

# THE EASTERN AL-ḤASA LATE PLEISTOCENE PROJECT A PRELIMINARY REPORT ON THE 1997 SEASON

by

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The first field season of the Eastern al-Ḥasa Late Pleistocene Project (EHLPP)<sup>1</sup> was conducted from 1 June to 12 July 1997. There were four major objectives for this season: (1) Relocation and assessment of sites located previously by the Wādī al-Ḥasa Survey (WHS) (MacDonald *et al.* 1980, 1982, 1983) and by the Wādī al-Ḥasa North Bank Survey (WHNBS) (Clark *et al.* 1992, 1994); (2) Test excavations at four sites, including Ṭor Ṣadaf (WHNBS 8), Ṭor Ṣageer (WHNBS 242), the Multaqa al-Widyān site complex (WHNBS 192-196), and Ṭabaqa (WHS 895); (3) Block excavations and further testing at 'Ayn al-Buḥayra (WHS 618); and (4) Geoarchaeological investigations concentrating on new work on Ṭor Ṣadaf, Ṭabaqa, and the Wādī al-Ḥasa and Wādī al-Aḥmar confluence, as well as continuing investigations at 'Ayn al-Buḥayra and at the juncture of the Wādī al-Ḥasa and Wādī al-Khasra<sup>2</sup> (Fig. 1).

These goals relate to the modelling of settlement patterning associated with the lacustrine and marsh ecology that typified areas of the Wādī al-Ḥasa during the interval from about 25,000 -11,000 bp. As detailed elsewhere (Olszewski and Coinman in press; Schuldenrein and Clark 1994), the eastern al-Ḥasa basin contained a Pleistocene lake which was present at least as late as about 20,000 bp. Local conditions fa-

vored extended visits by hunter-gatherers. Subsequent to this, during the approach of the Last Glacial Maximum (LGM), about 18/17,000 bp, it is likely that Pleistocene Lake al-Ḥasa shrank in extent or disappeared. During the LGM, hunter-gatherers probably were highly mobile, although the eastern al-Ḥasa would have remained attractive because of the many springs and ponds or small marshes. After the LGM, climatic conditions ameliorated, and the marsh and pond system became more extensive. This again favored longer stays at basecamps in the eastern al-Ḥasa basin. These favorable conditions persisted until at least 11,000 bp and the advent of the cooler and drier Younger Dryas climatic interval during which the marsh system in the eastern al-Ḥasa likely disappeared.

## Relocation and Assessment of WHS and WHNBS Sites (D. I. Olszewski and N.R. Coinman)

Of the 13 sites chosen for relocation, assessment, mapping, and surface collections during the 1997 EHLPP, these tasks were successfully completed for nine of the sites. The selected sites were described by WHS and WHNBS personnel as primarily Upper Paleolithic and/or Epipaleolithic based on surface collections made at those sites during the various survey seasons. The selected

1. The EHLPP team was directed by Nancy R. Coinman (Iowa State University) and Deborah I. Olszewski (Bishop Museum, Honolulu), and included J. B. Cooper (University of Nevada-Las Vegas), M. al-Nahar (Arizona State University), J.B. Hill (ASU), T. Clausen (ISU), J. Fox (ISU), and J. Williams (Southern Methodist University). Also participating were J. Schuldenrein (GeoArchaeology Associates, Inc.), Nabil Ali (Yarmouk Uni-

versity), and Jihad Darwish (Department of Antiquities representative). Funding was provided by Grant No. SBR9618766 from the National Science Foundation. This is EHLPP Contribution No. 1.

2. The Wādī al-Khasra was previously identified by us as the Wādī Abū Kharaf. We have corrected this to reflect the terminology used by local inhabitants.





sites include WHNBS 15, WHNBS 17, WHNBS 38, WHNBS 49, WHNBS 54, WHNBS 68, WHNBS 135, WHNBS 518, WHS 222, WHS 540, WHS 704, WHS 746, and WHS 921. All but 5 sites (WHNBS 518, WHS 222, WHS 540, WHS 746, and WHS 921) are within 4 km of Pleistocene Lake al-Ḥasa in the eastern basin of the al-Ḥasa drainage. WHNBS 518 is about 2 km downstream from the confluence of the Wādī al-Ḥasa and al-Aḥmar, and more than 15 km from Pleistocene Lake al-Ḥasa. WHS 222 is in the Wādī al-La'bān, not far from its confluence with the Wādī al-Ḥasa, while WHS 540 is along the King's Highway where it crosses the Wādī al-Ḥasa. WHS 746 is in the Wādī al-Ḥasa about 5 km downstream from Pleistocene Lake al-Ḥasa, and WHS 921 is on the plateau above the Wādī al-Ḥasa, not far from the confluence of the Wādī al-Ḥasa and Wādī al-Khasra. We were unable to relocate WHS 704, which is in the Wādī Abū ad-Diba, in the immediate vicinity of Pleistocene Lake al-Ḥasa. One new site (EHLPP 2) was discovered east of the area surveyed by MacDonald during 1982.

EHLPP 2 is a new Upper Paleolithic site that was located during reconnaissance of the remnant marls that lie along the southwestern margins of the al-Ḥasa lake bed. The site consists of a dense scatter of lithics that are primarily Upper Paleolithic, although there are Middle Paleolithic and some later Epipaleolithic pieces present. The site is extensive, minimally covering an area of some 100 by 50 m. The most diagnostic elements are eroding from the upper 0.30 m of the marl crust and consist of dense fossilized large mammal bone and teeth. In association with these faunal remains are long narrow bladelets and bladelet cores. Two K'sar Akil denticulated scrapers were recovered. The technological features of the long narrow blades and bladelets suggest an early rather than late Upper Paleolithic occupation.

WHNBS 17 was relocated at the northern end of a primary tributary to the Wādī al-Ḥasa where there are three major south-facing rock-shelters. It is situated at an elevation of 870 masl. Although this site was attributed to the Upper Paleolithic, few lithics were recovered that would suggest the site was occupied during this time period. The site measures some 70 m wide in front of the rock-shelter and 40 m deep. The interior of the rock-shelter is very deep, and a shovel test pit was initiated inside the drip-line to determine if any buried deposits remain. Approximately 40 cm of modern dung and ash were found directly overlying bedrock.

Surface lithics were extremely rare on the terrace in front of the rock-shelter while naturally decomposing flint was abundant along with a few ceramic sherds. However, at the smaller, neighboring rock-shelter to the east (WHNBS 15), a number of more typically Upper Paleolithic blades were found on the sloping terrace in front of the rock-shelter. It is unclear whether any of the three rock-shelters were occupied during the Upper or Epipaleolithic time periods.

WHNBS 38 was described as primarily Upper Paleolithic and includes two areas of cultural materials. One of these is on top of the marls and includes a few lithics, bone and a ground stone fragment. The primary concentration of lithics, however, is about 20 m southwest, and is eroding out of the marls several meters below the modern surface of the marls. We have designated this area as WHNBS 38X to distinguish it from the unrelated concentration on top of the adjacent marl finger. WHNBS 38X is about 10 by 11 m in size and was collected in two separate concentrations. There are a total of 185 lithics. Debitage is dominated by flakes, with some examples of blades and a couple of bladelets. Tools are rare and include burins and retouched pieces. The overall assemblage is not especially diagnostic, but the general character of the as-



semblage suggests that it may be Middle Paleolithic in age, with a few Upper Paleolithic elements.

WHNBS 49 is on the side of a ridge, just above the marls, and adjacent to a small erosional channel. It was described as an Upper Paleolithic locale. Our surface collection resulted in a total of 47 artifacts. These were very undistinguished and included primarily flake debitage with some examples of blades, a few cores, and a couple of retouched pieces. This collection may be Upper Paleolithic in age; possibly the most diagnostic pieces were collected during the 1992 WHNBS season.

WHNBS 54 is a rock-shelter located high above the surrounding terrain. It is in a tertiary drainage system, but can be seen from the Wādī al-Ḥasa drainage. WHNBS 54 was described as containing a mostly Epipaleolithic lithic assemblage. A pit with an associated backdirt pile appears to have been excavated at this site since the 1992 WHNBS season. Lithics are present in the backdirt. They contain no evidence of patination and are primarily a flake debitage assemblage with rare blades.

Based on the character of the lithic assemblage, which did not appear to be Epipaleolithic in age, we decided against surface collection. Additionally, it has been our experience that sites of Upper Paleolithic/Epipaleolithic age are situated no higher elevationally than immediately above the 12-30 m terrace throughout the wadi system. WHNBS 54 is considerably above this "marker boundary".

