Nancy R. Coinman
Department of Anthropology
Iowa State University
USA
ncoinman@iastate.edu

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Tale of Two Sites: Pleistocene Hunter-Foragers of the Jordanian Eastern Deserts

Abstract
Archaeological research on Upper Paleolithic hunter-foragers in the Wādī al-Ḥasā has identified distinctive differences in site structure and organization. Two sites dating between 26,000 and 20,000BP, Tha'lab al-Buḥayra (EHLPP 2) and 'Ayn al-Buḥayra (WHS 618, Spring Area) provide evidence of differences in artifact assemblages, activity areas, subsistence strategies and technologies. Variability in these structural and organizational aspects are suggested to define important functional differences among small sites. This research contributes to a better understanding of variability in Upper Paleolithic settlement patterns and organization.

Introduction

Archaeological surveys and settlement pattern studies of paleolithic hunter-foragers in the Levant have focused on monolithic, theoretical site types, such as special activity sites and base camps. For the most part, archaeological surveys that deal primarily with surface sites have been unable to define paleolithic site types beyond these general, functionally different site types in spite of the fact that ethnographic studies have provided rich documentation of a variety of small site types and complexly-organized base camps used by ethnographic and modern foragers. Surveys have found few small, short-term limited activity or task sites that could be confidently identified. Settlement pattern studies using survey data have inferred site function and functional differences primarily on the basis of site size and elevation (e.g., Coinman *et al.* 1986; Clark 1992; Henry 1987). Small encampments, stone tool knapping episodes, kill sites, resource extraction and processing sites, which have been identified more frequently in North America, are rare to non-existent in Levantine paleolithic settlement studies. The few exceptions include an Early Ahmarian knapping site in the Ḥasā (WHS 623X) (Lindly *et al.* 2000). Clearly, the dearth of such site types is partially due to the more ephemeral and circumscribed nature of limited, small task activities, as well as the lack of preservation on geologically dynamic surfaces that characterize the Levantine desert landscapes and have been surveyed systematically. Nonetheless, in some better-preserved, relatively undisturbed contexts, we should expect to find paleolithic activities like these represented in the archaeological record.

Two paleolithic sites are explored in this paper. Both were located during archaeological surveys in which some 370 paleolithic sites were identified in the Ḥasā (Coinman *et al.* 1986; MacDonald 1988; Olszewski and Coinman 1998). Of these, 78 were assigned to the Upper and / or Epipaleolithic and 75% (n = 57) are located within the upper four kilometers of the Pleistocene lake / marshes of the upper eastern basin of the Ḥasā . Because all of these sites have been identified on the basis of lithic surface assemblages and because surface assemblages often do not accurately predict subsurface cultural and temporal components, it is difficult to know what site types are actually represented by surface assemblages, particularly very large, extensive assemblages. Both sites have been identified as large "base camps" on the basis of their extensive surface manifestations (Coinman *et al.* 1986; Clark 1992). This paper explores these two sites in an effort to identify more specifically functional differences in previously identified large, complex "sites" and provides information on site variability and task activities that might be representative of paleolithic settlement patterns and intra-site organization.

Modeling Settlement Organization

For the last two decades, paleolithic archaeologists have concentrated on theoretical models of foragers and collectors developed from ethnoarchaeological and ethnographic studies of hunter-gatherer settlement patterns (e.g., Binford 1979, 1980; Kelly 1983, 1995; Kent 1987; Lee and DeVore 1976; O'Connell 1987; O'Connell *et al*. 1991; Yellen 1976, 1977). Theoretical discussions about settlement organization have often focused on the contrast between foragers and collectors and their mobility strategies. Marks and Freidel (1977), following Mortensen's (1972) original research, modeled paleolithic settlement systems as a foraging-collecting dichotomy in which "circulating" and "radiating" settlement systems were respectively distinguished by different residential mobility strategies of foragers and collectors. Binford's (1980) ethnoarchaeological research established the terms of "residential" and "logistical" to refer to contrasting mobility strategies, which equate with "circulating" foragers and "radiating" collectors in the Levant. Whether viewed as a dichotomy or a continuum defined by the degree to which a group is logistically organized, with foragers relying on such organization minimally and collectors relying on it extensively (Bamforth 1990; Kelly 1983), some American archaeologists have sought to go beyond what they see as merely descriptive cultural ecology to explain variation in human behavior and the archaeological record, possibly developing behavioral models that might be unprecedented ethnographically (e.g., O'Connell 1995; O'Connell and Elston 1997; Rhode 1997).

In the Levant, however, archaeologists have typically incorporated the traditional forager-collector model into paleolithic research inferring broad comparisons between cultural periods (Middle Paleolithic vs. Upper Paleolithic), as paleolithic groups are conjectured to have responded to long-term regional climatic changes of increasing aridity during the late Pleistocene (Marks and Freidel 1977), or between different Upper Paleolithic cultural units (Kaufman 2003; Williams 2000). Henry (1987, 1994, 1995) documented a long-term strategy comprised of a mix of residential and logistical strategies related to seasonality and elevational factors. Phillips (1987) and Gladfelter (1990, 1997) emphasized that Upper Paleolithic groups in southern Sinai were constrained by local variables (topography, biomass, short-term climatic fluctuations) which influenced resource availability and abundance and therefore led to a mix of logistical and residential strategies. Kaufman (1992) added that social interaction between groups across the landscape might also result in a variety of models featuring aggregation, dispersal, and transhumance between upland and lowland locales, thereby affecting the structure of archaeological sites.

Levantine settlement pattern studies, however, have had mixed success in actually defining specifically the variability and diversity in a spectrum of sites that might have defined a paleolithic settlement system. Generalized artifact distributions have been correlated with shorter-term occupations of Upper Paleolithic sites in a circulating system (e.g., Ein Aqev East in the Negev (Marks and Freidel 1977)), while longer-term camps are often distinguished by more specialized assemblages in which segregated activities occurred, denoting longer occupation periods and more spatially organized behaviors (Henry *et al*. 1996). The latter type of encampment is illustrated in the Middle Paleolithic settlement patterns at Rosh Ein Mor where the spatial patterning of activity loci remained consistent over multiple occupations (Marks and Freidel 1977; Hietala and Stevens 1977). Similarly, Henry *et al*. (1996) identified repeated occupations at Ṭur Faraj rockshelter in Jordan as part of a logistically-oriented procurement system in which redundant intra-site floor features and artifacts suggested a seasonal (probably fall - winter) encampment and where larger base camps were predicted to have been located at lower, warmer elevations. In contrast, however, Kaufman (2003) identified a number of sites in the Jordan Valley and the Negev (e.g., Nahal Ein Gev 1, Fazael IX, Ein Aqev) as either multipurpose base camps or specialized activity stations within larger logistical settlement systems based on tool kit diversity as a means to infer intra-site activities and site function. Small sites may also reflect more restricted base camp occupations in a circulating system, as inferred for the latest occupation at Boker Tachtit (Level 1), identified as an "ephemeral" camp on the basis of generalized artifact distributions (Marks and Freidel 1977; Hietala 1983a, b). Less frequently identified are the larger, long-term base camps, logistical settlement systems, and specific functions of small "special activity" sites. Small sites that are interpreted as satellite sites in logistical systems have typically included small quarry workshops in the Negev (e.g.,

Middle Paleolithic sites D40 and D44) (Marks and Freidel 1977; Munday 1976).

Archaeological Correlates

Identifying the general archaeological correlates for spatially organized behaviors has relied on ethnoarchaeological and ethnographic settlement pattern studies. For example, Binford's (1980) generalized comparisons between Nunamuit collectors and San foragers and the different types of sites and site organization established expectations for collecting and foraging settlement strategies. Expectations for artifact distributions generated by different activities, different sized groups and task groups have been identified in a number of classic ethnoarchaeological studies (e.g., Yellen 1976, 1977; Brooks and Yellen 1987). Archaeological expectations for residential camps will vary depending on group size and duration of occupation. We can expect the internal organization to vary from small task sites, although small nuclear families might create similar organizational patterns (Yellen 1996). Long-term camp sites should reflect greater complexity and diversity of activities carried out by a larger number of people, as well as more diversity in artifact categories (Yellen 1976, 1977). General cooking and consumption activities should be more apparent and localized in residential camps (Brooks and Yellen 1987; Speth and Tchernov 2001; Yellen 1991) and centered around hearths with animal remains likely to reflect consumption activities in terms of bone fragmentation and alteration (e.g., burning) (Binford 1983; O'Connell 1987; Stevenson 1991). Skeletal element representation is expected in general to reflect higher utility elements and fewer low utility parts that might have been left at kill / butchery sites due to transport decisions.

