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DIGGING DEEPER: TECHNICAL REPORTS FROM THE DHĪBĀN EXCAVATION AND DEVELOPMENT PROJECT (2004-2009) ¹

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Introduction

The Dhiban Excavation and Development Project (hereafter DEDP) integrates archaeological practice with sustainable site development. The project's focus is the site of Tall Dhibān (**Fig. 1**) where the DEDP has excavated for four seasons (2004, 2005, 2009 and 2010). Overall, the project has focused on recovering data that assists in the reconstruction of local societies from the site's earliest habitation (Early Bronze 1b, *circa* 3100 BCE) to the modern day. To further this understanding, research objectives during these seasons have included:

1. Creating a digital topographic site map for use in Geographic Information Systems (GIS) software.
2. Re-excavating and improving excavation areas from former projects (especially "Area L" on the uppermost part of the site).
3. Linking human activities to local environmental data at various periods of occupation.
4. Co-ordinating excavation with the Department of Antiquities' conservation and preservation efforts, and preparing the site for public presentation.

The following reports represent a significant step forward in our understanding of human activities at Dhibān, particularly regarding the nature of the Middle Islamic settlement and human activities during the site's recent history (Byzantine to present day). This article presents information about Dhibān's local environment, then discusses the creation of the digital site map that has aided researchers' understanding of the size

and occupational history of the site. The article also includes preliminary information on the glass, faunal and palaeoethnobotanical remains at the site. The article concludes with a discussion of how the DEDP envisions integrating archaeological excavation with the community and twenty-first century digital media. Information in this article complements and expands upon the information available in earlier *ADAJ* articles about the DEDP's research (Porter *et al.* 2005; Porter *et al.* in press).

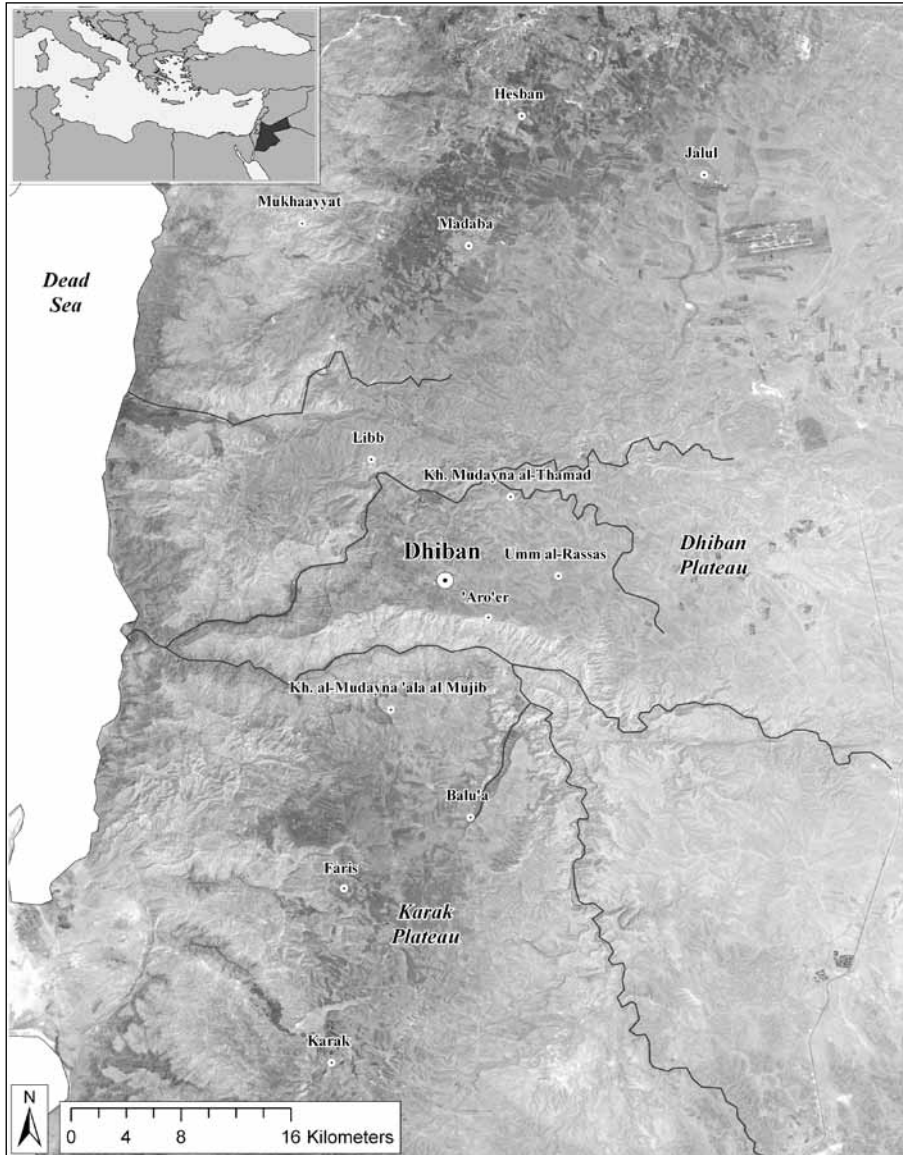
Palaeolandscape Assessment: Landscape and Hydrology

Dhibān is located on the Dhibān Plateau, which forms the southern edge of the Wādī al-Wālā watershed (**Fig. 1**). The site is flanked by the Wādī Sakrān to the west and Wādī Dhibān to the north. These local incised valleys effectively isolate the *tall* as a topographic feature distinct from the adjacent town and agricultural land. On a regional scale, the Dhibān Plateau is formed by the deeper wadi systems of the Wādī al-Wālā to the north and the Wādī al-Mūjīb to the south. While both of these larger systems contain water year-round, the pluvial inputs of these systems are not identical. Local topography indicates that the Wādī al-Mūjīb would not receive hydrologic inputs from rainfall in the Dhibān region, which would instead flow into the Wādī al-Wālā system and west to the Dead Sea.

Incision within these wadi systems was a function of hydrologic inputs and regional tec-

1. This article is the first of two bringing *ADAJ* readers up to date on the DEDP's research at Dhibān. It contains reports on mapping, the environment, numismatic data, glass finds, plant and animal remains, and digital documentation. The second article, which will appear

in the next issue of *ADAJ*, contains specific information regarding on-site survey, excavation, architectural phasing and preliminary ceramic vessel reports from the 2009 and 2010 seasons.



1. Map showing the location of Dhibān in west-central Jordan and related topographic features. Note Dhibān's central location between Wādī al-Wālā to the north and Wādī al-Mūjib to the south.

tonics. More localized wadi systems are relatively shallow, whereas larger systems downstream from local drainages form significantly deeper valleys. The geomorphic expression of these wadi systems reflects stream order as well as headward adjustments to base level changes during the Quaternary (e.g., de Jaeger and de Dapper 2002). However, the fact that archaeological construction at Dhibān occurs at the base of the site, almost within the local wadi systems, also indicates that minimal downcutting has occurred during historic periods. Wadi incision in these upstream areas was likely more frequent during periods of higher rainfall and wetter climatic conditions, which occurred during the Pleistocene (Cordova 2007). The last several thousand years seem to have resulted in minimal

downcutting and nominal sediment accumulation in the wadi channels immediately adjacent to Dhibān.

Despite the presence of several large regional faults and folds (al-Hunjul 1993a, 1993b), the limestone bedrock in the immediate area of Tall Dhibān exhibits minimal localized folding. Bedrock instead maintains a flat to slightly dipping (primarily to the south-east, though significant local variation exists) orientation. Local topography has been defined by the erosional action of the wadi networks examined above, creating isolated high points despite a lack of evident localized uplift. Wadi formation and morphology has been determined in part by bedrock (de Jaeger and de Dapper 2002), particularly in regions north of Tall Dhibān where wadi systems are

significantly incised. Despite their depth, these wadis remain passable on foot.

The expression of the landscape around Dhibān has likely been maintained without significant changes since at least Roman times, and potentially throughout the period of habitation of the site. The lack of recent incision within wadi drainages, paired with limited soil development and minimal sedimentary inputs, leaves a landscape affected primarily by degradational processes. The Dhibān Plateau as a whole has been exposed to significant fluvial and aeolian activity during the Quaternary, and erosion has been the dominant geologic process in this area during the Holocene. While this means that wadi systems in this region are more likely to have had sedimentary deposits removed than to have preserved depositional records, it also indicates a level of exposure for historical periods that may be a benefit to archaeological investigations.

