A LOWER PALEOLITHIC SURFACE SITE NEAR SHOBAK, WADI EL-BUSTAN, SOUTHERN JORDAN

by
Gary O. Rollefson

Introduction

In contrast to the relative intensity of research performed in some parts of the Near East, the highland regions of Jordan east of the Rift Valley remain virtually unsampled in terms of Pleistocene paleolithic investigations. Early surveys by Field (1960), Rhotert (1938), and Zeuner (1957) demonstrated the wealth of surface sites dating to the Lower, Middle, and Upper Paleolithic times, but beyond a couple of brief excavations (Waechter *et al.* 1938; Echegaray 1970), little effort was focused on the systematic recovery of information from *in situ* paleolithic deposits. Later surveys in Jordan were either limited in temporal scope (Mellaart 1962; de Contenson 1964) or dealt with areas which have been subjected to intensive disturbance due to agriculture or natural post-depositional agencies (Ibrahim *et al.* 1976; Kerestes *et al.* 1978).

As is often the case in paleolithic prehistory, one of the most fascinating sites in Jordan came about as the result of accident: in the course of excavating a sump at Ain el-Assad just south of Azraq in eastern Jordan, large numbers of bifaces, cores, flakes and flake implements appeared in the unearthed sediments (Harding 1967: 155). An examination of the artifacts still remaining in the backdirt piles from this uncontrolled excavation demonstrated the unique nature of this Late Acheulian site because of the very high percentages of cleavers (Rollefson, in press).

It was also by accident that a vast site was discovered at Fjaje, in southern Jordan. In December of 1978 an amateur archaeologist visited the agricultural station there[1], and his notice of several bifaces in the fields brought the attention of the author to this remarkable expanse of Late Acheulian occupation.

Setting and Description

The Fjaje agricultural station is located approximately 4 km northeast of the Shobak Crusader fortress, just north of the road from Nijil to Tafila (Figures 1 and 2). The paleolithic site lies within the fenced confines of the station on a triangular spit of land jutting out between two unnamed drainages which descend sharply to a confluence with the Wadi el-Bustan. The

1. The site was discovered by Dr. Edgar C. Harrell. I would like to express my gratitude to him for bringing the site to my attention. Iwould also like to thank the following people for the opportunity to examine their collections and for the transportation several of them provided to the site: Drs. Edgar and Paula Harrell, Randy and Jody Old, Csaba and Jackie Lengyel de Bagota, Scott Johnson, and Robin and Diana Haines. I would also like to thank Dr. Bruno Froehlich for his valuable help with the photography of the specimens.

