whole	Tooth		0.04	1		1			0.09	2.16		2.16		
105	BS44	58	18		25	L	Shell	Eggshell			0.80	20				20	0.02	0.39				0.39
105	BS44	58	18		25	L	Shell	Limestone		Fossil	0.08	2				2	0.01	0.25				0.25
105	BS44	58	18		25	L	Chaff Tempered Clay	Unburnt			0.92	23			9	14	0.42	10.51			8.8	1.71
105	BS44	58	18		25	L	Botanical	Charcoal			0.08	2				2	0.01	0.18				0.18
105	BS44	58	18		25	L	Chaff Tempered Clay	Burnt			2.68	67				67	0.35	8.78				8.78
105	BS44	58	18		25	L	Ceramic	Body Sherd			1.20	30		6	10	14	1.10	27.51		16.78	7.32	3.41
106	BR44	35	8		16	LW	Bone	Fragment			2.69	43		3	10	30	0.74	11.84		3.21	6.33	2.3
106	BR44	35	8		16	LW	Bone	Burnt			0.06	1				1	0.01	0.14				0.14
106	BR44	35	8		16	LW	Glass	Fragment			0.06	1				1	0.00	0.04				0.04
106	BR44	35	8		16	LW	Botanical	Charcoal			0.25	4		1	1	2	0.14	2.22		1.69	0.38	0.15
106	BR44	35	8		16	LW	Stone	Possible Lithic			0.06	1		1			0.09	1.5		1.5		
106	BR44	35	8		16	LW	Bone	Whole	Tooth		0.06	1				1	0.01	0.12				0.12
106	BR44	35	8		16	LW	Chaff Tempered Clay	Unburnt			1.13	18			3	15	0.24	3.84			2.25	1.59
106	BR44	35	8		16	LW	Metal				0.19	3			1	2	0.07	1.06			0.38	0.68
106	BR44	35	8		16	LW	Shell	Fragment		Terrestrial	0.56	9			5	4	0.17	2.67			2.36	0.31
106	BR44	35	8		16	LW	Shell	Eggshell			0.19	3				3	0.00	0.03				0.03
106	BR44	35	8		16	LW	Ceramic	Body Sherd			0.94	15	1	7	5	2	1.98	31.62	12.34	15.84	3.3	0.14
106	BR44	35	8		16	LW	Ceramic	Diagnostic	Painted		0.44	7		4	2	1	0.47	7.51		5.65	1.6	0.26
106	BR44	35	8		16	LW	Ceramic	Diagnostic	Rim		0.13	2		1	1		0.29	4.65		3.22	1.43	
107	BR43	58	23	203	14.5	L	Bone	Fragment			3.45	50		2	8	40	0.67	9.67		2.42	3.69	3.56
107	BR43	58	23	203	14.5	L	Bone	Burnt			0.41	6			1	5	0.11	1.59			1.01	0.58
107	BR43	58	23	203	14.5	L	Glass	Fragment			0.07	1				1	0.01	0.08				0.08
107	BR43	58	23	203	14.5	L	Shell	Fragment		Terrestrial	0.41	6			2	4	0.10	1.49			1.4	0.09
107	BR43	58	23	203	14.5	L	Shell	Limestone		Fossil	0.28	4				4	0.02	0.23				0.23
107	BR43	58	23	203	14.5	L	Chaff Tempered Clay	Unburnt			1.38	20			4	16	0.33	4.78			2.44	2.34
107	BR43	58	23	203	14.5	L	Bone	Whole	Tooth		0.07	1			1		0.05	0.68			0.68	
107	BR43	58	23	203	14.5	L	Bone	Whole	Vertebra		0.07	1				1	0.00	0.06				0.06
107	BR43	58	23	203	14.5	L	Bone	Whole	Mandible		0.07	1				1	0.00	0.0291				0.0291
107	BR43	58	23	203	14.5	L	Chaff Tempered Clay	Burnt			1.03	15				15	0.14	2.1				2.1
107	BR43	58	23	203	14.5	L	Botanical	Charcoal			0.07	1				1	0.00	0.02				0.02
107	BR43	58	23	203	14.5	L	Metal				0.07	1				1	0.03	0.39				0.39
107	BR43	58	23	203	14.5	L	Ceramic	Body Sherd			2.14	31	2	6	10	13	4.72	68.4	20	41.62	6.78	
107	BR43	58	23	203	14.5	L	Ceramic	Diagnostic	Rim		0.07	1		1			0.20	2.97		2.97		
107	BR43	58	23	203	14.5	L	Ceramic	Diagnostic	Handle		0.07	1			1		0.04	0.51			0.51	
107	BR43	58	23	203	14.5	L	Ceramic	Diagnostic	Inscribed?		0.07	1			1		0.05	0.73			0.73	
108	BS44	58	23	186	18	L	Bone	Fragment			2.06	37		3	2	32	0.35	6.36		2.1	0.98	3.28
108	BS44	58	23	186	18	L	Bone	Whole		Avian?	0.06	1				1	0.01	0.12				0.12
108	BS44	58	23	186	18	L	Bone	Burnt			0.06	1				1	0.00	0				
108	BS44	58	23	186	18	L	Glass	Fragment			0.11	2				2	0.01	0.17				0.17

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
108	BS44	58	23	186	18	L	Shell	Fragment		Terrestrial	0.33	6			1	5	0.02	0.32			0.09	0.23
108	BS44	58	23	186	18	L	Shell	Eggshell			0.17	3				3	0.00	0.05				0.05
108	BS44	58	23	186	18	L	Chaff Tempered Clay	Burnt			0.06	1		1			0.14	2.55		2.55		
108	BS44	58	23	186	18	L	Ceramic	Body Sherd			1.67	30		13	2	15	2.30	41.34		36.63	1.58	3.13
108	BS44	58	23	186	18	L	Bone	Whole	Tooth		0.06	1				1	0.01	0.18				0.18
108	BS44	58	23	186	18	L	Ceramic	Diagnostic	Painted		0.11	2		1	1		0.13	2.39		1.41	0.98	
108	BS44	58	23	186	18	L	Ceramic	Diagnostic	Glazed		0.06	1			1		0.06	1.08			1.08	
108	BS44	58	23	186	18	L	Ceramic	Diagnostic	Handle		0.06	1		1			0.19	3.36		3.36		
109	BR44	35	8		14	LW	Bone	Fragment			1.71	24		1	2	21	0.42	5.91		1.8	1.25	2.86
109	BR44	35	8		14	LW	Bone	Burnt			0.14	2				2	0.03	0.46				0.46
109	BR44	35	8		14	LW	Shell	Limestone		Fossil	0.07	1		1			0.06	0.86		0.86		
109	BR44	35	8		14	LW	Chaff Tempered Clay	Unburnt			1.71	24			1	23	0.35	4.9			1.87	3.03
109	BR44	35	8		14	LW	Botanical	Charcoal			0.29	4				4	0.01	0.2				0.2
109	BR44	35	8		14	LW	Shell	Fragment		Terrestrial	0.21	3				3	0.02	0.22				0.22
109	BR44	35	8		14	LW	Shell	Eggshell			0.21	3				3	0.00	0.06				0.06
109	BR44	35	8		14	LW	Ceramic	Body Sherd			0.71	10	1	2	6	1	1.55	21.73	14.53	4.02	2.81	0.37
109	BR44	35	8		14	LW	Bone	Whole	Vertebra		0.07	1		1			0.15	2.16		2.16		
109	BR44	35	8		14	LW	Ceramic	Diagnostic	Glazed		0.07	1		1			0.33	4.57		4.57		
109	BR44	35	8		14	LW	Bone	Whole	Tooth		0.07	1				1	0.01	0.17				0.17
109	BR44	35	8		14	LW	Ceramic	Diagnostic	Painted		0.07	1	1				1.37	19.14	19.14			
110	BP48	18	13	196	25	L	Bone	Fragment			1.52	38		1	1	36	0.20	4.95		0.62	0.94	3.39
110	BP48	18	13	196	25	L	Bone	Burnt			0.04	1				1	0.01	0.15				0.15
110	BP48	18	13	196	25	L	Glass	Fragment			0.08	2				2	0.00	0.11				0.11
110	BP48	18	13	196	25	L	Shell	Fragment		Terrestrial	0.04	1				1	0.00	0.01				0.01
110	BP48	18	13	196	25	L	Shell	Eggshell			0.28	7				7	0.01	0.16				0.16
110	BP48	18	13	196	25	L	Chaff Tempered Clay	Unburnt			0.72	18			5	13	0.22	5.5			4.02	1.48
110	BP48	18	13	196	25	L	Chaff Tempered Clay	Burnt			0.52	13				13	0.05	1.22				1.22
110	BP48	18	13	196	25	L	Ceramic	Body Sherd			2.48	62	2	5	22	33	2.27	56.8	15.61	16.58	18.14	6.47
110	BP48	18	13	196	25	L	Bone	Whole	Tooth		0.12	3				3	0.02	0.58				0.58
110	BP48	18	13	196	25	L	Bone	Whole	Vertebra	Fish	0.04	1				1	0.01	0.14				0.14
110	BP48	18	13	196	25	L	Ceramic	Diagnostic	Painted		0.32	8		1	1	6	0.32	8.03		6.43	0.99	0.61
110	BP48	18	13	196	25	L	Ceramic	Diagnostic	Rim		0.04	1			1		0.04	0.92			0.92	
111	BR44	36	13		31	LW	Bone	Fragment			2.45	76		6	10	60	0.66	20.51		12	3.79	4.72
111	BR44	36	13		31	LW	Bone	Whole			0.00	0					0.00	0				
111	BR44	36	13		31	LW	Bone	Burnt			0.32	10				10	0.03	1.05				1.05
111	BR44	36	13		31	LW	Glass	Fragment			0.03	1				1	0.00	0.0287				0.0287
111	BR44	36	13		31	LW	Chaff Tempered Clay	Unburnt			0.48	15	1	1	4	9	0.46	14.16	8.8	1.52	3.29	0.55
111	BR44	36	13		31	LW	Chaff Tempered Clay	Burnt			0.32	10			2	8	0.05	1.53			0.77	0.76
111	BR44	36	13		31	LW	Shell	Limestone		Fossil	0.03	1			1		0.05	1.61			1.61	
111	BR44	36	13		31	LW	Botanical	Charcoal			0.03	1				1	0.00	0.08				0.08
111	BR44	36	13		31	LW	Metal				0.06	2				2	0.01	0.39				0.39
111	BR44	36	13		31	LW	Bone	Whole	Tooth		0.06	2			2		0.11	3.5			3.5	
111	BR44	36	13		31	LW	Bone	Whole	Mandible		0.03	1				1	0.00	0.0974				0.0974
111	BR44	36	13		31	LW	Bone	Whole	Vertebra		0.10	3				3	0.00	0.0583				0.0583
111	BR44	36	13		31	LW	Bone	Whole	Scale	Fish	0.06	2				2	0.00	0.0147				0.0147
111	BR44	36	13		31	LW	Bone	Whole	Otholith	Fish	0.03	1				1	0.00	0.0163				0.0163
111	BR44	36	13		31	LW	Bone	Whole	Unknown		0.29	9		1		8	0.04	1.35		1.02		0.33
111	BR44	36	13		31	LW	Shell	Limestone		Fossil	0.35	11				11	0.02	0.53				0.53
111	BR44	36	13		31	LW	Shell	Eggshell			0.48	15				15	0.01	0.35				0.35
111	BR44	36	13		31	LW	Shell	Fragment		Terrestrial	0.03	1				1	0.00	0.0132				0.0132
111	BR44	36	13		31	LW	Ceramic	Body Sherd			1.00	31	2	12	5	12	2.50	77.45	37.81	33.48	2.38	3.78
111	BR44	36	13		31	LW	Ceramic	Diagnostic	Glazed		0.03	1			1		0.03	1.07			1.07	
111	BR44	36	13		31	LW	Ceramic	Diagnostic	Handle		0.03	1		1			0.25	7.65		7.65		
111	BR44	36	13		31	LW	Ceramic	Body Sherd	Burnt		0.10	3		1	2		0.11	3.53		1.23	2.3	
112	BS43	18	19		18	LW	Bone	Fragment			3.11	56		4	7	45	0.71	12.84		5.18	3.59	4.07
112	BS43	18	19		18	LW	Bone	Burnt			0.06	1				1	0.01	0.15				0.15
112	BS43	18	19		18	LW	Glass	Fragment			0.22	4				4	0.03	0.57				0.57

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
112	BS43	18	19		18	LW	Chaff Tempered Clay	Unburnt			3.22	58		8		50	2.16	38.96		34.42		4.54
112	BS43	18	19		18	LW	Shell	Fragment		Terrestrial	1.17	21			6	15	0.07	1.26			0.71	0.55
112	BS43	18	19		18	LW	Shell	Eggshell			0.61	11				11	0.01	0.23				0.23
112	BS43	18	19		18	LW	Botanical	Charcoal			0.28	5				5	0.02	0.43				0.43
112	BS43	18	19		18	LW	Ceramic	Body Sherd			1.89	34	1	14	5	14	4.42	79.56	13.5	58.66	4.53	2.87
112	BS43	18	19		18	LW	Ceramic	Diagnostic	Glazed		0.06	1			1		0.10	1.83			1.83	
112	BS43	18	19		18	LW	Bone	Whole	Tooth		0.06	1				1	0.02	0.36				0.36
112	BS43	18	19		18	LW	Ceramic	Diagnostic	Base		0.06	1		1			0.13	2.34		2.34		
112	BS43	18	19		18	LW	Ceramic	Diagnostic	Rim		0.06	1				1	0.00	0.08				0.08
113	BP48	18	14		17.5	L	Bone	Fragment			1.03	18		1	1	16	0.22	3.91		0.49	0.29	3.13
113	BP48	18	14		17.5	L	Bone	Burnt			0.06	1			1		0.03	0.52			0.52	
113	BP48	18	14		17.5	L	Glass	Fragment			0.11	2				2	0.01	0.16				0.16
113	BP48	18	14		17.5	L	Chaff Tempered Clay	Unburnt			1.83	32			7	25	0.58	10.16			6.66	3.5
113	BP48	18	14		17.5	L	Chaff Tempered Clay	Burnt			0.46	8			1	7	0.10	1.74			0.83	0.91
113	BP48	18	14		17.5	L	Metal	?			0.06	1			1		0.06	1.04			1.04	
113	BP48	18	14		17.5	L	Shell	Eggshell			0.06	1				1	0.00	0.01				0.01
113	BP48	18	14		17.5	L	Botanical	Charcoal			0.06	1				1	0.00	0.04				0.04
113	BP48	18	14		17.5	L	Ceramic	Body Sherd			2.40	42	5	19	7	11	9.21	161.12	75.08	79.4	4.85	1.79
113	BP48	18	14		17.5	L	Ceramic	Diagnostic			0.00	0					0.00	0				
113	BP48	18	14		17.5	L	Bone	Whole	Scale	Fish	0.06	1				1	0.00	0.01				0.01
114	BP48			186	25	L	Bone	Fragment			0.68	17			3	14	0.13	3.29			1.41	1.88
114	BP48			186	25	L	Glass	Fragment			0.08	2				2	0.01	0.28				0.28
114	BP48			186	25	L	Chaff Tempered Clay	Unburnt			0.28	7		1	2	4	0.11	2.78		2	0.18	0.6
114	BP48			186	25	L	Shell	Eggshell			0.04	1				1	0.00	0.04				0.04
114	BP48			186	25	L	Metal				0.04	1				1	0.01	0.26				0.26
114	BP48			186	25	L	Botanical	Charcoal			0.04	1				1	0.00	0.06				0.06
114	BP48			186	25	L	Ceramic	Body Sherd			0.64	16		2	7	7	0.47	11.85		5.05	4.95	1.85
114	BP48			186	25	L	Bone	Whole	Tooth		0.04	1				1	0.00	0.11				0.11
114	BP48			186	25	L	Bone	Whole	Rib		0.04	1				1	0.00	0.08				0.08
114	BP48			186	25	L	Ceramic	Diagnostic	Rim		0.04	1		1			0.06	1.39		1.39		
115	BP48	18	17		5	L	Bone	Fragment			3.00	15			5	10	0.87	4.33			3.5	0.83
115	BP48	18	17		5	L	Bone	Burnt			0.20	1				1	0.04	0.2				0.2
115	BP48	18	17		5	L	Metal				0.80	4		1		3	0.88	4.41		4.01		0.4
115	BP48	18	17		5	L	Chaff Tempered Clay	Unburnt			2.60	13		2	3	8	1.78	8.88		6.4	1.32	1.16
115	BP48	18	17		5	L	Chaff Tempered Clay	Burnt			5.20	26			5	21	1.15	5.76			3.37	2.39
115	BP48	18	17		5	L	Ceramic	Body Sherd			2.60	13	1	4	4	4	6.15	30.77	13.1	12.44	4.37	0.86
116	BP48	18	18		22	L	Bone	Fragment			2.50	55			7	48	0.19	4.08			0.32	3.76
116	BP48	18	18		22	L	Bone	Burnt			0.23	5			2	3	0.07	1.45			1.09	0.36
116	BP48	18	18		22	L	Glass	Fragment			0.18	4				4	0.04	0.84				0.84
116	BP48	18	18		22	L	Shell	Fragment		Terrestrial	0.14	3				3	0.01	0.25				0.25
116	BP48	18	18		22	L	Shell	Eggshell			0.09	2				2	0.00	0.01				0.01
116	BP48	18	18		22	L	Chaff Tempered Clay	Unburnt			1.68	37		4	3	30	1.00	22.07		14.38	4.57	3.12
116	BP48	18	18		22	L	Metal				0.45	10		1	1	8	0.26	5.73		2.2	1.34	2.19
116	BP48	18	18		22	L	Chaff Tempered Clay	Burnt			0.32	7				7	0.05	1				1
116	BP48	18	18		22	L	Shell	Limestone		Fossil	0.05	1				1	0.00	0.03				0.03
116	BP48	18	18		22	L	Ceramic	Body Sherd			1.64	36	3	5	9	19	2.08	45.77	22.84	14.06	6.41	2.46
116	BP48	18	18		22	L	Ceramic	Diagnostic	Painted		0.05	1				1	0.00	0.08				0.08
117	BR43	48	5		25.5	LW	Bone	Fragment			2.24	57		4	13	40	0.85	21.76		7.49	8.5	5.77
117	BR43	48	5		25.5	LW	Bone	Whole			0.04	1				1	0.01	0.16				0.16
117	BR43	48	5		25.5	LW	Glass	Fragment			0.12	3			1	2	0.02	0.39			0.27	0.12
117	BR43	48	5		25.5	LW	Shell	Fragment		Terrestrial	0.04	1				1	0.00	0.05				0.05
117	BR43	48	5		25.5	LW	Botanical	Charcoal			0.16	4			1	3	0.05	1.2			0.82	0.38
117	BR43	48	5		25.5	LW	Chaff Tempered Clay	Unburnt			0.47	12		1		11	0.18	4.68		1.92		2.76
117	BR43	48	5		25.5	LW	Shell	Eggshell			0.12	3				3	0.00	0.1				0.1
117	BR43	48	5		25.5	LW	Chaff Tempered Clay	Burnt			0.04	1			1		0.01	0.27			0.27	

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
117	BR43	48	5		25.5	LW	Ceramic	Body Sherd			1.18	30	1	16	5	8	3.00	76.38	24.68	47.1	3.37	1.23
117	BR43	48	5		25.5	LW	Ceramic	Diagnostic	Painted		0.04	1		1			0.10	2.45		2.45		
117	BR43	48	5		25.5	LW	Ceramic	Diagnostic	Glazed		0.04	1			1		0.06	1.56			1.56	
117	BR43	48	5		25.5	LW	Bone	Whole	Tooth		0.12	3				3	0.02	0.63				0.63
117	BR43	48	5		25.5	LW	Bone	Whole	Vertebra		0.08	2		1		1	0.06	1.51		1.39		0.12
117	BR43	48	5		25.5	LW	Bone	Whole	Jaw	Fish	0.04	1		1			0.05	1.37		1.37		
117	BR43	48	5		25.5	LW	Bone	Whole	Scale	Fish	0.04	1				1	0.00	0.0069				0.0069
117	BR43	48	5		25.5	LW	Ceramic	Body Sherd	Burnt		0.04	1		1			0.21	5.39		5.39		
117	BR43	48	5		25.5	LW	Ceramic	Diagnostic	Rim		0.04	1			1		0.04	1.09			1.09	
117	BR43	48	5		25.5	LW	Ceramic	Diagnostic	Base		0.04	1		1			0.09	2.34		2.34		
118	BP48	6	17,19		30	L	Ceramic	Diagnostic	Rim		0.10	3	3				0.12	3.55	3.55			
118	BP48	6	17,19		30	L	Ceramic	Body Sherd			1.17	35	22		2	11	0.88	26.32	23.82		1.13	1.37
118	BP48	6	17,19		30	L	Bone	Fragment			2.57	77	46		1	30	0.53	15.8	12.83		0.77	2.2
118	BP48	6	17,19		30	L	Bone	Burnt			0.17	5	3			2	0.02	0.58	0.41			0.17
118	BP48	6	17,19		30	L	Glass	Fragment			0.03	1	1				0.01	0.23	0.23			
118	BP48	6	17,19		30	L	Shell	Fragment		Terrestrial	0.03	1			1		0.03	0.96			0.96	
118	BP48	6	17,19		30	L	Botanical	Charcoal			0.20	6				6	0.00	0.04				0.04
118	BP48	6	17,19		30	L	Chaff Tempered Clay	Unburnt			0.03	1				1	0.01	0.38				0.38
118	BP48	6	17,19		30	L	Glass	Bead			0.03	1				1	0.00	0.09				0.09
118	BP48	6	17,19		30	L	Ceramic	Diagnostic	Glazed		0.03	1	1				0.02	0.68	0.68			
118	BP48	6	17,19		30	L	Bone	Whole	Vertebra		0.03	1				1	0.00	0.05				0.05
118	BP48	6	17,19		30	L	Bone	Whole	Scale	Fish	0.03	1				1	0.00	0.02				0.02
118	BP48	6	17,19		30	L	Ceramic	Body Sherd	Burnt		0.03	1	1				0.07	2.23	2.23			
119	CE27	8			9	W	Ceramic	Body Sherd			4.78	43	4	25	8	6	15.93	143.4	54.71	80.7	6.99	1
119	CE27	8			9	W	Bone	Fragment			26.00	234	3	21	46	164	8.84	79.54	2.8	37.58	21.79	17.37
119	CE27	8			9	W	Bone	Whole			0.22	2				2	0.04	0.32				0.32
119	CE27	8			9	W	Bone	Worked			0.22	2		2			0.70	6.31		6.31		
119	CE27	8			9	W	Bone	Burnt			3.11	28		3	11	14	1.63	14.68		5.07	7.33	2.28
119	CE27	8			9	W	Chaff Tempered Clay	Unburnt			1.44	13		7	4	2	3.84	34.57		30.74	3.47	0.36
119	CE27	8			9	W	Metal				0.33	3			3		0.03	0.29			0.29	
119	CE27	8			9	W	Shell	Unk			0.22	2				2	0.00	0.01				0.01
119	CE27	8			9	W	Ceramic	Diagnostic	Painted		1.11	10	4	6			8.07	72.65	60.09	12.56		
119	CE27	8			9	W	Ceramic	Diagnostic	Glazed		0.78	7		3	1	3	0.79	7.07		5.98	0.6	0.49
119	CE27	8			9	W	Bone	Whole	Mandible		0.11	1	1				1.62	14.62	14.62			
119	CE27	8			9	W	Bone	Whole	Rib		0.11	1	1				0.70	6.34	6.34			
119	CE27	8			9	W	Bone	Whole	Tooth		0.67	6		2		4	1.28	11.54		11.13		0.41
119	CE27	8			9	W	Ceramic	Diagnostic	Rim		0.67	6		3	3		1.34	12.03		8.7	3.33	
119	CE27	8			9	W	Ceramic	Diagnostic	Base		0.11	1	1				1.32	11.9	11.9			
119	CE27	8			9	W	Ceramic	Diagnostic	Painted Handle		0.22	2	2				8.13	73.18	73.18			
119	CE27	8			9	W	Ceramic	Diagnostic	Glazed Rim		0.22	2		2			2.23	20.04		20.04		
120	BP48	20	14	218	10	L	Ceramic	Body Sherd			1.20	12		3	6	3	2.22	22.22		16.99	4.66	0.57
120	BP48	20	14	218	10	L	Ceramic	Burnt			0.10	1		1			0.17	1.7		1.7		
120	BP48	20	14	218	10	L	Bone	Fragment			1.60	16			1	15	0.27	2.67			0.91	1.76
120	BP48	20	14	218	10	L	Bone	Burnt			0.70	7				7	0.06	0.63				0.63
120	BP48	20	14	218	10	L	Shell	Fragment		Terrestrial	0.10	1				1	0.00	0.04				0.04
120	BP48	20	14	218	10	L	Chaff Tempered Clay	Unburnt			0.60	6		1		5	0.23	2.34		1.34		1
120	BP48	20	14	218	10	L	Chaff Tempered Clay	Burnt			0.20	2				2	0.04	0.41				0.41
120	BP48	20	14	218	10	L	Metal				0.10	1			1		0.12	1.2			1.2	
121	BP48	18	13	140	12	L	Ceramic	Body Sherd			1.08	13	1	9	2	1	3.55	42.57	10.4	29.44	2.4	0.33
121	BP48	18	13	140	12	L	Bone	Fragment			0.92	11		1	1	9	0.15	1.74		0.8	0.21	0.73
121	BP48	18	13	140	12	L	Shell	Eggshell			0.33	4				4	0.01	0.12				0.12
121	BP48	18	13	140	12	L	Shell	Fragment		Terrestrial	0.42	5				5	0.01	0.1				0.1
121	BP48	18	13	140	12	L	Botanical	Charcoal			0.08	1				1	0.00	0.05				0.05
121	BP48	18	13	140	12	L	Chaff Tempered Clay	Unburnt			1.50	18		17	1		1.37	16.39		15.34	1.05	
121	BP48	18	13	140	12	L	Ceramic	Diagnostic	Painted		0.25	3	1	2			1.02	12.27	6.96	5.31		
121	BP48	18	13	140	12	L	Bone	Whole	Mandible		0.08	1				1	0.00	0.04				0.04
121	BP48	18	13	140	12	L	Bone	Whole	Tooth		0.08	1				1	0.01	0.07				0.07
122	BP48	20	19	217	11	L	Bone	Fragment			0.91	10			3	7	0.21	2.26			1.65	0.61

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
122	BP48	20	19	217	11	L	Bone	Burnt			0.18	2				2	0.04	0.48				0.48
122	BP48	20	19	217	11	L	Chaff Tempered Clay	Unburnt			0.36	4			2	2	0.12	1.3			0.89	0.41
122	BP48	20	19	217	11	L	Chaff Tempered Clay	Burnt			0.09	1				1	0.03	0.31				0.31
122	BP48	20	19	217	11	L	Shell	Fragment		Terrestrial	0.09	1				1	0.00	0.001				0.001
122	BP48	20	19	217	11	L	Shell	Eggshell			0.27	3				3	0.00	0.01				0.01
122	BP48	20	19	217	11	L	Ceramic	Body Sherd			1.55	17		4	12	1	2.35	25.81	14.34	11.4	0.07	
122	BP48	20	19	217	11	L	Ceramic	Diagnostic	Rim/Handle		0.09	1		1			0.32	3.57		3.57		
123	BP48	20	13		5	L	Bone	Fragment			1.20	6			1	5	0.31	1.54			0.84	0.7
123	BP48	20	13		5	L	Bone	Burnt			0.20	1				1	0.02	0.09				0.09
123	BP48	20	13		5	L	Glass	Fragment			0.20	1				1	0.02	0.12				0.12
123	BP48	20	13		5	L	Chaff Tempered Clay	Unburnt			1.40	7		1	3	3	0.72	3.62		2.09	0.73	0.8
123	BP48	20	13		5	L	Shell	Fragment		Terrestrial	0.60	3				3	0.02	0.11				0.11
123	BP48	20	13		5	L	Chaff Tempered Clay	Burnt			0.60	3				3	0.07	0.35				0.35
123	BP48	20	13		5	L	Ceramic	Body Sherd			1.60	8		1	2	5	1.11	5.57		2.93	1.37	1.27
124	BP48	15	17		3	L	Bone	Fragment			1.33	4			1	3	0.17	0.5			0.31	0.19
124	BP48	15	17		3	L	Chaff Tempered Clay	Unburnt			12.67	38		4	8	26	9.52	28.55		20	5.33	3.22
124	BP48	15	17		3	L	Chaff Tempered Clay	Burnt			8.33	25		2	2	21	2.86	8.59		3.22	1.12	4.25
124	BP48	15	17		3	L	Shell	Limestone		Fossil	0.67	2			1	1	0.38	1.14			1.1	0.04
124	BP48	15	17		3	L	Botanical	Charcoal			0.33	1				1	0.01	0.04				0.04
124	BP48	15	17		3	L	Shell	Eggshell			0.67	2				2	0.01	0.03				0.03
124	BP48	15	17		3	L	Ceramic	Body Sherd			1.00	3		1	1	1	0.79	2.36		1.76	0.53	0.07
124	BP48	15	17		3	L	Ceramic	Diagnostic	Painted		0.33	1				1	0.03	0.1				0.1
124	BP48	15	17		3	L	Ceramic	Body Sherd	Burnt		0.67	2		1	1		1.36	4.07		3.03	1.04	
125	BP48	20	18		4	L	Bone	Fragment			2.75	11				11	0.22	0.89				0.89
125	BP48	20	18		4	L	Bone	?			0.25	1			1		0.19	0.74			0.74	
125	BP48	20	18		4	L	Chaff Tempered Clay	Unburnt			0.25	1			1		0.16	0.64			0.64	
125	BP48	20	18		4	L	Shell	Fragment		Terrestrial	0.50	2				2	0.02	0.06				0.06
125	BP48	20	18		4	L	Ceramic	Diagnostic	Painted		0.75	3	1	1		1	2.25	9	5.9	3.01		0.09
126	BR44	35	4		29	LW	Bone	Fragment			0.76	22			4	18	0.11	3.13			1.44	1.69
126	BR44	35	4		29	LW	Bone	Burnt			0.17	5			1	4	0.03	0.84			0.32	0.52
126	BR44	35	4		29	LW	Chaff Tempered Clay	Unburnt			0.86	25			1	24	0.11	3.16			0.11	3.05
126	BR44	35	4		29	LW	Metal				0.07	2				2	0.02	0.59				0.59
126	BR44	35	4		29	LW	Botanical	Charcoal			0.07	2				2	0.00	0.03				0.03
126	BR44	35	4		29	LW	Shell	Fragment		Terrestrial	0.21	6				6	0.02	0.46				0.46
126	BR44	35	4		29	LW	Shell	Eggshell			0.03	1				1	0.00	0.01				0.01
126	BR44	35	4		29	LW	Chaff Tempered Clay	Burnt			0.14	4				4	0.01	0.37				0.37
126	BR44	35	4		29	LW	Ceramic	Body Sherd			0.45	13		1	3	9	0.19	5.64		1.39	2.42	1.83
126	BR44	35	4		29	LW	Ceramic	Diagnostic	Painted		0.03	1				1	0.00	0.08				0.08
126	BR44	35	4		29	LW	Bone	Whole	Tooth		0.10	3				3	0.01	0.28				0.28
126	BR44	35	4		29	LW	Bone	Whole	Vertebra		0.03	1				1	0.00	0.02				0.02
126	BR44	35	4		29	LW	Bone	Whole	Jaw		0.03	1				1	0.00	0.11				0.11
126	BR44	35	4		29	LW	Ceramic	Diagnostic	Rim		0.03	1				1	0.01	0.15				0.15
127	BR44	35	5		15	LW	Bone	Fragment			1.00	15			1	14	0.10	1.45			0.27	1.18
127	BR44	35	5		15	LW	Bone	Burnt			0.07	1			1		0.03	0.41			0.41	
127	BR44	35	5		15	LW	Chaff Tempered Clay	Unburnt			1.20	18			3	15	0.21	3.08			1.56	1.52
127	BR44	35	5		15	LW	Shell	Fragment		Terrestrial	0.60	9				9	0.03	0.49				0.49
127	BR44	35	5		15	LW	Shell	Eggshell			0.80	12				12	0.02	0.27				0.27
127	BR44	35	5		15	LW	Botanical	Charcoal			0.20	3				3	0.00	0.06				0.06
127	BR44	35	5		15	LW	Ceramic	Body Sherd			0.27	4			1	3	0.06	0.94			0.62	0.32
128	BR44	35	2		8.5	LW	Bone	Fragment			2.71	23			5	18	0.51	4.31			2.47	1.84
128	BR44	35	2		8.5	LW	Bone	Burnt			0.35	3			1	2	0.09	0.79			0.59	0.2
128	BR44	35	2		8.5	LW	Chaff Tempered Clay	Unburnt			1.41	12		2	6	4	1.12	9.51		3.4	5.46	0.65
128	BR44	35	2		8.5	LW	Metal				0.35	3			1	2	0.16	1.39			0.6	0.79
128	BR44	35	2		8.5	LW	Shell	Fragment		Terrestrial	0.24	2			1	1	0.03	0.24			0.23	0.01

