THE PALEOLITHIC INDUSTRIES OF AIN EL-ASSAD (LION'S SPRING), NEAR AZRAQ, EASTERN JORDAN

by
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INTRODUCTION

The Pleistocene prehistory of Jordan has been largely ignored over the past several generations, and in view of the wealth of surface indications of paleolithic occupations throughout the country, it is difficult to understand the lack of attention prehistoric archaeologists have paid to the area. In the past few years, however, several surveys have been conducted (Garrard and Stanley Price 1977) or are currently in progress (Miller 1978, personal communication; Henry 1978, personal communication from Sauer) which have located considerable numbers of Lower, Middle, and Upper Paleolithic sites. Beyond providing useful data for the settlement pattern studies advocated by Garrard and Stanley Price (1977: 109), it is hoped that sites suitable for excavation will be located so that detailed information concerning the technological and typological developments of Pleistocene period cultures can be compared synchronically and diachronically across a variety of environmental settings.

On the basis of what little information has been published on paleolithic sites in Jordan, Ain el-Assad ("Lion's Spring") near Azraq (Figures 1 and 2) appears to be one of the most significant sites in terms of a potentially stratified sequence of culture-bearing Pleistocene deposits. For details on the geological and environmental setting of this site, the discussion provided by Garrard and Stanley Price is very useful (1977: 109-15). It is the purpose of this paper to present the results of a typological and technological analysis of a large sample of artifacts from Ain el-Assad and to relate the cultural and temporal implications they entail with other paleolithic sites in the Near East.

BACKGROUND

The spring at Ain el-Assad has been known to prehistorians at least since the survey conducted in the 1920s and 1930s by Field (1960), but it was not until sometime in the 1950s that the significance the spring played for prehistoric occupants became known. (This awareness must have occurred after 1955, for Zeuner [1957] made no mention of paleolithic artifacts in his survey report).

Harding reported that the site was discovered during an operation related to an irrigation project. Blocked by earth slumps and heavy vegetation, an attempt was made to increase the spring's discharge by clearing the vegetation and digging a collection sump approximately five meters by five meters in areal extent. In the course of this excavation, handaxes began to appear approximately a meter below ground level, increasing in number "until finally when it was about half a meter below water-level, hand-axes were being found by the bucketful" (Harding 1967: 155). With Harding's limited description of the operations in mind, a visit to the site indicated that approximately one meter or more of deposits produced artifacts. It could not be determined from Harding's description nor from casual site inspection whether the bottom of the sump excavations extended into archaeologically sterile sediments or if the artifact deposits continue deeper into the earth.

Approximately 400 bifaces were recovered during this operation, and with an unspecified number ("several hundred") of flakes, cores, and flake tools, the artifacts were sent to the national museum in Amman. Unfortunately, this sample has became misplaced within the last twenty years or so, so it is not possible to examine the specimens.

On a visit to the spring, it was noticed that artifacts were eroding out of the backdirt piles left from the sump excavations (Pl. LXXXIII). With permission from Dr. Adnan Hadidi, Director General of the Department of Antiquities, these backdirt piles were investigated to obtain a sample which, it was hoped, would be sufficiently large to make substantive observations and interpretations concerning the typological and technological statuses of the occupational remains. After two short trips a sample of 538 artifacts was recovered, including 62 bifaces, 71 cores, and 112 flake implements.

METHODS OF ANALYSIS

The typological and technological compositions of the Ain el-Assad sample are presented in Tables 1-11. Before discussing these features, it is necessary to outline the various typologies and technological attributes used in the analysis.

The biface typology is based primarily on Bordes (1961), but modified to some extent. It was found useful to reduce the number of Bordes' types into several "classes" of bifaces (Rollefson 1978: 105-06). The classes are comprised of the following types: A) *Lanceolate Class:* lanceolates, ficrons, Micoquians, triangulars, and sub-triangulars (Pl. LXXXIV, 2); B) *Cordiform Class:* cordiforms, elongated cordiforms, amygdaloids, and subcordiforms (Pl. LXXXIV, 1); C) *Ovate Class:* ovates, limandes, and discoidals (Pl. LXXXV, 2); D) *Cleaver Class:* cleavers and cleavers on flakes (Pl. LXXX IV, 1 and LXXXV, 1); E) *"Non-Classic" Class:* lageniforms, lozengials, naviforms, and nucleiforms; F) *Other:* diverse; G) *Partial Class:* partials; H) *Abbevillian Class:* Abbevillians (Pl. LXXXV, 1).

Flake implements were typed according to Bordes (1961), and his procedure of providing *réel* and *essentiel* counts, relative frequencies, and indicies is followed here.

Core typologies are problematic in the case of published paleolithic site reports in the Near East, although recently attempts have been made to standardize type lists with detailed definitions. The core typology used in this study follows the one developed by Jelinek for the analysis of the Lower and Middle Paleolithic industries at the Tabun Cave in the Wadi Mughara in Mount Carmel (Jelinek 1972, personal communication).

The technological aspects of paleolithic manufacture have been largely overlooked in studies of Pleistocene assemblages from the Near East, even though the choices made by the prehistoric flintknappers in the production of tools is a reflection of the functional constraints of the raw materials used, the resources to be procured and processed, and of cultural traditions and restraints (Jelinek 1976). The monitoring of technological features of implements, cores, and unmodified debitage for the assessment of prehistoric cultural development has been demonstrated to be of considerable value (Jelinek n.d.; Rollefson 1978). The technological attributes selected for the present analysis are slightly modified from those used in the analysis of the Tabun material (Jelinek n.d.).