Quaternary deposits, including those associated with the archaeological sediments of the site, occur directly on the Cretaceous limestone bedrock. In the immediate area of Dhibān, Quaternary deposits consist of minimal soil thicknesses, designated as Red Mediterranean soils (Cordova *et al.* 2005). Soil formation has occurred largely within colluvial deposits, which vary from large slides and rock falls to finer-scale deposition resulting from sheetwash events. Slopes within the wadis are steep and subject to continual degradation owing to the grazing of local sheep and goats as well as both animal and human foot traffic. Soil preservation on the site proper is also minimal due to the extensive anthropogenic alteration of the site itself.

Due to the limited sedimentary archive present in the Dhibān region, colluvial deposits may reveal more about local landscape changes, including human activities and climatic events, than other sedimentary sources. Limited excavations into the colluvial deposits preserved behind wall construction within the nearby Wādī Sakrān reveal surface soils poor in organic material on top of alternating beds of coarse gravels and fine-grained peds. These beds are inclined toward the wadi, supporting the hypothesis of colluvial deposition alternating with periods of stability.

Gravels found behind the base of constructed

walls contain rounded clasts, which indicate fluvial deposition and transport as opposed to a colluvial origin. Walls were therefore constructed in trenches dug into extant wadi deposits. The presence of architectural features within local wadi bottoms may indicate a need to stabilize local hillsides against further degradation. Repeated episodes of colluvial deposition, followed by landscape stability, may indicate that colluvial action has responded to environmental triggers, possibly in the form of human activities further upslope or changes in local climatic conditions. Hypotheses developed by Cordova (1999) and others suggest that regional sedimentary accumulation within wadi systems may correlate with agriculturally induced soil degradation on local hillsides. Although a limited amount of pottery found within trenches indicates that these colluvial deposits correspond with periods of occupation at the site, further chronological control as well as sampling for agricultural indicators will be necessary to make any claims of causation for hillslope sediments at the site. Beyond the immediate site of Dhibān, the Dhibān Plateau has many similarly steep slopes into local wadi systems. Agricultural terraces are commonly found on these slopes, both as actively farmed fields and as abandoned architectural features. Some remnant wall construction can also be identified within wadi bottoms, suggesting that hillslope stabilization was necessary throughout the region, or that a single cultural group made use of wadi hillsides across the Plateau.

Investigations into palaeohydrology and palaeolandscape stability at Dhibān have only recently become a focus for the DEDP, and the latest observations represent the results of initial investigations into the nature of the historic landscape of the Plateau beyond the site proper. As work progresses on these wider-scale investigations, new insights will be forthcoming on the relationship between Dhibān's inhabitants and the Plateau's environment.

Topography and GIS

The purpose of the 2009-10 topographic survey was to consolidate and refine all previously collected survey data within a GIS. The project adopted ArchGIS for this purpose. To gain meaningful results from the GIS, a total cover-

age resolution of less than one meter for the site was required. In addition, selected areas were mapped at a higher resolution (<0.5m) to enable further analysis by the geoarchaeological team. The work was undertaken by Andrew T. Wilson with the help of undergraduate students from Knox College, the University of Liverpool and the University of California, Berkeley.

Several gaps existed in the earlier survey data. To identify areas which required refinement, a Triangular Irregular Network (TIN) was calculated using the 2004 - 05 survey point data. A TIN is the process by which all points within the survey area are connected using a series of triangles. Each triangle indicates the distance to the next point, the longer the triangles, the larger the distance between each control points. Areas with longer distances between control points indicate areas of the survey lacking in control points. Areas were re-surveyed if there was more than one meter between control points. The survey area was expanded in the 2009 - 10 seasons into the local wadi systems, requiring the addition of many survey points.

The new survey data proved vital in the creation of the digital site map and elevation model. Wilson processed the raw survey data in Arch-GIS to produce a digital elevation model (DEM) and one meter contour map for the site and its immediate environs (**Fig. 2**). The creation of the DEM has enabled further excavation and analysis (**Figs. 3 and 4**). Chief was the re-calculation of site size, now estimated at 12 hectares rather than the 2.5 to 7.5 hectares identified in earlier ASOR excavation reports (Winnett and Reed 1964: 5, 39, n2). The DEM also aided in the identification of terraces, several of which had received no archaeological attention up to this point and may prove important in understanding long-term settlement history.

Glass Objects from Dhibān 2004-2009: Preliminary Report

Between 2004 and 2009, 903 glass fragments dating from the Late Hellenistic to modern periods were excavated at Dhibān. Though glass from archaeological sites is most often used to investigate trade and issues of dating, this corpus yields information about household activities as well as a more specific glimpse into the lives of women and children at the site.

Glass Vessels / Housewares

To date, most of the glass from Dhibān has been excavated from mixed contexts. Much of it is found within the fill of a Middle Islamic building and courtyard complex situated on the acropolis (**Fig. 4**; Porter *et al.* 2005; Porter *et al.* in press; Porter 2010; Routledge *et al.* in press), though it dates from a variety of periods.

Hellenistic-Early Roman Period

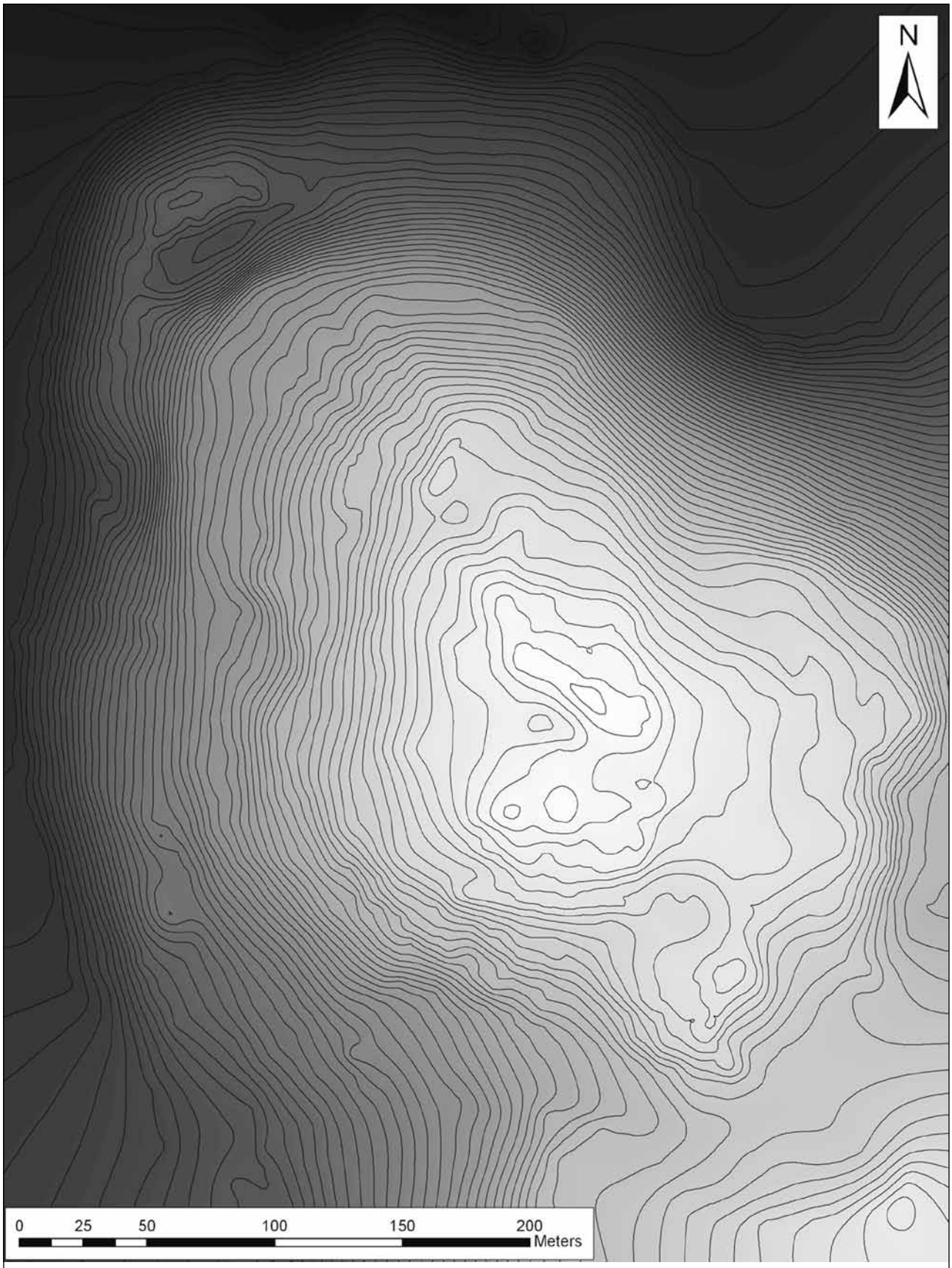
Within this period at Dhibān, we find a glass corpus consisting primarily of tablewares, mostly cups and bowls. There are two fragments of bowls with internal lathe cuts that appear to be Early Roman blown renditions of the Late Hellenistic pillar-molded bowl type. Prior to the invention of glass-blowing, glass vessels were very precious objects. After that technological shift, glass became more readily available but also easier to break. This was a simple function of the thickness of the glass. The cast vessels were thicker and thus harder to break, while the blown vessels had thinner walls which were much more fragile (Fischer 2000: 115). The thicker glass could be transported great distances without fear of breakage; the same was not true for the blown vessels. This suggests the blown glass objects were produced regionally.