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
128	BR44	35	2		8.5	LW	Botanical	Charcoal			0.47	4				4	0.01	0.05				0.05
128	BR44	35	2		8.5	LW	Ceramic	Body Sherd			1.88	16		5	7	4	2.12	18.02		11.62	5.38	1.02
128	BR44	35	2		8.5	LW	Ceramic	Diagnostic	Painted		0.12	1		1			0.34	2.89		2.89		
129	BR44	36			32	LW	Bone	Fragment			2.06	66		4	13	49	0.51	16.39		5.92	6.02	4.45
129	BR44	36			32	LW	Bone	Burnt			0.06	2		1		1	0.03	0.88		0.48		0.4
129	BR44	36			32	LW	Glass	Fragment			0.16	5		1	1	3	0.07	2.36		1.69	0.45	0.22
129	BR44	36			32	LW	Chaff Tempered Clay	Unburnt			0.44	14			14		0.24	7.57			7.57	
129	BR44	36			32	LW	Chaff Tempered Clay	Burnt			0.59	19			8	11	0.16	5.19			3.78	1.41
129	BR44	36			32	LW	Shell	Limestone		Fossil	0.47	15			5	10	0.02	0.57			0.3	0.27
129	BR44	36			32	LW	Shell	Fragment		Terrestrial	0.13	4				4	0.00	0.06				0.06
129	BR44	36			32	LW	Shell	Eggshell			0.31	10				10	0.01	0.25				0.25
129	BR44	36			32	LW	Botanical	Charcoal			0.06	2				2	0.00	0.05				0.05
129	BR44	36			32	LW	Metal				0.03	1				1	0.00	0				
129	BR44	36			32	LW	Ceramic	Body Sherd			0.53	17		5	7	5	0.53	16.88		11.24	4.35	1.29
129	BR44	36			32	LW	Ceramic	Diagnostic	Glazed		0.03	1		1			0.11	3.66		3.66		
129	BR44	36			32	LW	Ceramic	Diagnostic	Painted		0.03	1	1				0.41	13.03	13.03			
129	BR44	36			32	LW	Bone	Whole	Rib	Fish	0.03	1		1			0.00	0.07		0.07		
129	BR44	36			32	LW	Bone	Whole	Tooth		0.06	2		1		1	0.04	1.1287		1.12		0.0087
129	BR44	36			32	LW	Bone	Whole	Mandible		0.13	4				4	0.01	0.16				0.16
129	BR44	36			32	LW	Bone	Whole	Vertebra		0.06	2				2	0.00	0.03				0.03
129	BR44	36			32	LW	Bone	Whole	Scapula		0.03	1				1	0.00	0.01				0.01
129	BR44	36			32	LW	Bone	Whole	Vertebra	Fish	0.03	1				1	0.01	0.2				0.2
129	BR44	36			32	LW	Glass	Diagnostic	Rim		0.03	1				1	0.00	0.13				0.13
129	BR44	36			32	LW	Glass	Diagnostic	Base		0.03	1				1	0.01	0.2				0.2
130	BR44	36			19	LW	Bone	Fragment			1.37	26			3	23	0.09	1.8			0.5	1.3
130	BR44	36			19	LW	Bone	Whole			0.26	5				5	0.01	0.19				0.19
130	BR44	36			19	LW	Chaff Tempered Clay	Unburnt			0.74	14	1	7	4	2	2.14	40.74	13.49	23.13	3.87	0.25
130	BR44	36			19	LW	Shell	Fragment		Terrestrial	3.32	63		10	31	22	0.88	16.71		7.36	8.03	1.32
130	BR44	36			19	LW	Chaff Tempered Clay	Burnt			0.16	3				3	0.02	0.45				0.45
130	BR44	36			19	LW	Botanical	Charcoal			0.11	2				2	0.00	0.09				0.09
130	BR44	36			19	LW	Ceramic	Body Sherd			0.84	16		9	5	2	0.88	16.8		14.12	2.37	0.31
130	BR44	36			19	LW	Ceramic	Diagnostic	Painted		0.11	2		2			0.13	2.39		2.39		
130	BR44	36			19	LW	Bone	Whole	Vertebra		0.11	2				2	0.00	0.03				0.03
130	BR44	36			19	LW	Bone	Whole	Tooth		0.05	1			1		0.04	0.82			0.82	
130	BR44	36			19	LW	Ceramic	Body Sherd	Burnt		0.05	1		1			0.17	3.3		3.3		
130	BR44	36			19	LW	Ceramic	Diagnostic	Rim		0.16	3			2	1	0.07	1.34			1.12	0.22
131	BR44	36			17	LW	Bone	Fragment			1.94	33		1	4	28	0.27	4.62		1.61	1.22	1.79
131	BR44	36			17	LW	Bone	Whole			0.00	0					0.00	0				
131	BR44	36			17	LW	Bone	Burnt			0.24	4			1	3	0.02	0.35			0.16	0.19
131	BR44	36			17	LW	Glass	Fragment			0.06	1				1	0.00	0.05				0.05
131	BR44	36			17	LW	Chaff Tempered Clay	Unburnt			0.47	8		1	3	4	0.18	3.14		0.92	1.68	0.54
131	BR44	36			17	LW	Chaff Tempered Clay	Burnt			1.88	32		1	7	24	0.47	7.99		1.08	5.52	1.39
131	BR44	36			17	LW	Shell	Limestone		Fossil	0.29	5			2	3	0.07	1.27			1.09	0.18
131	BR44	36			17	LW	Botanical	Charcoal			0.18	3				3	0.01	0.17				0.17
131	BR44	36			17	LW	Shell	Eggshell			0.41	7				7	0.01	0.15				0.15
131	BR44	36			17	LW	Shell	Fragment		Terrestrial	0.06	1				1	0.00	0.04				0.04
131	BR44	36			17	LW	Ceramic	Body Sherd			0.41	7		2	4	1	0.29	4.95		2.74	2.09	0.12
131	BR44	36			17	LW	Bone	Whole	Epiphyses		0.12	2				2	0.01	0.13				0.13
131	BR44	36			17	LW	Bone	Whole	Mandible		0.06	1				1	0.01	0.19				0.19
131	BR44	36			17	LW	Bone	Whole	Scapula		0.06	1				1	0.00	0.02				0.02
131	BR44	36			17	LW	Bone	Whole	Vertebra		0.18	3				3	0.00	0.08				0.08
131	BR44	36			17	LW	Bone	Whole	Tooth		0.12	2				2	0.01	0.1				0.1
132	BR44	36		387	16	LW	Bone	Fragment			2.25	36		1	3	32	0.21	3.426		1.16	0.086	2.18
132	BR44	36		387	16	LW	Bone	Burnt			0.25	4		1	1	2	0.10	1.52		1.08	0.34	0.1
132	BR44	36		387	16	LW	Chaff Tempered Clay	Unburnt			0.31	5			4	1	0.14	2.23			2.19	0.04
132	BR44	36		387	16	LW	Chaff Tempered Clay	Burnt			0.06	1				1	0.00	0.07				0.07

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
132	BR44	36		387	16	LW	Metal				0.13	2				2	0.01	0.14				0.14
132	BR44	36		387	16	LW	Shell	Eggshell			0.13	2				2	0.00	0.05				0.05
132	BR44	36		387	16	LW	Shell	Fragment		Terrestrial	0.31	5				5	0.02	0.24				0.24
132	BR44	36		387	16	LW	Shell	Limestone		Fossil	0.25	4			3	1	0.05	0.86			0.69	0.17
132	BR44	36		387	16	LW	Ceramic	Body Sherd			0.94	15	1	7	4	3	2.04	32.67	8.75	19.74	3.35	0.83
132	BR44	36		387	16	LW	Ceramic	Diagnostic	Painted		0.06	1	1				0.69	10.98	10.98			
132	BR44	36		387	16	LW	Bone	Whole	Spine	Fish	0.13	2				2	0.00	0.01				0.01
132	BR44	36		387	16	LW	Bone	Whole	Tooth		0.25	4				4	0.03	0.5				0.5
132	BR44	36		387	16	LW	Bone	Whole	Vertebra		0.38	6				6	0.01	0.1				0.1
132	BR44	36		387	16	LW	Bone	Whole	Femur		0.31	5				5	0.01	0.18				0.18
132	BR44	36		387	16	LW	Ceramic	Diagnostic	Rim		0.06	1		1			0.00	0				
133	BR44	35	6		9	LW	Bone	Fragment			1.44	13				13	0.24	2.14				2.14
133	BR44	35	6		9	LW	Bone	Burnt			0.44	4			1	3	0.08	0.69			0.16	0.53
133	BR44	35	6		9	LW	Chaff Tempered Clay	Unburnt			3.56	32			5	27	0.84	7.56			3.93	3.63
133	BR44	35	6		9	LW	Botanical	Charcoal			0.11	1				1	0.01	0.07				0.07
133	BR44	35	6		9	LW	Shell	Eggshell			0.67	6				6	0.02	0.14				0.14
133	BR44	35	6		9	LW	Shell	Fragment		Terrestrial	0.67	6				6	0.01	0.05				0.05
133	BR44	35	6		9	LW	Shell	Limestone		Fossil	0.67	6				6	0.06	0.57				0.57
133	BR44	35	6		9	LW	Ceramic	Body Sherd			1.00	9			1	8	0.28	2.48			1.03	1.45
134	BP48	18	14		9	L	Bone	Fragment			1.11	10			1	9	0.07	0.62			0.43	0.19
134	BP48	18	14		9	L	Bone	Whole			0.22	2				2	0.04	0.34				0.34
134	BP48	18	14		9	L	Bone	Burnt			0.11	1				1	0.02	0.16				0.16
134	BP48	18	14		9	L	Chaff Tempered Clay	Unburnt			3.33	30		1	10	19	1.27	11.4		1.06	6.88	3.46
134	BP48	18	14		9	L	Chaff Tempered Clay	Burnt			0.78	7				7	0.10	0.86				0.86
134	BP48	18	14		9	L	Metal				0.11	1				1	0.04	0.35				0.35
134	BP48	18	14		9	L	Ceramic	Body Sherd			2.11	19	1	13	1	4	6.15	55.37	7.18	46.69	1.03	0.47
135	BP48	48	12	191	11.5	L	Bone	Fragment			1.57	18			3	15	0.23	2.63			1.22	1.41
135	BP48	48	12	191	11.5	L	Bone	Burnt			0.26	3				3	0.02	0.25				0.25
135	BP48	48	12	191	11.5	L	Glass	Fragment			0.17	2				2	0.01	0.14				0.14
135	BP48	48	12	191	11.5	L	Chaff Tempered Clay	Unburnt			4.00	46	3	8	5	30	2.36	27.14	13.11	7.68	3.15	3.2
135	BP48	48	12	191	11.5	L	Chaff Tempered Clay	Burnt			3.57	41			2	39	0.39	4.51			0.82	3.69
135	BP48	48	12	191	11.5	L	Shell	Fragment		Terrestrial	0.09	1				1	0.01	0.1				0.1
135	BP48	48	12	191	11.5	L	Shell	Eggshell			0.78	9			5	4	0.01	0.1			0.08	0.02
135	BP48	48	12	191	11.5	L	Botanical	Charcoal			0.35	4				4	0.00	0.02				0.02
135	BP48	48	12	191	11.5	L	Metal				0.35	4				4	0.03	0.35				0.35
135	BP48	48	12	191	11.5	L	Ceramic	Body Sherd			1.04	12	4	2	6		4.96	57.05	47.03	5.33	4.69	
135	BP48	48	12	191	11.5	L	Ceramic	Diagnostic	Painted		0.09	1				1	0.01	0.16				0.16
135	BP48	48	12	191	11.5	L	Bone	Whole	Vertebra	Fish	0.09	1				1	0.00	0.04				0.04
136	BR44	35	3	381	20	L	Bone	Fragment			0.95	19			2	17	0.08	1.61			0.9.	1.61
136	BR44	35	3	381	20	L	Bone	Burnt			0.35	7				7	0.06	1.12				1.12
136	BR44	35	3	381	20	L	Shell	Fragment		Terrestrial	0.05	1				1	0.00	0.01				0.01
136	BR44	35	3	381	20	L	Shell	Limestone		Fossil	0.35	7				7	0.03	0.55				0.55
136	BR44	35	3	381	20	L	Shell	Eggshell			0.15	3				3	0.01	0.12				0.12
136	BR44	35	3	381	20	L	Chaff Tempered Clay	Unburnt			1.80	36			1	35	0.22	4.47			0.6	3.87
136	BR44	35	3	381	20	L	Botanical	Charcoal			0.05	1				1	0.01	0.18				0.18
136	BR44	35	3	381	20	L	Metal				0.10	2				2	0.01	0.12				0.12
136	BR44	35	3	381	20	L	Sediment	Burnt			0.15	3		2	1		0.13	2.57		1.54	1.03	
136	BR44	35	3	381	20	L	Chaff Tempered Clay	Unburnt			0.55	11				11	0.03	0.57				0.57
136	BR44	35	3	381	20	L	Ceramic	Body Sherd			0.40	8		1	2	5	0.17	3.38		1.8	0.64	0.94
136	BR44	35	3	381	20	L	Ceramic	Diagnostic	Rim		0.05	1			1		0.03	0.51			0.51	
137	BR44	35		426	12	LW	Bone	Fragment			0.92	11		1		10	0.23	2.72		1.29		1.43
137	BR44	35		426	12	LW	Bone	?			0.08	1		1			0.24	2.84		2.84		
137	BR44	35		426	12	LW	Chaff Tempered Clay	Unburnt			0.83	10		3	2	5	0.76	9.17		7.35	1.48	0.34
137	BR44	35		426	12	LW	Chaff Tempered Clay	Burnt			0.42	5		1	2	2	0.42	5.08		2.61	2.12	0.35
137	BR44	35		426	12	LW	Shell	Limestone		Fossil	0.08	1				1	0.01	0.1				0.1
137	BR44	35		426	12	LW	Ceramic	Body Sherd			0.42	5			2	3	0.23	2.81			1.86	0.95

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
137	BR44	35		426	12	LW	Ceramic	Diagnostic	Rim		0.08	1			1		0.02	0.29			0.29	
138	BR44	35	3		9	LW	Bone	Fragment			1.89	17			3	14	0.33	2.99			1.3	1.69
138	BR44	35	3		9	LW	Bone	Burnt			0.33	3		1		2	0.09	0.77		0.61		0.16
138	BR44	35	3		9	LW	Glass	Fragment			0.11	1				1	0.01	0.08				0.08
138	BR44	35	3		9	LW	Chaff Tempered Clay	Unburnt			9.89	89		2	22	65	1.15	10.37		1.89	5.32	3.16
138	BR44	35	3		9	LW	Shell	Limestone		Fossil	2.11	19			5	14	0.33	2.95			1.89	1.06
138	BR44	35	3		9	LW	Shell	Eggshell			0.11	1				1	0.00	0.0147				0.0147
138	BR44	35	3		9	LW	Shell	Fragment		Terrestrial	0.11	1				1	0.00	0.019				0.019
138	BR44	35	3		9	LW	Botanical	Charcoal			0.33	3				3	0.01	0.12				0.12
138	BR44	35	3		9	LW	Chaff Tempered Clay	Burnt			0.89	8				8	0.10	0.86				0.86
138	BR44	35	3		9	LW	Metal				3.67	33		2	3	28	0.72	6.51		1.93	1.23	3.35
138	BR44	35	3		9	LW	Ceramic	Body Sherd			0.89	8		1	4	3	1.06	9.53		7.49	1.57	0.47
138	BR44	35	3		9	LW	Ceramic	Diagnostic	Rim		0.11	1		1			0.31	2.79		2.79		
138	BR44	35	3		9	LW	Ceramic	Body Sherd	Burnt		0.11	1			1		0.05	0.48			0.48	
139	BR44	35	2		19	LW	Bone	Fragment			0.32	6			1	5	0.06	1.13			0.38	0.75
139	BR44	35	2		19	LW	Chaff Tempered Clay	Unburnt			0.11	2			1	1	0.04	0.82			0.63	0.19
139	BR44	35	2		19	LW	Stone	Possible Lithic			0.05	1			1		0.02	0.31			0.31	
139	BR44	35	2		19	LW	Metal				0.05	1				1	0.02	0.47				0.47
139	BR44	35	2		19	LW	Shell	Fragment		Terrestrial	0.11	2				2	0.01	0.12				0.12
139	BR44	35	2		19	LW	Shell	Eggshell			0.37	7				7	0.00	0.05				0.05
139	BR44	35	2		19	LW	Ceramic	Diagnostic	Painted		0.05	1			1		0.04	0.76			0.76	
139	BR44	35	2		19	LW	Ceramic	Body Sherd			0.42	8			7	1	0.21	4			3.82	0.18
140	BR44	58	3		4	LW	Bone	Fragment			1.00	4				4	0.09	0.36				0.36
140	BR44	58	3		4	LW	Bone	Burnt			0.25	1			1		0.09	0.35			0.35	
140	BR44	58	3		4	LW	Chaff Tempered Clay	Unburnt			0.75	3		1		2	1.70	6.81		6.49		0.32
140	BR44	58	3		4	LW	Botanical	Charcoal			0.25	1				1	0.03	0.12				0.12
140	BR44	58	3		4	LW	Metal				0.50	2				2	0.08	0.3				0.3
140	BR44	58	3		4	LW	Ceramic	Body Sherd			0.50	2		1		1	0.43	1.71		1.64		0.07
141	BR43	48	5		14	LW	Ceramic	Diagnostic	Handle		0.07	1	1				0.94	13.16	13.16			
141	BR43	48	5		14	LW	Bone	Fragment			2.86	40		2	12	26	0.73	10.19		3.01	4.63	2.55
141	BR43	48	5		14	LW	Bone	Whole			0.00	0					0.00	0				
141	BR43	48	5		14	LW	Glass	Fragment			0.14	2				2	0.01	0.19				0.19
141	BR43	48	5		14	LW	Chaff Tempered Clay	Unburnt			1.29	18		2	4	12	0.64	9		4.25	2.39	2.36
141	BR43	48	5		14	LW	Shell	Limestone		Fossil	0.36	5			1	4	0.10	1.38			1.29	0.09
141	BR43	48	5		14	LW	Chaff Tempered Clay	Burnt			0.57	8			8		0.46	6.4			6.4	
141	BR43	48	5		14	LW	Shell	Fragment		Terrestrial	0.14	2				2	0.01	0.17				0.17
141	BR43	48	5		14	LW	Ceramic	Body Sherd			3.57	50		20	21	9	4.65	65.11		47.6	15.38	2.13
141	BR43	48	5		14	LW	Ceramic	Diagnostic	Decorated		0.07	1		1			0.09	1.32		1.32		
141	BR43	48	5		14	LW	Ceramic	Diagnostic	Glazed		0.07	1		1			0.27	3.71		3.71		
141	BR43	48	5		14	LW	Bone	Whole	Pharyngeal Grinding Mill	Scaridae	0.07	1				1	0.01	0.09				0.09
141	BR43	48	5		14	LW	Ceramic	Diagnostic	Base		0.07	1		1			0.82	11.41		11.41		
141	BR43	48	5		14	LW	Ceramic	Diagnostic	Rim		0.14	2			1	1	0.06	0.9			0.46	0.44
141	BR43	48	5		14	LW	Ceramic	Body Sherd	Burnt		0.64	9		9			2.73	38.18		38.18		
142	BR43	48	10		15.5	LW	Bone	Fragment			1.94	30		2	9	19	0.60	9.26		2.11	4.92	2.23
142	BR43	48	10		15.5	LW	Bone	Whole			0.00	0					0.00	0				
142	BR43	48	10		15.5	LW	Bone	Whole			0.06	1				1	0.01	0.18				0.18
142	BR43	48	10		15.5	LW	Bone	Burnt			0.39	6				6	0.07	1.07				1.07
142	BR43	48	10		15.5	LW	Glass	Fragment			0.13	2				2	0.01	0.1484				0.1484
142	BR43	48	10		15.5	LW	Chaff Tempered Clay	Unburnt			0.84	13	1	6	3	3	2.63	40.72	12.98	24.5	2.62	0.62
142	BR43	48	10		15.5	LW	Chaff Tempered Clay	Burnt			0.58	9		1	1	7	0.19	2.89		1.64	0.79	0.46
142	BR43	48	10		15.5	LW	Shell	Fragment		Terrestrial	0.06	1				1	0.00	0.0357				0.0357
142	BR43	48	10		15.5	LW	Ceramic	Body Sherd			1.23	19		5	8	6	0.91	14.13		5.92	6.7	1.51
142	BR43	48	10		15.5	LW	Ceramic	Diagnostic	Glazed		0.06	1				1	0.01	0.2				0.2
142	BR43	48	10		15.5	LW	Ceramic	Diagnostic	Rim		0.06	1				1	0.01	0.23				0.23
142	BR43	48	10		15.5	LW	Ceramic	Diagnostic	Base		0.06	1		1			0.12	1.88		1.88		
142	BR43	48	10		15.5	LW	Ceramic	Body Sherd	Burnt		0.39	6		1	2	3	0.25	3.93		1.8	1.1	1.03

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
143	BS43	18	25		15	LW	Bone	Fragment			1.53	23			4	19	0.26	3.87			2.23	1.64
143	BS43	18	25		15	LW	Bone	Burnt			0.07	1			1		0.03	0.45			0.45	
143	BS43	18	25		15	LW	Chaff Tempered Clay	Unburnt			1.73	26	1	8	11	6	3.92	58.87	20.08	31.67	6.23	0.89
143	BS43	18	25		15	LW	Metal				0.07	1			1		0.05	0.74			0.74	
143	BS43	18	25		15	LW	Stone	Possible Lithic			0.07	1			1		0.10	1.56			1.56	
143	BS43	18	25		15	LW	Shell	Eggshell			0.07	1				1	0.00	0.03				0.03
143	BS43	18	25		15	LW	Shell	Fragment		Terrestrial	0.20	3				3	0.01	0.13				0.13
143	BS43	18	25		15	LW	Ceramic	Body Sherd			2.27	34	1	8	12	13	3.86	57.84	11.32	35.57	8.33	2.62
143	BS43	18	25		15	LW	Ceramic	Diagnostic	Painted		0.13	2		1	1		0.08	1.24		0.98	0.26	
143	BS43	18	25		15	LW	Bone	Whole	Vertebra		0.07	1				1	0.00	0.03				0.03
143	BS43	18	25		15	LW	Ceramic	Diagnostic	Impression		0.07	1			1		0.04	0.62			0.62	
144	BS43	18	18		6.5	LW	Bone	Fragment			7.23	47			4	43	0.91	5.91			2.35	3.56
144	BS43	18	18		6.5	LW	Glass	Fragment			0.31	2				2	0.04	0.25				0.25
144	BS43	18	18		6.5	LW	Chaff Tempered Clay	Unburnt			3.54	23		1		22	1.43	9.32		5.58		3.74
144	BS43	18	18		6.5	LW	Glass	Faience			0.15	1				1	0.05	0.35				0.35
144	BS43	18	18		6.5	LW	Shell	Fragment		Terrestrial	0.15	1				1	0.01	0.06				0.06
144	BS43	18	18		6.5	LW	Botanical	Charcoal			0.31	2				2	0.01	0.04				0.04
144	BS43	18	18		6.5	LW	Ceramic	Body Sherd			6.92	45		9	10	26	5.27	34.27		24.38	6.7	3.19
144	BS43	18	18		6.5	LW	Ceramic	Diagnostic	Painted		0.31	2		1	1		0.62	4.01		3.32	0.69	
144	BS43	18	18		6.5	LW	Ceramic	Diagnostic	Glazed		0.15	1		1			1.01	6.55		6.55		
144	BS43	18	18		6.5	LW	Bone	Whole	Vertebra	Fish	0.15	1				1	0.02	0.1				0.1
144	BS43	18	18		6.5	LW	Ceramic	Diagnostic	Rim		0.15	1				1	0.03	0.2				0.2
145	BS44	58	25		10	LW	Bone	Fragment			0.50	5				5	0.03	0.32				0.32
145	BS44	58	25		10	LW	Bone	Burnt			0.50	5				5	0.04	0.42				0.42
145	BS44	58	25		10	LW	Glass	Fragment			0.10	1				1	0.00	0.04				0.04
145	BS44	58	25		10	LW	Chaff Tempered Clay	Unburnt			1.80	18			5	13	0.48	4.75			2.9	1.85
145	BS44	58	25		10	LW	Chaff Tempered Clay	Burnt			0.30	3				3	0.06	0.61				0.61
145	BS44	58	25		10	LW	Shell	Fragment		Terrestrial	0.20	2				2	0.01	0.09				0.09
145	BS44	58	25		10	LW	Ceramic	Body Sherd			0.70	7			2	5	0.24	2.39			1.87	0.52
145	BS44	58	25		10	LW	Ceramic	Diagnostic	Painted?		0.10	1				1	0.02	0.22				0.22
146	BS44	58	21		17	LW	Bone	Fragment			1.59	27			4	23	0.14	2.4			0.98	1.42
146	BS44	58	21		17	LW	Bone	Burnt			0.12	2				2	0.01	0.21				0.21
146	BS44	58	21		17	LW	Glass	Fragment			0.24	4				4	0.02	0.37				0.37
146	BS44	58	21		17	LW	Shell	Fragment		Terrestrial	0.18	3			1	2	0.01	0.21			0.17	0.04
146	BS44	58	21		17	LW	Ceramic	Body Sherd			0.71	12		4	7	1	0.63	10.72		6.88	3.8	0.04
147	BR47	3			26	L-Sect	Ceramic	Body Sherd			1.31	34		34			4.59	119.44		119.44		
147	BR47	3			26	L-Sect	Bone	Fragment			1.31	34		21	1	12	0.47	12.25		10.51	0.78	0.96
147	BR47	3			26	L-Sect	Bone	Whole			0.08	2		2			0.00	0.05		0.05		
147	BR47	3			26	L-Sect	Bone	Modified?			0.04	1		1			0.02	0.6		0.6		
147	BR47	3			26	L-Sect	Bone	Burnt			0.04	1		1			0.01	0.15		0.15		
147	BR47	3			26	L-Sect	Shell	Fragment		Fossil	0.04	1				1	0.00	0.066				0.066
147	BR47	3			26	L-Sect	Shell	Whole		Olivella	0.04	1		1			0.01	0.31		0.31		
147	BR47	3			26	L-Sect	Bone	Whole	Tooth	Rodent	0.04	1		1			0.00	0.03		0.03		
147	BR47	3			26	L-Sect	Bone	Whole	Rib		0.04	1		1			0.02	0.53		0.53		
147	BR47	3			26	L-Sect	Chaff Tempered Clay	Unburnt			0.27	7		4	3		0.72	18.59		15.8	2.79	
147	BR47	3			26	L-Sect	Ceramic	Diagnostic	Rim		0.04	1		1			0.04	1.01		1.01		
148	BR47	8			6	L-Sect	Ceramic	Body Sherd			7.33	44		14	20	10	11.29	67.71		50.28	15.24	2.19
148	BR47	8			6	L-Sect	Bone	Fragment			6.83	41		1	7	33	1.27	7.61		0.56	4.22	2.83
148	BR47	8			6	L-Sect	Bone	Worked			0.17	1			1		0.08	0.5			0.5	
148	BR47	8			6	L-Sect	Glass	Fragment			0.17	1				1	0.04	0.23				0.23
148	BR47	8			6	L-Sect	Shell	Mollusk			0.17	1			1		0.05	0.27			0.27	
148	BR47	8			6	L-Sect	Shell	Eggshell			0.67	4				4	0.01	0.08				0.08
148	BR47	8			6	L-Sect	Chaff Tempered Clay	Unburnt			27.50	165		17	37	111	21.15	126.88		77.83	28.55	20.5
148	BR47	8			6	L-Sect	Chaff Tempered Clay	Burnt			0.67	4				4	0.11	0.64				0.64
148	BR47	8			6	L-Sect	Bone	Whole	Mandible		0.17	1			1		0.08	0.5			0.5	
148	BR47	8			6	L-Sect	Ceramic	Diagnostic	Painted		0.50	3		1	1	1	0.37	2.22		0.94	1.05	0.23
148	BR47	8			6	L-Sect	Bone	Whole	Tooth		0.67	4				4	0.11	0.64				0.64

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
148	BR47	8			6	L-Sect	Bone	Whole	Vertebra		0.50	3				3	0.03	0.2				0.2
148	BR47	8			6	L-Sect	Bone	Whole	Cranium Frag		0.17	1				1	0.02	0.09				0.09
148	BR47	8			6	L-Sect	Ceramic	Diagnostic	Rim		0.33	2				2	0.10	0.57				0.57
149	BR47	13			6	L-Sect	Bone	Fragment			2.83	17		4	2	11	3.07	18.42		14.57	1.97	1.88
149	BR47	13			6	L-Sect	Bone	Burnt			0.50	3				3	0.04	0.25				0.25
149	BR47	13			6	L-Sect	Shell	Whole		Marine	0.17	1			1		0.10	0.6			0.6	
149	BR47	13			6	L-Sect	Chaff Tempered Clay	Unburnt			4.00	24		8		16	6.95	41.69		38.41		3.28
149	BR47	13			6	L-Sect	Chaff Tempered Clay	Burnt			0.67	4				4	0.10	0.6				0.6
149	BR47	13			6	L-Sect	Ceramic	Body Sherd			1.17	7		1	3	3	1.58	9.48		3.54	4.57	1.37
149	BR47	13			6	L-Sect	Ceramic	Diagnostic	Rim		0.17	1		1			1.15	6.9		6.9		
150	BR47	8			15	L-Sect	Ceramic	Body Sherd			10.53	158	1	41	47	69	12.29	184.33	18.41	114.18	38.39	13.35
150	BR47	8			15	L-Sect	Bone	Fragment			8.07	121		7	22	92	1.97	29.56		8.46	11.32	9.78
150	BR47	8			15	L-Sect	Bone	Burnt			0.87	13			3	10	0.21	3.16			1.86	1.3
150	BR47	8			15	L-Sect	Bone	Worked			0.07	1				1	0.01	0.1				0.1
150	BR47	8			15	L-Sect	Shell	Fragment		Terrestrial	0.53	8				8	0.03	0.46				0.46
150	BR47	8			15	L-Sect	Chaff Tempered Clay	Unburnt			18.13	272		40	48	184	15.96	239.47		164.48	40.32	34.67
150	BR47	8			15	L-Sect	Chaff Tempered Clay	Burnt			1.40	21			1	20	0.26	3.95			0.88	3.07
150	BR47	8			15	L-Sect	Bone	Whole	Tooth		0.93	14		1		13	0.28	4.26		1.47		2.79
150	BR47	8			15	L-Sect	Metal				0.07	1			1		0.13	1.98			1.98	
150	BR47	8			15	L-Sect	Ceramic	Diagnostic	Painted		0.40	6			4	2	0.20	2.99			2.78	0.21
150	BR47	8			15	L-Sect	Ceramic	Diagnostic	Rim		0.07	1				1	0.01	0.13				0.13
151	BR47	9			25	L-Sect	Ceramic	Body Sherd			0.96	24	1	16	7		2.46	61.44	17.57	38.38	5.49	
151	BR47	9			25	L-Sect	Bone	Fragment			0.32	8		5	3		0.32	7.95		5.27	2.68	
151	BR47	9			25	L-Sect	Shell	Fragment		Terrestrial	0.28	7				7	0.01	0.36				0.36
151	BR47	9			25	L-Sect	Chaff Tempered Clay	Unburnt			0.20	5			5		0.13	3.24			3.24	
151	BR47	9			25	L-Sect	Ceramic	Diagnostic	Painted		0.08	2			2		0.04	0.9			0.9	
151	BR47	9			25	L-Sect	Bone	Whole	Tooth		0.04	1			1		0.02	0.42			0.42	
151	BR47	9			25	L-Sect	Ceramic	Diagnostic	Rim		0.08	2		2			0.29	7.16		7.16		
151	BR47	9			25	L-Sect	Ceramic	Diagnostic	Painted Rim		0.04	1			1		0.02	0.5			0.5	
160	BS44	58	24		17	LW	Bone	Fragment			0.35	6				6	0.04	0.63				0.63
160	BS44	58	24		17	LW	Shell	Limestone		Fossil	0.18	3				3	0.01	0.17				0.17
160	BS44	58	24		17	LW	Metal				0.06	1		1			0.00	0				
160	BS44	58	24		17	LW	Botanical	Charcoal			0.53	9				9	0.01	0.1				0.1
160	BS44	58	24		17	LW	Chaff Tempered Clay	Unburnt			0.47	8				8	0.06	0.97				0.97
160	BS44	58	24		17	LW	Ceramic	Body Sherd			0.53	9				9	0.11	1.89				1.89
161	BS44	58	20	193	14	L	Bone	Fragment			0.71	10			1	9	0.14	1.91			0.67	1.24
161	BS44	58	20	193	14	L	Shell	Fragment		Terrestrial	0.57	8			2	6	0.08	1.05			0.25	0.8
161	BS44	58	20	193	14	L	Chaff Tempered Clay	Unburnt			1.07	15			6	9	0.42	5.85			4.25	1.6
161	BS44	58	20	193	14	L	Ceramic	Body Sherd			0.14	2			1	1	0.04	0.52			0.4	0.12
175	BS44	58	24		16	LW	Bone	Fragment			1.69	27			3	24	0.26	4.2			0.92	3.28
175	BS44	58	24		16	LW	Bone	Burnt			0.06	1				1	0.01	0.09				0.09
175	BS44	58	24		16	LW	Glass	Fragment			0.13	2			1	1	0.03	0.51			0.27	0.24
175	BS44	58	24		16	LW	Shell	Limestone		Fossil	0.25	4			1	3	0.04	0.64			0.25	0.39
175	BS44	58	24		16	LW	Chaff Tempered Clay	Unburnt			0.56	9			4	5	0.10	1.61			0.55	1.06
175	BS44	58	24		16	LW	Chaff Tempered Clay	Burnt			0.56	9				9	0.08	1.27				1.27
175	BS44	58	24		16	LW	Bone	Whole	Mandible		0.19	3			1	2	0.03	0.43			0.33	0.1
175	BS44	58	24		16	LW	Bone	Whole	Pelvis		0.06	1				1	0.00	0.05				0.05
175	BS44	58	24		16	LW	Bone	Whole	Tooth		0.06	1				1	0.01	0.1				0.1
175	BS44	58	24		16	LW	Bone	Fragment	Tooth		0.19	3				3	0.03	0.55				0.55
175	BS44	58	24		16	LW	Ceramic	Body Sherd			0.88	14		1	5	8	0.84	13.36		3.44	7.87	2.05
175	BS44	58	24		16	LW	Ceramic	Diagnostic	Glazed		0.06	1				1	0.01	0.21				0.21
175	BS44	58	24		16	LW	Ceramic	Diagnostic	Rim		0.06	1				1	0.01	0.16				0.16
176	BS44	38	25		15	LW	Bone	Fragment			0.27	4				4	0.03	0.39				0.39
176	BS44	38	25		15	LW	Glass	Fragment			0.07	1				1	0.00	0.06				0.06
176	BS44	38	25		15	LW	Shell	Limestone		Fossil	0.07	1				1	0.00	0.04				0.04

