

PRELIMINARY REPORT OF THE 2004 WĀDĪ AL-ḤASĀ CHERT SURVEY¹

Deborah I. Olszewski, Maire P. Crowley and Maysoon al-Nahar

The Wādī al-Ḥasā (وادي الحسا) region has been the focus of archaeological survey and Paleolithic research since 1979. Early surveys of the south bank (Wadi Hasa Survey or WHS) of the al-Ḥasā drainage system by MacDonald *et al.* (1980, 1982, 1983) located hundreds of sites attributed to the Lower, Middle, and Upper Paleolithic, as well as the Epipaleolithic. Additional survey of the north bank (Wadi Hasa North Bank Survey or WHNBS) of the al-Ḥasā system by Clark *et al.* (1992, 1994) further augmented the number of Paleolithic and Epipaleolithic sites.

Based on the results of these surveys, several sites were chosen for more extensive research and test excavations. Initial work was conducted under the auspices of the Wadi Hasa Paleolithic Project (WHPP), under the direction of Geoffrey A. Clark, and involved work at the Middle Paleolithic sites of 'Ayn Difla (WHS 634) and WHS 623, the Upper Paleolithic sites of 'Ayn al-Buḥayra (عين البحيرة) (WHS 618) and Yutil al-Ḥasā (يutil الحسا) Areas A and B (WHS 784), the Early Epipaleolithic sites of Ṭūr aṭ-Ṭariq (طور الطريق) (WHS 1065) and Yutil al-Ḥasā Areas C and E, and the Late Epipaleolithic in Area D at Yutil al-Ḥasā (Clark *et al.* 1987, 1988; Lindly and Clark 1987; Neeley *et al.* 1998; Olszewski *et al.* 1990, 1994).

Subsequent to the WHPP, the Eastern Hasa Late Pleistocene Project (EHLPP), under the direction of Deborah I. Olszewski and Nancy R. Coinman, continued test excavations at some of these sites, as well as including new sites. The EHLPP researched the Upper Paleolithic sites of Multaqa al-Widyān (ملتقى الوديان) (WHNBS 192-195), Ṭūr Ṣadaf (طور صدف) (WHNBS 8), Tha'lab al-Buḥayra (ثعلب البحيرة) (EHLPP 2), 'Ayn al-Buḥayra, and Yutil

al-Ḥasā Area A. This project also tested Early Epipaleolithic occupations at Yutil al-Ḥasā Area C, Ṭūr ṣaghīr (طور صغیر) (WHNBS 242), and Ṭūr aṭ-Ṭariq, as well as Late Epipaleolithic (Early Natufian) at aṭ-Ṭabaqa (WHS 895) and Yutil al-Ḥasā Area D (Coinman *et al.* 1999; Olszewski *et al.* 1998, 2001).

The overarching goal of the WHPP and the EHLPP was to investigate long-term adaptations of Paleolithic and Epipaleolithic groups to the lake/marsh context that existed in the Wādī al-Ḥasā (Schuldenrein and Clark 1994). During the Pleistocene, the eastern basin of the al-Ḥasā (in the vicinity of the Desert Highway) was characterized by Lake Hasa, and remnant lake bottom sediments (marls) can still be seen to the west of the Desert Highway, particularly near the Ottoman period castle and the Ḥajj road. Farther down-wādī, there are similar marl deposits, especially near the confluences of various major tributary wadis with the Wādī al-Ḥasā. These locales are likely to have been a series of large ponds, fed primarily by fresh-water springs (Olszewski *et al.* 2001: 39). Analyses geared toward reconstructing the environmental parameters of the al-Ḥasā area, such as palynology, and specifying the types of animals favored by Paleolithic hunters at the sites investigated are on-going.

Adaptations, however, are not strictly environmentally determined, and they include aspects of daily life in addition to procuring food and water. One of these primary considerations is the need for flint/chert² for the manufacture of stone tools. Chipped stone artifacts, of course, often constitute the main line of evidence for prehistoric behaviors due to their durability over long periods of time. In

1. The Wādī al-Ḥasā Chert Survey was funded by grants from the National Science Foundation (#0309247) and the University of Pennsylvania Museum of Archaeology and Anthropology (Penn Museum). We thank Dr. Jeremy A. Sabloff, former Director of the Penn Museum, Dr. Fawwaz al-Khraysheh, Director of the Department of Antiquities and his staff, Mr. Ashraf Rawashdeh, our representative from the Department of Antiquities, Pierre and Patricia Bikai,

Directors of ACOR and all the ACOR staff, and, finally, but not least, the people of Jordan. This is EHLPP Contribution No. 29.

