

THE EASTERN AL-ḤASĀ LATE PLEISTOCENE PROJECT PRELIMINARY REPORT ON THE 2000 SEASON¹

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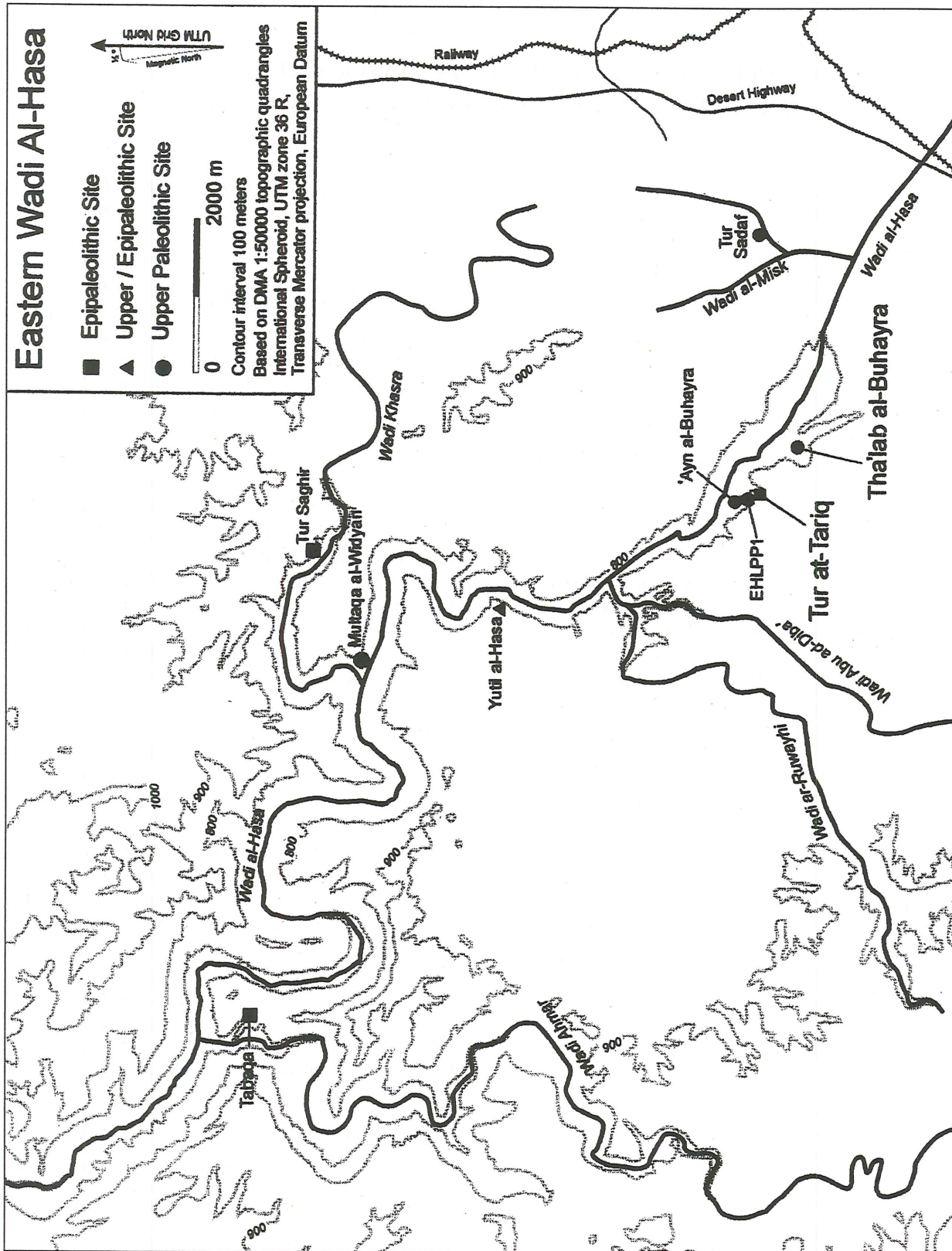
The Eastern al-Ḥasā Late Pleistocene Project (EHLPP) was initiated in 1997 as a research program focused on Upper Paleolithic and Epipaleolithic adaptations to lake and marsh settings in the interior Levant. One such context can be found in the Wādī al-Ḥasā region (وادي الحسا), a major drainage system in west-central Jordan which empties into the Wādī 'Arabah just south of the Dead Sea. During the Pleistocene period, Wādī al-Ḥasā was characterized by a series of lakes and marshes along much of its course. The most extensive lake and marsh was present in the eastern basin of Wādī al-Ḥasā (Schuldenrein and Clark 1994), in the wide, open area in which the modern village of Maḥaṭṭat al-Ḥasā (محطة الحسا) is situated and which the Desert Highway traverses in its route between 'Ammān and al-'Aqaba. In addition to the eastern basin Pleistocene lake and marsh, smaller lakes and marshes in the narrower portions of the main Wādī al-Ḥasā drainage also existed. These could have been created by natural damming at the confluences of major tributaries with the main Wādī al-Ḥasā channel, and each would have been elevationally lower the farther down the Wādī al-Ḥasā one progressed. All of the lakes and marshes were spring-fed and created attractive locales for hunter-gatherer groups for a variety of reasons including access to fresh water, to game, and to plant resources. In a generally xeric Pleistocene landscape, the resources present in areas such as the Wādī al-Ḥasā likely acted as "oases" and can be assumed to have witnessed a more intensive and diverse series of occupations by hunter-gatherer groups than many other areas of the Levant.

Field research and laboratory analysis for the EHLPP began in 1997; the 1997 fieldseason concentrated on three aspects of the research program (Fig. 1). These were: (1) relocating and assessing Upper Paleolithic and Epipaleolithic sites documented by surveys conducted in the late 1970s and early 1980s (MacDonald 1980; 1982; 1983) and early 1990s (Clark *et al.* 1992; 1994) but never test excavated; (2) testing of the Early Upper Paleolithic rockshelter site at Ṭūr Ṣadaf (طور صدف) (WHNBS 8), the Early Epipaleolithic rockshelter site at Ṭūr Ṣaghīr/Sageer (طور صغير) (WHNBS 242), the open-air Early Natufian site at Ṭabaqa (طبقة) (WHS 895), and the Early Upper Paleolithic open-air marl sites at the Multaqā al-Widyān (ملتقى الوديان) complex (WHNBS 192-195); and (3) extensive excavations at the Late Upper Paleolithic site of 'Ayn al-Buḥayra (عين البحيرة) (WHS 618). The results of the 1997 season are reported in Olszewski *et al.* (1998) and further details on the sites are available in Clark *et al.* (1987; 1988), Coinman (1990; 1993; 1997), Olszewski and Hill (1997), and Olszewski and al-Nahar (1997).

In 1998, field research efforts focused on test excavations at four Upper Paleolithic and Epipaleolithic sites. Three of the sites had been previously tested and excavations were renewed in the more promising areas. One site (Tha'lab al-Buḥayra (ثعلب البحيرة): EHLPP 2) was newly discovered during the 1997 fieldseason and was tested for the first time in 1998. The Upper Paleolithic was represented at three sites, Ṭūr Ṣadaf, Tha'lab al-Buḥayra, and Area A at Yutil al-Ḥasā (بتل الحسا) (WHS 784). Ṭūr Ṣadaf yielded two transitional

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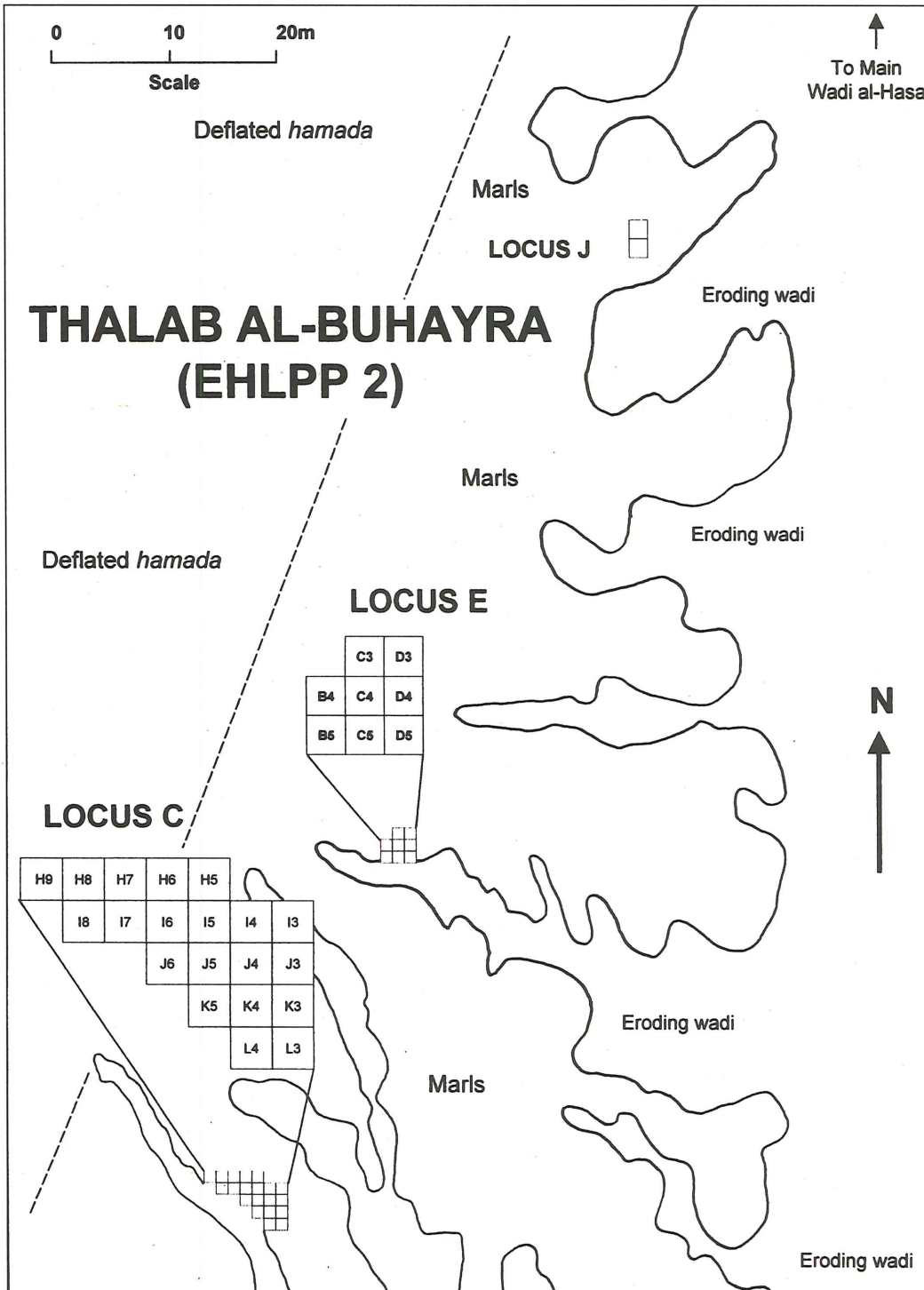
graphic Society, the United States Information Agency/American Centers for Oriental Research, and the Joukowsky Family Foundation. We would also like to acknowledge the geological help we received from Khaled Moumani, and the assistance of our Department of Antiquities representative, Hakim Mahameed, of Pierre and Patricia Bikai and all the support staff at ACOR, and of staff at the Department of Antiquities of Jordan. This is EHLPP Contribution No. 13.