WHNBS 68 was relocated in a small northern tributary of the Wādī al-Ḥasa near the confluence of the Wādī ar-Ruwayḥi and the al-Ḥasa. This is an Upper Paleolithic site situated at an elevation of approximately 815m asl on a narrow eroding ridge sloping to the southwest where it intersects with the lacustrine marls. Surface lithics are dense

and consist of long narrow bladelets with three el-Wad points collected, suggesting an early to middle Upper Paleolithic occupation period. The lithic assemblage is in very fresh condition with artifacts visible on the surface as well as eroding out of subsurface deposits along the edges of the site. The preserved area of the site is comprised of an area approximately 8 by 20m but narrows to about 1.5m in width where the ridge is eroding.

WHNBS 135<sup>3</sup> was originally scheduled to be test excavated during the 1997 EHLPP field season. Our visit to the site, however, revealed that the majority of the cultural deposits were confined to a spoil pile in front of the rock-shelter. This had been excavated out of the rock-shelter most probably when the mud brick wall was constructed across the front of the rock-shelter. Mapping and surface collection were chosen as an alternative strategy. A total of 61 artifacts were recovered; these include a flake and blade debitage and a few cores. No tools were found. Although this lithic assemblage is relatively nondiagnostic, when taken in conjunction with the lithics found during the 1993 WHNBS collection of this site, it is probable that the site is Upper Paleolithic in age. Of additional note are the presence of petroglyphs within the rock-shelter. Some of these are recent, but at least three have a darker patina suggesting some antiquity. The darker petroglyphs appear to include two animals and a "lizard". It is unlikely that the darker petroglyphs are Paleolithic in age.

WHNBS 518 is a lithic concentration that is eroding out of the marls about a meter or so below the current top of the marl finger. There are also natural pieces of flint. This site was described as Epipaleolithic in age during the 1993 WHNBS season. A total of 182 lithics were surface collected by us. These include a flake and blade de-

3. This site was named Yutil Abū Kharaf by us in previous publications (e.g., Olszewski and Coin-

man in press). We have discontinued use of this name.



bitage, several cores, a couple of endscrapers, and several retouched pieces. A number of the lithics are rolled, suggesting transport over some distance. The lithic assemblage contains no specific temporal diagnostics, and could be either Upper Paleolithic or Epipaleolithic in age.

Two reported Upper Paleolithic and Upper/Epipaleolithic sites in the lower al-Ḥasa region were relocated (WHS 222 and WHS 540). Neither were clearly defined sites, consisting of very limited surface scatters lacking definitive diagnostic lithics. Both illustrate the fact that few Upper or Epipaleolithic sites occur on the plateau or in the lower regions of the al-Ḥasa. No surface collections were made at either of these sites. Site WHS 540 was relocated on a north-facing terrace at an elevation of 525 masl overlooking the Wādī al-Ḥasa with steep eroding gullies on both sides. The cut-bank for the modern highway may have cut off a portion of this site on the northern boundaries. The site consists of a very light scatter of lithics in an area approximately 55 by 60 m. The surface is comprised of small gravel on which only a limited number of flakes were observed. However, Middle Paleolithic cores and flakes were present at WHS 540, as well as on the two higher terraces above.

WHS 222 is located on a terrace directly above the Wādī al-La'bān at an elevation of 390m asl and faces northeast. There was a light scatter of lithics but little that clearly defined this site as Upper and/or Epipaleolithic. The terrace is approximately 60 by 45 m and contains at least 4 burials in the form of rock piles. The site probably has been impacted by a bulldozer cut along the northwestern slopes. Middle Paleolithic cores and flakes are also present on this site and occur in greater numbers on the slopes and higher terraces above Site 222. Today, a spring can be seen in the very upper reaches of the tributary wadi that lies to the southwest.

WHS 746 is situated on a marl above the Wādī al-Ḥasa, in an area where the al-Ḥasa is relatively narrow. There are a series of eroding marls that are covered with a mantle of decomposing bedrock flint. WHS 746 consists of a very light scatter of lithics which are not clearly Upper Paleolithic. There are some Middle Paleolithic flakes and blades as well. Most of the lithics collected are heavily retouched and have considerable damage to their edges.

WHS 921 is also located on the higher land surfaces at an elevation of 906 masl. This site is situated on a northeast facing slope on the high plateau above the Wādī al-Ḥasa, just west of where the Wādī Abū al-Khasra meets the Wādī al-Ḥasa. It was reported to be an Epipaleolithic base camp. Lithics are moderately dense in an area approximately 60 by 40m but lack clear diagnostics of the Epipaleolithic. Middle Paleolithic artifacts are also present in limited numbers. No surface features are visible.

#### **Test Excavations at Ṭor Ṣadaf (WHNBS 8) (J. B. Cooper and D.I. Olszewski)**

Ṭor Ṣadaf, a rock-shelter in an oyster bed formation, was located during the 1992 WHNBS season (Clark *et al.* 1992). It is in a tertiary drainage to the Wādī al-Ḥasa, and a secondary drainage to the Wādī al-Misq. The rockshelter is south-facing and was identified in 1992 as Upper Paleolithic in age based on lithics collected from the surface.

The 1997 EHLPP tested Ṭor Ṣadaf over an eight-day period from 5 to 14 June. Two 1 by 1m units (K2 and K5) were excavated. Preliminary analysis of the lithics recovered from both test units indicates an early to middle Upper Paleolithic occupation of Early Ahmarian affiliation. Other cultural materials were less abundant, although a low to moderate density of fragmented bone was recovered from the units, in particular, from Unit K2. A total of 5,158 lithic artifacts were recovered during testing (Table 1).



Table 1. Lithic assemblages from Țor Șadaf (WHNBS 8) (in percentages).

	UNIT K2	UNIT K5
TOOLS	1.1	2.3
CORES	0.9	0.8
DEBITAGE	78.6	84.0
SHATTER	19.3	12.8
TOTAL N	3404	1754

Unit K2 was placed beneath the dripline of the rockshelter so that a portion of the unit was inside the dripline with the rest of the unit outside the dripline. A total of 19 arbitrary levels corresponding to four natural layers were excavated to an average depth of 0.95m below ground surface. Excavation in K2 was terminated when a sterile compacted silty clay deposit was reached. Natural Layer I (Arbitrary Levels 1-2) is a thin layer of light brown sediment just below the goat dung on the surface. Natural Layer II (Arbitrary Levels 3-12) is a thick layer of yellowish brown sediment distinguished from lower sediments by its position above a cobble/boulder lens. Natural Layer III (Arbitrary Levels 13-17) is a more compact dark yellowish brown sediment with intermixed large rocks. Natural Layer IV (Arbitrary Levels 18-19) contained a compacted silty clay with roof spall and limestone debris inclusions.

Artifact density was variable throughout the levels. It was moderately high in Levels 1-8, but somewhat less dense in Levels 9-11. Density of lithics rose steadily from Levels 12 to 17, and dropped considerably in Levels 18-19. Preliminary analysis of the tools shows that endscrapers in this unit are the most common tool (36%), followed by microliths (33%), which are primarily el-Wad points, and by retouched pieces (20%). Notch/denticulates and burins comprise the remainder of the tools. Trimming flakes comprise about 44% of the debitage, and the blade/bladelet to flake ratio is 1.5:1.

Unit K5 is three meters east of Unit K2

and five meters east of the back of the rockshelter. This unit is on the talus slope outside the dripline. Eleven arbitrary levels were excavated to an average depth of 0.55 m below ground surface. These correspond to four natural strata. Excavation in K5 terminated in an extremely compact silty clay. Lithic density was extremely low at this depth in the unit. Natural Layer I (Arbitrary Level 1) is a thin, loose silty loam which was present in the western and southern portions of the unit. Natural Layer II (Arbitrary Level 2) was present only in the southwestern quad of the unit. It is a dark, silty loam with calcium carbonate inclusions. Natural Layers III (Arbitrary Levels 3-5) and IV (Arbitrary Levels 6-11) are a very compacted silty to silty clay loam. A faint sulphur smell, indicative of water seepage, was detected during the excavation of these two layers.

One feature (Feature 1), a hearth, was located during the excavation of Unit K5. It is a pit excavated from near ground surface through Levels 1 and 3-4, and is capped by either a decomposing limestone rock or a calcium carbonate deposit. It extends east into the unexcavated Unit K6. Charcoal was abundant and consisted of many small twigs and twig fragments. The proximity of the hearth to the surface and the character of the charcoal suggest that it is not Paleolithic in age; it may be a recent to modern intrusion.