Specific expectations for stone tool making activities and associated discard behaviors have been particularly well studied (e.g., Keeley 1991; O'Connell 1995; Stevenson 1991). We can expect that tool use and associated spatial patterning might be complicated by refuse disposal and cleanup behaviors, the length of occupation, activity timing and retooling of hafted tools (Keeley 1991). Tools manufactured, used briefly and discarded (i.e., expedient tools) are expected to be abandoned nearer the locus of their last use (Keeley 1991), but the location of discarded tools will be determined by a variety of factors, including their size, function, use-life and various nuisance factors (O'Connell 1995; Stevenson 1991). However, we can also expect that hafted artifacts, such as projectile points, will occur more frequently at residential camp sites where they were manufactured and repaired / replaced rather than where they were used. The archaeological implication of this is that proximal portions of projectile points will most likely accumulate in domestic refuse where rehafting / retooling was carried out (Keeley 1982, 1991).

TABLE 1 provides general archaeological correlates for residential base camps and small task sites in terms of site size, assemblage composition, assemblage type, spatial patterning and the level

TABLE 1. Archaeological correlates of small site organization.

Modeling Settlement Organization Archaeological Correlates of Site Organization			
Site Type	**Residential Base Camp**		**Special Task Site**
Site Size	**Large**	**Small**	**Small**
Assemblage Composition	Diverse	Diverse	Restricted
Assemblage Type	Generalized	Generalized	Specialized
Spatial Patterning	Spatially segregated, relatively discrete use and activity areas	Spatially mixed, redundant use and activity areas	Relatively discrete use and activity areas
Resolution	Potentially fine- grained	Coarse-grained	Fine-grained

of archaeological resolution. Using these expectations, two late Pleistocene sites in the Wādī al-Ḥasā were evaluated to see how well they fit the general characteristics of large or small residential base camps or small task sites.

Comparative Settlement Patterns

Two late Upper Paleolithic sites, Tha'lab al-Buḥayra (EHLPP 2) and 'Ayn al-Buḥayra (WHS 618), are compared in terms of site location, geomorphology and intra-site organization (FIG. 1). The latter includes a comparative analysis of artifact and faunal assemblages in regard to composition and spatial distributions. The presence / absence and spatial distributions of specific categories of artifacts, fauna, features and potential activity areas are described and compared.

Site Location and Geomorphology

Initial comparisons of these two sites are made in terms of site location and geomorphology because these physical characteristics often suggest similar settlement site types to archaeologists carrying out surface surveys. However, these physical characteristics can be misleading and subsequent excavations might reveal a far more complex settlement type in terms of site size, site function and occupational duration.

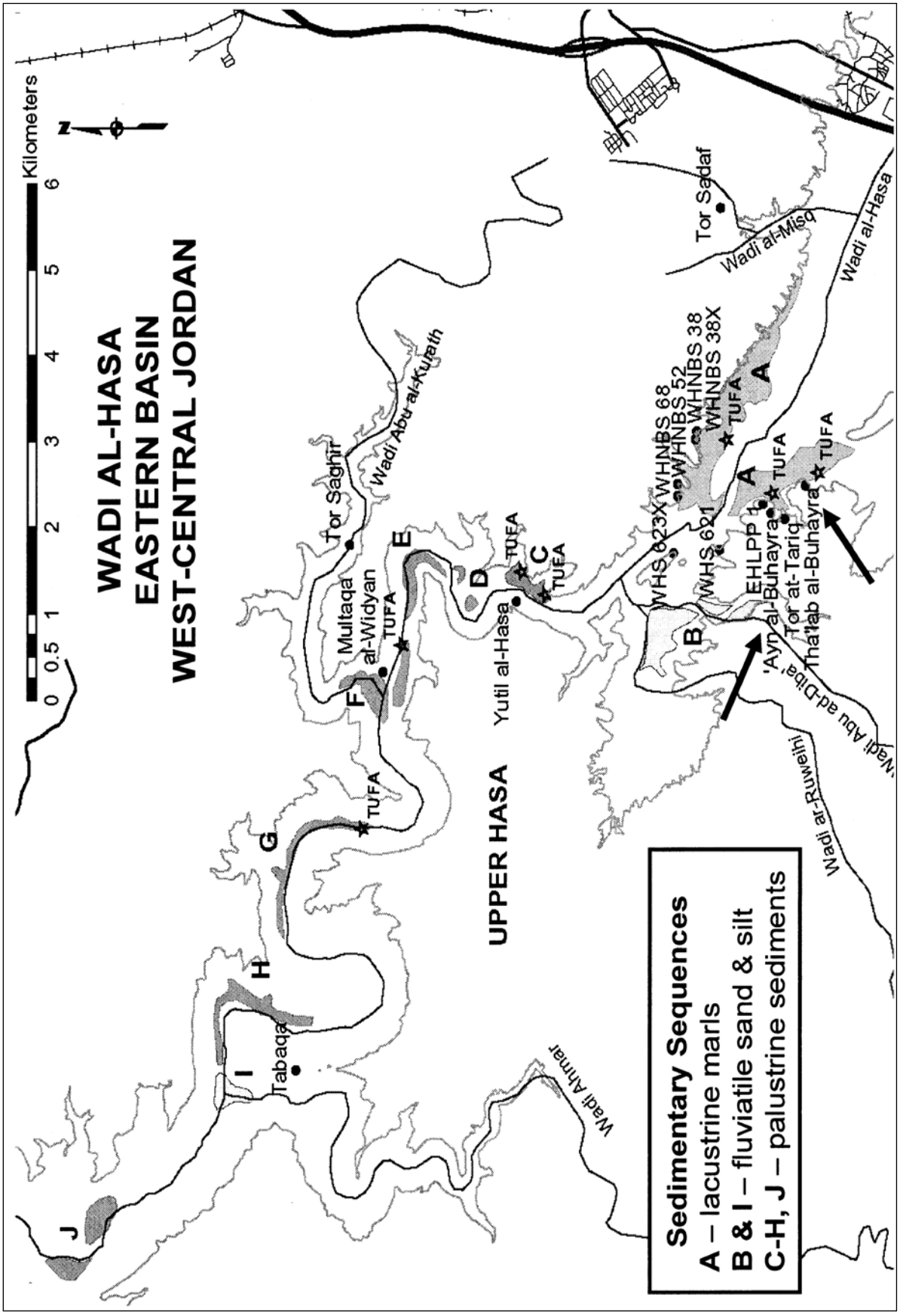
Locationally, Ayn al-Buḥayra is similar to a number of documented paleolithic sites in the Ḥasā in being located strategically on the changing margins of shallow playas and marshlands where springs would have provided fresh water for hunter-foragers as well as an array of targeted prey species (FIG. 2). At Ayn al-Buḥayra, the most intact area of this very extensive site is the remnant Spring Area of the site, while other known areas of the site have exhibited limited to no intact subsurface assemblages (Coinman 2000, 2003) (FIG. 3). The Spring Area and Tha'lab al-Buḥayra are positioned similarly in intermittent marls, spring deposits, and pond and marsh organic lenses. The latest exposed and eroded surfaces, representing these hydrological and depositional processes, occur at ~ 824 m asl at both sites. The geological and cultural sequences have been exposed through excavation to depths of 1-1.5m, while other exposures by various archaeologists and geologists have exposed the paleohydrological depositions at 'Ayn al-Buḥayra to depths of 2-3m. At Tha'lab al-Buḥayra, the area around the site of is characterized by exceptionally well-preserved and stratified lacustrine sediments with a number of crusty tufa outcrops denoting fossil springs (FIG. 4). Three of the four strata identified to date are natural, sterile strata: Stratum I, II and IV. Stratum III occurs between II and IV and is comprised of cultural deposits occurring at different elevations within the surrounding natural stratigraphy at Loci C and E. The cultural deposits comprise discrete stratigraphic units or cultural zones, separated vertically above and below from sterile sediments but lacking discernable internal stratigraphy or microstratigraphy. The cultural occupations at the two sites are partially correlated (and potentially overlapping) through depositional similarities and through radiocarbon dates ranging from at least 26,000 to approximately 19,000BP, after which this paleohydrological series in the eastern basin and Upper Paleolithic occupations at 'Ayn al-Buḥayra terminate (see TABLE 2).

