CHIPPED-STONE INDUSTRIES FROM NEOLITHIC LEVELS AT LERNA

THE PRESENT WORK is a description and analysis of chipped-stone industries from the Neolithic levels of the site at Lerna in the Argolid, Greece.[1]

The excavations at Lerna were conducted under the direction of John L. Caskey and were sponsored by the American School of Classical Studies at Athens. Preliminary field reports were published in *Hesperia* in the years 1954–1959; a summary of the sequence of settlements at the site was presented in the foreword to *Lerna*, I, *The Fauna*.[2] The fullest data concerning the Neolithic levels were obtained from the southwestern part of the mound, notably in the section of sediments untouched by subsequent disturbances, Areas JA and JB.[3]

The collection studied comprises 178 chipped-stone artifacts from the Lerna I complex, 172 from Lerna I/II, and 523 from Lerna II. Large numbers of chipped-stone artifacts were registered from a mixed Neolithic–EH II fill, but these have not been analyzed here since, especially in the case of debitage, Neolithic and Bronze Age artifacts could not be separated on the basis of technological or morphological criteria. The analyzed collection corresponding to Lerna I, Lerna I/II, and Lerna II contained

Lerna I: artifacts assigned on the basis of ceramics to the Early Neolithic of the Peloponnese,[4] i.e., dominated by Rainbow Ware.[5]

Lerna I/II: artifacts from transitional levels between Lerna I and Lerna II, some from trenches with intrusions of Middle Neolithic ceramic fragments. Thus the stratigraphic position of this set is uncertain.

Lerna II: materials of two partially overlapping sets, the first consisting of artifacts assigned entirely to the Middle Neolithic of the Peloponnese, with the characteristic "red-slipped and glazed wares",[6] corresponding in part to the so-called Urfirnis ware[7] (with some assigned to a specific period within the phase, some assignable only to the phase in general); the

[1] We were invited to study the material by Dr. Elizabeth C. Banks, to whom the responsibility for publication of the Neolithic chipped stone had been assigned as part of the Lerna Publications Project. Dr. Banks provided travel and *per diem* expenses for our study of the material in the Argos Museum, which took place over a three-week period in May and June, 1992. The primary investigator was Janusz K. Kozłowski, who was assisted in the recording and entering of data in Argos and in Krakow by Dr. Maltgorzata Kaczanowska; Maciej Pawlikowski surveyed the area around Lerna for sources of raw materials. The final phase of the research has been supported by the Polish Scientific Committee and Jagiellonian University (Grant No. 0962/92).

The Illustrations, which show almost all the retouched tools, are grouped on pp. 339–351. Tables 11–33 are on pp. 352–369. A glossary of terms is provided on pp. 371–372.

[2] Caskey 1954, 1955, 1956, 1957, 1958, 1959; *Lerna* I, pp. i–iv.

[3] Caskey 1957, pp. 155–156.

[4] Séfériadès 1993, p. 14.

[5] Caskey 1957, p. 161 and 1960, p. 286.

[6] Caskey 1957, p. 161.

[7] Séfériadès 1993, p. 15.

second set, analyzed only in comparison to the first, is comprised of artifacts from Lerna II supplemented with specimens from trenches that contained intrusive sherds identified as Late Neolithic (IIc), Final Neolithic (IId), or even Early Helladic. Separate stratigraphic units that would correspond to the Late and Final Neolithic could not be distinguished at Lerna. This was stressed by Caskey as representing "a distinct break in the occupation of the site at the end of the Neolithic period."[8]

On the basis of materials from Lerna I and II one can formulate only a very general characterization of the Early and Middle Neolithic lithic industries and a general description of the developmental trends. This is the consequence of two factors: (1) Recording procedures during Caskey's excavations at Lerna were not rigorously standardized, and there was no systematic sieving of excavated sediments. Because of this, the relative quantities of artifacts, particularly of small specimens, obtained in different sectors varied depending, in all likelihood, on the diligence of individual diggers. (2) Since the final study of architecture and pottery has not yet been completed, it was not possible to assign with certainty particular artifacts to their respective lithostratigraphic units or to particular structures.