1. Map of the Upper Paleolithic and Epipaleolithic sites in the eastern basin of Wadi al-Hasa.

Middle to Upper Paleolithic assemblages at the base of the deposits, as well as an overlying Early Ahmarian or Early Upper Paleolithic occupation. Three loci were tested at Tha'lab al-Buḥayra, including a specialized butchering and processing locale (Locus C), a generalized base camp area (Locus E), and an individual knapping event (Locus J) (Fig. 2). These are Upper Paleolithic but contain

lithic assemblages which differ in many respects from other Upper Paleolithic sites in the Wādī al-Ḥasā region, in that they include Ksar Akil scrapers and other micro-serrated tools, numerous narrow truncations, and few el-Wad or Ouchtata points. Finally, Area A at Yutil al-Ḥasā, first tested in 1984 (Clark et al. 1987; 1988; Olszewski et al. 1990), was expanded. It yielded a Late Upper Paleolithic



2. Map of Tha'lab al-Buḥayra (EHLPP 2) showing the locations of the 1998 and 2000 season excavation units.

occupation with some Ouchtata bladelets and points.

The Epipaleolithic sites tested in 1998 include Yutil al-Ḥasā Areas C and D and Ṭūr Ṣaghīr. Previous excavations in 1993 at Yutil al-Ḥasā identified an Early Epipaleolithic occupation in Area C and a Late Epipaleolithic (Early Natufian) occupation in Area D (Clark *et al.* 1994; Olszewski *et al.* 1994). Both areas were expanded by new excavations in 1998. The Early Epipaleolithic occupation in Area C is characterized by a number of backed bladelet forms including curved (arched), “lunate-type” (arched-backed and pointed), backed and truncated, and La Mouillah points. Microburin technique was used to produce the backed microliths. Interestingly, there are also Ouchtata bladelets and Dufour bladelets. The latter occur only in the deepest levels of the deposits. In Area D at Yutil al-Ḥasā, the lithic assemblage is typical of the Early Natufian, with numerous Helwan lunates and some directly backed lunates. There were also a number of small endscrapers on retouched blades. At Ṭūr Ṣaghīr, the Early Epipaleolithic lithic assemblage bears a close similarity to that recovered from Area C at Yutil al-Ḥasā. Common backed microlithic types consist of curved, “lunate-type”, backed and truncated, La Mouillah, narrow trapezes, Ouchtata bladelets and points, and Dufour bladelets; these are manufactured using the microburin technique. As at Yutil al-Ḥasā Area C, the Dufour bladelets at Ṭūr Ṣaghīr are confined to the lowest levels in the deposits. Also of note were the Feature 3 hearth area, which appears to be a section of the site used repeatedly for fires, and the presence of three “adzes”, several hammerstones, and examples of unworked chert nodules. More detailed information on these sites can be found in Coinman *et al.* (1999), Fox (2000), Olszewski (1997), and Olszewski *et al.* (1998a, b).

The 2000 fieldseason of the EHLPP occurred between 28 May and 8 July, 2000, and focused on three objectives within the overall research framework of the project. These were to gain a more extensive understanding of the Upper Paleolithic occupations at the open-air site of Tha‘lab al-Buḥayra which is situated within marl deposits of the main lake in the Ḥasā region, to examine the Early and Middle Epipaleolithic contexts at the open-air site of Ṭūr aṭ-Ṭariq/al-Tareeq طور الطريق (WHS 1065) which is at the edge of the main lake, and to conduct a chert raw material survey to identify potential sources of lithic raw material, information which has a direct bearing on technological and settlement choices made by prehistoric hunter-gatherers who occupied the region surrounding

Pleistocene Lake Hasa and its marshes. These topics are the discussed in the sections which follow.

The 2000 Excavations at Tha‘lab al-Buḥayra
ثعلب البحيرة (EHLPP2) (N. Coinman, T. Clausen, L. Saele, A. Sampson and J. Thompson)

During the 2000 season, research on the Upper Paleolithic of the Wādī al-Ḥasā was restricted to one site – Tha‘lab al-Buḥayra (EHLPP2). This site is a very large open-air site that is situated where the modern *ḥamada* intersects remnant lacustrine marls representing a series of ancient shorelines of Pleistocene Lake Hasa. The site was identified in 1997 and tested in 1998 (Olszewski *et al.* 1998; Coinman *et al.* 1999) (Fig. 2). Surface artifacts extend some 160m parallel to the shoreline (N-S) and 50m (E-W) across the *ḥamada* and marls. Ongoing erosion of the marls has resulted in the exposure of a sequence of distinct buried cultural strata characterized by large mammal bones, teeth, and lithic artifacts. Four stratigraphic cultural units have been documented suggesting a sequence of at least four temporally separated occupations.

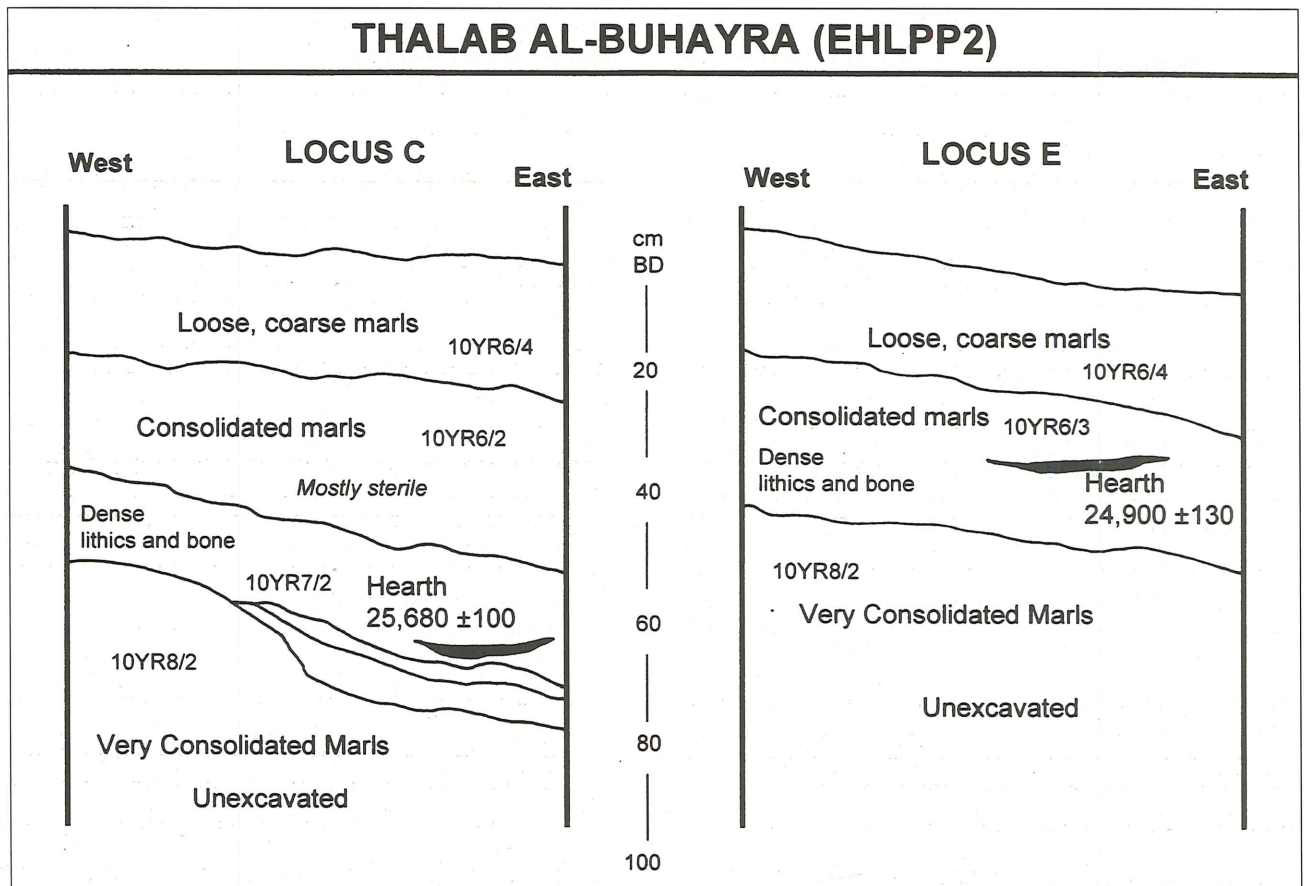
The area around Tha‘lab al-Buḥayra is characterized by exceptionally well-preserved lacustrine marls of the “Wadi Hasa Marl Formation” (Moumani 1996; 1997). Some of the remnant marls reach a height of 20m and register a long sequence of Pleistocene lake environments in which marl sediments are interstratified by dark organic lenses registering paludal episodes. The geomorphological integrity of the marls in the area of the site is relatively well-preserved, and the archaeological site, therefore, provides a good geoarchaeological model of Upper Paleolithic site location, structure, and morphology within a lacustrine context. A series of ancient shorelines are suggested by the position and slope of buried cultural assemblages and features (e.g. hearths) near the intersection of the marls and the *ḥamada*.

The three areas of the site that were tested in 1998 revealed Upper Paleolithic cultural assemblages in three stratigraphic zones. The most recent buried cultural unit was uncovered in Locus J, where relatively low lithic and bone densities occurred in a 0.10m cultural stratum between 0.15 and 0.25m below the modern marl surface. Most of this thin stratum is comprised of lithics representing a single knapping episode in which one core and some 600 pieces of associated debitage were recovered. This area of the site is undated but most likely represents one of the latest occupations at the site because the cultural material was recovered from an eroding zone that characteristically caps the remnant marls along the edge of

the lake plain. Locus E revealed a cultural zone of dense lithics and faunal remains extending from 0.20-0.50m below the modern marl surface (Fig. 3). Dispersed hearths, clusters of equid teeth, and very dense lithics characterized this area of the site. An AMS radiocarbon date of $24,900 \pm 130$ (Beta 129817) was obtained from sediments in one of two hearths (Unit B5, Level 4). Locus C was tested with four contiguous 1 by 1m units from which dense lithic and faunal assemblages were recovered. An extensive occupation area at some 40-80cm below the surface has been dated with an AMS radiocarbon date of $25,680 \pm 100$ (Beta 129818) from charcoal-rich sediments (Unit K3, Level 3 [Level 8 in other units, see below]) (Coinman 2000). Based on the 4m² test unit in 1998, we concluded that the occupation at Locus C was comparatively discrete, sandwiched between very fine, sterile lacustrine sediments below and relatively sterile marl sediments above. Given that the site contained at least three spatially separated occupation periods with essentially *in situ*, well preserved and dated artifact and faunal assemblages, we felt that expanding excavations to include broad ex-

posures at both Loci C and E, would greatly contribute to our understanding of a poorly-understood period within the later Upper Paleolithic sequence. More importantly, however, the site has the potential to address major issues of subsistence, hunting and procurement strategies, and butchering and processing techniques for late Upper Paleolithic sites in a lacustrine context. The preservation of the archaeological record provides an exceptional opportunity to understand not only late Pleistocene hunter-gatherer subsistence but important aspects of settlement – site location, size, activities, and duration of occupations.