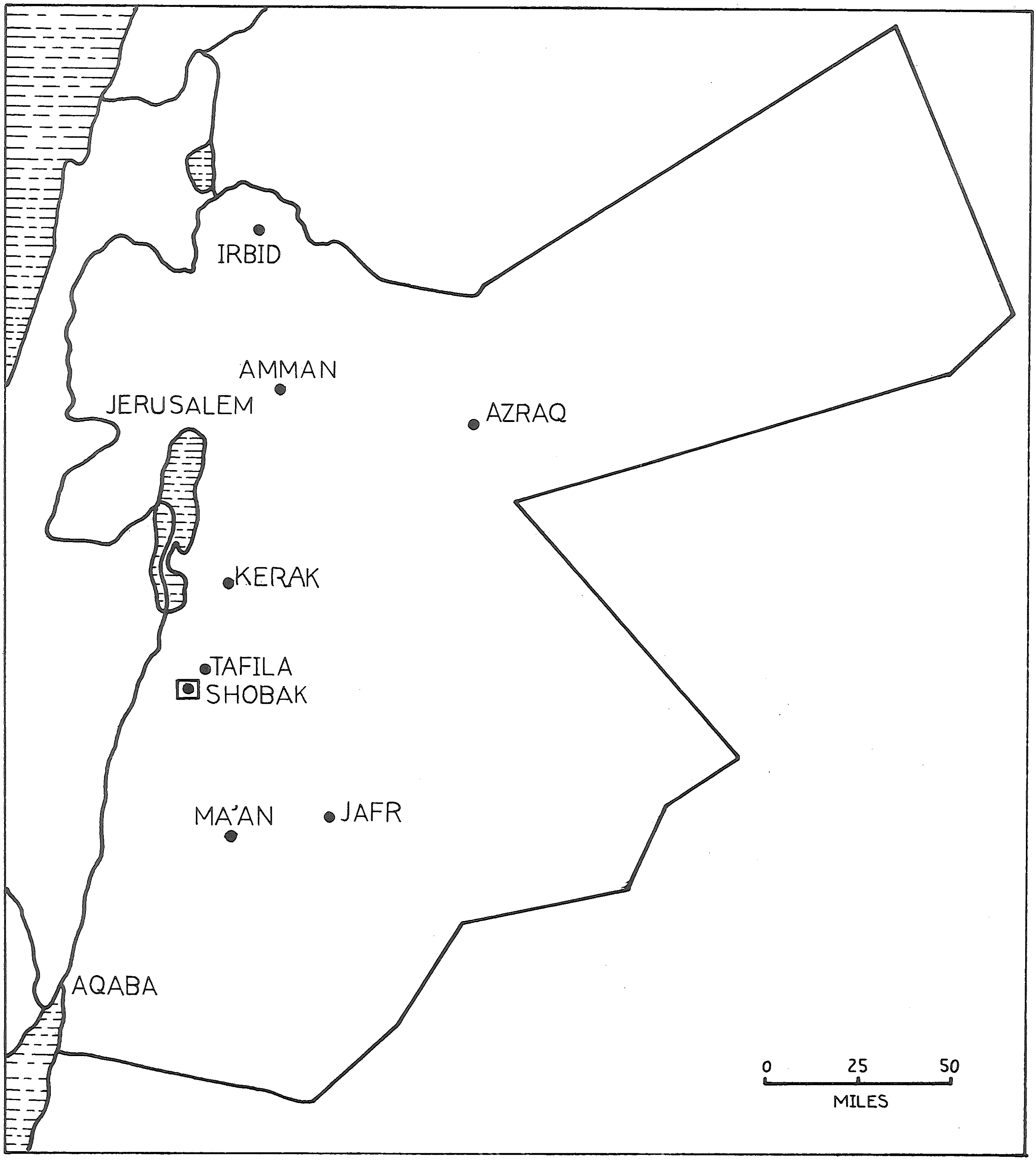

Figure 1. Location of the Shobak area in southern Jordan.

Wadi el-Bustan wends towards the northwest to join the system entailing the Wadi Hamra, the Wadi Ghuweir, the Wadi Dana, and eventually debouching into the Wadi Feinan on the eastern margin of the Wadi Arabah. Within the *ca.* 15 km distance from the Fjaje site to the Wadi Feinan, the absolute elevation of the land falls from approximately 1280 m to 250 m above sea level.

The surface of the Fjaje site slopes gently towards the south, although the fringes of the triangular peninsula drop suddenly to the northwest and northeast near both small wadis. Vegetation on the site includes several windrows of recently planted cypress trees along the driveway and among the buildings of the agricultural station, as well as smaller galleries of eucalyptus trees. In the more open parts of the site, which measures approximately six hectares (15 acres) in extent, the ground is sporadically dotted with low brush and perennials. In the western half of the triangle numerous "potholes" of variable depth and about a half meter in diameter occur in a rough grid at intervals of between one and two meters from each other. These holes appear to be related to agricultural experiments at the station.

Current annual rainfall amounts in the area of Shobak and Tafila vary considerably from year to year, but the average falls between 150-200 mm per year (Harris 1958: 150). Plowed fields just outside the station fences indicate that this rainfall is sufficient for dryfarming. Although much of the lack of forest growth in the immediate vicinity may be attributed to relatively recent cultural interference, this highland area was probably characterized by denser stands of trees and groundcover in the Late Pleistocene (*cf.* Butzer 1978: 7-12).

At present there are no stable natural water sources or basins in which rainfall (a winter phenomenon) can collect. However, near the base of the Wadi el-Bustan there are a number of springs and seeps which support relatively lush vegetation and affords the opportunity for intensive agriculture. Since these water sources are more than 150 m below the site's elevation, and approximately 1.5-2 km away downslope, it must be postulated that in the Late Pleistocene closer sources of stable, if seasonal, water were available to the occupants of paleolithic Fjaje. A kilometer or less south of the site there is a shallow wadi that may have provided the Acheulian inhabitants the seasonally available water necessary for their stay at Fjaje.

The artifacts at the Fjaje station are densely distributed over a broad area, and the size of the site indicates that it was a major focus of Late Acheulian hunting and gathering groups (compare Clark 1967; 1968; *cf.* Clark 1975). The physical nature of the exposed artifacts and the present geological circumstances indicate that few if any of the remains of the occupations of the Acheulian inhabitants are *in situ*. The potholes in the western part of the site, the foundation trench of a sceptic tank, and the exposures of the subsurface stratigraphy in the wadi cuts all indicate that episodes of extreme wind deflation and water erosion have disturbed the original depositional contexts of the artifacts. In some areas up to 15-20 cm of soil can be found above the porous and friable limestone bedrock, but for most of the site the thickness is generally 10 cm or less.

The resulting situation is one of a mixture of surface artifacts which represents unnumbered visits by paleolithic hunters who returned to the Fjaje site time and again, ostensibly timing their stay with the seasonal migrations of animals back and forth from the highlands of Jordan to the canyons leading to the Rift Valley below. Based on the present rainfall patterns in the Near East, the majority of the occupations probably occurred in late autumn or late spring, when major animal migrations probably took place.

The Artifacts

It must be stressed at the outset that the artifacts in the following discussion do not represent a controlled, systematic collection at the site. The following analysis relies heavily on the collections of amateur enthusiasts whose bias is obvious in the relative numbers of bifaces and cores in the collections compared to the numbers of flakes. For this reason, accurate density figures cannot be calculated, nor can relationships among artifact classes (flake to core ratios, for example) be established. Nevertheless, the collections present a remarkable array of the typological and technological expressions of Late Acheulian hunters and gatherers.

Typology

Table 1 presents the absolute and relative frequencies of biface types in the Fjaje collection (Bordes 1961) and Table 2 tabulates these bifaces according to biface classes (Rollefson 1978; in press). Of note in Table 2 are the generally high relative frequencies of lanceolate, **cordiform, and** ovate classes (Pl. XXXIII-XXXVII), the rarity of cleavers, and the relatively high abundance of diverse types. The general picture conveyed by the bifaces is that Fjaje represents a series of occupations from the Late Acheulian development, probably dating to a time contemporary with the early part of Europe's Last Interglacial or to the later part of the Penultimate Glacial series in the higher latitudes.