RESULTS OF THE ANALYSIS

Typology

The composition of the biface component of the Ain el-Assad collection is presented by type in Table 1 and by biface class in Table 2. Two points stand out which are of particular importance. First, the relatively high frequency of the "diverse" type (nearly one-fourth of the classifiable bifaces) is an indication that Bordes' biface typology is not entirely appropriate for the classification of bifaces from the Near East (Rollefson 1978: 134). This not surprising, since Bordes' types were defined primarily on specimens from Lower and Middle Paleolithic assemblages from western Europe. Similarly high percentages of diverse types were noted in the Late Acheulian and Yabrudian assemblages from the Tabun assemblages, where they ranged from 9.1% to 27.0% (Rollefson 1978: 107).

Table 1. Absolute and relative frequencies of biface types from the Ain el-Assad sample.

Biface Type	*All Bifaces*		*Classifiable Bifaces Only*	
	n	%	n	%
Lanceolate	1	1.6	1	1.9
Ficron	2	3.2	2	3.8
Cordiform	1	1.6	1	1.9
Amygdaloid	5	8.1	5	9.4
Sub-cordiform	2	3.2	2	3.8
Ovate	8	12.9	8	15.1
Discoid	1	1.6	1	1.9
Cleaver	16	25.8	16	30.2
Diverse	13	21.0	13	24.5
Partial	3	4.8	3	5.7
Abbevillian	1	1.6	1	1.9
Disc	1	1.6		
Unclassifiable	8	12.9		
Total	62	99.9	53	100.1

It was found in the Tabun biface components that approximately 65% of the diverse category was composed of burinated bifaces, *biface-racloirs,* and bifacial knives (Rollefson 1978: 104-5). In the Ain el-Assad sample no bifacial knives were noted, but one burinated biface occurs as well as three *biface-racloirs.* Among the rest of the diverse bifaces, three handaxes and one cleaver were used as cores (presumably after their original functions as tools were exhausted), and two specimens were unfinished biface "blanks". One piece was a cleaver with both lateral edges fashioned into racloirs, another implement was "D-shaped" (also present, but rare, in the Tabun assemblages), and one biface was a short, spiky, chisel-ended piece.

Table 2. Absolute and relative frequencies of biface classes in the Ain el-Assad sample.

Biface Class	*n*	%
Lanceloate	3	5.7
Cordiform	8	15.1
Ovate	9	17.0
Cleaver	16	30.2
Diverse	13	24.5
Partial	3	5.7
Abbevillian	1	1.9
Total	53	100.1

Also of interest is the very high relative frequency of cleavers. Normally, cleavers account for less than 5% of the bifaces in Near Eastern assemblages, but at 30.2% the Ain el-Assad sample ranks among the highest cleaver percentages in the region. This peculiar feature suggests that the activities in which bifaces were used at Ain el-Assad were of a specialised nature compared to most other known open-air Acheulian sites in the Levant. However, caution should be used in ascribing the nature of the activities carried out at Ain el-Assad, since the missing sample of some 400 bifaces from the original excavations could radically alter the nature of the sample analyzed in this study. It is possible, for example, that the selection of the bifaces in the 1950s was heavily biased towards long and pointed forms, artificially inflating the relative frequency of the generally shorter and squatter (and less appealing to the 20th century eye?) cleavers in the bifaces that were left behind.

A further comment on the cleaver types in the Ain el-Assad sample should be made. Bordes has suggested that there may be two distinct traditions of cleaver manufacture, with an African tradition specialising in the use of broad, thick flakes as the cleaver blanks, in contrast to the "European cleaver" which is commonly fashioned on a core (Bordes 1966: 52-3). None of the Ain el-Assad cleavers was made on a flake, perhaps indicating a cultural tradition divorced from those of the African continent.

Table 3. Absolute and relative frequencies of implements in the Ain el-Assad sample.

	All Types		*Essential Types*	
Type	*n*	%	*n*	%
Levallois flake	3	2.7		
Atypical Levallois flake	1	0.9		
Pseudo-Levallois point	2	1.8	2	3.3
Straight racloir	3	2.7	3	5.0
Convex racloir	11	9.8	11	18.3
Concave racolir	4	3.6	4	6.7
Double convex racloir	2	1.8	2	3.3
Double convex-concave racloir	1	0.9	1	1.7
Convergent convex racloir	1	0.9	1	1.7
Canted convergent racloir	2	1.8	2	3.3
Transverse straight racloir	1	0.9	1	1.7
Transverse convex racloir	3	2.7	3	5.0
Racloir on interior face	1	0.9	1	1.7
Thinned-back racloir	1	0.9	1	1.7
Bifacial racloir	1	0.9	1	1.7
Burin	1	0.9	1	1.7
Atypical burin	2	1.8	2	3.3
Naturally backed flake	7	6.2	7	11.7
Notch	2	1.8	2	33.3
Denticulate	4	3.6	4	6.7
Retouched on interior face	16	14.3		
Crudely retouched piece	25	22.3		
Marginally retouched piece	4	3.6		
Bifacially retouched piece	3	2.7		
Rabot	1	0.9	1	1.7
Diverse	10	8.9	10	16.7
Total	112	100.2	60	100.2