Our investigations during the 2000 season consisted of expanding the 1998 exposures at the two most productive areas of the site – Loci C and E (Fig. 2). Excavations were conducted in 5cm levels within 1m² units, which were divided into quadrants for the purpose of mapping and collecting artifacts and samples. In order to maximize the recovery of contextual information, we mapped in all cultural material greater than 2cm in size in each 5cm level. In areas of dense artifacts, multiple plan-views were necessary within a single 5cm level.



3. Schematic illustration of the natural and cultural stratigraphy exposed in two areas (Loci C and E) at Tha'lab al-Buḥayra (EHLPP 2).

These detailed planviews will be digitized for computerized mapping of artifact distributions and determining contextual associations between features such as hearths, soil discolorations, and activity-specific tools and faunal remains. All sediments were screened using a 4mm mesh; samples were collected for macrobotanical remains, pollen, phytoliths, and sediment analysis. Some artifacts, such as scrapers and truncations, were collected with a sample of their surrounding matrix for residue analysis for the purpose of defining tool use and the activities carried out at the site.

Locus C

This season's excavation of an additional 14 units provided extended profiles up to 6m in length of the buried cultural levels. The east-west exposures revealed an ancient shoreline with a gradient of about 8% that slopes downward from the northwest to the southeast. We also discovered that there are at least two closely associated occupations in some areas of Locus C, rather than a single, discrete occupation (Fig. 3). The cultural strata in Locus C occur from about 0.30m below the surface in the northwestern units (arbitrary Levels 7-9) and continue to a depth of 0.77m below the surface in the southeastern units (Levels 10-11). Levels 7-9 represent the main cultural occupation at Locus C, while Levels 10-11 may comprise a less substantial and limited occupation underlying the main cultural assemblage in four of the northern units. The two occupations appear to be separated stratigraphically by limited sediments, although the lithics give the initial impression of being larger and dominated by very large primary elements. The area where this potentially earlier occupation has been found is small and may not be representative. A number of radiocarbon samples consisting of bulk organic sediments were collected to determine the temporal relationship of this lower stratum to the dated overlying occupation. In addition, a 1m section was exposed on the west side of the excavation area where the eroding gully had been heavily vandalized. The exposed stratigraphy revealed the main occupation zone at approximately 0.40m below the modern surface, an absence of another lower occupation, but the presence of two flakes and an endscraper at 0.90m below the surface but in what appears to be an earlier deposition of fluvial gravels. The depositional context of these artifacts at 0.90m below the surface is therefore significantly different than that associated with Levels 10-11 in other units, where cultural material is found in extremely fine, consolidated grey marl sediments with no intervening fluvial gravel beds or sand

lenses. The prehistoric use of the area appears to have been closely associated with the ancient shoreline, and it is assumed that the use of the shoreline represents a series of short-term, limited activity occupation episodes.

Based on the 1998 excavations of an area of 4m², we initially concluded that lithic reduction was limited and the primary focus of activity had been the butchering and processing of large mammals, such as *Bos* and *Equus*. Extending the excavations to include an additional 14 units at Locus C during the 2000 season, we have a much altered picture of activities that occurred at the site. Activities at Locus C involved numerous hearths, extensive lithic reduction and faunal butchering and processing, which have resulted in suggestions of spatial patterning of cores, debitage, faunal remains and hearths.

Hearths: Excavations at Locus C revealed the remains of at least 13 hearths, in addition to three that were identified from the 1998 investigations. This is a conservative estimate since what the actual size of many of the hearths is unknown and some may simply be rather large, untidy remains of more formalized hearths. The hearths generally tend to occur most frequently along an arc from the northwest to the southeast of the excavated area, with a marked absence of hearths in the central and western units. Hearths consist of high concentrations of fine charcoal and ash, but most visibly by sediment discolorations. Most hearths have intense soil mottling and exhibit characteristic pink to bright red burned sediments that are usually underlain by dark brown and white ash sediments. Although it is clear from small, informal modern Bedouin campfires that the local marl sediments turn red or pink rather quickly when subjected to fire, sediments associated with the prehistoric hearths are also linked to the presence of red ochre or hematite, as well as reddish sandstone. These also contribute to reddish tones of some of the sediments. Samples of red minerals and red sandstone have been recovered for identification although their function and association with hearths, butchering, and lithic reduction is as yet unclear.

Some of the hearths appear to have rocks or cobbles that form informal rings around the central hearth area, but most are less well defined in terms of hearth stones. An enormous number of angular local limestone rocks occurs consistently and exclusively with the cultural assemblages, some of which are definitely fire-affected or fire-cracked rock. The precise function of such large quantities of rock is unclear, but their cultural association is

unambiguous.

Fauna: The faunal remains at Tha'lab al-Buḥayra are probably the most impressive of the artifacts recovered and certainly represent one of the largest samples of Upper Paleolithic faunal material from an open site in the Levant. Our investigations revealed an abundance of well-preserved large specimens representing *Bos*, *Equus*, and possibly *Sus*. Articular elements, long bones, cranial and mandibular fragments are particularly well represented, while axial elements are rare.

Approximately seventy-seven whole teeth were recovered this season from Locus C excavations. Most are the molars of large bovids and equids, the latter comprising the bulk of the teeth; however, we also recovered the remains of a mandible with two large, more or less intact, tusks. In close proximity a right zygomatic-maxillary fragment with teeth intact may be associated with the mandible and both appear to be a species of *Sus*. Eight teeth that differ from bovid and equid teeth in size, shape, and cusp configuration were recovered from sediments directly above and to the north of the mandible and may be the teeth of a single individual wild boar. Some smaller mammals, such as gazelle, are indicated by the recovery of a number of small teeth. Other cranial fragments were recovered from nearby units. The dense distribution of cranial and mandibular fragments, teeth, as well as splintered long bones suggest procurement of fatty-rich animal tissue and marrow that is abundant in crania, mandibles, and limb elements.

Lithics: The lithic assemblages at Locus C are more generalized than previously thought. A total of 5481 lithics were recovered from the 14 excavated units (**Table 1**), bringing the total for Locus C to 6720 when the lithics from 1998 (n=1239) are included. This season's excavations have revealed dense knapping areas with some of the most clearly defined knapping locales found in units to the west of the concentration of hearths, where core and debitage frequencies are exceptionally high. Preliminary attempts to characterize the distributions and co-occurrences or associations of cores, primary elements, tools and overall dense lithic assemblages with hearths or to demarcate separate zones of artifacts and features has resulted in no clear cut pattern as yet but there are some general patterns that might identify activity areas and site structure. The densest lithic assemblages (9-13% of the total lithics) occur in three units (K5, J5 and I4), although the highest frequencies of cores (>7) co-occur in only two of those units, with

as many as 7-15 cores occurring in six other units. Both of the hammerstones recovered were found in a unit (J4) contiguous to the units with the highest densities of lithics. Higher than average frequencies of primary elements (>50% cortex) are not strictly associated with high numbers of cores since primary elements occur in many units where core frequencies are relatively low. The unit average for primary elements is 9% of the total debitage with units ranging from 6.8-14.2%, which is greater than the occurrence of primary elements at Locus E, discussed below. Although no definitive spatial patterns can be identified, it should be noted that the actual area represented by 18 excavation units is relatively small, and the actual distance between categories of discarded bone and lithics is being measured between excavation units and not as a measure of absolute distance, which would have more meaning in behavioral terms. Computerized mapping programs that are capable of producing distributional maps, in conjunction with statistical programs designed for spatial analyses may be able to interpret and display patterns that suggest activity areas more closely associated with specific activities or sets of activities that occurred repeatedly at this locale.

One of the most interesting aspects of the Locus C lithic assemblages is reflected in the tool frequencies (**Table 1**). Sixty percent of the retouched pieces are scrapers and truncations, with scrapers making up 43.5% of the tools. These represent a broad range of sizes, blank forms, and retouch characteristics with widely varying types recovered in the same quadrant or behavioral context. The most distinctive scrapers, however, are the Ksar Akil scrapers (Besançon *et al.* 1975-77: 37) which feature micro-serrated edges. This season one example measured nearly 10cm in diameter while another featured micro-serration along half the working edge of a narrow endscraper. Truncations comprise 16.8% of the retouched tools, many of which are double truncations, occurring most often on narrow, bladelet-sized blanks. Another 27.3% of the tools consist of variously retouched blades and bladelets. El-Wad points are present but infrequent (5.6%). Ouchtata retouch and points are represented by only 1.2% of the tools. The combination of el-Wad points, truncations, and Ksar Akil scrapers is also well documented at Boker BE in the Negev (Jones *et al.* 1983). At Boker BE, double truncations are concentrated in Level V and comprise what is described as an unusual toolkit (Jones *et al.* 1983: 313-318).

The Locus C lithics vary from assemblages recovered at other Ahmarian sites in al-Ḥasā, such as

Table 1: Percentages of lithics at Loci C and E at Tha'lab al-Buḥayra (EHLPP2).

	LOCUS	LOCUS
	C	E
DEBITAGE		
Cores	1.8	0.4
Core Trimming Elements	1.7	0.3
Flakes	29.2	28.5
Blades	14.3	9.8
Bladelets	13.0	18.6
Trimming Flakes	39.6	42.3
Burin Spalls	0.4	0.1
TOTAL DEBITAGE (n)	4663	7755
SHATTER	10.0	11.7
TOOLS		
Scrapers	43.5	22.7
Burins		2.5
Burin Cores		
Perforators		0.6
Notches	1.2	1.8
Denticulates	0.6	
Truncations	16.8	27.7
Multi-Tools		0.6
Retouched Flakes	2.5	4.3
Retouched Blades	14.3	22.0
Retouched Bladelets	13.0	11.7
Ouchtata Bladelets / Pts	1.2	1.2
el-Wad Points	5.6	4.9
Varia	1.2	
TOTAL TOOLS (n)	161	163
TOTAL DEBITAGE (n)	4663	7755
SHATTER (n)	547	1055
TOTAL (n)	5371	8973
% Primary Elements	9.0	5.8
HAMMERSTONE	2	

the Early Ahmarian assemblages at Tūr Ṣadaf (Coinman and Fox 2000; Fox 2000) and EHLPP1 (Olszewski *et al.* 1998; Coinman 2000), and they

vary significantly from the later Upper Paleolithic sites of Yutil al-Ḥasā and 'Ayn al-Buḥayra (Coinman 2000). Core reduction is represented by almost equal amounts of flakes and blade/bladelet debitage, although a greater percentage of tools are made on blade/bladelet blanks. Endscrapers and truncations on particularly narrow blanks appear to be more frequent than wider, flake-sized tools. Metrical analyses of the retouched tools will be conducted in order to establish the dimensional parameters of tool types. In conjunction with residue analyses, we should be able to establish their function at specific activity areas of the site.