Table 1. Absolute and relative frequencies of bifaces in the Fjaje collection.

Biface Type	*All Bifaces*		*Classifiable Bifaces Only*	
	n	%	n	%
Lanceolate	12	7.5	12	9.0
Ficron	8	5.0	8	6.0
Micoquian	9	5.7	9	6.7
Elongated Triangular	2	1.2	2	1.5
Cordiform	8	5.0	8	6.0
Amygdaloid	27	17.0	27	20.1
Sub-cordiform	1	0.6	1	0.7
Ovate	12	7.5	12	9.0
Discoidal	10	6.3	10	7.5
Limande	15	9.4	15	11.2
Cleaver	5	3.1	5	3.7
Nucleiform	1	0.6	1	0.7
Diverse	16	10.1	16	11.9
Partial	6	3.8	6	4.5
Abbevillian	2	1.2	2	1.5
Disc	3	1.9		
Unclassifiable	22	13.8		
Totals	159	99.7	134	100.0

Among the diverse category of bifaces, several patterns are apparent.

Table 2. Absolute and relative frequencies of biface classes in the Fjaje collection.

Biface Class	n	%
Lanceolate	31	23.1
Cordiform	36	26.9
Ovate	37	27.6
Cleaver	5	3.7
Non-classic	1	0.7
Diverse	16	11.9
Partial	6	4.5
Abbevillian	2	1.5
Total	134	99.9

Among the 16 pieces in this category, five are bifaces which were converted to cores; as far as it is possible to determine, two of these were cordiforms, one an amygdaloid, another a lanceolate, and the last one a discoidal biface. In contrast, based on the general configurations of the specimens, three cores had been fashioned by the flintknappers to produce bifaces; one of these pieces bears two different stages of patination, suggesting that a core was selected as a suitable blank for the production of a biface long after it was discarded by an earlier flintworker. Two of the diverse bifaces are "D-shaped", a relatively rare type noted at Ain el-Assad in eastern Jordan and at Tabun in Mount Carmel in Palestine (Rollefson in press). Another of the implements in this classification is a remarkably well-worked, elegantly thin and sharp bifacial knife, also noted at Tabun but absent at Ain el-Assad.

The remaining five diverse bifaces are very individual in terms of their forms and degrees of retouch. One of them might be described as a "nosed" biface with a crudely retouched thick-body with special attention devoted to the production of a thick and steeply retouched tip. Opposed to this attention to detail, another thick and crudely worked biface received careful retouch at the tip which resulted in a short area with a pointed and sharply-edged tip. The third of these isolated diverse forms would normally be classified as a lanceolate except for a prominent bifacial notch carefully worked on one of the lateral edges. The fourth is very eccentric in terms of the contours of its edges. Finally, one massive piece, weighing approximately four kilograms, had one area bifacially retouched to a relatively slender and sharp point (Pl. XXXVIII). For whatever purpose this biface was used, momentum was obviously a desired feature.

Table 3 presents the absolute and relative frequencies of flake implements in the Fjaje collection classified according to Bordes' typology (Bordes 1961). Although the tabulation includes unmodified Levallois flakes, blades, and points and irregularly "retouched" pieces (types 45-50), only the essential typology will be discussed below.

As is often the case in the Near East, the use of Bordes' typology results in a rathor large relative frequency of "diverse" types (type 62) which include artifacts that do not comfortably conform with the other type definitions. Although this phenomenon may reflect a conservatism among lithic typologists analyzing Near Eastern assemblages, the fact that Bordes' typology was developed on the foundation of flake tools primarily from western Europe (especially France) probably also has much to do with the higher frequencies in this residual category.

Among the "other" implements at Fjaje, two of the pieces are simply too damaged to classify. Four others are heavily battered *pieces esquillees,* one of which exhibits a proximal truncation. Of the remaining five pieces in this category, one is a poorly fashioned convex racloir with very steep retouch, and it might qualify either as a type 10 (simple convex racloir) or type 26 (racloir with steep retouch). Another tool is a heavily battered concave racloir which bears a burin facet on the same edge; perhaps this piece should be considered

Table 3. Absolute and relative frequencies of implement types in the Fjaje collection.

	Actual		Essential	
Type	n	%	n	%
1	8	6.5		
2	2	1.6		
3	7	5.7		
5	1	0.8	1	1.6
9	1	0.8	1	1.6
10	7	5.7	7	10.9
11	3	2.4	3	4.7
19	1	0.8	1	1.6
21	1	0.8	1	1.6
25	3	2.4	3	4.7
27	1	0.8	1	1.6
29	1	0.8	1	1.6
30	2	1.6	2	3.1
31	2	1.6	2	3.1
32	4	3.2	4	6.2
33	1	0.8	1	1.6
35	1	0.8	1	1.6
38	1	0.8	1	1.6
40	1	0.8	1	1.6
42	5	4.1	5	7.8
43	13	10.6	13	20.3
45	5	4.1		
46/47	31	25.2		
48/49	1	0.8		
50	5	4.1		
56	1	0.8	1	1.6
59	1	0.8	1	1.6
60	2	1.6	2	3.1
62	11	8.9	11	17.2
Totals	123	99.7	64	100.3
Group I		32.5		0.0
Group II		14.6		28.1
Group III		8.9		17.2
Group IV		10.6		20.3
IR		14.6		28.1
ICh		8.1		15.6
IAu		0.0		0.0