Levels 2-5 provided the bulk of the artifacts recovered from K5, with lithic density dropping considerably as the sediment became increasingly more compact. Field laboratory analysis of the tools indicates that microliths, principally el-Wad points, were the most common tool class (66%), followed by endscrapers (12%). Other tools such as burins, truncations, notch/denticulates, retouched pieces, multiple tools, and varia were rare. Within the debitage class, trimming flakes comprised about 40% of the assemblage; the blade/bladelet to flake ratio



is 1.9:1.

In addition to the main rock-shelter ("north rock-shelter") tested at Țor Șadaf, a smaller rock-shelter ("south rock-shelter") about 10 to 15 m south of the main rock-shelter was investigated. The stratigraphy of this secondary rockshelter is discussed by Schuldenrein in this report. A total of three to four separate hearth lenses were discovered in the highly brecciated profile of the remaining deposits. Two of these hearths were sampled for radiocarbon dating. Seven lithic artifacts also were recovered; these are primarily nondiagnostic debitage, with one core. The lithics are probably Upper Paleolithic in age, as they do not have a Middle Paleolithic morphology/technology.

Initial investigations at Țor Șadaf have resulted in the discovery of a set of Early Ahmarian occupations. This is the first definite record of early Upper Paleolithic settlement in the Wādī al-Ḥasa drainage system. The proximity of Țor Șadaf to Pleistocene Lake al-Ḥasa is of some interest as it documents the importance of this ecological context in the earlier ranges of Upper Paleolithic times.

**Test Excavations at Țor Șageer (WHNBS 242)** (M. al-Nahar and D.I. Olszewski)

The rockshelter of Țor Șageer is in the tributary drainage of Wādī al-Khasra, about 2 km from its confluence with the Wādī al-Ḥasa. It was located during the 1993 WHNBS season (Clark *et al.* 1994), and described as a probable Epipaleolithic site. Țor Șageer faces south-southeast and is about 17m above the al-Khasra channel which runs immediately below it. A total of eight days between 15 and 26 June, 1997, were spent testing this site.

Two 1x1 m contiguous units (C4 and D4) were excavated to bedrock, about 0.70-0.75 m below ground surface. Both units are under the existing rock-shelter roof, inside the dripline, and about 0.50 m south of one

portion of the rock-shelter back wall. The rockshelter extends farther back (ca. 2 m or so) immediately to the northwest of Units C4 and D4. A total of 4,847 lithic artifacts were recovered from the two units (Table 2). These are Early Epipaleolithic in morphology/technology. A moderate density of bone also was recovered; many are identifiable pieces. The bone assemblage includes several small polished fragments which may be fragments of awls or points; one specimen might be a needle fragment. Two probable human teeth were recovered from Unit D4 (Level 12).

**Table 2.** Lithic assemblages from Țor Șageer (WHNBS 242) (in percentages).

	UNIT C4	UNIT D4
TOOLS	4.6	4.0
CORES	1.6	2.1
DEBITAGE	82.5	80.3
SHATTER	11.2	13.5
HAMMERSTONES	>0.1	0.1
TOTAL N	2732	2165

A total of 17 and 16 arbitrary levels were excavated in Units C4 and D4, respectively. These correspond to six natural strata which were identified in the north face profiles for the two units. The west face profile of Unit C4 is somewhat more complicated due to rodent activity, which was extensive in this portion of C4.

The natural strata in the north face profiles slope downward from east to west. Because of this, the correspondence of the arbitrary levels to natural strata within each unit varies somewhat. Natural Layer I (Arbitrary Levels 1-2 in C4 and Level 1 in D4) is a very pale brown, loose silty sand with rootlets and angular clasts. Level 2 in C4 contained the Feature 1 hearth stain. Natural Layer II (Arbitrary Levels 3-9 in C4 and Levels 2-4 in D4) is a light yellowish brown sediment. It is a lightly compacted, silty



sand which includes gravel, roots, twigs, and angular clasts. Natural Layer III (Arbitrary Levels 8-9 and 14-15 in C4 and Levels 5-9 in D4) is a light yellowish brown sediment that is somewhat more compact than upper strata. It is silty sand that includes ashy spots mixed with charcoal flecks. This stratum includes a higher quantity of diagnostic lithics, as well as large-sized debitage. Natural Layer IV (Arbitrary Levels 10-13 in C4 and D4) is contained within Natural Layer III in both units. It is a very pale brown sediment with a high density of lithics, ashy material, charcoal, and friable bone fragments. It also contained the Feature 2 hearth. Natural Layer V includes portions of Arbitrary Levels 15-17 in C4 and Levels 14-16 in D4. It is a very pale brown, compacted silty sand that includes pebbles and cobbles. Natural Layer VI was present only in Unit D4, where it included portions of Arbitrary Levels 14-15. It is a very pale brown, compact sediment with limestone fleck inclusions.

Unit C4 sustained relatively heavy rodent disturbance, particularly throughout the western portion of the unit in Levels 1-10. The upper levels (Levels 1-6) of both C4 and D4 appear to be a mixture of both late/recent and ancient materials as they include Epipaleolithic lithics, ancient fauna (mineral speckled), non-mineral speckled fauna (probably recent?), a pottery sherd, a piece of woven material, and a Bedouin shepherd's reed recorder (Level 5 in C4). The Feature 1 hearth stain found in Level 2 is probably late/recent in age given its proximity to ground surface and the *in situ* presence of late/recent artifacts in lower levels.

A probable "occupation zone" is coincident with Levels 11-14 in both units. These levels yielded a high density of lithic artifacts and fauna, as well as the Feature 2 hearth. There are preliminary indications of spatial differentiation in activities between the two units in this "occupation zone." These consist of a higher frequency of end-

scrapers (32% compared to 20%) in C4 and of cores (2.6% compared to 1.3%) and hammerstones in D4.

Overall, the tool assemblage from Tor Şageer is dominated by narrow microliths of various types (60%). These include La Mouillah points, and numerous examples of arched backed bladelets and backed and truncated bladelets. There are also a small number of "tanged" microlithic points which we have tentatively named "Şageer points." Many of the microliths are manufactured using the microburin technique. Endscrapers are the second most frequent tool type (12%). Other tools are rare, but include burins, backed pieces, notch/denticulates, retouched pieces, and varia. Of special interest are three tools in the Varia class; these resemble small adze or chisel tools reminiscent of larger such tools occasionally found in Natufian assemblages, for example at Wādī al-Ḥimmah 27 (Edwards 1991).

The Early Epipaleolithic occupation at Tor Şageer is interesting for several reasons. First, it appears to register an Epipaleolithic locale without an emphasis on the manufacture of microlithic tools. This is indicated by the relative paucity of microburins and by the large-sized debitage and few bladelet cores. Second, within the space of a 1 by 2 m tested area, there are preliminary indications of spatial differentiation in activities that were probably associated with the Feature 2 hearth. These activities included core reduction (cores, hammerstones, an untested flint nodule, numerous debitage) in one area and the more frequent use of endscrapers in another area. Third, the narrow backed microliths present in the tool assemblage appear to be slightly more robust than those found in the Early Epipaleolithic occupation at Yutil al-Ḥasa (Olszewski *et al.* 1994), perhaps indicating a slightly later period within the Early Epipaleolithic (following suggestions made by Garrard *et al.* (1987) for increasing robusti-



city of microliths with time in the al-‘Azraq region). The assemblage also includes a variety of tools not previously documented for Epipaleolithic sites in the Wādī al-Ḥasa region (e.g., the “adzes” and the “Ṣageer points”).

#### **Test Excavations at Multaqa al-Widyān (WHNBS 192-196) (J. B. Hill)**

On 26 and 27 June 1997, four lithic scatters (WHNBS 192-195) located in the dissected marls at the confluence of the Wādī al-Ḥasa and Wādī al-Khasra were evaluated for the presence of *in situ* archaeological remains. Because of the location of these “sites” as a series of lithic artifact concentrations along and at the bottoms of adjacent erosional gullies, the originating deposit or deposits were unknown. The goal of the testing procedure was to determine the location(s) of the originating deposit(s) and assess their integrity and temporal affiliation for possible future excavation work. The method employed was the shovel excavation of stepped section cuts next to and above the uppermost elements in each lithic artifact concentration, aimed toward identifying in section the stratum from which the artifacts had eroded. WHNBS 196, which is along the sloped face of one of the marl fingers adjacent to WHNBS 194, was not tested because the lithic concentration appeared to derive from much lower elevations within the marl, and may predate the Upper Paleolithic period. No surface collections were made of the lithic scatters (WHNBS 192-196) currently exposed on the surface of these marls; this will allow easy relocation of these sites in the event of future work.