Artifact Assemblages

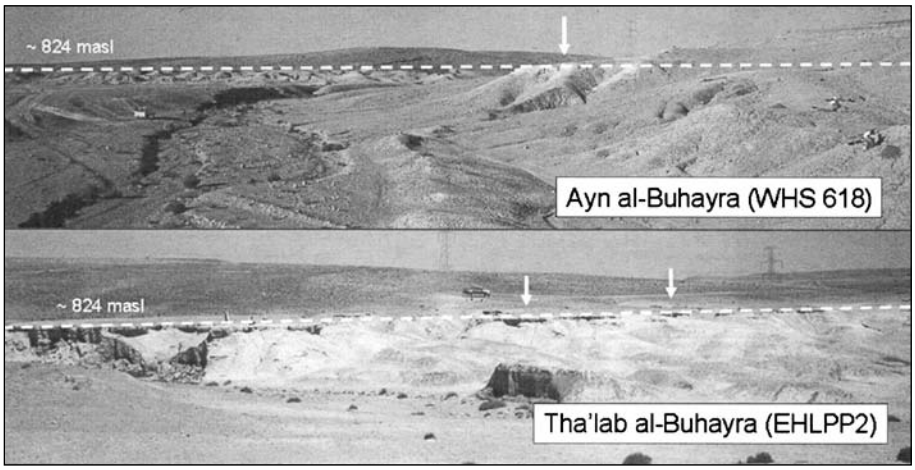
Artifact assemblages recovered from the two sites provide strong contrasts when assemblages and spatial distributions are compared (TABLE 3). Comparisons of debitage assemblages provide a means of identifying on-site reduction activities that inform on site function. Primary core reduction carried out on-site can be inferred by proportions of the total debitage assemblage and frequencies per square meter. Primary reduction is measured using cores, core trimming elements and primary debitage, the latter defined as debitage with more than 50% cortex (TABLE 4). Percentages of these reduction categories suggest similar levels of on-site core reduction occurred at 'Ayn al-Buḥayra and Locus C at Tha'lab al-Buḥayra, but significantly less primary reduction is indicated by the much lower percentages at Locus E at Tha'lab al-Buḥayra. FIG. 5. illustrates the comparative proportions at the two sites and highlights the dissimi-

TABLE 2. Comparative site depositions.

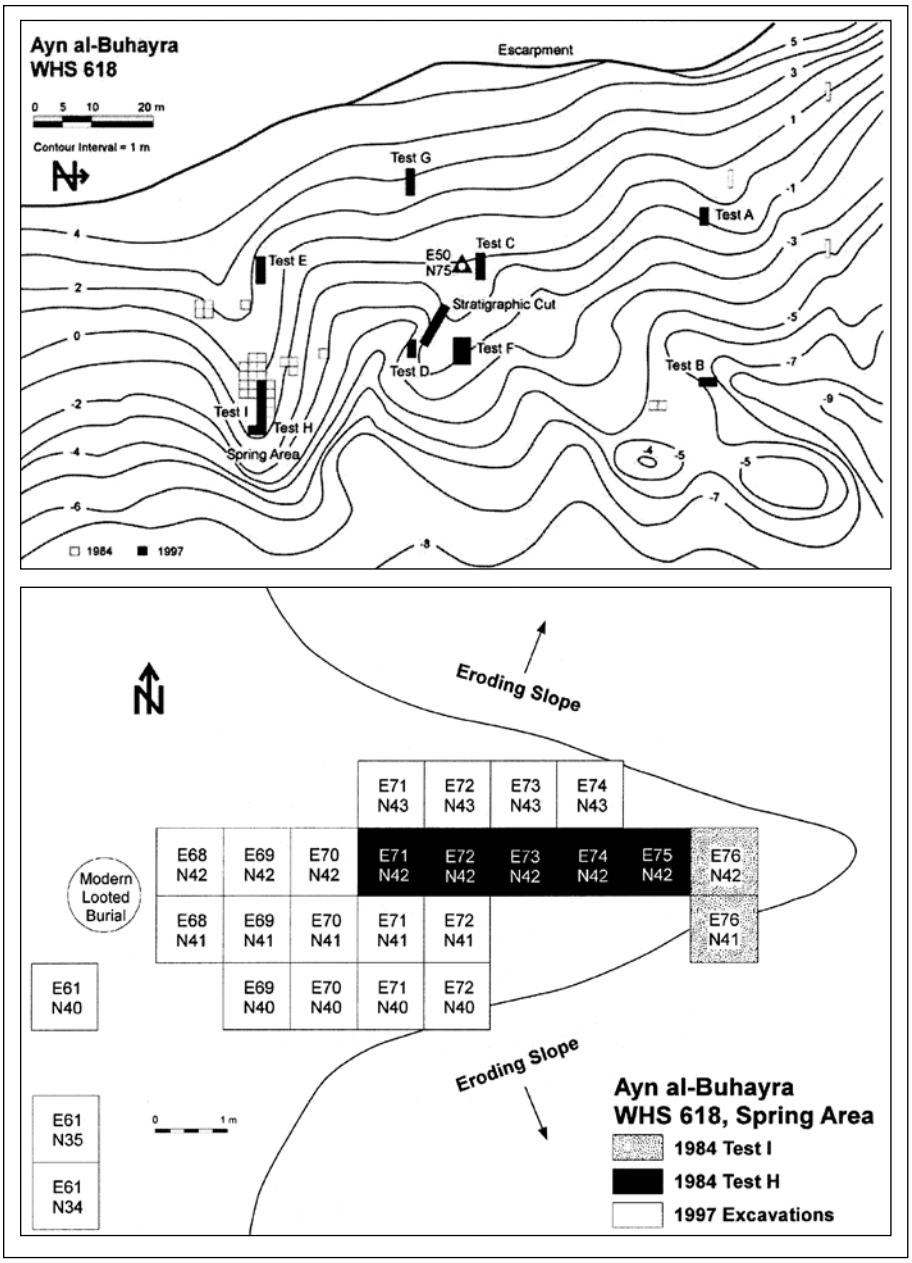
Tha'lab al-Buḥayra	**'Ayn** al-Buḥayra
Sterile	Late Occupation -20,000BP
Sterile	Hiatus
Locus E ~24-25,000BP	Earlier Occupation
Locus C ~25-26,000BP	?



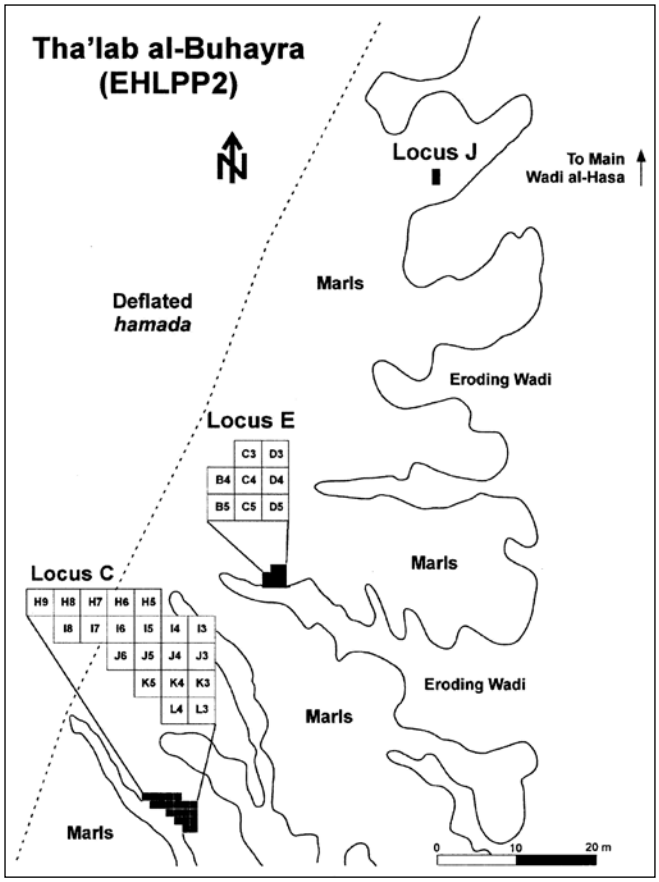
1. Map of paleolithic sites in the eastern Ḥasā basin showing the locations of Tha'lab al-Buḥayra and 'Ayn al-Buḥayra.