a burin variant (type 32 or 33). Another diverse flake

implement has very deliberate and continuous interior retouch on one lateral margin, but the retouch does not conform to the inverse scraper type (type 25); perhaps this piece represents an abandoned attempt to fashion a thinned-back racloir (type 27). A small pebble (53 mm) has two edges which bear scraper retouch on opposing faces; technically this might be considered as an alternating scraper (type 29), but since the retouch occurs on a small core, it seems preferable to leave it in the diverse category. And last, a large Levallois flake exhibits crude but continuous retouch on the distal margin, and it is possible that this is a flake chopper (type 61), but it is not certain if the retouch was intentional or if it may represent harsh post-depositional damage.

Near the bottom of Table 3 are several indices which characterize the nature of the Fjaje implement collection. The "actual" Group I (Levallois) Index is rather strong and mirrors the popularity of the use of the Levallois technique at the site (Pl. XXXIX), but since there are no retouched Levallois points at the site, the essential Group I Index is 0.0. The Group II (Mousterian) Index is only moderate, and possibly because of the presence of Levallois points, no Mousterian points contribute to this value. The Group III (Upper Paleolithic) Index is low or moderate (Pl. XL), but the Group IV (Denticulate) Index is rather strong.

In the Fjaje collection the Racloir Index (IR) is identical to the Group II value (Pl. XLI). The Charentian Index (IC), which represents the relative importance of racloir types 10 and 22-24, is fairly low, but this is expectable in view of the relatively frequent production of Levallois flakes. The Backed-Knife Index (IAu) demonstrates that no flakes or blades were intentionally backed to produce an implement.

Table 4 presents the absolute and relative frequencies of core types from Fjaje. The definitions of the three Levallois core types, of discoidal and spheroidal cores, and of prismatic blade cores are well described in the literature treating the Lower and Middle Paleolithic of Europe (especially by Bordes 1961); these definitions are used here and will not be amplified (Pl. XLII-XLIV). The types referring to core fragments, unclassifiable (due to damage), and diverse need little comment. However, the remaining five types demand some explanation in order to facilitate further discussion in this analysis and to provide a possible foundation for additional paleolithic core analyses from other sites in the Near East.

Table 4. Absolute and relative frequencies of core type in the Fjaje collection.

Type	n	%
Levallois flake	33	35.1
Levallois point	5	5.3
Levallois blade	1	1.1
Discoidal	24	25.5
Spheroidal (Globular)	2	2.1
Simple prismatic	3	3.2
Opposed prismatic	5	5.3
Opposed prismatic + side flakes	1	1.1
Prismatic + crested	1	1.1
Single-face	3	3.2
Single Platform	1	1.1
Diverse	11	11.7
Core fragment	2	2.1
Unclassifiable due to damage	2	2.1
Total	94	100.0

The single-face core is a type developed by Jelinek (personal communication) in the analysis of the Lower and Middle Paleolithic assemblages from the Tabun Cave. This core is one from which flakes have been detached from only one surface of a nodule (Pl. XLV e). The single platform core type is a variant of the single-face core: not only were the flakes removed from only one surface, but from a single restricted platform area (Pl. XLV f). (This core type, although rare at Fjaje, was developed while examining a large number of cores from numerous sites in Jordan which spanned the Lower, Middle, and Upper Paleolithic periods[2]).

2. The opportunity to examine the Fjaje specimens arose while I was studying the ACOR lithic collections as the William Foxwell Albright Fellow in 1978-79. I would like to express my sincere appreciation to the ACOR and ASOR boards for this opportunity, and in particular to Dr. James A. Sauer, ACOR Director, for his enthusiastic support and warm friendship.