Late Roman - Byzantine Period

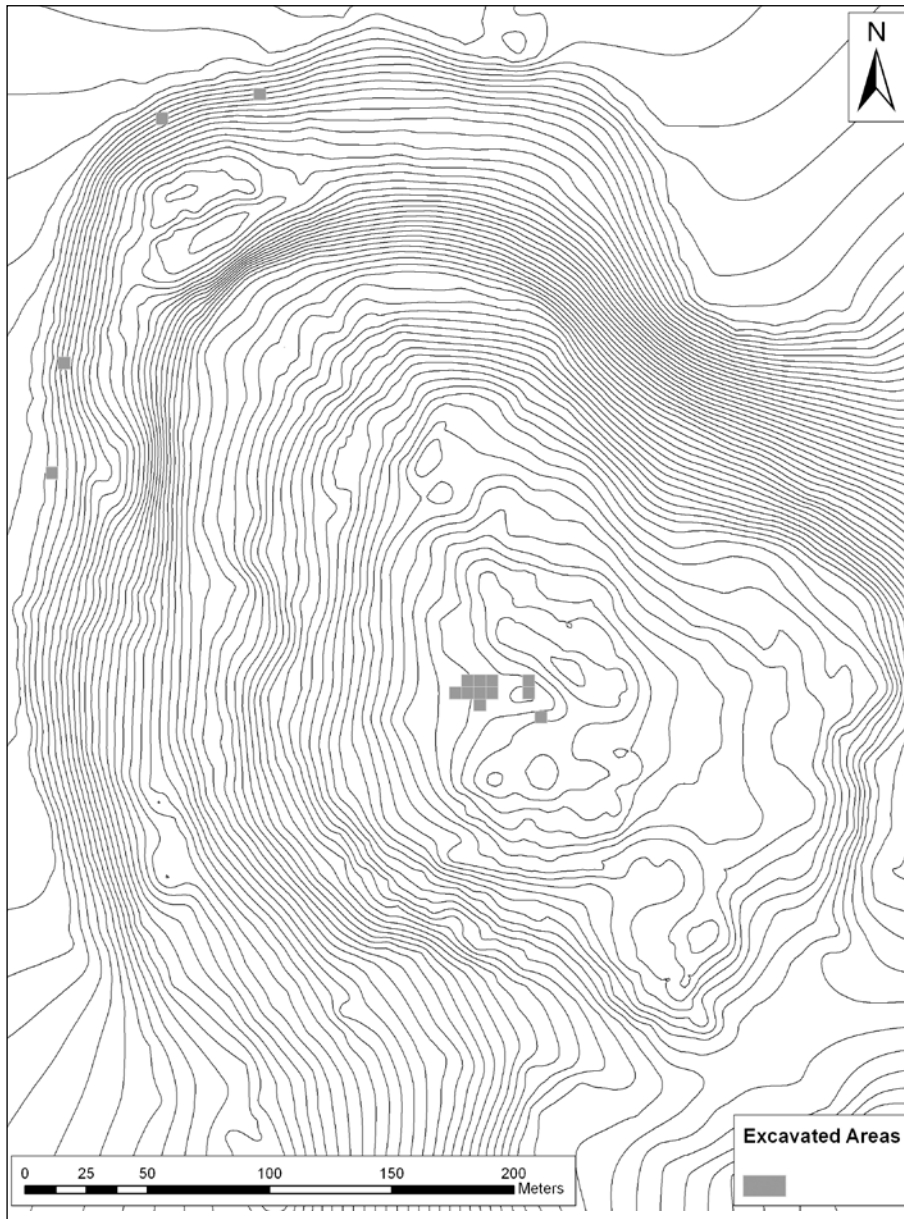
The Dhibān glass from these periods is again blown tablewares: cups, goblets, plates and bowls, with a few glass lamp fragments as well. There is one example of a 3rd-5th century blown lamp with blue dot decoration (parallel at Jalame (Weinberg 1988: 332)), as well as a 6th / 7th century lamp with ball stem (parallels at Sardis (Von Saldern 1980, pl. 23) and Nabretain (Fischer 2009: 343)). Here we begin to get a fuller picture of how glass was utilized within the household on a daily basis at the site.

Islamic Periods

The identifiable objects in the 2004-2009 corpus of Islamic glass consist almost exclusively of bracelets, which will be discussed further in a separate section of this report. There are also many glass vessel fragments at the site and, though it is not possible to determine, some may be from Islamic period wares. A very preliminary look at the 2010 materials suggests a



2. Shaded Digital Elevation Model (DEM) created from survey data collected in 2004, 2005 and 2009.



3. Excavation areas (grey squares) overlaying Dhibān's topographic features.

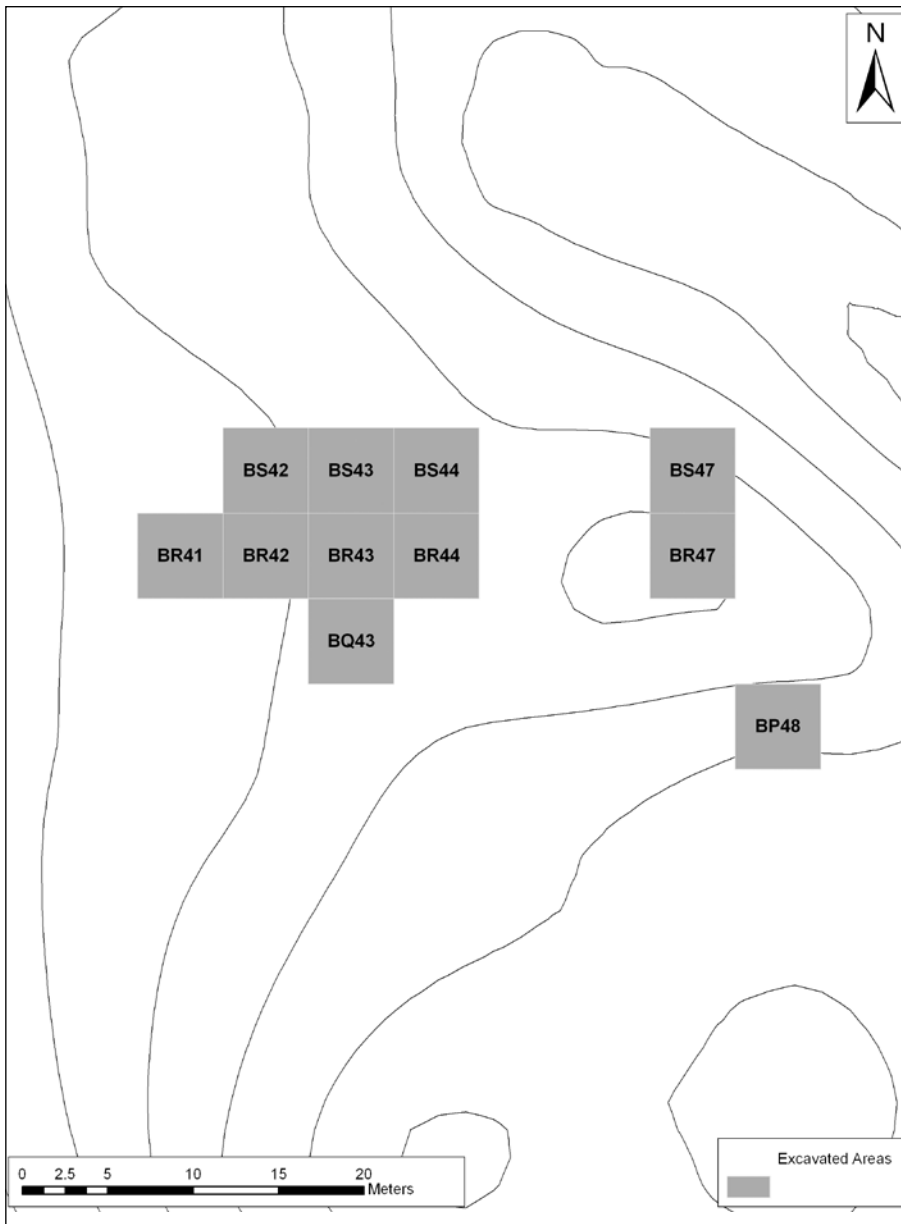
wider variety of glass objects from this period can be discussed in the future.