Non-Flaked Stone: In addition to a large chipped stone assemblage, we documented a number of interesting stones that were utilized but not flaked. Given the faunal evidence suggesting bone smashing for marrow extraction, we might expect large anvil stones (manuports) but these are noticeably absent from the areas excavated to date. A number of non-flaked stones, however, suggest the use of ground minerals and a possible grinding implement. One potential ground stone slab and two pigment stones were recovered. The potential grinding slab has a marked concave surface with hints of slick or polished areas, but no handstones were found. However, two small, soft stones that produce a fine, pale yellow talc-like pigment were found nearby and collected for examination to determine surface faceting that would result from grinding them on a flat stone. A larger loaf-like stone with a well-defined central depression and radiating channels easily produced by rubbing was found in the adjacent unit and produced a fine, pale yellow powdered pigment. Another very large stone of the same pale yellow mineral was found within a meter of the grinding slab but did not exhibit alteration that might suggest it was also used to produce a powdered pigment. It should be noted that these soft stones stand out as isolates among the hundreds of angular, fractured limestone fire-cracked rocks. Only small pieces of red ochre or hematite, as well as red sandstone, were recovered, although many areas exhibited sediments permeated with these red minerals or sandstones.

Locus E

Major efforts were directed at exploring site patterning in Locus E during the 2000 season since the initial test units in 1998 had revealed a later occupation component at the site where lithic and faunal assemblages varied from the earlier occupation at Locus C. This component is stratigraphically positioned above the Locus C occupations in

the uppermost centimeters of the consolidated marls and the lowermost section of loosely compacted, coarse marl sediments that characterize the tops of the marl formation (Fig. 3). Excavation of Units B5, C5 and D5 in 1998 located cultural material concentrated between 0.20 and 0.50m below the modern marl surface, which has been dated at $24,900 \pm 139$ (Beta 129817) on sediments obtained from one of two exposed hearths. Research objectives for the 2000 season were focused on expanding the area of exposure with the hope of defining more clearly site activities that might vary from those associated with the earlier occupation at Locus C. Comparative analyses of the lithic materials indicated a more generalized assemblage of lithics at Locus E with lower frequencies of cores, primary elements, and flakes, but higher frequencies of bladelets and trimming flakes. Tools at Locus E varied from Locus C with a lower proportion of scrapers but higher frequencies of truncations. Faunal remains were less frequent and represented by more fragmented pieces, although there was one concentration of equid teeth in D5.

During the 2000 season, we opened five additional contiguous units and expanded our original exposure to 8 square meters. The same methodologies described above were applied to the excavation of units at Locus E within 0.5m quadrants in 5cm levels. All sediments were screened, and all levels and features sampled for pollen, phytolith, and macrobotanical remains. Planviews of artifacts and features were completed for all levels in each unit.

Preliminary analyses of the lithics and planviews indicate that the original test units done in 1998 were a fairly accurate sample of the larger excavated area. The remnants of three informal hearths, consisting of dispersed charcoal in shallow basin-shaped features approximately 15-20cm in diameter were identified in 1998, while this season, an additional nine potential hearths have been documented. Only one hearth is demarcated by more formal rocks ringing a shallow depression (Feature 1 in C-3), the rest defined by dispersed charcoal sediments. Profiles along the north walls of B, C and D units revealed clearly the position of basin-shaped hearths on a prehistoric surface that sloped downward from west to east, similar to Locus C. Fifteen whole teeth were recovered from the five units excavated in 2000 with 10 of the 15 found in one unit – D4. This follows a similar pattern in 1998 in which the largest number of teeth (7) were found clustered in unit D5. All appear to be equid teeth, although a mandible fragment with small gazelle teeth has been recovered. A great many frag-

ments of molars of large mammals occurred in all units along with other fragmented bones. The more fragmentary nature of the faunal remains at Locus E contrasts with the generally larger, identifiable elements at Locus C, but the high frequencies of teeth and fragments would argue for similar marrow extraction and processing activities at Locus E.

Lithics from the 2000 excavations at Locus E reflect very similar proportions to those collected in 1998. Cores represent only 0.4% of the total debitage, while large flakes and small trimming flakes comprise the bulk of the debitage. In comparison to the 1998 collections, blades are less frequent at 9.8% but are compensated for in higher frequencies of bladelets (18.6%). Retouched tool types are limited, and the two most frequent types (truncations and scrapers) show reverse proportions from those found at Locus C. Truncations were consistently the most frequent retouched tool collected at Locus E, as they were in 1998 units, and comprise a more frequent tool type (27.7%) than is found at Locus C (16.8%). Scrapers, especially narrow endscrapers, make up the second most frequent tool type at Locus E with a frequency of 22.7%. This is considerably higher than the 13.5% scrapers recovered in 1998, and contrasts sharply with the high proportion of scrapers (43.5%) uncovered at Locus C. Density distributions of lithics exhibited a pattern of patchy strips that may be associated with areas surrounding hearths, but a computerized mapping program will be needed to sort out any residual patterning.

Survey of Marls East of the Ḥajj Road

During the last week of the 2000 session, an informal survey was conducted of the marls that stretch southeast from the Ḥajj road to the south of Qal'at al-Ḥasā قلعة الحسا. The purpose of this small survey was to identify and record any significant archaeological sites in similar geomorphological contexts as 'Ayn al-Buḥayra (WHS 618) (Coinman 1993; 2000; Olszewski et al. 1998) and Tha'lab al-Buḥayra. MacDonald's survey of the south bank of al-Ḥasā (WHS 1979-1982) (MacDonald 1988) did not extend east of the Ḥajj road. Here there are relatively well-preserved marls and deflated terraces that extend approximately one kilometer in a southeasterly direction and are cut by a series of eroding gullies. It was in this context that Tha'lab al-Buḥayra was identified in 1997.

The objective of the 2000 survey was to completely canvas this small area at the interface between the deflated *ḥamada* and the remnant marls

with the hope of identifying additional well-preserved Paleolithic sites. A total of 13 archaeological localities were documented, containing low density derived lithic scatters, but none appear to be well-defined or discrete sites containing *in situ* cultural material similar to Tha'lab al-Buḥayra or 'Ayn al-Buḥayra. For each of the lithic localities, we recorded GPS Coordinates (WGS-84), size, elevation, and the types of lithic elements present on the surface. No collections were made at any of the localities.

All of the scatters were located between 819 and 831m asl, with most located at about 825m asl, which is the interface between the deflated *ḥamada* and marls. No cultural materials were observed eroding from exposed undisturbed marl sediments, as is the geomorphological context at Tha'lab al-Buḥayra. However, the lithic scatters are important indicators of past activities in these areas and may be indicators of buried sites that are not visible at this point. Of the 13 scatters, two contained Levallois elements, while five contained what may be either Middle and Upper Paleolithic or Middle-Upper Paleolithic transitional elements. The MP/UP scatters exhibited both elongated Levallois blades and Upper Paleolithic blade cores and debitage with punctiform platforms. Six scatters were comprised solely of Upper Paleolithic blade and bladelet elements and tools. No new site numbers have been assigned to any of the localities at this point.

The 2000 Excavations at Ṭūr aṭ-Ṭarīq طور الطريق (WHS 1065) (J.B. Cooper, H. Jansson, U. Schurmans and D.I. Olszewski)

Ṭūr aṭ-Ṭarīq was first documented by the survey conducted by Burton MacDonald in 1982 (MacDonald *et al.* 1983). It was identified as an Epipaleolithic site and is in a small tributary drainage to the Wādī al-Ḥasā. The first excavations conducted at the site were in 1984 by the "Wadi Hasa Paleolithic Project (WHPP)" directed by Geoffrey A. Clark. The 1984 excavations consisted of a 44 by 1m trench which bisected the site in a north to south direction. The trench was excavated in 5 by 1m increments, each of which was given a letter designation, for example, Step Trench A and Step Trench B. The lowest section of the trench was a 4 by 1m section. The main impetus behind the trench strategy was to gain both a cross-section of the archaeological site and an understanding of how the colluvial deposits of the slope interfaced with the marl deposits at the edge of the lake. The results of the 1984 season included the documentation of two chronological phases within the Epipaleolithic se-

quence at the site, a field analysis of the lithic assemblages, radiocarbon dates, and a general impression of the probable limits of the site boundaries (Clark *et al.* 1987; 1988). The site appeared to be primarily situated in the upslope portion of the hillside, close to the Bahyia Coquina Member (Al-Hasa Phosphorite Formation) bedrock that forms a series of small overhangs, and occasionally small rockshelters. The majority of the excavated assemblage was thus confined to Step Trench A, B, and C, or the uppermost 15m of the trench.

Field laboratory analysis of the lithic assemblages identified two distinct configurations. The earliest is Early Epipaleolithic in character. It contains narrow backed nongeometric microliths and abundant evidence of the use of the microburin technique. This type of assemblage was present in most of the deposits in both Step Trench A and B, as well as the lower deposits in Step Trench C. Bedrock was reached in Step Trench A and B, but not in Step Trench C. Several hearth features were isolated and radiocarbon results yielded dates in the range of 16,500 to 15,500 bp for this Early Epipaleolithic occupation. Overlying the Early Epipaleolithic in Step Trench C was a lithic assemblage containing wide geometrics, most of which have a lunate form although some are also trapezes. This later occupation is Middle Epipaleolithic and bears a general resemblance to assemblages from al-Kharrāna (Kharaneh IV) in the al-Azraq region of Jordan (Muheisen and Wada 1995) and from the Geometric Kebaran of the western Levant (Bar-Yosef 1990). No materials suitable for dating this Middle Epipaleolithic occupation were recovered in 1984. Faunal materials showed evidence of the use of both gazelle and *Bos* (Clark *et al.* 1987; 1988). Ṭūr aṭ-Ṭarīq was interpreted as a base camp on the basis of the 1984 data.

In 1992, during the WHPP survey of the north bank of Wādī al-Ḥasā, Michael Neeley and a small team returned to Ṭūr aṭ-Ṭarīq to conduct further testing (Clark *et al.* 1992). They opened up two 2 by 2m units to better refine the occupations and to gain more of a horizontal exposure of these two regions of the site. Unit B was placed immediately adjacent to Step Trench B on its east side and Unit C about one meter west of Step Trench C. These excavations largely confirmed the sequence identified in 1984 for the B and C portions of the site, that is, for the five meter intervals (north to south) corresponding to Step Trench B and C. The Early Epipaleolithic assemblage was present in the lower deposits of Unit C, while the assemblage from Unit B was almost exclusively Early Epipaleolithic.

