E-87-2: A Site in Lake-Margin Deposits of the Green Phase

by Christopher L. Hill

INTRODUCTION

In the northern part of Section BT-B of Bir Tarfawi, east of and adjacent to the plateau escarpment, there is a large (ca. 200 x 200 m) remnant of lacustrine and aeolian sediments. Site E-87-2 is on the southwestern edge of these sediments (Fig. 30.1). The Middle Paleolithic sites associated with the Sand Pan (E-86-1, E-87-1 and E-87-4) are west of the edge of the escarpment, while to the south and east is the sedimentary remnant containing E-87-3 (Fig. 3.23).

The surface scatter at the site was first seen in 1986 when stratigraphic trenches were placed nearby to investigate the geological context of E-86-1. The surface scatter consisted of artifacts in various stages of weathering on top of and within sandy sediments on a gentle slope east of the plateau escarpment. Based on the stratigraphic trenches and the surficial geology, it was determined that the artifacts lay on the margin of a Pleistocene pond or lake which post-dated the sediments containing the Sand Pan sites. The site represents a Middle Paleolithic occupation on the western edge of a small lake, but the spatial and compositional patterns of the artifacts appear to be at least partially a product of redepositional processes.

COLLECTION AND EXCAVATION METHODS

The investigation of E-87-2 was conducted during the 1987 season, using the standard collection and excavation procedures of the Expedition. The axes of the grid were oriented northwest-southeast and southwest-northeast, so that the southeastern profile (along the line 20/21; Fig. 30.2) was essentially perpendicular to the "strike" of the basin margin and the angle of the inclined bedding planes was close to the true "dip".

Fig. 30.1 shows the locations of the surface scatter and the excavated portion of E-87-2. Excavation was begun where the surface scatter disappeared beneath the sediments; the collection includes only material recovered from the excavation and none of the exposed surface artifacts. Excavation followed the zone of artifacts, generally digging into the slope which forms the escarpment. The artifact zone lay within sediments which dipped slightly towards the northeast and were buried by strata which became progressively thicker towards the southwest (towards the edge of the escarpment).

The artifact zone was excavated by trowel in square-meter units. All artifacts found during excavation were identified and mapped. Tools and cores were individually labeled and keyed to the map, while debitage was simply bagged by the square meter. The sediment from each square meter was passed through a 4-mm screen; the provenance of artifacts recovered on the screens is thus known only to the square meter.

After the richest part of the artifact zone had been excavated, a stratigraphic trench was dug on the southeastern side of the grid to determine the vertical range of the artifacts. The trench was excavated into the top part of the sands beneath the densest portion of the artifact zone. The few artifacts recovered from the trench were collected and their locations recorded on a separate distribution map.

Two other sets of stratigraphic trenches were dug in the vicinity of the site under the direction of Dr. R. Schild, and document the lithostratigraphic context of the artifacts at E-87-2 (Chs. 3 and 4, this volume).

SEDIMENTOLOGICAL CONTEXT OF THE ARTIFACTS

The lithostratigraphic and sedimentological settings of E-87-2 have been described and interpreted elsewhere (Chs. 3 and 4, this volume). The sedimentological sequence is shown in Fig. 30.2. The surface artifacts were found on and embedded in sands on a northeast-slope east of the plateau escarpment (Fig. 30.1). Excavation showed that the buried artifacts occurred within three related sets of sandy deposits: along the truncations within Unit 4, on the surface of the contact between Units 4 and 5, and within the basal section of Unit 5 (bottom of 5a).

The top of the sediments just below the earliest artifacts at E-87-2 (Unit 3 in Fig. 30.2) contains cemented cylinders of sand thought to be either rhizoconcretions (part...
Figure 30.1. Map of E-87-2 and environs.
of the root zone of a stabilized land surface), or the filled-in tracks of organisms burrowing in water-saturated sediments in or near the edge of a water-filled basin. Above this are the sandy sediments of Unit 4, where the artifacts occur primarily on the surfaces of truncation planes and are associated with thin laminae of particles that are coarser than is usual for Unit 4. The truncation planes are nearly horizontal or dip very slightly towards the center of the basin.

The landscape setting associated with these surfaces was probably the gently sloping to near-horizontal beach and shore zone of a shallow lake lying to the northwest. The artifacts could have been deposited as part of a lake-edge occupation, or could have been washed in from an original position upslope. If artifacts were eroded and redeposited closer to the center of the basin, some size-sorting might occur: larger, heavier artifacts might not have been eroded or have been redeposited closer to the point of original deposition, while smaller, lighter artifacts would have been more easily eroded and moved farther away. In addition, the presence of rhizocorrosions, although not common enough to have destroyed the primary bedding structures, indicates that artifacts could have been moved by post-depositional bioturbation. This probably would have been mostly vertical movement of some of the smaller artifacts.

