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The View from Khirbat al-Ḥammām : Neolithic at a Crossroads

The crossroads metaphor is an apt one for the Neolithic of Jordan. Bioculturally, the advent of domestication economies represents a fundamental transition as human: environment relationships are altered in fundamental and far-reaching ways. But our own archaeological understanding of these phenomena is shifting as well. The Neolithic map of Jordan has 'filled out' considerably in the last several decades. As our appreciation of the Neolithic landscape spreads geographically across Jordan, how we understand this critical stage in the human career are at a crossroads as well. In particular, macro-scale models of the Pre-Pottery Neolithic that emphasized cultural homogeneity and focused on systemic change are bumping up against the archaeological reality that documents substantial local variation.

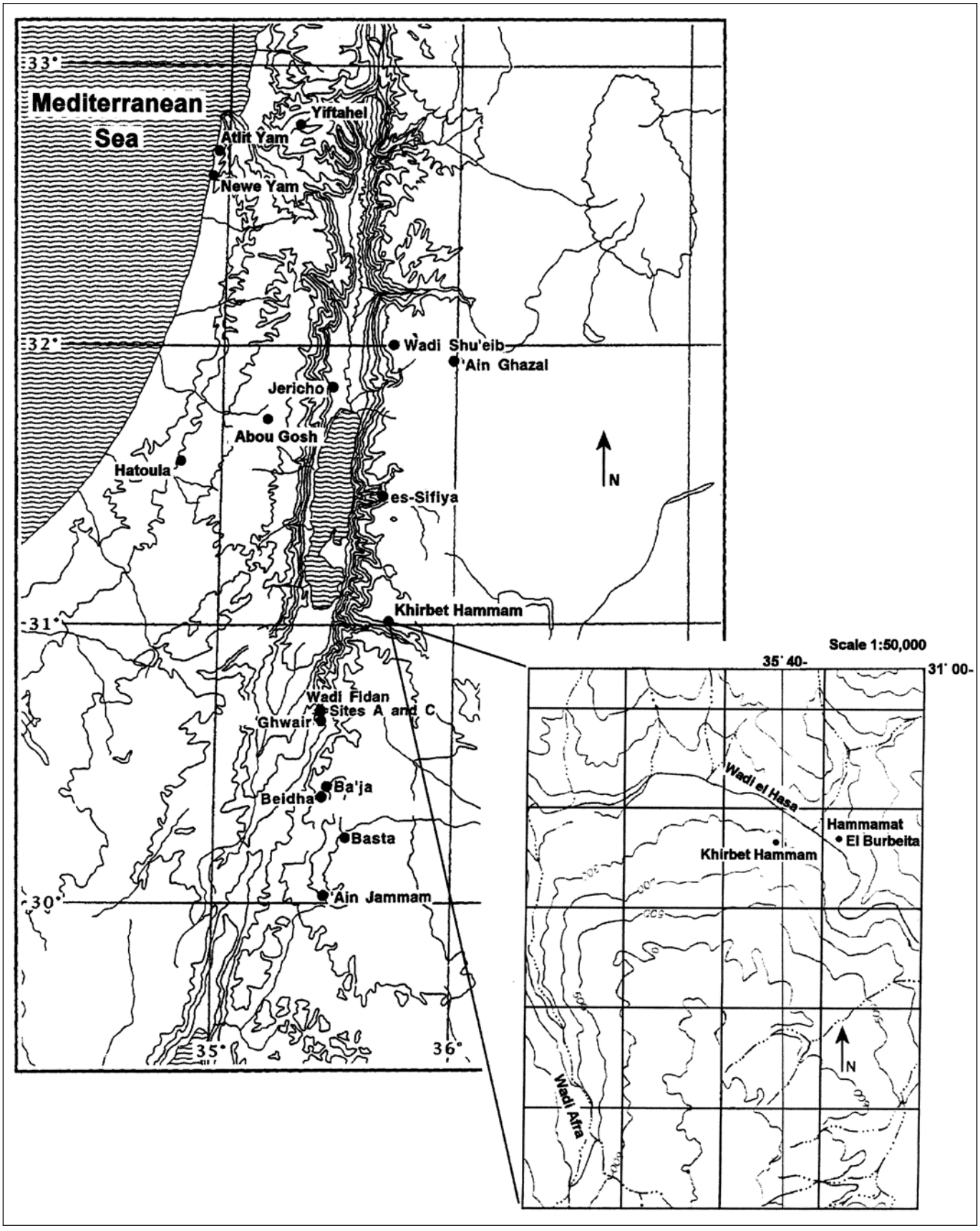
The tension between broadly synthetic and detailed, particularlistic explanations for culture change is hardly new. The pendulum arcs back and forth in predictable and productive ways. For the Neolithic Levant, emergent data suggest variation in local patterns of exchange, sexual labor, ritual performance and traditions, architecture and household organization, health status, and craft production. Exploring and comparing the pace and character of local changes can improve the resolution and advance our understanding of the dynamics of Early Neolithic society in Jordan (Asouti 2006; Peterson 2002; Verhoeven 2004).