Table 3 presents the absolute and relative frequencies of flake tools in the Ain el-Assad sample. The implements, for the most part, are typical examples of the type definitions provided by Bordes. The diverse category is once again relatively large. Three specimens are too fragmentary to confidently assign them to a specific type: two are pieces of racloir edges (one is straight, the other convex) and the third may be part of an inverse chopper. Four of the diverse tools are "battered pieces", or "wedges" *(pièces ésquillées)*. Two pieces are probably

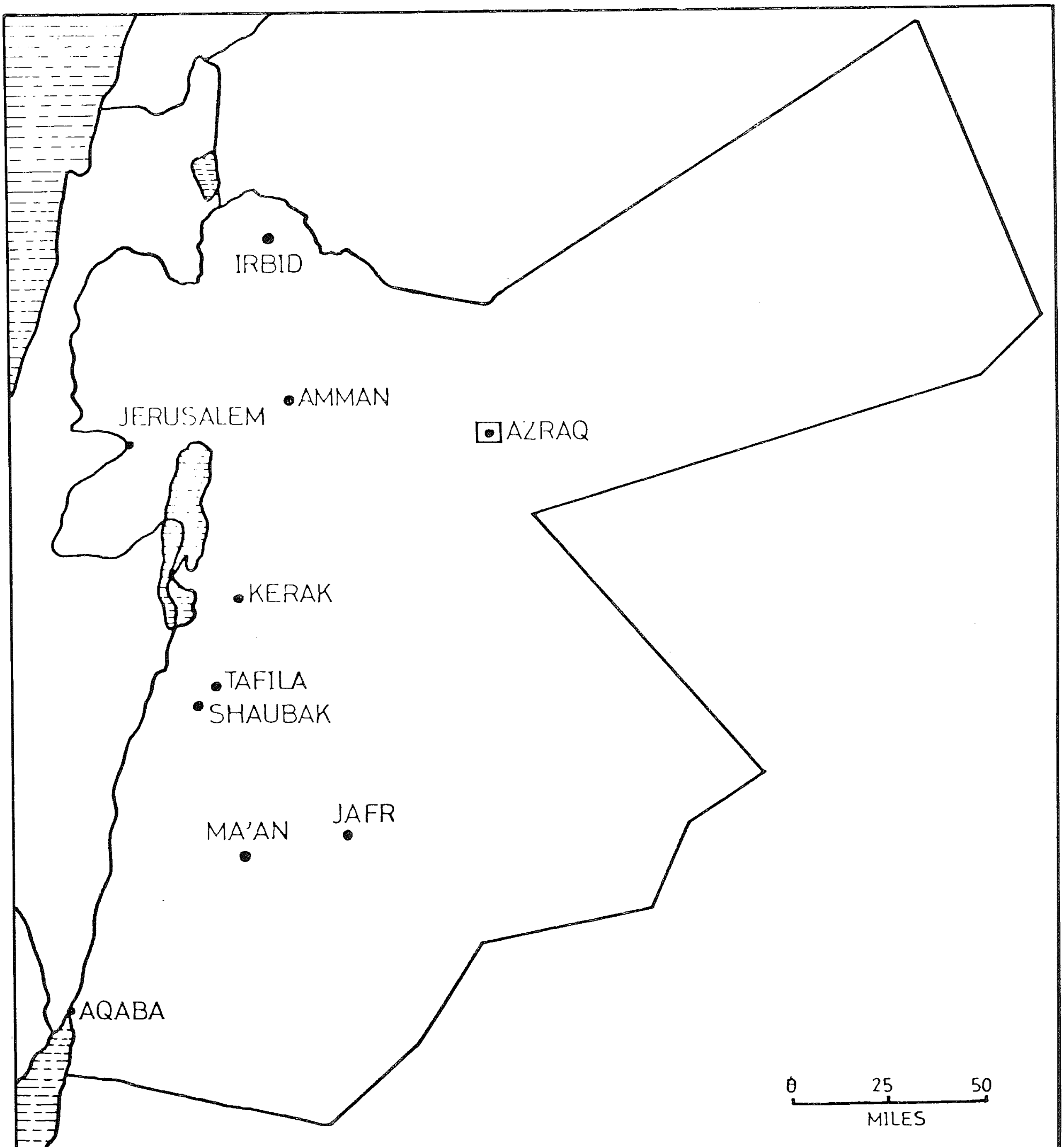

Figure 1. The location of Azraq in the high eastern desert of Jordan.

corescrapers, with portions of the working edges bearing denticulate areas. The final tool in this category has a denticulate edge which converges with another edge bearing bifacial retouch.

Several types in the *réel* ("overall") type list have been problematic for a long time in the classification of paleolithic implements. Specifically, pieces which bear irregular retouch on the interior (or bulbar) surface, crudely and marginally retouched pieces, and pieces with irregular bifacial retouch have generated much confusion in the interpretation of the nature of assemblages. The definition of the "Tayacian industry", for example, was based heavily on the presence of these "implement types", although as Bordes points out, the "retouch" on these flakes could well be due to post-depositional damage as the result of earth movement or trampling by hominids or animals on unretouched flakes (Bordes 1961: 49; Bordes and Bourgon 1951). In the case of Ain el-Assad, one can presume that mechanical shovels of some sort were used to excavate the sump, and it would be expected that a large amount of edge damage would result from this "careless" method of digging. Bordes developed an essential *(essentiel)* type list which excluded these "tools" of questionable origin to make interassemblage comparisons less confusing and less prone to error because of uncontrollable factors.