The area around these sites also was mapped using an EDM/electronic theodolite mapping station situated at the northwest corner of a rectangular masonry building (WHNBS 180) on the ridge to the southeast of the sites. The mapping datum was assigned North and East values of 1000 m,

and an elevation of 850 m asl, based on interpretation of the topographic map. All locations given here are from this mapping datum; the m asl in each case must be taken as an approximate value because of the arbitrary assignment of 850 m asl to the mapping datum.

WHNBS 192 was tested with a trench 1.2 by 0.5 m in a single 0.4 m step. This trench is on the northeast side of a small marl knoll at approximately N1078, E935, 837 m asl. Nine lithic artifacts were recovered from loose surface sediment and no *in situ* deposits were identified in this section cut.

WHNBS 193 was tested with two trenches, an upper and a lower, in the proximity of two discrete lithic scatters in the same erosional gully. The upper trench was 2.2 by 0.6 m in three steps of 0.3-0.4 m depth each. This trench is at approximately N1064, E888 and ranged in elevation from 838.43-839.44 m asl. The lower trench was an L-shaped cut measuring 1.1 m on each long side with two steps of 0.2 m depth. It is about N1068, E904, with an elevation of 836 m asl. A total of 17 pieces of shatter were recovered from these two units, all of which are derived from loose surface sediments. No intact cultural strata were identified.

WHNBS 194 was tested with four section cuts; two are near the top south side of a low marl ridge (Section Cuts 1 and 1A); one is midway down the same slope (Section Cut 3) and one at the slope bottom (Section Cut 2). Section Cuts 1 and 1A measured 2.0 by 0.8 m and 0.8 by 0.9 m, respectively, and were both 0.25 m deep in one step. Section Cut 1 is at N1058, E 905, and Section Cut 1A at N1060, E908. Both are at 836.6 masl. Section Cut 2 is at N1056, E912, at an elevation of 835.1 masl, and Section Cut 3 is at N1045, E914, at an elevation of 836 masl. No artifacts were recovered from any of these section cuts and no cultural strata were identified.



WHNBS 195 was tested with a single 1 by 1 m cut that was 0.35 m deep in one step. This trench is at N1033, E904, at an elevation of 836 masl. This site was the only area tested that produced *in situ* cultural deposits. A total of 595 lithic artifacts were recovered from a dark organic stratum 0.15-0.20 m thick. Among these artifacts were endscrapers, notch/denticulates, and several nondiagnostic retouched pieces, as well as 210 flakes and 92 blades. Preliminary assessment of this assemblage indicates an Upper Paleolithic affiliation, probably in the earlier range of this period.

At least two sites are represented by this series of lithic scatters in the Multaqa al-Widyān complex of sites. A partially intact, probable Upper Paleolithic component is at WHNBS 195 at an elevation of approximately 836 masl. Although several other section cuts were excavated at the same elevation in adjacent erosional gullies, none resulted in the identification of an extension of this component. WHNBS 195 currently lies about 4 m below the highest remaining element of the marls in which it is contained and was probably buried much deeper within the 30 m terrace prior to its erosion to present levels.

The other lithic scatters represent the remains of at least one site component that probably existed at a higher elevation within the marls. This stratum has since been completely removed by erosional processes that deposited the coarser fraction, including lithic artifacts, along the gully sides and in the gully bottoms. Nothing appears to remain *in situ* from this (these) upper component(s).

#### **Test Excavations at Ṭabaqa (WHS 895)** (D.I. Olszewski and J.B. Hill)

The site of Ṭabaqa is an extensive Early Natufian occupation on the east bank of the Wādī al-Aḥmar near the confluence of the Wādī al-Ḥasa and al-Aḥmar. It is about 16 km downstream from the eastern al-Ḥasa

Basin. The Early Natufian occupation is on the 30-35 m terrace, which is heavily dissected by erosional channels; it is buried below marl sediments which range from 0.5 to 2.0 m in thickness, depending on the degree of erosion to which various areas of the site have been subjected. Numerous lithics are eroding from the slopes of the dissected marls; preliminary examination of the distribution of the eroding lithics suggests that the Early Natufian occupation occurs over at least 1200 m<sup>2</sup>. A total of 9 field days between 28 June and 10 July, 1997, were spent at the site.

In 1986, Byrd cut a section into a marl slope at Ṭabaqa, locating a 0.30 m thick "cultural zone" from which he recovered chipped stone, bone, and macrobotanical remains (Byrd and Colledge 1991). We relocated Byrd's section cut and placed two of our test units (TUs 1 and 2) adjacent to this locale; these units were contiguous. We also placed an additional two test units (TUs 3 and 4) about 20 m to the south of this area, where a particularly dense concentration of surface lithics occurs. Test Unit 4 is about 4 m east and 1 m south of TU 3. The sediments of all four units were a very pale brown, silty marl with little internal stratigraphy. The most common change was greater sediment compaction with depth. In general, we found that the densest concentrations of cultural materials occurred in a "cultural zone" about 0.30 - 0.35 m in thickness. Lithic artifacts, however, continued to be recovered for at least an additional 0.10 m. A total of 7,246 lithic artifacts were recovered.

Test Unit 1 was placed immediately south of the section cut made by Byrd, while TU 2 adjoined TU 1 to the south (upslope). A small baulk was left between Byrd's section cut and TU 1. Level 1 in both units was essentially sterile overburden which was removed as a single excavation level (0.50 to 0.85 m in thickness). All other levels were excavated in 0.05 m increments.



Following our first day at the site, looters tore out this baulk and also excavated a large pit in both test units. This pit measured 1.45 by 0.85 by about 0.65 m deep. It was most extensive in TU 2 where Level 2 was present only in a 0.05 to 0.15 m "border" around the pit. Subsequent levels were gradually larger in area. Back-dirt from the looters' pit was screened and all artifacts collected. Further damage to TUs 1 and 2 was incurred when vandals collapsed the upper walls of the units. Fortunately, as these were sterile deposits, the damage was minimized. Profiles of these two units, however, were not drawn nor was a pollen column series collected. Pollen samples were taken from levels during excavation as an alternative strategy.

A total of 10 and nine arbitrary levels were excavated in TUs 1 and 2, respectively. This represents a depth of about 1.11 m in TU 1 and 1.25 m in TU 2. Neither unit was excavated to sterile; excavation ceased when the density of cultural materials dropped considerably. The quantity of artifacts recovered was greater from TU 1 than from TU 2; this is not surprising given that the looters' pit removed much of the deposit from most levels within TU 2.

Test Unit 3 was excavated to a depth of 0.40 m below ground surface (eight arbitrary levels), while TU 4 had six arbitrary levels (0.30 m below ground surface). Test Unit 4 is elevationally lower than TU 3 and was placed on an area thought to represent eroded/deflated deposits; it is probable that the cultural materials from TU 4 represent the basal portion of the "cultural zone" at Ṭabaqa.

The lithic assemblages from Ṭabaqa are similar proportionally in each of the tested areas (Table 3). Tools include Helwan lunates (28%) and other microliths (29%), followed by retouched pieces (ca. 13%), notch/denticulates (12%), endscrapers (10%), and various other tools such as rare burins, backed pieces, truncations, and side-

scrapers. Microburin technique is relatively common, being predominantly oriented to the manufacture of Helwan lunates. A few examples of unfinished Helwan lunates (exhibiting microburin scars and remnant notches, but no formal finishing retouch), as well as Helwan lunates with remnant microburin scars are present in the assemblages.

Table 3. Lithic assemblages from Ṭabaqa (WHS 895) (in percentages).

	TU 1	TU 2	TU 3	TU 4	LOOTERS' PIT
TOOLS	2.6	2.9	2.4	3.1	3.0
CORES	0.7	0.9	1.2	0.5	1.7
DEBITAGE	75.6	72.6	73.2	68.7	74.0
SHATTER	21.0	23.6	23.2	27.7	21.3
HAMMERSTONES	>0.1	-	-	-	0.1
TOTAL N	2353	1561	2059	546	727

Other cultural materials were rare. We recovered at least two small marine shells, small amounts of highly fragmented bone, and noted the presence of dispersed fire-affected rock and rare charcoal flecks in all test units.

Geomorphological reconnaissance of the site context at Ṭabaqa has revealed a number of quite interesting aspects of the paleo-environment. The information recovered thus far has important implications both for understanding the local environment during the period of site occupation, and for understanding the environment of the Wādī al-Ḥasa in general during the late Pleistocene and early Holocene.