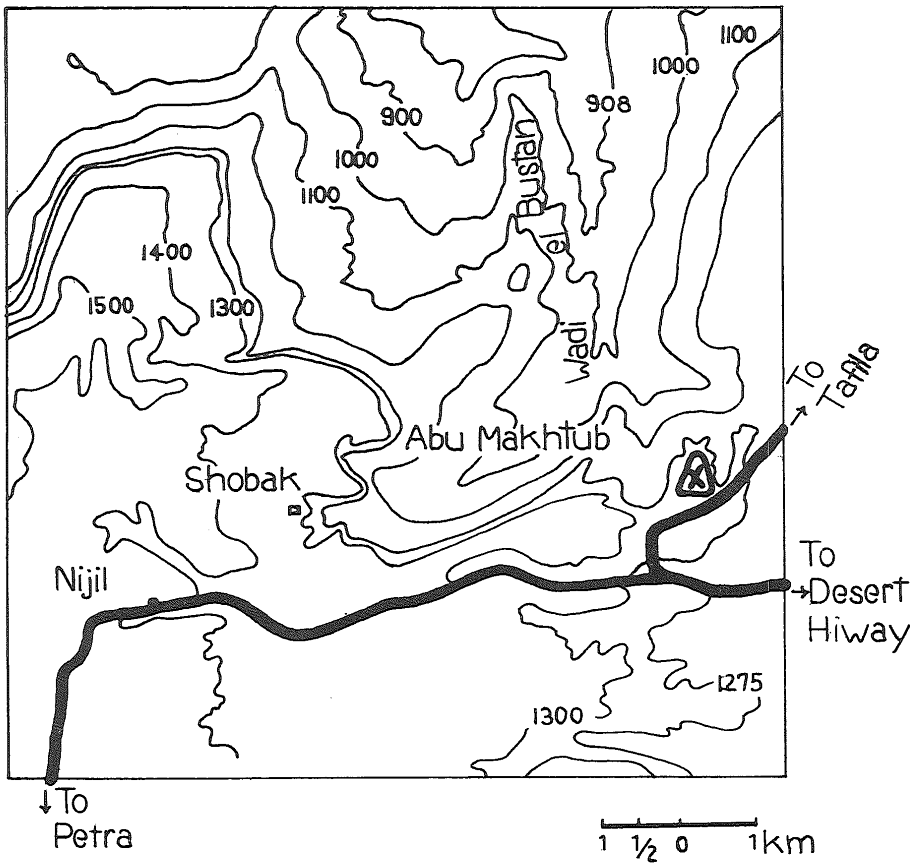

Figure 2. Location of the Fjaje site in relation to Shobak, the Wadi el-Bustan, and the village of Abu Makhtub.

In contrast to the simple prismatic blade core, which has a single platform from which blades were struck, the opposed prismatic blade core has two platforms on opposite ends of the nodule Characteristically, this type is defined by long parallel ridges between which negative ripples proceed from both ends of the core toward the center (Pl. XLV a).

The opposed prismatic + side flakes and the opposed prismatic + crested core types are not only rare at Fjaje, they are probably rare in Lower and Middle Paleolithic assemblages in general; they occur in high frequencies in Upper Paleolithic and more recent sites, and the sparse presence at Fjaje indicates a degree of temporal mixing in the collections. In the former core type, the opposed prismatic blade core discussed in the previous paragraph also bears evidence of the consistent removal of short, broad flakes at an angle of approximately 90° to the axis of the removal of the blades (Pl. XLV b-c). Normally, the negative blade scars on one surface form the platform for the removal of flakes on the opposite surface, but often flakes are removed from the same surface as that from which the blades were detached.

The opposed + crested core type is generally triangular in cross section. The surface from which the blades were removed is generally flat, and opposite to this flat surface is a high longitudinal ridge which forms the platform for the removal of flakes from the other two faces of the trihedral (Pl. XLV d).

The figures in table 4 reveal the strong Levallois influence at Fjaje, with all three types of Levallois cores accounting for 43.3% of the classifiable core types (excluding unclassifiables and core fragments). Discoidal and spheroidal cores represent 28. 9% of the same total, the variety of blade cores make up 11.1%, and diverse cores account for the remaining 11.7%. It has already been mentioned that two of the blade cores are probably Upper Paleolithic. One of the opposed prismatic cores exhibits platform preparation on both platforms, so possibly it should be considered as a kind of Levallois blade core.

Table 5. Absolute and relative frequencies of bifaces from the Fjaje collection in the cortex and patina classes.

Cortex Class	n	%
Partially cortical	43	27.0
Non-cortical	116	73.0
Total	159	100.0

Patina Class	n	%
Unpatinated	4	2.5
Overall Patina	131	82.4
Partially desilicified	24	15.1
Total	159	100.0

Technological Features

A description of the technologically related attributes monitored in this analysis has been discussed earlier (Rollefson, in press) and will not be repeated here.

The cortex and patina descriptions of the bifaces are presented in Table 5. Virtually no cortex was left by the Acheulian flintknappers on nearly three-fourths of the Fjaje specimens, although the remainder maintain substantial amounts of cortex on the surface area. As for post-depositional changes in the physical state of the biface surfaces, only 2.5% are unchanged from the time they were discarded. Of the remaining huge majority, 24 bifaces have undergone severe chemical and physical alterations to the point of becoming almost chalky in texture. Although all of the bifaces with overall patina have evidently been exposed repeatedly to patinating elements for a long time, the evidently longer exposure of the partially desilicified pieces has subjected them to an increased attack to wind abrasion to the point that on many of them the flake scar ridges have been severely eroded.

Table 6. Absolute and relative frequencies of cores from the Fjaje collection in the cortex and patina classes.

Cortex Class	n	%
Partially cortical	52	55.3
Non-cortical	42	44.7
Total	94	100.0

Patina Class	n	%
Unpatinated	4	4.2
Overall patina	80	85.1
Partially desilicified	10	10.6
Total	94	99.9

In contrast to the bifaces, only about half of the Fjaje cores are non-cortical (Table 6). On the other hand, the relative frequencies of unpatinated, patinated, and partially desilicified cores closely parallels the situation among the bifaces. This circumstance is tentative evidence that the Levallois elements and most of the blade cores are contemporaneous with the Acheulian bifaces. In other words, although the site probably contains a mixture of a number of temporally distinct occupational debris, these pertain overwhelmingly to the late Lower Paleolithic, and substantial components from later Middle and Upper Paleolithic visits to the site are not included in the collection.