Modern Period

In the modern period, Pepsi and Coca-Cola bottles predominate. There are some alcohol bottle fragments as well as glass cups for tea. This shift away from tablewares to objects that can be used out-of-doors is indicative of the site's most recent use as a recreational get-away from the modern city of Dhibān. As in earlier periods, the glass can give us a vivid picture of the kinds of activities people have engaged in at the site.

Glass-Working

Thus far there has been only one potential indication that glass may have been worked at the site of Dhibān. Within the Middle Islamic courtyard area excavated in 2005 (BR41, 28, 122, 7; see Porter *et al.* in press) was a small piece of glass adhered to ceramic. This may be evidence that glass was being melted in ceramic installations at the site, but may also be a poorly fired glazed pot or the result of a fire at the site. At this time we have no conclusive evidence of glass-working. Due to the size of Dhibān, particularly in the Byzantine and Islamic periods, it is possible — but not necessarily the case —



4. Map of Dhībān's acropolis ("Area L") with DEDP excavation units labeled.

that glass was being formed into objects on-site. Alternatively, local consumers could have taken advantage of the thriving regional trade in glass objects, particularly from Hebron or Damascus.

Bracelets

The glass corpus from Dhībān contains 101 bracelet fragments, which represents 11.9 % of the glass fragments as a whole (total = 903). Once unreadable body fragments are removed from the corpus (527 of the total of 903), glass bracelets make up 28.7 % of the readable corpus. This figure is quite high compared to other sites in the region and indicates the bracelets should receive special attention when interpret-

ing the site.

The proliferation of bracelets was clear during the 2004 and 2005 seasons. Previous chemical analysis has suggested the bracelets may be understood as having three separate periods and places of origin (Salvant 2007). Two of the compositions are considered Levantine, with a change in flux between the Byzantine and Islamic periods (Salvant 2007; but see Fischer and McCray 1999). The third composition is identified as an import from South Asia. The black bracelets which predominate at the site (75 % of the fragments) appear to be made from this third compositional type. Salvant has proposed that "these bracelets were imported from India"

(2007: 61). Salvant is relating them to bangles analyzed by Brill (1987), none of which have a date later than 1250 AD (Salvant 2007: 62). Brill's dating does not suggest this composition was only used until the 13th century, but merely indicates the dates of the glass he was analyzing.

Turning to the morphology of the bracelets yields a range of possible dates. Many of the bracelet types are very simple; Spaer (1988; 1992) has dated these types to "Pre-Islamic onwards". Sixty-five of the 101 bracelet fragments fall into Spaer's types A2a, A2b, C1a, C1b and D1a. A further 24 of the bracelets are of types found primarily in the Middle Islamic period and later (Spaer's A4a, A4b and A5b). Given the locations of excavation and soil deposition at Dhībān, it is likely the majority of bracelets excavated in the Middle Islamic building complex on the acropolis — though in mixed fill — are from the Middle or Late Islamic periods. Three bracelets from the area seem to be of an Ottoman type with added decorations, but they differ from Spaer's typology enough that they may instead be Middle Islamic. It is also possible some of the bracelets date from the Bani Hamida occupation of the site. This group is known to have made pilgrimages to Hebron, where glass bracelets have been sold in large quantities for centuries.

The prevalence of glass bracelets at sites in the region begs the question of their use and importance in daily life. To date, most studies of glass bracelet assemblages have focused on their chemical compositions as a way to look at ancient trade and technology. Less attention has been paid to their function. This seems to be a modern bias, with researchers assuming bracelets functioned as simple adornment and status markers as they do today. Given ethnographic parallels as well as historical records, this may be an overly simplistic interpretation.

Bracelets were produced for both adults and children. We do not have data to suggest that glass bracelets were worn by adult males, but it appears they may have been worn by male children. That they were worn by both adults and children is shown by the various circumferences produced, as well as their appearance in grave goods. Also, what may seem to be a bracelet when in fragmentary condition can be identified as a ring, anklet or hair ornament when

circumference is considered. The purpose of the bracelets is unclear, though ethnographic parallels suggest they may have had apotropaic and / or healing functions in addition to being status markers. Future investigations of the Dhībān glass will consider these issues while continuing to look at the roles all types of glass objects played in the history of the site.

Faunal Evidence from Middle Islamic Dhībān: Interim Report on the 2005 Season

This report is a preliminary analysis of faunal specimens recovered from the 2005 excavation season at Tall Dhībān. The vast majority of the specimens came from Middle Islamic period levels, that is to say the post-construction phase of a building complex. A small portion of the assemblage came from the narrow L - SECT trench dating from the Iron Age to Byzantine periods, as described by Porter *et al.* (in press).

Methods

The analysts developed a methodological framework prior to analysis. Reference manuals were used in lieu of a modern reference collection, including those by Schmid (1972), Boessneck *et al.* (1964), Boessneck (1969) and Prummel and Frisch (1986). Questionable identifications were checked against modern specimens where available. Measurements are those described by von den Driesch (1976). We followed Payne (1973) and Zeder (1991: 93) in determining mortality patterns among sheep / goats through tooth eruption and wear analysis. Bone fusion stages are based on Silver (1969).

This report is based on the 2,542 specimens analyzed to date. 17 % of this assemblage (n = 447) was identified to skeletal element. Gnawing and breakage are based on these 447 specimens. Of these, 353 fragments could also be attributed to a specific taxonomic category (**Table 1**). The remaining specimens were counted (n = 2,095) and broadly classified by size (e.g., "large mammal").

Damage to the Assemblage

Many of the bones in the Dhībān assemblage show signs of wear and tear indicative of post-depositional surface exposure, such as weathering. The majority of specimens show at least light root etching, suggesting they spent some

Table 1: Taxa represented in the Tall Dhibān faunal assemblage.

Taxon	Common Name	Middle Islamic		Iron through Byzantine	
		NISP	Percent	NISP	Percent
<i>Bos taurus</i>	Cattle	45	14.1	1	3.0
<i>Ovis aries</i> / <i>Capra hircus</i>	Sheep or Goat	151	47.2	21	63.6
<i>Ovis aries</i>	Sheep	14	4.4	0	0.0
<i>Capra hircus</i>	Goat	29	9.1	1	3.0
<i>Equus asinus</i>	Donkey	9	2.8	1	3.0
<i>Equus caballus</i>	Horse	1	0.3	0	0.0
<i>Equus</i> sp.	Other equid	3	0.9	0	0.0
<i>Canis familiaris</i>	Dog	2	0.6	0	0.0
<i>Camelus</i> sp.	Camel	1	0.3	0	0.0
<i>Gallus gallus</i>	Chicken	4	1.3	0	0.0
Aves	Other bird	18	5.6	4	12.1
<i>Dama dama</i> / <i>Cervus elaphus</i>	Fallow deer or Red deer	1	0.3	0	0.0
<i>Gazella</i> sp.	Gazelle	4	1.3	0	0.0
<i>Capra aegagrus</i>	Wild goat	1	0.3	0	0.0
<i>Lepus</i> spp.	Rabbit	1	0.3	0	0.0
<i>Vulpes vulpes</i>	Fox	4	1.3	0	0.0
<i>Sus scrofa</i> (wild)	Wild pig	9	2.8	0	0.0
<i>Sus scrofa</i>	Other pig (domestic)	6	1.9	1	3.0
Fish	Fish	14	4.4	1	3.0
<i>Rana</i> sp.	Frog	1	0.3%	0	0.0%
Microfauna	Rodents and other small animals	2	0.6%	3	9.1%
Total		320		33	

time near or on the surface. The weathering displays no patterns by taxon or body part, suggesting that butchery waste and meal refuse were discarded similarly.