This report of our recent excavations at Khirbat al-Ḥammām provides a case study of this local variation from the perspective of the Wādī al-Ḥasā. Several seasons of test excavation and analysis support a view of PPN villagers devising local strategies and local identities while forging meaningful regional connections.

Site Location and History of Previous Work

Khirbat al-Ḥammām is located on the south side of the Wādī al-Ḥasā, the southernmost major drainage into the Dead Sea depression (FIG. 1). Today, it's a region of rugged topography and distinctive geology and landforms, with over a 1,000m drop between the plateau and the terrace upon which Khirbat al-Ḥammām rests at approximately 290 masl. The wadi provides a source of perennial water, and the Ḥasā Dam was recently constructed upstream from the site. Khirbat al-Ḥammām is among a growing number of PPNB sites documented in central and southern Jordan (e.g. 'Ayn Jamām, Ba'ja, Basṭa, Bayḍa, al-Ḥimmah, aṣ-Ṣifayya, Ghuwayr).

Khirbat al-Ḥammām was first described by Nelson Glueck (1939) as a large site with standing ruins. Burton MacDonald's multi-year survey of the south bank of the Wādī al-Ḥasā relocated and published additional details about the site (MacDonald 1988). Gary Rollefson and Zeidan Kafafi suggested a Pre-Pottery Neolithic occupation based on a closer look at the surface artifacts and the exposed roadcut (Rollefson and Kafafi 1985). In 1999, I conducted the first subsurface investigations, opening a small 2 x 1m unit off the roadcut. Radiocarbon dates, typological assessment of projectile points, and a paucity of specialized naviform core and blade technology all pointed towards a LPPNB occupation — although admittedly we never reached the bottom of cultural deposits in that unit (Peterson 2004). Shortly after the 1999 season, the Jordanian government purchased the site insuring its protection from the escalating farming activities and other threats to the site's integrity. In 2006 we were able to resume research at the site in conjunction with test excavations at some nearby Natufian sites (Neeley, this volume). Our efforts concentrated on conducting an intensive survey of visible



1. Location of Khirbat al -Ḥammām and other Pre-Pottery Neolithic sites mentioned in text.

architectural elements, surface collecting a small area, producing a detailed topographic map, examining the immediate area for evidence of Holocene landscape alterations, and excavating a modest 8m^2 in a new area of the site that we described as the East Field.

Khirbat al-Ḥammām , unlike most of the other PPN sites in central and southern Jordan, has not been actively 'downsized'. The site terrace has been protected from the severe erosion that has substantially truncated many other sites in the central and southern parts of Jordan (FIG. 2). As a result, we can calculate the surface area of the site with a certain degree of confidence that is not present in many other cases. After examining the area below the road cut and finding evidence for Neolithic-style walls and large pieces of site furniture (primarily large boulder querns and mortars), we estimated that the site covers between 6-7 hectares, effectively doubling our 1999 estimate (FIG. 3). So Khirbat al-Ḥammām is a medium-sized PPN site that is uniquely preserved compared to others in central and southern Jordan.