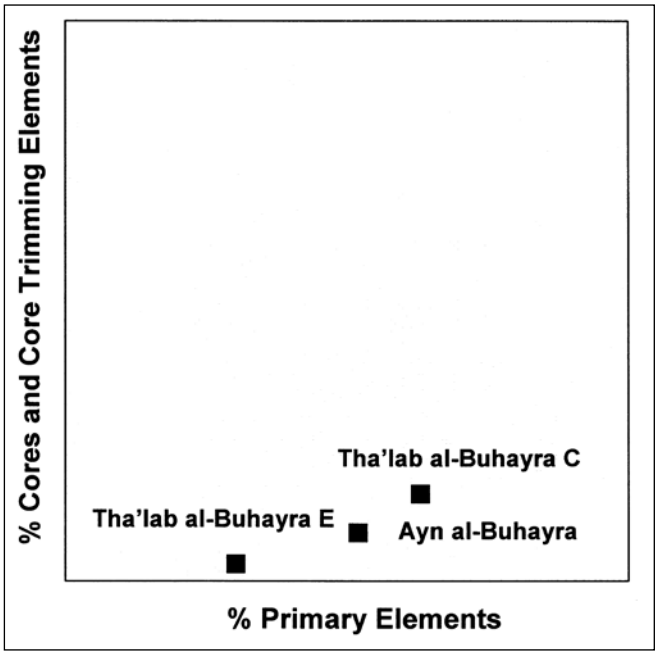
2. Site locations of ʻAyn al-Buḥayra (looking southeast) and Thaʻlab al-Buḥayra (looking northwest) at ~ 824 masl in late Pleistocene lake/marsh sediments in the Eastern Ḥasā basin.



3. Site maps of ʻAyn al-Buḥayra (WHS 618): a: locations of excavations during 1984 and 1997; b: Spring Area excavation units during 1984 and 1997.



4. Site map of Tha'lab al-Buḥayra (EHLPP 2) showing the 1998 and 2000 excavation units.



5. Plot of primary reduction at Tha'lab al-Buḥayra (Locus C and E) and 'Ayn al-Buḥayra, Spring Area. (Primary = >50% cortex; CTEs = core trimming elements).

larity of the Locus E assemblage in terms of overall relative proportions of primary reduction elements. However, when densities of primary reduction elements (cores, core trimming elements and primary elements combined) per excavated square meter within comparable levels are compared (TABLE 5), the densest accumulations were recovered at Locus E at Tha'lab al-Buḥayra, followed by 'Ayn al-Buḥayra and Locus C at Tha'lab al-Buḥayra, suggesting a far greater intensity of reduction activities occurred at Locus E. In summary, primary core reduction was carried out at both sites, but the intensity of such activities varied between and within the two sites.

Secondary reduction activity includes the production of debitage for the purpose of producing blanks for tools, which may or may not have been recovered from the site. Comparisons of secondary debitage includes such classes as flakes, blades and bladelets, as well as trimming flakes which

TABLE 3. Assemblage composition.

Composition	**Tha'lab** al-Buḥayra	**'Ayn** al-Buḥayra
Lithic Reduction	Primary with limited secondary	Primary & secondary
Lithic Tool Kits	Limited, specialized tool kits	Diverse tool kit
Organic Tools	Absent	Present
Processing Equipment	Present	Present, but limited
Pigments	Present, abundant	Present, less abundant
Fauna	Diversity of genera; low utility elements; marrow processing	Limited genera; high utility elements; limited marrow processing

TABLE 4. Core reduction and debitage.

% of Total Debitage	Tha'lab al-Buḥayra				'Ayn al-Buḥayra	
	Locus C		Locus E		Spring Area	
	n	%	n	%	n	%
Cores	111	1.8%	56	.4%	121	1.0%
Core trimming elements	92	1.5%	58	.5%	140	1.1%
Primary debitage	755	12.4%	744	6.1%	1367	10.3%

TABLE 5. Density of reduction activity.

Density per square meter	Tha'lab al-Buḥayra		'Ayn al-Buḥayra
	Locus C n=958	Locus E n=958	Spring Area n=1628
Primary Reduction Elements*	53.2	107.3	70.8

*Cores, core trimming elements and primary elements combined.

TABLE 6. Secondary debitage production.

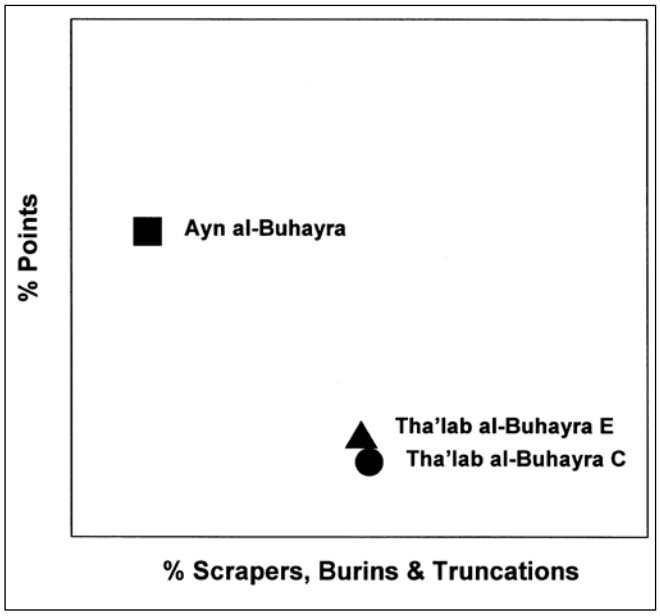
% Secondary Debitage	'Ayn al-Buḥayra		Tha'lab al-Buḥayra
	Locus C	Locus E	Spring Area
	n=5846	n=12,221	n=12,919
Flakes	36.7	26.7	32.7
Blades	17.0	10.6	7.9
Bladelets*	16.3	19.2	19.5
Blades + Bladelets	33.3	29.8	27.4
Trimming Flakes†	26.5	42.5	37.6

* <12 mm width
† flakes smaller than 20mm

are included here since they are general products of core reduction and blank production (TABLE 6). Specific classes of debitage vary between the sites, with the highest proportions of flakes recovered from Locus C at Tha'lab al-Buḥayra and 'Ayn al-Buḥayra, whereas the highest production of of blades / bladelets and trimming flakes were found at Locus E. A plot of the multiple dimensions of secondary debitage production, FIG. 6, illustrates that, overall, the sites vary in the production of debitage with each being characterized by slightly different emphases on secondary debitage products.

Tool Kits

Comparisons of assemblages include examinations of artifact class diversity. There are striking differences in composition at the two sites although, overall, the same classes make up approximately



6. Plot of secondary debitage Tha'lab al-Buḥayra (Locus C and E) and 'Ayn al-Buḥayra, Spring Area.

75% of each retouched tool assemblage (TABLE 7 and FIG. 7). The diversity of artifacts is much lower at Tha'lab al-Buḥayra, suggesting more restricted site functions at the known areas of this site (Coinman 2005). The restricted and clearly specialized set of formal tools is comprised of a variety of scrapers (including varieties of Ksar Akil scrapers with micro-serrated edges), standardized truncations, and limited numbers of el-Wad point fragments (Coinman 2002). In contrast, the artifact assemblage at the Spring Area of 'Ayn al-Buḥayra is more diverse, including a more generalized variety of lithic and organic tools with and an emphasis on the production of small Ouchtata points (Coinman 1997, 2003). (FIG. 8) illustrates the dissimilarity in lithic tool kits between the two sites, highlighting the more restricted nature of the tool kits recovered from both loci at Tha'lab al-Buḥayra, in which scrapers and truncations dominate each assemblage. At 'Ayn al-Buḥayra, a wider variety of retouched tools is dominated by small Ouchtata points.