In subsequent discussions, only the essential type list will be considered.

Table 4. Essential typological indices for the flake implements in the Ain el-Assad sample.

Index	*Value*
Racloir Index	51.7
Charentian Index	25.0
Yabrudian Index	28.3
Backed-Knife Index	0.0
Group I	13.8
Group II	55.0
Group III	16.7
Group IV	10.0

The essential typological indices in Table 4 provide a summary of the general character of the Ain el-Assad collection of flake tools. The Racloir Index refers to all the racloirs divided by the total number of implements, multiplied by 100. The Charentian Index refers to a specific set of racloirs (Pl. LXXXVI, 1), as does the Yabrudian Index. In the first case, only simple convex racloirs (Pl. LXXXVI, 2) and all transverse racloirs are included in the numerator, while in the second case, these types are joined by canted convergent racloirs as well. The Backed-Knife Index refers only to intentionally backed flakes and blades, of which none occurred in the Ain el-Assad sample. (Naturally backed flakes have steep cortex forming a "natural backing" opposite a sharp edge). The Group I Index refers to all unretouched and retouched Levallois flakes, blades, and points in relation to the total number of tools. The Group II Index relates all racloirs, pseudo-Levallois points, and Mousterian points (none in the sample analyzed) to the total number of flake implements. Group III, or the "Upper Paleolithic Group", includes all burins, endscrapers, borers, and backed pieces. The Group IV Index is referent of the number of notches and denticulates in relation to the total number of implements.

Table 5. Absolute and relative frequencies of core types in the Ain el-Assad sample.

	All Types		*Classifiable Types Only*	
Type	n	%	n	%
Levallois flake core	1	1.4	1	2.0
Discoidal core	11	15.5	11	22.4
Spheroidal/Globular core	1	1.4	1	2.0
Core on a flake	1	1.4	1	2.0
Formless core	6	8.4	6	12.2
Tabular core	3	4.2	3	6.1
Core-chopper tool	2	2.8	2	4.1
Single-face core	12	16.9	12	24.5
Demi-disc core	7	9.8	7	14.3
Diverse	5	7.0	5	10.1
Rejected core	8	11.3		
Core fraqment	5	7.0		
Unflaked nodule	2	2.8		
Broken, unflaked piece	3	4.2		
Unclassifiable (too damaged)	4	5.6		
Total	71	99.7	49	99.7

In terms of scrapers, the Racloir Indices indicate that the Ain el-Assad sample is rich, especially in the types included in the Charentian and Yabrudian groups.

The absence of intentionally backed pieces is typical of Late Acheulian assemblages in the Near East. The low value for the Levallois Group (Group I) stands in contrast to the usually much higher values for Late Acheulian sites in the coastal areas of the Near East. The "Upper Paleolithic Group" is moderately represented at Ain el-Assad, but the Denticulate Group (Group IV) is relatively low.

It was mentioned earlier that core typologies for Lower and Middle Paleolithic assemblages have been poorly developed for the Near East, and detailed descriptions and counts are rare in the literature of the area. Of note in the breakdown of core types in Table 5 are the relatively high frequencies of discoidal, single-face, and demi-disc cores, which together account for 60% of the classifiable cores (Pl. XXXVII). Levallois cores, which are more prominent in the coastal areas of the Levant, especially in the Middle Paleolithic, are represented by a single specimen in the collection.

Technological Features

Relative and absolute frequencies of attributes relating to the method of the production of flakes in the Ain el-Assad sample are presented in tables 6-11. Each of the technological features will be discussed in turn.

The types of platform occuring on the flakes are tabulated in Table 6. Plain platforms have a single facet and may be either cortical or non-cortical; a particular kind of plain platform exhibits a pattern of ripples which crosses the platform from one lateral edge to the other, referred to as "transverse preparation" in the table. Dihedral platforms manifest two facets separated by a ridge that extends more or less perpendiculary from the exterior surface of the flake to the interior surface; dihedral platforms with one of the facets traversing part of the platform from a lateral edge were noted as a distinct category ("dihedral with one transverse scar"). Multiple facet platforms consist of three or more facets crossing the platform from the exterior surface to the interior surface of the flake. "Isolated point" types are unfacetted, roughly triangular platforms which manifest a prominent projection on the exterior edge of the platform produced by the removal of one previous flake from the core or by the intersection of the negative bulbs of two previous flake removals. The "crushed/punch" type of platform consists simply of the point of percussion: the rest of the platform was shattered away in the course of the detachment of the flake from the core.

Table 6. Absolute and relative frequencies of platform types on the flakes in the Ain el-Assad sample.

Type	*n*	%
Plain	168	54.7
Transverse preparation	22	7.2
Dihedral	46	15.0
Dihedral with one transverse scar	13	4.2
Multiple facet	32	10.4
Isolated point: one flake	2	0.6
Isolated point: two flakes	3	1.0
Crushed/punch	21	6.8
Subtotal	307	99.9
Missing	98	(24.2)
Total	405	

Of the sample of 405 flakes, 76% were complete enough to classify the platforms. Plain platforms dominate the assemblage, especially when the transverse and "isolated point" types are included (totalling 63.5%). Since only 1.6 % of all the platforms were classified as belonging to the isolated point types, it seems that these varieties should be considered as artificially inspired categories and should be lumped with the plain platform type in future analyses.