Dog and rodent activity also impacted the Tall Dhibān assemblage. 5% of the assemblage displays evidence for gnawing or digestion (17 specimens with dog gnawing; 6 specimens with rodent gnawing). Dog gnawing appears mainly on the elements' ends, while small bones of the foot frequently have a 'digested' appearance. Oddly, only two dog elements have so far been identified. Possibly, dogs were disposed of elsewhere. Rodent gnawing occurs mainly on the sharp edges of elements. Their presence is supported by a handful of rodent bones in the assemblage.

In spite of the evidence for potentially destructive weathering and gnawing, both a number of fish bones and small, friable specimens

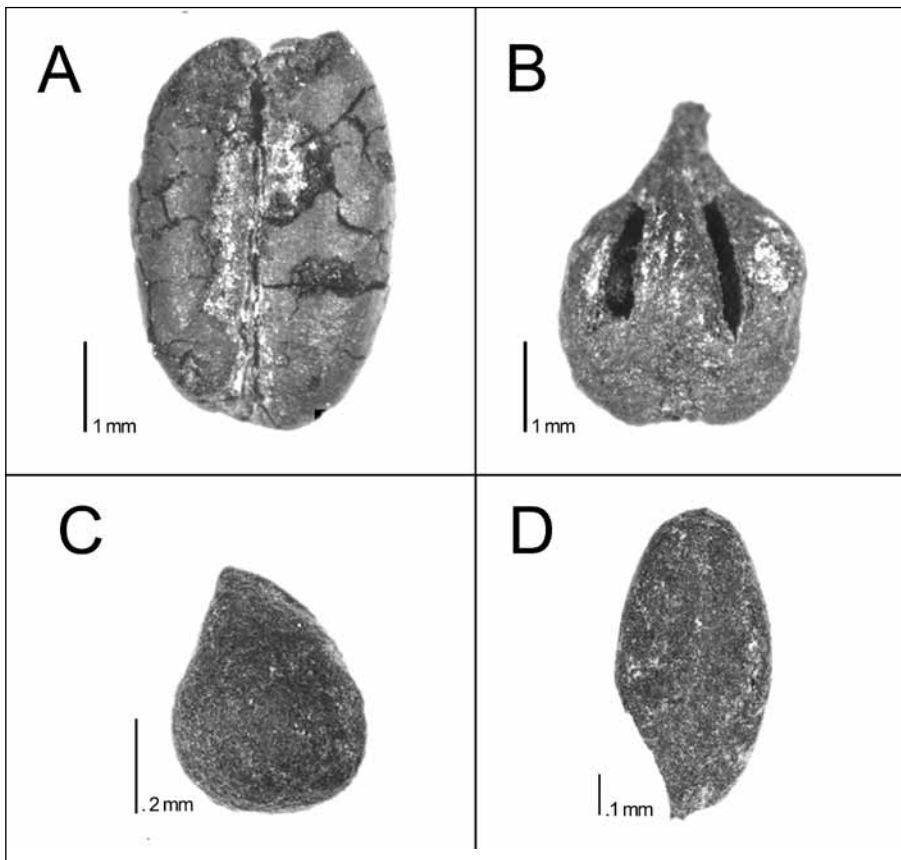
from very young individuals were recovered, attesting to careful recovery practices as well as favorable soil conditions.

8 % (n = 35) of the identified assemblage has butchery evidence, mostly in the form of slicing. The marks include ones from skinning, disarticulation, meat removal and marrow extraction; however, most relate to dismemberment. This is not surprising as dismemberment requires less skill than other processes and was likely to have been done quickly.

The Tall Dhibān Animals

The following results draw upon the specimens from the Middle Islamic period (**Table 1**). Details of the 33 identified specimens from the Byzantine – Iron Age trench are presented in **Fig. 5**, but are not discussed further.

Sheep and goats dominate the Middle Islamic assemblage, at 61 % overall. Goats are nearly



5. Four archaeological seeds from Middle Islamic contexts at Dhibān: (A) Wheat (*Triticum* sp.), (B) Grape (*Vitis vinifera*), (C) Fig (*Ficus carica*), (D) Canarygrass (*Phalaris* sp.).

twice as frequent as sheep (1.7 : 1). Sheep and goats were killed at young ages: mandibular tooth eruption and wear data on ten specimens indicates that over 50 % of ovicaprids were killed by the age of 12 months and 70 % were killed before reaching 24 months. Only two individuals reached maturity, one killed between 4 and 6 years and one reaching old age (>8 years). The latter were likely females maintained for breeding, whereas the majority of young animals were likely killed for meat.

These preliminary results are suggestive of a focus on young animals for meat production during the Middle Islamic period. Indeed, 8 of 9 sexed pelvises came from females, suggesting that milk production was not a focus. Dominance of young animals and females further suggests that Dhibān was a producing site, sending surplus young males for consumption elsewhere. The preference for goats reflects the arid environment of the site and that wool production was not important.

The next most common taxon in the assemblage is cattle, at 14 %. Bone fusion data indicate that cattle were killed at around 2.5 years,

before maturity. From tooth data, however, we know that some mature cattle were present. Pathologies observed on 20 % of toe bones suggest the use of older individuals for labor. The assemblage produced only two pelvis fragments, both from females. Despite evidence that cattle were slaughtered young, the inhabitants may not have consumed much beef: more than 80 % of the cattle elements are from non-meat-bearing parts of the carcass.

The third most common mammalian taxon in the Tall Dhibān assemblage is pig. These 15 fragments make up 4.7 % of the assemblage. The majority of specimens come from wild boar. Boar may have arrived at the site in portions; this is suggested by some articulating bones (a distal tibia with an attached astragalus and calcaneus). However, a high occurrence of foot bones (80 % of the pig sample) suggests that, like cattle, pigs may have been butchered at the site but consumed elsewhere.

13 horses and donkey specimens constitute 4 % of the assemblage. One large specimen comes from a horse (*Equus caballus*), but most of the others are from domestic donkeys (*Equus*

asinus).

Chickens and as yet unidentified birds make up 7 % of the assemblage. The majority of bird bones are upper limb elements. Fish species, likewise unidentified, constitute 4.4 % of the assemblage and consist mainly of vertebrae and cranial bones.

Conclusions

Preliminary analysis of this faunal assemblage has already provided economic insights. Dhibān probably raised animals to supply meat to urban markets, thereby indicating regional interconnectivity. The cattle and pig evidence suggests that crops were also grown and animals hunted. Thus, the economic strategy was partly exchange-based and partly localized, with hunting and farming in the vicinity of the settlement providing food sources over and above the flocks of sheep and goat.

Palaeoethnobotanical Research

In accordance with the research strategy of investigating multiple issues of archaeological importance at Dhibān, including palaeoenvironments, agricultural economies and modes of site occupation, the investigation of palaeoethnobotanical remains was one of the objectives of the 2009 season. Data derived from palaeoethnobotanical analyses often shed light on communities' subsistence strategies, economic intensification and other cultural phenomena (Dennell 1976; Hastorf 1988; Morrison 1994; Pearsall 1983). The research design of the 2009 season was aimed at addressing cultural and social questions rather than morphological or biological studies of plant remains *stricto sensu*.