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
176	BS44	38	25		15	LW	Shell	Fragment		Terrestrial	0.13	2				2	0.00	0.05				0.05
176	BS44	38	25		15	LW	Shell	Eggshell			0.33	5				5	0.00	0.06				0.06
176	BS44	38	25		15	LW	Chaff Tempered Clay	Unburnt			0.27	4				4	0.08	1.14				1.14
176	BS44	38	25		15	LW	Chaff Tempered Clay	Burnt			0.07	1				1	0.01	0.21				0.21
176	BS44	38	25		15	LW	Ceramic	Body Sherd			0.33	5			2	3	0.17	2.5			2.04	0.46
176	BS44	38	25		15	LW	Ceramic	Diagnostic	Base		0.07	1		1			0.08	1.15		1.15		
177	BS44	58	16		25	LW	Bone	Fragment			2.24	56			8	48	0.38	9.53			2.88	6.65
177	BS44	58	16		25	LW	Bone	Burnt			0.08	2				2	0.01	0.16				0.16
177	BS44	58	16		25	LW	Bone	Unk			0.04	1			1		0.01	0.3			0.3	
177	BS44	58	16		25	LW	Chaff Tempered Clay	Unburnt			3.36	84		1	7	76	0.99	24.69		9.07	5.5	10.12
177	BS44	58	16		25	LW	Metal				0.16	4			1	3	0.15	3.73			3.12	0.61
177	BS44	58	16		25	LW	Shell	Limestone		Fossil	0.04	1			1		0.04	0.9			0.9	
177	BS44	58	16		25	LW	Bone	Whole	Tooth		0.04	1				1	0.02	0.43				0.43
177	BS44	58	16		25	LW	Bone	Whole	Vertebra	Fish	0.04	1				1	0.00	0.0609				0.0609
177	BS44	58	16		25	LW	Chaff Tempered Clay	Burnt			1.08	27				27	0.16	3.91				3.91
177	BS44	58	16		25	LW	Botanical	Charcoal			0.08	2				2	0.01	0.14				0.14
177	BS44	58	16		25	LW	Shell	Limestone		Fossil	0.04	1				1	0.00	0.0724				0.0724
177	BS44	58	16		25	LW	Shell	Eggshell			0.16	4				4	0.00	0.0896				0.0896
177	BS44	58	16		25	LW	Shell	Fragment		Terrestrial	0.08	2				2	0.00	0.0828				0.0828
177	BS44	58	16		25	LW	Ceramic	Body Sherd			2.36	59	1	6	6	46	3.09	77.34	38.15	24.19	5.55	9.45
177	BS44	58	16		25	LW	Ceramic	Diagnostic	Painted		0.04	1		1			0.18	4.58		4.58		
177	BS44	58	16		25	LW	Ceramic	Diagnostic	Base		0.04	1		1			0.06	1.5		1.5		
177	BS44	58	16		25	LW	Ceramic	Diagnostic	Rim		0.12	3			1	2	0.07	1.75			0.85	0.9
177	BS44	58	16		25	LW	Ceramic	Body Sherd	Burnt		0.16	4		1		3	0.23	5.73		5.37		0.36
178	BS44	58	19	182	20	L	Bone	Fragment			0.18	3.55		1		2.6	0.20	3.94		1.39		2.55
178	BS44	58	19	182	20	L	Bone	Burnt			0.15	3				3	0.02	0.39				0.39
178	BS44	58	19	182	20	L	Shell	Fragment		Terrestrial	0.05	1				1	0.00	0.04				0.04
178	BS44	58	19	182	20	L	Chaff Tempered Clay	Unburnt			1.55	31			3	28	0.23	4.5			1.06	3.44
178	BS44	58	19	182	20	L	Botanical	Charcoal			0.20	4				4	0.01	0.11				0.11
178	BS44	58	19	182	20	L	Bone	Whole	Tooth		0.10	2				2	0.01	0.15				0.15
178	BS44	58	19	182	20	L	Ceramic	Body Sherd			1.15	23		2	4	17	0.64	12.84		6.58	2.86	3.4
179	BS44	58	23		18	LW	Bone	Fragment			1.00	18			1	17	0.10	1.75			0.22	1.53
179	BS44	58	23		18	LW	Bone	Burnt			0.22	4				4	0.03	0.53				0.53
179	BS44	58	23		18	LW	Botanical	Charcoal			0.06	1				1	0.00	0.05				0.05
179	BS44	58	23		18	LW	Chaff Tempered Clay	Unburnt			0.67	12	1		6	5	1.04	18.66	15.81		2.11	0.74
179	BS44	58	23		18	LW	Chaff Tempered Clay	Burnt			0.83	15			3	12	0.26	4.68			3.06	1.62
179	BS44	58	23		18	LW	Bone	Whole	Vertebra		0.06	1				1	0.00	0.0184				0.0184
179	BS44	58	23		18	LW	Shell	Limestone		Fossil	0.33	6			1	5	0.04	0.72			0.4	0.32
179	BS44	58	23		18	LW	Shell	Eggshell			0.11	2				2	0.00	0.0428				0.0428
179	BS44	58	23		18	LW	Shell	Fragment		Terrestrial	0.44	8				8	0.01	0.13				0.13
179	BS44	58	23		18	LW	Ceramic	Body Sherd			0.28	5		1	1	3	0.14	2.5		1.81	0.34	0.35
179	BS44	58	23		18	LW	Ceramic	Body Sherd	Burnt		0.17	3			2	1	0.13	2.35			1.99	0.36
180	BS44	58	24		3	LW	Bone	Fragment			3.00	9			1	8	0.43	1.28			0.5	0.78
180	BS44	58	24		3	LW	Bone	Burnt			0.33	1				1	0.07	0.21				0.21
180	BS44	58	24		3	LW	Chaff Tempered Clay	Unburnt			2.33	7				7	0.41	1.24				1.24
180	BS44	58	24		3	LW	Chaff Tempered Clay	Burnt			0.67	2				2	0.07	0.2				0.2
180	BS44	58	24		3	LW	Ceramic	Body Sherd			2.00	6		2		4	1.93	5.78		5.04		0.74
202	BR43	48	4		33	LW	Bone	Fragment			3.76	124		10	60	54	0.83	27.36		12.44	9.9	5.02
202	BR43	48	4		33	LW	Bone	Burnt			0.12	4				4	0.02	0.72			0.12	0.6
202	BR43	48	4		33	LW	Glass	Fragment			0.06	2			1	1	0.00	0.0887			0.04	0.0487
202	BR43	48	4		33	LW	Chaff Tempered Clay	Unburnt			0.76	25		6	11	8	0.56	18.59		14.45	2.87	1.27
202	BR43	48	4		33	LW	Chaff Tempered Clay	Burnt			1.03	34		22	12		0.19	6.22		3.55	2.67	
202	BR43	48	4		33	LW	Botanical	Charcoal			0.06	2			2		0.00	0.0067			0.0067	
202	BR43	48	4		33	LW	Shell	Eggshell			0.52	17				17	0.01	0.33				0.33

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
202	BR43	48	4		33	LW	Bone	Whole	Vertebra		0.03	1				1	0.00	0.0037				0.0037
202	BR43	48	4		33	LW	Bone	Whole	Tooth		0.06	2				2	0.00	0.0374				0.0374
202	BR43	48	4		33	LW	Shell	Limestone		Fossil	0.06	2				2	0.00	0.1165				0.1165
202	BR43	48	4		33	LW	Shell	Fragment		Terrestrial	0.09	3				3	0.00	0.1015				0.1015
202	BR43	48	4		33	LW	Glass	Bead			0.03	1				1	0.01	0.2959				0.2959
202	BR43	48	4		33	LW	Ceramic	Body Sherd			2.45	81	1	21	50	9	2.88	95.1	16.11	51.83	25.44	1.72
202	BR43	48	4		33	LW	Ceramic	Diagnostic	Painted		0.06	2		2			0.35	11.62		11.62		
202	BR43	48	4		33	LW	Ceramic	Diagnostic	Base		0.09	3		2	1		0.24	7.86		6.87	0.99	
202	BR43	48	4		33	LW	Ceramic	Diagnostic	Rim		0.03	1		1			0.11	3.67		3.67		
202	BR43	48	4		33	LW	Ceramic	Body Sherd	Burnt		0.15	5		5			0.49	16.29		16.29		
202	BR43	48	4		33	LW	Ceramic	Body Sherd	Unknown		0.03	1		1			0.40	13.05		13.05		
203	BR43	48	24		8	LW	Bone	Fragment			2.38	19				19	0.29	2.35				2.35
203	BR43	48	24		8	LW	Bone	Whole			0.13	1				1	0.01	0.07				0.07
203	BR43	48	24		8	LW	Bone	Burnt			0.25	2			1	1	0.06	0.49			0.43	0.06
203	BR43	48	24		8	LW	Glass	Fragment			0.13	1				1	0.01	0.06				0.06
203	BR43	48	24		8	LW	Shell	Fragment		Terrestrial	0.13	1				1	0.01	0.08				0.08
203	BR43	48	24		8	LW	Chaff Tempered Clay	Unburnt			1.13	9				9	0.19	1.54				1.54
203	BR43	48	24		8	LW	Ceramic	Body Sherd			3.75	30		8	9	13	3.48	27.86		18.35	6.29	3.22
204	BR43	48	3		7	LW	Bone	Fragment			5.71	40		4	2	34	1.38	9.64		4.4	1.1	4.14
204	BR43	48	3		7	LW	Shell	Fragment		Terrestrial	0.29	2				2	0.01	0.05				0.05
204	BR43	48	3		7	LW	Chaff Tempered Clay	Unburnt			1.43	10	1	2	1	6	1.29	9.04	2.66	5.09	0.66	0.63
204	BR43	48	3		7	LW	Stone	Possible Lithic			0.14	1				1	0.03	0.22				0.22
204	BR43	48	3		7	LW	Ceramic	Body Sherd			4.86	34	1	9	8	16	8.23	57.64	10.93	36.54	6.77	3.4
204	BR43	48	3		7	LW	Ceramic	Diagnostic			0.29	2		2			0.36	2.53		2.53		
211	BR43	58	21		23.5	LW	Bone	Fragment			2.09	49		2	1	46	0.27	6.42		1.73	0.28	4.41
211	BR43	58	21		23.5	LW	Bone	Burnt			0.30	7				7	0.06	1.33				1.33
211	BR43	58	21		23.5	LW	Glass	Fragment			0.04	1				1	0.00	0.09				0.09
211	BR43	58	21		23.5	LW	Metal				0.26	6		1		5	0.11	2.68		1.47		1.21
211	BR43	58	21		23.5	LW	Chaff Tempered Clay	Unburnt			1.06	25		1		24	0.29	6.89		3.28		3.61
211	BR43	58	21		23.5	LW	Chaff Tempered Clay	Burnt			0.47	11		3	2	6	0.64	15.07		11.44	2.98	0.65
211	BR43	58	21		23.5	LW	Botanical	Seed			0.04	1				1	0.00	0.05				0.05
211	BR43	58	21		23.5	LW	Botanical	Charcoal			0.13	3				3	0.01	0.23				0.23
211	BR43	58	21		23.5	LW	Shell	Limestone		Fossil	0.04	1				1	0.00	0.03				0.03
211	BR43	58	21		23.5	LW	Ceramic	Body Sherd			1.02	24	1	2	6	15	1.45	33.99	16.95	9.73	3.99	3.32
211	BR43	58	21		23.5	LW	Ceramic	Diagnostic	Rim		0.17	4			2	2	0.09	2.05			1.48	0.57
211	BR43	58	21		23.5	LW	Ceramic	Body Sherd	Burnt		0.09	2		1		1	0.24	5.68		5.41		0.27
216	BR44	36			26	LW	Bone	Fragment			2.88	75		1	2	72	0.38	9.89		2.08	0.8	7.01
216	BR44	36			26	LW	Bone	Burnt			0.15	4				4	0.03	0.81				0.81
216	BR44	36			26	LW	Glass	Fragment			0.12	3		2		1	0.13	3.48		3.11		0.37
216	BR44	36			26	LW	Chaff Tempered Clay	Unburnt			1.69	44		1	1	42	0.35	9.12		1.87	0.71	6.54
216	BR44	36			26	LW	Shell	Fragment		Terrestrial	1.27	33			7	26	0.17	4.34			2.08	2.26
216	BR44	36			26	LW	Shell	Eggshell?			0.27	7				7	0.01	0.15				0.15
216	BR44	36			26	LW	Ceramic	Body Sherd			2.15	56	4	18	8	26	3.34	86.76	24.64	51.16	7.33	3.63
216	BR44	36			26	LW	Ceramic	Diagnostic	Painted		0.04	1				1	0.00	0.11				0.11
216	BR44	36			26	LW	Ceramic	Diagnostic	Glazed		0.04	1				1	0.02	0.59				0.59
216	BR44	36			26	LW	Bone	Whole	Rib		0.08	2		1	1		0.05	1.19		0.78	0.41	
216	BR44	36			26	LW	Bone	Whole	Tooth		0.19	5			1	4	0.08	2.04			0.8	1.24
216	BR44	36			26	LW	Glass	Diagnostic	Rim		0.04	1			1		0.08	2.18			2.18	
216	BR44	36			26	LW	Ceramic	Diagnostic	Rim		0.15	4		2	2		0.37	9.57		7.78	1.79	
218	BR43	48	24		19	LW	Bone	Fragment			2.21	42		2	5	35	0.43	8.19		1.87	2.73	3.59
218	BR43	48	24		19	LW	Bone	Whole			0.05	1			1		0.01	0.18			0.18	
218	BR43	48	24		19	LW	Bone	Burnt			0.05	1				1	0.00	0				
218	BR43	48	24		19	LW	Glass	Fragment			0.05	1				1	0.00	0.01				0.01
218	BR43	48	24		19	LW	Chaff Tempered Clay	Unburnt			0.58	11			2	9	0.13	2.5			0.96	1.54
218	BR43	48	24		19	LW	Shell	Fragment		Terrestrial	0.11	2				2	0.01	0.24				0.24
218	BR43	48	24		19	LW	Chaff Tempered Clay	Burnt			0.05	1				1	0.01	0.11				0.11
218	BR43	48	24		19	LW	Metal				0.05	1				1	0.03	0.64				0.64

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
218	BR43	48	24		19	LW	Shell	Fragment		Terrestrial	0.16	3				3	0.00	0.09				0.09
218	BR43	48	24		19	LW	Ceramic	Body Sherd			1.37	26	1	6	2	17	1.54	29.27	9.86	14.96	1.39	3.06
218	BR43	48	24		19	LW	Bone	Whole	Tooth		0.16	3				3	0.01	0.25				0.25
218	BR43	48	24		19	LW	Ceramic	Diagnostic	Painted		0.05	1		1			0.19	3.68		3.68		
218	BR43	48	24		19	LW	Ceramic	Diagnostic	Rim		0.11	2			1	1	0.02	0.45			0.31	0.14
219	BR43	48	5,6		18	LW	Bone	Fragment			0.72	13		1		12	0.09	1.57		0.66		0.91
219	BR43	48	5,6		18	LW	Bone	Burnt			0.06	1				1	0.00	0.05				0.05
219	BR43	48	5,6		18	LW	Bone	Burnt			0.06	1				1	0.00	0.03				0.03
219	BR43	48	5,6		18	LW	Metal				0.06	1				1	0.02	0.34				0.34
219	BR43	48	5,6		18	LW	Chaff Tempered Clay	Unburnt			0.89	16			9	7	0.34	6.03			5.01	1.02
219	BR43	48	5,6		18	LW	Chaff Tempered Clay	Burnt			0.06	1				1	0.02	0.4415				0.4415
219	BR43	48	5,6		18	LW	Shell	Fragment		Terrestrial	0.11	2				2	0.00	0.04634				0.04634
219	BR43	48	5,6		18	LW	Ceramic	Diagnostic	Painted		0.06	1		1			0.00	0				
219	BR43	48	5,6		18	LW	Ceramic	Body Sherd			0.44	8			4	4	0.24	4.37		1.77	2.04	0.56
219	BR43	48	5,6		18	LW	Ceramic	Diagnostic			0.00	0					0.00	0				
219	BR43	48	5,6		18	LW	Bone	Whole	Mandible		0.06	1				1	0.00	0.0216				0.0216
219	BR43	48	5,6		18	LW	Ceramic	Diagnostic	Rim		0.06	1			1		0.03	0.5			0.5	
219	BR43	48	5,6		18	LW	Ceramic	Body Sherd	Burnt		0.06	1			1		0.06	1.14			1.14	
220	BR43	48	9		11	LW	Bone	Fragment			2.45	27		1	2	24	0.32	3.57		0.51	0.91	2.15
220	BR43	48	9		11	LW	Bone	Burnt			0.27	3				3	0.02	0.27				0.27
220	BR43	48	9		11	LW	Glass	Fragment			0.09	1				1	0.01	0.09				0.09
220	BR43	48	9		11	LW	Chaff Tempered Clay	Unburnt			0.45	5		1	1	3	0.29	3.24		1.73	1	0.51
220	BR43	48	9		11	LW	Ceramic	Body Sherd			1.55	17		5	10	2	1.65	18.18		8.74	9.24	0.2
220	BR43	48	9		11	LW	Bone	Whole	Mandible		0.09	1				1	0.00	0.03				0.03
220	BR43	48	9		11	LW	Ceramic	Diagnostic	Rim		0.09	1			1		0.07	0.74			0.74	
220	BR43	48	9		11	LW	Ceramic	Body Sherd	Burnt		0.18	2		1	1		0.49	5.4		4.79	0.61	
221	BR43	48	5		25.5	LW	Bone	Fragment			3.06	78		7	11	60	0.75	19.14		6.94	5.72	6.48
221	BR43	48	5		25.5	LW	Bone	Burnt			0.24	6		1	2	3	0.09	2.36		0.94	1.11	0.31
221	BR43	48	5		25.5	LW	Glass	Fragment			0.20	5				5	0.02	0.51				0.51
221	BR43	48	5		25.5	LW	Shell	Fragment		Terrestrial	0.35	9				9	0.04	0.92			0.54	0.38
221	BR43	48	5		25.5	LW	Shell	Eggshell			0.63	16				16	0.02	0.45				0.45
221	BR43	48	5		25.5	LW	Shell	Limestone		Fossil	0.04	1				1	0.00	0.06				0.06
221	BR43	48	5		25.5	LW	Botanical	Charcoal			0.12	3				3	0.00	0.12				0.12
221	BR43	48	5		25.5	LW	Chaff Tempered Clay	Unburnt			0.31	8				8	0.06	1.62				1.62
221	BR43	48	5		25.5	LW	Ceramic	Body Sherd			1.57	40		12	11	17	1.53	39.06		27.11	8.81	3.14
221	BR43	48	5		25.5	LW	Ceramic	Diagnostic	Painted		0.08	2		2			0.34	8.58		8.58		
221	BR43	48	5		25.5	LW	Bone	Whole	Scale	Fish	0.04	1				1	0.00	0.0061				0.0061
221	BR43	48	5		25.5	LW	Ceramic	Diagnostic	Rim		0.04	1		1			0.05	1.36		1.36		
222	BR43	58	17		10.5	LW	Bone	Fragment			2.76	29		2	5	22	0.46	4.78		1.48	1.43	1.87
222	BR43	58	17		10.5	LW	Bone	Burnt			0.29	3				3	0.04	0.4				0.4
222	BR43	58	17		10.5	LW	Chaff Tempered Clay	Unburnt			2.29	24		2		22	0.56	5.93		4.09		1.84
222	BR43	58	17		10.5	LW	Chaff Tempered Clay	Burnt			2.38	25		4	2	19	0.74	7.73		4.09	1.72	1.92
222	BR43	58	17		10.5	LW	Botanical	Charcoal			0.10	1			1		0.10	1.1			1.1	
222	BR43	58	17		10.5	LW	Ceramic	Body Sherd			0.67	7	1	2	3	1	2.25	23.6	19.48	1.84	2.01	0.27
223	BR43	48	3		30	LW	Bone	Fragment			4.83	145		3	13	129	0.64	19.06		3.46	5.63	9.97
223	BR43	48	3		30	LW	Bone	Burnt			0.23	7		1		6	0.08	2.37		1.35		1.02
223	BR43	48	3		30	LW	Glass	Fragment			0.20	6		1		5	0.18	5.35		5.09		0.26
223	BR43	48	3		30	LW	Shell	Eggshell			0.87	26			2	24	0.02	0.47			0.04	0.43
223	BR43	48	3		30	LW	Shell	Fragment		Terrestrial	0.03	1				1	0.00	0.03				0.03
223	BR43	48	3		30	LW	Shell	Limestone		Fossil	0.07	2				2	0.01	0.23				0.23
223	BR43	48	3		30	LW	Metal				0.23	7	1		1	5	0.36	10.88	8.47		1.23	1.18
223	BR43	48	3		30	LW	Chaff Tempered Clay	Unburnt			2.33	70		3	4	63	0.59	17.63		6.12	3.35	8.16
223	BR43	48	3		30	LW	Botanical	Shell		Olea		1				1	0.00	0.0805				0.0805
223	BR43	48	3		30	LW	Ceramic	Body Sherd			1.97	59	2	11	24	22	2.42	72.69	25.61	21.26	20.58	5.24
223	BR43	48	3		30	LW	Bone	Whole	Tooth		0.07	2				2	0.01	0.37				0.37
223	BR43	48	3		30	LW	Bone	Whole	Vertebra	Fish	0.03	1				1	0.00	0.04				0.04
224	AX54	6			30	S	Ceramic	Diagnostic	Rim		0.30	9	2	6	1		0.92	27.69	14.56	12.61	0.52	

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
224	AX54	6			30	S	Ceramic	Diagnostic	Base		0.03	1	1				0.89	26.75	26.75			
224	AX54	6			30	S	Ceramic	Diagnostic	Handle		0.07	2	1	1			1.16	34.84	26.13	8.71		
224	AX54	6			30	S	Ceramic	Body Sherd			2.87	86	17	43	20	6	8.25	247.42	177.61	58.57	10.41	0.83
224	AX54	6			30	S	Bone	Fragment			2.33	70		21	24	25	0.42	12.48		8.33	3.05	1.1
224	AX54	6			30	S	Bone	Whole			0.07	2			2		0.00	0.05			0.05	
224	AX54	6			30	S	Bone	Burnt			0.37	11		5	6		0.16	4.88		3.76	1.12	
224	AX54	6			30	S	Glass	Fragment			0.20	6		1	3	2	0.04	1.24		0.77	0.35	0.12
224	AX54	6			30	S	Shell	Fragment		Terrestrial	0.17	5			3	2	0.01	0.41			0.31	0.1
224	AX54	6			30	S	Shell	Eggshell			0.33	10			1	9	0.00	0.09			0.01	0.08
224	AX54	6			30	S	Chaff Tempered Clay	Unburnt			2.43	73		6	7	60	0.64	19.23		11.31	2.64	5.28
224	AX54	6			30	S	Chaff Tempered Clay	Burnt			0.63	19				19	0.03	1				1
224	AX54	6			30	S	Metal				0.03	1			1		0.01	0.37			0.37	
224	AX54	6			30	S	Botanical	Charcoal			0.03	1		1			0.02	0.49		0.49		
224	AX54	6			30	S	Ceramic	Diagnostic	Painted		0.03	1				1	0.00	0.08				0.08
224	AX54	6			30	S	Bone	Whole	Tooth		0.03	1				1	0.01	0.16				0.16
224	AX54	6			30	S	Bone	Whole	Mandible		0.07	2			2		0.00	0.13			0.13	
224	AX54	6			30	S	Bone	Whole	Vertebra		0.07	2				2	0.00	0.02				0.02
224	AX54	6			30	S	Bone	Whole	Scapula		0.03	1	1				0.11	3.25	3.25			
225	BR44	36			22	LW	Bone	Fragment			1.50	33		2	5	26	0.43	9.47		2.5	4.33	2.64
225	BR44	36			22	LW	Bone	Whole			0.05	1				1	0.00	0.01				0.01
225	BR44	36			22	LW	Glass	Fragment			0.09	2				2	0.02	0.45				0.45
225	BR44	36			22	LW	Chaff Tempered Clay	Unburnt			0.18	4		3	1		0.39	8.52		7.73	0.79	
225	BR44	36			22	LW	Chaff Tempered Clay	Burnt			0.05	1				1	0.00	0.08				0.08
225	BR44	36			22	LW	Botanical	Charcoal			0.14	3				3	0.01	0.3				0.3
225	BR44	36			22	LW	Metal				0.05	1				1	0.02	0.37				0.37
225	BR44	36			22	LW	Shell	Fragment		Terrestrial	0.23	5				5	0.01	0.2				0.2
225	BR44	36			22	LW	Shell	Eggshell			0.32	7				7	0.00	0.06				0.06
225	BR44	36			22	LW	Ceramic	Body Sherd			1.05	23	2	7	9	5	1.99	43.76	18.14	16.97	7.82	0.83
225	BR44	36			22	LW	Bone	Whole	Vertebra		0.14	3				3	0.00	0.08				0.08
225	BR44	36			22	LW	Bone	Whole	Tooth		0.09	2				2	0.01	0.31				0.31
225	BR44	36			22	LW	Ceramic	Diagnostic	Rim		0.09	2		2			0.58	12.75		12.75		
226	BS47	16	16	187	19	L	Bone	Fragment			2.32	44		5	6	33	0.77	14.57		9.37	2.41	2.79
226	BS47	16	16	187	19	L	Bone	Burnt			1.42	27		3	4	20	0.42	8.01		2.64	2.67	2.7
226	BS47	16	16	187	19	L	Glass	Fragment			0.05	1			1		0.01	0.23			0.23	
226	BS47	16	16	187	19	L	Shell	Fragment		Terrestrial	0.42	8				8	0.00	0				
226	BS47	16	16	187	19	L	Shell	Eggshell			0.05	1				1	0.00	0.09				0.09
226	BS47	16	16	187	19	L	Chaff Tempered Clay	Unburnt			0.95	18		6	5	7	1.03	19.59		14.28	3.53	1.78
226	BS47	16	16	187	19	L	Chaff Tempered Clay	Burnt			0.16	3		3			0.21	3.91		3.91		
226	BS47	16	16	187	19	L	Botanical	Charcoal			0.05	1				1	0.00	0.02				0.02
226	BS47	16	16	187	19	L	Ceramic	Body Sherd			2.11	40		23	14	3	5.25	99.68		85.74	13.12	0.82
226	BS47	16	16	187	19	L	Ceramic	Diagnostic	Painted		0.05	1				1	0.01	0.18				0.18
226	BS47	16	16	187	19	L	Bone	Whole	Tooth		0.26	5				5	0.03	0.61				0.61
226	BS47	16	16	187	19	L	Ceramic	Diagnostic	Base		0.05	1		1			0.21	3.95		3.95		
226	BS47	16	16	187	19	L	Ceramic	Diagnostic	Rim		0.11	2			2		0.05	0.86			0.86	
229	BS43	18	23		15	LW	Bone	Fragment			2.53	38			5	33	0.42	6.28			3.24	3.04
229	BS43	18	23		15	LW	Chaff Tempered Clay	Unburnt			0.47	7		1	5	1	0.78	11.67		6.83	4.67	0.17
229	BS43	18	23		15	LW	Shell	Fragment		Terrestrial	0.07	1				1	0.01	0.09				0.09
229	BS43	18	23		15	LW	Metal				0.07	1				1	0.01	0.12				0.12
229	BS43	18	23		15	LW	Shell	Eggshell			0.27	4				4	0.01	0.13				0.13
229	BS43	18	23		15	LW	Ceramic	Body Sherd			0.80	12		2	7	3	0.62	9.25		2.96	5.42	0.87
229	BS43	18	23		15	LW	Ceramic	Diagnostic	Painted		0.13	2		1	1		0.77	11.55		10.57	0.98	
229	BS43	18	23		15	LW	Ceramic	Diagnostic	Glazed		0.13	2				2	0.03	0.4				0.4
229	BS43	18	23		15	LW	Bone	Whole	Tooth		0.13	2				2	0.02	0.26				0.26
229	BS43	18	23		15	LW	Ceramic	Diagnostic	Rim		0.13	2		2			0.38	5.75		5.75		
229	BS43	18	23		15	LW	Ceramic	Diagnostic	Handle		0.07	1		1			0.57	8.53		8.53		
230	BS43	18	18		28	LW	Bone	Fragment			1.50	42		4	5	33	0.33	9.32		4.01	2.38	2.93
230	BS43	18	18		28	LW	Bone	Whole			0.11	3			1	2	0.03	0.84			0.68	0.16

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
230	BS43	18	18		28	LW	Glass	Fragment			0.04	1				1	0.00	0.06				0.06
230	BS43	18	18		28	LW	Chaff Tempered Clay	Unburnt			0.14	4		1	3		0.24	6.68		5.3	1.38	
230	BS43	18	18		28	LW	Metal				0.04	1			1		0.12	3.24			3.24	
230	BS43	18	18		28	LW	Shell	Fragment		Terrestrial	0.04	1				1	0.00	0.1				0.1
230	BS43	18	18		28	LW	Shell	Eggshell			0.04	1				1	0.00	0.02				0.02
230	BS43	18	18		28	LW	Ceramic	Body Sherd			0.93	26		15	7	4	1.56	43.74		36.7	6.17	0.87
230	BS43	18	18		28	LW	Bone	Whole	Tooth		0.07	2			1	1	0.02	0.69			0.46	0.23
230	BS43	18	18		28	LW	Ceramic	Diagnostic	Rim		0.07	2			2		0.06	1.61			1.61	
231	BS43	7			15	LW	Bone	Fragment			1.20	18			2	16	0.12	1.81			0.38	1.43
231	BS43	7			15	LW	Bone	Burnt			0.13	2			1	1	0.05	0.78			0.55	0.23
231	BS43	7			15	LW	Glass	Fragment			0.33	5				5	0.02	0.33				0.33
231	BS43	7			15	LW	Shell	Fragment		Terrestrial	6.93	104		4	8	92	0.32	4.85		1.42	0.5	2.93
231	BS43	7			15	LW	Botanical	Modern Seed			0.07	1				1	0.00	0.04				0.04
231	BS43	7			15	LW	Chaff Tempered Clay	Unburnt			0.07	1			1		0.03	0.52			0.52	
231	BS43	7			15	LW	Chaff Tempered Clay	Burnt			0.07	1			1		0.03	0.39			0.39	
231	BS43	7			15	LW	Ceramic	Body Sherd			0.60	9		4	4	1	0.67	9.98		6.56	3.01	0.41
231	BS43	7			15	LW	Ceramic	Diagnostic	Painted		0.07	1				1	0.01	0.09				0.09
231	BS43	7			15	LW	Bone	Whole	Mandible		0.07	1				1	0.00	0.04				0.04
231	BS43	7			15	LW	Bone	Whole	Vertebra		0.07	1				1	0.00	0.03				0.03
231	BS43	7			15	LW	Bone	Whole	Unknown		0.07	1				1	0.00	0.04				0.04
231	BS43	7			15	LW	Ceramic	Diagnostic	Rim		0.07	1			1		0.03	0.44			0.44	
232	BS43	26	23,24,25		18	LW	Bone	Fragment			1.61	29		1	7	21	0.45	8.08		1.68	3.84	2.56
232	BS43	26	23,24,25		18	LW	Bone	Burnt			0.17	3			1	2	0.06	1.05			0.69	0.36
232	BS43	26	23,24,25		18	LW	Glass	Fragment			0.06	1			1		0.02	0.28			0.28	
232	BS43	26	23,24,25		18	LW	Shell	Eggshell			0.17	3				3	0.00	0.05				0.05
232	BS43	26	23,24,25		18	LW	Chaff Tempered Clay	Unburnt			0.06	1			1		0.04	0.7			0.7	
232	BS43	26	23,24,25		18	LW	Metal				0.06	1				1	0.01	0.22				0.22
232	BS43	26	23,24,25		18	LW	Ceramic	Body Sherd			1.06	19		7	7	5	1.72	30.96		21.28	8.19	1.49
232	BS43	26	23,24,25		18	LW	Ceramic	Diagnostic	Painted		0.06	1			1		0.03	0.53			0.53	
232	BS43	26	23,24,25		18	LW	Ceramic	Diagnostic	Glazed		0.11	2			2		0.09	1.56			1.56	
233	BS43	18	23		7	LW	Bone	Fragment			3.00	21		2	1	18	1.17	8.16		5.44	0.26	2.46
233	BS43	18	23		7	LW	Bone	Burnt			0.14	1				1	0.03	0.18				0.18
233	BS43	18	23		7	LW	Glass	Fragment			0.14	1				1	0.01	0.06				0.06
233	BS43	18	23		7	LW	Chaff Tempered Clay	Unburnt			1.14	8			3	5	0.75	5.25			4.64	0.61
233	BS43	18	23		7	LW	Shell	Fragment		Terrestrial	0.14	1				1	0.01	0.07				0.07
233	BS43	18	23		7	LW	Botanical	Charcoal			0.14	1				1	0.01	0.05				0.05
233	BS43	18	23		7	LW	Ceramic	Body Sherd			3.57	25		4	7	14	3.30	23.1		15.22	5.98	1.9
233	BS43	18	23		7	LW	Bone	Whole	Vertebra		0.43	3				3	0.02	0.16				0.16
233	BS43	18	23		7	LW	Ceramic	Diagnostic	Handle		0.29	2		2			0.94	6.59		6.59		
234	BS43	18	25		14	LW	Bone	Fragment			2.50	35		2	2	31	0.67	9.44		5.38	0.85	3.21
234	BS43	18	25		14	LW	Bone	Burnt			0.07	1				1	0.00	0.05				0.05
234	BS43	18	25		14	LW	Bone	?			0.07	1				1	0.00	0.03				0.03
234	BS43	18	25		14	LW	Bone	Fragment			2.79	39	0	4	2	33	1.15	16.11	0	11.97	0.85	3.29
234	BS43	18	25		14	LW	Glass	Fragment			0.29	4			1	3	0.04	0.52			0.2	0.32
234	BS43	18	25		14	LW	Glass	Faience			0.07	1			1		0.16	2.3			2.3	
234	BS43	18	25		14	LW	Chaff Tempered Clay	Unburnt			1.71	24		1	5	18	0.70	9.81		4.35	2.84	2.62
234	BS43	18	25		14	LW	Shell	Fragment		Terrestrial	0.21	3				3	0.01	0.1				0.1
234	BS43	18	25		14	LW	Shell	Eggshell			0.14	2				2	0.00	0.02				0.02
234	BS43	18	25		14	LW	Bone	Whole	Tooth		0.14	2				2	0.02	0.33				0.33
234	BS43	18	25		14	LW	Metal				0.07	1				1	0.01	0.11				0.11
234	BS43	18	25		14	LW	Botanical	Charcoal			0.07	1				1	0.00	0.02				0.02
234	BS43	18	25		14	LW	Ceramic	Body Sherd			3.14	44	1	13	9	21	5.42	75.92	9.19	55.62	6.66	4.45
234	BS43	18	25		14	LW	Ceramic	Diagnostic	Painted		0.14	2		2			0.12	1.71		1.71		
234	BS43	18	25		14	LW	Ceramic	Diagnostic	Rim		0.29	4		2		2	0.91	12.74		11.81		0.93
234	BS43	18	25		14	LW	Ceramic	Diagnostic	Base		0.07	1		1			0.12	1.74		1.74		
235	BS43	18	17,22		11	LW	Glass	Fragment			0.18	2				2	0.02	0.25				0.25
235	BS43	18	17,22		11	LW	Bone	Fragment			3.82	42		2	4	36	0.58	6.37		0.99	1.83	3.55
235	BS43	18	17,22		11	LW	Bone	Whole			0.18	2		1	1		0.04	0.44		0.21	0.23	