2. We use the terms chert and flint interchangeably, while recognizing that most Levantine researchers prefer the term "flint" due to the generally high quality lithic raw materials used throughout the region and throughout much of the Paleolithic and Epipaleolithic periods.

this regard, understanding their typology and technology is one key to interpreting Paleolithic behavior. An equally important variable is to examine where the sources of flint/chert are located with respect to the archaeological sites, and to determine if the prehistoric flintknappers preferentially used only certain types or sources of flint/chert. Obviously, flint/chert sources and preferential use can also be monitored over time, with the expectation that prehistoric groups may have varied their use of sources. Identifying these prehistoric choices thus has implications for assessing the mobility of groups over the landscape, as well as whether or not they used methods of conserving flint/chert if this raw material was perceived to be scarce or difficult to obtain.

Previous Chert Survey in the Wādī al-Ḥasā Region

During the 2000 field season of the EHLPP, the question of the location of chert sources in the al-Ḥasā region was addressed through pedestrian survey transects in areas on both the south and north banks of the Wādī al-Ḥasā drainage system (Olszewski *et al.* 2001: 53-57). The 2000 chert survey began with six nonsystematic surveys (A-F), which were designed to allow the survey participants to gain an appreciation of the types of cherts and other knappable rocks that might be encountered in the al-Ḥasā region (Fig. 1). Following this introduction to the hard rock geology of the area, the EHLPP team walked 16 systematic transects (#1-16). In these systematic transects, team members were spaced from 50 to 150m apart, depending on the local topographic situation. Each person collected relevant chert samples along their line, and, in some cases, also collected examples of various marker beds within the geological formations that would aid in later placing the chert samples into the correct geological formation.

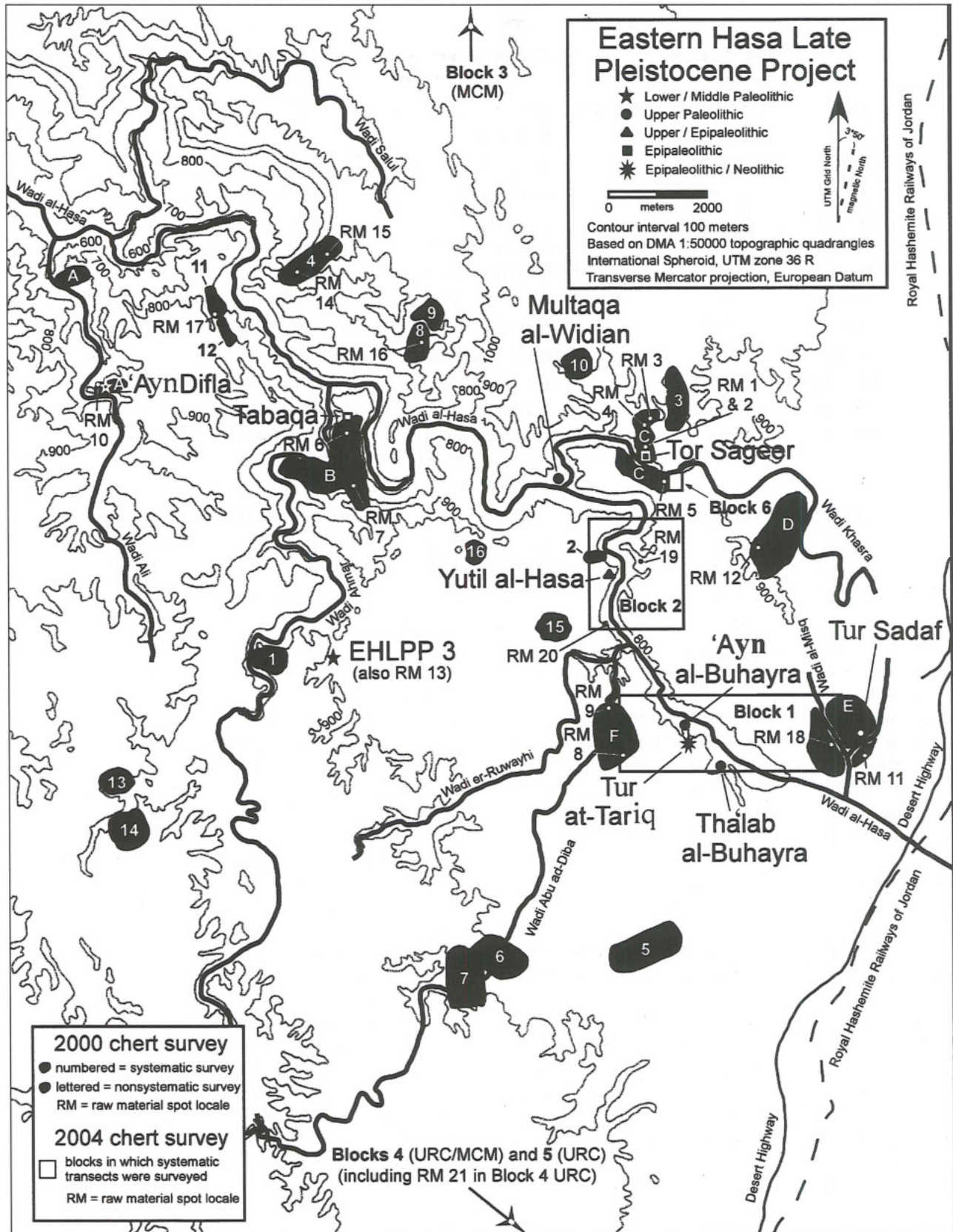
There are three major geological formations with wide exposure in the Wādī al-Ḥasā system. All contain varying amounts of chert, are pre-Quaternary in age (Cretaceous), and belong to the "Belqa Group" (descriptions are taken from Moumani 1997). The lowest formation examined by the 2000 survey is the Wadi Umm Ghudran Formation (WG). This formation is not exposed in the vicinity of Pleistocene Lake Hasa, but can be found downstream of the confluence with the Wādī ar-Ruwayḥī (وادي الرويحي), and coincides with where the Wādī al-Ḥasā narrows considerably. The WG consists of various limestone, sandstone, and quartzite occurrences. There are also brecciated cherts, chert lenses, and nodular cherts.