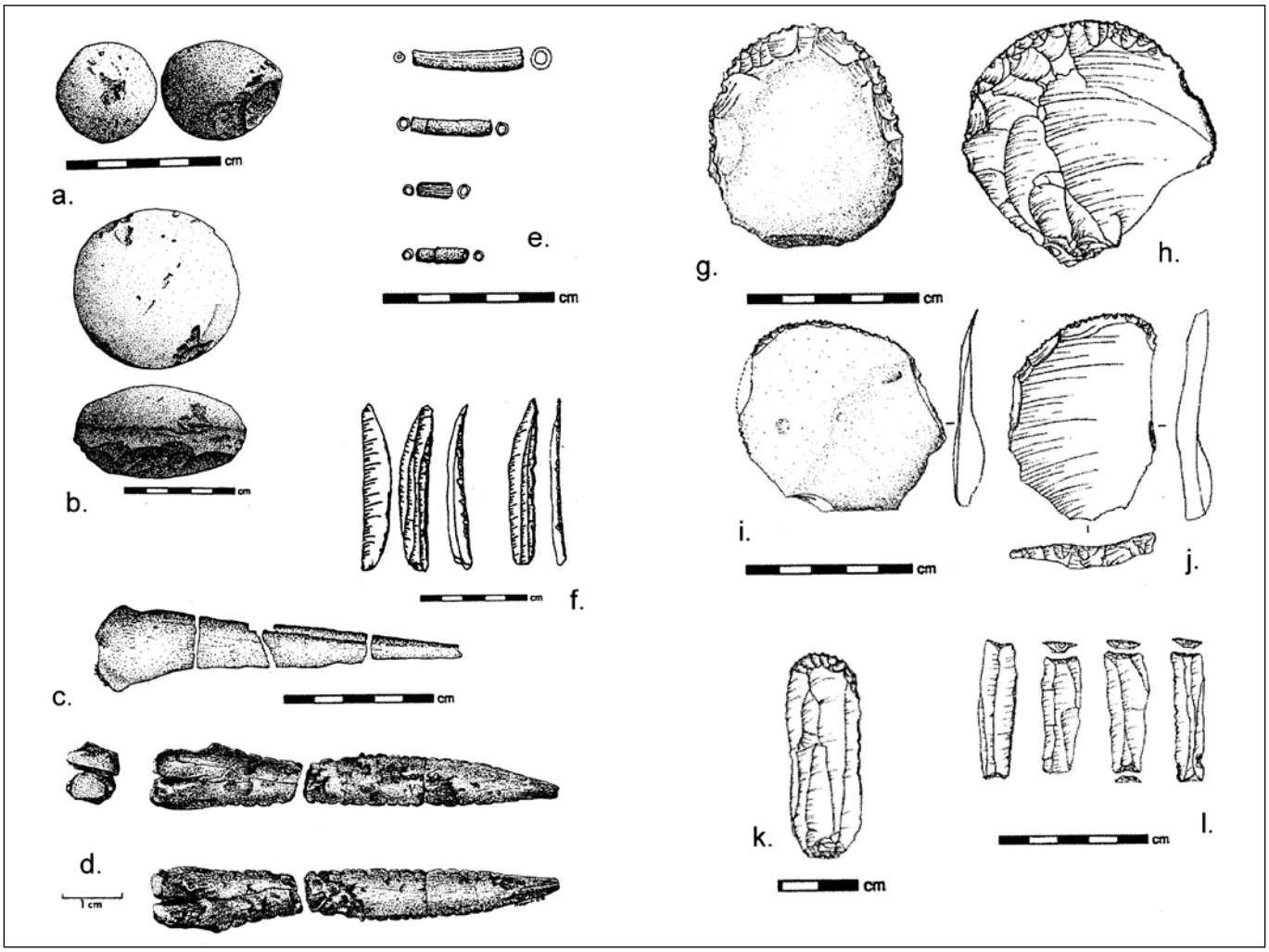
Organic tools and other artifacts are differentially represented at the two sites. Worked bone tools in the form of awls, points and a possible antler pressure flaker have been recovered from the Spring Area of 'Ayn al-Buḥayra (Coinman 1997), as well as worked dentalium shell beads and unworked ostrich eggshells. No worked bone or organic artifacts have been recovered from Tha'lab al-Buḥayra to date in spite of the fact that the preservation of faunal remains is excellent, emphasizing the differences in assemblage composition.

Faunal Assemblages

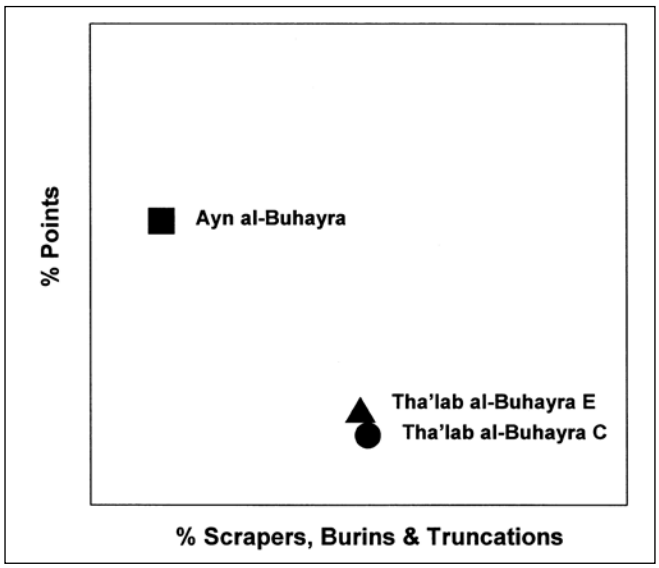
The composition of the faunal assemblages varies between sites as well. When the faunal remains from both sites are compared (bearing in mind that both assemblages were recovered from similar depositional contexts in consolidated marl sediments), the contrasts are even more compelling (FIG. 9). At 'Ayn al-Buḥayra, appendicular elements of equids, bovids and gazelle outnumber axial elements and, in contrast to Tha'lab al-Buḥayra, cranial and mandibular elements occur in much lower frequencies. From 'Ayn al-Buḥayra far fewer complete teeth have been recovered from an excavated area very comparable in size and volume to Locus C at Tha'lab al-Buḥayra. Appendicular elements at 'Ayn al-Buḥayra include decidedly more high utility upper hind and forelimbs, suggesting more

TABLE 7. Percentages of tools comprising tool kits.

% Total Retouched Tools	**'Ayn** al-Buḥayra		**Tha'lab** al-Buḥayra
	Locus C	**Locus E**	**Spring Area**
	n=272	n=307	n=633
Scrapers	38.2	30.9	10.4
Truncations	19.1	24.6	1.6
Burins	1.1	1.3	3.9
Points	16.9	20.6	60.8
Totol % of Tool Assemblage	75.3	77.4	76.7



7. Artifacts from ʻAyn al-Buḥayra (a-f) and Thaʻlab al-Buḥayra (g-l): a, b – hammerstones; c – awl; d – serrated bone point; e – dentalium shell beads; f – Ouchtata points; g-j – microserrated scrapers; k – microserrated endscraper; l – truncations.



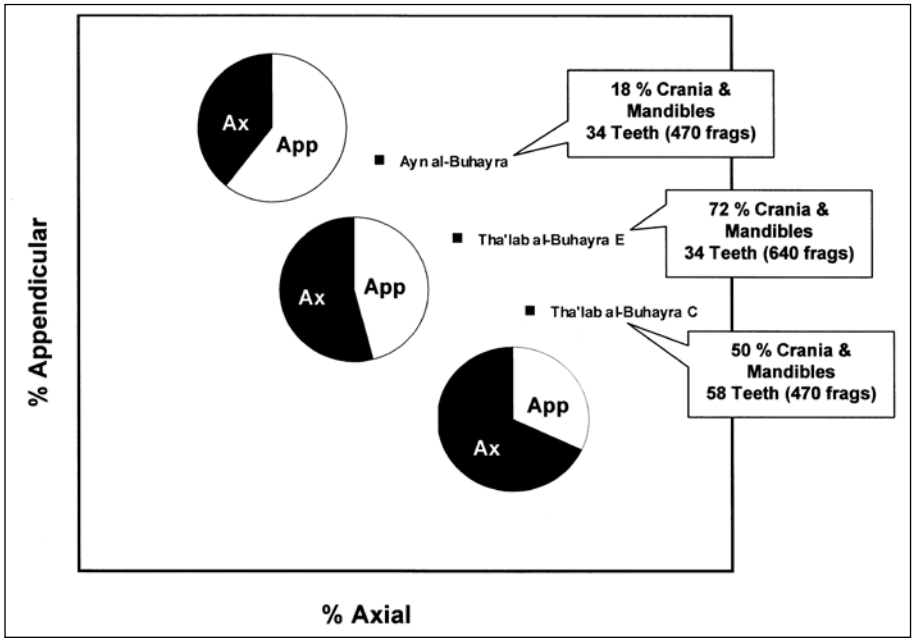
8. Plot of tool kits at Thaʻlab al-Buḥayra (Locus C and E) and ʻAyn al-Buḥayra, Spring Area.

selective transport of appendages to the site of ʻAyn al-Buḥayra from a task site (or, indeed, from another area of the same site), while low utility elements are more frequent at both loci of Thaʻlab al-Buḥayra (Thompson 2001: 93,111).

Genera recovered from Thaʻlab al-Buḥayra include *Bos, Equus, Sus, Camelus, Gazelle* and *Testudo*. Equids are the most prevalent at both sites. While the faunal assemblage from ʻAyn al-Buḥayra includes ostrich eggshell, wild boar and camel have not been recovered from this site.