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
235	BS43	18	17,22		11	LW	Bone	Burnt			0.09	1			1		0.02	0.26			0.26	
235	BS43	18	17,22		11	LW	Chaff Tempered Clay	Unburnt			1.18	13		1	3	9	0.79	8.67		5.21	1.93	1.53
235	BS43	18	17,22		11	LW	Metal				0.09	1			1		0.05	0.5			0.5	
235	BS43	18	17,22		11	LW	Shell	Fragment		Terrestrial	0.82	9				9	0.04	0.48				0.48
235	BS43	18	17,22		11	LW	Shell	Eggshell			0.09	1				1	0.00	0.01				0.01
235	BS43	18	17,22		11	LW	Ceramic	Body Sherd			1.91	21		3	4	14	1.07	11.73		6.67	2.07	2.99
235	BS43	18	17,22		11	LW	Ceramic	Diagnostic	Painted		0.09	1				1	0.03	0.38				0.38
235	BS43	18	17,22		11	LW	Ceramic	Diagnostic	Rim		0.09	1			1		0.10	1.07			1.07	
236	BS43	18	24		3.5	LW	Bone	Fragment			2.86	10		1	2	7	0.84	2.93		1.03	1.08	0.82
236	BS43	18	24		3.5	LW	Bone	Burnt			0.57	2				2	0.03	0.09				0.09
236	BS43	18	24		3.5	LW	Glass	Fragment			0.29	1				1	0.02	0.06				0.06
236	BS43	18	24		3.5	LW	Metal				0.57	2		1		1	1.69	5.9		5.8		0.1
236	BS43	18	24		3.5	LW	Chaff Tempered Clay	Unburnt			0.86	3		1	2		2.13	7.44		3.61	3.83	
236	BS43	18	24		3.5	LW	Ceramic	Body Sherd			3.14	11		6	3	2	6.41	22.45		19.92	2.12	0.41
236	BS43	18	24		3.5	LW	Ceramic	Diagnostic	Painted		0.57	2		1		1	0.59	2.07		1.93		0.14
248	BS44	34		69		LW	Bone	Fragment			#DIV/0!	19		1	3	15	#DIV/0!	3.26		0.56	1.74	0.96
248	BS44	34		69		LW	Bone	Burnt			#DIV/0!	2			2		#DIV/0!	0.7			0.7	
248	BS44	34		69		LW	Glass	Fragment			#DIV/0!	1				1	#DIV/0!	0.12				0.12
248	BS44	34		69		LW	Shell	Eggshell			#DIV/0!	4				4	#DIV/0!	0.0279				0.0279
248	BS44	34		69		LW	Botanical	Charcoal			#DIV/0!	1				1	#DIV/0!	0.001				0.001
248	BS44	34		69		LW	Ceramic	Body Sherd			#DIV/0!	13		2	4	7	#DIV/0!	11.63		6.86	3.99	0.78
248	BS44	34		69		LW	Bone	Whole	Vertebra		#DIV/0!	1				1	#DIV/0!	0.63				0.63
248	BS44	34		69		LW	Bone	Whole	Tooth		#DIV/0!	2				2	#DIV/0!	0.22				0.22
248	BS44	34		69		LW	Ceramic	Diagnostic	Glazed		#DIV/0!	2		2			#DIV/0!	9.54		9.4		0.14
289	L Sect	10		43	9	L-SECT	Ceramic	Body Sherd			5.89	53	2	23	13	15	14.44	129.92	15.13	93.94	17.39	3.46
289	L Sect	10		43	9	L-SECT	Bone	Fragment			0.56	5			1	4	0.11	1.02			0.6	0.42
289	L Sect	10		43	9	L-SECT	Bone	Whole			0.33	3				3	0.03	0.28				0.28
289	L Sect	10		43	9	L-SECT	Bone	Burnt			0.33	3				3	0.07	0.61				0.61
289	L Sect	10		43	9	L-SECT	Chaff Tempered Clay	Unburnt			1.11	10			10		0.71	6.43			6.43	
289	L Sect	10		43	9	L-SECT	Chaff Tempered Clay	Burnt			0.11	1				1	0.01	0.1				0.1
289	L Sect	10		43	9	L-SECT	Shell	Limestone		Fossil	0.44	4				4	0.06	0.54				0.54
289	L Sect	10		43	9	L-SECT	Shell	Fragment			2.22	20				20	0.06	0.5				0.5
289	L Sect	10		43	9	L-SECT	Shell	Eggshell			0.44	4				4	0.02	0.15				0.15
289	L Sect	10		43	9	L-SECT	Ceramic	Diagnostic	Rim		0.22	2				2	0.05	0.48				0.48
293	BR47	6		33	20	L-SECT	Ceramic	Diagnostic	Rim		0.15	3		1	1	1	0.15	2.91		1.64	1.08	0.19
293	BR47	6		33	20	L-SECT	Ceramic	Body Sherd			4.40	88	1	30	19	38	6.30	125.95	9.75	94.95	14.7	6.55
293	BR47	6		33	20	L-SECT	Chaff Tempered Clay	Unburnt			6.70	134			5	129	0.97	19.46			2.5	16.96
293	BR47	6		33	20	L-SECT	Chaff Tempered Clay	Burnt			3.75	75			3	72	0.40	7.98			1.25	6.73
293	BR47	6		33	20	L-SECT	Bone	Fragment			9.15	183		5	34	144	1.81	36.14		7.3	14.77	14.07
293	BR47	6		33	20	L-SECT	Bone	Burnt			2.00	40		3	4	33	0.32	6.43		2.44	0.36	3.63
293	BR47	6		33	20	L-SECT	Bone	Fragment		Marine	0.05	1				1	0.00	0.05				0.05
293	BR47	6		33	20	L-SECT	Shell	Fragment		Terrestrial	0.35	7				7	0.02	0.34				0.34
293	BR47	6		33	20	L-SECT	Bone	Whole	Tooth		0.25	5				5	0.03	0.53				0.53
293	BR47	6		33	20	L-SECT	Bone	Burnt	Vertebra		0.05	1				1	0.00	0.04				0.04
293	BR47	6		33	20	L-SECT	Metal	Nail			0.05	1		1			0.19	3.7		3.7		
293	BR47	6		33	20	L-SECT	Ceramic	Diagnostic	Painted		0.05	1				1	0.01	0.2				0.2
293	BR47	6		33	20	L-SECT	Bone	Whole	Mandible		0.05	1				1	0.00	0.06				0.06
300	BR47	11		86	32.5	L-Sect	Ceramic	Diagnostic	Rim		0.15	5		4		1	0.22	7.05		6.61		0.44
300	BR47	11		86	32.5	L-Sect	Ceramic	Diagnostic	Handle		0.06	2	1	1			0.72	23.46	17.4	6.06		
300	BR47	11		86	32.5	L-Sect	Ceramic	Diagnostic	Painted Base Rim		0.03	1	1				0.09	2.99	2.99			
300	BR47	11		86	32.5	L-Sect	Ceramic	Body Sherd			2.25	73	6	30	23	14	6.83	221.84	84.86	117.04	16.86	3.08
300	BR47	11		86	32.5	L-Sect	Chaff Tempered Clay	Unburnt			8.25	268		9	113	146	1.64	53.16		17.95	14.93	20.28
300	BR47	11		86	32.5	L-Sect	Chaff Tempered Clay	Burnt			0.86	28			3	25	0.16	5.26			1.98	3.28
300	BR47	11		86	32.5	L-Sect	Bone	Fragment			5.82	189		3	18	168	0.73	23.77		3.06	6.73	13.98
300	BR47	11		86	32.5	L-Sect	Bone	Burnt			1.11	36		4		32	0.11	3.67			0.94	2.73
300	BR47	11		86	32.5	L-Sect	Shell	Burnt		Fossil	1.82	59		1	2	56	0.14	4.47		0.26	0.2	4.01
300	BR47	11		86	32.5	L-Sect	Shell	Burnt		Terrestrial	1.60	52			6	46	0.05	1.51			0.27	1.24
300	BR47	11		86	32.5	L-Sect	Shell	Burnt		Eggshell	0.12	4				4	0.00	0.1				0.1
300	BR47	11		86	32.5	L-Sect	Botanical	Burnt			0.06	2				2	0.00	0.05				0.05

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
300	BR47	11		86	32.5	L-Sect	Ceramic	Diagnostic	Painted		0.03	1		1			0.03	1.1		1.1		
300	BR47	11		86	32.5	L-Sect	Bone	Burnt	Vertebra		0.03	1				1	0.00	0.04				0.04
300	BR47	11		86	32.5	L-Sect	Bone	Burnt	Spine	Fish	0.03	1				1	0.00	0.08				0.08
300	BR47	11		86	32.5	L-Sect	Shell	Burnt	Burnt	Fossil	0.06	2				2	0.01	0.2				0.2
328	BS43	27	3	280	7	LW	Chaff Tempered Clay	Unburnt			0.57	4			2	2	0.16	1.09			0.58	0.51
328	BS43	27	3	280	7	LW	Bone	Fragment			4.86	34	1	2	7	24	2.43	17.04	8.93	3.01	2.28	2.82
328	BS43	27	3	280	7	LW	Bone	Burnt			0.14	1			1		0.07	0.5			0.5	
328	BS43	27	3	280	7	LW	Unk				0.86	6	6				32.30	226.12	226.12			
328	BS43	27	3	280	7	LW	Shell	Unburnt		Eggshell	0.57	4				4	0.01	0.06				0.06
328	BS43	27	3	280	7	LW	Shell	Limestone		Fossil	0.14	1				1	0.00	0.02				0.02
328	BS43	27	3	280	7	LW	Botanical	Seed		Vitis	0.14	1				1	0.00	0.03				0.03
328	BS43	27	3	280	7	LW	Botanical			Reed	0.14	1				1	0.00	0.01				0.01
328	BS43	27	3	280	7	LW	Ceramic	Burnt			1.43	10		1	3	6	0.72	5.07		1.31	2.08	1.68
328	BS43	27	3	280	7	LW	Ceramic	Burnt	Glazed		0.14	1			1		0.07	0.51			0.51	
328	BS43	27	3	280	7	LW	Ceramic	Burnt	Painted		0.29	2			2		0.13	0.92			0.92	
328	BS43	27	3	280	7	LW	Ceramic	Burnt	Rim		0.14	1		1			0.62	4.36		4.36		
329	BS43	27	24		4	LW	Bone	Fragment			3.75	15			2	13	0.86	3.45			1.09	2.36
329	BS43	27	24		4	LW	Glass	Fragment			0.25	1				1	0.13	0.5				0.5
329	BS43	27	24		4	LW	Metal	Unk			0.25	1				1	0.17	0.69				0.69
329	BS43	27	24		4	LW	Bone	Whole	Vertebra		0.25	1				1	0.03	0.1				0.1
329	BS43	27	24		4	LW	Bone	Fragment	Tooth		0.25	1				1	0.04	0.14				0.14
329	BS43	27	24		4	LW	Bone	Fragment	Jaw/Tooth		0.25	1				1	0.01	0.04				0.04
329	BS43	27	24		4	LW	Botanical	Charcoal			0.25	1				1	0.07	0.29				0.29
329	BS43	27	24		4	LW	Shell	Unburnt		Eggshell	1.00	4				4	0.01	0.02				0.02
329	BS43	27	24		4	LW	Shell	Burnt		Eggshell	0.25	1				1	0.00	0.004				0.004
329	BS43	27	24		4	LW	Shell	Burnt		Eggshell	0.25	1				1	0.00	0.004				0.004
329	BS43	27	24		4	LW	Ceramic	Body Sherd			11.00	44		14	14	16	18.59	74.35		59.73	12	2.62
329	BS43	27	24		4	LW	Ceramic	Diagnostic	Rim		0.25	1		1			1.14	4.57		4.57		
331	BS44	80	24	275	22	LW	Chaff Tempered Clay	Unburnt			1.27	28				28	0.15	3.22				3.22
331	BS44	80	24	275	22	LW	Chaff Tempered Clay	Burnt			1.45	32				32	0.20	4.42				4.42
331	BS44	80	24	275	22	LW	Bone	Fragment			1.18	26		1		25	0.16	3.44		0.91		2.53
331	BS44	80	24	275	22	LW	Bone	Burnt			0.09	2				2	0.03	0.56				0.56
331	BS44	80	24	275	22	LW	Glass	Fragment			0.09	2				2	0.01	0.13				0.13
331	BS44	80	24	275	22	LW	Shell	Unburnt		Eggshell	0.05	1				1	0.00	0.02				0.02
331	BS44	80	24	275	22	LW	Shell	Fragment		Terrestrial	0.05	1				1	0.00	0.02				0.02
331	BS44	80	24	275	22	LW	Botanical	Charcoal			0.32	7				7	0.02	0.45				0.45
331	BS44	80	24	275	22	LW	Ceramic	Body Sherd			1.64	36	1	14	15	6	2.99	65.77	17.92	34.38	11.83	1.64
331	BS44	80	24	275	22	LW	Ceramic	Diagnostic	Painted		0.05	1		1			0.15	3.19			3.19	
331	BS44	80	24	275	22	LW	Ceramic	Diagnostic	Glazed		0.05	1				1	0.01	0.13				0.13
331	BS44	80	24	275	22	LW	Ceramic	Diagnostic	Ceramic Frag		0.23	5			5		0.17	3.64			3.64	
332	BS44	80	23	283	10	LW	Bone	Fragment			3.50	35		1	4	30	0.76	7.56		0.29	2.01	5.26
332	BS44	80	23	283	10	LW	Bone	Whole			0.10	1			1		0.01	0.11			0.11	
332	BS44	80	23	283	10	LW	Bone	Burnt			0.30	3			2	1	0.24	2.42			2.06	0.36
332	BS44	80	23	283	10	LW	Chaff Tempered Clay	Unburnt			6.20	62	2	7	5	48	6.33	63.26	22.57	28.48	3.96	8.25
332	BS44	80	23	283	10	LW	Chaff Tempered Clay	Burnt			2.20	22		2	5	15	1.93	19.34		13.99	4.14	1.21
332	BS44	80	23	283	10	LW	Glass	Fragment			0.20	2			1	1	0.13	1.25			0.22	1.03
332	BS44	80	23	283	10	LW	Metal	Jewelry			0.20	2				2	0.02	0.2				0.2
332	BS44	80	23	283	10	LW	Ceramic	Body Sherd			3.60	36		6	14	16	2.89	28.85		12.9	12.7	3.25
332	BS44	80	23	283	10	LW	Ceramic	Diagnostic	Painted		0.30	3		2	1		0.51	5.08		4.29	0.79	
332	BS44	80	23	283	10	LW	Ceramic	Diagnostic	Glazed		0.30	3				3	0.03	0.28				0.28
332	BS44	80	23	283	10	LW	Ceramic	Diagnostic	Rim		0.10	1			1		0.09	0.85			0.85	
340	BS44	72	20	238	7.5	LW	Bone	Fragment			1.87	14				14	0.20	1.51				1.51
340	BS44	72	20	238	7.5	LW	Chaff Tempered Clay	Unburnt			0.67	5				5	0.06	0.48				0.48
340	BS44	72	20	238	7.5	LW	Chaff Tempered Clay	Burnt			0.53	4				4	0.07	0.53				0.53
340	BS44	72	20	238	7.5	LW	Glass	Fragment			0.13	1				1	0.01	0.06				0.06
340	BS44	72	20	238	7.5	LW	Ceramic	Body Sherd			1.47	11	1	3	2	5	3.83	28.73	15.83	10.87	1.17	0.86
340	BS44	72	20	238	7.5	LW	Ceramic	Diagnostic			0.13	1			1		0.14	1.07			1.07	
341	AW54	3		27	8	S	Ceramic	Body Sherd			2.00	16	2	4	4	6	3.42	27.33	17.76	5.89	2.31	1.37
341	AW54	3		27	8	S	Chaff Tempered Clay	Unburnt			1.38	11			1	10	0.26	2.11			0.68	1.43

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
341	AW54	3		27	8	S	Chaff Tempered Clay	Burnt			1.25	10		1		9	0.68	5.45		4.48		0.97
341	AW54	3		27	8	S	Bone	Fragment			1.25	10				10	0.17	1.37				1.37
341	AW54	3		27	8	S	Bone	Burnt			0.13	1			1		0.05	0.38			0.38	
341	AW54	3		27	8	S	Sediment	Insect Cast			3.25	26		1	21	4	0.42	3.32		0.73	2.12	0.47
341	AW54	3		27	8	S	Botanical	Charcoal			0.50	4				4	0.02	0.14				0.14
341	AW54	3		27	8	S	Shell	Unburnt		Eggshell	0.13	1				1	0.00	0.03				0.03
342	AW54	3		26	8	S	Ceramic	Diagnostic	Base		0.13	1	1				4.59	36.7	36.7			
342	AW54	3		26	8	S	Ceramic	Diagnostic	Rim		0.25	2	1			1	8.93	71.4	71.4			
342	AW54	3		26	8	S	Ceramic	Body Sherd			0.63	5	2	1	1	1	9.46	75.7	71.4	3.3	0.95	0.05
342	AW54	3		26	8	S	Bone	Fragment			0.50	4		1	1	2	0.38	3.06		1.8	0.9	0.36
342	AW54	3		26	8	S	Bone	Burnt			0.13	1				1	0.09	0.69				0.69
342	AW54	3		26	8	S	Chaff Tempered Clay	Burnt			1.00	8				8	0.13	1.05				1.05
342	AW54	3		26	8	S	Chaff Tempered Clay	Unburnt			0.38	3				3	0.04	0.34				0.34
342	AW54	3		26	8	S	Glass	Fragment			0.13	1		1			0.28	2.2		2.2		
342	AW54	3		26	8	S	Chaff Tempered Clay	Unburnt			0.13	1				1	0.00	0.03				0.03
343	AW54	3		28	9	S	Ceramic	Diagnostic	Handle		0.11	1	1				5.01	45.12	45.12			
343	AW54	3		28	9	S	Ceramic	Body Sherd			2.33	21	2	8	5	6	6.33	56.93	27.22	24.3	4.03	1.38
343	AW54	3		28	9	S	Chaff Tempered Clay	Unburnt			0.22	2			2		0.20	1.83			1.83	
343	AW54	3		28	9	S	Chaff Tempered Clay	Burnt			0.78	7			7		0.56	5.06			5.06	
343	AW54	3		28	9	S	Bone	Fragment			1.22	11		1	2	8	0.57	5.11		3.03	1.16	0.92
343	AW54	3		28	9	S	Shell	Whole		Terrestrial	0.11	1				1	0.00	0.02				0.02
359	BR44	46	2	468	9	LW	Bone	Fragment			1.56	14			1	13	0.32	2.86			0.72	2.14
359	BR44	46	2	468	9	LW	Bone	Whole	Tooth		0.11	1				1	0.05	0.43				0.43
359	BR44	46	2	468	9	LW	Bone	Burnt			1.00	9				9	0.11	0.96				0.96
359	BR44	46	2	468	9	LW	Bone	Fragment	Tooth		0.11	1				1	0.05	0.41				0.41
359	BR44	46	2	468	9	LW	Glass	Bead			0.11	1			1		0.20	1.77			1.77	
359	BR44	46	2	468	9	LW	Shell			Limestone Fossil	0.11	1			1		0.09	0.8			0.8	
359	BR44	46	2	468	9	LW	Shell	Unburnt		Eggshell	0.11	1				1	0.02	0.18				0.18
359	BR44	46	2	468	9	LW	Botanical	Charcoal			0.22	2				2	0.01	0.08				0.08
359	BR44	46	2	468	9	LW	Chaff Tempered Clay	Unburnt			3.89	35				35	0.53	4.77				4.77
359	BR44	46	2	468	9	LW	Chaff Tempered Clay	Burnt			2.11	19			2	17	0.36	3.22			2.01	1.21
359	BR44	46	2	468	9	LW	Glass	Fragment			0.22	2	1		1		0.20	1.77			1.77	
359	BR44	46	2	468	9	LW	Ceramic	Body Sherd			2.33	21	1	6	9	5	4.26	38.37	17.97	12.05	7.39	0.96
359	BR44	46	2	468	9	LW	Ceramic	Diagnostic	Painted		0.33	3		2	1		0.71	6.43		5.59	0.84	
359	BR44	46	2	468	9	LW	Ceramic	Diagnostic	Handle		0.11	1		1			1.22	10.95		10.95		
359	BR44	46	2	468	9	LW	Ceramic	Diagnostic	Base		0.11	1			1		0.16	1.42			1.42	
365	AW54	3	10	58	5	S	Chaff Tempered Clay	Unburnt			3.20	16			1	15	0.22	1.12			0.51	0.61
365	AW54	3	10	58	5	S	Bone	Whole	Tooth		0.20	1				1	0.00	0.009				0.009
365	AW54	3	10	58	5	S	Bone	Whole	Vertebra	Fish	0.20	1				1	0.01	0.03				0.03
365	AW54	3	10	58	5	S	Chaff Tempered Clay	Burnt			4.00	20				20	0.44	2.22				2.22
365	AW54	3	10	58	5	S	Bone	Fragment			2.40	12		1		11	0.22	1.11		0.87		0.24
365	AW54	3	10	58	5	S	Bone	Burnt			0.40	2				2	0.04	0.2				0.2
365	AW54	3	10	58	5	S	Glass	Fragment			0.20	1				1	0.02	0.12				0.12
365	AW54	3	10	58	5	S	Shell	Limestone		Fossil	0.20	1				1	0.01	0.07				0.07
365	AW54	3	10	58	5	S	Botanical	Charcoal			0.40	2				2	0.00	0.01				0.01
365	AW54	3	10	58	5	S	Unk				1.00	5				5	0.08	0.42				0.42
365	AW54	3	10	58	5	S	Ceramic	Body Sherd			2.40	12		7	1	4	4.07	20.35		18.99	0.76	0.6
365	AW54	3	10	58	5	S	Ceramic	Body Sherd	Flakes		0.80	4				4	0.03	0.14				0.14
372	BS44	80	19	270	16	LW	Bone	Fragment			1.00	16			1	15	0.29	4.66			0.97	3.69
372	BS44	80	19	270	16	LW	Chaff Tempered Clay	Unburnt			3.00	48				48	0.38	6.05				6.05
372	BS44	80	19	270	16	LW	Chaff Tempered Clay	Burnt			0.56	9				9	0.09	1.49				1.49
372	BS44	80	19	270	16	LW	Glass	Fragment			0.13	2				2	0.01	0.15				0.15
372	BS44	80	19	270	16	LW	Clay	Plaster			0.06	1		1			0.20	3.21		3.21		
372	BS44	80	19	270	16	LW	Metal	Unk			0.06	1				1	0.02	0.32				0.32
372	BS44	80	19	270	16	LW	Shell	Unburnt		Terrestrial	0.06	1				1	0.00	0.02				0.02
372	BS44	80	19	270	16	LW	Ceramic	Body Sherd			1.56	25			11	14	0.80	12.74			10.61	2.13
372	BS44	80	19	270	16	LW	Ceramic	Diagnostic	Rim		0.06	1				1	0.01	0.15				0.15

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
373	AX55	8		57	12	S	Ceramic	Diagnostic	Rim		0.17	2	2				4.52	54.24	54.24			
373	AX55	8		57	12	S	Bone	Whole	Tooth		0.25	3			3		0.18	2.18			2.18	
373	AX55	8		57	12	S	Ceramic	Body Sherd			3.83	46	11	18	8	9	25.00	300.01	227.56	63.64	6.57	2.24
373	AX55	8		57	12	S	Bone	Fragment			3.00	36		4	7	25	1.57	18.86		12.03	3.55	3.28
373	AX55	8		57	12	S	Bone	Burnt			0.17	2				2	0.06	0.68				0.68
373	AX55	8		57	12	S	Chaff Tempered Clay	Unburnt			0.75	9			1	8	0.20	2.36			0.93	1.43
373	AX55	8		57	12	S	Chaff Tempered Clay	Burnt			0.58	7			3	4	0.17	2.03			1.82	0.21
373	AX55	8		57	12	S	Glass	Fragment			1.33	16	2		4	10	0.70	8.37	5.9		1.22	1.25
373	AX55	8		57	12	S	Stone	Tesserae			0.08	1			1		0.18	2.19			2.19	
373	AX55	8		57	12	S	Botanical	Charcoal			2.00	24			1	23	0.10	1.19			0.46	0.73
373	AX55	8		57	12	S	Shell	Unburnt		Eggshell	0.17	2				2	0.00	0.02				0.02
373	AX55	8		57	12	S	Shell	Limestone		Fossil	0.17	2				2	0.01	0.09				0.09
373	AX55	8		57	12	S	Shell	Limestone		Fossil	0.17	2				2	0.01	0.09				0.09
377	AW54	3	16	104	7	S	Ceramic	Diagnostic	Base		0.14	1	1				2.98	20.84	20.84			
377	AW54	3	16	104	7	S	Ceramic	Body Sherd			5.43	38	2	8	10	18	7.99	55.94	22.31	19.9	10.23	3.5
377	AW54	3	16	104	7	S	Chaff Tempered Clay	Unburnt			15.43	108			2	106	1.49	10.46			0.35	10.11
377	AW54	3	16	104	7	S	Bone	Whole	Tooth		0.29	2				2	0.08	0.57				0.57
377	AW54	3	16	104	7	S	Chaff Tempered Clay	Burnt			2.14	15		3	2	10	1.38	9.68		6.81	1.53	1.34
377	AW54	3	16	104	7	S	Bone	Fragment			4.86	34		3	7	24	0.92	6.42		1.31	2.74	2.37
377	AW54	3	16	104	7	S	Glass	Fragment			0.29	2			2		0.11	0.75			0.75	
377	AW54	3	16	104	7	S	Botanical	Charcoal			0.29	2				2	0.01	0.08				0.08
377	AW54	3	16	104	7	S	Shell	Limestone		Fossil	0.14	1				1	0.02	0.15				0.15
377	AW54	3	16	104	7	S	Shell	Fragment		Marine	0.43	3				3	0.04	0.28				0.28
377	AW54	3	16	104	7	S	Shell	Unburnt		Eggshell	2.00	14				14	0.02	0.16				0.16
377	AW54	3	16	104	7	S	Ceramic	Diagnostic	Rim		0.14	1		1			0.88	6.14		6.14		
391	AW54	10	24	122	8	S	Ceramic	Diagnostic	Rim		0.13	1	1				27.40	219.17	219.17			
391	AW54	10	24	122	8	S	Ceramic	Diagnostic	Handle		0.13	1	1				1.49	11.91	11.91			
391	AW54	10	24	122	8	S	Chaff Tempered Clay	Unburnt			33.25	266		4	20	242	6.61	52.86		12.97	14.2	25.69
391	AW54	10	24	122	8	S	Chaff Tempered Clay	Burnt			18.63	149			10	139	2.98	23.86			6.83	17.03
391	AW54	10	24	122	8	S	Bone	Fragment			2.00	16		2	1	13	0.99	7.89		5	1.16	1.73
391	AW54	10	24	122	8	S	Bone	Fragment	Tooth		0.25	2				2	0.04	0.3				0.3
391	AW54	10	24	122	8	S	Bone	Burnt			0.88	7			3	4	0.33	2.67			1.35	1.32
391	AW54	10	24	122	8	S	Metal	Nail			0.13	1			1		0.62	4.97			4.97	
391	AW54	10	24	122	8	S	Shell	Fragment		Terrestrial	0.25	2				2	0.00	0.02				0.02
391	AW54	10	24	122	8	S	Botanical	Seed			0.25	2				2	0.01	0.08				0.08
391	AW54	10	24	122	8	S	Botanical	Charcoal			0.25	2				2	0.00	0				0
391	AW54	10	24	122	8	S	Ceramic	Body Sherd			0.50	4		3		1	1.33	10.63		10.51		0.12
392	AX55	8	24	92	13	S	Ceramic	Diagnostic	Rim		0.92	12	3	6	3		6.30	81.96	51.98	27.18	2.68	0.12
392	AX55	8	24	92	13	S	Ceramic	Diagnostic	Base		0.15	2	2				2.70	35.1	35.1			
392	AX55	8	24	92	13	S	Ceramic	Body Sherd			9.69	126	14	54	32	26	43.01	559.17	329.63	198.1	25.29	6.15
392	AX55	8	24	92	13	S	Bone	Fragment			7.31	95	1	5	13	76	2.79	36.25	14.21	6.12	6.61	9.31
392	AX55	8	24	92	13	S	Bone	Burnt			0.15	2				2	0.03	0.36				0.36
392	AX55	8	24	92	13	S	Chaff Tempered Clay	Unburnt			7.00	91		7	8	76	2.72	35.42		18.46	6.56	10.4
392	AX55	8	24	92	13	S	Chaff Tempered Clay	Burnt			0.62	8		3	5		0.99	12.88		9.66	3.22	
392	AX55	8	24	92	13	S	Glass	Fragment			0.69	9			1	8	0.08	1.07			0.38	0.69
392	AX55	8	24	92	13	S	Stone	Tesserae			0.46	6		6			6.43	83.65		83.65		
392	AX55	8	24	92	13	S	Metal	Nail			0.31	4			2	2	0.46	5.96			5.83	0.13
392	AX55	8	24	92	13	S	Botanical	Charcoal			1.54	20				20	0.07	0.97				0.97
392	AX55	8	24	92	13	S	Shell	Limestone		Fossil	0.08	1				1	0.01	0.1				0.1
392	AX55	8	24	92	13	S	Ceramic	Body Sherd			0.08	1			1		0.10	1.34			1.34	
393	BR44	51	3	488	33	LW	Bone	Fragment			4.00	132		4	20	108	1.04	34.34		5.4	12.58	16.36
393	BR44	51	3	488	33	LW	Bone	Whole	Tooth		0.15	5				5	0.05	1.63				1.63
393	BR44	51	3	488	33	LW	Bone	Whole	Unknown	Fish	0.24	8				8	0.01	0.3706				0.3706
393	BR44	51	3	488	33	LW	Bone	Burnt			0.15	5				5	0.02	0.81				0.81
393	BR44	51	3	488	33	LW	Chaff Tempered Clay	Unburnt			9.45	312	2	18	34	258	4.54	149.88	38.32	54.35	22.99	34.22
393	BR44	51	3	488	33	LW	Chaff Tempered Clay	Burnt			4.03	133		10	17	106	1.47	48.56		24.67	7.76	16.13