Dihedral platforms form the next most popular type which, when "dihedral with one transverse scar" frequencies are included, account for almost one-fifth of the platforms. Multiple-facet platforms occur only once in every ten flakes, probably related to the low frequency of Levallois cores. The "crushed/punch" platforms are probably badly damaged plain platforms for the most part, although there is of course no way to demonstrate this assertion. In summary, little in the way of platform preparation on cores is evidenced in the Ain el-Assad sample.

Table 7. Absolute and relative frequencies of techniques of flake production in the Ain el-Assad sample.

Technique	*n*	%
"Normal"	112	32.8
Clactonian	99	29.0
Levallois flake	4	1.2
Levallois blade	2	0.6
Disc core	36	10.6
Normal blade	26	7.6
Bifacial retouch	41	12.0
Other	19	5.6
Punch	2	0.6
Subtotal	341	100.0
Indeterminate	64	(15.8)
Total	405	

Recognizable techniques of flake production, based primarily on patterns of flake scars observed on the exterior surfaces of flakes, conform nicely to what would be anticipated in a Late Acheulian assemblage (Table 7). "Normal" technique refers to an undifferentiated pattern of flake production; i.e., there is nothing distinctive about the flake to indicate a specialized method of manufacture. The Clactonian technique reflects the attitude of the platform in relationship to the interior surface: arbitrarily, if the angle formed between these two surfaces is equal to or greater than 110° it was considered to reflect techniques characteristic of the Clactonian Industry in Britain and northern Europe. It should be stressed here that the Clactonian technique as evidenced at Ain el-Assad is not to be taken as an indication of any "cultural connection" with the Clactonian industries found elsewhere; rather, the technique should be considered to be one of the extremes of the range of variation of the "normal" flaking technique.

The Levallois technique is well described by Bordes (1968: 27-30), and his criteria are used here. In some respects, especially the patterns formed by the ridges left from previous flake scars on the exterior surface, the discoidal technique could be confused with the Levallois technique. However, in the latter method the negative ripples are centripetally oriented, while in the former they trend toward a tangential vector.

Levallois blade, "normal" blade, and "punch" techniques are distinguished solely by the platforms manifested on the blade. Levallois blades have mutliple facet platforms, normal blades have plain or dihedral platforms, and punch blades have crushed platforms. All three blade techniques, apart from the platform type, are evidenced by generally parallel edges on the blank with one or more longitudinal ridges on the exterior surface that parallels the lateral edges. (The definition of a "blade", as it is used in this study, is discussed below).

The bifacial retouch technique is very recognizable in the association of the platform, exterior ridge pattern, and the flake profile (Bordes 1972: 86-7, fig. 26). The platform is usually lipped over the bulb of percussion and is normally multiple facet; the exterior flake scars often converge towards the center (although often they do not); and the profile of the flake is generally quite in-curvate.

The punch technique is defined here primarily on the basis of the platform as well as the normally curved profile of the flake or blade.

The "other" technique includes any pattern which does not confrom to others mentioned above. Of the 19 instances of "other" technique, nine involved the removal of a core edge from a core, manifested by a central crest down the length of the flake, with negative bulbar scars radiating towards one or both lateral edges from this ridge. Three flakes exhibited two bulbs and points of percussion, one on each face, resulting from the removal of one flake from another near the original platform ("Janus" or "Kombewa" flakes); two other flakes were removed from other flakes, but the "opposed platform" phenomenon was not present. Three more pieces were flakes which removed, either intentionally or by accident, retouched edges from an implement (included as "diverse" tools on the type list). The last two instances of "other" technique apparently reflect efforts to remove angular and convoluted areas from a core to provide better surfaces for subsequent flake production.

The absolute and relative frequencies of flake forms, the products of flaking techniques, are show in Table 8. "Normal" flakes, in this case, is misleading and refers to two general concepts of the results of flaking procedures. In one case, normal flakes are the products of the "normal" flaking technique; that is, non-descript pieces of more or less irregular outline shapes with no particular pattern of scar ridges on the exterior face. But in another sense, normal flakes also refer to flake forms that would be *expected* from a particular technique of flaking. For example, the Levallois flake technique produces a "normal" Levallois flake; or, the bifacial flaking technique produces a normal flake of bifacial retouch. The confusion engendered by this category is an unfortunate oversight, and, apologetically, a better method of discriminating flake form is called for in the future.

Table 8. Absolute and relative frequencies of flake form in the Ain el-Assad sample.

Form	*n*	%
"Normal"	320	79.0
Angular	36	8.9
Second-order point	2	0.5
First-order blade	6	1.5
Second-order blade	19	4.7
Formless debris	2	0.5
Other	15	3.7
Overshot	5	1.2
Total	405	100.0

Angular flakes are defined as those pieces which have two or more exterior scars whose surfaces converge to an angle of less than 90⁰. The "other" technique which removed core edges invariably fit into this category of flake form, and the Clactonian technique often produced angular flakes.