2. View of Khirbat al -Ḥammām Terrace.

Chronology of Early Neolithic Developments

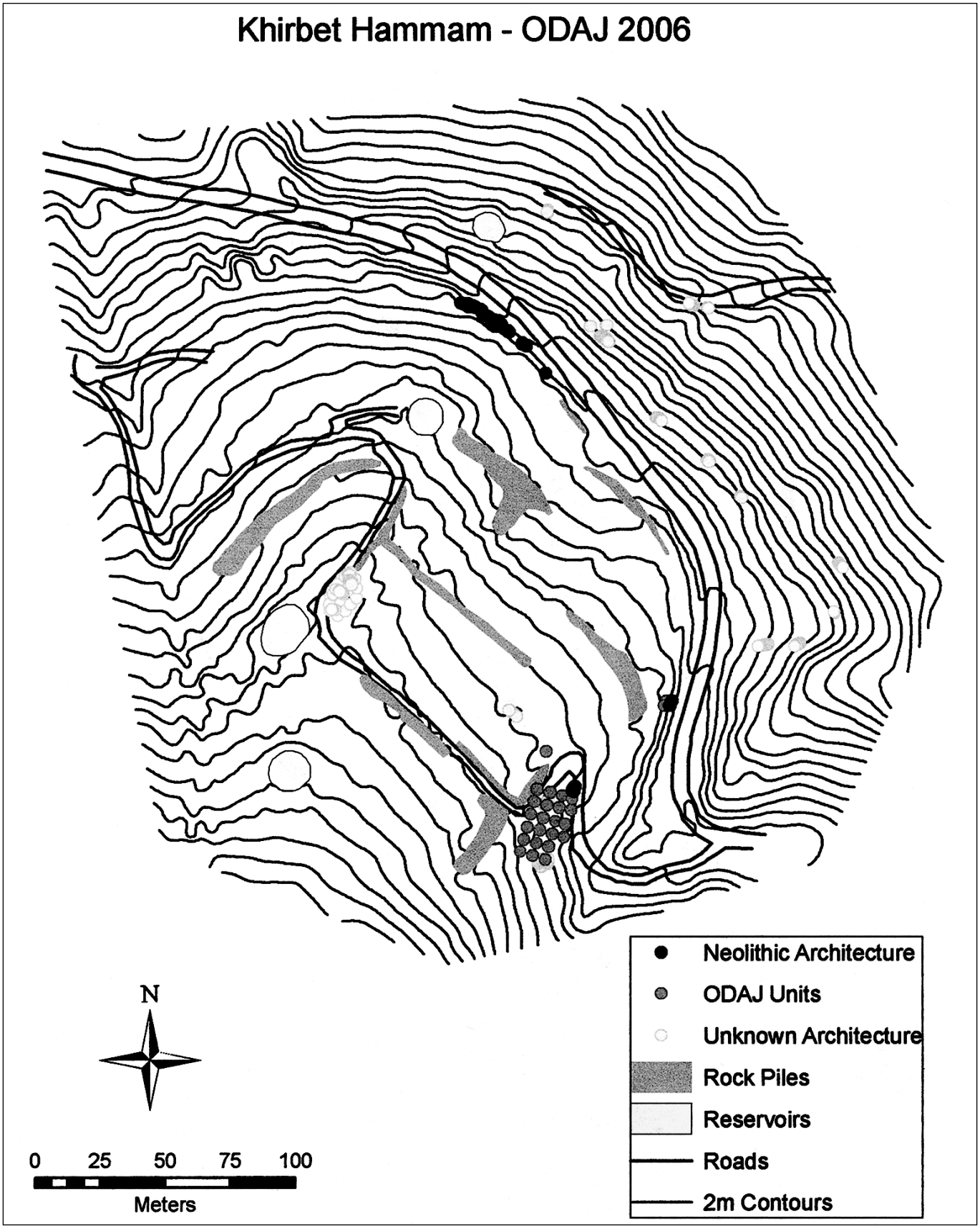
When the 2006 fieldseason began, Khirbat al-Ḥammām fit, more or less comfortably, within the established chronology for PPNB developments. Evidence from test excavations in 1999 suggested that the site was among a number of LPPNB sites established in central and southern Jordan. But new AMS dates and techno-typological consideration require revision of this scenario.

Two AMS dates the East Field excavations suggest that the site may have been occupied during the MPPNB as well (TABLE 1). One sample (#221348) comes from wood charcoal that was in contact with a hard-packed surface that contained chunks of plaster that we defined as a floor. The other sample (#221347) comes from 5cm above this surface. The conventional and calibrated B.P. dates fit within the MPPNB sequence using the chronology proposed by Kuijt and Goring-Morris (2002: 366). Furthermore, the calibrated B.C. dates straddle the MPPNB/LPPNB boundary using the Aurenoche *et al*. (2001) chronology.

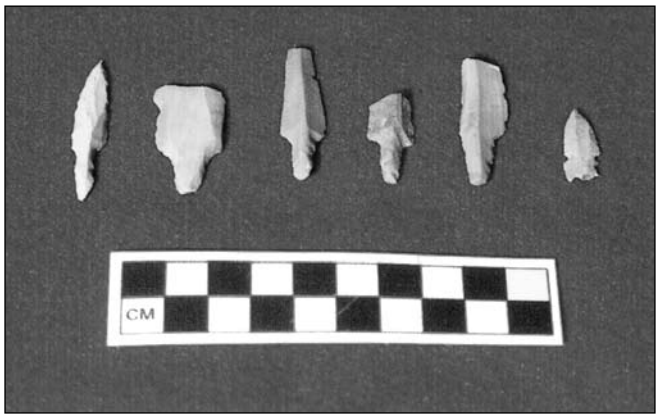
Typological evidence also suggests an earlier component. Byblos points are, by far, the most numerous point type. But there are several notable exceptions. Specimen #25 (FIG. 4) was found on the surface of Test Trench 2 before excavations began. The point produced on a blade has bilateral notches. The base is broken but it appears to have had either barbs or a contracting tang/stem. Morphologically the point is most similar to Helwan points. Specimen #60 was found in the first 10cm of fill which had been greatly disturbed from both natural and cultural causes, and appears to be the base of an el Khiam point (Rudnicki n.d.). These point types are widely regarded as types fossiles of the PPNA and EPPNB (Banning 1998; Bar-Yosef 1981; Gopher 1994). Erosion of the sloped site terrace, as well as a range of modern subsurface disturbances may be

TABLE 1. AMS Dates from 2006 al -Ḥammām Excavations (Beta-Analytic Laboratories).