Processing Equipment and Materials

Manuports that might have functioned as anvils have been identified at both sites in association with faunal material and lithic debitage, although in low numbers and with less than definitive surface alterations to clearly identify their function(s). Two large



9. Comparisons of faunal assemblages at Tha'lab al-Buḥayra (Locus C and E) and 'Ayn al-Buḥayra.

flat stones identified at Tha'lab al-Buḥayra (Locus C) might have been grinding slabs for mineral pigments but, because of the pervasive soil staining at this locus, it is unclear whether the mineral staining on the surfaces is associated with grinding pigments or has been absorbed by contact with the surrounding matrix. At 'Ayn al-Buḥayra, at least six non-flaked flat stones might have functioned as anvils and were associated with splintered bone as well as debitage. One of two hammerstones recovered from this site was found in association with a potential anvil; the hammerstone is large, flat, and exhibits both battering and striations, suggesting it might have had multiple functions (FIG. 7b)

Pigments and soil staining from ochres and red sandstones have been recovered at both sites. Hematite has not been positively identified at either site. Evidence of pigments is far more ubiquitous at Tha'lab al-Buḥayra, especially Locus C, than at 'Ayn al-Buḥayra. Two large cores of a soft, pale yellow mineral were found in association with two possible grinding slabs at Locus C at Tha'lab al-Buḥayra, while diffuse soil staining at this locus includes a spectrum of colors ranging from pale yellow-brown to brilliant reds and pinks. Some stains are from granular red sandstone, typical of the area to the south of the Ḥasā. At 'Ayn al-Buḥayra, soil staining from red ochres is limited, but small, thin intact pieces of worked red ochre have been recovered from this site. In summary, potential manuports in the form of anvils and grinding slabs have been recovered from both sites along with pigments such as ochres and red sandstone.

Features

Features include hearths and artifact or faunal concentrations that might be inferred to be activity areas (TABLE 8). Hearths and potential hearths occur at both sites and vary in depth and the degree to which they are formally constructed and configured with hearth stones. A series of four hearths have been confidently identified at the Spring Area of 'Ayn al-Buḥayra, with three of the hearths dated radiometrically to between approximately 23,500 and 20,300BP (uncalibrated). They are distributed along a sloping east-west line that could be correlated with a series of occupations associated with the changing margins of the wetlands or ponds. An additional hearth was identified in the south profile, while another area within the line of hearths might represent a remnant hearth. Three of the known hearths at the Spring Area of 'Ayn al-Buḥayra were constructed using perimeter stones. One of the three hearths at Tha'lab al-Buḥayra, Locus E is constructed with stones and has been dated by AMS to ~ 24,000BP (uncalibrated), while the other two are well-defined but shallow. One of the shallow hearths produced a date of ~ 25,000BP (uncalibrated). At Locus C, high concentrations of fine charcoal and ash in conjunction with pink to bright red burned sediments demarcate burning or hearth areas, but none are delineated by perimeter stones.

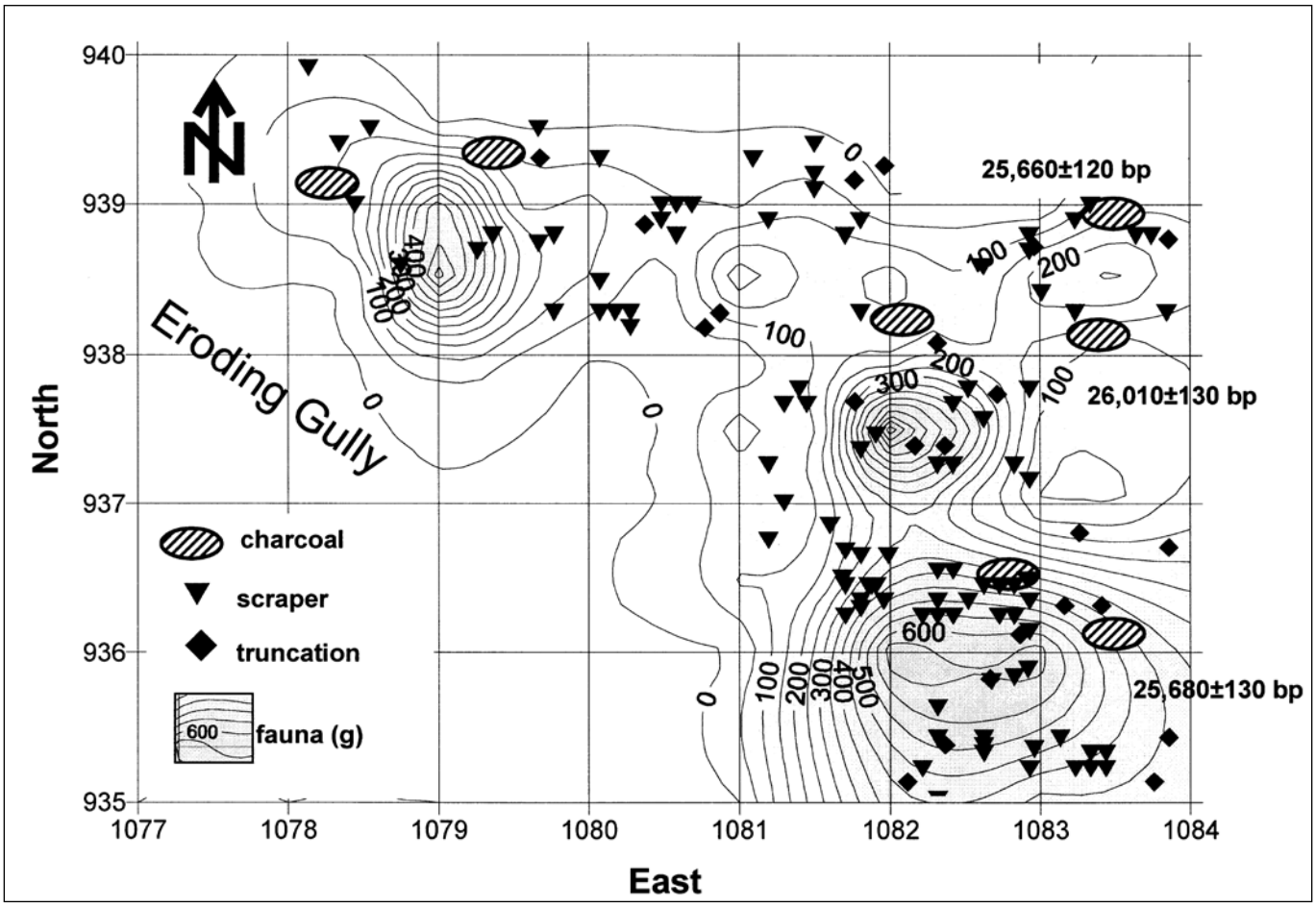
TABLE 8. Site features.

Features	**Tha'lab** al-Buḥayra	**'Ayn** al-Buḥayra
Hearths	Multiple, formal & informal	Multiple, formal
Artifact Clusters	Spatially discrete, redundant	Spatially discrete, diverse
Activity Areas	Present, redundant	Present, diverse

Three hearth areas have been dated by AMS to the period ~ 26-25,000BP (uncalibrated). Hearths, therefore, occur at both sites but vary in their construction, with the most formalized hearths found at 'Ayn al-Buḥayra and at Locus E, Tha'lab al-Buḥayra.

Artifact Concentrations

Spatial patterning is reflected in both the more diverse set of artifacts recovered from the Spring Area of 'Ayn al-Buḥayra and the more specialized tool kits at Tha'lab al-Buḥayra, suggesting discrete and localized activity areas. The area excavated at Locus E at Tha'lab al-Buḥayra is spatially too small to define patterning, but at Locus C the spatial distributions of scrapers and truncations appear to be co-occur with or surround dense faunal remains in rather redundant clusters (FIG. 10). The densities of artifacts and faunal remains, as well as the lack of definable cultural strata within the cultural deposits, imply that a series of similar activities occurred in this area. In contrast, lithic and organic artifacts at the Spring Area of 'Ayn al-Buḥayra are more differentially distributed. Artifact concentrations vary in composition and show potential associations with hearths when they are plotted against the contour densities of Ouchtata points (FIG. 11). Dentalium shell beads and red ochre are clearly distributed