Typical features include use of the microburin technique and numerous examples of narrow backed microliths, principally curved, pointed, backed and truncated, and truncated bladelets. The Middle Epipaleolithic appears to have been present in the uppermost level of Unit B and in the upper levels of Unit C. While this assemblage contains some narrow backed forms such as curved, backed and truncated, and truncated bladelets, its most distinguishing characteristic are the wide geometrics, described as "Hasa" lunates, atypical trapezes, double truncated bladelets, and backed and bi-truncated bladelets (Neeley *et al.* 1998; Stevens 1996).

Neeley's analyses suggest that Ṭūr at-Ṭariq was a base camp locale, but one which saw repeated shorter-term rather than longer-term occupations (Neeley 1997; Neeley *et al.* 1998). He refined the Early Epipaleolithic sequence on the basis of characteristics of the lithic assemblages, identifying an earlier, relatively mobile phase and a later less mobile phase. Ancillary data from the analysis of the groundstone assemblages also suggests base camp functions for the Early Epipaleolithic occupations at Ṭūr at-Ṭariq, as do the pollen which show a shift from somewhat drier to somewhat more mesic steppe conditions with the addition of riparian species associated with the lake/marsh (Neeley *et al.* 1998; Peterson 1999). The Middle Epipaleolithic occupation at the site is described as ephemeral.

Given the results of the previous excavations at Ṭūr at-Ṭariq, the EHLPP fieldseason in 2000 was oriented toward two major objectives. The first of these was to ascertain if it was possible to gain a better understanding of the Middle Epipaleolithic occupation at the site and its context vis-a-vis the Early Epipaleolithic occupations, particularly because this type of Middle Epipaleolithic has not been often encountered at sites in Jordan and because it is the only known example of the Middle Epipaleolithic in the Ḥasā region. The second goal was to obtain samples for radiocarbon dating for the Middle Epipaleolithic, if at all possible. To accomplish these goals, five 1 by 1m squares were excavated during the 2000 fieldseason. Square B1 is 50cm west of Step Trench B; its northern wall coincides with the horizontal plane marking the southern boundary of Unit B to the east of the step trench. It is about one meter north of the line marking the southern extent of Step Trench B, and was excavated to serve as a control for the Early Epipaleolithic lithic assemblages which are the predominant phase in the B area of the site. Squares C1 and C2 form a 1 by 2m excavation (with the two meter length oriented north-south). These

squares begin two meters east of Step Trench C and their western walls are on line with the eastern edge of Unit B, some two meters to the north. They are placed to coincide with the uppermost two meters of the Step Trench C area. Finally, Squares C3 and C4 are a 1 by 2 meter excavation oriented east-west. They are situated 50cm to the west of Step Trench C and 50cm south of Unit C. Their eastern and western walls are in line with the eastern and western walls of Unit C; they terminate 50cm north of the boundary between Step Trench C and D. The squares placed in the C area of the site were excavated to recover materials from the Middle Epipaleolithic occupation and the underlying Early Epipaleolithic.

Square B1 was excavated to bedrock, some 64cm below modern ground surface. Thirteen levels were dug within two recognized natural layers. This stratigraphy is far less complex than the five natural layers recognized in other portions of the B area of the site in 1984 and 1992 (Clark *et al.* 1987; 1988; Neeley *et al.* 1998), and probably indicates that excavations west of the step trench are at the limits of the site occupation area. Natural Layer I consists of Arbitrary Levels 1-8. The sediment is a loosely compacted, coarse sandy silt (Munsell 10YR7/3 to 10YR7/4, dry). Cobbles and small boulders are typical inclusions in the top 25cm of the deposit in Natural Layer I. A small pocket of pale brown silt with flecks of charcoal was isolated within Natural Layer I and labeled Natural Layer Ib. It likely represents a natural event such as a void left by a boulder subsequently transported downslope or the decomposition of organic material. Natural Layer II contains Arbitrary Levels 9-12 and Natural Level 13. The sediment is a dry, loose, pale brown silt (10YR7/4, dry) with minimal inclusions. Rodent disturbance is present in the eastern half of the square in this natural layer.

Cultural materials were more common in Natural Layer I (more than 3,000 pieces) than in Natural Layer II (more than 1,100 artifacts). The lithic assemblage in both natural layers is typically Early Epipaleolithic in its characteristics. The most common tool class is microliths, which contains numerous examples of narrow backed forms. These include curved, backed and truncated, and pointed bladelets; there are also rare La Mouillah points. Microburin technique is present. Other tools are endscrapers, burins, notch/denticulates, truncations, and retouched pieces. Four wide lunates were recovered (three from Natural Layer I). They are likely incidental inclusions and do not represent a Middle Epipaleolithic occupation in this area of

the site. Fauna was not well preserved, although a few pieces are burnt. The presence of abundant cobbles and small boulders in Natural Layer I, the packing of artifacts and bone around these rocks, and the vertical placement of some of the lithics within the deposits all suggest that some downslope movement of materials has occurred in this area of the site. Lithic edges are fresh, however, indicating that such movement has not been extensive and that the materials have not traveled far from their original location on the site. The rarity of Middle Epipaleolithic lithic materials in Square B1, as well as in Step Trench A and B and Unit B, further suggests that the Middle Epipaleolithic occupation at the site was situated farther south and east than the area tested by Square B1.

Squares C1 and C2 contain the most complex stratigraphy excavated in the EHLPP 2000 fieldseason at this site. Six natural layers were recognized; they were dug in a series of 22 arbitrary levels extending about 1.10m below modern ground surface. Bedrock was not reached in either square. The stratigraphy in Squares C1 and C2 is analogous to that recovered from the eastern profile of Step Trench C in 1984 (Table 2) (Clark *et al.* 1987; 1988; Neeley *et al.* 1998). The arbitrary levels excavated in 2000 in these two squares correlate with natural layers as depicted in Table 3. Natural Layers I and II are mixed deposits; Natural Layers III and IV contain Middle Epipaleolithic microliths, and Natural Layers V and VI have Early Epipaleolithic assemblages.

Natural Layer I is a thin, loose, dusty, sandy silt (Munsell 10YR7/4, dry) excavated as Arbitrary

Table 2: Correlation of stratigraphy of the 1984 Step Trench C eastern profile with the 2000 Squares C1 and C2.

	2000: Squares C1 & C2	1984: Step Trench C eastern wall
Natural Layer	I	1
Natural Layer	II	2a, 2b
Natural Layer	III	4a
Natural Layer	IV	4b
Natural Layer	V	5
Natural Layer	VI	5

Table 3: Correlation of Natural Layers with Arbitrary Levels for Squares C1 and C2.

	Square C1 Arbitrary Levels	Square C2 Arbitrary Levels
Natural Layer I	1	1
Natural Layer II	2-4	2-4
Natural Layer III	5-6	5-6
Natural Layer IV	7-10	7-11
Natural Layer V	11-16	-
Natural Layer VI	17-22	12-22

Level 1 in both squares. It consists of the churned up modern ground surface and probably represents the top portion of Natural Layer II. Inclusions in Natural Layer I are cobbles, pebbles, and gravels. The cultural assemblage is a mixture of Early Epipaleolithic artifacts and more recent materials such as glass and a tang from a Neolithic Byblos point. Lithics are particularly dense (n=2,423).

The sediment from Natural Layer II is a loose, fine, dusty sandy silt (Munsell 10YR6/4, dry) with a moderate amount of gravel, and few cobbles and pebbles. Arbitrary Levels 2-4 in both squares correspond to this natural layer. More than 3,200 lithics were recovered in this natural layer. The lithic assemblage is primarily Early Epipaleolithic in character and includes narrow curved, backed and truncated, and truncated bladelets, as well as a few microburins. Other tools include moderately frequent retouched pieces, and rare endscrapers, burins, backed pieces, sidescrapers, and truncations. There are also several Middle Epipaleolithic wide lunates and a few ceramic sherds. While the assemblage appears to be somewhat mixed, there is one stratigraphic anomaly that could account for the intrusive presence of the wide lunates. This anomaly occurs in Square C2 and includes an area of Natural Layer III sediment that protrudes upwards in the sequence (thus accounting for the wide lunates which may be from the Natural Layer III protrusion). A piece of dentalium shell and several small fragments of vesicular basalt groundstone were also recovered. Faunal remains are quite fragmentary, although some pieces are probably identifiable. Perhaps more important, however, is the fact that an Early Epipaleolithic lithic assemblage overlies a later Middle Epipaleolithic assemblage. This is the same phenomenon observed in Step Trench C in 1984 and can be explained by the downslope displacement of Early Epipaleolithic materials from an occupation situated a few meters upslope (Clark *et al.* 1987; 1988).

Natural Layer III is comprised of Arbitrary Levels 5-6 in both squares. It is a relatively loose, sandy silt (10YR6/4, dry) with moderate gravels, cobbles and a few small boulders. The rock inclusions are more abundant than in Natural Layer II. Of some interest is the fact that the sediment contains small compacted chunks which are slightly salty to the taste. This type of compaction appears to have developed from the percolation of water into the sediments; the water may be derived from a spring near the bedrock ledge at the top of the site. These levels are the first example of relatively frequent wide geometrics such as wide lunates and wide trapezes. There are also narrow

backed microliths such as curved, backed and truncated, pointed, and truncated bladelets, along with a small number of microburins. The tang from a Neolithic Amuq point was also recovered, but it may derive from the southwestern quad of Square C2 where Natural Layer III is absent and there is a downward intrusion of Natural Layer II sediments which are known to be mixed in character. The lithic assemblage, which numbers more than 3,000 pieces, also contains a moderate frequency of endscrapers, truncations, notch/denticulates, and retouched pieces, as well as rare burins and perforators. Other finds include yellow ochre and a possible piece of groundstone of vesicular basalt. Faunal remains continue to be fragmentary, but include an increasing number of identifiable pieces compared to the upper natural layers; some bone is burnt. The assemblage from Natural Layer III is provisionally interpreted as Middle Epipaleolithic in age and is probably not far displaced downslope.

The sediment from Natural Layer IV appears to represent a colluvial episode at the site, although Squares C1 and C2 were the only area to document this during the 2000 field season. This colluvial episode was also recorded two meters to the west in Step Trench C in 1984 in Natural Layer 4b (Clark et al. 1987; 1988). The sediment in Natural Layer IV is a moderately compact, sandy silt (Munsell 10YR5/4, dry) with very abundant cobbles and small boulders, as well as abundant gravels and pebbles. Some of the sediment is compacted as in Natural Layer III as the likely result of water percolation. Arbitrary Levels 7-10 in Square C1 and Arbitrary Levels 7-11 in Square C2 correspond to Natural Layer IV. The faunal assemblage is comparatively well-preserved in this natural layer and includes many large fragments in the size range of *Bos*, as well as teeth fragments that appear to belong to *Bos*. Moderate amounts of bone are burnt, and fire-affected and burnt rock was also observed. About 3,700 lithics were recovered from this natural layer; these are characteristically Middle Epipaleolithic. Wide lunates and wide trapezes are especially common; there are also examples of narrow backed microliths, particularly backed and truncated, and truncated bladelets. Microburin technique is present but not common. Other tools include a moderate frequency of endscrapers, truncations, retouched pieces, and rare notch/denticulates. Cores are especially abundant compared to other layers in the sequence. Other finds of interest are yellow ochre, a dentalium shell, and a possible groundstone fragment of vesicular basalt. Evidence of some downslope displacement of cultural materials is possibly shown by the wedg-

ing of lithics and bone among the rocks present in this layer.