Sample Number	Material	Conventional B.P. dates	Calibrated B.C. dates (2 sigma)	Calibrated B.P. dates (2 sigma)	Context
Beta-221347	Wood charcoal	8310±40 B.P.	7500-7290	9450-9240	
Beta-221348	Wood charcoal	8440±40 B.P.	7570-7470	9520-9420	Floor contact in Feature 3



3. Topographic map of Khirbat al -Ḥammām.



4. Projectile points from Khirbat al -Ḥammām . Specimen #25 on far right.

responsible for the stratigraphic inversion of earlier points on top of later, *in situ* deposits.

Strategic exploitation of high quality raw materials for naviform blade production is a hallmark of MPPNB chipped stone at sites like ‘Ayn Ghazāl, with substantial shifts to flake-based production evident by the PPNC (Quintero 1998; Rollefson 1990). The shift away from naviform blade production has been correlated with LPPNB/PPNC manifestations at a number of sites (Gebel and Beinert 1997: 242; Nissen, Muheisen, and Gebel 1987: 98-100; Rollefson 1999: 7-8), although local variation in the timing of the shift away from naviform blade and tool production is beginning to be documented as well (Barzilai and Garfinkel 2006; Galili *et al*. 2005). Technologically, the blade: flake ratios show a marked increase at and below the floor contact levels (Levels 4 and 5) (TABLE 2). Most of the blades show evidence of naviform production and were made on high quality chert with evidence of weathered cortex indicative of having been quarried from bedded deposits. This material stands in stark contrast to the local wadi cobbles that are also used in knapping, but which can be differentiated on the basis of their lighter color, mechanically weathered cortex, and internal flaws that hamper standardized blade production (Koska n.d.).

TABLE 2. Flake and Blade Ratios by Level.

Levels trench 2&3 combined	Blades	Flakes	%Blades
1	23	82	28%
2	21	56	37%
3	22	83	27%
4- floor and floor fill (5cm)	58	79	73%
5- subfloor	29	54	58%

There is obviously still much to be learned about the chronology of Khirbat al-Ḥammām . We have yet to reach the bottom of cultural deposits. But the current temporal data are more parsimonious with the notion that Khirbat al-Ḥammām has a complex, multi-phase occupational history. And within the Wādī al-Ḥasā, Khirbat al-Ḥammām is not alone in this respect. Recent excavations al-Ḥimmah, a site several kilometers from Khirbat al-Ḥammām on the north side of the wadi channel, Cheryl Makarawicz and her crew report evidence of PPNA, LPPNB, PPNC, and PN components (Makarewicz and Austin 2006; Cheryl Makarewicz personal communication). It seems to me that the possibility of relatively long, *in situ* developments during the Pre-Pottery Neolithic now have to be seriously considered in the Wādī al-Ḥasā .

Environmental Parameters

Our environmental reconstructions rely heavily on the work of Brett Hill, who relocated sites in the Ḥasā area and analyzed landscape change using settlement data and paleoenvironmental indicators in the region (Hill 2002, 2006). The data base he compiled includes settlement data from both the MacDonald (1988) surveys of the Ḥasā’s south bank and the Clark (Clark *et al*. 1992, 1994) surveys of the Ḥasā’s north bank. Hill observes that Neolithic and Chalcolithic sites in the Ḥasā are often perched on steep, sometimes unstable slopes with awkward access to agricultural lands either in the floodplain below or plateau above (Hill 2006: 77-78). Did people choose to settle in these awkward settings because they were the only options in an environment with few attractive options for farming? A more likely explanation, Hill believes, is that the Ḥasā of today looks drastically different than the Ḥasā of 8-10,000 years ago.

Specifically, Hill suggests that a substantial amount of channel incision, due to both climactic and anthropogenic changes, can be inferred from site data, Dead Sea sedimentation records, and isotopic studies of speleotherms. Geoarchaeological survey during 2006 led us to hypothesize that the Neolithic Wādī al-Ḥasā may well have been domi-