The cortex and patina classes for the flakes and flake tools are provided in Table 7. Cortical flakes, with cortex covering 90-100% of the exterior surface, are very rare in the collection, and in view of the large numbers of cores and bifaces, this situation probably represents a bias in the selectivity of the amateur archaeologists who collected the specimens. Of the other flakes in the sample, a relatively high 63% possess virtually no cortex, and on the remaining 34% cortex amounts ranged between 10 and 90% of the surface. Eleven flakes and blades had cortex on one lateral edge opposing a sharp non-cortical lateral, but in only one case was the cortical edge steep enough to be considered a type 38 flake implement.

There is a slight difference in the relative frequencies for the patina classes among the flakes in the sample. The relatively higher number of unpatinated pieces compared to the bifaces and cores is explainable in part by the presence of material from later periods of occupation. Of the 15 pieces in this category, five are undoubtedly blades from Upper Paleolithic or later times, and five flakes appear to be from later periods as well (although this is an intuitive impression). If these 10 specimens are removed from consideration, the unpatinated class represents 3.0%, the patinated categories account for 92.1%, and the desilicified examples make up the remaining 4.9%.

Table 7. Absolute and relative frequencies of attribute states of all flakes, including implements, among the cortex classes, patina classes, and flake condition classes at Fjaje.

Cortex Class	n	%
Cortical	5	2.8
Partially cortical (PC)	46	26.3
PC with cortical platform	3	1.7
Naturally backed flake (NBF)	4	2.3
NBF with cortical platform	1	0.6
Naturally backed blade	6	3.4
Non-cortical	107	61.1
Non-cortical except platform	3	1.7
Total	175	99.9

Patina Class	n	%
Unpatinated	15	8.6
Edge patina	1	0.6
Overall Patina	151	86.3
Partially desilicified	7	4.0
Desilicified	1	0.6
Total	175	100.1

Flake Condition	n	%
Complete	24	13.7
Striking platform absent	3	1.7
Other edges absent	93	53.1
Striking platform and other edges absent	55	31.4
Total	175	99.9

The flake condition classes in Table 7 describe where breaks have occurred on broken specimens and indicate generally the nature of the fragment. Since more than 85% of the flakes and blades at Fjaje are broken in one area or another, this may indicate the degree of post-depositional disturbance and damage at this unprotected open-air site, especially in view of the long period of pastoralism and agriculture in the Near East. During the analysis of the collection, no systematic attention was focused on whether the breaks appeared to be recent or contemporary with the discard of the artifacts based on different patina stages on the same piece, but the relatively high frequency of dubious "tools" (types 45-50) at 40.0% indicates that much of the damage to the flakes did not occur during the paleolithic occupations.

The absolute and relative frequencies of the kinds of platforms on the Fjaje flakes and blades are tabulated in Table 8. Of the classifiable platforms (n=119), only half are plain (or single facet) while almost all of the other half is composed of dihedral or multiple facet platforms. Among the multiple facet platforms are three examples of the classic Levallois chapeau-de-gendarme. In view of the relatively large representation of Levallois cores, these figures are not unexpected.

The combination of platforms and the patterns of flake scars on the exterior surfaces of the flakes permits a determination of the techniques used in lithic manufacture (*cf.* Rollefson, in press). The relative frequencies of these techniques are tabulated in Table 9. In the same Table, the frequencies of flake forms are presented; these are the results of the techniques, whether intended or not. In approximately a third of the cases, the technique used could not be confidently determined, primarily because a large number of blades whose platforms were missing (The presence of the platform is crucial to distinguish between the Levallois blade technique, with a multiple facet

Table 8. Absolute and relative frequencies of platform types among the flakes from the Fjaje collection.

Platform Type	n	%
Plain	59	49.6
Transverse	1	0.8
Dihedral	18	15.1
Transverse dihedral	3	2.5
Multiple facet	34	28.6
Chapeau-de-gendarme	3	2.5
Crushed	1	0.8
Subtotal	119	99.9
Missing	56	(32.0)
Total	175	

platform, and the normal blade techniques, with plain or dihedral platforms).

A comparison of the techniques and forms in Table 9 is very revealing. At the outset, the relative frequencies of Levallois point technique and Levallois point forms are essentially identical, and there is a very close correspondence between the frequencies for all blade techniques and all blade forms (37% and 31%). However, beyond these congruities, superficially expected relationships are not so clear. For example, unspecialized techniques (including normal, Clactonian, and disc core) account for only 42% of the evident techniques, yet unspecialized flake forms (normal and angular) make up 58% of the forms. Part of this discrepancy can be explained by the classification system used: in the results of the analysis it is not possible to distinguish between "normal" flakes produced by normal flaking techniques and "normal Levallois flakes" produced by the Levallois flake technique (see discussion in Rollefson, in press).

Table 9. Absolute and relative frequencies of flaking techniques and flake forms among the flakes from the Fjaje collection.