The densest concentration of artifacts occurs along the contact between Units 4 and 5, on the upper surface of the Unit 4 sands; rare artifacts also occur in the basal 5 cm of Unit 5. Like the truncation surfaces within Unit 4, the upper surface of Unit 4 is nearly horizontal or dips very gently towards the center of the basin. Above this and closer to the edge of the basin, rare artifacts occur in the laminated sands dipping towards the basin. Rhizoliths are more common in the basal section of Unit 5 than in Unit 4, but they have not destroyed the primary bedding.

Closer to the center of the basin, there is no primary bedding in the sediments directly above the contact between Units 4 and 5, but there are numbers of rhizoliths and carbonate-cemented concretions.

The contact between Units 4 and 5 marks a change in the local depositional setting. The dense concentration of artifacts along the upper surface of Unit 4 could represent an occupation at the edge of the basin immediately before an increase in the size of the lake. Like the artifacts found in Unit 4, they could represent occupation on this surface, or occupation upslope and redeposition on this surface (or a combination of both). The artifacts in the laminated beds at the base of Unit 5 also could have been deposited in either or both of these ways. There may have been some horizontal movement of artifacts because of bioturbation, especially closer to the center of the basin.

**HORIZONTAL DISTRIBUTION OF THE ARTIFACTS**

Figures 30.3-30.5 show the horizontal distribution of all artifacts in the artifact zone, based on the total artifact content of each square meter. They will be used to examine whether there is any patterning related to artifact-size, and whether there is any patterning related to the typological or technological classification of the artifacts. The system of artifact analyses (Ch. 19, this volume) is relevant to both of these issues since it is morphological (typological), metrical, and technological. However, artifact categories based on attributes of size, typology and technology carry implications for all three systems, which complicates the interpretation of horizontal distribution patterns.
Figure 30.3. E-87-2, contour diagram of density per m² of (A) primary flakes, (B) Levallois core-preparation flakes, (C) unidentifiable flakes, (D) chips, and (E) all debitage, and of (F) the proportions of chips:debitage and of (unidentifiable+Levallois preparation flakes):debitage.
Fig. 30.4. E-87-2, contour diagram of density per m² of (A) Levallois cores, (B) Levallois flakes and (C) denticulates.

The debitage can be divided into two general classes, flakes and chips. Most of the flakes at E-87-2 are unidentifiable flakes, Levallois core-preparation flakes, or primary flakes. This classification is based on core-reduction sequences, but also has implications for size-sorting.
Fig. 30.3D shows the distribution of the chips, which are the smallest artifacts (<15 mm). There are three concentrations with densities of >800 per m² in the eastern central part of the site inside a larger concentration with densities of >400 per m². A smaller concentration of chips with densities of >400 per m² occurs on the northern side of the site.

The distributions of the three most common types of unretouched flakes are shown in Fig. 30.3A-C. Levallois core-preparation flakes are significantly smaller than primary flakes (see below), but all these types have dimensions of >20 mm. The three flake-groups share two areas of high concentration in the central part of the site; there is also an isolated concentration (Square K25), which has higher frequencies of unidentified and Levallois core-preparation flakes, but very few primary flakes.

In general, the distribution of the debitage shows the smallest artifacts concentrated closer to the center of the lake basin, while larger forms are concentrated closer to the basin-edge. Fig. 30.3F shows two clusters, based on the relative frequency of chips to all debitage and of unidentified and Levallois core-preparation flakes to all debitage. In the concentration on the eastern side of the site, closer to the center of the basin, chips make up >90% of the debitage (the 80% chip-contour is also shown). There are five small concentrations in the western part of the site, closer to the basin-edge, where unidentified and Levallois core-preparation flakes form >60% of the debitage (the 50% flake-contour is also shown).

Cores (Fig. 30.5A) represent a very small part of the collection, but are potentially informative because they are the largest artifacts and because they represent a specific aspect of the lithic reduction sequence. Over 90% of the identifiable cores are Levallois, and their horizontal distribution is shown in Fig. 30.4A. The Levallois cores are mostly on the western side of the site. Four squares had three or more Levallois cores (one, M29, contained six Levallois and one unidentifiable cores). Four other squares had four or five cores, two to four of which are Levallois cores (M31, J25, J30, and F30); three of these squares are in the extreme northwest of the site. The highest density of cores is closer to the edge of the basin than the flakes, and there are fewer cores associated with the concentrations of primary flakes and Levallois core-preparation flakes. The lowest density of cores (0-2 cores per m²) coincides with the highest concentrations of chips, near the center of the basin.

The two most frequent classes of tools, Levallois flakes and denticulates (including convergent forms), are smaller than cores but larger than unretouched non-Levallois flakes and chips. Their distributions are shown in Fig. 30.4B and C, where the densest concentrations are on the western side of the site. The highest concentration of Levallois flakes lies between the four squares with the highest concentration of Levallois cores (Fig. 30.4A and B). Two of the concentrations of denticulates are also associated with the core concentrations, but Square H24, also with high numbers of denticulates, is associated with the high concentration of debitage in that vicinity (Figs. 30.3E, 30.4C and 30.5C).