There have been a number of archaeobotanical studies of assemblages from Jordan and surrounding areas that are contemporary with cultural occupations at Dhibān and mainly Iron Age in date (Crawford and LaBianca 1986; Kislev 1993; Liphshitz 1993; Liphshitz and Waisel 1987, 1989; Weiss and Kislev 2004; Willcox 1992). Other projects in Jordan which inform this study involve tests of both microbotanical and macrobotanical assumptions and methodologies (Charles *et al.* 2003; Mithen *et al.* 2008). The ability to track shifting agricultural strategies and site-use through time contributes to regional knowledge of the impact of

shifting political and / or imperial interventions, especially during time periods - such as the Roman and Byzantine eras — from which there is comparatively little data available from Jordan.

2009 Sampling and Laboratory Strategy

During the 2009 season, sediment was extracted from every locus on the site as a bulk sample regardless of context, generating 158 flotation samples. Identifiable features (e.g. *ṭābōn*, floor) were sampled in full. The volume of the sample selected for each locus was informed by prior laboratory work on material from the 2004 and 2005 seasons at Dhibān. From these analyses it was possible to ascertain the amount needed to acquire a representative sample of remains from the field for viable intra-site comparison (Pearsall 1999; van der Veen 1985; van der Veen and Fieller 1982). The mean volume of sample collected was 17 litres, with a standard deviation of 9 litres.

These samples were then immersed in a flotation machine that separated botanical remains from the surrounding sediment matrix (Wright 2005). When immersed in water, artifacts and ecofacts whose density is less than water float to the top. These include ancient carbonized botanical remains. The investigation of these carbonized remains is essential, as a widely held and empirically demonstrated assumption is that carbonized botanical remains are present on archaeological sites due to human agency (van der Veen 2007). After processing the samples, the light fraction was bagged and shipped to the University of California, Berkeley for laboratory analysis, whereas the heavy fraction was processed on-site.

In addition to macrobotanical samples, approximately 50 gm of sediment were collected from the same area in each locus for microbotanical analysis. These samples were also shipped to the University of California, Berkeley. As the preservation of botanical remains is dependent on a variety of factors (Miksicek 1987), other techniques that help to locate botanical remains were also exploited. The identification of microscopic starches and phytoliths are instrumental in identifying plant taxa that may have disappeared from the archaeological record as a result of adverse preservation conditions (Piperno 2006). Phytoliths are microscopic

silicate bodies that form in and around the cell walls of plants. As the shapes of these bodies are often diagnostic, they also have the potential to reveal traces of ancient irrigation regimes and agricultural systems (Mithen *et al.* 2008; Rosen and Weiner 1994). Laboratory work on macrobotanical remains has followed standard procedures of analysis, with personal modification (Pearsall 1999).

Preliminary Results

Preliminary analyses of the samples recovered from Dhibān have yielded insights into the lives of its ancient inhabitants. Research on the macrobotanical remains continues, especially on the Iron Age and Middle Islamic cultural occupations. Identified remains common to both the Iron Age and Middle Islamic periods include domesticated grape (*Vitis* sp.), probably the common grape (*Vitis vinifera*; **Fig. 5B**), as well as fig (*Ficus carica*, **Fig. 5C**), which echoes the results of nearby excavations such as Óisbān (Crawford and LaBianca 1986). Barley (*Hordeum* sp.) and wheat (*Triticum* sp.) are also found in contexts dating to both periods. Especially interesting is the presence of free-threshing wheat (*Triticum aestivum* / *durum*, **Fig. 5A**), which has a high water requirement. Agricultural weeds such as *Silene* sp. and *Phalaris* sp. (**Fig. 5D**) indicate agricultural regimes that would have required irrigation and co-ordinated labor to maintain.

In Middle Islamic contexts an abundance of weeds are present, such as *Phalaris* sp., *Galium* sp., *Malva* sp., numerous Poaceae (grasses) as well as potentially economic / subsistence crops such as *Vicia ervilia*. There are also a large number of leguminous taxa (*Astragalus* sp., *Trifolium* sp. and *Coronilla* sp.), which may be indicative of seeds being introduced in dung that was burned as fuel, as they are commonly consumed by grazing animals such as sheep and goat. Also present in Middle Islamic contexts are the remains of rachis and culms of wheat and barley; there is a notable contrast with the density of economic crops (here wheat, barley, fig, grape, lentil, pea and chickpea) in the same floor contexts, which is less than one seed per liter (n=27). This may indicate on-site processing of agricultural materials, though owing to competing crop processing models (Stevens 2003; van der Veen 2007), further research is necessary to

disentangle such hypotheses.

Directions for Future Research

The results of this preliminary analysis have raised several questions about the ways in which the inhabitants of Dhibān interacted with their agricultural and environmental landscape. A pressing issue at a semi-arid site like Dhibān is the extent to which economic crops such as barley or fig entered the archaeological record as burned dung fuel, or as accidental spillage during cooking or crop processing. Continuing research will concentrate on the identification and analysis of wood charcoal to address this question, in addition to evaluating proxies for dung fuel burning such as the ratio of seeds to wood charcoal (Miller 1988). The identification of wood charcoal will also indicate the intensity of wood collection by communities at Dhibān through time, both in diversity and quantity.

The presence of agricultural weeds and wheat / barley rachis in the Middle Islamic period are tantalizing indicators of crop processing and agricultural activity. A key objective will be to assess the intensity and scale of this production in comparison to other forms of economic intensification. To that end, analysis of heavy fraction residues and the integration of the results of both microscopic and macroscopic palaeoethnobotanical analyses with faunal remains (e.g. van der Warker and Peres 2011) should shed light on the relationships between animal husbandry and plant production. The scale of irrigation in all periods will be assessed through isotopic analyses of select cereals (Ferrio *et al.* 2005). In combination, these methods should generate a more holistic view of the social and economic conditions of these communities, as reflected in their interaction with the biological world around them.

Digital Documentation and Dissemination

Archaeologists have increasingly embraced the use of digital documentation during fieldwork and post-excavation. Persuasive arguments for digitally recording archaeological sites have been made in terms of cost, portability, organization, ease of use, data standardization and creative re-use. Although there are problematic issues concerning format longevity, archival methods and durability, the technol-

ogy of digital recording is rapidly adapting to meet the demands of archaeological research and becoming progressively cheaper and easier to use. The move toward digital recording has also been viewed as part of a more inclusive and reflexive methodology, though the implementation of training in digital methods for archaeologists remains for the most part unrealized.

Bearing the complications and benefits of digital documentation in mind, a relatively modest methodology was devised for field recording at Tall Dhibān. Digital photography and videography was first handled by a graduate student trench supervisor, who was subsequently assisted by an undergraduate whom she trained on-site. Photographs were taken with a DSLR in RAW format, and were stored as both RAW files and converted JPG files. These photographs were then downloaded to a pair of parallel hard drives that were kept in separate locations for better data security. Site tours were both photographed and video recorded in high definition, with an auxiliary pocket-sized video recorder to supplement the footage. Several undergraduates used the video camera for a separate video project, being an introduction to the site for students in 2010. Much of this footage remains unedited but is stored securely on the project hard drives.

The strategy for the 2009 field season at Tall Dhibān included both digital documentation and public outreach components, efforts that will be expanded in subsequent years. The strategy for digital documentation and dissemination at Dhibān was one of immediacy: although standard archive-quality photography was taken and catalogued on-site for use in later reports and presentations, we also wanted to make information about the site available as it was being revealed throughout the season. This was challenging for both logistical and social reasons, but was rewarding in terms of increased connectivity with local and global audiences. Although internet access in and around Dhibān was limited, residents took an avid interest in our photos and site blog (<http://Dhiban.wordpress.com>). One resident was reported as “downloading every single photo” and another as “reading every blog entry,” commenting on the contents of the entries after inviting several students over for dinner. Contributions to the blog were made by undergraduate and graduate students, as well

as two of the site directors. The families and friends of the students involved in the project also commented on the blog. We received a total of 2,500 hits (and an additional 4,000 collective hits on individual photographs) for the six-week season, a moderate success for a site-specific archaeological research blog.

Excavation blogs and online photographic archives are becoming standard practice in archaeology, and at Dhibān they promoted greater communication between the excavation team and local community. Although the blog was in English, many residents of Dhibān were able to read it despite not being conversationally proficient in that language. Digital photography beyond the technological capability of mobile telephones was also rare in the community, with the result that local participants in the excavation actively sought documentation of their work and would often pose for photographs, sometimes demanding that they be taken over and over again. This was not a universal characteristic; some of the men participating in the excavation were uncomfortable with photography and we respected their wish to stay out of the site documentation strategy. Negotiating the complexities of representation in the photo archive and online was an unexpected, yet productive, aspect of community outreach during the season, and one that will be expanded upon in future fieldwork.