Technique	n	%
Normal	28	22.6
Clactonian	17	13.7
Levallois flake	14	11.3
Levallois point	10	8.1
Levallois blade	16	12.9
Disc core	7	5.6
Normal blade	29	23.4
Punch blade	1	0.8
Other	2	1.6
Subtotal	124	100.0
Indeterminate	51	(29.1)
Total	175	

Form	n	%
Normal	97	55.4
Angular	5	2.8
2nd order point	14	8.0
1st order blade	11	6.2
2nd order blade	48	27.4
Total	175	99.9

The problems entailed in the failure to distinguish between normal Levallois flakes and normal flakes are emphasized in a comparison of the figures in Table 8 with those in Table 4. Levallois flake cores account for 36.7% of the classifiable cores, yet only 11.3% of the recognizable flaking techniques could be attributed to the Levallois method. Part of this lack of conformity is probably related to the non-random character of the sample, yet some of the variance in the figures is not altogether unexpected. In the preliminary preparation of a Levallois flake core, it is anticipated that a number of flakes will be produced that are indistinguishable from normal flakes; the shaping of a Levallois flake core requires a normal technique to remove the cortex and thin the core. Comparing the number of Levallois flake cores to the number of Levallois flakes, the resulting ratio of 2.5 flakes per core is not disturbing.

However, the ratio of unspecialized flakes to unspecialized cores is only 3.4 (2.5 if diverse cores are included), and this value is very low, emphasizing the bias in the collection of the sample. Therefore strict correlations of flakes, techniques, and cores are probably misleading.

Table 10. Technological indices for the artifact collection from Fjaje.

IL	32.2
ILty	10.9
IF	48.7
IFs	31.1
I lam	33.7

Table 10 presents the technological indices of the Fjaje collection. The collection is characterized by the Levallois technique (IL=32.2), but the essential Levallois typological index is low (ILty = 10.9), which indicates that relatively few of the Levallois pieces were retouched into other flake tool types. The Facetting Index (IF), which includes dihedral and multiple facet platforms, is strong, as is the strict Facetting Index (IFs, which refers to multiple facet platforms only).

The Blade Index (I iam) is very strong for an Acheulian collection. It should be emphasized that in this analysis the definition of a blade relies on the technique determination, not the more common but misleading metrical definition of the term (see Rollefson, in press, for a more detailed discussion). One of the problems involved with using the length/width ratio to define blades is that this should be applied strictly to complete flakes only, and in the situation at Fjaje, only 24 of the flakes in the sample are complete. Of these, 13 are more than twice as long as they are wide, resulting in a value of 54.2 for a "Long Flake Index". However, since the complete flake sample is so small, it would be improper to use this figure for a meaningful comparison with other assemblages.

Comparisons with Ain el-Assad

The only other Lower Paleolithic site in Jordan to have been analyzed in detail is Ain el-Assad, near Azraq. Both sites are Late Acheulian, but just how specifically close in time they may be cannot be determined on the basis of the present evidence. The occupations may overlap in time, or they may be separated by tens of thousands of years. Both are open-air sites of high artifact density which indicates that occupations were frequent in each site. But here the similarities apparently end.

At present there are no sound paleoenvironmental data available for either location, and any attempt to recreate the Late Pleistocene environments in which each site was situated necessarily requires some considered speculation. The scenarios presented below should be viewed with considerable caution.

If Fjaje was occupied during a time contemporary with the Penultimate Glaciation in

Europe, the climate in the area of the site was probably a little cooler and was characterized by an increase in precipitation (and possibly a different seasonal pattern of rainfall). As a consequence. moderate or dense forest cover may have covered most of the ridges from Kerak to Ras en-Naqb, although how far east this forestation may have extended is difficult to predict. Even if Fjaje dates to a time contemporary with Europe's Last Interglacial, with a climate not substantially different from the present one, still the vegetation cover probably was more dense than at present because of the absence of the cultural impacts of pastoralism, agriculture, and other factors.

The environmental circumstances at Ain el-Assad were probably considerably different, even if a considerable increase in rainfall converted the present desert to a different vegetation zone. Lying several hundred meters lower in absoulute elevation than Fjaje, and probably subjected to a rainshadow effect in some degree by the mountains to the west, the countryside in much of the Azraq basin probably was characterized by savannah vegetation at best. Near the Ain el-Assad site itself, however, local vegetation may have been very lush due to the permanent water of the spring and to the expansion of the standing water in the Azraq Basin. In fact, it is possible that the Ain el-Assad site may have been occasionally underwater as a lake formed and expanded at certain times in the Pleistocene.

The density of artifacts at Ain el-Assad is testimony to the popularity of this location, and the popularity was undoubtedly due to the permanent fresh water of the spring. The water was not only necessary to the hominid occupants, but it would also have served the needs of any animals in the area, making the site doubly attractive for Acheulian hunters and gatherers. This is in direct contrast to the lack of evident permanent water resources at Fjaje. It was mentioned earlier that Fjaje was probably occupied only during certain periods of the year, perhaps during major game migrations to and from the Jordan Valley along the Wadi el-Bustan. Although Ain el-Assad also probably was occupied for only relatively short periods of time, the permanent water resource suggests that the occupations could have occurred at any time of the year.

If these conjectural reconstructions of the environment reflect to any degree the actual circumstances for the two sites, they may provide some insight into the reasons for the disparities in the technological and typological differences in the artifacts in the two collections.