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
393	BR44	51	3	488	33	LW	Glass	Fragment			0.18	6			1	5	0.04	1.37			0.31	1.06
393	BR44	51	3	488	33	LW	Metal	Bead		Bronze	0.03	1		1			0.09	2.84		2.84		
393	BR44	51	3	488	33	LW	Botanical	Charcoal			1.00	33			3	30	0.05	1.77			1.01	0.76
393	BR44	51	3	488	33	LW	Metal				0.21	7				7	0.12	4.07				4.07
393	BR44	51	3	488	33	LW	Chaff Tempered Clay	Unburnt			0.09	3				3	0.01	0.43				0.43
393	BR44	51	3	488	33	LW	Shell	Unburnt		Terrestrial	0.21	7				7	0.00	0.14				0.14
393	BR44	51	3	488	33	LW	Shell	Limestone		Fossil	0.18	6				6	0.01	0.4				0.4
393	BR44	51	3	488	33	LW	Shell	Unburnt		Eggshell	0.36	12				12	0.01	0.18				0.18
393	BR44	51	3	488	33	LW	Shell	Unburnt		Eggshell	0.36	12				12	0.01	0.18				0.18
393	BR44	51	3	488	33	LW	Ceramic	Body Sherd			2.42	80	1	35	14	30	3.86	127.34	12.22	96.16	12.48	6.48
393	BR44	51	3	488	33	LW	Ceramic	Diagnostic			0.21	7		3	4		0.35	11.49		9.31	2.18	
393	BR44	51	3	488	33	LW	Ceramic	Diagnostic	Rim		0.18	6		2	4		0.35	11.49		9.31	2.18	
397	AW54	3	18,23	105	7	S	Ceramic	Diagnostic	Base		0.14	1	1				1.73	12.09	12.09			
397	AW54	3	18,23	105	7	S	Chaff Tempered Clay	Unburnt			30.57	214		9	1	204	6.55	45.88		21.78	0.45	23.65
397	AW54	3	18,23	105	7	S	Chaff Tempered Clay	Burnt			22.14	155		4	7	144	4.04	28.28		9.6	4.56	14.12
397	AW54	3	18,23	105	7	S	Bone	Fragment			4.86	34		4	6	24	1.89	13.21		10.42	0.74	2.05
397	AW54	3	18,23	105	7	S	Bone	Burnt			0.57	4			1	3	0.10	0.69			0.3	0.39
397	AW54	3	18,23	105	7	S	Glass	Fragment			0.29	2				2	0.03	0.2				0.2
397	AW54	3	18,23	105	7	S	Shell	Fragment	Unburnt	Terrestrial	0.14	1				1	0.01	0.07				0.07
397	AW54	3	18,23	105	7	S	Shell	Whole	Unburnt	Terrestrial	0.29	2				2	0.02	0.12				0.12
397	AW54	3	18,23	105	7	S	Metal	Jewelry			0.14	1			1		0.40	2.77			2.77	
397	AW54	3	18,23	105	7	S	Ceramic	Body Sherd			1.00	7		5	2		1.92	13.41		11.71	1.7	
402	BS44	80	18	308	22	LW	Bone	Fragment			3.36	74			8	66	0.36	7.85			2.75	5.1
402	BS44	80	18	308	22	LW	Bone	Whole	Vertebra	Fish	0.05	1				1	0.00	0.07				0.07
402	BS44	80	18	308	22	LW	Bone	Whole		Fish	0.23	5				5	0.02	0.39				0.39
402	BS44	80	18	308	22	LW	Bone	Burnt			0.05	1				1	0.00	0.02				0.02
402	BS44	80	18	308	22	LW	Shell	Fragment		Marine	0.05	1				1	0.00	0.09				0.09
402	BS44	80	18	308	22	LW	Glass	Fragment			0.05	1				1	0.01	0.27				0.27
402	BS44	80	18	308	22	LW	Chaff Tempered Clay	Unburnt			1.59	35		2	2	31	0.59	12.94		5.64	1.89	5.41
402	BS44	80	18	308	22	LW	Chaff Tempered Clay	Burnt			1.32	29		2	3	24	0.35	7.59		2.31	2.35	2.93
402	BS44	80	18	308	22	LW	Botanical	Charcoal			0.18	4			1	3	0.02	0.33			0.17	0.16
402	BS44	80	18	308	22	LW	Shell	Unburnt		Eggshell	0.14	3				3	0.00	0.06				0.06
402	BS44	80	18	308	22	LW	Sediment	Iron Oxide Infused			0.14	3				3	0.04	0.94				0.94
402	BS44	80	18	308	22	LW	Ceramic	Body Sherd			1.77	39		8	13	18	1.67	36.78		19.94	12.38	4.46
402	BS44	80	18	308	22	LW	Ceramic	Diagnostic	Glazed		0.05	1				1	0.01	0.17				0.17
402	BS44	80	18	308	22	LW	Ceramic	Diagnostic	Rim		0.05	1		1			0.17	3.71		3.71		
405	BS44	64	13	338	13	LW	Bone	Fragment			2.15	28	2	2	4	20	1.35	17.58	7.08	4.97	2.11	3.42
405	BS44	64	13	338	13	LW	Bone	Burnt			0.46	6		1		5	0.17	2.19		1.62		0.57
405	BS44	64	13	338	13	LW	Chaff Tempered Clay	Unburnt			0.92	12			5	7	0.63	8.17		2.52	4.23	1.42
405	BS44	64	13	338	13	LW	Chaff Tempered Clay	Burnt			1.00	13			5	8	0.33	4.35			3.01	1.34
405	BS44	64	13	338	13	LW	Metal	Unk			0.08	1		1			0.37	4.76		4.76		
405	BS44	64	13	338	13	LW	Botanical	Charcoal			0.23	3				3	0.02	0.21				0.21
405	BS44	64	13	338	13	LW	Shell	Fragment		Terrestrial	0.08	1				1	0.00	0.01				0.01
405	BS44	64	13	338	13	LW	Ceramic	Body Sherd			1.46	19		5	6	8	2.90	37.73		17.01	5.82	14.9
405	BS44	64	13	338	13	LW	Ceramic	Diagnostic	Painted		0.31	4	1	1	2		1.07	13.93	8.45	4.01	1.47	
406	BR44	56	3	526	6	LW	Bone	Fragment			3.00	18		1	7	10	0.70	4.18		0.63	2.3	1.25
406	BR44	56	3	526	6	LW	Chaff Tempered Clay	Unburnt			3.50	21		2	4	15	1.44	8.62		2.21	4.61	1.8
406	BR44	56	3	526	6	LW	Metal	Unk			0.67	4		2	1	1	1.20	7.19		4.63	2.4	0.16
406	BR44	56	3	526	6	LW	Botanical	Charcoal			1.17	7				7	0.02	0.09				0.09
406	BR44	56	3	526	6	LW	Shell	Unburnt		Eggshell	0.50	3				3	0.01	0.05				0.05
406	BR44	56	3	526	6	LW	Chaff Tempered Clay	Burnt			1.33	8				8	0.20	1.18				1.18
406	BR44	56	3	526	6	LW	Ceramic	Body Sherd			3.17	19	3	11	3	2	9.31	55.85	21.97	30.28	3.2	0.4
406	BR44	56	3	526	6	LW	Ceramic	Diagnostic	Painted		0.33	2		2			0.52	3.13		3.13		
406	BR44	56	3	526	6	LW	Ceramic	Body Sherd	Fragment		0.17	1				1	0.00	0				
408	AW54	10	8	148	6	S	Ceramic	Body Sherd			2.50	15	1	6	7	1	7.61	45.66	14.1	23.93	7.23	0.4
408	AW54	10	8	148	6	S	Bone	Fragment			5.00	30			4	26	0.70	4.18			1.84	2.34

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
408	AW54	10	8	148	6	S	Bone	Burnt			2.17	13			4	9	0.73	4.39			2.43	1.96
408	AW54	10	8	148	6	S	Bone	Fragment	Tooth		0.17	1				1	0.02	0.1				0.1
408	AW54	10	8	148	6	S	Bone	Whole	Vertebra		0.17	1				1	0.03	0.16				0.16
408	AW54	10	8	148	6	S	Chaff Tempered Clay	Unburnt			4.67	28		1	3	24	1.26	7.57		3.54	1.36	2.67
408	AW54	10	8	148	6	S	Chaff Tempered Clay	Burnt			6.33	38			4	34	1.16	6.93			3.01	3.92
408	AW54	10	8	148	6	S	Shell	Unburnt		Eggshell	0.33	2				2	0.01	0.06				0.06
408	AW54	10	8	148	6	S	Ceramic	Diagnostic	Rim		0.17	1			1		0.15	0.9			0.9	
408	AW54	10	8	148	6	S	Ceramic	Diagnostic	Base		0.17	1		1			0.89	5.31		5.31		
409	AX55	12	23	159	16	S	Ceramic	Diagnostic	Handle		0.13	2	2				4.85	77.62	77.62			
409	AX55	12	23	159	16	S	Ceramic	Diagnostic	Rim		0.06	1	1				2.11	33.79	33.79			
409	AX55	12	23	159	16	S	Ceramic	Body Sherd			4.44	71	20	22	21	8	26.39	422.29	331.17	69.12	20.62	1.38
409	AX55	12	23	159	16	S	Stone	Tesserae			0.06	1		1			0.30	4.74		4.74		
409	AX55	12	23	159	16	S	Tabun				0.13	2	2				5.20	83.15	83.15			
409	AX55	12	23	159	16	S	Chaff Tempered Clay	Unburnt			13.69	219		4	31	184	3.09	49.4		15.57	12.56	21.27
409	AX55	12	23	159	16	S	Chaff Tempered Clay	Burnt			7.00	112		4	29	79	3.29	52.61		26.79	15.74	10.08
409	AX55	12	23	159	16	S	Bone	Fragment			4.44	71	14	2	9	46	2.23	35.75	19.67	3.84	6.91	5.33
409	AX55	12	23	159	16	S	Bone	Whole	Vertebra	Fish	0.19	3			1	2	0.01	0.2			0.11	0.09
409	AX55	12	23	159	16	S	Bone	Whole	Tooth	Human	0.06	1				1	0.04	0.61				0.61
409	AX55	12	23	159	16	S	Bone	Whole		Fish	0.06	1				1	0.00	0.02				0.02
409	AX55	12	23	159	16	S	Bone	Burnt			0.69	11				11	0.10	1.64				1.64
409	AX55	12	23	159	16	S	Glass	Fragment			0.56	9				9	0.05	0.85				0.85
409	AX55	12	23	159	16	S	Metal	Coin			0.06	1				1	0.03	0.48				0.48
409	AX55	12	23	159	16	S	Metal	Jewelry			0.06	1				1	0.01	0.21				0.21
409	AX55	12	23	159	16	S	Botanical	Charcoal			0.19	3				3	0.01	0.23				0.23
409	AX55	12	23	159	16	S	Shell	Limestone		Fossil	0.06	1				1	0.00	0.07				0.07
409	AX55	12	23	159	16	S	Shell	Unburnt		Eggshell	0.56	9				9	0.01	0.11				0.11
409	AX55	12	23	159	16	S	Ceramic	Body Sherd	Flakes		1.25	20				20	0.16	2.57				2.57
417	AW54	6		129	7	S	Chaff Tempered Clay	Unburnt			3.14	22				22	0.37	2.58				2.58
417	AW54	6		129	7	S	Chaff Tempered Clay	Burnt			0.29	2			2		0.12	0.85			0.85	
417	AW54	6		129	7	S	Bone	Fragment			2.00	14			3	11	0.60	4.21			2.78	1.43
417	AW54	6		129	7	S	Bone	Burnt			0.14	1				1	0.01	0.06				0.06
417	AW54	6		129	7	S	Bone	Whole	Vertebra	Fish	0.29	2				2	0.01	0.09				0.09
417	AW54	6		129	7	S	Glass	Fragment			0.29	2				2	0.01	0.08				0.08
417	AW54	6		129	7	S	Dung	Burnt			0.29	2			1	1	0.11	0.75			0.61	0.14
417	AW54	6		129	7	S	Ceramic	Body Sherd			3.71	26		6	11	9	4.12	28.82		16.62	10.17	2.03
418	AW54	10	10	149	7	S	Chaff Tempered Clay	Burnt			5.71	40			1	39	0.64	4.46			0.47	3.99
418	AW54	10	10	149	7	S	Chaff Tempered Clay	Unburnt			4.43	31			1	30	0.46	3.24			0.36	2.88
418	AW54	10	10	149	7	S	Glass	Fragment			0.14	1				1	0.01	0.07				0.07
418	AW54	10	10	149	7	S	Botanical	Charcoal			0.57	4			1	3	0.09	0.64			0.59	0.05
418	AW54	10	10	149	7	S	Shell	Unburnt		Eggshell	1.57	11				11	0.03	0.18				0.18
418	AW54	10	10	149	7	S	Shell	Limestone		Fossil	0.14	1				1	0.01	0.08				0.08
418	AW54	10	10	149	7	S	Dung				0.14	1				1	0.05	0.37				0.37
418	AW54	10	10	149	7	S	Ceramic	Body Sherd			3.57	25		7	6	12	3.05	21.34		13.23	5.56	2.55
419	AW55	5	11,16	83	7	S	Chaff Tempered Clay	Unburnt			7.43	52			4	48	1.33	9.33			2.63	6.7
419	AW55	5	11,16	83	7	S	Chaff Tempered Clay	Burnt			11.29	79				79	1.14	7.99				7.99
419	AW55	5	11,16	83	7	S	Bone	Fragment			1.14	8				8	0.19	1.32				1.32
419	AW55	5	11,16	83	7	S	Bone	Burnt			1.00	7		1	2	4	0.41	2.84		1.17	1.2	0.47
419	AW55	5	11,16	83	7	S	Botanical	Seed			0.14	1				1	0.03	0.19				0.19
419	AW55	5	11,16	83	7	S	Bone	Fragment	Jaw	Marine	0.29	2			1	1	0.19	1.33			1.2	0.13
419	AW55	5	11,16	83	7	S	Bone	Whole	Vertebra		0.14	1			1		0.06	0.4			0.4	
419	AW55	5	11,16	83	7	S	Shell	Whole		Terrestrial	0.14	1				1	0.02	0.15				0.15
419	AW55	5	11,16	83	7	S	Ceramic	Body Sherd			1.57	11		4	2	5	1.86	13		10.4	1.74	0.86
420	AX55	18		195	7	S	Ceramic	Body Sherd			5.14	36	1	7	7	21	7.40	51.79	11.48	29.11	7.16	4.04
420	AX55	18		195	7	S	Chaff Tempered Clay	Unburnt			2.14	15		1	2	12	0.85	5.95		2.16	1.62	2.17
420	AX55	18		195	7	S	Chaff Tempered Clay	Burnt			1.86	13		1		12	0.52	3.66		1.74		1.92
420	AX55	18		195	7	S	Bone	Fragment			3.14	22			4	18	0.71	4.94			3.05	1.89
420	AX55	18		195	7	S	Bone	Burnt			1.14	8				8	0.18	1.26				1.26
420	AX55	18		195	7	S	Glass	Fragment			0.29	2				2	0.04	0.31				0.31

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
420	AX55	18		195	7	S	Shell	Unburnt		Eggshell	1.00	7				7	0.02	0.12				0.12
422	AW55	3	2,7	110	7	S	Ceramic	Body Sherd				29	7	8	10	14			192.01	31.57	6.86	3.54
422	AW55	3	2,7	110	7	S	Ceramic	Diagnostic	Rim			1	1						30.94			
422	AW55	3	2,7	110	7	S	Bone	Fragment				14			5	9					3.69	1.67
422	AW55	3	2,7	110	7	S	Bone	Whole	Vertebra	Fish		2				2						0.14
422	AW55	3	2,7	110	7	S	Bone	Whole	Unknown	Fish		1				1						0.07
422	AW55	3	2,7	110	7	S	Bone	Burnt								2						0.38
422	AW55	3	2,7	110	7	S	Chaff Tempered Clay	Burnt						2	1	19				3.4	0.67	1.78
422	AW55	3	2,7	110	7	S	Chaff Tempered Clay	Unburnt						1	1	5				3.23	0.43	1.36
422	AW55	3	2,7	110	7	S	Shell			Terrestrial		1				1						0.04
422	AW55	3	2,7	110	7	S	Sediment	Burnt				5				5						0.67
424	AW54	10	15	232	6	S	Ceramic	Diagnostic	Rim		0.33	2	1	1			2.39	14.31	8.45	5.86		
424	AW54	10	15	232	6	S	Ceramic	Body Sherd			1.83	11	1	6	4		3.42	20.5	20.5			
424	AW54	10	15	232	6	S	Chaff Tempered Clay	Burnt			6.67	40			1	39	0.91	5.46			0.39	5.07
424	AW54	10	15	232	6	S	Chaff Tempered Clay	Unburnt			6.50	39			3	36	0.88	5.28			1.74	3.54
424	AW54	10	15	232	6	S	Bone	Fragment			1.00	6			1	5	0.19	1.11			0.81	0.3
424	AW54	10	15	232	6	S	Glass	Fragment			0.33	2				2	0.02	0.11				0.11
424	AW54	10	15	232	6	S	Shell	Unburnt		Terrestrial	0.17	1				1	0.01	0.05				0.05
424	AW54	10	15	232	6	S	Dung				0.50	3				3	0.04	0.22				0.22
424	AW54	10	15	232	6	S	Metal	Unk			0.17	1				1	0.02	0.09				0.09
432	AX55	20	24	250	11	S	Ceramic	Diagnostic	Rim		0.09	1	1				1.01	11.09	11.09			
432	AX55	20	24	250	11	S	Ceramic	Diagnostic	Base		0.18	2	1	1			1.81	19.95	14.93	5.02		
432	AX55	20	24	250	11	S	Ceramic	Body Sherd			7.00	77	5	19	23	30	11.12	122.37	42.14	54.62	20.18	5.43
432	AX55	20	24	250	11	S	Chaff Tempered Clay	Burnt			2.64	29		2	3	24	0.95	10.44		5.31	2.56	2.57
432	AX55	20	24	250	11	S	Chaff Tempered Clay	Unburnt			4.27	47		4	3	40	1.54	16.9		10.06	2.08	4.76
432	AX55	20	24	250	11	S	Bone	Fragment			6.27	69		1	9	59	1.60	17.61		4.25	6.04	7.32
432	AX55	20	24	250	11	S	Bone	Whole	Unknown		0.45	5		1	1	3	0.36	3.99		2.57	0.85	0.57
432	AX55	20	24	250	11	S	Bone	Whole	Scale	Fish	0.09	1				1	0.00	0.01				0.01
432	AX55	20	24	250	11	S	Bone	Whole	Vertebra		0.09	1				1	0.00	0.03				0.03
432	AX55	20	24	250	11	S	Bone	Burnt			1.36	15				15	0.22	2.37				2.37
432	AX55	20	24	250	11	S	Bone	Whole	Spine	Fish	0.09	1				1	0.02	0.2				0.2
432	AX55	20	24	250	11	S	Bone	Whole	Tooth		0.09	1				1	0.03	0.31				0.31
432	AX55	20	24	250	11	S	Glass	Fragment			1.18	13			3	10	0.21	2.31			1.43	0.88
432	AX55	20	24	250	11	S	Glass	Diagnostic	Rim		0.09	1			1		0.08	0.91			0.91	
432	AX55	20	24	250	11	S	Metal	Coin			0.18	2			2		0.21	2.31			2.31	
432	AX55	20	24	250	11	S	Shell	Unburnt		Eggshell	8.91	98				98	0.12	1.27				1.27
432	AX55	20	24	250	11	S	Shell	Unburnt		Marine	0.09	1				1	0.00	0.04				0.04
432	AX55	20	24	250	11	S	Botanical	Charcoal			0.82	9				9	0.05	0.52				0.52
432	AX55	20	24	250	11	S	Shell	Limestone		Fossil	0.09	1				1	0.01	0.09				0.09
433	AX55	17	23	249	11.5	S	Ceramic	Diagnostic	Handle		0.09	1	1				1.69	19.46	19.46			
433	AX55	17	23	249	11.5	S	Ceramic	Diagnostic	Base		0.09	1	1				1.85	21.28	21.28			
433	AX55	17	23	249	11.5	S	Ceramic	Body Sherd			2.78	32	4	10	4	14	13.94	160.36	118.26	35.81	3.84	2.45
433	AX55	17	23	249	11.5	S	Chaff Tempered Clay	Unburnt			5.22	60		2	3	55	1.11	12.77		4.52	1	7.25
433	AX55	17	23	249	11.5	S	Chaff Tempered Clay	Burnt			3.13	36			2	34	0.43	4.89			0.49	4.4
433	AX55	17	23	249	11.5	S	Bone	Fragment			7.74	89	2	6	18	63	2.42	27.82	11.56	4.05	6.84	5.37
433	AX55	17	23	249	11.5	S	Bone	Burnt			0.26	3			1	2	0.09	1.05			0.7	0.35
433	AX55	17	23	249	11.5	S	Glass	Fragment			0.35	4				4	0.04	0.46				0.46
433	AX55	17	23	249	11.5	S	Metal	Coin			0.09	1				1	0.06	0.66				0.66
433	AX55	17	23	249	11.5	S	Bone	Whole	Vertebra		0.09	1				1	0.00	0.05				0.05
433	AX55	17	23	249	11.5	S	Shell	Eggshell			0.35	4				4	0.00	0.04				0.04
433	AX55	17	23	249	11.5	S	Sediment	Burnt			0.09	1				1	0.02	0.22				0.22
433	AX55	17	23	249	11.5	S	Ceramic	Diagnostic	Rim		0.09	1		1			0.31	3.55		3.55		
437	AX55	27	20	242	6	S	Ceramic	Body Sherd			2.33	14	3	3	3	5	26.78	160.65	145.4	10.45	3.14	1.66
437	AX55	27	20	242	6	S	Tabun	Fragment			0.33	2		2			1.16	6.93		6.93		
437	AX55	27	20	242	6	S	Chaff Tempered Clay	Unburnt			0.50	3			3		0.65	3.87			2.28	1.59
437	AX55	27	20	242	6	S	Chaff Tempered Clay	Burnt			1.83	11			10	1	0.09	0.56				0.56
437	AX55	27	20	242	6	S	Bone	Fragment			1.67	10			5	5	0.18	1.06			0.6	0.46
437	AX55	27	20	242	6	S	Glass	Fragment			0.50	3		1	1	1	0.14	0.83		0.65	0.11	0.07

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
437	AX55	27	20	242	6	S	Shell	Whole		Mussel?	0.17	1			1		0.17	1			1	
437	AX55	27	20	242	6	S	Bone	Whole	Unknown		0.17	1				1	0.01	0.04				0.04
437	AX55	27	20	242	6	S	Shell	Fragment		Terrestrial	0.17	1				1	0.17	1				1
437	AX55	27	20	242	6	S	Sediment	Insect Cast			2.33	14			14		2.33	14			14	
437	AX55	27	20	242	6	S	Ceramic	Diagnostic	Rim		0.17	1				1	0.09	0.53				0.53
443	BS44	90	17,18,23		17	LW	Bone	Fragment			0.88	15		2	4	9	0.70	11.97		8.65	1.9	1.42
443	BS44	90	17,18,23		17	LW	Bone	Whole			0.06	1		1			0.09	1.58		1.58		
443	BS44	90	17,18,23		17	LW	Bone	Burnt			0.88	15			5	10	0.21	3.57			2.32	1.25
443	BS44	90	17,18,23		17	LW	Glass	Fragment			0.41	7			1	6	0.09	1.58			0.3	1.28
443	BS44	90	17,18,23		17	LW	Chaff Tempered Clay	Unburnt			1.41	24			24		0.78	13.18			13.18	
443	BS44	90	17,18,23		17	LW	Chaff Tempered Clay	Burnt			1.82	31			31		1.00	16.96			16.96	
443	BS44	90	17,18,23		17	LW	Shell	Burnt		Eggshell	0.35	6				6	0.00	0.06				0.06
443	BS44	90	17,18,23		17	LW	Shell	Unburnt		Eggshell	1.18	20			3	17	0.01	0.24				0.24
443	BS44	90	17,18,23		17	LW	Ceramic	Body Sherd			2.59	44		17	10	17	4.01	68.14		58.28	7.66	2.2
443	BS44	90	17,18,23		17	LW	Ceramic	Diagnostic	Painted		0.06	1		1			0.10	1.74		1.74		
443	BS44	90	17,18,23		17	LW	Bone	Whole	Scale	Fish	0.06	1				1	0.00	0.02				0.02
443	BS44	90	17,18,23		17	LW	Ceramic	Diagnostic	Rim		0.06	1			1		0.03	0.51			0.51	
447	BR44	56	2	545	6	LW	Chaff Tempered Clay	Unburnt			1.83	11			1	10	2.78	16.68			7.84	8.84
447	BR44	56	2	545	6	LW	Chaff Tempered Clay	Burnt			3.00	18			8	10	3.50	21			13.37	7.63
447	BR44	56	2	545	6	LW	Bone	Fragment			4.33	26		1	1	24	2.90	17.42		0.6	7.15	9.67
447	BR44	56	2	545	6	LW	Ceramic	Body Sherd			4.67	28	3	15	5	5	18.90	113.42	38.42	56.08	10.85	8.07
447	BR44	56	2	545	6	LW	Ceramic	Diagnostic	Painted		0.33	2	1	1			4.37	26.19	17.57	8.62		
447	BR44	56	2	545	6	LW	Bone	Fragment	Tooth		0.17	1				1	1.21	7.28				7.28
447	BR44	56	2	545	6	LW	Ceramic	Diagnostic	Rim		0.17	1		1			1.69	10.11		10.11		
447	BR44	56	2	545	6	LW	Ceramic	Body Sherd	Burnt		0.17	1		1			5.96	35.77		35.77		
450	BS44	84	18,19	326	10	LW	Ceramic	Body Sherd	Pithos fragment		9.50	95	6	25	64		33.51	335.14	210.81	83.34	40.99	
450	BS44	84	18,19	326	10	LW	Bone	Fragment			1.70	17			2	15	0.24	2.36			0.83	1.53
450	BS44	84	18,19	326	10	LW	Bone	Whole			0.20	2				2	0.01	0.09				0.09
450	BS44	84	18,19	326	10	LW	Bone	Burnt			0.30	3				3	0.11	1.14				1.14
450	BS44	84	18,19	326	10	LW	Glass	Fragment			0.20	2				2	0.03	0.29				0.29
450	BS44	84	18,19	326	10	LW	Metal	Hook		Bronze	0.10	1		1			0.22	2.19		2.19		
450	BS44	84	18,19	326	10	LW	Shell			Eggshell	0.50	5			2	3	0.02	0.17			0.08	0.09
450	BS44	84	18,19	326	10	LW	Botanical	Charcoal			1.30	13				13	0.04	0.41				0.41
450	BS44	84	18,19	326	10	LW	Shell	Fragment		Marine	0.10	1				1	0.01	0.07				0.07
450	BS44	84	18,19	326	10	LW	Bone	Whole	Mandible		0.10	1				1	0.01	0.07				0.07
450	BS44	84	18,19	326	10	LW	Bone	Whole	Tooth		0.10	1				1	0.00	0.02				0.02
450	BS44	84	18,19	326	10	LW	Unk				0.10	1				1	0.02	0.17				0.17
450	BS44	84	18,19	326	10	LW	Ceramic	Body Sherd			2.10	21		7	9	5	5.23	52.3	44.54	6.88	0.88	
450	BS44	84	18,19	326	10	LW	Ceramic	Diagnostic	Painted		0.20	2		2			0.49	4.88		4.88		
450	BS44	84	18,19	326	10	LW	Bone	Whole	Scale	Fish	0.10	1				1	0.00	0.01				0.01
450	BS44	84	18,19	326	10	LW	Ceramic	Diagnostic	Glazed		0.30	3		1	1	1	0.84	8.35		7.55	0.65	0.15
450	BS44	84	18,19	326	10	LW	Bone	Whole	Unknown	Fish	0.20	2				2	0.05	0.49				0.49
453	BP49	13	16		12	LW	Bone	Fragment			3.75	45			2	43	0.43	5.21			1.5	3.71
453	BP49	13	16		12	LW	Bone	Burnt			0.58	7				7	0.04	0.51				0.51
453	BP49	13	16		12	LW	Glass	Fragment			0.17	2				2	0.02	0.19				0.19
453	BP49	13	16		12	LW	Chaff Tempered Clay	Unburnt			2.17	26		2	3	21	0.78	9.32		4.04	2.56	2.72
453	BP49	13	16		12	LW	Unk				0.08	1			1		0.08	0.93			0.93	
453	BP49	13	16		12	LW	Bone	Fragment	Tooth		0.08	1				1	0.01	0.07				0.07
453	BP49	13	16		12	LW	Chaff Tempered Clay	Burnt			0.92	11			4	7	0.25	3.02			2.07	0.95
453	BP49	13	16		12	LW	Shell	Eggshell			0.17	2				2	0.01	0.09				0.09
453	BP49	13	16		12	LW	Ceramic	Body Sherd			3.67	44		3	12	29	2.11	25.26		8.25	9.84	7.17
453	BP49	13	16		12	LW	Ceramic	Diagnostic	Painted		0.08	1		1			0.60	7.18		7.18		
453	BP49	13	16		12	LW	Ceramic	Diagnostic	Painted		0.08	1				1	0.00	0.03				0.03
453	BP49	13	16		12	LW	Bone	Whole	Mandible	Rodent	0.08	1				1	0.02	0.21				0.21
453	BP49	13	16		12	LW	Ceramic	Diagnostic	Handle		0.08	1		1			0.67	8		8		
453	BP49	13	16		12	LW	Ceramic	Diagnostic	Painted Rim		0.08	1			1		0.02	0.28			0.28	
455	BS44	90	17,22	445	4.5	LW	Chaff Tempered Clay	Unburnt			24.67	111		3		108	3.51	15.79		1.36		14.43
455	BS44	90	17,22	445	4.5	LW	Chaff Tempered Clay	Burnt			10.67	48			3	45	1.30	5.86			0.63	5.23
455	BS44	90	17,22	445	4.5	LW	Bone	Fragment			2.89	13			2	11	0.53	2.38			0.93	1.45
455	BS44	90	17,22	445	4.5	LW	Bone	Burnt			0.67	3				3	0.14	0.64				0.64
455	BS44	90	17,22	445	4.5	LW	Glass	Fragment			0.44	2				2	0.06	0.26				0.26