The marl deposits in which Ṭabaqa is situated appear to be part of an ancient oxbow lake in which a meander of the al-Aḥmar channel was isolated by the incision of a more direct channel. The isolation of this meander led to a much lower energy fluvial environment. Fluctuations in the hydrologic situation in this low energy environment led to the deposition of fine marl sediments with several strata of dark organic deposits,



probably representing ancient marsh environments (see Schuldenrein, this report). One of these marsh deposits is visible in section at approximately the same elevation as the Early Natufian artifact deposits at the site, and may be an indication of the environment during the occupation of the site. In any event, the site is associated with a slack water basin off of the main wadi channels.

While it is probable that the site was so located because of the presence of a slack water environment, the fact that the site is buried under further low energy alluvial deposits provides confirmation that there was slow moving water at a much higher elevation and a much later date than has been previously suspected for this area (e.g., Schuldenrein and Clark 1994).

Low energy alluvial deposits at this elevation suggest that the 30-35 m terrace, ubiquitous in the lower portions of the al-Ḥasa drainage system, was still an active floodplain in the Early Natufian, and long enough afterward to bury the site under 1 to 2 m of alluvial deposits. Such a situation has important implications for models of Pleistocene Lake al-Ḥasa and its disappearance (Schuldenrein in press; Schuldenrein and Clark 1994). The marl sediments located along the Wādī al-Ḥasa, and cited as evidence for the lake extending far down the wadi, may indicate a fluvio/limnic environment (Schuldenrein, this report) later than the proposed 15 kyr Lake al-Ḥasa breach.

Furthermore, if there was an active floodplain at the elevation of the 30-35 m terrace postdating the Early Natufian, the floodplain and subsequent terrace would have provided an early Holocene land surface extending several hundred meters across the al-Ḥasa valley bottom. Much of this valley bottom surface may have existed at least into Neolithic times and would have been an ideal setting for early agriculturalists. This former land surface was subsequently

almost completely removed by erosion, leaving only small terrace remnants along the present wadi sides. The former presence of such an extensive and hospitable surface and its removal may be relevant to the notable lack of documented Neolithic sites in this area. These preliminary indications from the geomorphological setting of Ṭabaqa require confirmation from more detailed and refined analyses, and merit considerable further research.

**Expanded Excavations at 'Ayn al-Buḥayra (WHS 618) (N.R. Coinman, T.G. Clausen, J. Fox and J. Williams)**

Investigations at 'Ayn al-Buḥayra in 1997 focused primarily on the Spring Area of the site. This area was tested in 1984 (Clark *et al.* 1988) and was found to have an *in situ* Late Ahmarian occupation (Coinman 1993). Research efforts in 1997 concentrated on broad exposures in order to define potential activity areas that would help characterize the nature of the late occupation at the site, allow us to recover spatial information on site activities and delineate the duration of occupation. We were particularly interested in corroborating the presence of the Late Ahmarian in the eastern deserts of the Levant, especially at large open-air sites in a lacustrine/marsh environment. In addition, we were seeking information that would further define the technological and typological features of this late Upper Paleolithic site. The 1984 excavations and subsequent analyses indicated a somewhat unique lithic assemblage with strong similarities to contemporaneous sites in the Negev, as well as containing fossilized faunal remains and rare examples of worked bone (Coinman 1997). In all, this area of the site was suggested to have excellent potential for the recovery of a well-preserved assemblage of bone and lithics.

The Spring Area is atypical of the rest of the site in that it consists of a lacustrine marl formation capped by a spring tufa. The



Late Ahmarian occupation rests on top of the tufa, which is dated to 20,300 +/- 600 bp (UA-4395), while an earlier occupation in another area of the site dates to ca. 25,000 bp (Beta-55928) (Clark *et al.* 1988: 240; Schuldenrein and Clark 1994: Table 1). The eroding remnant "tufa knoll" measures approximately 6 m (N-S) by 15 m (E-W) with the surface sloping away to the east. The white marl and tufa formations intersect a limestone bedrock that is covered with rocky colluvial debris and significant reddish alluvial sediments. The marl and tufa events appear to overlie the reddish deposits and demarcate both the high lake stand and spring activity at this location on the shores of Pleistocene Lake al-Ḥasa.

Excavations during the 1997 season included opening sixteen contiguous 1 x 1 m units to a depth of about 0.30 m below the surface. The Late Ahmarian occupation is best described as a relatively homogeneous, discrete "occupation zone" varying in thickness from 15 to 30 cm and sitting directly upon uneven consolidated tufa. The assemblage is striking in that it consists of enormous quantities of rather well-preserved large mammal bone and teeth, most likely *Bos* and equids. Other fauna are represented in the assemblage in small quantities and include a large lower canine (*Felis?*) and ostrich egg shell. Some examples of worked bone in the form of awls and points were recovered, and butchering cut marks were visible on many of the

specimens.

Lithics in all of the units were quite dense, consisting of cores, debitage, utilized pieces and retouched tools (Table 4). A preliminary analysis of the lithics from the Spring Area (n=12,183) reflects a full spectrum of reduction activities, including large numbers of very small trimming pieces. Cores comprise 0.8%, debitage 71.6%, shatter 25.2% and retouched tools 2.4%. By far, the most interesting of the retouched lithics are the small finely retouched pointed bladelets, previously referred to as Ouchtata bladelets because of the characteristic graded fine retouch that consistently occurs on the right obverse from the proximal end grading toward the pointed tip (Coinman 1993). A surprising 49% of all of the retouched pieces recovered from this area in 1997 are Ouchtata pointed bladelets – incongruously small tools in association with dense quantities of large mammal bones.

Of some significance is the preliminary evidence for discrete distributions of various artifact classes. Concentrations of artifacts were noted in most of the contiguous units. Two remnant hearths were uncovered: one was comprised of a concentration of fine charcoal (Feature 3) and the other a windbreak of rocks associated with charcoal (Feature 2). In another area, there is a very clearly defined distribution of Ouchtata bladelets, dentalium shell, and hematite. Further analyses will examine more closely the discrete spatial distributions of these ar-

**Table 4.** Lithic assemblages from 'Ayn al-Buḥayra (WHS 618) and from WHS 618X (in percentages).

	WHS 618 Spring Area	WHS 618 E61 N40	WHS 618 No.&So. Slopes	WHS 618 Test F Extension	WHS 618 Other Tests	WHS 618 TOTALS	WHS 618X
TOOLS	2.4	1.1	1.7	0.7	4.3	2.1	1.2
CORES	0.8	0.6	1.8	-	4.5	1.1	0.5
DEBITAGE	71.6	76.1	63.0	80.5	67.6	70.8	76.1
SHATTER	25.2	22.2	34.0	18.8	23.6	26.0	22.2
TOTAL N	12,183	2436	3561	765	791	19,732	5411



tifacts and specific densities of bone, skeletal elements, and worked bone tools in order to characterize more clearly the nature of the activities during the Late Ahmarian occupation.

The recovery of such a rich *in situ* assemblage of artifacts in an open-air site in the deserts of the eastern Levant underscores the uniqueness of the site. As a result of subsurface tests in 1984 and a series of test units across the site in 1997, it is now apparent that limited *in situ* cultural deposits may be preserved at this exceptionally large site and those appear to be in the Spring Area.

Some 7 m upslope from the spring, we initiated a deep stratigraphic test in order to define the geomorphological relationship between the western slope deposits associated with the limestone bedrock and the marl and tufa formations.

A single 1 x 1 m unit (E61N40) was excavated to a depth of 1.3 m below the surface in 12 arbitrary levels. This test was extremely informative in illustrating a different geomorphology juxtaposed to the marl and tufa downslope. The natural strata consisted of reddish and yellowish red alluvial sediments over an underlying marl. The lowest marl deposits would correlate with deep consolidated marl formations, registering earlier lake bed sediments. These underlie later lacustrine marl and tufa deposits that formed downslope to the east. The lithics recovered from this test unit also varied significantly from those at the Spring in being a dark translucent brown flint and reflecting different techno-typological attributes.

A very limited number of backed or finely retouched bladelets were recovered in the upper levels while multifaceted platforms were uncovered in the lowest levels, suggesting an earlier component in this area of the site that preceded the latest phase of marl and tufa formation and the subsequent Late Ahmarian occupation at ca. 20,300 bp.