The horizontal and vertical distributions of artifacts suggest two possible explanations for the archaeological record at E-87-2; the differences between the two depend on the degree to which sedimentological processes have affected the final nature of that record. First, the artifacts in Unit 4 and those on the upper surface of Unit 4 or within the base of Unit 5 might represent two distinct occupations, separated stratigraphically and with taxonomically different artifacts. In this scenario, sedimentological processes could have acted upon both artifact sets independently, but not affected the taxonomic integrity of either.

Alternatively, sedimentary processes could have played a major role in defining the ultimate character of the archaeological record. In this explanation, the artifacts are derived from several occupations along the edge of the basin, but the occupation surfaces have been altered by sedimentological processes affecting the artifacts. The artifact set dominated by smaller pieces on top of Unit 4 and within Unit 5 may be derived from an upslope occupation associated with the truncated surfaces within Unit 4, which would have originally contained the normal range of artifacts. If up-slope material were eroded and redeposited on the uneroded downslope section of Unit 4, the horizontal distribution ought to reflect a concentration of artifacts by weight (and, thus, size). The expected scatter would, in fact, resemble the observed scatter (Figs. 30.3 and 30.4), with larger artifacts upslope and smaller artifacts downslope.

There is some indication that these distributions may still reflect some patterns which can be related to human behavior, especially in relation to the reduction of Levallois cores. Most cores and formal tools occur together, away from the center of the lake margin, and tend to be associated with some of the higher concentrations of primary flakes and Levallois core-preparation flakes.

**ARTIFACTS**

The artifacts from E-87-2 were divided into debitage, cores, and formal tools, using standardized procedures based on metrical, typological and technological attributes (Ch. 19, this volume). The collection includes 53,156 artifacts; most of these are various forms of debitage; formal tools and cores together constitute slightly more than 1% of the collection. Almost all the artifacts are quartzite sandstone (a quartzite); a few pieces are sandstone or quartz.
TABLE 30.1
E-87-2. Absolute and Percentage Frequencies of Debitage-Types

<table>
<thead>
<tr>
<th>Debitage-Types</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary flake</td>
<td>1061</td>
<td>6.5</td>
</tr>
<tr>
<td>Primary blade</td>
<td>3</td>
<td>0.2</td>
</tr>
<tr>
<td>Flake from single platform core</td>
<td>3</td>
<td>0.2</td>
</tr>
<tr>
<td>Flake from opposed platform core</td>
<td>2</td>
<td>0.2</td>
</tr>
<tr>
<td>Unidentifiable flake</td>
<td>9008</td>
<td>55.4</td>
</tr>
<tr>
<td>Blade from single platform core</td>
<td>8</td>
<td>0.5</td>
</tr>
<tr>
<td>Blade from opposed platform core</td>
<td>2</td>
<td>0.1</td>
</tr>
<tr>
<td>Unidentifiable blade</td>
<td>109</td>
<td>0.7</td>
</tr>
<tr>
<td>Levallois core-preparation flake</td>
<td>6018</td>
<td>37.0</td>
</tr>
<tr>
<td>Early-stage core-preparation flake</td>
<td>51</td>
<td>0.3</td>
</tr>
<tr>
<td>Core-trimming flake</td>
<td>1</td>
<td>0.01</td>
</tr>
<tr>
<td>Core-trimming element</td>
<td>2</td>
<td>0.01</td>
</tr>
<tr>
<td>Subtotal</td>
<td>16,268</td>
<td>99.9</td>
</tr>
<tr>
<td>Chip or chunk</td>
<td>36,165</td>
<td>68.8</td>
</tr>
<tr>
<td>Notch spall</td>
<td>134</td>
<td>0.3</td>
</tr>
<tr>
<td>Total</td>
<td>52,567</td>
<td>100</td>
</tr>
</tbody>
</table>

TABLE 30.2
E-87-2. Metrical Data on the Debitage
(measurements in mm)

<table>
<thead>
<tr>
<th>Debitage-Types</th>
<th>Mean</th>
<th>St. Dev</th>
<th>Range</th>
<th>Range Mode</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>29.1</td>
<td>10.36</td>
<td>12-105</td>
<td>21-25</td>
<td>454 1879</td>
</tr>
<tr>
<td>Width</td>
<td>25.7</td>
<td>8.81</td>
<td>8-76</td>
<td>21-25</td>
<td>471 1879</td>
</tr>
<tr>
<td>Thickness</td>
<td>6.0</td>
<td>3.27</td>
<td>3-39</td>
<td>1-5</td>
<td>1061 1879</td>
</tr>
<tr>
<td>L/W ratio</td>
<td>1.2</td>
<td>0.42</td>
<td>4-0.9</td>
<td>0.9-1.1</td>
<td>479 1879</td>
</tr>
</tbody>
</table>

DEBITAGE

Table 30.1 presents the absolute and percentage frequencies of debitage-types and Table 30.2 summarizes the metrical data for all measured debitage.