Overlying the WG is the Amman Silicified Limestone Formation (ASL). The ASL has numerous chert beds, often brecciated, and generally forms a relatively steep topography throughout the al-Ḥasā region. Other beds within the ASL include phosphatic cherts, dolomite cherts, coquinas, phosphates, and coquinal limestone. Some nodular chert is also present. The ASL is found mainly downstream of the confluence with the Wādī ar-Ruwayḥī, as well as in the plateau areas on the north and south banks of the al-Ḥasā system. There is also a small exposure of ASL near Pleistocene Lake Hasa. This begins near the mouth of the Wādī al-Misq (وادي المسك) and continues down stream along the Wādī al-Ḥasā proper.

The uppermost formation surveyed in 2000 is the Al-Hisa Phosphorite Formation (AHP). One prominent member of this formation is the Bahiya Coquina (BC), often easily recognizable due to the presence of numerous fossilized oyster shells. The AHP is characterized by phosphate, phosphatic chert, phosphatic limestone, chert, microcrystalline limestone, and, of course, coquinal limestone. This formation is widespread in the al-Ḥasā region, characterizing the majority of the landscape in the vicinity of Pleistocene Lake Hasa, as well as the plateau tops throughout the immediate region.

Examples of chert were encountered in virtually all transects in 2000, with nodular chert in the AHP occurring only as non-*in situ* examples. While this type of information was helpful in the general assessment of chert availability with the al-Ḥasā region, the goal of the 2000 chert survey was to find *in situ* nodular sources, as analysis of the stone artifacts from the archaeological sites indicated that nodular cherts were the preferred source type. To this end, the systematic transects during 2000 recorded a series of spot locales of *in situ* chert raw materials, including both bedded and nodular cherts (RM 1-17; see Figure 1). A handheld GPS unit was used to record each UTM location. These RM locations are not intended to indicate unique or exclusive chert sources, but rather serve as a method of spot-identifying promising chert sources that can eventually be compared to the archaeological materials. **Table 1** describes these RM spot locales.