Before describing first-and second-order blades and points, it is necessary to present the definition of blades used in this analysis. Bordes defines a blade as "a flake more than twice as long as it is wide..." and goes on to note that, under this definition, "of course there may always be the chance of *accidental* blades from the earliest period onwards" (Bordes 1968: 27, emphasis added). Although this is a popularly used definition in the Lower and Middle Paleolithic, the accidental production of long flakes would appear to be a quite different conceptual thing from the consistent and intentional manufacture of long, regular, parallel-sided pieces which bear evidence of the removal of similar pieces by long parallel-sided ridges on their exterior surfaces. It is this latter product of lithic manufacture that is defined as a blade in this study, and no matter what the relative dimensions of the flake may by, if it bears convergent or haphazardly-oriented flake scars on the exterior surface, it is simply considered a flake of one kind or another, but not a blade.

First-order blades have two parallel blades scars on the exterior surface separated by a single longitudinal ridge; second-order blades have two or more such ridges on the exterior. First-order points have two convergent flake scars separated by a single medial ridge (e.g. Fleisch 1970: 83, Fig. 17-11); second-order points have three or more convergent flake scars on the exterior surface separated by a "Y-pattern" set of ridges (Fleisch 1970: 83, Fig. 17-17).

Overshot pieces are flakes or blades which "misfired" upon detachment from the core, removing the distal end of the core in the process. "Other" flakes are comprised of nine core edges, three Kombewa flakes, and three flakes detached from larger flakes.

There is an apparent discrepancy in the comparison of the frequencies for Levallois and normal blade techniques in Table 7 (n=28, or 8.2% of the recognizable techniques) with the number of blades produced (n=25, or 6.2% of the total in Table 8). This difference is explained by the fact that although a blade technique was used, a blade did not always result; instead, either an overshot piece or a non-parallel-sided form resulted. In general terms, the Ain el-Assad collection is not distinguished by large numbers of blades or points, but is characterized by flakes produced by "normal" methods.

Table 9. Absolute and relative frequencies of artifacts in the cortex categories in the Ain el-Assad sample.

Cortex Category	*n*	%
	Flakes	
Cortical	10	2.5
Cortical with cortical platform	5	1.2
Partially cortical	131	32.3
Partially cortical with cortical platform	12	3.0
Naturally backed flake	6	1.5
Naturally backed flake with cortical platform	3	0.7
Naturally backed blade	1	0.2
No cortex	220	54.3
No cortex except on platform	17	4.2
Total	405	99.9
	Bifaces	
Partially cortical	38	61.3
No cortex	24	38.7
Total	62	100.0
	Cores	
Cortical	5	7.0
Partially cortical	48	67.6
No cortex	18	25.3
Total	71	100.0

The categories for the amount of cortex remaining on flakes, cores and bifaces are arbitraily defined as follows: cortical flakes and cores are pieces whose sufaces are covered by 90-100% cortex; partially cortical flakes, cores, and bifaces bear cortex on 10-90% of their surfaces; and non-cortical pieces have less than 10% cortex on their surfaces. Naturally backed flakes and blades are partially cortical pieces where the cortex covers a perpendicular lateral edge opposite a sharp lateral edge.

The very low incidence of cortical flakes in the collection (Table 9), which number far fewer than the number of cores, is a very good indication that much of the lithic manufacturing processes took place somewhere beyond the area excavated at the spring. Even just the fashioning of bifaces from this sample would lead one to expect a much larger number of cortical flakes. Additionally, the number of flakes of bifacial retouch is very low compared to the number of bifaces, further suggesting off-site manufacturing. The picture portrayed in Table 9 suggests that the occupants of the site produced the bifaces somewhere else, bringing them and a relatively large number of already reduced cores to this particular area to accomplish those activities which were carried on; those tasks for which bifaces were innapropriate could be accomplished with flakes struck off the cores.

The extent of the patination of artifacts from the excavation is tabulated in Table 10. Although a variety of factors control the development of patina, one probable chemical agent indicated by a slight sufurous order was noticed while examining the sediments underwater in the sump. The vast majority of the artifacts in the Ain el-Assad sample appear to be covered with patina, and two pieces have become so altered by physical and/or chemical changes that they are desilicified into a white, chalky texture. Rates of patination are extremely difficult to assess (if not impossible), but several examples provide some insight into the process. Two typical Upper Paleolithic punch blades were completely patinated to a dark matte black, as were many of the Lower Paleolithic specimens, but two rectangular scrapers characteristic of the Bronze Age (James Sauer, personal communication) retained their original color of reddish- to slightly pinkish-brown).

Table 10. Absolute and relative frequencies of artifacts in patina categories in the Ain el-Assad sample.