These factors considerably diminish the value of the analyses we carried out. Moreover, since permission to remove chipped-stone artifacts from Greece had not been requested, we could not carry out mineralogical and geochemical analysis of individual artifacts and organic residues on them, nor could we conduct use-wear analysis using larger magnification with, for example, the scanning electron microscope.

In this article we have been concerned to make the results of our analysis, in spite of a somewhat different theoretical approach, comparable with the results of analyses carried out by Curtis Runnels for the chipped-stone industries from the Early Helladic levels at Lerna and also with the results obtained from the exemplary studies of the Early and Middle Neolithic stone industries from the Argolid and Thessaly by Catherine Perlès.[9]

RAW MATERIALS
(in collaboration with Maciej Pawlikowski)

Macroscopic analysis of the raw materials of the artifacts has enabled us to distinguish, in addition to obsidian, the following raw material types:

Chalcedony

Ch1: various shades of yellow, with intercalations in the form of bands; semitransparent, with silky luster; very good cleavage, uneven fracture

Ch2: dirty pink in color, without intercalations; glassy luster; conchoidal along the fracture; on the edge of one of the artifacts, a trace of melaphyre

Ch3: milky white in color, without intercalations; matt; conchoidal at the fracture, translucent

[8] Caskey 1957, p. 161.

[9] Runnels 1985; Perlès 1987a and 1990b; Binder and Perlès 1990.

Flints

F1: gray flint, without intercalations; silky luster; medium cleavage, conchoidal or uneven along the fracture

F2: brown in color, with secondary siliceous veins; silky luster, opaque; conchoidal fracture

F3: yellowish, without intercalations; opaque, matt; conchoidal fracture

F4: gray, without intercalations; silky luster; fracture conchoidal or even

F5: honey colored, without intercalations; silky luster, opaque; conchoidal fracture

F6: brown, without intercalations; silky luster, opaque; conchoidal fracture

F7: beige gray in color, intercalations in the form of white dots; silky luster, opaque; conchoidal fracture

F8: black flint, without intercalations; silky luster, opaque; conchoidal fracture

Radiolarites

R1: brown red, without intercalations; silky luster, opaque; conchoidal, uneven fracture

R2: brown red, without intercalations; silky luster, opaque; conchoidal fracture

R3: rusty red, with light intercalations, veins in places; opaque; conchoidal fracture

R4: greenish, without intercalations; silky, opaque; poor cleavage

Hornstone

H1: greenish black, without intercalations; glassy luster, opaque; medium cleavage, cracked

In order to identify the sources of raw materials used for lithics at the site of Lerna, a field survey was conducted within a radius of thirty kilometers from Argos. Rock materials in secondary deposits in river beds and regions of primary deposits were explored. Areas covered by the field survey are given in Figure 1. The presence of siliceous raw materials was established in deposits east of Argos in Area 8 and Area 4a.

Siliceous raw materials occur there only in secondary deposits. These are Tertiary and Quaternary gravels with grains up to 10 cm. in size (average size 3–5 cm.) which were carried by a river taking its source near the locality of Andrianopouleika and flowing into the Bay of Argos near Tolo.

The gravels contain flints and chalcedonites, gray, reddish, or brown red in color. The technological properties of these raw materials are good, allowing the production of blades 2–3 cm. long. Most pebbles, however, are strongly weathered and cracked inside. The quantity of good-quality raw material in the gravels can be estimated at about 30 to 40%.

The flints described above are genetically related to Triassic limestones that form the mountains of Arachneo and Mavrovouni. Localization of these flints in primary outcrops of limestone requires further fieldwork, especially the exploration of the river valley intersecting the mountain massifs mentioned above.

Red and brown-red chalcedonites are probably genetically related to siliceous hydrothermal veins, which appear alongside magma intrusions (diabase) in the vicinity of Rousveneika.

Individual flint pebbles were also found in the gravels of the Inachos River (Fig. 1, Area 6a). They constitute about 3 to 5% of the gravel material and are dark gray, strongly weathered, and often covered with a brown patina. Their technological qualities are poor.

Survey within a thirty-kilometer radius from the site of Lerna has established no deposits of radiolarites or hornstone.