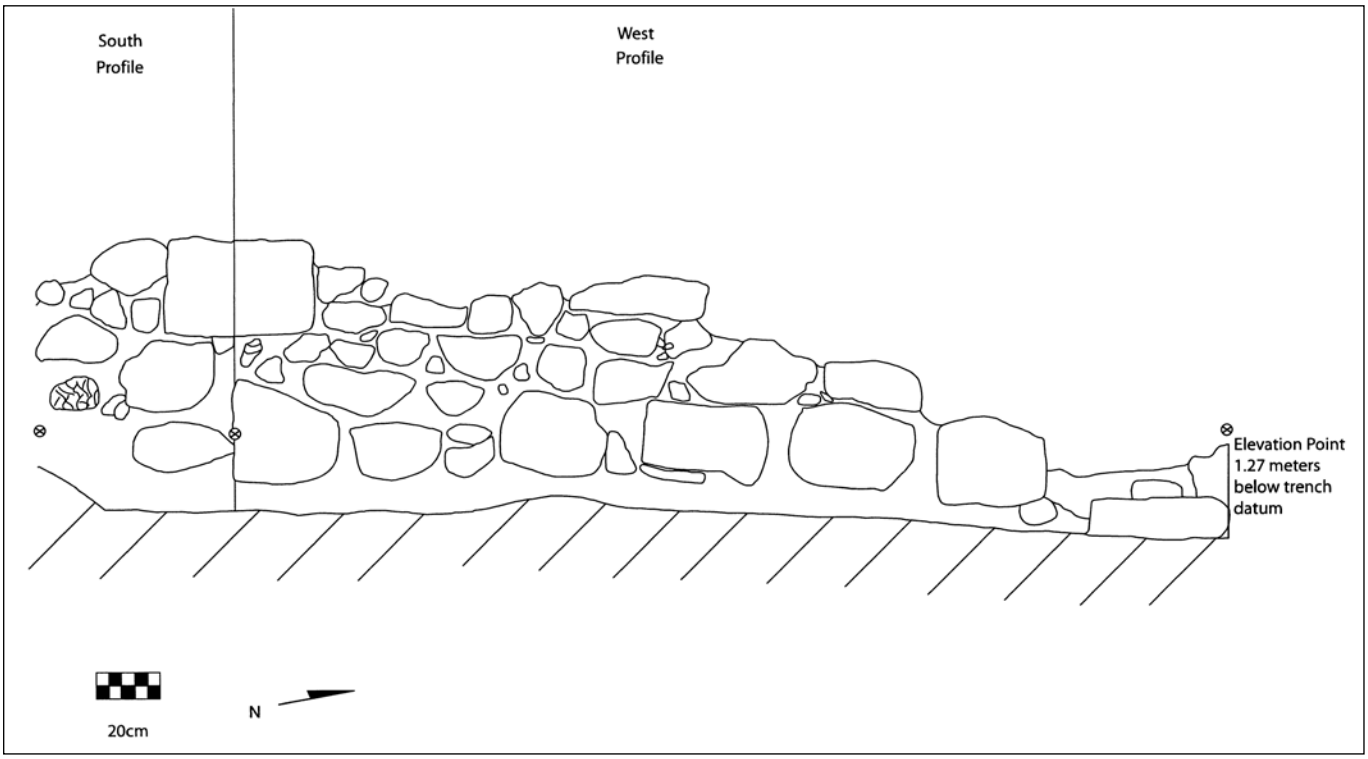
nated by a wide, slow moving waterway – one that built up rich, alluvial soil rather than scouring it away. This wadi valley may have provided large expanses of arable land in a broad, flat floodplain. Hill identified a landform in a tributary wadi that may represent a remnant of the ancient wadi channel that was preserved by a fluke and remains intact elevated 30m above the current wadi bed. Further exploration of this landform by a quaternary geologist should be able to date the feature and lend support to this hypothesis. High agricultural productivity at Khirbat al-Ḥammām is supported by indirect, artifactual evidence. The site's surface is littered with hundreds of handstones and large querns. And other researchers are beginning to concern themselves with the local landscape reconstructions as well. Hydrological investigations at Ba'ja, for example, led Gebel and Kinzel (2007) to suggest that significant amounts of channel incision postdate that site's PPN occupation (Gebel and Kinzel 2007).

Reconstructions of local environmental conditions are beginning to portray the Wādī al-Ḥasā as agriculturally productive and capable of supporting a large, thriving community – perhaps several contemporaneous communities. And available chronological data suggest a long, multi-phase occupational history. Artifacts and economic data sets further add to our knowledge of Neolithic lifeways in the Wādī al-Ḥasā and are discussed next.

Local Character and Regional Connections

Architecture

There are many examples of the distinctive, shared-wall architectural style that can be found at PPNB sites across central and southern Jordan (Byrd 2005; Fino 2004; Gebel and Kinzel 2007; Kinzel 2004; Mahasneh 1997; Makarewicz and Austin 2006; Nissen, Muheisen and Gebel 1987, 1991; Peterson 2004; Simmons and Najjar 2006). And there is also considerable variation in how this shared-wall tradition is expressed from site to site. The 1999 test excavations established that stone walls were preserved to a height of over 2m at Khirbat al-Ḥammām, and the site appeared to share in this agglomerative tradition. The larger, horizontal exposure in the East Field confirmed this uncovering additional, well-preserved architecture (FIG. 5). Feature 1 was assumed, throughout the excavation of Test Trench 2, to be a single wall formed double row of rectangular limestone blocks. However, when we moved southwards and opened Test Trench 3, the two rows diverged suggesting that they defined walls of separate structures that abut-



5. South and west profiles of Test Trenches 2 and 3.

ted one another along only one side. There is also evidence that individual structures went through cycles of internal modification. For example, the internal dividing wall (Feature 2) within the structure does not extend to the floor, suggesting that it was a later addition. Lime plaster is used within these complex, interior spaces, to create floor surfaces and floor surfaces are sometimes elaborated with red painted designs, a feature of PPN culture with a wide geographic distribution in the southern Levant (Peterson 2004). Lastly, we documented a number of subfloor, stone channel constructions during a survey of the roadcut (FIG. 6). These are evocative of similar features at Basta (Nissen, Muheisen and Gebel 1987, 1991).