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
455	BS44	90	17,22	445	4.5	LW	Shell	Unburnt		Eggshell	3.11	14				14	0.03	0.14				0.14
455	BS44	90	17,22	445	4.5	LW	Shell	Burnt		Eggshell	1.33	6				6	0.03	0.14				0.14
455	BS44	90	17,22	445	4.5	LW	Shell	Limestone		Fossil	0.67	3				3	0.14	0.62				0.62
455	BS44	90	17,22	445	4.5	LW	Dung	Fragment			2.44	11				11	0.24	1.07				1.07
455	BS44	90	17,22	445	4.5	LW	Botanical	Charcoal			0.67	3				3	0.00	0				
455	BS44	90	17,22	445	4.5	LW	Ceramic	Body Sherd			3.56	16	3	3	3	7	3.59	16.15	6.3	4.07	4.06	1.72
455	BS44	90	17,22	445	4.5	LW	Ceramic	Diagnostic	Glazed		0.22	1			1		0.16	0.72			0.72	
457	AW54	9		188	6	S	Chaff Tempered Clay	Unburnt			21.33	128		32	96	NA	34.92	209.5		49.66	58.08	101.76
457	AW54	9		188	6	S	Chaff Tempered Clay	Burnt			5.00	30			30	NA	6.90	41.38			20.16	21.22
457	AW54	9		188	6	S	Bone	Fragment			0.50	3				3	0.05	0.32				0.32
457	AW54	9		188	6	S	Bone	Burnt			0.17	1				1	0.01	0.05				0.05
457	AW54	9		188	6	S	Glass	Fragment			0.17	1			1		0.10	0.61			0.61	
457	AW54	9		188	6	S	Shell	Fragment		Terrestrial	0.33	2				2	0.01	0.07				0.07
457	AW54	9		188	6	S	Shell	Fragment		Fossil	0.33	2				2	0.02	0.12				0.12
457	AW54	9		188	6	S	Ceramic	Diagnostic	Handle		0.17	1			1		0.19	1.16			1.16	
457	BS44	82	23	473	6	LW	Bone	Fragment			3.83	23			2	21	0.48	2.9			0.65	2.25
457	BS44	82	23	473	6	LW	Bone	Burnt			0.83	5				5	0.08	0.47				0.47
457	BS44	82	23	473	6	LW	Glass	Fragment			0.50	3				3	0.08	0.46				0.46
457	BS44	82	23	473	6	LW	Chaff Tempered Clay	Unburnt			8.83	53			2	51	1.39	8.36			1.79	6.57
457	BS44	82	23	473	6	LW	Chaff Tempered Clay	Burnt			2.67	16				16	0.35	2.11				2.11
457	BS44	82	23	473	6	LW	Botanical	Charcoal			0.83	5			2	3	0.08	0.45			0.27	0.18
457	BS44	82	23	473	6	LW	Sediment	Oxidized Iron			0.33	2			1	1	0.26	1.57			1.09	0.48
457	BS44	82	23	473	6	LW	Shell	Fragment		Terrestrial	0.17	1				1	0.01	0.07				0.07
457	BS44	82	23	473	6	LW	Shell	Limestone		Fossil	0.33	2				2	0.02	0.12				0.12
457	BS44	82	23	473	6	LW	Bone	Whole		Fish	0.17	1				1	0.02	0.14				0.14
457	BS44	82	23	473	6	LW	Ceramic	Body Sherd			6.83	41		3	14	24	4.28	25.68		11.08	10.26	4.34
458	BS44	82	19	463	20	LW	Ceramic	Diagnostic	Rim		0.20	4		1	3		0.49	9.77		5.08	4.69	
458	BS44	82	19	463	20	LW	Bone	Fragment			0.65	13		1	12		0.44	8.78		1.39	7.39	
458	BS44	82	19	463	20	LW	Bone	Burnt			0.05	1			1		0.04	0.7			0.7	
458	BS44	82	19	463	20	LW	Chaff Tempered Clay	Unburnt			0.30	6			6		0.62	12.43		5.28	7.15	
458	BS44	82	19	463	20	LW	Chaff Tempered Clay	Burnt			0.30	6		2	4		0.40	8.06		5.09	2.97	
458	BS44	82	19	463	20	LW	Ceramic	Body Sherd			2.05	41		10	31		1.34	26.83		26.83		
461	AW54	12		205	6	S	Ceramic	Body Sherd			3.33	20	1	4	5	10	5.01	30.05	13.05	11.9	3.59	1.51
461	AW54	12		205	6	S	Chaff Tempered Clay	Burnt			1.33	8			1	7	0.29	1.75			0.78	0.97
461	AW54	12		205	6	S	Bone	Fragment			1.17	7			1	6	0.52	3.12			2.32	0.8
461	AW54	12		205	6	S	Bone	Burnt			0.50	3				3	0.03	0.2				0.2
461	AW54	12		205	6	S	Shell	Limestone		Fossil	0.17	1				1	0.02	0.09				0.09
461	AW54	12		205	6	S	Shell	Unburnt		Eggshell	0.17	1				1	0.00	0.01				0.01
461	AW54	12		205	6	S	Sediment	Burnt			0.67	4				4	0.18	1.06				1.06
461	AW54	12		205	6	S	Chaff Tempered Clay	Unburnt			1.83	11			1	10	1.55	9.32		7.3	1.06	0.96
463	AX55	16	4,5	1	11	S	Ceramic	Body Sherd			3.27	36	3	12	10	11	10.99	120.84	48.27	60.68	10.32	1.57
463	AX55	16	4,5	1	11	S	Chaff Tempered Clay	Unburnt			3.45	38		2	2	34	2.99	32.88		25.8	0.9	6.18
463	AX55	16	4,5	1	11	S	Chaff Tempered Clay	Burnt			3.36	37			3	34	0.83	9.09			2.45	6.64
463	AX55	16	4,5	1	11	S	Bone	Fragment			2.55	28		2	3	23	0.86	9.5		4.43	2.12	2.95
463	AX55	16	4,5	1	11	S	Bone	Burnt			0.09	1				1	0.00	0.04				0.04
463	AX55	16	4,5	1	11	S	Bone	Burnt			0.82	9				9	0.15	1.65				1.65
463	AX55	16	4,5	1	11	S	Glass	Fragment			0.18	2			1	1	0.06	0.65			0.59	0.06
463	AX55	16	4,5	1	11	S	Bone	Fragment	Tooth		0.18	2				2	0.02	0.27				0.27
463	AX55	16	4,5	1	11	S	Stone	Tesserae			0.36	4		4			4.45	48.92		48.92		
463	AX55	16	4,5	1	11	S	Botanical	Charcoal			0.36	4				4	0.01	0.16			0.16	
463	AX55	16	4,5	1	11	S	Stone	Grinding Stone	Basalt		0.36	4	1	3			23.86	262.41	245.68	16.73		
463	AX55	16	4,5	1	11	S	Metal	Nail			0.36	4				4	0.14	1.49			1.49	
463	AX55	16	4,5	1	11	S	Sediment	Burnt			0.09	1				1	0.03	0.34			0.34	
463	AX55	16	4,5	1	11	S	Shell	Unburnt		Terrestrial	0.09	1				1	0.00	0.03			0.03	
463	AX55	16	4,5	1	11	S	Ceramic	Slag			0.36	4		4			0.81	8.86		8.86		
486	AX55	28	13	248	5	S	Ceramic	Body Sherd			1.60	8	2	5	1		25.62	128.08	109.53	18.11	0.44	
486	AX55	28	13	248	5	S	Chaff Tempered Clay	Burnt			0.60	3				3	0.07	0.33				0.33
486	AX55	28	13	248	5	S	Bone	Fragment			0.40	2			2		0.18	0.88			0.88	
486	AX55	28	13	248	5	S	Glass	Fragment			0.40	2			1	1	0.15	0.74			0.59	0.15

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
486	AX55	28	13	248	5	S	Stone	Tesserae			0.40	2		2			2.38	11.91		11.91		
486	AX55	28	13	248	5	S	Ceramic	Fragment			0.20	1				1	0.03	0.16				0.16
486	AX55	28	13	248	5	S	Ceramic	Diagnostic	Rim		0.20	1		1			0.66	3.3		3.3		
487	AW54	10	14	230	6	S	Ceramic	Diagnostic	Rim		0.17	1	1				1.86	11.14	11.14			
487	AW54	10	14	230	6	S	Ceramic	Body Sherd			5.00	30	5	9	8	8	78.20	469.21	444.1	16.76	6.33	2.02
487	AW54	10	14	230	6	S	Chaff Tempered Clay	Unburnt			8.17	49	2	3	7	37	4.28	25.66	10.23	6.74	4.5	4.19
487	AW54	10	14	230	6	S	Chaff Tempered Clay	Burnt			8.67	52			3	49	1.40	8.42			2.84	5.58
487	AW54	10	14	230	6	S	Bone	Fragment			2.00	12		2		10	0.70	4.17		3.2		0.97
487	AW54	10	14	230	6	S	Bone	Whole	Scale	Fish	0.33	2				2	0.00	0.02				0.02
487	AW54	10	14	230	6	S	Bone	Burnt			0.17	1				1	0.03	0.19				0.19
487	AW54	10	14	230	6	S	Glass	Fragment			0.33	2			1	1	0.06	0.36			0.23	0.13
487	AW54	10	14	230	6	S	Dung/Charcoal				0.17	1				1	0.01	0.03				0.03
487	AW54	10	14	230	6	S	Shell	Unburnt		Eggshell	0.33	2				2	0.01	0.03				0.03
490	AW54	10	3	228	5	S	Ceramic	Diagnostic	Rim		0.60	3	1	1	1		6.33	31.65	21.93	8.02	1.7	
490	AW54	10	3	228	5	S	Ceramic	Diagnostic	Handle		0.40	2	1	1			16.29	81.44	59.85	21.59		
490	AW54	10	3	228	5	S	Ceramic	Body Sherd			4.80	24	4	9	5	6	18.47	92.33	63.04	23.69	3.57	2.03
490	AW54	10	3	228	5	S	Chaff Tempered Clay	Unburnt			9.20	46		4	1	41	2.58	12.91		7.31	0.92	4.68
490	AW54	10	3	228	5	S	Chaff Tempered Clay	Burnt			9.60	48			4	44	1.33	6.66			1.96	4.7
490	AW54	10	3	228	5	S	Bone	Fragment			2.20	11	1		2	8	0.83	4.16	1.85		0.89	1.42
490	AW54	10	3	228	5	S	Bone	Burnt			1.40	7				7	0.11	0.55				0.55
490	AW54	10	3	228	5	S	Tabun/Dung				0.40	2		2			2.03	10.16		10.16		
490	AW54	10	3	228	5	S	Dung	Fragment			0.80	4			2	2	0.39	1.97			1.52	0.45
490	AW54	10	3	228	5	S	Dung	Burnt			0.20	1			1		0.54	2.69			2.69	
490	AW54	10	3	228	5	S	Unk				0.80	4				4	0.01	0.05				0.05
490	AW54	10	3	228	5	S	Botanical	Charcoal			0.60	3				3	0.00	0.02				0.02
490	AW54	10	3	228	5	S	Ceramic	Diagnostic	Base		0.20	1		1			0.82	4.08		4.08		
491	AW54	21	16	248	6.5	S	Ceramic	Body Sherd			2.00	13	1	6	4	2	5.28	34.31	13.33	15.2	5.35	0.43
491	AW54	21	16	248	6.5	S	Chaff Tempered Clay	Unburnt			2.00	13			1	12	0.31	2.01			0.31	1.7
491	AW54	21	16	248	6.5	S	Chaff Tempered Clay	Burnt			2.62	17		1	1	15	0.53	3.47		1.26	0.22	1.99
491	AW54	21	16	248	6.5	S	Bone	Fragment			3.23	21		1	3	17	0.55	3.59		0.47	1.08	2.04
491	AW54	21	16	248	6.5	S	Bone	Burnt			0.92	6				6	0.12	0.8				0.8
491	AW54	21	16	248	6.5	S	Bone	Whole			0.62	4		1		3	0.49	3.16		2.98		0.18
491	AW54	21	16	248	6.5	S	Glass	Fragment			0.46	3			1	2	0.08	0.53			0.28	0.25
491	AW54	21	16	248	6.5	S	Bone	Whole	Spine	Fish	0.15	1				1	0.01	0.06				0.06
491	AW54	21	16	248	6.5	S	Bone	Whole	Maxilla		0.46	3				3	0.03	0.17				0.17
491	AW54	21	16	248	6.5	S	Bone	Whole	Tooth		0.31	2				2	0.02	0.1				0.1
491	AW54	21	16	248	6.5	S	Bone	Whole	Vertebra		0.46	3				3	0.01	0.08				0.08
491	AW54	21	16	248	6.5	S	Shell	Unburnt		Eggshell	0.92	6				6	0.01	0.05				0.05
491	AW54	21	16	248	6.5	S	Ceramic	Diagnostic	Rim		0.46	3		3			1.46	9.51		9.51		
492	AX55	28	16	247	6	S	Chaff Tempered Clay	Unburnt			0.50	3				3	0.06	0.37				0.37
492	AX55	28	16	247	6	S	Bone	Fragment			1.00	6		1		5	0.22	1.33		1.33		
492	AX55	28	16	247	6	S	Bone	Burnt			0.17	1				1	0.09	0.52				0.52
492	AX55	28	16	247	6	S	Glass	Fragment			0.17	1				1	0.15	0.92				0.92
492	AX55	28	16	247	6	S	Shell	Unburnt		Terrestrial	0.50	3				3	0.03	0.2				0.2
492	AX55	28	16	247	6	S	Ceramic	Body Sherd			0.83	5		2	3		1.80	10.8		8.07	2.73	
493	AX55	19		189	3	S	Chaff Tempered Clay	Burnt			46.33	139		1	14	124	9.36	28.09		3.49	9.13	15.47
493	AX55	19		189	3	S	Bone	Fragment			0.67	2			1	1	0.33	0.99			0.76	0.23
493	AX55	19		189	3	S	Shell	Unburnt		Eggshell	0.33	1				1	0.01	0.02				0.02
493	AX55	19		189	3	S	Ceramic	Body Sherd			0.33	1		1			2.17	6.51		6.51		
495	AW55	3	5,10	109	6.5	S	Ceramic	Body Sherd			3.85	25	4	9	9	3	11.25	73.13	31.27	32.78	8.1	0.98
495	AW55	3	5,10	109	6.5	S	Stone	Tesserae			0.15	1		1			0.56	3.65		3.65		
495	AW55	3	5,10	109	6.5	S	Chaff Tempered Clay	Unburnt			0.31	2				2	0.05	0.3				0.3
495	AW55	3	5,10	109	6.5	S	Bone	Fragment			4.46	29	2		6	21	2.08	13.52	9.09		2.3	2.13
495	AW55	3	5,10	109	6.5	S	Bone	Whole	Vertebra	Fish	0.46	3				3	0.02	0.16				0.16
495	AW55	3	5,10	109	6.5	S	Bone	Burnt			0.31	2			1	1	0.10	0.67			0.38	0.29
495	AW55	3	5,10	109	6.5	S	Glass	Fragment			0.15	1				1	0.01	0.09				0.09
495	AW55	3	5,10	109	6.5	S	Ceramic	Diagnostic	Rim		0.31	2		1	1		1.30	8.43		7.33	1.1	
495	AW55	3	5,10	109	6.5	S	Ceramic	Body Sherd	Flakes		0.62	4			4		0.13	0.87				0.87
501	AX55	31	18,19,23,24	290	12	S	Ceramic	Diagnostic	"Plaster"		0.83	10	6	4			20.31	243.66	208.79	34.87		
501	AX55	31	18,19,23,24	290	12	S	Ceramic	Diagnostic	Shoulder		0.08	1	1				5.64	67.68	67.68			
501	AX55	31	18,19,23,24	290	12	S	Ceramic	Diagnostic	Handle		0.08	1	1				1.33	15.96	15.96			
501	AX55	31	18,19,23,24	290	12	S	Ceramic	Body Sherd			3.33	40	2	10	12	16	5.29	63.52	17.1	33.46	9.97	2.99

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
501	AX55	31	18,19,23,24	290	12	S	Stone	Tesserae			0.17	2		1	1		0.86	10.28		6.22	4.06	
501	AX55	31	18,19,23,24	290	12	S	Chaff Tempered Clay	Unburnt			6.17	74		6	5	63	2.58	31.01		15.49	4.99	10.53
501	AX55	31	18,19,23,24	290	12	S	Chaff Tempered Clay	Burnt			1.58	19			1	18	0.35	4.17			0.85	3.32
501	AX55	31	18,19,23,24	290	12	S	Bone	Fragment			1.92	23		1	3	19	0.61	7.3		2.38	1.94	2.98
501	AX55	31	18,19,23,24	290	12	S	Bone	Burnt			0.83	10			1	9	0.14	1.7			0.49	1.21
501	AX55	31	18,19,23,24	290	12	S	Glass	Fragment			0.33	4		2	1	1	0.18	2.14		1.49	0.53	0.12
501	AX55	31	18,19,23,24	290	12	S	Bone	Whole	Spine	Fish	0.08	1				1	0.00	0.03				0.03
501	AX55	31	18,19,23,24	290	12	S	Botanical	Charcoal			0.25	3				3	0.03	0.38				0.38
501	AX55	31	18,19,23,24	290	12	S	Metal	Nail			0.08	1				1	0.02	0.28				0.28
501	AX55	31	18,19,23,24	290	12	S	Metal	Unk			0.08	1				1	0.02	0.18				0.18
501	AX55	31	18,19,23,24	290	12	S	Shell	Unburnt		Eggshell	0.25	3				3	0.01	0.1				0.1
504	AW54	20	21	518	6	S	Ceramic	Diagnostic	Base		0.17	1	1				2.12	12.71	12.71			
504	AW54	20	21	518	6	S	Ceramic	Body Sherd			2.67	16	2	10	3	1	13.97	83.82	30.69	49.4	3.27	0.46
504	AW54	20	21	518	6	S	Stone	Tesserae			0.17	1		1			2.47	14.83		14.83		
504	AW54	20	21	518	6	S	Chaff Tempered Clay	Unburnt			1.00	6				6	0.17	1.02				1.02
504	AW54	20	21	518	6	S	Chaff Tempered Clay	Burnt			1.17	7				7	0.09	0.56				0.56
504	AW54	20	21	518	6	S	Bone	Fragment			3.33	20		2	4	14	1.12	6.71		3.27	1.91	1.53
504	AW54	20	21	518	6	S	Bone	Burnt			0.67	4				4	0.13	0.78				0.78
504	AW54	20	21	518	6	S	Botanical	Charcoal			0.33	2				2	0.02	0.09				0.09
504	AW54	20	21	518	6	S	Ceramic	Diagnostic			0.17	1		1			0.47	2.79		2.79		
504	AW54	20	21	518	6	S	Bone	Whole	Tooth		0.17	1				1	0.02	0.13				0.13
505	AW54	3	18,19,23,24	56	5	S	Ceramic	Body Sherd			2.80	14	4	2	4	4	49.44	247.18	236.86	7.23	2.51	0.58
505	AW54	3	18,19,23,24	56	5	S	Chaff Tempered Clay	Burnt			23.00	115		1	7	107	3.55	17.77		1.95	2.79	13.03
505	AW54	3	18,19,23,24	56	5	S	Chaff Tempered Clay	Unburnt			2.80	14				14	0.24	1.18				1.18
505	AW54	3	18,19,23,24	56	5	S	Shell	Fragment		Marine	0.20	1				1	0.01	0.04				0.04
505	AW54	3	18.19.23.24	56	5	S	Bone	Fragment			0.20	1				1	0.03	0.17				0.17
507	AW54	3	14	106	8	S	Ceramic	Body Sherd			3.88	31	2	9	14	6	10.42	83.34	35.43	34.82	12.3	0.79
507	AW54	3	14	106	8	S	Chaff Tempered Clay	Unburnt			5.13	41		2	8	31	1.19	9.53		2.17	4.31	3.05
507	AW54	3	14	106	8	S	Chaff Tempered Clay	Burnt			4.88	39			1	38	0.57	4.59			0.39	4.2
507	AW54	3	14	106	8	S	Bone	Fragment			2.38	19			2	17	0.31	2.47			0.82	1.65
507	AW54	3	14	106	8	S	Bone	Burnt			0.75	6			1	5	0.22	1.76			1.03	0.73
507	AW54	3	14	106	8	S	Sediment	Burnt			0.25	2			2		0.10	0.83			0.83	
507	AW54	3	14	106	8	S	Shell	Unburnt		Terrestrial	0.25	2				2	0.01	0.08				0.08
507	AW54	3	14	106	8	S	Glass	Fragment			0.13	1			1		0.06	0.44			0.44	
510	AW54	10	18	23	6.5	S	Ceramic	Body Sherd			2.77	18	4	7	4	3	20.28	131.82	99.77	27.74	3.75	0.56
510	AW54	10	18	23	6.5	S	Chaff Tempered Clay	Unburnt			9.08	59		2	11	46	2.35	15.25		4.29	6.42	4.54
510	AW54	10	18	23	6.5	S	Chaff Tempered Clay	Burnt			10.46	68			10	58	2.32	15.05			7.49	7.56
510	AW54	10	18	23	6.5	S	Bone	Fragment			3.85	25			3	22	0.62	4.06			1.61	2.45
510	AW54	10	18	23	6.5	S	Bone	Burnt			1.38	9			3	6	0.40	2.59			2.05	0.54
510	AW54	10	18	23	6.5	S	Bone	Whole		Fish	0.15	1				1	0.01	0.08				0.08
510	AW54	10	18	23	6.5	S	Bone	Whole	Tooth		0.31	2				2	0.01	0.05				0.05
510	AW54	10	18	23	6.5	S	Stone	Tesserae			0.15	1		1			0.53	3.47		3.47		
510	AW54	10	18	23	6.5	S	Bone	Whole	Vertebra		0.15	1				1	0.02	0.1				0.1
510	AW54	10	18	23	6.5	S	Unk				0.15	1			1		0.22	1.46			1.46	
510	AW54	10	18	23	6.5	S	Dung				0.77	5				5	0.16	1.07				1.07
510	AW54	10	18	23	6.5	S	Botanical	Charcoal			0.31	2				2	0.01	0.06				0.06
516	BR44	42			16	LW	Ceramic	Diagnostic	Rim		0.06	1	1				1.32	21.07	21.07			
516	BR44	42			16	LW	Ceramic	Diagnostic	Glazed		0.00	0					0.08	1.28			1.12	0.16
516	BR44	42			16	LW	Ceramic	Body Sherd			8.06	129	2	30	53	44	13.26	212.21	62.42	96.37	43.75	9.67
516	BR44	42			16	LW	Bone	Fragment			0.00	0					0.67	10.66		1.4	4.39	4.87
516	BR44	42			16	LW	Bone	Burnt			1.38	22			2	20	0.25	4.07			1.59	2.48
516	BR44	42			16	LW	Glass	Fragment			0.44	7			4	3	0.18	2.81			2.23	0.58
516	BR44	42			16	LW	Bone	Whole	Vertebra		0.06	1				1	0.00	0.06				0.06
516	BR44	42			16	LW	Stone	Tesserae			0.06	1		1			0.17	2.64		2.64		
516	BR44	42			16	LW	Bone	Fragment	Tooth		0.13	2			1	1	0.06	0.94			0.6	0.34
516	BR44	42			16	LW	Chaff Tempered Clay	Unburnt			21.00	336		24	35	277	6.67	106.77		47.41	23.87	35.49
516	BR44	42			16	LW	Chaff Tempered Clay	Burnt			5.00	80			8	72	0.80	12.85			4.65	8.2
516	BR44	42			16	LW	Botanical	Shell		Pistacia		1				1	0.00	0.04				0.04
516	BR44	42			16	LW	Shell	Fragment		Marine	0.13	2				2	0.00	0.006				0.006
516	BR44	42			16	LW	Shell	Fragment		Terrestrial	0.06	1				1	0.01	0.08				0.08
516	BR44	42			16	LW	Shell	Unburnt		Eggshell	1.25	20				20	0.02	0.26				0.26
516	BR44	42			16	LW	Shell	Limestone		Fossil	0.13	2				2	0.00	0.07				0.07

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
516	BR44	42			16	LW	Botanical	Charcoal			0.38	6				6	0.01	0.14				0.14
516	BR44	42			16	LW	Bone	Whole	Scale	Fish	0.38	6				6	0.00	0.03				0.03
516	BR44	42			16	LW	Bone	Whole	Scale	Fish	0.38	6				6	0.00	0.03				0.03
516	BR44	42			16	LW	Ceramic	Diagnostic	Base		0.06	1		1			0.34	5.37		5.37		
517	BR44	42	5,9	513	16	LW	Ceramic	Diagnostic	Base		0.06	1	1				4.38	70.14	70.14			
517	BR44	42	5,9	513	16	LW	Ceramic	Diagnostic	Rim		0.06	1	1				3.49	55.9	55.9			
517	BR44	42	5,9	513	16	LW	Ceramic	Diagnostic	Glazed		0.19	3	2		1		4.22	67.58	66.14		1.44	
517	BR44	42	5,9	513	16	LW	Ceramic	Body Sherd			4.69	75	7	17	23	28	14.02	224.39	153.64	48.12	16.15	6.48
517	BR44	42	5,9	513	16	LW	Stone	Tesserae			0.06	1		1			0.42	6.75		6.75		
517	BR44	42	5,9	513	16	LW	Bone	Fragment			5.50	88	1	12	14	61	3.02	48.35	0.97	28.54	8.23	10.61
517	BR44	42	5,9	513	16	LW	Bone	Whole			0.13	2	1			1	0.42	6.67	6.6			0.07
517	BR44	42	5,9	513	16	LW	Bone	Burnt			0.56	9			2	7	0.05	0.83			0.24	0.59
517	BR44	42	5,9	513	16	LW	Dung	Fragment			0.19	3			3		0.19	2.96			2.96	
517	BR44	42	5,9	513	16	LW	Chaff Tempered Clay	Burnt			5.88	94			8	86	0.88	14.12			3.63	10.49
517	BR44	42	5,9	513	16	LW	Bone	Fragment	Tooth		0.19	3			1	2	0.07	1.14			0.48	0.66
517	BR44	42	5,9	513	16	LW	Glass	Fragment			0.13	2				2	0.01	0.19				0.19
517	BR44	42	5,9	513	16	LW	Botanical	Charcoal			0.81	13			3	10	0.05	0.84			0.38	0.46
517	BR44	42	5,9	513	16	LW	Shell	Fragment		Terrestrial	0.25	4				4	0.00	0.04				0.04
517	BR44	42	5,9	513	16	LW	Shell	Limestone		Fossil	0.06	1				1	0.00	0.07				0.07
517	BR44	42	5,9	513	16	LW	Shell	Fragment		Marine	0.06	1				1	0.01	0.11				0.11
517	BR44	42	5,9	513	16	LW	Chaff Tempered Clay	Unburnt			4.06	65				65	0.56	8.93				8.93
517	BR44	42	5,9	513	16	LW	Sediment	Burnt			0.19	3				3	0.05	0.73				0.73
517	BR44	42	5,9	513	16	LW	Ceramic	Diagnostic	Painted		0.44	7	2	3	1	1	2.99	47.76	30.41	16.09	0.9	0.36
519	BS44	82	24	435	41	LW	Ceramic	Diagnostic	Painted		0.05	2			2		0.04	1.75			1.75	
519	BS44	82	24	435	41	LW	Bone	Fragment			1.24	51		2	5	44	0.23	9.4		3.81	1.52	4.07
519	BS44	82	24	435	41	LW	Bone	Burnt			0.17	7			1	6	0.03	1.31			0.51	0.8
519	BS44	82	24	435	41	LW	Bone	Whole		Marine	0.02	1				1	0.00	0.06				0.06
519	BS44	82	24	435	41	LW	Bone	Whole	Tooth		0.02	1				1	0.00	0.01				0.01
519	BS44	82	24	435	41	LW	Chaff Tempered Clay	Unburnt			2.10	86			5	81	0.35	14.28			3.02	11.26
519	BS44	82	24	435	41	LW	Chaff Tempered Clay	Burnt			1.17	48				48	0.18	7.25				7.25
519	BS44	82	24	435	41	LW	Glass	Fragment			0.02	1				1	0.01	0.28				0.28
519	BS44	82	24	435	41	LW	Shell	Fragment		Terrestrial	0.05	2				2	0.00	0.02				0.02
519	BS44	82	24	435	41	LW	Botanical	Seed			0.02	1				1	0.01	0.4				0.4
519	BS44	82	24	435	41	LW	Botanical	Charcoal			0.15	6				6	0.01	0.3				0.3
519	BS44	82	24	435	41	LW	Shell	Fragment		Marine	0.02	1				1	0.00	0.13				0.13
519	BS44	82	24	435	41	LW	Ceramic	Body Sherd			1.90	78		8	23	47	1.21	49.48		22.24	18.97	8.27
519	BS44	82	24	435	41	LW	Ceramic	Diagnostic			0.10	4		1	2	1	0.15	6.26		4.26	1.75	0.25
520	BR44	42	4,5	513	12	LW	Chaff Tempered Clay	Unburnt			13.33	160		7	26	127	5.90	70.75		31.21	23.02	16.52
520	BR44	42	4,5	513	12	LW	Chaff Tempered Clay	Burnt			4.58	55			10	45	1.08	12.95			7.97	4.98
520	BR44	42	4,5	513	12	LW	Bone	Fragment			2.67	32			3	29	0.41	4.86			2.05	2.81
520	BR44	42	4,5	513	12	LW	Bone	Burnt			1.50	18		2	1	15	0.39	4.73		2.62	0.55	1.56
520	BR44	42	4,5	513	12	LW	Glass	Fragment			0.25	3			1	2	0.03	0.37			0.21	0.16
520	BR44	42	4,5	513	12	LW	Bone	Whole	Femur		0.08	1				1	0.00	0.02				0.02
520	BR44	42	4,5	513	12	LW	Sediment	Burnt			0.67	8		1		7	0.19	2.28		1.32		0.96
520	BR44	42	4,5	513	12	LW	Bone	Whole	Mandible		0.25	3				3	0.01	0.1				0.1
520	BR44	42	4,5	513	12	LW	Unk				0.08	1		1			0.26	3.09		3.09		
520	BR44	42	4,5	513	12	LW	Botanical	Charcoal			0.33	4				4	0.02	0.27				0.27
520	BR44	42	4,5	513	12	LW	Shell	Unburnt		Eggshell	0.50	6				6	0.01	0.1				0.1
520	BR44	42	4,5	513	12	LW	Shell	Limestone		Fossil	0.17	2				2	0.01	0.11				0.11
520	BR44	42	4,5	513	12	LW	Metal	Unk			0.17	2				1	0.06	0.77				0.77
520	BR44	42	4,5	513	12	LW	Shell	Fragment		Terrestrial	0.08	1				1	0.00	0.04				0.04
520	BR44	42	4,5	513	12	LW	Ceramic	Body Sherd			3.92	47		9	12	26	3.75	44.99		31.53	9.1	4.36
520	BR44	42	4,5	513	12	LW	Ceramic	Diagnostic	Handle		0.08	1		1			0.56	6.73		6.73		
520	BR44	42	4,5	513	12	LW	Ceramic	Diagnostic	Rim		0.08	1			1		0.08	0.93			0.93	
526	BS44	82	24	458	7	LW	Ceramic	Diagnostic	Rim		0.14	1		1			0.94	6.58		6.58		
526	BS44	82	24	458	7	LW	Bone	Fragment			7.43	52			6	46	1.31	9.16			4.59	4.57
526	BS44	82	24	458	7	LW	Bone	Burnt			0.43	3			2	1	0.21	1.49			1.05	0.44
526	BS44	82	24	458	7	LW	Ceramic	Body Sherd			4.00	28		2	10	16	2.73	19.13		4.61	11.25	3.27

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
526	BS44	82	24	458	7	LW	Bone	Whole	Tooth		0.14	1				1	0.01	0.1				0.1
526	BS44	82	24	458	7	LW	Chaff Tempered Clay	Unburnt			5.43	38			6	32	1.85	12.94			7.57	5.37
526	BS44	82	24	458	7	LW	Chaff Tempered Clay	Burnt			3.00	21				21	0.53	3.71				3.71
526	BS44	82	24	458	7	LW	Glass	Fragment			0.29	2			1	1	0.03	0.22			0.15	0.07
526	BS44	82	24	458	7	LW	Botanical	Charcoal			0.14	1				1	0.01	0.05				0.05
527	BS44	80	24	285	27	LW	Ceramic	Body Sherd			3.15	85		15	28	42	2.46	66.38		31.54	24.59	10.25
527	BS44	80	24	285	27	LW	Ceramic	Diagnostic	Painted		0.70	19	1	2	6	10	0.74	20.06	9.29	3.47	5.61	1.69
527	BS44	80	24	285	27	LW	Bone	Fragment			4.74	128			10	118	0.51	13.75			3.2	10.55
527	BS44	80	24	285	27	LW	Bone	Burnt			0.41	11				11	0.06	1.72				1.72
527	BS44	80	24	285	27	LW	Glass	Fragment			0.26	7			1	6	0.04	0.99			0.41	0.58
527	BS44	80	24	285	27	LW	Chaff Tempered Clay	Unburnt			1.96	53		11	42		1.77	47.72		19.33	28.39	
527	BS44	80	24	285	27	LW	Bone	Whole	Vertebra	Fish	0.19	5				5	0.01	0.15				0.15
527	BS44	80	24	285	27	LW	Bone	Whole	Tooth		0.04	1				1	0.00	0.11				0.11
527	BS44	80	24	285	27	LW	Bone	Fragment	Tooth		0.04	1				1	0.00	0.12				0.12
527	BS44	80	24	285	27	LW	Unk				0.04	1		1			0.12	3.2		3.2		
527	BS44	80	24	285	27	LW	Chaff Tempered Clay	Burnt			0.26	7			7		0.16	4.28			4.28	
527	BS44	80	24	285	27	LW	Shell	Unburnt		Eggshell	1.00	27				27	0.02	0.48				0.48
527	BS44	80	24	285	27	LW	Botanical	Charcoal			0.63	17				17	0.01	0.4				0.4
527	BS44	80	24	285	27	LW	Sediment	Iron Oxide Infused			0.22	6				6	0.03	0.76				0.76
527	BS44	80	24	285	27	LW	Shell	Fragment		Terrestrial	0.22	6				6	0.00	0.08				0.08
527	BS44	80	24	285	27	LW	Ceramic	Diagnostic	Glazed		0.15	4			2	2	0.05	1.48			1.27	0.21
527	BS44	80	24	285	27	LW	Ceramic	Body Sherd	Burnt		0.04	1				1	0.00	0.07				0.07
527	BS44	80	24	285	27	LW	Ceramic	Diagnostic	Rim		0.04	1				1	0.01	0.35				0.35
530	BS44	82	25	470	12	LW	Bone	Fragment			6.25	75			10	65	1.55	18.63			9.92	8.71
530	BS44	82	25	470	12	LW	Bone	Burnt			0.50	6			6		0.74	8.9			8.9	
530	BS44	82	25	470	12	LW	Chaff Tempered Clay	Unburnt			6.92	83			7	76	1.77	21.22			9.98	11.24
530	BS44	82	25	470	12	LW	Chaff Tempered Clay	Burnt			3.75	45			6	39	1.22	14.69			9.28	5.41
530	BS44	82	25	470	12	LW	Metal				0.08	1		1			0.92	11.08		11.08		
530	BS44	82	25	470	12	LW	Sediment	Vitrified			0.42	5		5			0.10	1.19		1.19		
530	BS44	82	25	470	12	LW	Shell	Fragment		Terrestrial	0.58	7				7	0.02	0.21				0.21
530	BS44	82	25	470	12	LW	Shell	Fragment		Marine	0.08	1				1	0.03	0.35				0.35
530	BS44	82	25	470	12	LW	Botanical	Charcoal			0.83	10				10	0.04	0.43				0.43
530	BS44	82	25	470	12	LW	Ceramic	Body Sherd			3.33	40		12	9	19	4.81	57.77		46.12	6.05	5.6
535	BS44	80	24	289	19	LW	Chaff Tempered Clay	Unburnt			12.05	229		5	28	196	2.98	56.7		9.54	21.74	25.42
535	BS44	80	24	289	19	LW	Chaff Tempered Clay	Burnt			8.95	170			18	152	1.57	29.83			13.17	16.66
535	BS44	80	24	289	19	LW	Bone	Fragment			3.68	70		1	9	60	0.69	13.18		1.06	4.51	7.61
535	BS44	80	24	289	19	LW	Bone	Burnt			0.32	6			1	5	0.08	1.55			0.7	0.85
535	BS44	80	24	289	19	LW	Bone	Whole		Fish	0.05	1				1	0.01	0.11				0.11
535	BS44	80	24	289	19	LW	Glass	Fragment			0.68	13			2	11	0.15	2.94			1.58	1.36
535	BS44	80	24	289	19	LW	Shell	Limestone		Fossil	0.05	1			1		0.05	0.98			0.98	
535	BS44	80	24	289	19	LW	Shell	Fragment		Marine	0.05	1				1	0.00	0.06				0.06
535	BS44	80	24	289	19	LW	Botanical	Charcoal			0.79	15				15	0.02	0.29				0.29
535	BS44	80	24	289	19	LW	Sediment	Burnt			0.63	12				12	0.08	1.57				1.57
535	BS44	80	24	289	19	LW	Shell	Unburnt		Eggshell	0.05	1				1	0.00	0.03				0.03
535	BS44	80	24	289	19	LW	Metal	Unk			0.16	3				3	0.02	0.33				0.33
535	BS44	80	24	289	19	LW	Ceramic	Body Sherd			6.95	132		25	37	70	6.13	116.42		78.44	25.71	12.27
535	BS44	80	24	289	19	LW	Ceramic	Diagnostic	Painted		0.58	11		3	6	2	0.63	11.98		7.32	4.38	0.28
535	BS44	80	24	289	19	LW	Ceramic	Diagnostic	Glazed		0.11	2				2	0.02	0.41				0.41
540	BS44	82	14	477	2	LW	Ceramic	Body Sherd			5.50	11	1		5	5	10.09	20.17	13.42		5.27	1.48
540	BS44	82	14	477	2	LW	Ceramic	Diagnostic	Painted		0.50	1			1		0.33	0.65			0.65	
540	BS44	82	14	477	2	LW	Bone	Fragment			2.50	5			1	4	0.51	1.02			0.69	0.33
540	BS44	82	14	477	2	LW	Chaff Tempered Clay	Unburnt			4.50	9		1	1	7	2.24	4.48		2.2	0.59	1.69
540	BS44	82	14	477	2	LW	Chaff Tempered Clay	Burnt			4.00	8				8	0.82	1.63				1.63
540	BS44	82	14	477	2	LW	Metal	Unk			0.50	1				1	0.17	0.33				0.33
542	BR44	65	9	578	10	LW	Ceramic	Diagnostic	Rim		0.20	2			2		0.20	1.99			1.99	