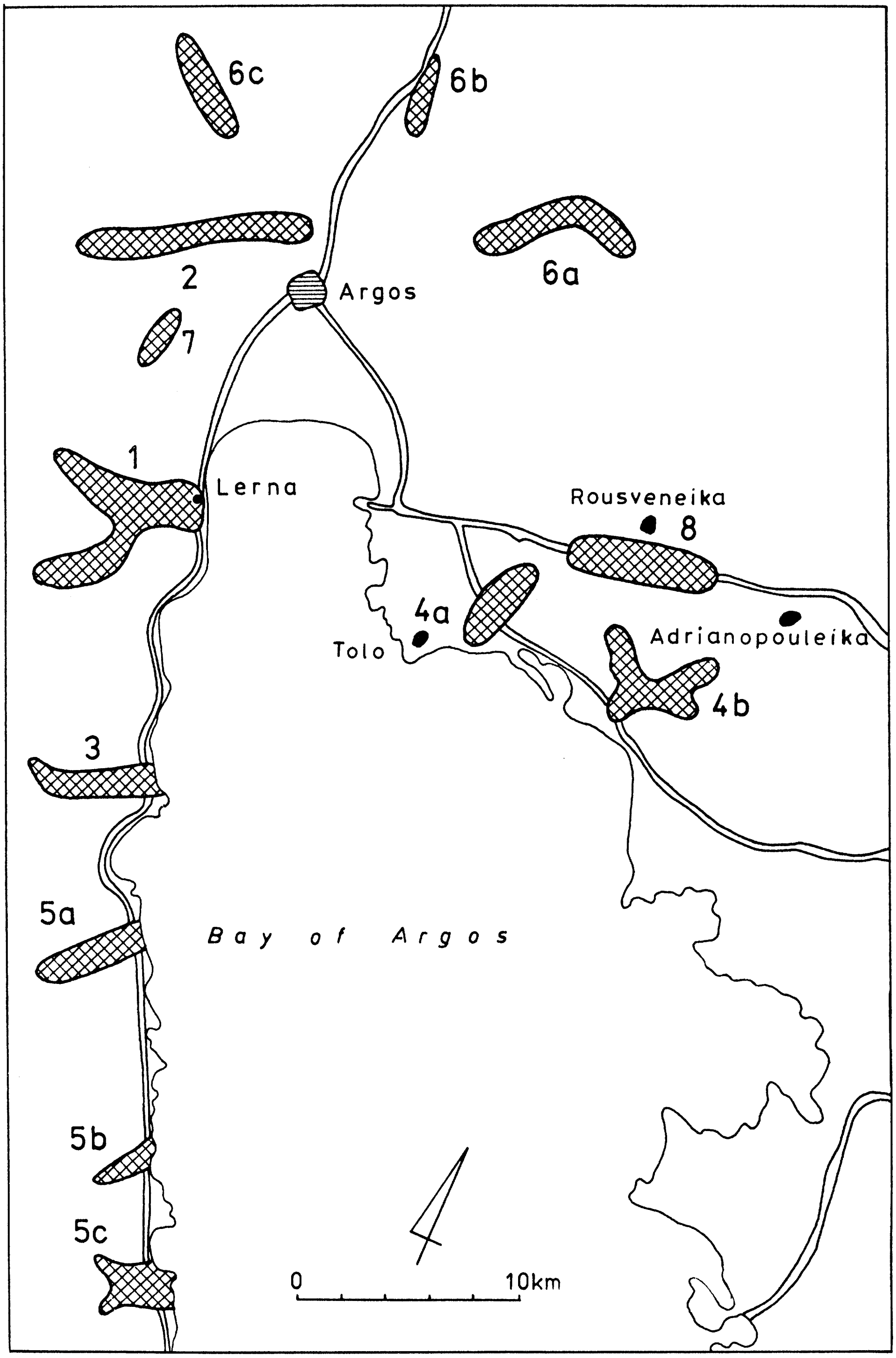


FIG. 1. Areas surveyed for sources of raw materials in the western Argolid

The chalcedony found in the Neolithic levels of the site is different from the chalcedony identified in the surveyed area. Ch1–Ch3 are extralocal raw materials.