I suggest that the agglomerative architectural tradition extends back into the MPPNB in central and southern Jordan (e.g. Ghuwayr, Khirbat al-Ḥammām). Given the climate, topography, and available construction materials, the 'pueblo-style' construction is a sensible solution to home building. So sensible, in fact, that this vernacular architectural tradition is still being practiced in the area today (Kinzel 2004). Undoubtedly socioeconomic, ideological, and practical factors were influential in the adoption of this architectural canon. The development of extended family households and the proxemics of these households have been explored by a number of ethnographers. Among the Ketchi Maya, for instance, larger, extended families emerge when heritable resources (agricultural land, flocks of animals, etc.) become economically more important (Wilk 1990: 39-40). In the Puebloan Southwest households expand vertically and horizontally as families and lineages grow, rooms become structurally unsound, and vermin infest structures – just to name several influential factors (Adams 1983; Mindelhoff 1891; Morgan 1881).

Lithic Technology

The chipped stone assemblage from Khirbat al-Ḥammām demonstrates broad technological similarities with widespread, PPNB lithic patterns. The increase in naviform technology through time and standard point types were discussed earlier. In addition, the range of tool types is consistent with Early Neolithic sites elsewhere (TABLE 3). Unifacially retouched Byblos points predominate among the projectile points (FIG. 4). And a massive tool component is present -- presumably linked to agricultural labor and field clearance.

A preliminary functional analysis of the glossed blades from 2006 excavations at Khirbat al-Ḥammām shows that the majority were unretouched with unilateral usewear. Exceptions are one denticulated specimen and one steeply backed, more massive specimen (FIG. 7). Tool metrics combined with location and invasiveness of gloss suggest that most of these tools were hafted and suitable for harvesting cereals. The Khirbat al-Ḥammām assemblage shows strong similarities with the 'Ayn Ghazāl glossed blades with respect to a number of metric attributes and breakage patterns (Olszewski 1994; Vande Walle n.d.). Vande Walle asks whether some of the retouched and utilized blades might have been harvesting implements on which gloss had not yet formed. However, the unglossed specimens tend to exhibit distinctive patterns of retouch and/or wear suggesting different functions. For example, wear and retouch are often discontinuous, bilateral, or both.

A sample of the ground stone was analyzed and

6. Subfloor channel exposed in roadcut.

7. Glossed blades.

Class	1999 n	1999 % [1]	2006 n	2006 % [1]	Total n	Total % [1]
Projectile point	5	7.5	17	16	22	13
Glossed blade	4	6	14	13	18	10
Burin	3	4.5	6	6	9	5
Truncation	2	3	0	-	2	1
End scraper	2	3	2	2	4	2
Side scraper	1	1.5	2	2	3	2
Notch	7	11	5	5	12	7
Piercing tools Awl, drill, borer	5	7.5	10	9	15	9
Large bifacial Adze, pick, chisel	7	11	1	1	8	5
Composite tool	1	1.5	0	-	1	0.5
Microlith	1	1.5	0	-	1	0.5
Retouched flake/blade	25	37.5	29	27	54	31
Unclassified	3	4.5	21	19	24	14
Total	**121**	**100**	**107**	**100**	**173**	**100**
Utilized flake/blade [2]	55		45		100	

[1] Provides percentages excluding utilized , and unclassified pieces.
[2] Utilized pieces reported as item of interest, but not included in totals.