### Other Tests at 'Ayn al-Buḥayra

Extensive testing in other parts of the site during 1984 and 1997 have highlighted the rather rare preservation of the Spring Area. It now seems clear that there remains little *in situ* outside the Spring Area and that extensive occupation surfaces have simply eroded away while a thick deflated mantle of lithics remains across the site. Surface artifacts in the far northern part of the site on both the colluvial slopes and eroding out of the shoreline marls suggested a technological sequence extending from the late Middle Paleolithic, through the transitional Middle/Upper Paleolithic, and Early Ahmarian. Diagnostic artifacts recovered from the surface included an Emirah point, Levallois cores, Levallois points with multifaceted platforms, transitional points with single platforms, long, narrow blade cores, and al-Wad points. Unfortunately, all five test units were unsuccessful in locating any buried deposits associated with such a local cultural sequence.

In all cases, the sediments were essentially sterile, suggesting that the earlier cultural periods represented by what must have been significantly higher occupational land surfaces have long since deflated into a palimpsest of cultural debris.

### WHS 618X

Reconnaissance around the site of WHS 618 revealed a dense surface assemblage approximately 50 m south of the Site 618 boundaries. The lithics consisted of long narrow blades and el-Wad points and suggest an Early Ahmarian occupation separated from the larger site of WHS 618. This site has not been recorded previously, and for the sake of convenience, we designated it WHS 618X during the testing phase. A 4 x 0.5 m trench was initiated to investigate the subsurface deposits. Four natural levels were identified, consisting of sloping reddish brown alluvial and colluvial sediments. The varying slope of the sediments and the



orientations of the artifacts suggest cultural deposits that have been affected by post-depositional processes. The lithic assemblage recovered consists of 5,411 pieces with a technology dominated by an emphasis on the production of bladelets (43%) and el-Wad points (25%). A substantial number of smaller, finely retouched bladelets (12%) were also recovered, primarily in the upper levels. However, the stratigraphic distribution of different temporally-sensitive Ahmarian pointed bladelets suggests a widely-varying temporal span within the long-lived Ahmarian techno-complex.

**Geo-archaeological Research for the 1997 EHLPP Fieldseason (J. Schuldenrein)**

Geo-archaeological field investigations for the EHLPP were undertaken between 12 and 19 June 1997. Efforts focused on examinations of baseline stratigraphic contexts at the rockshelter of *Ṭor Ṣadaf* (WHNBS 8) and the open air site of *Ṭabaqa* (WHS 895). Field work was not performed at the site of *Yutil al-Ḥasa* (WHS 784), scheduled for further excavations during the 1998 EHLPP field season, because previous work and geo-archaeological sampling at the site had been done in 1993.

Additionally, general observations of landscape relations and geomorphology were made at *Multaqa al-Widyān* (WHNBS 192-196), at the confluence of the *Wādī al-Ḥasa* and *Wādī al-Khasra*. These observations were geared to help develop the chrono-stratigraphy of the *al-Khasra* marl and fluvio-limnic terrace system, initially explored in earlier phases of *Wādī al-Ḥasa* research.

The third focus of the research was detailed geo-chemical sampling at *‘Ayn al-Buḥayra* (WHS 618). Here, the objective was to document the changes within Pleistocene *Lake al-Ḥasa*, and specifically to test variability in the sedimentation patterns and salinity of lake and site related spring waters over the past 40,000 years (Schul-

denrein and Clark 1994). A slope terrain transect was performed at *‘Ayn al-Buḥayra* to examine the extent and pattern of surface erosion since initial excavations at the site in 1984. At all locations, extensive radiocarbon samples were taken to index the sedimentary history of the upper *al-Ḥasa* basin.

*Ṭor Ṣadaf* (WHNBS 8)

The rockshelter is situated along a tributary to the *Wādī al-Misq*, a low order feeder of the *al-Ḥasa*. *Ṭor Ṣadaf* is a south-southeast facing rock-shelter with an extensive talus that slopes ca. 12 degrees toward the wadi. The overhang is about 2 m above the surface and two test pits (K2 and K5) were under excavation at the time of the geo-archaeological investigations. The surface gradient running parallel to the overhang is relatively steep (7 degrees S; 15 degrees W). The rock-shelter has been formed in fossiliferous and cemented oyster shell limestone. The facies is highly localized and is underlain by a softer, tabular member, which has been locally undermined by lateral migrations of the older – possibly Pleistocene – antecedent of the *Wādī al-Misq*. The undermining has created a strath bench 3-4 m above the channel floor in the immediate vicinity of *Ṭor Ṣadaf*.

Cultural deposits have been identified at two primary loci. The two excavation units along the “north rock-shelter” feature a dominantly Early Ahmarian lithic assemblage. Excavation unit K2, preserving the more intact archaeological deposits, is characterized by a complex stratigraphy that indicates intermittent episodes of calcification and variable moisture over the past 25,000 or more years. These are probably related to broader climatic trends, pending assessments of the site microenvironment and the history of rockshelter evolution. Unit K5 exposed generally colluviated deposits, although evaluations of the integrity and contexts of deposits await further study.

The “south rock-shelter” contains up to



1.8 m of brecciated sediment that was separated into four primary facies, based largely on bedding, sedimentology, and morphology of the larger clasts. Both alluvial and colluvial vectors of sedimentation are represented. At least three lenticular hearths capped by consolidated ash deposits were collected and have potential for producing radiocarbon dates. Significantly, the lowermost hearth is at least 4.5 m below the surface of excavation Unit K2 in the "north rockshelter," offering the possibility of an Early Upper Paleolithic and/or Middle Paleolithic occupation.

Considerable effort was focused on assessing the stratigraphic context of the "south rock-shelter." The overhang has collapsed and shorn off the parent bedrock in one or two episodes. Three massive collapsed blocks are in evidence. The rear wall of the shelter is inclined ca. 60 degrees in the direction of the wadi and vertical displacements of 0.7 to 1.17 m were measured. Further, the disposition of the alluvial sediments is concave and it is not possible to determine whether this is a function of settling of fines in the former (i.e., pre-collapsed) shelter, or whether the concavity is post-depositional and may be attributed to events accompanying the collapse. Sedimentological samples were taken from all strata and gravel morphometric specimens were also collected to determine the source and processes of rockshelter evolution. Together with the radiometric data, it should be possible to link the sequence of occupations to primary environmental events along the Wādī al-Misq and greater al-Ḥasa drainage net.

*Multaqa al-Widyān (WHNBS 192-196)*

The significance of these sites, associated with the Wādī al-Ḥasa and Wādī al-Khasra, is that they verify the critical function of ponding environments at primary wadi junctures. In 1993, initial documentation of the landscape demonstrated the presence of a 6-

7 m high fluvial terrace outcropping along the upper reaches of the Wādī al-Khasra. The most prominent feature near the confluence with the al-Ḥasa is a 30 m high marl terrace whose exposure revealed chemical sedimentation in the form of laminar detrital and aragonite facies. At this stage of the research it is not yet clear whether or not the 30 m terrace is a unique feature exclusively associated with the confluence of major wadis or whether it represents the downstream variant of the 6-7 m high alluvial terrace. Because the Multaqa al-Widyān site complex preserves lithics of a yet indeterminate "Early Upper Paleolithic" association (Coinman and Olszewski, pers. comm.), it is not yet possible to classify the age of terminal sedimentation; moreover, specific stratigraphic associations between the marls and the depositional contexts of the assemblages remain to be verified.

Only generalized landscape observations were recorded at these sites. However, site-landform associations of the al-Ḥasa-Wādī al-Khasra terraces with Upper Paleolithic and Epipaleolithic occupations at parallel confluences and microenvironments will enable us to project more detailed geoarchaeological reconstructions at Ṭabaqa and 'Ayn al-Buḥayra to these less intensively investigated locales.

*Ṭabaqa (WHS 895)*

Ṭabaqa is an Early Natufian site dated to ca. 12,500-11,000 bp B. Byrd's test section isolated *in situ* archaeological deposits whose stratigraphic contexts were not defined over the course of exploratory excavation (Byrd and Colledge 1991). Initial field observations revealed that the site is associated with a series of incised knolls. The gullying that produced the knoll complex has exposed a series of stratified fluvio-limnic sediments at the confluence of the Wādī al-Aḥmar and Wādī al-Ḥasa. These are the local manifestation of the more extensive Lake al-Ḥasa marls, probably re-



cording the later phases of sedimentation. Four discrete marl strata were exposed, each indicative of a unique Pleistocene Age depositional environment. The present investigations disclosed that the Natufian site of Ṭabaqa articulates stratigraphically with the basal portion of the uppermost marl deposition.