Only F1 in the group of flints shows some similarity to the local raw material Gr-Ar-F1, which occurs in Area 8 (Fig. 1). It is gray in color, contains no intercalations, and is semitransparent, with silky luster, good cleavage, and a conchoidal fracture. It is composed of 77% chalcedony, with quartz and small amounts of carbonates; grain fraction is very fine (40 mμ.). The pebbles of this flint occurring in the investigated area are too small to furnish blades as large as those at Lerna II. Primary deposits of this type of flint with concretions larger than river pebbles are probably located outside the investigated area. Artifacts made from F1 are, therefore, more mesolocal than local.

The dominant raw material at Lerna is obsidian. Since analyses of trace elements (OES or instrumental NA analysis) in the obsidian used for the production of the chipped-stone artifacts, or for the age of the obsidian (FT analysis), could not be carried out, the obsidian of the Lerna artifacts could not be compared with obsidian from various sources. However, examination of obsidian artifacts from the Mesolithic and Neolithic layers of the nearby site of Franchthi Cave in the eastern Argolid, using the above-mentioned methods, showed them to have parameters identical with those of obsidian from the island of Melos. It can thus be suggested that the varieties of obsidian used in the Neolithic industries at Lerna originate from this same source. Other Neolithic artifacts from the Aegean also display geochemical similarities to obsidians from the island of Melos. The exceptions are some artifacts from Greek Macedonia that may be of Anatolian origin.[10]

LERNA I

General Structure of the Assemblage

The assemblage contains a total of 178 artifacts. Flakes predominate, accounting for 31.5% of the total, 38.2% when flake fragments are included. Complete blades and blade fragments (26.4%) and splintered pieces (28.5%) come next. Among specimens made of materials other than obsidian (29 specimens, or 16.3%), as many as a third are retouched tools, but there are no splintered pieces. There are also few of the small flakes (less than 1.5 cm. in size), chips, and splinters that come primarily from retouching and splintering (5.6%). Finally, there are individual unworked fragments (2 specimens, one of limestone and the other of radiolarite R1), indeterminate thermal fragments, and a single core of chalcedony (Ill. 1:1). The major technological structure of the assemblage is presented in Table 11.

The raw-material structure of major technological categories of Lerna I artifacts shows that procurement, the location of main production stages, the maintenance of used tools, and ways of discard differed for particular raw materials (Tables 12 and 13).

Obsidian was brought to the site as partially decorticated cores; these were not exhausted in one production episode but were partly used up and then taken away from the site. Hence, there are no cores, although a considerable quantity of flakes is present. The majority of

[10] Renfrew and Aspinall 1990.

these flakes, as we will demonstrate, comes from core rejuvenation. Both flakes and blades of obsidian were transformed into splintered pieces in the last phase of reduction.

In the case of *chalcedony* Ch1 the possibility that prepared blanks were brought to the site cannot be excluded. These blanks were then fully exhausted, and tools made from them were reshaped a number of times. Retouched tools of this raw material are more numerous than are blades and flakes combined (Table 13). A single exhausted microlithic chalcedony Ch1 core, used for the production of bladelets which are not preserved in the collection, represents the residual stage of core exploitation. The presence of this core, however, is not sufficient to prove local production of large blades. In addition, the core was used as an end scraper, which may account for the fact that it was discarded locally.

Some types of *flint* (F4, F5, F8) and *hornstone* (H1) are represented only by individual flakes. This may indicate that discard of artifacts made of these materials was even more limited on the site. Unfortunately, we do not know in what form they circulated.

Fragments of *limestone* and *radiolarite* R1 were not treated or transformed into blanks. Only radiolarite R2 was used for tool production on a small scale. But it is likely that this production took place away from the site.

Cores

The collection from Lerna I contains only one core, a short, conical blade core of chalcedony Ch1 with a circular flaking surface (Ill. 1:1). The present height of the core is 16 mm.; thus in its final stage of exploitation it was used for detaching bladelets. Its height is in distinct contrast to the size of chalcedony blades, which are up to 140 mm. long. The core in question, however, had been shortened by removal of a tablet. The fact that the core was locally discarded is exceptional in the collection. It may be explained by the fact that the exhausted core was used as a scraper for hide, the scraper being made on a small, well-rounded section of the platform edge.