In general, the 2000 chert survey accomplished its goals of identifying cherts and potential chert sources within the Wādī al-Ḥasā system. The picture that emerged after this research indicated that while cherts are nearly ubiquitous with the Wādī al-Ḥasā, many of the available cherts likely were not extensively used by Paleolithic and Epi-paleolithic groups. This is because the majority of the cherts are bedded, brecciated, or otherwise



1. Map showing 2000 and 2004 chert survey areas.

Table 1: Spot Locales for Chert Raw Materials Identified during the 2000 Field Season.

#	Formation	Raw Material	Description
RM 1	WG/ASL	matte chert banded with silicified limestone	bedded; brecciated
RM 2	ASL	matte chert	bedded; generally flawed
RM 3	ASL/AHP	matte chert	surface nodules
RM 4	ASL/AHP	chert	surface nodules
RM 5	WG	silicified limestone	bedded; near top of WG
RM 6	WG	silicified limestone	bedded
RM 7	ASL	grey to grey-brown chert	<i>in situ</i> nodules in limestone
RM 8	AHP	grey chert	nodules in sediment
RM 9	AHP	siliceous coquina	bedded in BC coquinal limestone
RM 10	ASL	grey chert	bedded and <i>in situ</i> nodules
RM 11	AHP	chert	<i>in situ</i> nodules
RM 12	ASL	matte to grey chert	<i>in situ</i> nodules within chert bed
RM 13	AHP	cream-colored chert (EHLPP 3)	rubble surface
RM 14	WG/WSL	matte to grey chert	<i>in situ</i> nodules in limestone
RM 15	ASL	translucent and grey chert	bedded
RM 16	ASL	matte to grey chert	<i>in situ</i> nodules in limestone
RM 17	ASL	chert	bedded and <i>in situ</i> nodules

flawed, and while usable flakes can be struck from them, it would be difficult to prepare adequate cores from such sources. Additionally, there is a much wider range of knappable raw material in the al-Ḥasā region than was selected for use by most of its prehistoric inhabitants. These include, for example, highly siliceous phosphatic cherts, which have not been documented in any of the Wādī al-Ḥasā archaeological collections, and siliceous coquina, the use of which appears to be confined to Ṭūr at-Ṭariq³, where this raw material can be found in abundance as rubble on the hilltop immediately above the site.

Several questions remained after the 2000 chert survey. The first of these concerns the characterization of *in situ* nodular chert sources. Time constraints during 2000 allowed the team to identify spot locales, but not to follow these laterally to measure the distance over which they are exposed or to document the variability in quality and color of chert that might be present within each *in situ* nodular source. The second question relates to whether prehistoric groups in the al-Ḥasā region used the al-Ḥasā chert sources exclusively, or transported cherts from other areas into the al-Ḥasā

region. There are two geological formations that bear upon this research theme, neither of which was investigated by the 2000 chert survey. These formations are the Muwaqqar Chalk-Marl Formation (MCM) and the Umm Rijam Chert Formation (URC); they are within 7 to 15km of the al-Ḥasā. The MCM is present to the north, south, and southeast, while the URC is found to the south, in the vicinity of Jurf ad-Darāwīsh (جرف الدراويش). Finally, several of the nonsystematic chert surveys of the 2000 season were conducted near the archaeological sites. This meant that systematic collection of cherts and documentation was lacking for the immediate vicinity of the sites, particularly those in the vicinity of Pleistocene Lake Hasa.

The 2004 Wādī al-Ḥasā Chert Survey

The 2004 Wādī al-Ḥasā Chert Survey took place between June 27 and July 12, 2004. Its main goal was to build upon and expand, both in detail and areas covered, the work undertaken by the EHLPP in 2000. The 2004 project surveyed a total of 17 systematic transects, ten of which are within the Wādī al-Ḥasā in the areas designated as Blocks 1, 2 and 6 (see Figure 1). These were designed to

3. The use of siliceous coquina at Ṭūr at-Ṭariq appears to be most prevalent during its later occupation. This later phase was originally described as Middle Epipaleolithic (Clark *et*

al. 1987, 1988; Neeley *et al.* 1998), but is now known to be Neolithic in age based on radiocarbon dates obtained during the 2000 season of the EHLPP.

provide systematic recording of cherts available in the immediate vicinity of several of the archaeological sites. Seven transects were placed in Blocks 3, 4, and 5, outside the Wādī al-Ḥasā drainage system, to examine the MCM and URC formations for chert sources. Finally, lateral explorations of five RM locales (#s 7, 11, 12, 14, and 16) found during the 2000 survey were undertaken.