The Artifacts

In terms of the bifaces, the most striking contrast between Fjaje and Ain el-Assad concerns the cleavers: nearly a third of the bifaces from the latter site are cleavers, which is much higher than the 3.7% figure for Fjaje. In fact, the high percentage of cleavers sets the assemblage apart from nearly every other Acheulian site in the Near East (Rollefson, in press). The diverse category is much higher at Ain el-Assad, although roughly a third of the diverse bifaces at both sites were converted into cores. Partially as a result of the increased emphasis on cleavers and diverse biface types at Ain el-Assad, the lanceolate, cordiform, and ovate class frequencies at Fjaje are relatively much higher. However, if the cleavers from both sites are removed from consideration, the percentages of the cordiform class are much closer (28% for Fjaje and 22% for Ain el-Assad) as well as for the ovate class (29% and 24%); on the other hand, the lanceolate classes remain quite different (24% and 8%). In summary, emphasis on tasks which required lanceolate bifaces occurred at Fjaje, while those involving cleavers were especially important at Ain el-Assad. Other activities using bifaces from the other classes appear to be of similar overall significance (Pl. XLVI).

Pl. XLVII indicates that the essential flake tool components of the two collections are very different. The major variations involve much higher frequencies of notches and denticulates at Fjaje, while at Ain el-Assad simple racloirs (types 9 and 10), transverse racloirs (type 23), and naturally backed knives (type 38) were more important.

The various typological and technological indices for the two sites provide a more detailed comparison. The essential Group I Index is identical at 0.0 for both sites; i.e., no retouched Levallois points occur in either collection. The same value holds for both sites in the Backed Knife Index as well. But in terms of the other indices, the differences are very pronounced. At Ain el-Assad the Group II (Mousterian) and Racloir Indices are nearly twice as high (55.0 and 51.7) as those at Fjaje, and the Charentian Index is nearly 10% higher than Fjaje's value. Conversely, the Group III (Upper Paleolithic) and Group IV (Denticulate) Indices at Fjaje are both more than three times as important as the same indices at Ain el-Assad (5.0 and 6.7).

In the technological realm, the differences between the two sites are just as dramatic. The Levallois Index at Ain el-Assad is negligible at 1.8 compared to the 32.2 figure for Fjaje, and the Levallois Typological Index at the former site is 0.0. The facetting indices, both in the broad and strict senses, are much higher in the Fjaje collection than those at Ain el-Assad (29.6 and 10.4). Finally, the Blade Index at Fjaje is more than five times the 6.2 value at Ain el-Assad. (The "Long Flake Index" for Ain el-Assad is 18.5, about a third of the Fjaje figure).

Overall, there are major differences in the relative numbers of tool types at each site and in the methods used to produce the implements. Although both sites are "contemporary" in the broad sense of having been occupied in the Late Acheulian, the dramatic typological and technological variation indicates that the *kinds* of occupation were different.

In great part this is probably due to the different environmental circumstances of the two sites, but other factors important to the explanation of the differences must not be overlooked (although they may be indirectly associated with the environment). Certainly one of the implications directly concerned with the local environments is the seasonal nature of short-term occupations at Fjaje compared to the less seasonally associated visits of possibly longer duration at Ain el-Assad, where probably more stable faunal and floral communities were available for exploitation. The variations in biface production and flake tool manufacture may very well be linked to differences in the exploitable resources at the two locations.

It is not impossible that the differences manifested in the tools and techniques of manufacture represent cultural variation and are unrelated to the exploitable resources. In other words, the faunal and floral resources in the areas may not have varied considerably, but the social groups inhabiting the sites had different traditions of exploiting them which show up in the variations of the methods they used to produce the implements. This proposition, while perhaps tantalizing, cannot be substantiated on these two sites alone, and similarities and differences with other Late Acheulian sites in the Near East fail to provide support for such a hypothesis. There is simply not enough available information to determine whether the cultural explanation is more suitable than the functional one.

One aspect which may be crucial to the differences in the use of the Levallois technique at Fjaje and Ain el-Assad is the relative abundance of flint nodules in the immediate vicinity of the two sites. It is possible, for example, that in areas of restricted lithic resources the Levallois technique may be a more efficient method of producing implements (MacBurney 1975: 416-17), especially if the major focus is on utilizing available large nodules for the manufacture of bifaces. Therefore, one of the implications of the prevalence of the use of the Levallois technique at Fjaje is that local flint resources were relatively scarce, while at Ain el-Assad they were much more abundant. Unfortunately, during the times both sites were briefly visited, no reconnaissance for lithic resources was undertaken.

Summary

The huge Lower Paleolithic surface site at Fjaje represents a major focus of repeated occupations by Late Acheulian groups who probably exploited the seasonal game migrations to and from the Jordan Rift Valley.

An apparently prolonged period of deflation and probably agriculturally and pastorally-related disturbances suggests that little *in situ* associations remain among the artifacts, but on the basis of patination and desilicification, little post-Acheulian mixture is evident at the site.

A comparison of the Fjaje collection with the artifacts from Ain el-Assad in eastern Jordan reveals major typological and technological differences. For the most part these differences probably relate to the supposed variation in the environmental situations and consequent different floral and faunal resources to be exploited, as well as differences in the seasonality nature of the occupations. However, variations in locally available lithic resources may also have played an important part in the observed variations.

The inevitable cliches concerning necessary additional research to resolve the questions and substantiate or refute tentative answers to a variety of archaeological problems are a standard closing in many articles involving paleolithic prehistory. But in no case is this appeal more important than in the investigation of such a poorly investigated area as Jordan.

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Gary O. Rollefson