An estimate of the sizes of obsidian cores used for the production of blades larger than the obsidian specimens found at Lerna I is given by the dimensions of a tablet (Fig. 2) detached from the carefully prepared platform of a blade core measuring 85 × 79 mm. It was detached after the angle between the platform and the flaking surface had become larger than 100 degrees, making further detaching of blades from the flaking surface impossible.

Flakes

Forty-nine of the 56 intact flakes from Lerna I are of obsidian. There are only 6 cortical flakes (1 fully cortical specimen, 2 with the distal and 2 with the lateral cortex, and 1 with the distal and lateral cortex). Only 12% of the flakes come from partially decorticated nodules. This indicates that cores were shaped on the site after they had been decorticated elsewhere. The dorsal pattern of flakes (Table 14) shows a predominance of specimens with scars running in one direction (48.2%) and flakes with perpendicular scars (25.0%). In addition, flakes with radial scars (14.3%), flakes with opposing scars (8.9%), and one tablet are present.

If we take into account the equal proportions of platforms formed by a single blow (37.5%) and linear platforms (33.9%), then we may conjecture that these flakes come either from rejuvenation of core platforms and lateral crests or are the product of the splinter

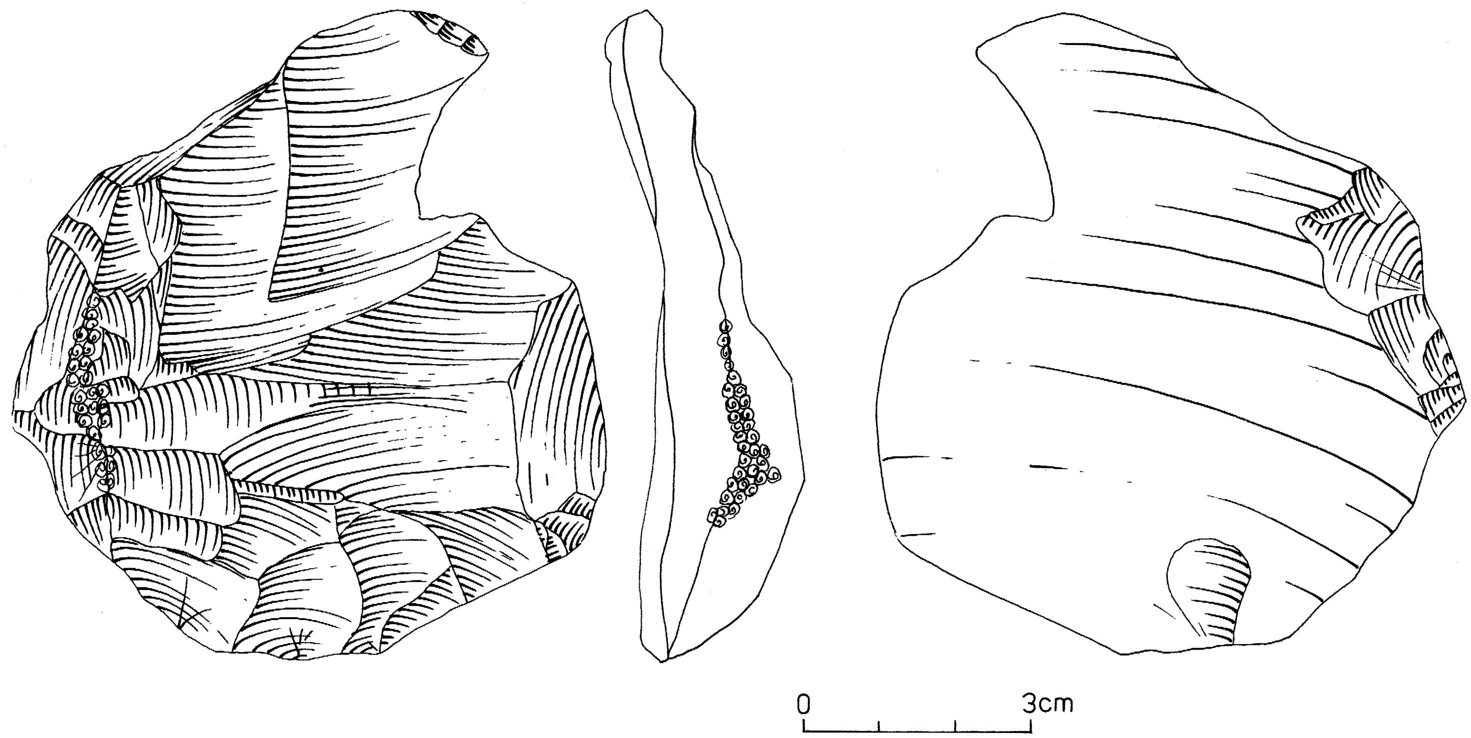


Fig. 2. Lerna I. Large tablet detached from obsidian core

technique (Table 15). Core platforms were rejuvenated by detaching small triangular or subtriangular flakes or by detaching tablets. Some hinged flakes (8.9%) were detached during rejuvenation of platform and flaking surface. Flakes which were detached from lateral crests and platform periphery have had irregularities on the butt edges carefully removed (39.3%).

That direct percussion was used for core rejuvenation is evidenced by the presence of distinct points of percussion, often together with percussion cones (26.8%). This correlation has been experimentally confirmed.[11] A hammerstone was also used in the splinter technique, which produced numerous flakes with linear platforms and bulbar scars (16.1%).