The requirements for hosting our collection of field photography and on-site student experiences also called for a non-traditional approach to the archive. Rather than setting up independent hosting of our blog and site photos, we chose to use pre-existing online resources, namely wordpress.com, for our blog, and flickr.com for our photography. While we have less control of the potential longevity and accessibility of our data, using these sites immediately allowed us to connect with a larger online audience, as these sites have pre-existing online communities and higher ‘discoverability’ than individually hosted websites. These sites are also relatively easy to use, allowing us to update at a rapid pace, even from the non-optimal internet connections that were locally available. We are still working on long-term hosting for our full archive, but these selections are still available for public use and licensed for not-for-profit re-use by educators

and other interested parties.

In an effort to further strengthen links with the community of Dhibān, the project sponsored an installation of photographs in Dhibān's town hall in 2010. As a result, local residents are now able to see more of what occurs during the excavations. The installation included photographs of the town as well as work on-site, thereby bringing work on the *tall* into the wider community in physical as well as digital forms.

Future work at Dhibān will bring more resources to elaboration of the 'immediate' archive, with even greater participation of students in on-site documentation. Integrating more student photography into the archive in the form of standard, official depictions of archaeology, as well as more informal photography documenting more experiential aspects of the site, will be a priority for future seasons. Digital documentation and dissemination at Dhibān is still at its formative stage, but will serve as a valuable resource giving greater, immediate visibility to the excavations and inviting stakeholders into the conversation about work performed at the site.

Concluding Remarks

During four seasons of excavation at Dhibān, the DEDP has focused on creating a new site map, collecting new data and finding innovative ways to share these discoveries in Jordan and beyond. The project completed its initial objectives in 2004 and 2005, namely to recover information from the old ASOR excavation areas to allow their publication. The reports in this article suggest many new avenues of research yet to be undertaken and form the heart of the project's research program for the coming years. Site mapping has led project members, first, to acknowledge the greater size of the site compared to previous estimates and, second, to prompt interest in the relationship of the designated ancient monument with the surrounding landscape. Analysis of recovered materials has revealed important information about past economic activities, including Dhibān's role as a regional supplier of meat to urban markets and the possibility that earlier residents developed and maintained an irrigation system. Future research will focus on understanding the economic relationship between Dhibān and the wider world throughout its long history, seeking to resolve

whether Dhibān's role as a regional supplier of food was limited to the Middle Islamic period, or whether it included earlier periods as well. Fragments of glass bracelets suggest complex economic and social relationships enjoyed by the residents of Middle and Late Islamic Dhibān. Future excavation will continue to illuminate these relationships for all periods of Dhibān's history. Finally, the project will also continue to present the results of our work to the contemporary community of Dhibān, seeking new and innovative ways to integrate what happens on the site with life in the town.

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Bibliography

- Boessneck, J.
1969 Osteological Differences Between Sheep (*Ovis aries* Linné) and Goat (*Capra hircus* Linné). Pp. 331-358 in D. Brothwell and E. Higgs (eds.), *Science in Archaeology*. London: Thames & Hudson.
- Boessneck, J., Müller, H.-H. and Teichert, M.
1964 Osteologische Unterscheidungsmerkmale zwischen Schaf (*Ovis aries* Linné) und Ziege (*Capra hircus* Linné). *Kühn-Archiv* 78: 1-129.
- Berggren, A. and Hodder, I.
2003 Social Practice, Method, and Some Problems of Field Archaeology. *American Antiquity* 68 (3): 421-435.
- Brill, R. H.
1987 Chemical Analysis of Some Early Indian Glasses. Pp. 1-26 in H.C. Bhardwaj (ed.), *Archaeometry of Glass: Proceedings of the Archaeometry Session of the XIV International Congress on Glass 1986, New Delhi, India*. Calcutta: Indian Ceramic Society.
- 1988 Scientific Investigations of the Jalame Glass and Related Finds. Pp. 257-295 in G. Weinberg (ed.), *Excavations at Jalame: Site of a Glass Factory in Late Roman Palestine*. Columbia: University of Missouri Press.
- Charles, M., Hoppe, C., Jones, G., Bogaard, A. and Hodgson, J.G.
2003 Using Weed Functional Attributes for the Identification of Irrigation Regimes in Jordan. *Journal of Archaeological Science* 30: 1429-1441.
- Cordova, C.E.
1999 Landscape Transformation in the Mediterranean-Steppe Transition Zone of Jordan: A Geoarchaeological Approach. *The Arab World Geographer* 2 (3):182-198.
- Cordova, C.E., Foley, C., Nowell, A. and Bisson, M.
2005 Landforms, Sediments, Soil Development, and Prehistoric Site Settings on the Madaba-Dhiban Plateau, Jordan. *Geoarchaeology: An International Journal* 20 (1): 29-56.
- Cordova, C.E.
2007 *Millennial Landscape Change in Jordan*. Tucson: University of Arizona Press.
- Crawford, P. and LaBianca, Ø.S.
1986 Paleoethnobotany and Paleoenvironment. Pp. 123-146 in P. Crawford, O.S. LaBianca, and L. Lacelle (eds.), *Hesban 2: Environmental Foundations: Studies of Climatical, Geological, Hydrological, and Phytological Conditions in Hes-*

- ban and Vicinity. Berien Springs, MI: Andrews University Press.
- Dennell, R.
1976 The economic importance of plant resources represented on archaeological sites. *Journal of Archaeological Science* 3: 229-247.
- Dikshit, M. G.
1969 *History of Indian Glass*. University of Bombay: Bombay.
- von den Driesch, A.
1976 *A Guide to the Measurement of Animal Bones from Archaeological Sites*. Cambridge: Harvard University Press.
- Ferrio, J.P., Araus, J.-L., Buxo, R., Voltas, J. and Bort, J.
2005 Water Management Practices and Climate in Ancient Agriculture: Inferences from the Stable Isotope Composition of Archaeobotanical Remains. *Vegetation History and Archaeobotany* 14: 510-517.
- Fischer, A.
2000 Strength-testing Glass: The Hellenistic / Early Roman Corpus of Sepphoris, Israel. Pp. 111-115 in S. Pike, and S. Gitin, (eds), *The Practical Impact of Science on Near Eastern and Aegean Archaeology*. London: Archetype Publications.
2009 Material Culture: Glass. Pp. 306-343 in E.M. Meyers, and C.L. Meyers, (eds), *Excavations at Nabretain: Synagogue and Environs*. Winona Lake, IN: Eisenbrauns
- Fischer, A. and McCray, W.P.
1999 A Study of Glass-working Activities as Practised at Sepphoris, Israel (37 B.C.-A.C. 1500). *Journal of Archaeological Science* 26: 893-905.
- Hamilakis, Y., Anagnostopoulos, A. and Ifantidis, F.
2009 Postcards from the Edge of Time: Archaeology, Photography, Archaeological Ethnography (A Photo-Essay). *Public Archaeology* 8(2,3): 289-309.
- Hastorf, C.A. and Popper, V.S. eds.
1988 *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains*. Chicago: University of Chicago Press.
- Hodder, I.
1997 'Always Momentary, Fluid and Flexible': Towards A Reflexive Excavation Methodology. *Antiquity* 71: 691-700.
- al-Hunjul, N.G.
1993a *The Geology of Madaba Area: Map Sheet 3153-II, Geological Mapping Division National Mapping Project*. Amman: Geology Directorate, Geological Map Division, Natural Resources Authority.
1993b *The Geology of Dhiban Area (Wadi al Mujib): Map Sheet 3152-I, Geological Mapping Division National Mapping Project*. Amman: Geology Directorate, Geological Map Division, Natural Resources Authority.
- Kislev, M.E.
1993 Food Remains. Pp. 354-361 in I. Finkelstein, S. Bunimovitz, and Z. Lederman (eds.), *Shiloh: The Archaeology of a Biblical Site*. Tel Aviv: Institute of Archaeology.
- Korfmann, M.
1966 Zur Herstellung nahtloser Glasringe. *Bonner Jahrbucher* 166: 48-61.
- Lipshchitz, N.
1993 Palaeobotanical Remains. Pp. 351-353 in I. Finkelstein, S. Bunimovitz and Z. Lederman (eds.), *Shiloh: The Archaeology of a Biblical Site*. Tel Aviv: Institute of Archaeology.
- Lipshchitz, N. and Waisel, Y.
1989 Botanical Remains. Pp. 219-222 in Z. Herzog, G. Rapp and O. Negbi (eds.), *Excavations at Tel Michal, Israel*. Minneapolis: University of Minnesota Press.
1987 Analysis of the Botanical Material of the 1975-76 Seasons. Pp. 252-256 in A. Ben-Tor, Y. Portugali, M. Avissar, U. Baruch, and M. Hunt (eds.), *Tell Qiri: A Village in the Jezreel Valley*. Jerusalem: Institute of Archaeology.
- Meyer, C.M.
1992 *Glass from Quseir al-Qadim and the Indian Ocean Trade*. Chicago: University of Chicago.
- Miksicek, C.H.
1987 Formation Processes of the Archaeobotanical Record. *Advances in Archaeological Method and Theory* 10: 211-247.
- Miller, N.F.
1984 The use of dung as fuel: an ethnographic example and an archaeological application. *Paléorient* 10: 71-79.
- Mithen, S., Jenkins, E., Jamjoum, K., Nuimat, S., Northcliff, S. and Finlayson, W.
2008 Experimental Crop Growing in Jordan to Develop Methodology for the Identification of Ancient Crop Irrigation. *World Archaeology* 40: 7-25.
- Morrison, K.D.
1994 The Intensification of Production: Archaeological Approaches. *Journal of Archaeological Method and Theory* 1: 111-159.
2007 Rethinking Intensification: Power Relations and Scales of Analysis in Precolonial South India. Pp. 235-248 in T.L. Thurston and C.T. Fisher (eds.), *Seeking a Richer Harvest: The Archaeology of Subsistence Intensification, Innovation, and Change*. New York: Springer.