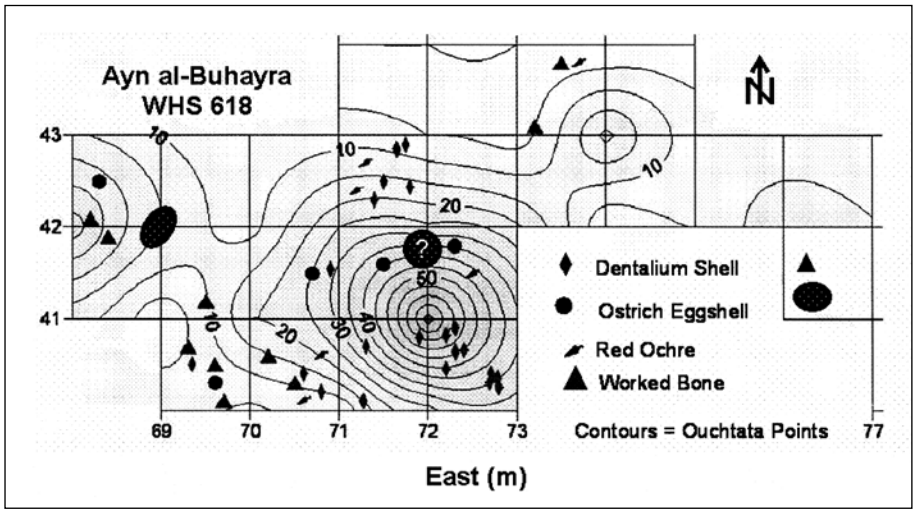


10. Spatial distributions of artifacts against the contour distributions of fauna at Locus C, Tha'lab al-Buḥayra.

more discretely and are associated with the highest densities of Ouchtata points, while worked bone artifacts appear in three peripheral areas. Ouchtata bladelet and point manufacture and re-tooling is suggested to be concentrated in at least two areas uncovered so far, both of which might be associated with hearths. Hearth-centered activities such as tool manufacture and retooling are supported by the co-occurrences of dense debitage, primary reduction and an overall tool assemblage dominated by high proportions of proximal Ouchtata point fragments. Overall, most of the lithic and organic artifacts are associated with an undated but potential hearth in the central excavated area, while only two worked bone artifacts and a single ostrich eggshell fragment were recovered from the more formal hearth to the west, which is surrounded by high frequencies of primary debitage and Ouchtata points. Thus, the artifact concentrations might represent activities associated with hearths at ‘Ayn al-Buḥayra and are clearly diverse in composition.

Conclusions

Comparisons at the Upper Paleolithic site of Tha‘lab al-Buḥayra and the Spring Area of ‘Ayn al-Buḥayra reveal strong similarities as well as important differences. The known areas of the two sites occur in similar but successive stratigraphic units of lacustrine / marsh sediments and were most likely occupied at different times, although it is possible that a lower, earlier occupation underlying the late occupation at the Spring Area of ‘Ayn al-Buḥayra is situated in a similar depositional unit to the cultural zone at Tha‘lab al-Buḥayra and could thus overlap with it in time. At present, however, the series of radiocarbon dates, as well as the morphological differences in the earlier el-Wad points at Tha‘lab al-Buḥayra and the later Ouchtata points at the Spring Area of ‘Ayn al-Buḥayra, suggest the sites were occupied at different times. The composition of artifacts, fauna and more formally constructed hearths at ‘Ayn al-Buḥayra imply a wide spectrum of activities and may have included a range of tool making tasks along with meat consumption within the context of relatively short-term encampments. In contrast, Tha‘lab al-Buḥayra, with a more restricted set of tools focused primarily on scrapers in conjunction with extensive use of pigments, exhibits characteristics of a limited activity or task site. Primary butchering and carcass processing activities, including marrow extraction and possibly brain-tanning and skin processing, are inferred from the differential frequencies of lower limb, low utility skeletal elements and the high number of splintered and smashed long bones and cranial elements. Additional support for short term butchering at this site comes from the high frequency of utilized edges on flakes and blades which has been identified in a pilot use-wear study of debitage from Locus C. Approximately 12% of a sample of debitage (n = 412, Unit I5, Levels 1 - 10) exhibits modified edges attributed to cutting or scraping, suggesting that a good proportion of the ‘debitage’ actually represents expedient, discarded tools (Voss n.d.). Together, these aspects of the Tha‘lab al-Buḥayra faunal and artifact assemblages suggest a relatively homogeneous composition with redundant spatial distributions that are more typical of small, repeated task episodes through time. Alternatively, we might only have so far exposed spa-



11. Spatial distributions of artifacts and red ochre against contour distributions of Ouchtata points and fragments at the Spring Area, ‘Ayn al-Buḥayra.

tially segregated work areas of a larger residential base camp at Tha'lab al-Buḥayra.

The Spring Area of 'Ayn al-Buḥayra exhibits diversity in the use of space as well as diversity in the types of artifact assemblages and the types of activities inferred. As such, the Spring Area of 'Ayn al-Buḥayra appears to suggest a small encampment where a variety of different activities were carried out and where the consumption of meat and limited butchering / skin processing occurred. This is suggested by a lack of evidence for carcass processing in the faunal assemblage, as well as in the nature of the tool kits and in the differential representation of higher meat utility skeletal elements. The number of hearths at 'Ayn al-Buḥayra and their linear distribution might also be interpreted to mean that the encampments were small and repeatedly occupied through time, but functionally different from the limited task activities identified at Tha'lab al-Buḥayra.

At both sites, expanded excavations are needed to further define these suggested patterns since density distributions indicate the directional extension of similar artifact concentrations in the direction of unexcavated areas. Currently, we have uncovered segments of two very extensive sites. At Tha'lab al-Buḥayra the subsurface depositional units are still intact and, together with its extensive surface assemblages, this site holds the most potential for exploring the nature of Upper Paleolithic settlement organization. The question remains to be investigated as to whether the unexplored areas will reflect similar and redundant site activities and use of space and organization, or whether they will reflect a larger residential base camp with spatially segregated but different activity areas occurring repeatedly over time. Perhaps, we have uncovered only one segment of a much larger settlement's different activity areas at Tha'lab al-Buḥayra.

At 'Ayn al-Buḥayra, the archaeological record at the Spring Area is deep and still intact but fragile. The edges of the preserved spur of consolidated marls and cultural deposits are eroding and the exposed paleohydrological record has been subject to indiscriminate and unauthorized sampling with deep column samples and broad cutbacks. Yet, the unexcavated portions of the Spring Area remnant have the potential to link the two sites in an overlapping temporal sequence. Further investigations might define more clearly the similarities and differences of these sites, similarly situated along the margins of late Pleistocene ponds and wetlands in the Wādī al-Ḥasā. Any future research, however, can only contribute substantively to a more informed and complex picture of Upper Paleolithic settlement patterns and organizational differences during the late Pleistocene.

References Cited

Bamforth, D. 1990. Settlement, Raw Material, and Lithic Procurement in the Central Mojave Desert. *Journal of Anthropological Archaeology* 9: 70-104.

Binford, L. 1979. Organization and Formation Processes: Looking at Curated Technologies. *Journal of Anthropological Research* 35(3): 255-273.

—— 1980. Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45(1): 4-20.

—— 1983. *In Pursuit of the Past: Decoding the Archaeological Record*. New York: Academic Press.

Brooks, A. and Yellen, J. 1987. The Preservation of Activity Areas in the Archaeological Record: Ethnoarchaeological and Archaeological Work in Northwest Ngamiland, Botswana. Pp.63-106 in S. Kent (ed.), *Method and Theory for Activity Area Research - An Ethnoarchaeological Approach*. New York: Columbia University Press.

Clark, G. 1992. Wadi Hasa Paleolithic Settlement Patterns: Negev and South Jordan Models Compared. *SHAJ* IV: 89-95. Amman: Department of Antiquities.

Coinman, N. 1997. Worked Bone in the Levantine Upper Paleolithic: Rare Examples from the Wadi al-Hasa, West-Central Jordan. *Paléorient* 22/2: 113-121.

—— 2000. The Upper Paleolithic in the Wadi al-Hasa. Pp.143-159 in N. R. Coinman (ed.) *The Archaeology of the Wadi al-Hasa, West-Central Jordan, Vol. 2: Excavations at Middle, Upper and Epipaleolithic Site*. Arizona State University Anthropological Research Papers No. 52. Tempe.

—— 2002. New Evidence of Ksar Akil Scrapers in the Levantine Upper Paleolithic. *Paléorient* 28/2:87-104.

—— 2003. The Upper Paleolithic of Jordan: New Data from the Wadi al-Hasa. Pp. 151-170 in N. Goring-Morris and A. Belfer-Cohen (eds.), *More Than Meets the Eye: Studies on Upper Paleolithic Diversity in the Near East*. Oxford: Oxbow Books.

—— 2005. Subsistence and Technology: Implications for Settlement Organization in the Levantine Upper Paleolithic. *Journal of the Israel Prehistoric Society* Vol. 35: 159-177.