Flake dimensions are given in Tables 1, 2, and 16–18. Cortical-flake size differs very little from that of other flakes (Tables 1 and 2). It is important that the standard deviation of cortical-flake size is much smaller than that of other flakes; moreover, cortical flakes never reach the maximum dimensions of flakes without cortex. This supports the hypothesis that these flakes, too, come from an advanced stage of core reduction and not from core preparation. The length:width ratio is close to 1.0, and the shape of flakes approximates either a square or an isosceles triangle, suggesting that most of these flakes come from the rejuvenation of core platforms and flaking surfaces (Tables 19 and 20).

TABLE 1. Flakes from Lerna I: dimensions

	Mean	Std Dev	Minimum	Maximum	Number
Length	21.30	11.69	10.00	85.00	43
Width	19.48	10.00	9.00	78.00	56
Thickness	4.93	2.73	1.50	19.00	56
Width:Length	0.94	0.36	0.45	1.75	43
Thickness:Width	0.26	0.10	0.10	0.55	56

TABLE 2. Cortical flakes from Lerna I: dimensions

	Mean	Std Dev	Minimum	Maximum	Number
Length	19.33	5.57	10.00	25.00	6
Width	20.33	7.20	13.00	33.00	6
Thickness	4.83	1.60	3.00	7.00	6
Width:Length	1.09	0.34	0.76	1.60	6
Thickness:Width	0.25	0.08	0.15	0.37	6

Flaking angles range from 90 to 100 degrees (72.7% of all flakes), which again confirms the absence of specimens from initial core preparation, for which the angle is, as a rule, larger than 100 degrees.

The small quantity of flakes in other raw materials, in contrast to the predominance of flakes of obsidian, does not allow us to perform a separate attribute analysis for each raw material.

BLADES

Out of the total number of 47 blades there are only 5 complete specimens. Most blades are of obsidian (40), fewer of siliceous rocks (7, including 4 of chalcedony Ch1, one of flint

[11] Pellegrin 1991.

F4, and 2 of burnt flint). The specimens come predominantly from single-platform cores; only one blade is from a double-platform core. There are also two that were detached after crest removal (Table 21).

If one judges by their cross sections (28 trapezoidal, 17 triangular, only 2 multifaceted and irregular) and profiles (42 straight, only 3 convex, 2 twisted), these blades were detached from cores with flat, weakly convex flaking surfaces. The flaking surfaces tended to be rectangular rather than triangular since blades have predominantly parallel sides (32 examples) and only rarely convergent (5 examples) or irregular (9 examples) sides.