Methodology

All the 2004 transects within blocks were surveyed systematically to determine the range of variability of good quality, knappable chert available to prehistoric flintknappers. Each team member collected samples of each type of chert found on their transect line, thus providing an indication of how chert varied in color, texture, and knapping quality.

Three to four people participated on each survey day, with each member collecting an average of 15 to 30 chert samples per transect line. Participants' transect lines within the blocks were spaced variously from about 20 to 50 meters apart, depending on the terrain. For the lateral exploration of RM locales, the original GPS coordinates were used as an origin point, with an A-line and a B-line tracing the *in situ* cherts laterally in both directions from the 2000 season GPS origin point. Both A- and B-line transects collected chert samples from *in situ* nodules to gather information on chert quality and color.

GPS readings (UTM) were taken at the beginning and end of each transect line, using a GPS unit accurate to within several meters. GPS readings were also recorded at various significant points on the landscape, such as the tops of ridges, or where the chert outcrop seemed particularly noteworthy. Chert outcrops were documented using both digital and 35mm film photography.

Transects within blocks (see Figure 1)

Six blocks were designated for chert survey transect research. Three are within the Wādī al-Ḥasā (Blocks 1, 2, and 6), one (Block 3) examined the MCM on the Karak Plateau to the north, and

two (Blocks 4 and 5) studied the MCM and URC in the vicinity of Jurf ad-Darāwīsh to the south.

The position of Block 1 was chosen because this area contains Ṭūr Ṣadaf, Ṭūr aṭ-Ṭariq, 'Ayn al-Buḥayra, and Tha'lab al-Buḥayra, which span an extensive period of time, from approximately 45,000 to 8,400 bp. The sequence of industries found at these sites includes the "transitional" Early Upper Paleolithic, Early and Late Upper Paleolithic, Early Epipaleolithic, and the Neolithic (Pre-Pottery Neolithic B: see Footnote 3). It is possible that site occupants intensively exploited the local cherts, so a detailed systematic survey of the raw material resources in the vicinity of these four sites was deemed important.

A total of 6 transects were surveyed within Block 1. Transect lines 1 and 2 were walked near Ṭūr Ṣadaf, through the AHP. Lines 3 and 4 were near the sites of Ṭūr aṭ-Ṭariq and 'Ayn al-Buḥayra and also sampled the AHP. A final two transects are located west of Transects 1 and 2. These (Transects 5 and 6) were walked generally south and north; they document sections of the AHP and the ASL.

Rubble rock characterizes the AHP terrain of Block 1, and contains some knappable chert. In addition, bedded chert was found both in the BC and above it. High quality knappable chert could occasionally be obtained from the bedded sources, although this source is generally unpredictable in quality. The BC also contains nodules of good quality silicified oyster shells that knap and look like cherts. One of these locales in Transect 2 was designated RM 18 (Table 2). In other areas, nodules were found partially buried in sediment in Transects 3 and 4, with a smaller number of such occurrences in Transects 5 and 6. These nodules are usually good quality chert of the type used at Paleolithic and Epipaleolithic sites in the Wādī al-Ḥasā. It is likely that they are approximately *in situ*, although it is not possible to be certain. The ASL in Block 1 mainly yields brecciated cherts with many flaws, likely removing it from consideration as a principle prehistoric chert source.

Block 2 focused on the immediate vicinity of

Table 2: Spot Locales for Chert Raw Materials Identified during the 2004 Field Season.

#	Formation	Raw Material	Description
RM 18	BC	oyster shell chert	<i>in situ</i> nodules
RM 19	ASL	matte to whitish chert	<i>in situ</i> nodules
RM 20	ASL	chert	<i>in situ</i> nodules
RM 21	URC	medium to dark grey chert	<i>in situ</i> nodules

Yutil al-Ḥasā, which has three major periods of occupation during the Late Upper Paleolithic, the Early Epipaleolithic, and the Late Epipaleolithic (Early Natufian). Three transects were walked in this block; two (Transects 12 and 13) are across the al-Ḥasā channel from the site, and the third (Transect 14) is along the same side of the channel as the site, but upstream, closer to the confluence with the Wādī ar-Ruwayḥī. All of these transects sampled a small section of the WG and a more extensive section of the ASL.