Coinman, N., Clark, G. and Lindly, J. 1986. Prehistoric

Hunter-Gatherer Settlement in the Wadi Hasa, West-Central Jordan. Pp. 129-169 in L. Straus (ed.), *The End of the Paleolithic in the Old World*. BAR International Series 284. Oxford: British Archaeological Reports.

Gladfelter, B. 1990. The Geomorphic Setting of Upper Paleolithic Sites in the Wadi el-Sheikh, Southern Sinai. *Geoarchaeology* 5(2): 99-119.

—— 1997. The Ahmarian Tradition of the Levantine Upper Paleolithic: The Environment of the Archaeology. *Geoarchaeology* 12(4): 363-393.

Henry, D. 1987. Topographic Influences on Epipaleolithic Land-Use Patterns in Southern Jordan. Pp. 21-27 in A. Hadidi (ed.), *Studies in the History and Archaeology of Jordan III*. London: Routledge and Kegan Paul.

—— 1994. Prehistoric Cultural Ecology in Southern Jordan. *Science* 265: 336-341.

—— 1995. Middle Paleolithic Sites. Pp. 49-84 in *Prehistoric Cultural Ecology and Evolution: Insights from Southern Jordan*. New York: Plenum Press.

Henry, D., Hall, S., Hietala, H., Demidenko, Y., Usik, V, Rosen, A. and Thomas, P. 1996. Middle Paleolithic Behavioral Organization: 1993 Excavation of Tor Faraj, Southern Jordan. *Journal of Field Archaeology* 23(1): 31-53.

Hietala, H. and Stevens, D. 1977. Spatial Analysis: Multiple Procedures in Pattern Recognition Studies. *American Antiquity* 42(4): 539-559.

Hietala, H. 1983a. Boker Tachtit: Intralevel and Interlevel Spatial Analysis. Pp. 217-281 in A. Marks (ed.), *Prehistory and Paleoenvironments in the Central Negev, Israel*, Vol. III. Dallas: Southern Methodist University Press.

—— 1983b. Boker Tachtit: Spatial Distributions. Pp. 191-216 in A. Marks (ed.), *Prehistory and Paleoenvironments in the Central Negev, Israel*, Vol. III. Dallas: Southern Methodist University Press.

Kaufman, D. 1992. Hunter-Gatherers of the Levantine Epipaleolithic: The Socioecological Origins of Sedentism. *Journal of Mediterranean Archeology* 5(2): 165-201.

—— 2003. Cultural Variability in the Late Upper Paleolithic of the Levant. Pp. 209-215 in N. Goring-Morris and A. Belfer-Cohen (eds.), *More Than Meets the Eye: Studies on Upper Paleolithic Diversity in the Near East*. Oxford: Oxbow Books.

Keeley, L. 1982. Hafting and Retooling: Effects on the Archaeological Record. *American Antiquity* 47: 798-809.

—— 1991. Tool Use and Spatial Patterning: Complications and Solutions. Pp 257-268 in E. Kroll and T. Price (eds.), *The Interpretation of Archaeological Spatial Patterning*. New York: Plenum Press.

Kelly, R. 1983. Hunter-Gatherer Mobility Strategies. *Journal of Anthropological Research* 39: 277-306.

—— 1995. *The Foraging Spectrum: Diversity in Hunter-Gatherer Lifeways*. Washington: Smithsonian Institution Press.

Kent, S. (ed.) 1987. *Method and Theory for Activity Area Research - An Ethnoarchaeological Approach*. New York: Columbia University Press.

Lee, R. and DeVore, I. (eds.) 1976. *Kalahari Hunter-Gatherers: Studies of the !Kung San and Their Neighbors*. Cambridge: Harvard University Press.

Lindly, J., Beck, R. and Clark, G. 2000. Pp. 211-226 in N. R. Coinman (ed.), *The Archaeology of the Wadi al-Hasa, West-Central Jordan, Vol. 2: Excavations at Middle, Upper and Epipaleolithic Site*. Arizona State University Anthropological Research Papers No. 52. Tempe.

MacDonald, B. (ed.) 1988. *The Wadi el Hasa Archaeological Survey 1979-1983, West-Central, Jordan*. Waterloo: Wilfred Laurier University Press.

Marks, A. and Freidel, D. 1977. Prehistoric Settlement Patterns in the Advat-Aqev Area. Pp. 131-159 in A. Marks (ed.), *Prehistory and Paleoenvironments in the Central Negev, Israel*, Vol. II. Dallas: Southern Methodist University Press.

Mortensen, P. 1972. Seasonal Camps and Early Villages in the Zagros. Pp. 293-297 in P.Ucko, R. Tringham, and G. Dimbleby (eds.), *Man, Settlement and Urbanism*. London: Duckworth.

Munday, F. 1976. Intersite Variability in the Mousterian Occupation of the Avadat/Aqev Area. Pp. 113-140 in A. Marks (ed.), *Prehistory and Paleoenvironments in the Central Negev, Israel*, Vol. I. Dallas: Southern Methodist University.

O'Connell, J. 1987. Alyawara Site Structure and its Archaeological Implication. *American Antiquity* 52: 74-108.

—— 1995. Ethnoarchaeology Needs a General Theory of Behavior. *Journal of Archaeological Research* 3(3): 205-255.

O'Connell, J., Hawkes, K., and Blurton-Jones, N. 1991. Distribution of Refuse Producing Activities at Hadza Residential Base Camps: Implications for Analyses of Archaeological Site Structure. Pp. 61-76 in E. Kroll and T. Price (eds.), *The Interpretation of Archaeological Spatial Patterning*. New York: Plenum Press.

O'Connell, J. and Elston, R. 1997. History, Theory,

Archaeology, and the Management of Cultural Resources: Commentary. Pp. 261-265 in C. Beck (ed.), *Models for the Millennium: Great Basin Anthropology Today*. Salt Lake City: University of Utah Press.

Olszewski, D. and Coinman, N. 1998. Late Plesitocene Settlement Patterns in the Wadi al-Hasa, West-Central Jordan. Pp. 177-203 in N. R. Coinman (ed.), *The Archaeology of the Wadi al-Hasa, West-Central Jordan, Vol. 1: Surveys, Settlement Patterns, and Paleoenvironments*. Anthropological Research Papers No. 50. Tempe: Arizona State University.

Phillips, J. 1987. Upper Paleolithic Hunter-Gatherers in the Wadi Feiran, Southern Sinai. Pp. 169-182 in O. Soffer (ed.), *The Pleistocene Old World*. New York: Plenum Press.

Rhode, D. 1997. The Role of Paleoecology in the Development of Great Basin Archaeology and Vice-Versa. Pp. 29-49 in C. Beck (ed.), *Models for the Millennium: Great Basin Anthropology Today*. Salt Lake City: University of Utah Press.

Speth, J. and Tchernov, E. 2001. Neanderthal Hunting and Meat-Processing in the Near East. Pp. 52-72 in C. Stanford and H. Bunn (eds.), *Meat-Eating and Human Evolution*. Oxford: Oxford University Press.

Stevenson, M. 1991. Beyond the Formation of Hearth-Associated Artifact Assemblages. Pp. 269-299 in E. Kroll and T. Price (eds.), *The Interpretation of Archaeological Spatial Patterning*. New York: Plenum Press.

Thompson, J. R. 2001. *Preliminary Analysis of the Faunal Assemblages from Thalab al-Buhayra (EHLPP2) and Ain al-Buhayra (WHS 618): Two Upper Paleolithic Sites in the Wadi al-Hasa, Jordan*. Unpublished M.A. thesis, Department of Anthropology. Ames: Iowa State University.

Voss, D. 2007. Use-Wear at Tha'lab al-Buhayra (EHLPP2). Manuscript. Department of Anthropology, Iowa State University. Ames, Iowa.

Williams, J. 2000. Land Use and Technological Trends in the Levantine Upper Paleolithic. *Journal of The Israel Prehistoric Society* 30: 33-47.

Yellen, J. 1976. Settlement Patterns of the !Kung. Pp. 47-72 in R. Lee and I. DeVore (eds.), *Kalahari Hunter-Gatherers: Studies of the !Kung San and Their Neighbors*. Cambridge: Harvard University Press.

—— 1977. *Archaeological Approaches to the Present: Models for Reconstructing the Past*. New York: Academic Press.

—— 1991. Small Mammals: !Kung San Utilization and the Production of Faunal Assemblages. J*ournal of Anthropological Archaeology* 10: 1-26.

—— 1996. Behavioural and Taphonomic Patterning at Katanda 9: A Middle Stone Age Site, Kivu Province, Zaire. *Journal of Archaeological Science* 23: 915-932.