Primary blanks (or flakes) are the second most frequent identifiable flake-type; almost all (98.9%) of them are quartzitic sandstone, and the rest are sandstone. Primary flakes have mean dimensions of 33.4 x 28.1 x 9.0 mm, with a mean length:width ratio of 1.3; secondary flakes have mean dimensions of 32.7 x 28.0 x 7.2 mm, with a length:width ratio of 1.2; and tertiary flakes have mean dimensions of 27.4 x 24.6 x 5.0 mm with a mean length:width ratio of 1.2. Primary flakes are not significantly different from secondary flakes in length, width or length:width ratio (p=0.05), but are significantly thicker (p<0.001). They are significantly larger than tertiary and Levallois preparation flakes in all dimensions and in length:width ratio (p=0.001). Although no significant difference in size (p=0.05) exists between the widths, primary flakes are significantly shorter, thinner and have a smaller length:width ratio than core-trimming elements (p=0.001).

Over 69% of the flakes are tertiary and some 17% are secondary. The secondary flakes are significantly larger in all dimensions than the tertiary (p<0.001) and have a higher length:width ratio (p<0.05). All the secondary and >99% of the tertiary flakes are quartzitic sandstone; there are a few tertiary flakes of quartz.

The most common identifiable platforms on primary flakes are lisse (40%), followed by cortical (32%) and lisse+cortical (21%); dihedral platforms constitute about 6%, while pointed, straight faceted and convex faceted platforms are each <1%. Secondary flakes have mostly lisse platforms (62%) with equal numbers of lisse+cortical and dihedral (12% each), and fewer cortical platforms (5%); pointed, straight faceted and convex faceted platforms are each <3% of secondary flakes. Tertiary flakes are also dominated by lisse platforms (76%); dihedral platforms are the second most common type (14%, which is similar to their frequency on secondary flakes); convex faceted (4.1%), straight faceted (2.8%) and pointed (1.7%) platforms occur in slightly higher relative frequencies; there are rare lisse+cortical and chapeau de gendarme platforms on tertiary flakes.

Overall, lisse platforms are the most common type in the E-87-2 debitage, accounting for >69% of the identifiable platforms. Dihedral platforms (12.8%) are fairly common, followed by cortical and lisse+cortical platforms each at around 5%. Faceted platforms also make up about 6% of the platforms, of which 2.8% are straight and 3.3% convex. Pointed platforms are >1% and chapeau de gendarme <1% of the identifiable platforms.

Flakes from single and opposed platform cores are a very minor constituent of the debitage. They may actually be flakes from Levallois cores, removed at an early stage in the reduction sequence (cf. Chmielewski 1968: 136). Of the identifiable platforms, five are lisse and one is cortical.

About 11% of all debitage, or 83% of the identifiable flakes, are Levallois core-preparation flakes. Their mean dimensions are 28.1 x 25.2 x 5.3 mm, with a length:width ratio of 1.2. They are significantly smaller in all dimensions and have a lower length:width ratio than primary flakes (p<0.001); they are also significantly smaller in length, width and thickness than core-trimming elements (p<0.05). Over 81% of the Levallois core-preparation flakes are tertiary, slightly less than 19% are secondary, and there are rare primary Levallois core-preparation flakes. Of the identifiable platforms, >73% are lisse, 14% are dihedral, while cortical, lisse+cortical, pointed, straight faceted, convex faceted and chapeau de gendarme platforms are each <4%.

Pieces which might be Levallois preparation or bifacial trimming flakes, early-stage core-preparation flakes, other core-trimming elements and undifferentiated core-trimming elements together form <2% of identifiable debitage,
TABLE 30.3
E-87-2, Absolute and Percentage Frequencies of Core-Types

<table>
<thead>
<tr>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single platform</td>
<td>1</td>
</tr>
<tr>
<td>Ninety-degree</td>
<td>2</td>
</tr>
<tr>
<td>Levallois</td>
<td>70</td>
</tr>
<tr>
<td>Levallois on a flake</td>
<td>20</td>
</tr>
<tr>
<td>Discoidal</td>
<td>1</td>
</tr>
<tr>
<td>Subtotal</td>
<td>94</td>
</tr>
<tr>
<td>Fragment or unid.</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>111</td>
</tr>
</tbody>
</table>

excluding chips and chunks. The sizes of core-trimming elements have been compared with those of otherdebitage groups above. Most core-trimming elements are secondary (72.7%) or tertiary (22.7%); one is primary (4.5%).

CORES
There are 111 cores from E-87-2, constituting about 0.2% of the total collection. Table 30.3 shows the frequencies of the various types of cores. Almost all are Levallois; single platform, ninety-degree and discoidal cores occur in low frequencies. Metrical data for all measured cores are presented in Table 30.4. Except for one Levallois flake core of quartz, all cores are quartzitic sandstone.