No cherts could be assigned to the WG in the transects walked in Block 2. The ASL sequence, however, was well documented. Aside from the bedded cherts, a couple of *in situ* nodule locales were noted. The first was designated RM 19 (Transect 12) and occurs relatively high in the ASL sequence (see **Table 2**). These chert nodules are small, irregular in shape, and have a smooth veneer; they outcrop in a limestone/dolomite bed. Given their position in the ASL sequence, they may correspond to the same source as RM 16. The second nodular occurrence was labeled RM 20 and is located in Transect 14 (see **Table 2**). RM 20 contains high quality chert nodules with a cortical rind, occurring relatively high in the ASL sequence. These appear to outcrop in a chert bed, and may be similar to the source noted for RM 12. The RM 20 source, however, appears to be exposed only for a short distance, perhaps some 20 to 30m.

Because it is possible that raw materials from chert-yielding formations outside the immediate Wādī al-Ḥasā drainage system were used by prehistoric groups, Blocks 3, 4, and 5 were placed to sample these outlying geological formations. Two transects (Transects 10 and 11) in Block 3 on the Karak Plateau attempted to sample the MCM, which is described as pale red to yellow marl that contains concretions including cherts (Moumani 1997; Shawabkeh 1990). The MCM on the Karak Plateau, however, is overlain either by fluvial and lacustrine gravels or by other colluvial deposits. No exposed MCM in Block 3 yielded *in situ* chert.

Blocks 4 and 5 sampled both MCM and URC formations in the areas south and southeast of Jurf ad-Darāwish. Transects 16 and 17 were walked in Block 4, and Transects 7, 8, and 9 in Block 5. The most accessible MCM was found in Block 5, where large exposures of the chalk-marl can be easily accessed and examined. The MCM here, however, did not yield chert. In Block 5, the MCM was mainly overlain by colluvial deposits of URC cherts.

The URC formation is characterized by thick

exposures of chalky calcareous marl, chalk beds with *in situ* cherts (both nodular and thinly bedded), limestone, chert concretions, and thickly bedded chert (Moumani 1997). The transects in Block 4 yielded *in situ* nodular chert of exceptionally high quality; there are also thin bedded cherts, often highly fractured, that possess the same cortical rind as the nodular cherts. Two separate beds of nodular chert, ranging in color from medium to dark grey and brownish-grey were observed in Transects 16 and 17. A spot locale designation of RM 21 (Transect 16) was assigned to the URC nodules (**Fig. 2**; see **Table 2**). In contrast, the URC cherts found in Block 5 occur as a rubble surface on top of the MCM formation. While these cherts are essentially in place, they are not *in situ* in their original chalk bed context.

The final block, Block 6, had one survey transect (Transect 15). This block is on the opposite side of the wadi from Ṭūr Ṣaghīr, and to the southeast of the site. It was placed to systematically examine more of the ASL formation near this Early Epipaleolithic site. A nodular *in situ* chert embedded in a chert bed (similar to RMs 12 and 20) was noted on this transect. This particular source type often yields a relatively glossy, almost translucent chert, which bears some resemblance to the raw material used to manufacture artifacts at Ṭūr Ṣaghīr.

Lateral exploration of RMs 7, 11, 12, 14, and 16

The final task of the 2004 Chert Survey was to conduct detailed lateral explorations of five RMs identified during the 2000 field season. These transects are indicated on Figure 1 by their RM numbers. The goals were to examine the lateral extent of these *in situ* outcrops and to comprehensively sample the chert occurring in each RM.

The geologically oldest occurring *in situ* nodular source in the al-Ḥasā is RM 14 (**Fig. 3**). This source is either within the top of the Wādī as-Sir Limestone (WSL) or the basal portion of the WG. This nodular outcrop is particularly rich and laterally extensive. It owes its exposure, which would have also been visible during the Pleistocene, to the fact that it is present on the north side of the al-Ḥasā drainage, which has been uplifted some 100 to 150m above the south bank of the al-Ḥasā drainage. Nodular chert of a light grey or somewhat whitish appearance is typical, although some tested nodules have translucent chert immediately under the cortex, or yield a brownish-grey chert. A few examples contain hints of pink coloration. Some parts of the outcrop are sections of limestone with readily visible nodules, which occur in at least



2. RM 21: *in situ* Nodular Chert in the URC Formation.



3. RM 14: *in situ* Nodular Chert in the WSL/WG Formation.

three different levels or lines within the limestone over approximately a 30m thick section. Other portions of the outcrop are less thick, and can become essentially "hidden" by colluvial deposits. The raw material yielded by this source is reminiscent of some of the artifacts from Yutil al-Ḥasā.