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
542	BR44	65	9	578	10	LW	Bone	Fragment			1.70	17		1	1	15	0.49	4.93		2.52	0.56	1.85
542	BR44	65	9	578	10	LW	Bone	Burnt			1.40	14			1	13	0.24	2.35			0.83	1.52
542	BR44	65	9	578	10	LW	Chaff Tempered Clay	Unburnt			2.00	20		4	16		3.79	37.91		13.63	11.58	12.7
542	BR44	65	9	578	10	LW	Ceramic	Body Sherd			2.60	26	1	10	15		5.79	57.85	11.18	27.64	12.76	6.27
542	BR44	65	9	578	10	LW	Chaff Tempered Clay	Burnt			3.60	36			4	32	0.66	6.6			2.33	4.27
542	BR44	65	9	578	10	LW	Metal	Coin			0.10	1			1		0.14	1.41			1.41	
545	BR44	65	3	565	14.5	LW	Ceramic	Diagnostic	Painted		0.07	1				1	0.00	0.06				0.06
545	BR44	65	3	565	14.5	LW	Ceramic	Body Sherd			4.76	69		13	22	34	4.03	58.46		34.7	17.2	6.56
545	BR44	65	3	565	14.5	LW	Ceramic	Diagnostic	Glazed		0.07	1				1	0.02	0.25				0.25
545	BR44	65	3	565	14.5	LW	Bone	Fragment			4.28	62		1	9	52	0.90	13.08		1.69	5.62	5.77
545	BR44	65	3	565	14.5	LW	Bone	Burnt			0.34	5				5	0.08	1.14				1.14
545	BR44	65	3	565	14.5	LW	Bone	Whole	Scale	Fish	0.14	2				2	0.00	0.02				0.02
545	BR44	65	3	565	14.5	LW	Bone	Whole	Vertebra	Fish	0.07	1				1	0.00	0.02				0.02
545	BR44	65	3	565	14.5	LW	Glass	Fragment			0.28	4			1	3	0.03	0.37			0.17	0.2
545	BR44	65	3	565	14.5	LW	Chaff Tempered Clay	Unburnt			2.00	29			2	27	0.41	5.92			1.24	4.68
545	BR44	65	3	565	14.5	LW	Chaff Tempered Clay	Burnt			1.24	18			4	14	0.32	4.67			2.36	2.31
545	BR44	65	3	565	14.5	LW	Botanical	Charcoal			0.62	9				9	0.05	0.6794				0.6794
545	BR44	65	3	565	14.5	LW	Shell	Unburnt		Eggshell	0.07	1				1	0.00	0.02				0.02
549	BS44	80	16	549	28	LW	Bone	Fragment			2.21	62		2	4	56	0.44	12.24		3.92	1.73	6.59
549	BS44	80	16	549	28	LW	Bone	Whole	Pharyngeal Grinding Mill	Scaridae	0.04	1			1		0.01	0.35			0.35	
549	BS44	80	16	549	28	LW	Bone	Burnt			0.50	14				14	0.11	3.09				3.09
549	BS44	80	16	549	28	LW	Ceramic	Body Sherd			1.18	33	1	18	9	5	3.51	98.3	17.76	68.74	10.52	1.28
549	BS44	80	16	549	28	LW	Chaff Tempered Clay	Unburnt			6.68	187		10	21	156	2.36	66.07		28.58	13.05	24.44
549	BS44	80	16	549	28	LW	Chaff Tempered Clay	Burnt			3.75	105			6	99	0.58	16.3			2.28	14.02
549	BS44	80	16	549	28	LW	Metal				0.07	2		1		1	0.13	3.57		3.45		0.12
549	BS44	80	16	549	28	LW	Metal	Slag			0.07	2			1	1	0.08	2.24			1.98	0.26
549	BS44	80	16	549	28	LW	Botanical	Charcoal			0.18	5				5	0.03	0.8				0.8
549	BS44	80	16	549	28	LW	Shell	Fragment		Terrestrial	0.21	6				6	0.02	0.58				0.58
549	BS44	80	16	549	28	LW	Shell	Limestone		Fossil	0.04	1				1	0.01	0.15				0.15
550	BS44	58	19	82	20	LW	Bone	Fragment			6.30	126					0.53	10.65				
550	BS44	58	19	82	20	LW	Bone	Burnt			0.15	3					0.05	1				
550	BS44	58	19	182	20	LW	Ceramic	Body Sherd			1.75	35					3.84	76.88				
550	BS44	58	19	182	20	LW	Ceramic	Diagnostic	Glazed		0.10	2					0.36	7.12				
550	BS44	58	19	182	20	LW	Bone	Whole	Scale	Fish	0.10	2					0.00	0.01				
550	BS44	58	19	182	20	LW	Glass	Fragment			0.30	6					0.01	0.15				
550	BS44	58	19	182	20	LW	Shell	Fragment		Terrestrial	0.35	7					0.01	0.1				
550	BS44	58	19	182	20	LW	Shell	Limestone		Fossil	0.05	1					0.08	1.57				
550	BS44	58	19	182	20	LW	Metal				0.05	1					0.05	1.01				
550	BS44	58	19	182	20	LW	Shell	Unburnt		Eggshell	0.50	10					0.01	0.14				
551	BS44	58	25	192	10	LW	Bone	Fragment			6.80	68					1.15	11.45				
551	BS44	58	25	192	10	LW	Bone	Burnt			0.40	4					0.03	0.3				
551	BR44	58	25	192	10	LW	Ceramic	Body Sherd			2.50	25					6.72	67.16				
551	BR44	58	25	192	10	LW	Ceramic	Diagnostic	Rim		0.10	1					0.23	2.33				
551	BR44	58	25	192	10	LW	Ceramic	Diagnostic	Base		0.10	1					0.68	6.8				
551	BR44	58	25	192	10	LW	Ceramic	Diagnostic	Painted		0.10	1					0.20	1.99				
551	BR44	58	25	192	10	LW	Glass	Fragment			1.50	15					0.09	0.86				
551	BR44	58	25	192	10	LW	Botanical	Charcoal			1.30	13					0.02	0.1675				
551	BR44	58	25	192	10	LW	Shell	Limestone		Fossil	0.50	5					0.01	0.08				
551	BR44	58	25	192	10	LW	Shell	Fragment		Terrestrial	0.10	1					0.00	0.01				
551	BR44	58	25	192	10	LW	Shell	Unburnt		Eggshell	0.10	1					0.00	0.01				
551	BR44	58	25	192	10	LW	Chaff Tempered Clay	Unburnt			0.50	5					0.25	2.46				
552	BR44	35	5	411	15	LW	Bone	Fragment			3.80	57					0.27	4.07				
552	BR44	35	5	411	15	LW	Ceramic	Body Sherd			1.20	18					2.23	33.42				
552	BR44	35	5	411	15	LW	Ceramic	Diagnostic	Base		0.07	1					0.08	1.18				
552	BR44	35	5	411	15	LW	Ceramic	Diagnostic	Painted		0.07	1					0.14	2.03				
552	BR44	35	5	411	15	LW	Glass	Fragment			0.13	2					0.00	0.02				

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
552	BR44	35	5	411	15	LW	Botanical	Charcoal			0.33	5					0.00	0.0113				
552	BR44	35	5	411	15	LW	Shell	Fragment		Marine	0.07	1					0.02	0.26				
552	BR44	35	5	411	15	LW	Shell	Limestone		Fossil	0.07	1					0.01	0.08				
553	BS44	58	24	191	17	LW	Bone	Fragment			5.18	88					0.59	10.03				
553	BS44	58	24	191	17	LW	Bone	Whole	Vertebra	Fish	0.24	4					0.00	0				
553	BS44	58	24	191	17	LW	Ceramic	Body Sherd			0.59	10					0.44	7.41				
553	BS44	58	24	191	17	LW	Ceramic	Diagnostic	Glazed		0.06	1					0.42	7.12				
553	BS44	58	24	191	17	LW	Ceramic	Diagnostic	Rim		0.06	1					0.02	0.42				
553	BS44	58	24	191	17	LW	Glass	Fragment			0.18	3					0.01	0.1				
553	BS44	58	24	191	17	LW	Glass	Fragment		Faience	0.06	1					0.01	0.1				
553	BS44	58	24	191	17	LW	Botanical	Charcoal			0.12	2					0.02	0.3596				
553	BS44	58	24	191	17	LW	Shell	Fragment		Terrestrial	0.06	1					0.00	0.07				
553	BS44	58	24	191	17	LW	Shell	Fragment		Marine	0.06	1					0.00	0.06				
553	BS44	58	24	191	17	LW	Shell	Unburnt		Eggshell	0.06	1					0.00	0.04				
554	BR44	35	4	410	29	LW	Bone	Fragment			1.69	49					0.29	8.44				
554	BR44	35	4	410	29	LW	Bone	Whole	Vertebra	Fish	0.07	2					0.00	0				
554	BR44	35	4	410	29	LW	Ceramic	Body Sherd			0.86	25					2.31	66.93				
554	BR44	35	4	410	29	LW	Glass	Fragment			0.14	4					0.00	0.13				
554	BR44	35	4	410	29	LW	Metal	Clasp		Bronze	0.14	4					0.03	0.87				
554	BR44	35	4	410	29	LW	Stone	Tesserae			0.03	1					0.15	4.33				
555	BS44	58	20	193	14	LW	Bone	Fragment			6.14	86					0.38	5.26				
555	BS44	58	20	193	14	LW	Bone	Whole	Vertebra	Fish	0.07	1					0.00	0				
555	BS44	58	20	193	14	LW	Ceramic	Body Sherd			1.00	14					2.19	30.6				
555	BS44	58	20	193	14	LW	Ceramic	Diagnostic	Rim		0.14	2					0.22	3.14				
555	BS44	58	20	193	14	LW	Ceramic	Diagnostic	Glazed		0.07	1					0.07	0.97				
555	BS44	58	20	193	14	LW	Ceramic	Diagnostic	Painted		0.07	1					0.01	0.08				
555	BS44	58	20	193	14	LW	Glass	Fragment			0.21	3					0.08	1.11				
555	BS44	58	20	193	14	LW	Shell	Fragment		Terrestrial	0.07	1					0.00	0.01				
555	BS44	58	20	193	14	LW	Botanical	Charcoal			0.36	5					0.01	0.1556				
556	BR44	35	6	416	9	LW	Bone	Fragment			6.67	60					1.00	9				
556	BR44	35	6	416	9	LW	Bone	Whole	Vertebra	Fish	0.11	1					0.00	0				
556	BR44	35	6	416	9	LW	Ceramic	Body Sherd			1.67	15					3.22	28.94				
556	BR44	35	6	416	9	LW	Ceramic	Fragment			1.44	13					0.13	1.15				
556	BR44	35	6	416	9	LW	Glass	Fragment			0.22	2					0.01	0.05				
556	BR44	35	6	416	9	LW	Chaff Tempered Clay	Unburnt			0.33	3					0.02	0.19				
556	BR44	35	6	416	9	LW	Shell	Limestone		Fossil	0.11	1					0.01	0.12				
556	BR44	35	6	416	9	LW	Shell	Fragment		Terrestrial	0.44	4					0.00	0.03				
556	BR44	35	6	416	9	LW	Shell	Unburnt		Eggshell	0.22	2					0.01	0.12				
557	BP48	18	19	209	12	L	Bone	Fragment			4.67	56					0.46	5.56				
557	BP48	18	19	209	12	L	Ceramic	Body Sherd			3.08	37					7.38	88.5				
557	BP48	18	19	209	12	L	Glass	Fragment			0.50	6					0.02	0.29				
557	BP48	18	19	209	12	L	Shell	Unburnt		Eggshell	1.08	13					0.01	0.14				
557	BP48	18	19	209	12	L	Stone				0.17	2					0.15	1.83				
557	BP48	18	19	209	12	L	Botanical	Charcoal			0.08	1					0.00	0.015				
557	BP48	18	19	209	12	L	Chaff Tempered Clay	Unburnt			0.08	1					0.00	0.05				
557	BP48	18	19	209	12	L	Chaff Tempered Clay	Burnt			0.08	1					0.00	0.05				
557	BP48	18	19	209	12	L	Shell	Fragment		Terrestrial	0.08	1					0.00	0.012				
557	BP48	18	19	209	12	L	Shell	Fragment		Marine	0.08	1					0.01	0.1				
558	BR44	35	2	414	19	LW	Bone	Fragment			2.89	55					0.25	4.83				
558	BR44	35	2	414	19	LW	Ceramic	Body Sherd			0.84	16					2.60	49.39				
558	BR44	35	2	414	19	LW	Ceramic	Diagnostic	Painted		0.26	5					1.24	23.59				
558	BR44	35	2	414	19	LW	Glass	Fragment			0.21	4					0.01	0.25				
558	BR44	35	2	414	19	LW	Shell	Fragment		Terrestrial	0.26	5					0.00	0.03				
558	BR44	35	2	414	19	LW	Chaff Tempered Clay	Unburnt			0.32	6					0.02	0.32				
558	BR44	35	2	414	19	LW	Botanical	Charcoal			0.05	1					0.00	0.0225				
559	BR43	48	5,6,23	216	18	LW	Bone	Fragment			2.61	47					0.43	7.75				
559	BR43	48	5,6,23	216	18	LW	Bone	Whole	Vertebra	Fish	0.06	1					0.00	0				
559	BR43	48	5,6,23	216	18	LW	Ceramic	Body Sherd			1.06	19					2.94	52.83				
559	BR43	48	5,6,23	216	18	LW	Ceramic	Diagnostic	Glazed		0.28	5					0.50	8.99				
559	BR43	48	5,6,23	216	18	LW	Ceramic	Diagnostic	Painted		0.11	2					0.84	15.17				

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
559	BR43	48	5,6,23	216	18	LW	Ceramic	Diagnostic	Rim		0.06	1					0.17	3.07				
559	BR43	48	5,6,23	216	18	LW	Glass	Fragment			0.17	3					0.00	0.08				
559	BR43	48	5,6,23	216	18	LW	Shell	Fragment		Terrestrial	0.06	1					0.00	0.03				
560	BR44	35	3		20	LW	Bone	Fragment			2.80	56					0.31	6.17				
560	BR44	35	3		20	LW	Ceramic	Body Sherd			0.55	11					0.74	14.81				
560	BR44	35	3		20	LW	Ceramic	Diagnostic	Rim		0.05	1					0.01	0.54				
560	BR44	35	3		20	LW	Ceramic	Diagnostic	Painted		0.05	1					0.15	0.87				
560	BR44	35	3		20	LW	Glass	Fragment			0.25	5					0.00	0.26				
560	BR44	35	3		20	LW	Chaff Tempered Clay	Unburnt			0.25	5					0.00	2.99				
560	BR44	35	3		20	LW	Botanical	Charcoal			0.20	4					0.01	0.09				
560	BR44	35	3		20	LW	Botanical	Rachis			0.10	2					0.00					
560	BR44	35	3		20	LW	Shell	Fragment		Terrestrial	0.65	13					0.39	0.12				
560	BR44	35	3		20	LW	Shell	Limestone		Fossil	0.05	1					2.29	0.07				
561	BS44	38	25	192	15	LW	Bone	Fragment			2.80	42					0.52	7.79				
561	BS44	38	25	192	15	LW	Ceramic	Body Sherd			0.87	13					0.14	45.83				
561	BS44	38	25	192	15	LW	Glass	Fragment			0.73	11					0.00	1.41				
561	BS44	38	25	192	15	LW	Glass	Diagnostic	Rim		0.20	3					0.00	2.14				
561	BS44	38	25	192	15	LW	Shell	Fragment		Terrestrial	0.07	1					0.00	0.0161				
561	BS44	38	25	192	15	LW	Botanical	Charcoal			0.20	3					0.00	0.0098				
561	BS44	38	25	192	15	LW	Botanical	Seed		Hordeum	0.07	1				1						
561	BS44	38	25	192	15	LW	Shell	Unburnt		Eggshell	0.07	1					0.96	0.01				
617	AW54	31	18	298	10.5	S	Ceramic	Body Sherd			3.90	41	8	11	8	14	19.32	202.82	156.64	37.98	6.04	2.16
617	AW54	31	18	298	10.5	S	Ceramic	Diagnostic	Base		0.19	2	2				1.37	14.35	14.35			
617	AW54	31	18	298	10.5	S	Bone	Fragment			1.05	11		1		10	0.30	3.11		1.11		2
617	AW54	31	18	298	10.5	S	Bone	Whole	Vertebra	Fish	0.10	1				1	0.00	0.04				0.04
617	AW54	31	18	298	10.5	S	Bone	Burnt			0.19	2				2	0.01	0.12				0.12
617	AW54	31	18	298	10.5	S	Chaff Tempered Clay				26.76	281	2	24	41	214	10.82	113.64	14.04	41.4	29.87	28.33
617	AW54	31	18	298	10.5	S	Chaff Tempered Clay	Burnt			0.19	2			2		0.84	8.85			0.96	7.89
617	AW54	31	18	298	10.5	S	Sediment	Carbonized			0.76	8				8	0.07	0.75				0.75
617	AW54	31	18	298	10.5	S	Botanical	Seed		Pisum	1.33	14				14	0.05	0.49				0.49
617	AW54	31	18	298	10.5	S	Shell	Eggshell			0.19	2				2	0.00	0.05				0.05
617	AW54	31	18	298	10.5	S	Botanical	Seed		Pisum Frag	1.90	20				20	0.01	0.14				0.14
682	AW54	30		263	4.5	S	Ceramic	Body Sherd			4.44	20	2	5	11	2	11.57	52.05	23.41	22.1	6.15	0.39
682	AW54	30		263	4.5	S	Bone	Fragment			2.67	12		1	3	8	0.72	3.24		0.97	0.89	1.38
682	AW54	30		263	4.5	S	Bone	Burnt			3.78	17			3	14	0.51	2.28		0.77	1.51	
682	AW54	30		263	4.5	S	Glass	Fragment			0.22	1			1		0.12	0.56			0.56	
682	AW54	30		263	4.5	S	Chaff Tempered Clay	Unburnt			5.33	24			2	22	0.81	3.65			1.21	2.44
682	AW54	30		263	4.5	S	Chaff Tempered Clay	Burnt			5.33	24			2	22	0.96	4.31			1.6	2.71
682	AW54	30		263	4.5	S	Shell	Unburnt		Terrestrial	0.22	1				1	0.02	0.08				0.08
683	AW54	27		273	6.5	S	Ceramic	Body Sherd				12	2	5	3	2			69.71	15.84	1.89	0.37
683	AW54	27		273	6.5	S	Bone	Fragment				19		2	3	14				4.72	1.6	2.35
683	AW54	27		273	6.5	S	Bone	Burnt				5			1	4					0.18	0.82
683	AW54	27		273	6.5	S	Glass	Fragment				3	1			2			2.43			0.48
683	AW54	27		273	6.5	S	Chaff Tempered Clay	Burnt				23		3	6	14				7.34	2.69	1.72
683	AW54	27		273	6.5	S	Chaff Tempered Clay	Unburnt				21		1	7	13				2.11	4.02	2.05
683	AW54	27		273	6.5	S	Stone	Tesserae				1		1						14.65		
683	AW54	27		273	6.5	S	Charcoal					5			1	4					0.13	0.06
683	AW54	27		273	6.5	S	Shell			Eggshell		1				1						,02
691	AW54	30		265	4	S	Ceramic	Body Sherd				21	1	11	7	2			24.17	31.75	6.48	0.4
691	AW54	30		265	4	S	Bone	Fragment				20				20						2.68
691	AW54	30		265	4	S	Glass					1				1						0.06
691	AW54	30		265	4	S	Chaff Tempered Clay					123		3	10	111				7	5.62	12.06
691	AW54	30		265	4	S	Chaff Tempered Clay	Burnt				39			7	32					5.74	3.92
692	AW54	30		264	6	S	Ceramic	Body Sherd			3	18		3	9	6	2.88	17.27		9.02	7.21	1.04
692	AW54	30		264	6	S	Ceramic	Diagnostic	Handle		0.17	1	1				6.80	40.77	40.77			
692	AW54	30		264	6	S	Bone	Fragment			7.5	45		3	13	29	3.19	19.11		10.42	4.55	4.14

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
692	AW54	30		264	6	S	Bone	Whole			1.33	8			2	6	0.23	1.38			1.29	0.09
692	AW54	30		264	6	S	Bone	Burnt			0.67	4				4	0.02	0.1				0.1
692	AW54	30		264	6	S	Glass				0.67	4				4	0.01	0.07				0.07
692	AW54	30		264	6	S	Chaff Tempered Clay				11.50	69	1	2	13	53	4.70	28.22	9.96	3.3	8.78	6.18
692	AW54	30		264	6	S	Chaff Tempered Clay	Burnt			8.17	49			11	38	2.04	12.26			7.79	4.47
701	AW54	31		292	6.5	S	Ceramic	Body Sherd			2.46	16	3	4	4	5	7.86	51.11	29.9	16.97	2.47	1.77
701	AW54	31		292	6.5	S	Bone	Fragment			3.08	20		1	3	16	0.56	3.65		0.97	0.77	1.91
701	AW54	31		292	6.5	S	Bone	Burnt			1.38	9				9	0.15	1				1
701	AW54	31		292	6.5	S	Glass				0.15	1				1	0.03	0.21				0.21
701	AW54	31		292	6.5	S	Chaff Tempered Clay				4.00	26		2	7	17	1.71	11.11		5.43	3.85	1.83
701	AW54	31		292	6.5	S	Chaff Tempered Clay	Burnt			8.62	56		6	13	37	3.04	19.78		6.32	8.12	5.34
734	AW54	32		299	4.5	S	Ceramic	Body Sherd			3.78	17	2	3	7	5	21.56	97.03	74.16	14.16	7.65	1.06
734	AW54	32		299	4.5	S	Bone	Fragment			4.22	19			3	16	0.71	3.19			1.4	1.79
734	AW54	32		299	4.5	S	Bone	Whole	Jaw		0.22	1		1			1.88	8.45		8.45		
734	AW54	32		299	4.5	S	Bone	Whole	Tooth		0.22	1			1		0.04	0.16			0.16	
734	AW54	32		299	4.5	S	Bone		Vertebra	Rodent	0.67	3				3	0.05	0.24				0.24
734	AW54	32		299	4.5	S	Bone		Burnt		0.67	3				3	0.11	0.5				0.5
734	AW54	32		299	4.5	S	Glass				0.22	1				1	0.03	0.12				0.12
734	AW54	32		299	4.5	S	Chaff Tempered Clay	Burnt			9.33	42		1	3	38	1.70	7.63		0.74	1.56	5.33
734	AW54	32		299	4.5	S	Chaff Tempered Clay				8.22	37			6	31	1.83	8.25			4.52	3.73
796	AW54	25	20	414	6.5	S	Ceramic	Body Sherd			7.08	46	20	7	8	11	230.25	1496.61	1447.4	39.79	6.88	2.54
796	AW54	25	20	414	6.5	S	Bone	Fragment			0.92	6			2	4	0.36	2.37			1.94	0.43
796	AW54	25	20	414	6.5	S	Bone	Burnt			0.15	1				1	0.01	0.05				0.05
796	AW54	25	20	414	6.5	S	Metal				0.46	3		2		1	1.87	12.17		11.28		0.89
796	AW54	25	20	414	6.5	S	Chaff Tempered Clay	Burnt			1.69	11			2	9	0.44	2.88			1.52	1.36
796	AW54	25	20	414	6.5	S	Chaff Tempered Clay				4.46	29			3	26	0.74	4.83			1.91	2.92
796	AW54	25	20	414	6.5	S	Charcoal				0.15	1				1	0.02	0.13				0.13
799	AW54	32	18	381	7.5	S	Ceramic	Body Sherd			5.07	38	6	13	11	8	29.02	217.64	171	34.4	9.8	2.44
799	AW54	32	18	381	7.5	S	Ceramic	Diagnostic	Rim		0.13	1	1				4.91	36.81	36.81			
799	AW54	32	18	381	7.5	S	Bone	Fragment			2.40	18			1	17	0.34	2.52			0.71	1.81
799	AW54	32	18	381	7.5	S	Bone	Whole			0.13	1		1			0.31	2.36		2.36		
799	AW54	32	18	381	7.5	S	Bone	Whole	Vertebra	Fish	0.13	1				1	0.08	0.6				0.6
799	AW54	32	18	381	7.5	S	Bone	Whole	Tooth		0.27	2				2	0.02	0.18				0.18
799	AW54	32	18	381	7.5	S	Bone	Burnt			0.80	6				6	0.13	0.99				0.99
799	AW54	32	18	381	7.5	S	Glass				0.27	2		1		1	0.16	1.18		1.05		0.13
799	AW54	32	18	381	7.5	S	Metal				0.13	1		1			0.65	4.9		4.9		
799	AW54	32	18	381	7.5	S	Chaff Tempered Clay				14.00	105		3	10	92	3.61	27.1		9.21	5.87	12.02
799	AW54	32	18	381	7.5	S	Chaff Tempered Clay	Burnt			8.27	62		2	7	53	2.40	18.03		6.45	5.43	6.15
799	AW54	32	18	381	7.5	S	Sediment	Carbonized			2.53	19		2	3	14	1.37	10.24		4.85	2.46	2.93
799	AW54	32	18	381	7.5	S	Shell	Eggshell			0.13	1				1	0.00	0.01				0.01
801	AW54	26	18	450	5.5	S	Ceramic	Body Sherd			11.64	64	8	11	13	32	51.52	283.35	208.39	62.14	9.03	3.79
801	AW54	26	18	450	5.5	S	Ceramic	Diagnostic	Base		0.18	1	1				2.83	15.59	15.59			
801	AW54	26	18	450	5.5	S	Bone	Fragment			1.09	6			1	5	0.24	1.33			1.03	0.3
801	AW54	26	18	450	5.5	S	Bone	Whole			0.18	1			1		0.16	0.87			0.87	
801	AW54	26	18	450	5.5	S	Shell	Limestone		Fossil	0.18	1				1	0.02	0.09				0.09
801	AW54	26	18	450	5.5	S	Chaff Tempered Clay				2.73	15				15	0.19	1.02				1.02
801	AW54	26	18	450	5.5	S	Chaff Tempered Clay	Burnt			0.55	3				3	0.04	0.2				0.2
801	AW54	26	18	450	5.5	S	Ceramic	Diagnostic	Handle		0.36	2		1	1		2.54	13.99		12.22	1.77	
801	AW54	26	18	450	5.5	S	Ceramic	Diagnostic	Rim		0.18	1		1			2.22	12.22		12.22		
803	AW54	26	24	469	5	S	Ceramic	Body Sherd			4.00	20		7	7	6	7.18	35.91		30.29	4.8	0.82
803	AW54	26	24	469	5	S	Ceramic	Diagnostic	Base		0.20	1		1			0.61	3.03		3.03		
803	AW54	26	24	469	5	S	Bone	Fragment			1.00	5			1	4	0.13	0.64			0.35	0.29
803	AW54	26	24	469	5	S	Bone	Burnt			0.20	1				1	0.02	0.1				0.1

HF	Unit	Locus	SG	Bag	Volume	Field	Material	Type	Part	Spec	Density	CountTotal	>25	>12.5	>8	>4	WeightDens	Weight Total	Weight >25	Weight >12.5	Weight >8	Weight >4
803	AW54	26	24	469	5	S	Chaff Tempered Clay				0.20	1				1	0.01	0.06				0.06
803	AW54	26	24	469	5	S	Chaff Tempered Clay	Burnt			0.80	4				4	0.10	0.5				0.5
803	AW54	26	24	469	5	S	Metal				0.20	1				1	0.11	0.57				0.57
807	AW54	26	23	462	7	S	Ceramic	Body Sherd			2.86	20	3	4	4	9	33.51	234.58	221.63	10.83	1.37	0.75
807	AW54	26	23	462	7	S	Bone	Fragment			1.14	8			1	7	0.12	0.83			0.23	0.6
807	AW54	26	23	462	7	S	Bone	Burnt			0.29	2				2	0.01	0.07				0.07
807	AW54	26	23	462	7	S	Chaff Tempered Clay				1.14	8				8	0.09	0.61				0.61
807	AW54	26	23	462	7	S	Chaff Tempered Clay	Burnt			0.57	4				4	0.09	0.64				0.64
808	AW54	26	19	497	5.5	S	Ceramic	Body Sherd			8.36	46	3	9	8	26	43.28	238.02	190.57	39.15	4.88	3.42
808	AW54	26	19	497	5.5	S	Bone	Fragment			0.91	5			1	4	0.10	0.56			0.13	0.43
808	AW54	26	19	497	5.5	S	Chaff Tempered Clay	Burnt			3.82	21			1	20	0.38	2.1			0.13	1.97
808	AW54	26	19	497	5.5	S	Chaff Tempered Clay				4.55	25				25	0.40	2.19				2.19
808	AW54	26	19	497	5.5	S	Shell	Eggshell			0.18	1				1	0.00	0.01				0.01
808	AW54	26	19	497	5.5	S	Botanical	Seed		Pisum	1.27	7				7	0.03	0.18				0.18
808	AW54	26	19	497	5.5	S	Shell			Terrestrial	0.18	1				1	0.01	0.04				0.04
831	AW54	39	19	517	5.5	S	Ceramic	Body Sherd			14.18	78	26	5	5	42	200.51	1102.8	1075.5	19.91	2.58	4.81
831	AW54	39	19	517	5.5	S	Ceramic	Diagnostic	Base		0.18	1		1			2.12	11.67		11.67		
831	AW54	39	19	517	5.5	S	Bone	Fragment			0.73	4			1	3	0.13	0.7			0.17	0.53
831	AW54	39	19	517	5.5	S	Bone	Burnt			0.73	4		1	1	2	0.29	1.62		1.05	0.25	0.32
831	AW54	39	19	517	5.5	S	Chaff Tempered Clay				19.09	105	1	12	38	54	14.96	82.29	16.38	43.74	14.52	7.65
831	AW54	39	19	517	5.5	S	Metal				0.36	2		2			3.36	18.5		18.5		
831	AW54	39	19	517	5.5	S	Chaff Tempered Clay	Burnt			6.36	35			9	26	1.14	6.25			3.1	3.15
831	AW54	39	19	517	5.5	S	Botanical	Seed			1.64	9				9	0.07	0.4				0.4
844	AW54	26	15	358	4	S	Ceramic	Body Sherd			0.50	2		1	1		0.96	3.85		3.04	0.81	
844	AW54	26	15	358	4	S	Glass	Fragment			0.25	1				1	0.02	0.07				0.07
844	AW54	26	15	358	4	S	Chaff Tempered Clay	Unburnt			3.25	13		1	2	10	4.73	18.92		17.11	0.91	0.9
459A	BS44	82	18	480	14	LW	Bone	Fragment			6.36	89			10	79	1.16	16.24			4.28	11.96
459A	BS44	82	18	480	14	LW	Bone	Burnt			0.79	11				11	0.07	0.98				0.98
459A	BS44	82	18	480	14	LW	Ceramic	Body Sherd			6.07	85		6	26	53	2.56	35.81		8.03	17.5	10.28
459A	BS44	82	18	480	14	LW	Ceramic	Diagnostic	Rim		0.36	5			2	3	0.14	1.98			0.65	1.33
459A	BS44	82	18	480	14	LW	Ceramic	Diagnostic	Painted		0.21	3				3	0.09	1.26				1.26
459A	BS44	82	18	480	14	LW	Chaff Tempered Clay	Unburnt			23.71	332		3	28	301	4.87	68.23		4.03	19.58	44.62
459A	BS44	82	18	480	14	LW	Chaff Tempered Clay	Burnt			14.71	206		5	13	188	3.45	48.24		11.73	10.36	26.15
459A	BS44	82	18	480	14	LW	Glass	Fragment			0.07	1				1	0.01	0.12				0.12
459A	BS44	82	18	480	14	LW	Botanical	Charcoal			0.36	5				5	0.01	0.17				0.17
459A	BS44	82	18	480	14	LW	Bone	Whole	Scale	Fish	0.07	1				1	0.00	0.01				0.01
459B	BS44	82	18	480	16	LW	Ceramic	Body Sherd			6.00	96		9	32	55	4.28	68.51		22.32	28.49	17.7
459B	BS44	82	18	480	16	LW	Ceramic	Diagnostic	Painted		0.13	2			2		0.18	2.84			2.84	
459B	BS44	82	18	480	16	LW	Bone	Fragment			4.75	76			10	66	1.35	21.57			5.94	15.63
459B	BS44	82	18	480	16	LW	Bone	Burnt			0.44	7				7	0.47	7.52				7.52
459B	BS44	82	18	480	16	LW	Bone	Whole	Vertebra	Fish	0.19	3				3	0.42	6.71				6.71
459B	BS44	82	18	480	16	LW	Bone	Whole	Scale	Fish	0.06	1				1	0.00	0.006				0.006
459B	BS44	82	18	480	16	LW	Chaff Tempered Clay	Unburnt			2.38	38			1	37	0.47	7.47			1.39	6.08
459B	BS44	82	18	480	16	LW	Shell	Limestone		Fossil	0.13	2				2	0.15	2.36				2.36
459B	BS44	82	18	480	16	LW	Chaff Tempered Clay	Burnt			0.81	13				13	0.10	1.57				1.57
459B	BS44	82	18	480	16	LW	Shell	Unburnt		Eggshell	0.31	5				5	0.00	0.06				0.06
459B	BS44	82	18	480	16	LW	Shell	Unburnt		Marine	0.31	5				5	0.00	0.05				0.05