Lisse platforms occur on all the types of cores represented, while dihedral and faceted platforms occur only on Levallois cores. Slightly more than half of the cores have lisse platforms, and about 44% have unidentifiable platforms; dihedral and faceted platforms each occur on <4% of the cores. Lisse platforms have mean angles of 83.6°; the two dihedral platforms have a mean angle of 87.0°, and faceted platforms have a mean of 83.3°.

The mean dimensions of the Levallois flake cores (Fig. 30.6: a, d, i; Fig. 30.7: b, c, e; Fig. 30.8: g) are 49.5 x 46.3 x 18.1 mm and their mean platform-angle is 83.0°. Some 66% of the Levallois cores (where a determination can be made) are unstruck and, of those that have been struck, about 42% have hinged. Some 56% of the Levallois cores show some preparation, 26% have much preparation, <4% are completely prepared and >11% are not prepared at all.

The discoidal core measures 46 x 48 x 18 mm. There are four platforms, all lisse and one of them hinged. The hinged platform has an angle of 125°, while the other three range from 78° to 81°. The core is partially prepared.

The single platform core measures 60 x 54 x 33 mm; the platform is lisse at an angle of 88°. The core has some preparation but retains cortex on its base.

One ninety-degree core measures 36 x 25 x 16 mm and has platform-angles of 78° and 87°. The second has dimensions of 42 x 45 x 33 mm, with platform-angles of 78° and 90°. All platforms are lisse and both cores have some preparation.

TOOLS
The inventory of formal tools from E-87-2 is given in Table 30.5. The mean dimensions for all tools are: length - 46.4 mm (standard deviation: 12.27 mm, n=187); width - 37.2 mm (standard deviation: 10.73 mm, n=346); thickness - 8.7 mm (standard deviation: 3.33 mm, n=458); the mean length:width ratio is 1.2 (standard deviation: 0.36, n=167). Except for one of sandstone, all the tools are quartzitic sandstone.

The blanks used for tools are overwhelmingly Levallois; besides the 184 unretouched Levallois pieces, 220 of the retouched tools are on Levallois flakes; other blank types each make up <4% of the tools.

Levallois Pieces
About 40% of the tools from E-87-2 are Levallois pieces. Metrical data for them are given in Table 30.6.

Typical Levallois Flakes (Type 1). Of the identifiable platforms, about 51% are lisse, about 24% are dihedral, and about 18% are convex faceted and <5% are straight faceted (Fig. 30.6: j; Fig. 30.7: a; Fig. 30.9: e, h).

Atypical Levallois Flakes (Type 2). Over 64% of the platforms are lisse, >16% are dihedral, and about 14% are convex faceted.

Typical Levallois Points (Type 3). The illustrated piece (Fig. 30.8: j) was found embedded in sediments exposed on the surface and has been weathered, probably by aeolian abrasion.

Sidescrapers
The mean size of all sidescrapers is 50.5 x 40.9 x 9.0 mm; their mean length:width ratio is 1.1.

Single Straight Sidescrapers (Type 9). Of the two unbroken pieces, one measures 40 x 41 x 10 mm (Fig. 30.6: c) and the other 54 x 38 x 14 mm. The mean width for the single straight sidescrapers is 36.2 mm and the mean thickness is 8.8 mm.

Twelve are on Levallois flakes, two are on tertiary flakes, and one is secondary; all have obverse retouch. Nine have retouch on the sinister side, five on the dexter side and one is the sinister side and distal end. Most of the retouch is along the entire lateral edge (ten); two are retouched on the distal and central portions of the edge; proximal, distal, and the combination of proximal plus central portions account for one each. Scaled retouch is the most common form
Figure 30.6. E-87-2, tools and cores. a, d, i, Levallois Cores; b, h, Tayac points; c, sidescraper; e-g, denticulates; j, Levallois flake.
(seven); six have nibbling retouch and two have stepped retouch. On eight pieces the scraper retouch is 2 mm deep and seven have a depth of 1 mm.

**Single Convex Sidescraper (Type 10).** The single unbroken example measures 62 × 35 × 7 mm; for all members of this type, the mean width is 35.3 mm and the mean thickness is 9.2 mm. All are on Levallois flakes, six retouched on the dexter side and one on the sinister side. Four have retouch on the distal and central portions of the edge (Fig. 30.8: i), two have retouch along the entire edge, and one is retouched on the distal and proximal portions. All the retouch is obverse; five are scaled, one is subparallel and one is nibbling. Four have retouch 1 mm deep and three are 2 mm deep.

**Single Concave Sidescraper (Type 11).** This is a Levallois flake, 46 mm long and 13 mm thick, with 2-mm deep, scaled, obverse retouch on the central and proximal parts of the sinister side.