RMs 7, 12, and 16 represent *in situ* nodular sources relatively high in the ASL sequence. RM 16 is a nodular source outcropping in a limestone or dolomite (Fig. 4). In this regard, it is quite similar in surface appearance to RM 14. The nodules have a smooth veneer and yield a fairly consistent medium grey chert, although some nodules have a thin translucent chert immediately under the cortex. A few nodules yield a whitish chert. The visibility of this outcrop is quite variable. Some sec-



4. RM 16: *in situ* Nodular Chert in the ASL Formation.

tions quite easily seen, while in others, the limestone/dolomite outcropping is quite low to the modern ground surface and thus subjected to colluvial deposits that hide the nodules unless one is looking quite closely at the ground surface. The medium grey color of the majority of the nodules sampled is similar to that seen in the artifacts found at Multaqa al-Widyān and perhaps at aṭ-Ṭabaqa as well.

The RM 7 and 12 spot locales are likely the same source in the ASL (Fig. 5). This source oc-

curs just above the RM 16 type of chert nodule. RMs 7 and 12 are chert nodules that have formed in a chert bed. In some cases, these nodules are not distinct from the chert bed, except for their “tops,” which have a limestone cortical rind. In other cases, they form separate material which erodes out of the chert bed and is primarily deposited in the sediments immediately downslope from the source bed. In the RM 12 locale, the chert tends to have a glossy luster, and thus is quite similar to the artifacts from Ṭūr Şaghīr. In the RM 7 area, however,



5. RM 7: *in situ* Nodular Chert in the ASL Formation.

there are at least three "lines" of these nodules. Two produce a medium grey, almost glossy, chert comparable to the artifacts at aṭ-Ṭabaqa (which is located nearby), while the remaining line of chert nodules (which have a smooth veneer) yields white chert. This white chert has been documented only rarely at Paleolithic and Epipaleolithic sites in the Wādī al-Ḥasā.

The geologically youngest *in situ* source locale explored is RM 11, which occurs in the BC member of the AHP. RM 11 is primarily a bedded chert, although there are some portions that appear more nodular in form. Generally speaking, this source type is not as high quality as the other RM locales investigated. It is likely that it did not serve as a principle raw material resource for the prehistoric inhabitants of the Wādī al-Ḥasā.

Although transects were walked laterally to document the extent of the exposed RM sources, in no case did the survey "run out of" visible nodules. Most lines were ended simply when the nodular sources became more sparsely visible or patchy across the landscape. This likely indicates that such sources were widely available throughout the al-Ḥasā region during the Paleolithic and Epipaleolithic.

Concluding Remarks

The results of the 2004 chert survey in the Wādī al-Ḥasā and the surrounding region add considerable new knowledge and insight into available chert source types and locations. It is now apparent that the best *in situ* nodular occurrences comprise one source in the WSL/WG, two sources in the ASL, and one source in the URC. While some aspects of these are superficially similar, there are differences as well, particularly in type of cortex and a general consistency in color or texture within the separate sources explored. Additionally, some sources, such as the WSL/WG nodules, are not widely available (either today or during the Pleistocene). Others, such as the URC, require transport over medium-to long-range distances (7 to 10km). These sometimes subtle differences can be used as a first approximation in assessing the likely principle chert source for each of the al-Ḥasā Paleolithic and Epipaleolithic sites.

As during the 2000 season, the chert survey of 2004 did not locate a nodular source of translucent chert, which is seen principally at Late Epipaleolithic (Early Natufian) sites. The lack of pinpointing a source for this material, despite fairly extensive pedestrian coverage of many parts of the al-Ḥasā south and north banks, suggests that nodular translucent chert may have been transported

into the al-Ḥasā from a considerable distance away.

The combination of the 2004 and 2000 survey results is thus beginning to yield a detailed map of the Wādī al-Ḥasā chert sources. This field work provides the baseline data for Ph.D. thesis research (by M.P.C.) that will compare the geological chert source samples to the chert used to make stone artifacts at the Wādī al-Ḥasā Paleolithic and Epipaleolithic sites of Ṭūr aṭ-Ṭariq, Yutil al-Ḥasā, aṭ-Ṭabaqa, Ṭūr Şaghīr, Ṭūr Şadaf, 'Ayn al-Buḥayra, and Tha'lab al-Buḥayra. The ultimate goals of this research are to examine the proximity of *in situ* chert sources to the archaeological sites and to test a chert raw material procurement and utilization model for Late Pleistocene adaptations in the Wādī al-Ḥasā lake/marsh ecological system.