A 50 m SW to NE geo-archaeological transect was designed to link stratigraphic observations across the test section excavated by Byrd to an 8 m high marl exposure that preserved all four marl units. The exposure is linked to an extensive 30 m lacustrine terrace originally recognized by the investigator in 1993. While this terrace has not been dated, preliminary indications are that its formation dates to the late Pleistocene and it is probably at least 40,000 years old. Ongoing gulying during the Holocene has created a "badlands" environment at the al-Aḥmar-al-Ḥasa and all key confluences along the al-Ḥasa.

In general, the four marl units trend to progressively more fluvial, and less limnic, up the sequence. Accordingly, massive to stacked organic sediments occur near the base (i.e., at ca. 6-8 m). Overlying deposits consist of alternating beds of brown silty alluvium and standing water organic clays. These are ultimately displaced by low energy blocky silts to within 4 m of the surface. Preliminary indications are that the Natufian occupation occurred at the transition from the organic marls to the alternating fluvial and marsh beds immediately underlying the blocky alluvium.

Additional field work included a more extensive north-south stratigraphic transect bisecting the Wādī al-Ḥasa and incorporating the marl sequences on both sides of the drainage. The purpose of this section was to document the end of marl sedimentation, the onset of Holocene erosion, and the initial aggradation of the contemporary 5 m high al-Ḥasa alluvial plain.

A significant discovery along this tran-

sect was the preservation of what appears to be an extensive peat-like lens capping the basal marl facies. This provided an optimal radiocarbon specimen to complement an extensive battery of radiocarbon samples for both sections. Collectively, these dates should register key points in the sedimentological history of the drainage and the marl sequence at this critical confluence.

Finally, observations along the Wādī al-Aḥmar disclosed massive boulder gravels in the contemporary wadi bed. These are absent within the al-Ḥasa east of the confluence with the al-Aḥmar, but line the channel bed downstream. Indications are that these are high energy, earlier Pleistocene gravels almost certainly precedent to the Upper Paleolithic occupation of the basin.

The sequence at the al-Ḥasa-al-Aḥmar juncture suggests that the lacustrine basin was gradually transformed into a more paludal setting with the passage of time and that the Natufian clays and silts may document the last major phase of this transformation. Recent research (Macumber and Head 1991) has suggested that a "backing up" effect characterized the greater Jordan Valley, effectively marking the end of the Pleistocene, ca. 11,000 bp. This phenomenon is potentially analogous to the onset of paludal environments in the al-Ḥasa at this time.

#### *'Ayn al-Buḥayra (WHS 618)*

This is a complex Upper Paleolithic site (Coinman 1993) whose depositional context has been discussed in some detail in earlier studies (Schuldenrein and Clark 1994; Schuldenrein, in press). 'Ayn al-Buḥayra is perhaps the al-Ḥasa's best stratigraphically documented site because of its unique setting along the Pleistocene lake. The occupation is linked directly to terminal events in the history of the lake and explanations of the changing Ahmarian occupations may be correlated with the shift from peak lake levels to the transformation of the al-Ḥasa into a series of paludal sub-basins.



Accordingly, research in 1997 focused on exploring the stratigraphic significance of the tufa, thought to be the remnant spring feeding the lake at the time of the occupations. It now appears that the source of the spring may have been an aquiclude at a bedrock facies break in the parent limestone. Because archaeological excavations were ongoing at the time of the stratigraphic study, it was possible to demonstrate that the gray-black discoloration of the archaeological deposits at Test F represents the effects of ponding along the lake margin at the time during which the spring was active. The black colors represent the cumulative effects of humic enrichment by plant disaggregation, reduction of subaqueous sediments, and the impacts of human activity. Micro-stratigraphic analysis will facilitate detailed reconstruction of site formation and should enable isolation of the loci of occupation from a sedimentological perspective.

'Ayn al-Buḥayra also furnished an opportunity to examine the changing sedimentology of the lake basin near the end of the lake's duration. Geo-chemical sampling was performed at two marl outcrops in the lake interior, 150 m east of the site proper. A series of 30 specimens were taken which can be indexed stratigraphically by facies changes in the al-Ḥasa marls as well as by radiometric specimens; four of the latter were taken. Trace element analysis of cations, specifically examinations of changing vertical trends in cation ratios, should furnish indications of the shifting balance in fresh water to salt water supply. This type of analysis has been undertaken successfully in the al-Lisān Basin and should be applicable to the al-Ḥasa as well. It may then be possible to determine if the influx of fresh water into the al-Ḥasa influenced settlement trends during the Upper Paleolithic and whether or not this contributed to the creation of optimal microenvironments during the Ahmarian.

A third objective of the 'Ayn al-Buḥayra research was examination of the erosional gradients at the site. Since the initial investigations in 1984, nearly 35% of the tufa outcrop has eroded and slope backwearing has resulted in general attrition of the site. A terrain texture study of the surfaces verifies ongoing colluviation and scree sedimentation along the upper site slope and the midslope. Gullying has intensified, essentially splitting the site between Tests H/I to the south and Test Areas C, D, F, and G to the north. The mouth of the gully is migrating westward and headcutting has accelerated as well.

#### *Remaining Tasks*

Field work for the 1997-98 EHLPP has concluded. Analysis efforts will begin in August of 1997 and will consist of sedimentological analysis geared to a reconstruction of late Paleolithic environments and to an examination of formation process at the principal sites examined. The core of the environmental reconstructions will be the evolution of the lake basin, beginning with the dating of the initial lacustrine deposits and synthesis of the evolution of the feeder drainages and their role in the formation of the micro-environments in which Upper Paleolithic and Epipaleolithic populations thrived.

Specific analysis tasks include the following: (1) sedimentological analysis at Ṭor Ṣadaf; (2) detailed examination of micro-stratigraphy of the marls at Ṭabaqa and their relationship to the Natufian site; (3) reconstruction of the terrace chronology along the Wādī al-Ḥasa and Wādī al-Khasra with emphasis on the evolution of paludal environments at the confluences; (4) identifications of the Ahmarian spring environments at 'Ayn al-Buḥayra, keying on documentation of hydrology, geochemistry, and hydrography of the later stages of the lake; (5) micro-stratigraphy at 'Ayn al-Buḥayra; (6) landscape reconstruction at



Yutil al-Ḥasa; and (7) detailed stratigraphy at Yutil al-Ḥasa.

### Concluding Remarks

The 1997 EHLPP field season resulted in the accomplishment of several of the major goals of the project and in the discovery of sites which fill in some of the chronological gaps in the Upper Paleolithic and Epipaleolithic sequence for the Wādī al-Ḥasa region. Our relocation and assessment of a number of the WHS and WHNBS sites has confirmed the sparsity of Upper Paleolithic and Epipaleolithic sites in areas away from the lake/marsh system of the eastern al-Ḥasa basin, and particularly on the plateaus surrounding the Wādī al-Ḥasa. This highlights the importance of the lake/marsh ecological context during these chronological periods, especially in the context of modelling ancient settlement systems.

Two newly discovered sites (EHLPP 2 and WHS 618X), as well as testing at Ṭor Ṣadaf (WHNBS 8) and at the Multaqa al-Widyān site complex (WHNBS 192-196) led to the recognition of a substantial Early Ahmarian (early to middle Upper Paleolithic) presence in the eastern al-Ḥasa basin. In conjunction with Late Ahmarian assemblages from 'Ayn al-Buḥayra (WHS 618) (Coinman 1993; and results of the 1997 EHLPP season) and Yutil al-Ḥasa (WHS 784)(Olszewski *et al.* 1990), this affords great potential to study responses over time within the Upper Paleolithic period to fluctuations in the lake/marsh ecology, and to document the technological continuity and change within the Ahmarian.

Testing at Ṭor Ṣageer (WHNBS 242) revealed an occupation during the Early Epipaleolithic that appears to have emphasized activities that were not oriented to the production of microlithic tools. This adds considerable dimension to our understanding of site activity differentiation during this period of time. Additionally, the lithic assemblage from this site, which includes a

small number of unusual types ("adze/chisels" and "Ṣageer points"), as well as relatively narrow backed microliths including La Mouillah points, may represent an interval of the Early Epipaleolithic that closes the gap between the nongeometric and geometric Early Epipaleolithic occupations at Ṭor aṭ-Ṭariq (WHS 1065) (Neeley *et al.*, in press; Olszewski, in press).