Appendix E

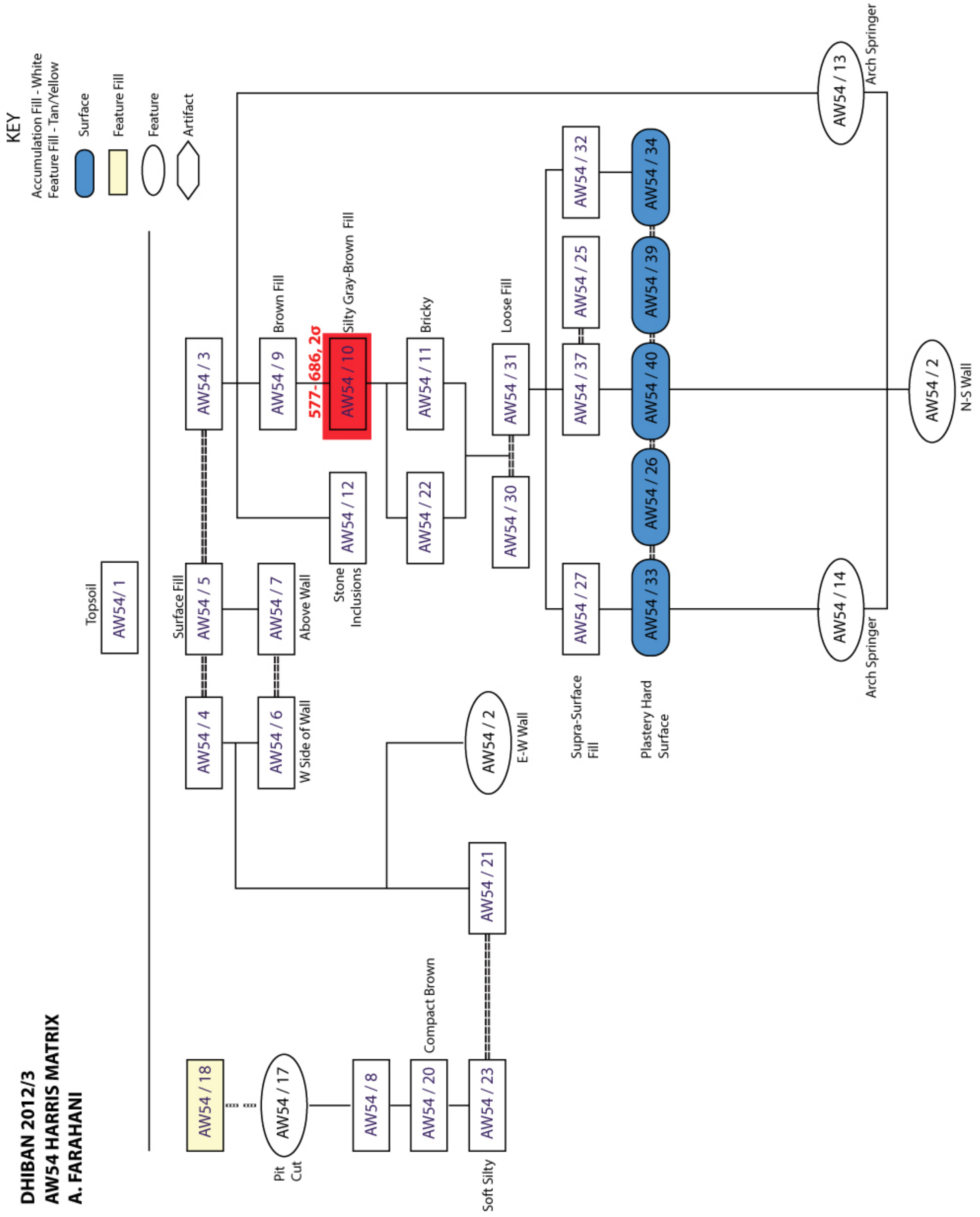
Wood Charcoal Data

FlotNum	Period	FractionSize	Samnum	Weight (g)	Potential ID	Hi-Mag Features	Low-Mag Features	ID_Confidenc
217	Byzantine	2mm	C1-1	0.072	Platanus orientalis	r-section: opposite ray-vessels, helical thickenings on rays, rays majority procumbent homocellular, t-section: very large, scalariform perf plates (in radial as well)	x-section: wide multiseriate rays, diffuse solitary vessels, angular, "ray flaring" around growth ring	3
217	Byzantine	2mm	C1-2	0.2636	Platanus orientalis	x-section: wide multiseriate rays, 5-15 seriate, diffuse		3
217	Byzantine	2mm	C2-1	0.1197	Platanus orientalis	r-section: opposite ray-vessels, scalariform perf plates t-	x-section: wide multiseriate rays, diffuse solitary	3
217	Byzantine	2mm	C2-2	0.2686	Platanus orientalis	x-section: wide multiseriate rays, diffuse solitary vessels,		3
217	Byzantine	2mm	C3	0.1644	Zizyphus spina-christi	r-section, majority rays upright homocellular with some procumbent, alternate ray-vessels, no thickenings visible, t-section: ~2-7 cell rows uniseriate	x-section: uniseriate rays, diffuse solitary pores, multiple small pores	3
217	Byzantine	2mm	C4-1	0.0392	Zizyphus spina-	r-section, majority rays upright homocellular with some	x-section: exclusively uniseriate rays, diffuse vessels	
217	Byzantine	2mm	C4-2	0.0492				
217	Byzantine	2mm	C5	0.0823	Platanus orientalis	r-section: opposite ray-vessels, scalariform perf plates t-	x-section: wide multiseriate rays, diffuse solitary	
217	Byzantine	2mm	C6	0.2906				
217	Byzantine	2mm	C7	0.1626				
217	Byzantine	2mm	C8	0.0893	Platanus orientalis	x-section: wide multiseriate rays, 2-7 seriate, diffuse-	x-section: see hi-mag	
217	Byzantine	2mm	C9	0.1135				
217	Byzantine	2mm	C10	0.0218				
217	Byzantine	2mm	C11	0.1172				
217	Byzantine	2mm	C12	0.128				
217	Byzantine	2mm	C13	0.33				
217	Byzantine	2mm	C14	0.0557				
217	Byzantine	2mm	C15	0.2709				
217	Byzantine	2mm	C16	0.208				
217	Byzantine	2mm	C17	0.1087				
217	Byzantine	2mm	C18	0.0684				
217	Byzantine	2mm	C19	0.1761				
217	Byzantine	2mm	C20	0.3753				
305	Byzantine	2mm	C1	0.0125	cf. Pistacia	x-section: biseriate and 3 seriate rays, sparse vessels, r-		2
306	Byzantine	2mm	C1	0.0769	cf. Pistacia			
306	Byzantine	2mm	C2	0.0052				
313	Middle Islamic	2mm	C1	0.0688				
313	Middle Islamic	2mm	C2	0.1128				
313	Middle Islamic	2mm	C3	0.3937				
313	Middle Islamic	2mm	C4	0.0481				
314	Middle Islamic	2mm	C1	0.0906	Salicaceae	x-section: exclusively uniseriate rays, r-section: helical	x-section: uniseriate rays, diffuse porous vessels,	3
314	Middle Islamic	2mm	C2	0.0503			x-section: uniseriate or multiseriate rays (?), diffuse to	
314	Middle Islamic	2mm	C3	0.0054	Salicaceae	x-section: exclusively uniseriate rays, r-section: helical	x-section: uniseriate rays, diffuse porous vessels,	
314	Middle Islamic	2mm	C4	0.0111				
314	Middle Islamic	2mm	C5	0.0111				
318	Middle Islamic	2mm	C1			r-section: majority square to upright ray cells, about 8-10	x-section: badly preserved, majority vessels solitary(?),	
338	Byzantine	2mm	C1	0.0125	cf. Pistacia	x-section: solitary infrequent vessels, 3-4seriate observed, with alternating uniseriate sometimes biseriate, r-section: majority upright cells then 3-4 rows of procumbent		3
338	Byzantine	2mm	C2	0.0243	cf. Pistacia	x-section: solitary infrequent vessels, 3-4seriate observed,		2
338	Byzantine	2mm	C3	0.0233	cf. Pistacia	x-section: solitary infrequent vessels, 3-4seriate observed,		
338	Byzantine	2mm	C4	0.0197				
338	Byzantine	2mm	C5	0.0331		x-section: exclusively biseriate and uniseriate rays		
338	Byzantine	2mm	C6	0.031				2
353	Middle Islamic II	2mm	C1					
353	Middle Islamic II	2mm	C2	0.034	Quercus		x-section: vessels exclusively solitary, arranged in radial pattern, dendritic pore pattern, multiple uniseriate rays, ring-porous	
353	Middle Islamic II	2mm	C3	0.0212	cf. Pistacia		x-section: radial multiples, not solitary pores, bi to 3 seriate, r-section: heterocellular procumbent with 1 series of square-upright cells, inter-vessel pits hard to identify, initially scalariform but could be alternate in slit like apertures	1
353	Middle Islamic II	2mm	C4	0.0584	cf. Pistacia	t-section: clear multi-seriate rays, 3 to 6 seriate	x-section: radial multiples, multiseriate rays	1

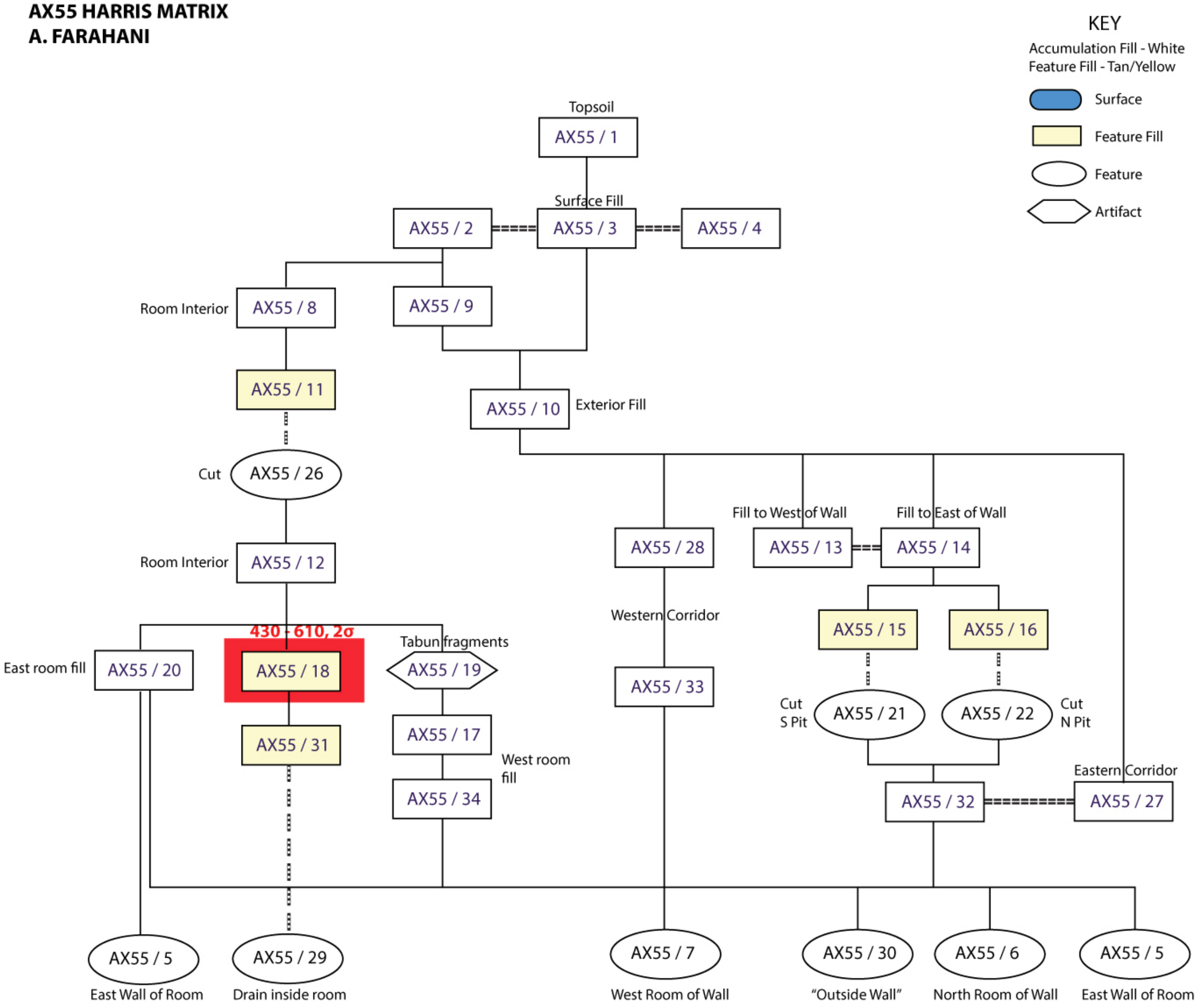
FlotNum	Period	FractionSize	Samnum	Weight (g)	Potential ID	Hi-Mag Features	Low-Mag Features	ID_Confidenc
353	Middle Islamic II	2mm	C5	0.0312				
353	Middle Islamic II	2mm	C6	0.0669				
353	Middle Islamic II	2mm	C7	0.0568	Zizyphus spina-christi	t-section: uniseriate and biseriate, r-section: heterocellular, some upright, some procumbent, inter-vessel pits apparently alernate in slit-like apertures, x-section: vessels solitary, in pairs, and occasionally in multiples, radially arranged, uni and bi seriate rays		
353	Middle Islamic II	2mm	C8	0.0534				
353	Middle Islamic II	2mm	C9	0.0308				
354	Middle Islamic II	2mm	C1	0.029	Salicaceae	x-section: exclusively uniseriate rays, r-section: TBD	x-section: diffuse porous, manyy solitary and tuple vessels(nothing observed greater than pairs of two), exclusively uniseriate rays	4
354	Middle Islamic II	2mm	C2	0.0054	Salicaceae	see above	see above	3
354	Middle Islamic II	2mm	C3	0.0021	Salicaceae	see above	see above	
354	Middle Islamic II	2mm	C4	0.0172		t-section: clear multiseriate rays, bi to 4 seriate	x-section: solitary and tuple vessels, not enough of growth ring to assess porosity, wide multiseriate rays	1
355	Middle Islamic II	2mm	C1			x-section: biseriate and 3seriate rays, vessels sparse, some clusters, many solitary,		
358	Middle Islamic II	2mm	C1	0.0769	cf. Pistacia	r-section: observed alternate inter-vessel pits	x-section: biseriate and 3seriate rays, vessels sparse, some chains, many solitary, bands of radial parenchyma present	4
358	Middle Islamic II	2mm	C2	0.0339	Zizyphus spina-christi	r-section: "weakly heterocelluar" large walls of mostly square but some upright cells (>40), alternate inter-vessel pits, t-section: not observed	x-section: diffuse porous, mostly solitary vessels, some in tuples and 3/4-chains, multiseriate rays	3
358	Middle Islamic II	2mm	C3	0.022	Zizyphus spina-christi	see above	see above	see above
358	Middle Islamic II	2mm	C4	0.0373	Zizyphus spina-christi	see above	see above	see above
358	Middle Islamic II	2mm	C5	0.0345				
358	Middle Islamic II	2mm	C6	0.2443				
359	Middle Islamic II	2mm	C1	0.0908			x-section: diffuse porous, wide multiseriate rays	
359	Middle Islamic II	2mm	C2	0.0816			x-section: diffuse porous, wide multiseriate rays	
359	Middle Islamic II	2mm	C3	0.0727	Zizyphus spina-christi		x-section: diffuse porous, uniseriate rays	
359	Middle Islamic	2mm	C4	0.1832				
359	Middle Islamic	2mm	C5	0.1644				
359	Middle Islamic	2mm	C6	0.1442				
359	Middle Islamic	2mm	C7	0.0814				
359	Middle Islamic	2mm	C8	0.3309				

Appendix F

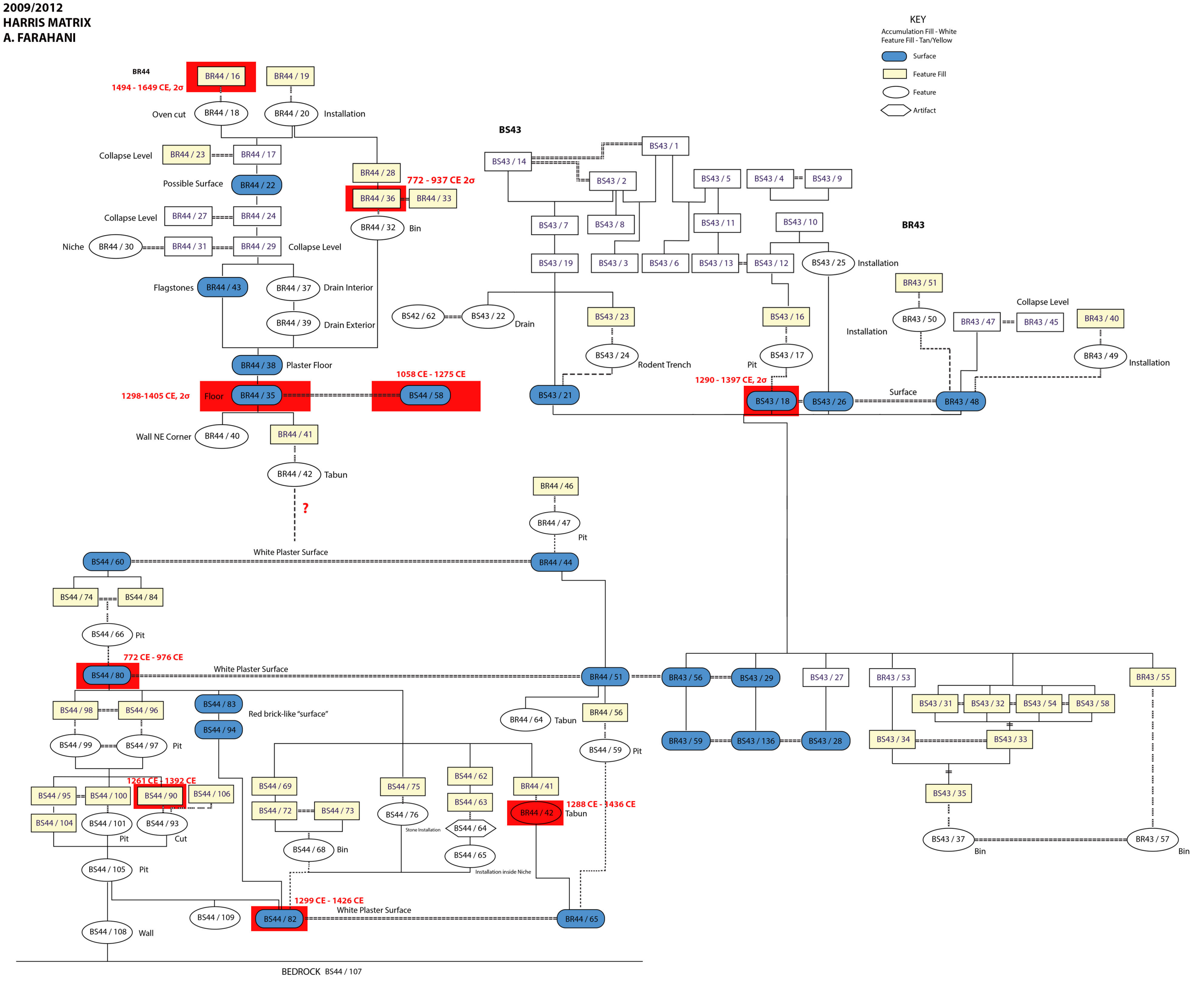
Harris Matrices

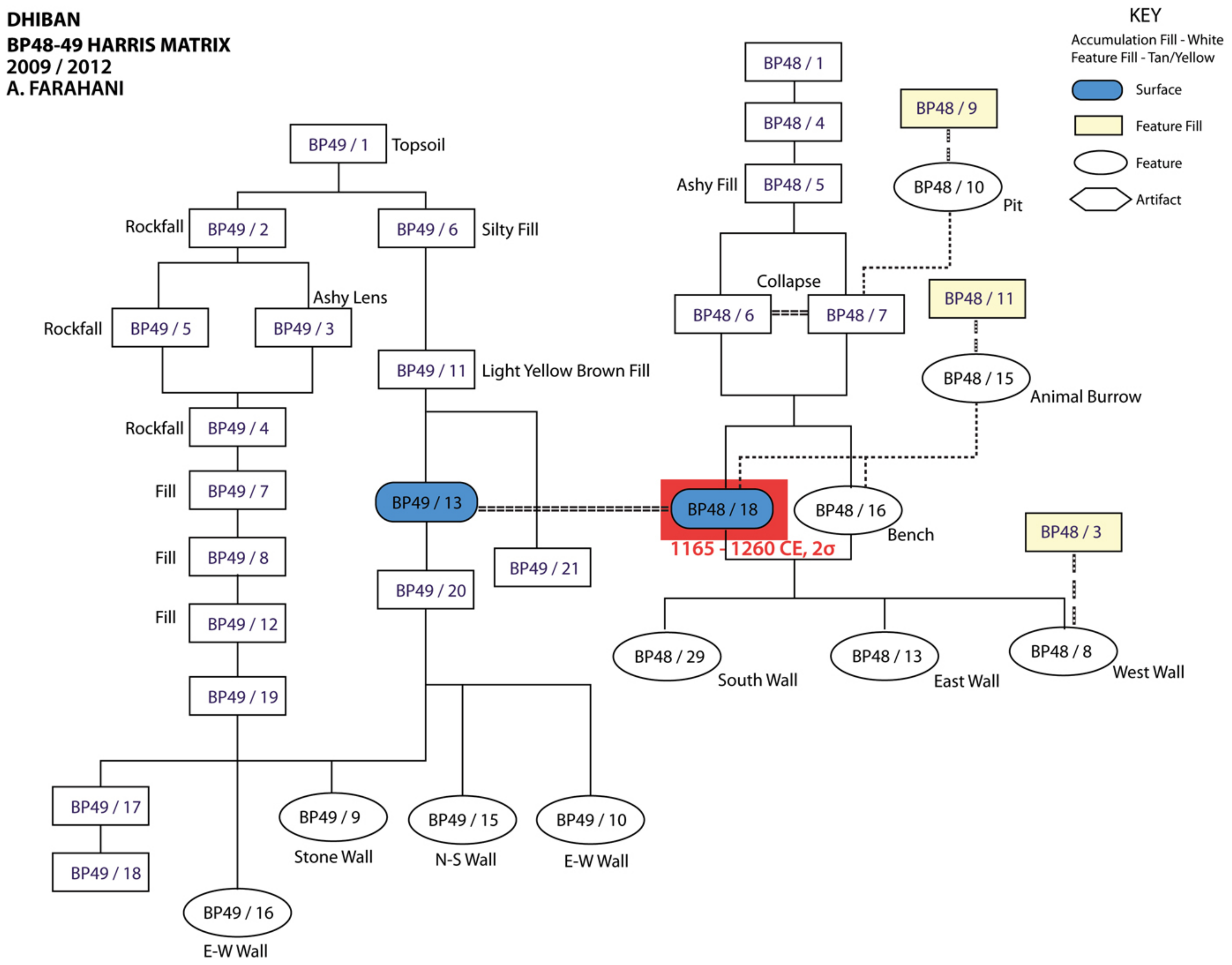

DHIBAN 2012/3
AW54 HARRIS MATRIX
A. FARAHANI
KEY
Accumulation Fill - White
Feature Fill - Tan/Yellow
Surface
Feature Fill
Feature
Artifact
Topsoil
AW54/ 1
AW54 / 18
Pit Cut
AW54 / 17
AW54 / 8
AW54 / 20
Compact Brown
AW54 / 23
Soft Silty
AW54 / 21
AW54 / 4
AW54 / 5
Surface Fill
AW54 / 3
AW54 / 6
W Side of Wall
AW54 / 7
Above Wall
AW54 / 9
Brown Fill
AW54 / 2
E-W Wall
AW54 / 12
Stone Inclusions
577-686, 2σ
AW54 / 10
Silty Gray-Brown Fill
AW54 / 22
AW54 / 11
Bricky
AW54 / 30
AW54 / 31
Loose Fill
Supra-Surface Fill
AW54 / 27
AW54 / 37
AW54 / 25
AW54 / 32
Plastery Hard Surface
AW54 / 33
AW54 / 26
AW54 / 40
AW54 / 39
AW54 / 34
AW54 / 14
Arch Springer
AW54 / 13
Arch Springer
AW54 / 2
N-S Wall

DHIBAN 2012
AX55 HARRIS MATRIX
A. FARAHANI



DHIBAN BARREL-VAULTED ROOM
2009/2012
HARRIS MATRIX
A. FARAHANI




DHIBAN
BP48-49 HARRIS MATRIX
2009 / 2012
A. FARAHANI
KEY
Accumulation Fill - White
Feature Fill - Tan/Yellow
Surface
Feature Fill
Feature
Artifact
BP49 / 1
Topsoil
BP49 / 2
Rockfall
BP49 / 6
Silty Fill
BP49 / 5
Rockfall
BP49 / 3
Ashy Lens
BP49 / 11
Light Yellow Brown Fill
BP49 / 4
Rockfall
BP49 / 7
Fill
BP49 / 8
Fill
BP49 / 12
Fill
BP49 / 19
BP49 / 13
BP49 / 21
BP49 / 20
BP49 / 17
BP49 / 18
BP49 / 16
E-W Wall
BP49 / 9
Stone Wall
BP49 / 15
N-S Wall
BP49 / 10
E-W Wall
BP48 / 1
BP48 / 4
BP48 / 5
Ashy Fill
Collapse
BP48 / 6
BP48 / 7
BP48 / 9
BP48 / 10
Pit
BP48 / 11
BP48 / 15
Animal Burrow
BP48 / 18
1165 - 1260 CE, 2σ
BP48 / 16
Bench
BP48 / 3
BP48 / 29
South Wall
BP48 / 13
East Wall
BP48 / 8
West Wall

Appendix G

AMS Radiocarbon Data

DHBC14Num	LabNum	Bag	Unit	Locus	SG	Type	Uncal BP	Error	d13C	Weight (g)	Frac	FlotNum	LowerCal1σ	UpperCal1σ	LowerCal2σ	UpperCal2σ	CalibMethod	Calibsoft
DHB-RC-20	OxA-23489	14	CJ8	2		Charcoal	1.11	0	-24.2		>2mm	PT5	MODERN	MODERN	MODERN	MODERN	IntCal09	Oxcal4.1.7
DHB-RC-6b	OxA-23486	215	BR44	16		Charcoal	263	24	-22.5	0.2861	>2mm	no flot	1530	1664	1522	1799	IntCal09	Oxcal4.1.7
DHB-RC-19	OxA-23488	14	DM17	2		Charcoal	291	23	-21.9		>2mm	PT4	1524	1649	1515	1648	IntCal09	Oxcal4.1.7
DHB-RC-6a	OxA-23485	215	BR44	16		Charcoal	306	23	-22.7	0.2861	>2mm	no flot	1522	1644	1494	1649	IntCal09	Oxcal4.1.7
DHB-RC-9	AA100551	435	BS44	82	24	Triticum	573	38	-22	0.0086	>2mm	362	1316	1413	1299	1426	IntCal09	Oxcal4.2
DHB-RC-11	AA100553	513	BR44	42	4,5	Hordeum	578	65	-24	0.0082	>2mm	361	1305	1415	1288	1436	IntCal09	Oxcal4.2
DHB-RC-5	OxA-23484	414	BR44	35	2	Triticum	605	24	-20.7	0.0115	>2mm	230	1306	1396	1298	1405	IntCal09	Oxcal4.1.7
DHB-RC-2	OxA-23457	234	BS43	18	18	Triticum	626	23	-20.7	0.0154	>2mm	212	1298	1391	1290	1397	IntCal09	Oxcal4.1.7
DHB-RC-22	AA101219		CL13	9		Vicia	683	37	-20.4	0.0067	>2mm	321	1275	1385	1265	1392	IntCal09	Oxcal4.2
DHB-RC-18	AA100560	445	BS44	90	17,22	Hordeum	690	37	-24.8	0.0086	>2mm	363	1274	1383	1261	1392	IntCal09	Oxcal4.2
DHB-RC-4	OxA-23574	192	BS44	58	19	Triticum	825	37	-20.8	0.0141	>2mm	225	1185	1259	1058	1275	IntCal09	Oxcal4.1.7
DHB-RC-1	OxA-23456	213	BP48	18	18	Triticum	832	24	-20.7	0.0136	>2mm	200	1184	1252	1165	1260	IntCal09	Oxcal4.1.7
DHB-RC-10	AA100552	285	BS44	80	24	Hordeum	1167	38	-23.9	0.0103	>2mm	353	781	938	772	976	IntCal09	Oxcal4.2
DHB-RC-3	OxA-23483	400	BR44	36		Triticum	1190	24	-21.8	0.0159	>2mm	210	783	880	772	937	IntCal09	Oxcal4.1.7
DHB-RC-13	AA100555	148	AW54	10	8	Vitis	1391	39	-25.3	0.0084	>2mm	306	616	665	577	686	IntCal09	Oxcal4.2
DHB-RC-14	AA100556	93	AX54	6		Hordeum	1404	39	-24.8	0.0055	>2mm	217	611	659	579	675	IntCal09	Oxcal4.2
DHB-RC-12	AA100554	251	AX55	18		Triticum	1524	38	-22.1	0.0056	>2mm	343	442	597	430	610	IntCal09	Oxcal4.2
DHB-RC-21	OxA-23490	17	DM17	5		Charcoal	1856	26	-22.5		>2mm	PT9	126	215	85	229	IntCal09	Oxcal4.1.7
DHB-RC-15	AA100557	92	BR47	9		Hordeum	1918	45	-22.5	0.0076	>2mm	220	26	131	-35	219	IntCal09	Oxcal4.2
DHB-RC-16	AA100558	80	BR47	10		Triticum	1963	39	-22.2	0.0084	>2mm	215	-20	79	-45	125	IntCal09	Oxcal4.2
DHB-RC-24	AA101221		CL13	13		Charcoal	2485	40	22.9	0.0176	>2mm	319	761	540	774	485	IntCal09	Oxcal4.2
DHB-RC-7	OxA-23575	127	L-sect	20	4.1	Hordeum	2511	30	-20	0.0048	>2mm	283	-770	-553	-789	-538	IntCal09	Oxcal4.1.7
DHB-RC-23	AA101220		CL13	12		Charcoal	2539	46	-24	0.0222	>2mm	322	794	590	804	521	IntCal09	Oxcal4.2
DHB-RC-17	AA100559	33	BR47	6		Hordeum	2837	41	-22.1	0.008	>2mm	245	-1048	-927	-1128	-899	IntCal09	Oxcal4.2
DHB-RC-8	OxA-23487	174	L-sect	24	4.1	Hordeum	2907	26	-20.2	0.0086	>2mm	293	-1187	-1041	-1209	-1010	IntCal09	Oxcal4.1.7