Despite the fact that Natural Layer IV contains evidence for colluviation at the site and a short downslope shift in cultural materials, this natural layer contained one *in situ* feature, a hearth (Feature A). The top of the hearth was observed at the base of Arbitrary Level 8, at approximately 40cm below modern ground surface. It was excavated through Arbitrary Levels 9-11. The hearth had an oval to circular shape and a funnel-like cross-section. The maximum diameter was 70cm (east-west) and 50cm (north-south). At the base of the hearth the diameter was 30cm (east-west) and 35cm (north-south). Its total depth was 26cm. The hearth was capped by several large cobbles and small boulders, some of which are burnt on the bottom. The fill contained both loose and compact ash, as well as charcoal. Several charcoal samples were recovered for radiocarbon dating. The sediment surrounding the hearth was fire-affected and discolored. A few lithics and bone pieces were recovered from the hearth fill; the lithics are not diagnostic. The Feature A hearth appears to have been constructed near the end of the colluvial episode responsible for the abundant cobbles and small boulders in Natural Layer IV. On this basis, it should be Middle Epipaleolithic in age.

Natural Layer V is primarily present in Square C1; a wedge of this natural layer occurs in the northern half of Square C2. In Square C1, Arbitrary Levels 11-16 correspond to Natural Layer V. The sediment is a moderately compact, clayey silt (Munsell 10YR5/6, dry) with few cobbles but abundant gravels; compaction is more noticeable than in upper deposits. Insect disturbance and a couple of rodent burrows were noted. A few fire-affected and burnt rocks were observed. The lithic assemblage contains over 2,500 pieces and is typically Early Epipaleolithic in character. Narrow backed microliths are abundant and include curved, backed and truncated, truncated, and pointed bladelets. There are also a couple of wide lunates; these may have migrated downward through the deposits as a result of the insect and rodent disturbance. Other tools include a moderate frequency of burins, truncations, notch/denticulates, and retouched pieces, and rare endscrapers, backed pieces, and sidescrapers. Cores are moderately abundant. Both lithic and bone density decreased after Arbitrary Level 12; some pieces of bone are quite large and should be identifiable.

The last depositional unit is Natural Layer VI. This was present in both Squares C1 and C2, and corresponds to Arbitrary Levels 17-22 and 12-22 in

those squares, respectively. It is a somewhat more compact clayey sand (Munsell 10YR 6/6, dry) than that present in Natural Layer V, and includes moderately abundant gravels and pebbles, a few cobbles, and at the base of excavations, an occasional small boulder. Insect and rodent disturbance is present. The lithic assemblage numbers about 4,800 pieces, and is Early Epipaleolithic. Typical narrow backed microliths include curved, truncated, and backed and truncated bladelets. There are also some wide lunates and wide trapezes, which may have been displaced downward through insect and rodent activities. Other tools include a moderate number of retouched pieces, and rare endscrapers, burins, truncations, and notch/denticulates. Microburin technique is common.

It is possible that Natural Layers V and VI in Squares C1 and C2 represent a truncated soil that was in the initial states of development when its formation was halted by the erosional phase that removed the top of Natural Layer V and deposited Natural Layer IV on top of the truncated soil. This interpretation draws some support from the leeching of the clayey sand, a slight color change, and the abrupt contact point between Natural Layers IV and V. The greyish sediment that infilled the rodent burrows may have derived from a truncated A horizon, rich in organic material. In any event, there appears to be a marked environmental change between the natural layers that characterize the Early and Middle Epipaleolithic horizons in this area of the site.

The final area of the site to be excavated is represented by Squares C3 and C4. Four natural stratigraphic layers were identified. Bedrock was not reached. Based on comparisons of these lithic assemblages with the 1992 Unit C excavation assemblages from the natural layers identified in that season (Neeley *et al.* 1998), the following tentative correlation is proposed. Natural Layer I from Squares C1 and C2 probably corresponds to Unit C Natural Layers 1 and 4; Natural Layer II from Squares C1 and C2 to Unit C Natural Layer 5a, and Natural Layer III from Squares C1 and C2 to Unit C Natural Layer 5. Natural Layer IV is a cobble intrusion at the base of the excavation in the eastern half of Square C3. The natural layers in Squares C3 and C4 are more or less horizontal; this contrasts with the Squares C1 and C2 area where the natural stratigraphy generally follows the slope.

Natural Layer I is characterized by a loose, silty sand (Munsell 10YR7/4, dry) with pockets of more compact sediment. Abundant cobbles and pebbles are the major inclusions. Arbitrary Levels 1-5 in Square C3 and Arbitrary Levels 1-4 in Square C4

are correlated with Natural Layer I. The lithic assemblage is Middle Epipaleolithic in character and contains more than 7,500 pieces. Wide lunates are especially common; there are also examples of wide trapezes. Narrow backed microliths are typically backed and truncated or truncated bladelets. Microburin technique is uncommon. Other tools include abundant retouched pieces, moderately frequent notch/denticulates, truncations, and endscrapers, and rare burins. Faunal remains are not well preserved. The especially high density of lithic artifacts in Square C4, Arbitrary Levels 1 and 2, may be indicative of downslope movement of some portion of the cultural materials, although the horizontal stratigraphy of Natural Layer I indicates that it is an ancient intact surface that has been truncated more recently.

The sediment from Natural Layer II is a silty sand (Munsell 10YR6/4, dry) with an increased presence of gravels, cobbles, and small boulders compared to Natural Layer I. Rodent activity was present in the form of a burrow tunnel in the eastern half of Square C4. Arbitrary Levels 6-11 in Square C3 and Arbitrary Levels 5-11 in Square C4 correspond to this natural layer. Bone preservation is poor, and most materials are extremely fragmentary with few identifiable pieces. The lithic assemblage contains over 4,300 pieces; in Square C4, the field analysis suggests that Arbitrary Levels 5-8 may contain a Middle Epipaleolithic assemblage while Arbitrary Levels 9-11 are Early Epipaleolithic in character. This pattern was not discernible in Square C3. Wide lunates and wide trapezes are present, as are narrow backed microliths such as backed and truncated, curved, and truncated bladelets. Microburins are characteristic as well. Other tools include a moderate frequency of retouched pieces, and rare endscrapers, burins, borers, truncations, and notch/denticulates. Lithic density decreases beginning about Arbitrary Level 9. The horizontal stratigraphy suggests that Natural Layer II is primarily an *in situ* ancient occupation surface.

Natural Layer III is a more compact, clayey silt (Munsell 10YR7/3, dry) with fewer pebbles, cobbles, and small boulders. Arbitrary Levels 12-17 in Square C3 and Arbitrary Levels 12-18 in Square C4 correspond to this natural layer. The lithic assemblage numbers over 1,000 artifacts. These are Early Epipaleolithic and include a few narrow curved backed bladelets. One wide lunate was also recovered. Other tools consist of rare endscrapers, burins, truncations, notch/denticulates, and retouched pieces. The horizontal stratigraphy suggests an ancient *in situ* deposit, with perhaps a

trickle-down effect of artifacts from an occupation horizon above.

The cobble and small boulder area in the north-western quad of Square C3 was identified as Natural Layer IV. The interstices are infilled with fine sands, silts, and clays (Munsell 10YR6/4, dry).

The occupational history at Tūr at-Tariq is relatively straight forward, although some areas of the site have yielded somewhat complex stratigraphies. In the 2000 fieldseason, the five 1 by 1m squares excavated yielded a total of over 39,000 lithic artifacts representative of the Early and Middle Epipaleolithic periods, as well as some mixing in the uppermost arbitrary levels with later materials (glass, sherds, and Neolithic point tangs). These lithic assemblages are roughly delimited in **Tables 4 and 5**. Compared to excavations during the WHPP seasons in 1984 and 1992, the EHLPP fieldseason in 2000 at this site added confirmatory evidence to the depiction of an Early Epipaleolithic occupation with at least two phases (the earliest emphasizing increased mobility compared to the later phase), and to the presence of a Middle Epipaleolithic occupation. The results of the 2000 fieldseason, however, suggest that the Middle Epipaleolithic is more than an ephemeral phenomenon at the site. Rather, it appears to be relatively *in situ* in areas west of the 1984 Step Trench and may have moved slightly downslope in areas east of the step trench. The Feature A hearth from Square C2, Layer IV, appears to be associated with the Middle Epipaleolithic occupation and results of radio-

Table 4: Preliminary lithic analysis of assemblages from the EHLPP 2000 fieldseason at Tūr at-Tariq (WHS 1065): Early Epipaleolithic assemblages.

	Sq. B1	Sq. C1*	Sq. C2*	Sq. C3	Sq. C4
Scrapers	4.4	3.4	2.7	2.9	8.2
Burins	4.0	3.1	1.4	3.6	2.7
Truncations	4.0	4.2	6.8	10.7	4.1
Notch/Denticulates	10.1	3.8	4.1	-	11.6
Retouched Pieces	16.7	9.2	6.2	40.0	10.3
Other Tools	2.6	0.4	0.7	2.1	6.2
Nongeometrics	54.6	68.6	69.9	34.3	47.9
Geometrics	3.5	7.3	8.2	6.4	8.9
Total Tool Frequency	5.5	5.8	4.7	7.8	3.9
Cores	0.8	0.3	0.5	1.3	0.6
Microburins	0.5	1.6	0.6	0.6	0.2
Debitage	71.0	73.2	74.4	71.6	66.6
Shatter	22.2	19.1	19.8	18.7	28.7
Grand Total	(4,112)	(4,485)	(3,108)	(1,791)	(3,730)
Excluding Natural Layers I and II.					

Table 5: Preliminary lithic analysis of assemblages from the EHLPP 2000 fieldseason at Tūr at-Tariq (WHS 1065): Middle Epipaleolithic assemblages.