Obsidian blades were detached from cores with platforms formed by detaching one large flake or tablet. Hence, blade butts are formed by a single blow (7 specimens). When core platforms were strongly inclined in relation to the flaking surface, linear butts could be formed (7 specimens). Blades from siliceous rocks, on the other hand, were detached from cores with platforms prepared with fine retouching, which is confirmed by the presence of faceted butts (4 specimens; Table 22).

The point of impact can be seen on 11 blades; it is not observable on 14 others. A well-defined bulb is found on 10 blades. Four specimens have no bulb. It should be added that 4 blades show spontaneous bulbar scars. This suggests that for both obsidian and siliceous rocks percussion technique was employed rather than pressure technique. Often, overhangs are carefully removed from the butt edge, which is sometimes abraded (12 specimens). Less frequent is an uneven butt edge with the point of impact located on the protruding interscar ridge (7 specimens). The mean flaking angle of about 90 degrees and the small butts confirm that the soft-hammer technique was used. The mean blade length is 35 mm. (Tables 3 and 23), with a considerable standard deviation (20.33 mm.). The range of blade sizes is fairly broad, from small obsidian bladelets (16 mm.) to large blades made in siliceous rocks (69 mm., exceptionally even as much as 140 mm.). The mean width is 13.62 mm. (with a standard deviation of 5.02 mm.). This relatively small average width is the effect of the presence of narrow obsidian blades. The distribution of width values (Table 24) forms a unimodal, skewed curve with a range of 8 to 14 mm. and a mode between 14 and 16 mm. The average thickness is 3.02 mm. (standard deviation of 1.16 mm.). The values of thickness are distributed fairly uniformly between 1 and 3 mm. (Table 25). The width:thickness ratio is 0.24 and that of width:length is 0.34 (Tables 26 and 27).

TABLE 3. Blades from Lerna I: dimensions

	Mean	Std Dev	Minimum	Maximum	Number
Length	35.00	20.33	16.00	69.00	5
Width	13.62	5.02	5.00	25.00	45
Thickness	3.02	1.16	1.00	7.00	45
Width:Length	0.34	0.07	0.26	0.41	5
Thickness:Width	0.24	0.08	0.12	0.44	45

The frequencies of blade fragments are as follows: 3 distal fragments; 1 distal-mesial fragment (distal parts total 4); 16 mesial fragments; 14 mesial-proximal fragments (proximal parts total 20); 6 proximal fragments.

The distal parts are least numerous (Table 28). They were obtained by simple breaking or by hinged fracture (Table 29). Mesial fragments were obtained by double fracture

(8 specimens), breaking and fracture (5), and double breaking (3); proximal parts, by fracture (11), hinged fracture (6), and only occasionally by breaking (1).

The fact that distal fragments were discovered very rarely suggests that blades were brought to the site with the distal end already removed. This is in agreement with the predominance of straight profiles on preserved blades and the fact that distal ends were separated by intentional fracture. We cannot unequivocally answer the question whether mesial parts were obtained intentionally and used in this form as, for example, inserts for sickles, or whether they, too, were accidentally formed when broken from blades already without their distal ends. Use-wear analysis has not provided a clear answer. Traces of mounting in hafts preserved on proximal parts possibly support a supposition that mesial fragments were broken during use.

Small Flakes and Chips

Small flakes and chips together total ten specimens, i.e., 5.6%. They are sometimes the product of retouching (3), although most often they are the product of the splintered technique (7). All but one are made of obsidian.

Tools

Among the 47 retouched tools, splintered pieces dominate (25). The biggest group is composed of obsidian tools (39), followed by tools of chalcedony Ch1 (7) and one tool of radiolarite R2. In the group of retouched tools (without splintered pieces) obsidian specimens are also most numerous (14), although proportionally the number of tools made in siliceous rocks (8) is higher. There are no specimens of splintered pieces made of siliceous rocks.

In terms of morphology six groups can be distinguished (Table 30):

1. End scrapers (4), represented by two specimens on blades (distal fragments; Ill. 1:2, 3) and two on flakes (Ill. 1:4), including a hyper-microlithic end scraper (Ill. 1:5). One of the blade end scrapers has parallel retouch, the other a lateral notch.