Patina Category	*n*	%		
	Flakes			
No patina	27	6.7		
Overall patina	377	93.1		
Desilicified	1	0.2		
Total	405	100.0		
	Cores			
No patina	4	5.6		
Overall patina	67	94.4		
Total	71	100.0		
	Bifaces			
Overall patina	62	100.0		
	Implements			
	AllTypes		*EssentialTypes*	
No patina	8	7.1	7	10.9
Overall patina	103	92.0	56	87.5
Desilicified	1	0.9	1	1.6
Total	112	100	64	100.0

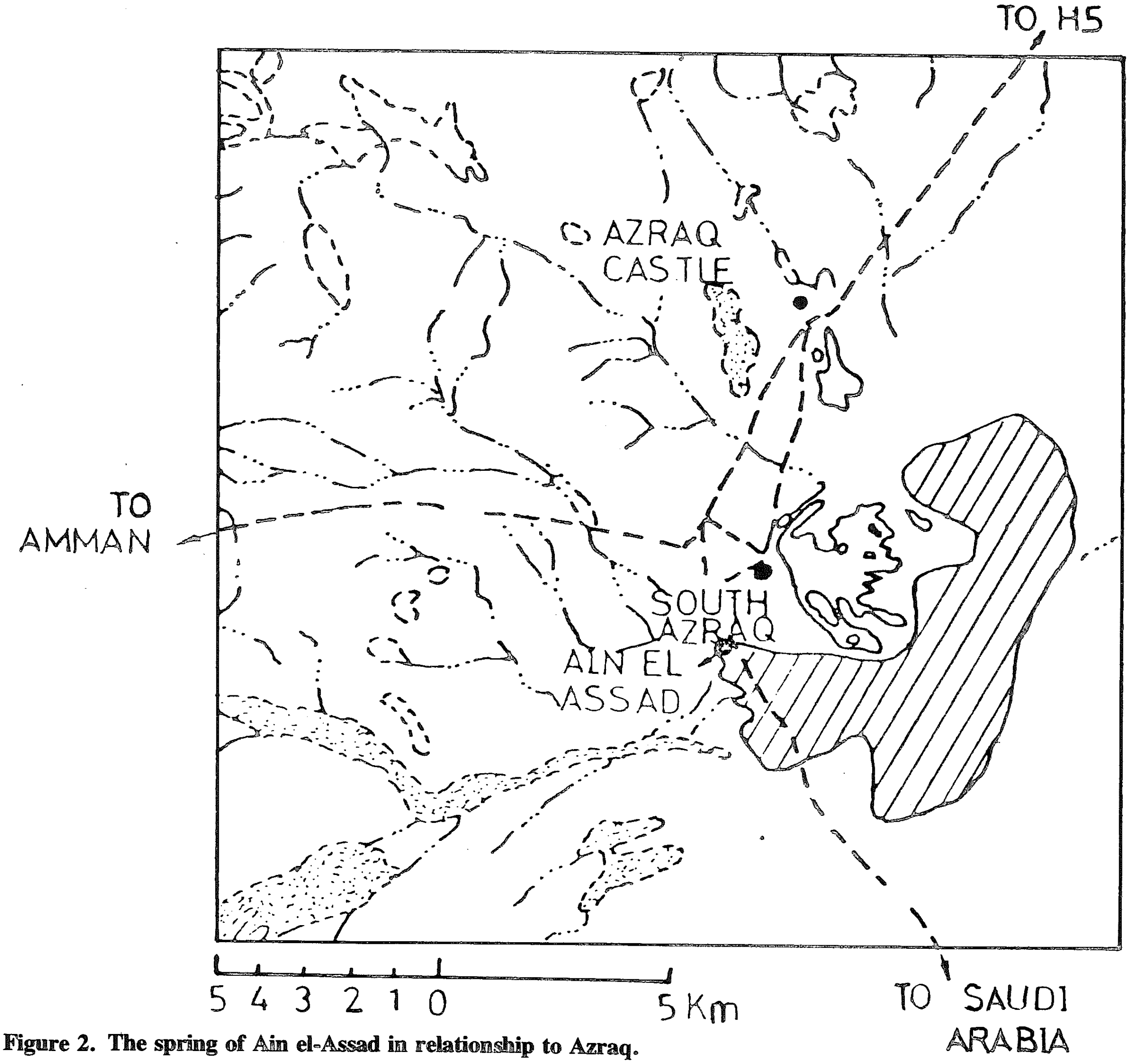

Figure 2. The spring of Ain el-Assad in relationship to Azraq.

Different patina colors have been used to demonstrate temporal distinctions in mixed assemblages (Bordes n.d.; de Lumley 1969). This seriological use of patina color is based implicity on the assumption that as the patination processes continue to operate through time, the patina will change from one color to another. This assumption, in turn, rests on another: that flint as a physical/chemical entity reacts homogeneously in similar environments of physical and chemical reagents, despite slight differences in the crystalline structure of the raw materials. Finally, it must be assumed that the physical and chemical agents reponsible for patination are distributed homogeneously throughout the surfaces and sediments on and in which the artifacts lie. Obviously, any one of these assumptions is difficult to uphold, and the combination of all three presents very high odds against satisfying all the requirements of all the assumptions. Nevertheless, in the absence of other kinds of data, it is not entirely inconceivable that different colors of patina might indicate periods of differential exposure to patinating elements. With the caveats pointed out in mind, the implications of the figures in Table 11 will be discussed.

Three general patina colors were noted in the Ain el-Assad sample. The unpatinated materials mentioned earlier were reddish- or pinkish- brown in color and matte in texture; the two Bronze Age scrapers and several flakes were of similar color, but because they had lain in a small stream leading out of the spring, they had developed a high luster as the result of "stream polish". Although this stream polish constitutes patina of a sort, artifacts bearing it and artifacts with no patina of any kind were lumped into the "other" patina category.

The second major patina category consisted of a coal-black color with either matte or lustrous textures, presumably depending on exposure to stream polish. The last major category was termed the "Gray Series", although the colors ranged from a very dark gray to off-white. No examples of lustrous texture were noted in this category.