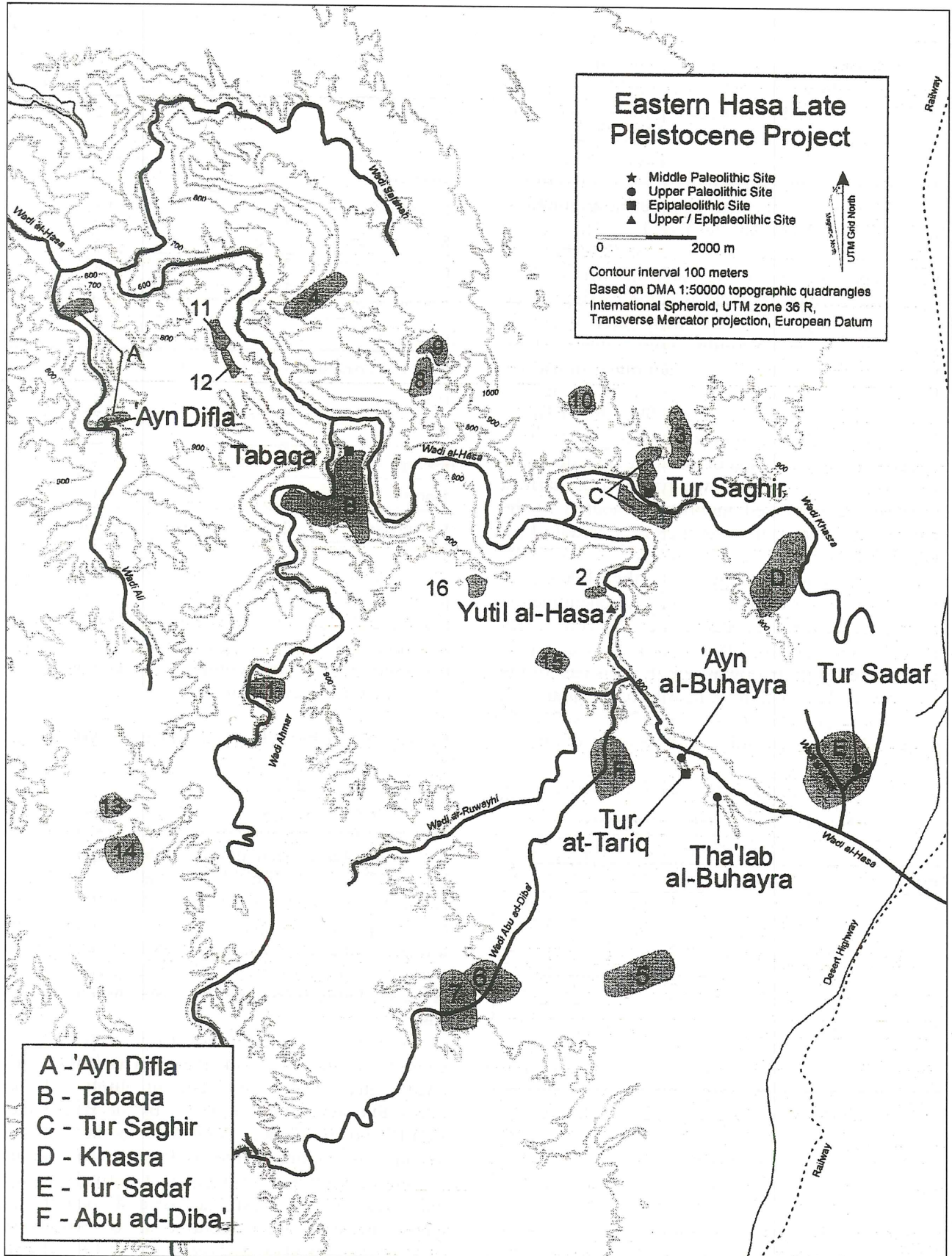
	Sq. C1	Sq. C2	Sq. C3	Sq. C4
Scrapers	6.8	6.1	3.2	3.9
Burins	5.2	6.7	5.4	2.3
Truncations	7.6	1.4	12.2	5.9
Notch/Denticulates	4.0	6.1	1.8	7.9
Retouched Pieces	10.4	8.1	37.8	15.7
Other Tools	2.0	1.4	4.9	3.0
Nongeometrics	46.2	45.9	12.2	48.2
Geometrics	17.7	24.3	22.5	13.1
Total Tool Frequency	5.7	5.1	7.0	5.5
Cores	0.7	0.7	0.8	0.5
Microburins	0.2	0.03	0.2	0.03
Debitage	75.6	77.8	77.4	68.6
Shatter	17.7	16.4	14.6	25.4
Grand Total	(4,362)	(2,918)	(3,175)	(5,541)

carbon analysis of charcoal from the hearth should prove informative. Analyses of faunal, phytolith, pollen, and macrobotanical remains from this excavation season will provide additional information necessary for a more complete understanding of the prehistoric occupations here.

Survey for Chert Raw Material Sources (U. Schurmans, H. Jansson, J.B. Cooper, M. al-Nahar and D.I. Olszewski)

A final goal of the EHLPP 2000 fieldseason was to survey for sources of chert raw materials that could have been exploited by Upper Paleolithic and Epipaleolithic hunter-gatherers in Wādi al-Ḥasā. This was accomplished through systematic sampling of 16 transect areas and nonsystematic sampling of six transect areas in areas both north and south of the main Wādi al-Ḥasā drainage (**Fig. 4**). **Table 6** lists the various transects and areas.

Fifteen of the areas selected for sampling were chosen on the basis of their proximity to archaeological sites of the Upper Paleolithic and Epipaleolithic that have been tested by the WHPP and EHLPP projects since 1984, and on the basis of available exposures of three of the main formations present in the Wādi al-Ḥasā area. The final transect was placed in Wādi 'Alī وادي علي and coincides in part with the Middle Paleolithic site of 'Ayn Diflā عين دفلى (WHS 634) (Clark *et al.* 1987; 1988; Lindly and Clark 1987). Nonsystematic survey transects



4. Map of the transect areas in a survey for sources of chert raw materials in the eastern basin of Wādī al-Hasā.

Table 6: Chert raw material transect areas.

Transect No./Name	Area	Formations/ Members	Method
1	Wādī Aḥmar	WG, ASL, SP	systematic
2	Wādī al-Ḥasā	WG, ASL, SP	systematic
3	Wādī al-Khanāṣiri al-Gharbī	ASL, SP, BC	systematic
4	Wādī al-Ḥasā	WG, ASL, SP	systematic
5	Wādī ar-Riwāq	BC, QP	systematic
6	Wādī Abū aḍ-Ḍibā'	BC, QP	systematic
7	Wādī Abū aḍ-Ḍibā'	SP, BC, QP	systematic
8	Wādī al-Ḥasā tributary	WG, ASL, SP	systematic
9	Wādī al-Ḥasā tributary	ASL, SP	systematic
10	Wādī Khaṣra (Kurrāth) tributary	WG, ASL, SP	systematic
11	Wādī al-Ḥasā	WG, ASL	systematic
12	Wādī al-Ḥasā	ASL, AHP	systematic
13	Wādī Aḥmar	WG, ASL, AHP	systematic
14	Wādī Aḥmar	WG, ASL, SP, BC, QP	systematic
15	Wādī ar-Ruwayḥī	AHP, BC, QP	systematic
16	Wādī ar-Ruwayḥī	AHP, BC, QP	systematic
'Ayn Diflā	Wādī 'Alī	WG, ASL, AHP	nonsystematic
Ṭabaqa	Wādī al-Ḥasā/Wādī Aḥmar	WG, ASL, AHP	nonsystematic
Ṭūr Ṣaghīr	Wādī Khaṣra (Kurrāth)	WG, ASL, SP, AHP	nonsystematic
Khaṣra (Kurrāth)	Wādī Khaṣra (Kurrāth)	ASL, SP, BC, QP	nonsystematic
Ṭūr Ṣadaf	Wādī al-Misk; Wādī al-Misk tributary	ASL, SP, BC, QP	nonsystematic
Abū aḍ-Ḍibā'	Wādī Abū aḍ-Ḍibā'	BC, QP	nonsystematic

were designed to obtain an impression of available knappable materials in the immediate vicinity of archaeological sites or in areas of relatively close proximity. Systematic sampling involved spacing the individual surveyors at intervals of 50 to 150m, depending on topographic conditions, and having each surveyor sample all *in situ* occurrences of knappable and nonknappable raw material in their transect line.

There are three major formations in the Wādī al-Ḥasā region which yield cherts (descriptions are from Moumani 1997). These are pre-Quaternary in

age (Cretaceous) and belong to the "Belqa Group". From oldest to youngest, they are the "Wadi Umm Ghudran" (WG), "Amman Silicified Limestone" (ASL), and "Al-Hasa Phosphorite" (AHP) Formations. The WG Formation contains various limestone, sandstone, and quartzite occurrences. There are also brecciated cherts and chert lenses. The ASL Formation is a series of large, hard chert beds that yield a steep slope topography. Brecciated cherts are especially common in the sequence; there are also bedded cherts, phosphatic cherts, dolomite cherts, coquinas, phosphates, and coquinal

limestone. The phosphate increases toward the top of the ASL Formation. The AHP Formation is composed of three members in the Wādī al-Ḥasā area. These are the "Sultani Phosphorite" (SP), the "Bahiya Coquina" (BC), and the "Qatrana Phosphorite" (QP). In general, the AHP contains phosphate, phosphatic chert, phosphatic limestone, chert, microcrystalline limestone, and a prominent oyster shell coquina (the BC).

All three formations yielded numerous types of knappable rock. These included quartzite, bedded chert, nodular chert, phosphatic chert, siliceous phosphorite, and siliceous coquina. In fact, most raw material encountered was knappable, even some portions of the brecciated cherts. The color range was fairly extensive, although most cherts, phosphatic cherts, and siliceous phosphorites tend to fall into various shades of grey (light, medium, and dark). Some occurrences are white, others have ring bands of purple to pink within a grey matrix. Also noted are a creamy beige chert that tends to occur most frequently within the QP. Some of the bedded and brecciated cherts from the ASL yield an almost translucent grey chert, as do several nodules (not *in situ*). Most of the chert knappable raw material encountered has a "matte" or dull finish; more rarely were "glossy" finish cherts seen or collected in the transects. As a general observation, the cherts encountered in the transect surveys in the WG Formation tended to occur most frequently with a "matte" finish, while those from the ASL Formation were somewhat more fine-grained and included "glossy" and translucent types.

Most transect surveys encountered chert nodules which had rolled downslope from unknown sources. These nodules usually have either a smooth, thin, orange desert varnished surface or a thicker, whitish limestone cortex. When examined, the nodules often yield high quality chert of the type that prehistoric groups frequently exploited. During the course of the transect surveys, two *in situ* exposures of nodular chert were located. These *in situ* occurrences were encountered in several of the transects indicating that this type of nodular chert is not a highly localized phenomenon. One such occurrence of nodular chert in limestone bedding occurs in the WG Formation, the other in the ASL Formation. It is suspected that similar *in situ* nodular chert is also part of the AHP Formation, but the transect survey did not encounter it *in situ*. Both instances of *in situ* nodular cherts occur relatively high in their respective sequences within the WG and ASL Formations. Elevations were obtained using a GPS (Global Positioning System) unit, but the numerous faults throughout the Wādī

al-Ḥasā region mean that the layers within these formations can have significantly different elevations meters asl depending on the upward or downward movement of blocks of land due to faulting. For example, the *in situ* nodular chert in the ASL Formation occurred at 1030m asl in Transect 4 but the same *in situ* nodular chert is at 856m asl in the Khaṣra خصرة Transect.

Bedded chert, brecciated chert, phosphatic chert, siliceous phosphorite, and siliceous coquina occur widely throughout the Ḥasā region. They generally appear as narrow bands (ca. 15 to 30cm) of raw material which can be stacked one on top of another. Most have a desert varnished surface of light orange to dark orange to black coloration. A few of these occurrences have a thin, light yellowish limestone cortex. Moderate sized blocks of these raw materials often can be pulled away from their bedding by hand or can be loosened with a hammerstone and then pulled away. Once separated, they can be easily knapped, although some are riddled with flaws and break in unpredictable ways. These types of raw material are the most ubiquitous in the landscape.