**Double Straight-Convex Sidescrapers (Type 13).** Both are on Levallois flakes; the unbroken piece measures 69 × 65 × 11 mm. Both have obverse retouch, one scaled (1 mm deep) and one stepped (2 mm deep) along the entire dexter side and distal end.

**Double Concavo-Convex Sidescrapers (Type 17).** Both are Levallois flakes, the whole one measuring 37 × 41 × 9 mm, with 2-mm deep, alternate, scaled, bilateral retouch. The second example is 64 mm long, 7 mm thick, and has obverse stepped retouch along the entire dexter side and the distal end.

**Convergent Straight Sidescraper (Type 18).** Both are Levallois flakes, the unbroken one being 48 × 60 × 10 mm, with bilateral, obverse, stepped retouch.

**Transverse Straight Sidescraper (Type 22).** This is a Levallois flake, measuring 72 × 71 × 8 mm (Fig. 30.9: i), with obverse stepped retouch to a depth of 2 mm on the distal end.
Upper Paleolithic Types

Atypical Endscrapers (Type 31). The mean size of this type is 55.0 x 44.7 x 8.3 mm. All are Levallois flakes with obverse retouch (Fig. 30.9: b, g). Four have retouch only on the distal end, two have retouch on the distal end and dexter side and one has distal and sinister retouch. Six have scaled retouch and one is stepped; six are convex scrapers and one is convex and straight.

Atypical Burins (Type 33). This is a broken Levallois flake, 54 mm long and 9 mm thick, with stepped, inverse retouch on the distal and central parts of the dexter side. The burin is proximal and sinister, and is damaged.

Notched Pieces

Notched Pieces (Type 42). The average dimensions of the notches are 47.5 x 38.2 x 8.5 mm, with a mean length:width ratio of 1.2. Twenty-four have lateral distal notches (Fig. 30.7: f), 20 have central notches and ten have lateral proximal notches. Thirty-three are notched are on the dexter side and 20 on the sinister side. Forty-two of the notches are obverse and 14 are inverse. Forty notches are
Figure 30.8. E-87-2, tools and cores. a, Varium; b, c, Tayac points; d, e, h, denticulates; f, piece with bifacial retouch; g, Levallois core; i, sidescraper; j, Levallois point.
formed by retouch and 14 are single-blow. The others were unidentifiable.

**Denticulates**

*Simple Denticulates (Type 43).* The mean size of simple denticulates is 48.7 x 35.8 x 9.0 mm and their mean length:width ratio is 1.4 (Fig. 30.6: e-g; Fig. 30.8: d, e, h; Fig. 30.9: c). Metrical data for all denticulates combined are given in Table 30.7. A hundred and five simple denticulates are on Levallois flakes, three are on primary, 12 are on secondary, seven are on tertiary flakes, one is on a chunk and 15 could not be identified. Thirty-one are sinister, 42 are dexter, 27 are bilateral, six are denticulated on the distal end, two on the proximal end, three are sinister and distal, six are dexter and distal, one is bilateral and distal, and 25 could not be identified. A hundred pieces have obverse denticulations, 13 are alternating, 12 are inverse, nine are
TABLE 30.7
E-87-2. Metrical Data on Denticulates
(measurements in mm)

<table>
<thead>
<tr>
<th>Mean</th>
<th>St. Dev</th>
<th>Range</th>
<th>Modal No. in Sample</th>
<th>Range</th>
<th>Mode</th>
<th>Size</th>
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</thead>
<tbody>
<tr>
<td>Length</td>
<td>48.5</td>
<td>11.52</td>
<td>28-75</td>
<td>36-40</td>
<td>9</td>
<td>46</td>
</tr>
<tr>
<td>Width</td>
<td>35.6</td>
<td>10.33</td>
<td>14-62</td>
<td>36-40</td>
<td>26</td>
<td>107</td>
</tr>
<tr>
<td>Thickness</td>
<td>9.2</td>
<td>3.52</td>
<td>3-21</td>
<td>6-10</td>
<td>79</td>
<td>169</td>
</tr>
<tr>
<td>L:W ratio</td>
<td>1.3</td>
<td>0.61</td>
<td>0.5-3.7</td>
<td>1.1-1.4</td>
<td>12</td>
<td>133</td>
</tr>
<tr>
<td>Denticulated edge</td>
<td>32.1</td>
<td>13.80</td>
<td>5-130</td>
<td>26-30</td>
<td>40</td>
<td>169</td>
</tr>
<tr>
<td>Longest denticulation</td>
<td>8.5</td>
<td>5.84</td>
<td>3-60</td>
<td>6-10</td>
<td>76</td>
<td>169</td>
</tr>
</tbody>
</table>

1. Maximum length of the denticulated part of the edge
2. Length of largest individual denticulation

alternate, four are unifacial and four could not be identified.
Denticulations are most often along the entire edge (48), 15
are on the distal part, 12 on the central part and two on the
proximal part; one is denticulated on the distal and proximal
parts of the lateral edge, 21 are distal and central, five are
central and proximal, three are along the whole of one edge
and the distal part of the other, and three are along the
whole of one edge and the central part of the other.