- Moser, S., Glazier, D., Phillips, J.E., el-Nemr, L.N., Mousa, M.S., Aiesh, R.N., Richardson, S., Conner, A. and Seymour, M.
 2002 Transforming Archaeology Through Practice: Strategies for Collaborative Archaeology and the Community Archaeology Project at Quseir, Egypt. *World Archaeology* 34 (2): 220-248.
- Payne, S.
 1973 Kill-off Patterns in Sheep and Goats: The Mandibles from Asvan Kale. *Anatolian Studies* 23: 281-303.
- Pearsall, D.M.
 1999 *Paleoethnobotany: A Handbook of Procedures*. Second edition. New York: Academic Press.
- Piperno, D.R.
 2006 *Phytoliths: A Comprehensive Guide for Archaeologists and Paleoecologists*. Lanham, MD: AltaMira.
- Prummel, W. and Frisch, H. J.
 1986 A Guide for the Distinction of Species, Sex and Body Side in Bones of Sheep and Goat. *Journal of Archaeological Science* 13(6): 567-577.
- Porter, B., Routledge, B., Steen, D., Parslow, C., DeJong, L. and Zimmerle, W.
 2005 "Tall Dhiban 2004 pilot season: Prospection, preservation, and planning." *Annual of the Department of Antiquities of Jordan* 49: 201-216.
 2010 Locating Middle Islamic Dhiban on the Mamluk Imperial Periphery. *Fondation Max van Berchem Bulletin* 24: 5-7.
- Porter, B., Routledge, B., Fatkin, D., Zimmerle, W., Hakes, J., Salvant, J. and Schultz, W.
 In press The Dhiban Excavation and Development Project's 2005 Season. *Annual of the Department of Antiquities of Jordan*.
- Renfrew, J. M.
 1973 *Palaeoethnobotany: The prehistoric food plants of the Near East and Europe*. New York: Columbia University Press.
- Richards, J.D.
 2002 Digital Preservation and Access. *European Journal of Archaeology* 5 (3): 343.
- Rosen, A.M. and Weiner, S.
 1994 Identifying Ancient Irrigation: a New Method using Opaline Phytoliths from Emmer Wheat. *Journal of Archaeological Science* 21: 125-132.
- Routledge, B.E., Fatkin, D.S., Porter, B.W., Adelsberger, K.A. and Wilson, A.T.
 In press Long Term Settlement Change at Dhiban. *Studies in the History and Archaeology of Jordan* 11.
- von Saldern, A.
 1980 *Ancient and Byzantine Glass from Sardis*. Cambridge: Harvard University Press.
- Salem-Liebich, H.
 1978 Glass. Pp. 138-147 in O. Grabar (ed.), *City in the Desert Qasr al-Hayr East*. Harvard Middle Eastern Monographs 23-24. Cambridge: Harvard University Press.
- Salvant, J.
 2007 *Glass Bracelets Excavated from Dhiban, Jordan*. MSc dissertation. University College London, Institute of Archaeology.
- Schmid, E.
 1972 *Atlas of Animal Bones*. London: Elsevier Publishing Company.
- Shindo, Y.
 1995 Islamic Glass Bracelets found in the Red Sea Region. Pp. 269-276 in *Annales du 13 congrès de l'Association Internationale pour l'Histoire du Verre*. Amsterdam: Pays-Bas.
- Silver, I.A.
 1969 The Ageing of Domestic Animals. Pp. 283-302 in D. Brothwell and E. Higgs (eds.), *Science in Archaeology*. London: Thames & Hudson.
- Spaer, M.
 1988 The Pre-Islamic glass bracelets of Palestine. *Journal of Glass Studies* 30:51-61.
 1992 The Islamic bracelets of Palestine. *Journal of Glass Studies* 34: 44-62.
 2001 *Ancient Glass in the Israel Museum, Beads and other Small Objects*. Jerusalem: The Israel Museum, 191-209.
- Steiner, M. L.
 1995 Glass Bracelets from Tall Abu Sarbut. *Studies in the History and Archaeology of Jordan* V: 537-539.
- Stevens, C.J.
 2003 An investigation of consumption and production models for prehistoric and Roman Britain. *Environmental Archaeology* 8: 61-76.
 2001 The Democratization of Technology. Pp. 271 in *Proceedings of the Seventh International Conference on Virtual Systems and Multimedia (VSMM'01)*. DOI: <http://doi.ieeeecomputersociety.org/10.1109/VSM.2001.969681>
- van der Veen, M.
 1985 Carbonized Seeds, Sample Size, and On-site Sampling. Pp. 165-174 in N.R.J. Fieller, D.D. Gilbertson and N.G.A. Ralph (eds.), *Palaeoenvironmental Investigations: Research Design, Methods, and Data Analysis*. Oxford: British Archaeological Reports International Series.
 2007 Formation Processes of Desiccated and Carbonized Plant Remains – The Identification of Routine Practice. *Journal of Archaeological Science* 34: 968-990.
- van der Veen, M. and Fieller, N.
 1982 Sampling Seeds. *Journal of Archaeological Sci-*

- ence 9:287-298.
- VanDerwarker, A.M. and Peres, T.M.
2011 *Integrating Zooarchaeology and Paleoethnobotany*. Springer, New York.
- Weinberg, G.D.
1988 *Excavations at Jalame: Site of a Glass Factory in Late Roman Palestine*. Columbia, MO: University of Missouri Press.
- Weiss, E. and Kislev, M.E.
2004 Plant Remains as Indicators for Economic Activity: A Case Study from Iron Age Ashkelon. *Journal of Archaeological Science* 31: 1-13.
- Whitcomb, D.S.
1983 Islamic glass from al-Qadim, Egypt. *Journal of Glass Studies* 25:101-108.
- Willcox, G.
1992 Archaeobotanical Investigations at Pella, 1983. Pp. 253-256 in A.W. McNicoll *et al.* (eds.), *Pella in Jordan 2*. Sydney: Mediterranean Archaeology Supplement.
- Wright, P.
2005 Flotation samples and some paleoethnobotanical implications. *Journal of Archaeological Science* 32(1): 19-26.
- Zeder, M.A.
1991 *Feeding Cities: Specialized Animal Economy in the Ancient Near East*. Washington: Smithsonian Institution Press.