The transect survey for chert raw material sources resulted in two major observations of relevance to the modelling of prehistoric behaviors in the Ḥasā region regarding raw material as a variable in settlement and lithic technology decisions. First, raw material is essentially available everywhere. In virtually all areas surrounding the archaeological sites which have been excavated by the EHLPP and WHPP projects, knappable, good quality chert can be found within 50 to 100 meters of each site. The slope topography of the Ḥasā region has probably not been considerably altered since the occupation of many of these sites, suggesting that these raw materials were probably not buried and thus unavailable. It is possible that vegetation cover was heavier during the Pleistocene than today, and this may have affected the visibility of some of the raw material sources. The wide availability of raw material suggests that it should not have been a major factor in lithic technology decisions or even in choice of site location.

The second observation, however, adds an interesting highlight to the issue of raw material availability. Examination of the raw materials comprising the lithic artifacts from the sites of Ṭūr Ṣaghīr, Yutil al-Ḥasā, and Ṭabaqa by one of us (DIO) has shown, not surprisingly, that certain preferences for chert raw material are characteristic of each site and often of different temporal occupations at the sites as well. This also appears to be true for the sites of Ṭūr aṭ-Ṭariq and Tha'lab al-

Buḥayra, based on casual examination during field laboratory analyses. For example, both the Late Upper Paleolithic and Early Epipaleolithic occupations (Areas A and C, respectively) at Yutil al-Ḥasā show a marked preference for light to medium grey “matte” finish cherts. This contrasts with the Early Epipaleolithic at Ṭūr Ṣaghīr, which is characterized by a high frequency of either finer-grained grey cherts or by almost translucent, “glossy” finish grey to grey-brown cherts. Both of these examples, in turn, contrast with the Late Epipaleolithic (Early Natufian) occupations at Yutil al-Ḥasā (Area D) and Ṭabaqa, where the preferred raw materials are a finer-grained “glossy” finish grey chert and a translucent, almost chalcedonous, light grey “glossy” finish chert. Regardless of the site or the temporal occupation, cortical surfaces on cores and debitage most frequently are either a thick, whitish limestone cortex or a smooth, orange desert varnish; both are indicative of nodular cherts rather than bedded cherts.

The fact that certain raw material preferences are expressed at each site, however, ultimately has less impact than might be expected. This is because, with the possible exception of the translucent, almost chalcedonous raw material,² the main types of chert available in the closest proximity to each site were the types chosen most frequently for exploitation. For example, it appears that if a “matte” finish chert source was closest to the site, then prehistoric groups did not venture another hundred meters or so farther upslope to obtain somewhat finer-grained cherts nor did they travel farther afield to exploit the very fine-grained, almost translucent, “glossy” finish cherts which seem to be less widely available in general across the Ḥasā region. One possible reason that movement to the somewhat more localized occurrences of exceptionally high-quality raw material may have been restricted is the presence of a series of Pleistocene lakes in the Wādī al-Ḥasā drainage. These might have made travel between the south and north sides of the Wādī al-Ḥasā somewhat less easy because many portions of the main drainage of the Wādī al-Ḥasā would have been infilled with water, as one lake abutted the natural dam that created the next lake immediately downstream. It is not hard to imagine that traveling from the north to the south sides of the Wādī al-Ḥasā during some temporal periods might have required walking quite far to the east in order to skirt

around the eastern end of the main Lake Hasa in the eastern basin. Given the proximity of acceptable quality chert to all sites, such trips for even higher quality raw material were probably considered unwarranted.

Concluding Remarks

The wealth of information that has been obtained from archaeological work on the late Pleistocene in the Wādī al-Ḥasā region since 1984 during both the WHPP and the EHLPP projects has offered considerable insight into interior Levantine adaptations during the Upper Paleolithic and Epipaleolithic periods. Lake/marsh contexts such as existed in the Wādī al-Ḥasā acted to tether prehistoric groups to these “oases” during climatic episodes that otherwise created relatively harsh, xeric conditions across much of the Levant. The variability in these adaptations has in many ways exceeded the expectations of models originally developed for archaeological behaviors observed in the western Levant and, in many respects, the data derived from these and other Late Pleistocene projects in Jordan has fundamentally altered how researchers conceptualize and interpret the prehistoric signatures left by these ancient groups.

The excavations at Tha‘lab al-Buḥayra during the 1998 and 2000 seasons have identified and brought to light a little known time period within the Upper Paleolithic. This is what might best be referred to as the “tail-end” of the *early* Upper Paleolithic since the core technology and tools have a stronger association to the early Ahmarian than to what follows after 24,000 bp at such late Upper Paleolithic sites in al-Ḥasā as Yutil al-Ḥasā, ‘Ayn al-Buḥayra, or at “Ein Aqev East” in the Negev. More importantly, however, the archaeological record at Tha‘lab al-Buḥayra is so well-preserved as to provide an unprecedented opportunity to study subsistence strategies during the waning years of the Pleistocene and in what had been an optimal ecological setting with a focus on abundant lacustrine/marsh resources. The unusually well-preserved faunal material, in association with stone tool production, provides detailed information on what most likely were logistical procurement strategies featuring hunting, butchering, and processing of large ungulates within the context of small, short-term encampments – areas that were used repeatedly over millennia. The site has provided details on site size and the duration of occupations, as

2. The transect surveys did not isolate a consistent source for chalcedonous chert, although some portions of bedded cherts in several of the transects yielded chalcedonous chert at the outer edges of the beds. Cortical surfaces for lithic ar-

tifacts of this material from Ṭabaqa and Yutil al-Ḥasā Area D, however, suggest that prehistoric groups here were using nodular forms of chalcedonous chert, some of which was derived from wadi cobbles.

well as new information on intra-site activities and patterning. Detailed analyses by specialists on the fauna, pollen, phytoliths and macrobotanical remains should allow us to reconstruct the paleoecology of these Pleistocene lake environments which represent an important ecological context for late Paleolithic human groups in the Levant.

The archaeological evidence along the ancient shorelines of Pleistocene Lake Hasa attests to the long-term use of one of the lacustrine environments in the eastern Ḥasā during the late Pleistocene. It is important to note, however, that all of the archaeological evidence for shoreline occupations is associated with Middle and Upper Paleolithic sites and that little evidence documents human use of the lake's shoreline after approximately 19,000 bp. This would suggest that at the end of the Last Glacial Maximum (ca. 19,000 bp), the lake receded significantly and that spring-fed fresh water ponds that were concentrated around the northwestern portion of Lake Hasa dried up. The lacustrine-dominated ecology of the eastern Ḥasā shifted to one characterized by more widely dispersed marshy localities while Lake Hasa, and the extensive system of lakes along the course of the Ḥasā drainage most likely diminished significantly in size and became increasingly saline. The geological contexts, landscape chronologies, and geoarchaeology of late Pleistocene sites in the Ḥasā remains to be explored in greater detail since without a better understanding of the geological background, we cannot clearly understand or appreciate the dynamics of human adaptive strategies and land use at a time of irrevocable worldwide climatic change at the end of the Pleistocene.

The Epipaleolithic in the Wādī al-Ḥasā documents the presence of groups during the early, middle, and late phases of this temporal period. Early Epipaleolithic occupations are present at Yutil al-Ḥasā Area C, Ṭūr Ṣaghīr, and Ṭūr aṭ-Ṭariq. The lithic assemblages from Yutil al-Ḥasā Area C and Ṭūr Ṣaghīr are closely similar, while backed microliths from Ṭūr aṭ-Ṭariq emphasize slightly different morphologies. This is a probable result of chronological change in assemblages given that Ṭūr aṭ-Ṭariq is about 5,000 radiocarbon years younger than the other two sites. Of special interest is the fact that radiocarbon dates from Ṭūr Ṣaghīr are chronologically indistinguishable from radiocarbon dates from Late Upper Paleolithic occupations at Yutil al-Ḥasā Area A and 'Ayn al-Buḥayra spring area; all of these fall into the interval between about 23,000 to 19,000 bp (Olszewski and Coinman n.d.). Given that the lithic assemblages are quite distinct, with finely retouched bladelets,

Ouchtata points, and Ouchtata bladelets at Late Upper Paleolithic occupations, and narrow backed microliths manufactured using the microburin technique at Early Epipaleolithic occupations, there appears to be support for arguing that functional differences are being documented between relatively contemporary sites rather than the presence of different ethnic groups.

Although only one site has a Middle Epipaleolithic occupation, the site of Ṭūr aṭ-Ṭariq, this phase in the Ḥasā is notable for yielding a wide geometric (wide lunates and wide trapezes) type of assemblage with little emphasis on microburin technique. Ṭūr aṭ-Ṭariq is one of only two examples in Jordan of this type of assemblage, the other being at "Kharaneh IV" in the al-Azraq region. Quite interestingly, both of these sites are associated with lake/marsh contexts. The 2000 EHLPP field season was able to investigate this phase in more detail with expanded excavations at Ṭūr aṭ-Ṭariq and the discovery of one hearth feature that appears to be Middle Epipaleolithic in age. Radiocarbon dating of charcoal from this feature has the potential for providing the first reliable dating of this type of Middle Epipaleolithic in Jordan.

The Late Epipaleolithic in Wādī al-Ḥasā has documented only Early Natufian occurrences. These are present at Yutil al-Ḥasā Area D and Ṭabaqa. Both sites have numerous examples of Helwan lunates and of short endscrapers on retouched blades. There are also indications of relatively extensive use of groundstone technology in the form of mortars, handstones, and other portable groundstone items from Ṭabaqa, and bedrock mortars and cupmarks in the bedrock ledge above the Yutil al-Ḥasā Area D rockshelter which may be associated with this period of occupation at the site. Quite interestingly, both of these Early Natufian sites occur some kilometers away from the eastern basin of the Ḥasā, suggesting that the lakes and marshes present there had disappeared some time prior to the Early Natufian use of the Ḥasā region. Sites such as Ṭabaqa and Yutil al-Ḥasā Area D also serve as data points refuting the notion that Early Natufian occupations occurred only in Mediterranean forest contexts which are primarily characteristic of the western Levant.

Finally, a survey for chert raw material sources was conducted during the 2000 EHLPP field season. Chert, in both bedded and nodular form, is widely available in the three major formations that characterize the geology here. Preliminary analysis suggests that no prehistoric group had to travel farther than 50-100 meters from where they camped

to gain access to good quality knappable chert, and they appear to have followed the principle of least effort in this regard in virtually all cases. The fact that chert raw material is so abundant in al-Ḥasā means that models of settlement patterning and of lithic technology for the Ḥasā need not consider raw material to be a major variable in prehistoric decision-making. This should prove an interesting contrast to other lake/marsh areas, such as al-Azraq, where raw material sources may have been less widely available.

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