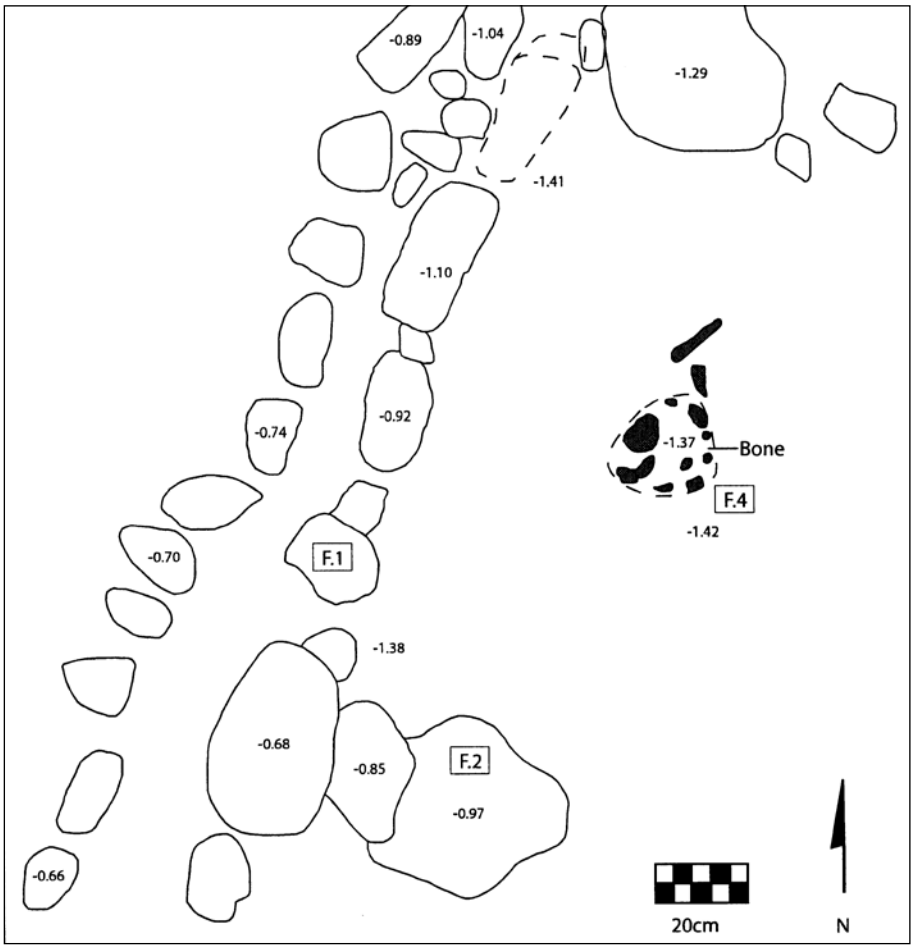
TABLE 3. Chipped Stone Tool Forms (1999-2006)

reported from the 1999 fieldwork (Peterson 2004). A noteworthy addition from 2006, are the three large 'pierced stones' found on the floor of the main room we excavated (FIG. 8). In the relatively unstandardized terminology applied to ground stone these are variously described as mace heads, digging stick weights, loom weights, etc without much in the way of formal description. These specimens are quite large compared to those described elsewhere (average diameter 17cm, thickness 7cm, weight 4 kilograms) (Wright 1992). A child's skull lay directly under two of these large pierced stones, which were resting on a rough ḥuwwar floor (FIG. 9).

8. Pierced ground stone items.

Human Remains and Mortuary Treatment

The skull, just mentioned, was fragmented from the weight of the stones, but the fragile bone fragments had remained tightly clustered, as if to suggest that they had been placed in a container that subsequently disintegrated. The fill directly associated with the skull contained a glycermis shell bead. The skull appeared to be resting on the floor of the structure, rather than in a pit. So perhaps the skull was placed in the structure to mark its aban-



9. Plan view of Test Trench 2 at Floor, Level 4. Cluster of bone designates location of child's skull.

donment rather than its founding.

Based on root development of the first premolar, the individual died at age 3 or 4 (Moorresson, Fanning, and Hunt 1963). Infants and juveniles are represented at other PPN sites. The assemblage of plastered skulls, for example, includes some juveniles (Bonogofsky 2003). And at MPPNB 'Ayn Ghazāl infants were found in subfloor pits and foundation deposits (Rollefson, Simmons, and Kafafi 1992). The numbers of infant and child remains has been increasing with new examples from several sites in southern Jordan: e.g. Ghuwayr I (Simmons and Najjar 2006) and Ba'ja (Gebel *et al*. 2006).

The osteologist reports that the method of skull removal is not clear from the remains. The cranium and mandible are complete, but no cut marks are present. Neither are there vertebral fragments are present. The central and lateral permanent incisors, that were still been developing beneath the gumlines, show evidence of multiple hypoplastic bands. These bands are hallmarks of events that disrupt normal growth patterns (laying down the enamel) in teeth. The presence of multiple enamel hypoplasias on multiple teeth is indicative of systemic stress (as opposed to localized damage to an individual tooth) that affected the child over a significant period of his/her short life. The placement of the bands can be used as a rough estimation of the timing of stress events and suggests critical problems beginning around age 2 (Sullivan n.d.). Hypoplasias were common among adolescents and adults from MPPNB burials at 'Ayn Ghazāl (Rollefson, Simmons, Kafafi 1992).

The tradition of skull caching and intramural burial has been a hallmark of the PPN. And the residents at Khirbat al-Ḥammām appear to be participating in this ritual practice. But placing a child's skull in a container on the floor of a structure is less well-documented. The variation may indicate an interplay between local and regional forces in forging mortuary practices. Other cases of local variation in PPNB mortuary practices reinforce this interpretation (e.g. collective burials at Ba'ja described in Gebel, Hermansen and Kinzel 2006).