Tayac Points (Type 51). These include both Tayac
points and convergent denticulates. All are on Levallois
flakes (Fig. 30.6: b, h; Fig. 30.8: b, c; Fig. 30.9: a, d); their
mean size is 47.7 x 34.8 x 9.9 mm, with a mean
length:width ratio of 1.2. Twenty-four are bilateral and four
are denticulated along the dexter edge and the distal end.
Twenty-three are denticulated along the whole of both
des; four along the whole of one edge and part (three
distal and one proximal) of the other; the last piece is
denticulated along the distal part of one edge and the central
part of the other. Twenty-four are obverse, two are alternate,
one is inverse and one is alternating.

Pieces with Continuous Retouch
The mean size of all pieces with continuous retouch is 47.2
x 36.1 x 9.7 mm; the mean length:width ratio is 1.2.

Pieces with Obverse Retouch (Type 46). Only three are
unbroken. Seven are Levallois flakes, one is a primary flake
and one is a secondary flake. Four have retouch on the
distal end, two have retouch on the sinister side, one is
bilateral, one is dexter and one is sinister side
plus distal end. Most retouch (seven pieces) is
nibbling, one has scaled retouch and the last has
stepped retouch.

Piece with Alternating Retouch (Type 47). This is a
fragment of a secondary flake, 40 mm wide and 12 mm
thick, with stepped alternating retouch on the proximal part
of the dexter side.

Piece with Alternate Retouch (Type 48). A Levallois
flake (57 x 42 x 8 mm) has inverse sinister and obverse
dexter retouch (Fig. 30.7: d).

Piece with Bifacial Retouch (Type 50). This is a
broken Levallois flake, 39 mm wide and 12 mm thick, with
bifacial retouch along the entire dexter side (Fig. 30.8: f).

Other Flake-Tools
Varia (Type 99). A Levallois flake, measuring 44 x 47
x 14 mm (Fig. 30.8: a), has obverse retouch on the dexter
edge (proximal and central parts), while the sinister edge has
steep inverse retouch, similar to a snub-nosed sidescraper.
Five of this type are Levallois flakes, one is primary, one
is tertiary, and one is unidentifiable. Seven have obverse
retouch.

Discussion of the Lithic Artifacts
The artifacts from E-87-2 give some indication of what
stages in the reduction sequence were predominant at the
site, which, in turn, can help to infer what types of human
behavior occurred. In addition, comparison of particular
characteristics with other assemblages, especially the tools,
indicates of the taxonomic status of the assemblage.

In terms of the overall structure (Schild and Wendel
1975), the most prominent artifact category is debitage,
although the collection also contains high numbers of cores
and tools. The high absolute number of artifacts indicates
either a few high-intensity occupations or more frequent
lower-intensity occupations. Since the assemblage is
apparently redeposited, we cannot choose between these
two.

In technological structure, almost 86% of the debitage
(chips, chunks, and unidentifiable flakes) cannot be related
to a particular stage of the knapping sequence. Of the
identifiable debitage, the initial group (primary and early-
stage core-preparation flakes) constitutes about 15%, while
some 83% (Levallois core-preparation flakes) is associated
with preparing Levallois cores. The rest of the debitage is
probably waste derived from the early preparation of cores
or pre-cores, and the final stages in the preparation of
Levallois cores. The presence of notch spalls indicates that
some of the chips can probably be attributed to creating and
rejuvenating retouched tools.

These conjectures are supported by the cores, which are
predominantly Levallois. It is likely that the few cores not
classified as Levallois are early-stage Levallois pre-cores.
For each core, there are about 500 pieces of debitage, of
which two-thirds are chips and one-third are flakes
(including Levallois core-preparation flakes). The
core:debitage ratio thus indicates that the cores were prepared at the site.

A noteworthy aspect of the cores is that most are unstruck and over a third of those that were struck were hinged. When the number of struck and unstruck Levallois cores is compared to the number of Levallois flakes, there are about 24 Levallois flakes per core; that is, there are 3-4 times as many Levallois flakes as would be expected if only the successfully struck cores were used. If the unstruck and struck-but-hinged cores are added, there are about four Levallois flakes per core. The ratio of Levallois flakes:cores indicates two possibilities: either many of the flakes were removed from cores that were taken away from the site or were so reduced that they are not identifiable as cores; or many of the unstruck and struck-but-hinged cores were abandoned after several Levallois flakes had been removed. The near-absence of identifiable core-rejuvenation debitage would indicate that, in the second case, only minimal reshaping was necessary to prepare the cores before removing additional flakes.