Testing at Ṭabaqa (WHS 895) yielded Late Epipaleolithic assemblages (Early Natufian period) that augment preliminary work at the site by Byrd (Byrd and Colledge 1991). Perhaps the most significant observations in this regard are those related to the geomorphology of the Ṭabaqa locale, where a probable oxbow lake/marsh was in existence at the time of the Early Natufian occupation there. This occupation is buried beneath 1-2 m of marl deposits, indicating that the 30-35 m terrace in the lower portions of the al-Ḥasa drainage continued in existence at least as late as the advent of the Younger Dryas ca. 11,000 bp, and that this region was considerably wetter than previously believed.

The 1997 excavations at 'Ayn al-Buḥayra (WHS 618) have emphasized the existence of a well-developed Late Ahmarian technocomplex in the eastern Levant that is comprised of a distinct bladelet technology focused on the production of "Ouchtata points". A study of the typological and functional attributes of these rather unique artifacts is on-going, and this season's collection will greatly augment our sample. The recovery of such great numbers of faunal remains, including whole teeth and ostrich egg shells add significantly to our understanding of subsistence patterns in a lacustrine/marsh ecological setting. Spatially discrete artifact distributions provided one of the first have provided one of the first opportunities to examine *in situ* activities in the Ahmarian (e.g., see Phillips 1991). And most importantly, the excellent condition and preservation of the fauna,



worked bone, and other non-lithic artifacts substantiates the presence of organic technologies in open-air Upper Paleolithic sites outside the Mediterranean zone of northern Israel and Lebanon (e.g., the Levantine Aurignacian at Hayonim Cave [Belfer-Cohen and Bar-Yosef 1981] and particularly in sites where unusual conditions of preservation have acted to differentially preserve some types of organic remains [Coinman 1997]).

During the testing phase at three sites (Ṭor Ṣadaf, Ṭor Ṣageer, and Ṭabaqa) and the expanded excavations at 'Ayn al-Buḥayra, including excavations at WHS 618X, numerous flotation, phytolith and pollen samples were taken. Analyses of these samples will begin immediately after shipment to the specialists associated with this project (Marci Donaldson, macrobotanical remains; Arlene Miller Rosen, phytoliths; and Suzanne Fish, pollen). Additionally, analysis of the faunal remains will be undertaken by Margaret Glass, and geo-archaeological sediments will be processed and analyzed by Joseph Schuldenrein.

This extensive sampling strategy was undertaken to aid in the reconstruction of the paleoenvironment, paleoecology, and geomorphology of the Wādi al-Ḥasa region, and in certain aspects of subsistence/seasonality. Radiocarbon samples were more limited in number; the best samples are from 'Ayn al-Buḥayra and Ṭor Ṣageer.

A second season of the EHLPP is planned for the summer of 1998. Archaeological investigations will be undertaken more extensively at Ṭor Ṣadaf and Ṭor Ṣageer during this second season. Other plans include initial testing at EHLPP 2, and further work at Yutil al-Ḥasa in the areas of

the site which previously yielded Early and Late Epipaleolithic occupations.

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**Bibliography**

- Belfer-Cohen, A. and Bar-Yosef, O.  
 1981 The Aurignacian at Hayonim Cave. *Paléorient* 7: 19-42.
- Byrd, B.F. and Colledge, S.  
 1991 Early Natufian Occupation along the Edge of the Southern Jordanian Steppe. Pp. 265-276 in O. Bar-Yosef and F. Valla (eds), *The Natufian Culture in the Levant*. Ann Arbor: International Monographs in Prehistory.
- Clark, G.A., Lindly, J. Donaldson, M. Garrard, A. Coinman, N. Schuldenrein, J. Fish, S. and Olszewski, D.  
 1988 Excavations at Middle, Upper and Epipaleolithic Sites in Wadi al-Hasa, West-Central Jordan. Pp. 209-285 in A. Garrard and H.G. Gebel (eds), *The Prehistory of Jordan*. Oxford: BAR Int. Ser. 396(i).
- Clark, G.A., Neeley, M. MacDonald, B. Schuldenrein, J. and 'Amr, K.  
 1992 Wadi al-Hasa Paleolithic Project-1992: Preliminary Report. *ADAJ* 36: 13-23.
- Clark, G.A., Olszewski, D.I. Schuldenrein, J. Rida, N. and Eighmey, J.  
 1994 Survey and Excavation in the Wadi al-Hasa: A Preliminary Report of the 1993 Season. *ADAJ* 38: 41-55.
- Coinman, N.R.  
 1993 WHS 618 - Ain el-Buhira: An Upper *Paleolithic* Site in the Wadi al-Hasa, West-Central Jordan. *Paléorient* 19(2): 17-37.  
 1997 Worked Bone in the Levantine Upper Paleolithic: Rare Examples from the Wadi al-Hasa, West-Central Jordan. *Paléorient* 22(2): 113-121.
- Edwards, P.  
 1991 Wadi Hammeh 27: An Early Natufian Site at Pella, Jordan. Pp. 123-148 in O. Bar-Yosef and F. Valla (eds), *The Natufian Culture in the Levant*. Ann Arbor: International Monographs in Prehistory.
- Garrard, A.N., Betts, A. Byrd, B. and Hunt, C.  
 1987 Prehistoric Environment and Settlement in the Azraq Basin. An Interim Report on the 1985 Excavation Season. *Levant* 19: 5-25.
- MacDonald, B., Banning, E. and Pavlish, L.  
 1980 The Wadi al-Hasa Survey 1979: A Preliminary Report. *ADAJ* 24: 169-183.
- MacDonald, B., Rollefson, G. Banning, E. Byrd, B. and D'Annibale, C.  
 1983 The Wadi al-Hasa Survey 1982: A Preliminary Report. *ADAJ* 27: 311-324.
- MacDonald, B., Rollefson, G. and Roller, D.  
 1982 The Wadi al-Hasa Survey 1981: A Preliminary Report. *ADAJ* 26: 117-131.
- Macumber, P. and Head, M.  
 1991 Implications of the Wadi al-Hammeh Sequences for the Terminal Drying of Lake Lisan, Jordan. *Palaeogeography, Palaeoclimatology, Palaeoecology* 84: 163-173.
- Neeley, M.P., Peterson, J.D. Clark, G.A. and Fish, S.K.  
 in press WHS 1065 (Tor al-Tareeq), an Epipaleolithic Site in the Wadi al-Hasa, West-Central Jordan. In N.R. Coinman (ed.), *The Archaeology of the Wadi al-Hasa West-Central Jordan, Vol. 2: Archaeological Excavations in the Wadi al-Hasa Tempe: Anthropological Research Papers*, Arizona State University.
- Olszewski, D.I.  
 1997 From the Late Ahmarian to the Early Natufian: A Summary of Hunter-Gatherer Activities at Yutil al-Hasa, West-Central Jordan. Pp. 171-182 in H.G. Gebel, Z.



Kafafi and G. Rollefson (eds), *The Prehistory of Jordan II. Perspectives from 1996*. Studies in Early Near Eastern Production, Subsistence, and Environment. Berlin: ex oriente.

Olszewski, D.I., Clark, G.A. and Fish, S.

1990 WHS 784X (Yutil al-Hasa): A Late Aḥmarian Site in the Wadi al-Hasa, West-Central Jordan. *Proceedings of the Prehistoric Society* 56: 33-49.

Olszewski, D.I. and Coinman, N.R.

in press Late Pleistocene Settlement Patterns in the Wadi al-Hasa, West-Central Jordan. In N.R. Coinman (ed.), *The Archaeology of the Wadi al-Hasa West-Central Jordan, Vol. 1: Surveys, Settlement Patterns, and the Paleoenvironments of the Wādī al-Ḥasa*. Tempe: Anthropological Research Papers, Arizona State University.

Phillips, J.

1991 Refitting, Edge-Wear and Chaînes Opératoires: A Case Study from Sinai. Pp. 305-317 in *24 Ans d'Études Technologiques en Préhistoire. Xle Recontres Internationales d'Archéologie et d'Histoire d'Antibes*. Juan-les-Pins: Editions APDCA.

Schuldenrein, J.

in press Geomorphology and Stratigraphy of Prehistoric Sites Along the Wadi al-Hasa. In N.R. Coinman (ed.), *The Archaeology of the Wadi al-Hasa West-Central Jordan, Vol. 1: Surveys, Settlement Patterns, and the Paleoenvironments of the Wadi al-Hasa*. Tempe: Anthropological Research Papers, Arizona State University.

Schuldenrein, J. and Clark, G.A.

1994 Landscape and Prehistoric Chronology of West-Central Jordan. *Geoarchaeology* 9(1): 31-55.