Shell
Preliminary work on the shell from the site has been completed by Aldona Kurzawska (TABLE 4). Both freshwater and marine shell specimens are included in the 2006 assemblage (n=46) and both types are culturally modified. Khirbat al-Ḥammām's shell inventory mirrors general trends found at many PPNB sites and she notes that Yiftahel, Abu Gosh, and Jericho have similar profiles (Kurzawska n.d.; Peterson 2004). The shell data are relevant because they document that the site's residents were actively involved in fairly widespread economic and social networks on par with other large, well-documented PPNB sites.

Fauna
Our faunal remains were relatively well-preserved and have undergone preliminary analysis. From the 2006 fieldwork, one hundred forty-four (144) specimens could be identified to species. Of these 90% were caprines, with fox, cattle and possible wild ibex present in small numbers. Interestingly, within the caprine sample, all of the specimens were goat. The size of the goat bones is broadly comparable from those from PPNB 'Ayn Ghazāl and are interpreted as domestic (Wasse n.d.). The only gazelle bone was a single heavily worn awl made on a distal metapodial. Otherwise gazelle is entirely absent from both the 1999 (n=616) and 2006 excavated samples (Peterson 2004; Wasse n.d.). Gazelle were the game of choice among Natufian hunters at the Wādī Juhayra sites on the plateau nearby (Wasse n.d.). And they continue to be hunted by PPN villagers at other sites across central and southern Jordan (Driesch, Cartajena and Manhart 2004; Mahasneh 1997; Nissen, Muheisen and Gebel 1991; Simmons and Najjar 2006). The lack of gazelle from the PPNB deposits at Khirbat al-Ḥammām is unique, and may point to significant socio-economic variation among sites.

Flora
Chantel White has identified grass phytoliths from several soil samples submitted. They have not currently been identified to species. She also analyzed five samples for us looking for spherulites – which trace the presence of fecal material in archaeological deposits – which have been used to identify animal penning areas. Spherulites were present, but in low concentrations, that may be the by-products of humans, dogs, or birds rather than flocks of ruminants. That they are preserved even in low quantities suggests future potential for this line of inquiry (White n.d.). A limited flotation program has failed to produce substantial macrobotanicals from the site (Crawford n.d.). However, good preservation of seed and wood remains at nearby al-Ḥimmah (Makarewicz and Goodale 2004) encourages us to expand this aspect of our research program.

Conclusions
Two decades of survey, excavation and geoarchaeological study in the Wādī al-Ḥasā have produced a wealth of information. And the test excavations at Khirbat al-Ḥammām are beginning to shed light on Neolithic occupation in the area. It's clear that the residents at Khirbat al-Ḥammām were inextricably linked to a larger PPNB world via ritual practice, symbolism, trade relationships, and shared technological repertoires (plaster production, chipped stone styles, etc.). But from the vantage of Khirbat al-Ḥammām's multi-phase occupation, I suggest that local Neolithic populations made the transition from MPPNB to LPPNB *in situ*. Geoarchaeological investigations suggest that the Ḥasā environs may well have provided a stable and productive foundation supporting these developments. And continuity between the MPPNB and LPPNB is manifest across a range of behavioral correlates including masonry construction techniques, shell acquisition, and faunal exploitation patterns. Based on these data, I would advance the idea that there are significant local vectors that contribute to PPN culture and identity-construction in the Wādī al-Ḥasā. To further explore and refine the interplay between large-scale, regional and local influences on PPN lifeways is the challenge facing us now.

Acknowledgements
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Species	Origin[1]	TT1	TT2	TT3	surface
Nerita polita	RS	-	-	-	1
Theodoxus jordani	F	-	-	1	-
Melanoides tuberculata	F	-	2	1	-
Melanopsis praemorsa buccinoidea	F	-	9	9	-
Cypraea isabella	RS	-	-	-	1
Cypraea sp.	RS/MS	1	-	1	-
Nassarius gibbosulus	MS	-	1	-	-
Sphincterohila zonata	L	-	3	5	-
Gastropod	RS/MS	-	-	-	1
Glycymeris sp.	RS/MS	-	2	1	1
Acanthocardia tuberculata	MS	-	-	2	-
Cerastoderma glaucum	MS	-	-	1	-
Donax sp.	RS/MS	-	-	1	-
fossil bivalve	Fs	-	-	1	-

1 RS = Red Sea; MS = Mediterranean Sea; F = freshwater; L=land; FS= fossil

TABLE 4. Summary of Sell from 2006 Excavations at Khirbat Ḥammām.

Larissa Rudnicki, and Abby Vande Walle made sizable contributions to the analysis of the 2006 lithic collections. Becky Shafstall assisted with the figure preparation. A special debt of gratitude is owed to Michael Gregory who took care of our two sons in my absence and is unfailingly supportive of my research.

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