Levallois flakes were the most common blanks for retouched tools, but primary, secondary, and tertiary flakes were also used. When the retouched flakes are compared to the larger debitage, they differ in both size and flake-type. In size, Levallois pieces and retouched flakes are significantly larger than measured unretouched flakes. Some 13-15% of unretouched flakes but 2-7% of retouched flakes are primary or secondary; 63% of the unretouched flakes are tertiary, while only 4% of the retouched flakes are tertiary; in contrast, 9% of the unretouched flakes are Levallois, while 87% of retouched flakes are Levallois. It is interesting to note that 72% of the unretouched and 60% of the retouched flakes have no dorsal cortex.

There are few significant differences in size between unretouched Levallois flakes and retouched tools. In length, Levallois pieces do not differ from sidescrapers, Upper Paleolithic types, and notches but this could be related to the number of pieces in the tool-classes. Denticulates are significantly longer than Levallois flakes (p<0.05). In width, there are no significant differences between Levallois pieces and the retouched tool classes. In thickness, the only significant difference (p<0.05) is between Levallois flakes and denticulates, but this could, again, be a function of the low frequencies of other retouched tool classes. There are no significant differences in size between denticulates and sidescrapers, or denticulates and notches.

Most retouched tools are denticulates or notched pieces. The dominance of these two classes is a characteristic of most Middle Paleolithic assemblages from this region. This dominance may indicate that the same kinds of activities occurred at each locality, or that these types of artifacts could be used in a wide variety of ways. One way to evaluate the possible uses of these artifacts is to consider the resources which could have existed in the immediate vicinity during the period of occupation. If the occupations represented by the E-87-2 aggregate were along the margins of a lake, this might indicate that the artifacts were used to obtain or process resources located near the lake, perhaps plants.

Evaluations of the taxonomic status of the collection are based on the predominance of Levallois elements (as debitage, cores, and formal tools), and the relative proportions of certain groups of formal tools. The dominance of the Levallois technique indicates that the assemblage can be considered as a Middle Paleolithic (as defined by Rolland 1981, 1988) assemblage. In typology, it falls into the range of the "Denticulate Middle Paleolithic" with <20% sidescrapers, high percentages of denticulates and always more denticulates than sidescrapers (Marks 1968: 300).

FOSSIL FAUNA FROM E-87-2

Almost all of the faunal remains collected during the excavation of E-87-2 are small splinters and fragments of bone and tooth enamel; the identifications include probable rhinoceros, giraffe and gazelle (Ch. 8, this volume). The relative paucity and the condition of the fossils may be an indication of the taphonomic conditions associated with the site. The remains were probably exposed to weathering and possibly abraded and sorted by lake-margin processes. It cannot be determined whether the fauna is part of the background fauna, which might normally be associated with a lake-margin setting, or was specifically related to human activities at the site. An eggshell fragment was recovered from Square J28 and a fragment of a marine bivalve was found in Square D21.

DeDecker and Williams (Ch. 6, this volume) report that fossil ostracods recovered from a trench close to the center of the basin which contains the site (Tr. 14/87) indicate the presence of a slightly saline to saline lake. The fossil ostracods are reworked, indicating that redeposition was going on only 10 m away from where the E-87-2 artifacts were deposited.

AGE OF E-87-2

The dating of E-87-2 relies on the stratigraphic position of sediments associated with the site and age estimates based on U-series geochronology. Its age relative to the Sand Pan sites is known from a series of trenches connecting the two basins (Figs. 3.27 and 3.30): the basin containing E-87-2 is eroded into, and is therefore later than, the sediments of the Sand Pan, where the sites are dated to about 175-225 ka by amino acid epimerization of eggshells, and 270-110 ka by TL (Chs. 13 and 18, this volume).

There are U-series dates for various sediments in the E-87-2 basin, but all of them are very old or have very large standard deviations (Ch. 11, this volume). The lacustrine sequence of E-87-2 is thought to correlate stratigraphically
with the Green Phase of the East Lake (Ch. 3, this volume), which may date to about 100 ka or possibly somewhat later.

**SUMMARY**

Interpretation of the artifacts at E-87-2 can be based on their typology, technological attributes, paleogeographic setting, and spatial distribution. The assemblage is Middle Paleolithic with a strong emphasis on the Levallois technique. The retouched tools are dominated by denticulates. The artifacts were recovered from sandy sediments which are interpreted as lake-margin deposits.

The spatial distribution indicates that the assemblage has been sorted by size (the smallest artifacts were recovered nearer the center of the basin), so that the distribution does not solely reflect human activities. Nevertheless, some inferences can be made concerning the possible character of the occupations represented by the site. The presence of the artifacts along bedding planes interpreted as surfaces formed in ageomorphic setting associated with the sandy margin of a pond or lake implies that people were using this resource-zone. The density of artifacts (about 425 artifacts per m² of excavation) appears to indicate either intensive long-term or multiple short-term occupations of the lake margin.

**ACKNOWLEDGMENTS**

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