Returning momentarily to the assumptions underlying the seriological use of patina color, two points should be mentioned which tend to substantiate it use in the case of Ain el-Assad. First, a number of the artifacts in the Gray Series were damaged recently, and in the recent fractures a dark black color stood out. Conversely, damaged artifacts in the Black Series showed the same black color in the recent fractures, but never gray. Secondly, the two Upper Paleolithic punch blades were black, but no evidence of techniques typical of later manufacturing traditions appeared on gray specimens.

Table 11. Absolute and relative frequencies of artifacts in the patina color categories in the Ain el-Assad sample.

Patina Color	*n*	%		
	Flakes			
Gray Series	124	30.6		
Black Series	249	61.5		
Other	32	7.9		
Total	405	100.0		
	Cores			
Gray Series	32	45.1		
Black Series	35	49.3		
Other	4	5.6		
Total	71	100.0		
	Bifaces			
Gray Series	19	30.6		
Black Series	43	69.4		
Total	62	100.0		
	Implements			
	All Types		*Essential Types*	
Gray Series	32	28.6	21	32.8
Black Series	70	62.5	35	54.7
Other	10	8.9	8	12.5
Total	112	100.0	64	100.0

(It must be admitted that the original color of the paleolithic artifacts remains in question: although the Bronze Age scrapers and flakes were brown in nature, it might be that the Bronze Age flintknappers brought the raw materials to Ain el-Assad from an outcrop not availble to the earlier inhabitants. It might be, for example, that the local flint was black in color, and that patination of this flint resulted in a gray color).

For these reasons it appears that at least two major periods of occupation occurred during Lower Paleolithic times (based on the two series of color among the bifaces), with subsequent minor occupations during the Upper (and Middle?) Paleolithic and post-Pleistocene periods. In the culture-bearing deposits at Ain el-Assad, it is quite possible that stratified assemblages occur, which would constitute the only such paleolithic site known east of the Jordan River.

An examination of the figures in Table 11 reveals a curious feature in the relative stability of the percentages of the patina categories across artifact classes. The only exception to this pattern is the cores, where the Gray Series is higher than would normally be expected. The reasons which might explain this phenomenon are conjectural at present, but it may indicate that the general function of the site in Lower Paleolithic times remained essentially unchanged. If the Gray Series artifacts are indeed older than the Black Series, whatever general activities were carried out in the earlier occupation(s) were also pursued in the later one(s).

The specific activities carried out at Ain el-Assad at any time will probably never be determined, but by comparing the biface types of both the Black and Gray Series, it is evident that there was some variation in the specific tasks performed. (A similar comparison of flake tools has not been attempted). Although the sample sizes are fairly small, Plate LXXXVIII indicates major differences between the biface patina series in the lanceolate, cordiform, and ovate classes, although the remaining classes are more comparable, including the cleaver class. Whatever activities these biface classes entail, there was apparently a different focus on them between the two occupations.

The relative age of the material from Ain el-Assad is difficult to determine in the absence of any geological, climatological, and palynological information. In terms of technological and typological comparisons with other sites in the Near East, stratified *in situ* Acheulian assemblages are not numerous, which emphasizes the potential value of Ain el-Assad. Furthermore, site reports on Acheulian materials are largely devoid of detailed information to facilitate interassemblage comparisons. In general, "we know the Lower Paleolithic of this region only in its broadest outlines" (Hours 1975: 252). Although taxonomic distinctions have been presented delineating the differences within the Acheulian, it has been stated that there is insufficient evidence to discriminate between Middle and Late Acheulian assemblages (Hours *et al.* 1973). On the other hand, Clark (1976:637) has noted that the relatively high frequencies of the ovate types indicate a Late Acheulian association, although the low numbers of the Micoquian type suggests that the Final Acheulian is not the case. The presence of two patination series in the Ain el-Assad samples may reflect the extreme ends of the temporal range of the Late Acheulian, but the possibility that both Middle and Late Acheulian occupations are represented (the Gray and Black Series, respectively) cannot be overlooked.

Summary and Conclusions

The Late Acheulian site at Ain el-Assad, in the oasis setting in the eastern desert of Jordan, presents the first potential glimpse at stratified *in situ* deposits of late Lower Paleolithic assemblages from the high desert environs of the Near East. The large numbers of artifacts from a relatively small (uncontrolled) excavation appear to span a long period of cultural development, although artifacts from the Lower Paleolithic predominate. Although no means of geological relative or absolute methods of dating are presently available, typological considerations indicate that Ain el-Assad was occupied during the late Penultimate Glaciation and/or during the Last Interglacial. Currently known information regarding the environmental parameters of the occupation(s) at Ain el-Assad is negligible; consequently, little can be said at present to place the typological and technological data in perspective both to the contemporary environment at the site and compared to contemporary environments elsewhere in the Near East.

The current economic situation in Jordan is one of rapidly expanding scope, resulting in widespread construction activities throughout the countryside. The sump at Ain el-Assad is located only 50-75 meters from one large construction project, and the availability of this site is in grave jeopardy. A concentrated investigation of the Ain el-Assad deposits is urgently needed to salvage to the greatest extent possible the information lying at this consistent focus of paleolithic habitation. The data available now are suggestive, and the inferences they entail are tantalizing, but the general picture they convey is much too vague compared to the potential this site possesses.

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