Deborah I. Olszewski
University of Pennsylvania

Maire P. Crowley
University of Pennsylvania

Maysoun al-Nahar
University of Jordan

References

- Clark, G.A., Lindly, J., Donaldson, M., Garrard, A., Coinman, N., Schuldenrein, J., Fish, S. and Olszewski, D.
1987 Paleolithic Archaeology in the Southern Levant: A Preliminary Report at Middle, Upper and Epipaleolithic Sites in the Wadi Hasa, West-Central Jordan. *ADAJ* 31: 19-78.
- 1988 Excavations at Middle, Upper and Epipaleolithic Sites in the Wadi Hasa, West-Central Jordan. Pp. 209-285 in A. Garrard and H.G. Gebel (eds.), *The Prehistory of Jordan*. BAR Int. Seri. 396(i). Oxford: British Archaeological Reports.
- 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., Olszewski, D.I., Abdo, K., Clausen, T.G., Cooper, J.B., Fox, J.R., al-Nahar, M., Richey, E. and Saele, L.S.
1999 The Eastern al-Hasa Late Pleistocene Project. Preliminary Report on the 1998 Season. *ADAJ* 43: 9-25.
- Lindley, J. and Clark, G.A.
1987 A Preliminary Lithic Analysis of the Mousterian Site of 'Ain Difla (WHS 634) in the Wadi Ali,

- West-Central Jordan. *Proceedings of the Prehistoric Society* 53: 279-292.
- MacDonald, B., Banning, E. and Pavlish, L.
1980 The Wadi el Hasa Survey 1979: A Preliminary Report. *ADAJ* 24: 169-183.
- MacDonald, B., Rollefson, G. and Roller, D.
1982 The Wadi el Hasa Survey 1981: A Preliminary Report. *ADAJ* 26: 117-131.
- MacDonald, B., Rollefson, G., Banning, E., Byrd, B. and D'Annibale, C.
1983 The Wadi el Hasa Survey 1982: A Preliminary Report. *ADAJ* 27: 311-324.
- Moumani, K.
1997 The Geology of Al Husayniyya al Janubiyya (Jurf Ed Darawish Area). Map Sheet No. 3151-II. Amman: Geology Directorate, Geological Mapping Division, Bulletin 38.
- Neeley, M.P., Peterson, J.D., Clark, G.A., Fish, S.F. and Glass, M.
1998 Investigations at Tor al-Tareeq: An Epipaleolithic Site in the Wadi el-Hasa, Jordan. *JFA* 25(3): 295-317.
- Olszewski, D.I., Clark, G.A. and Fish, S.
1990 WHS 784X (Yutil al-Hasa): A Late Ahmarian Site in the Wadi Hasa, West Central Jordan. *Proceedings of the Prehistoric Society* 56: 33-49.
- Olszewski, D.I., Stevens, M., Glass, M., Beck, R., Cooper, J. and Clark, G.A.
1994 The 1993 Excavations at Yutil al-Hasa (WHS 784), an Upper/Epipaleolithic Site in West-Central Jordan. *Paléorient* 20(2): 129-141.
- Olszewski, D.I., Coinman, N.R., Schuldenrein, J., Clausen, T., Cooper, J.B., Fox, J., Hill, J.B., al-Nahar, M. and Williams, J.
1998 The Eastern al-Hasa Late Pleistocene Project. Preliminary Report on the 1997 Season. *ADAJ* 42: 53-74.
- Olszewski, D.I., Coinman, N.R., Clausen, T., Cooper, J.B., Jansson, H., al-Nahar, M., Saele, L.S., Sampson, A.J., Schurmans, U. and Thompson, J.R.
2001 The Eastern al-Hasa Late Pleistocene Project. Preliminary Report on the 2000 Season. *ADAJ* 45: 39-60.
- Schuldenrein, J. and Clark, G.A.
1994 Landscape and Prehistoric Chronology of West-Central Jordan. *Geoarchaeology* 9(1): 31-55.
- al-Shawabkeh, K.
1990 *Adir 3152 II Geological Map*. Amman: Geology Directorate, Geological Mapping Division.