2. Truncations on regular blades (2). One is a distal, the other a proximal fragment. The distal fragment has a semisteep, simple retouch; the proximal part is broken off (Ill. 1:6). The proximal fragment has a notched, inverse retouch; from the notch three flat, dorsal removals, similar to Kostienki knives (see Glossary), have been detached. The edges are irregularly denticulated (Ill. 2:1).

3. Blades with lateral retouch (7). The largest blade (140 mm.) has a discontinuous, irregular, dorsal-ventral retouch. There was probably a pointed tip at the broken distal end (Ill. 1:8). On the left edge there is mainly inverse retouch, while a bilateral, obverse-inverse retouch of the base forms a kind of tang. Another complete blade, also chalcedony Ch1, has inverse retouch on one edge and irregular, notched-denticulated retouch on the other edge (Ill. 1:7). There are two proximal fragments, one with fine, steep retouch on the left edge and the other with fine, steep retouch forming a broad, shallow notch on the edge (Ill. 1:2, 3). One of the two mesial fragments has fine, steep retouch on the left edge (Ill. 2:4), the other flat, marginal retouch of the right edge (Ill. 2:5). The latter specimen has a break in the distal end, and on the dorsal side short pressure scars can be seen extending from this break. A distal fragment has a fine, steep retouch on the left side forming a concave edge (Ill. 2:6). Three more blade fragments (one proximal-mesial and two mesial) belong in this group.

Although it is uncertain whether the retouch is intentional, the fragments show traces of use wear, indicating that they were used as sickle inserts (Ill. 2:7–9). The proximal fragment of a blade was fractured from a proximal notch (Ill. 2:10) and was also used as a sickle insert.

4. Retouched flakes, represented by 2 specimens, one with inverse, distal retouch (Ill. 2:11), the other with a lateral, obverse notch (Ill. 2:12).

5. A lateral burin on a snap made on a splintered piece (Ill. 2:13) and a burin spall of the Corbiac-type burin (see Glossary). The latter specimen has retouch on the distal part, which was earlier than the burin blow, and retouch from the ventral side of the burin spall (Ill. 3:1).

6. A small tanged arrowhead with barbs formed by obverse retouch on a flake (the tip of the arrowhead is located on the proximal part of the flake). Ventral retouch is present only in the notches separating the tang from the barbs (Ill. 3:2).

Three of the end scrapers are obsidian; only the hyper-microlithic specimen is of radiolarite R2. One of the two truncated pieces is of obsidian, the other of chalcedony Ch2. Among retouched blades as many as six specimens are of chalcedony Ch2. Other groups of artifacts are all of obsidian, and all splintered pieces are also of obsidian.

As far as splintered pieces are concerned, complete specimens (14) are mostly on flakes (9). Only two flakes were splintered perpendicular to the axis (i.e., the axis of the splintered piece is perpendicular to the flake axis of force; Ill. 3:3, 4). Other flakes were splintered parallel to the axis (Ill. 3:5–11). Only one splintered piece has four poles (Ill. 3:3). The extent of splintered removals varies as more or less of the original dorsal and ventral surfaces of the flakes is removed.

There are four splintered pieces on blades (Ill. 3:12–15). These are typical bipolar splintered pieces. On two, the detachments are not very extensive (splinter scars are visible only near the distal extremities), while the other two have longer splinter scars covering most of the blade. One of the pieces has lateral notches.

Only one specimen represents a "core"-type splintered piece. It is thicker, made on a chunk. This is also a bipolar piece, with one punctiform pole (Ill. 3:16).

Functional Analysis

Use-wear analysis using magnifications up to ×100 was performed on all the material from Lerna I.[12] When obsidian artifacts were examined, a narrower range of use-wear traces was taken into account than in the case of artifacts made in siliceous rocks, since post-depositional changes, which occur more frequently on obsidian, had to be eliminated. Thus, the interpretation of functions of obsidian artifacts has been based on (a) luminosity of polish; (b) texture of polish (smooth, very smooth, uneven, rough); (c) rounding of the edge ("émoussé", rounded, very rounded); (d) extent of polish. In addition to these features, for artifacts made of siliceous rocks the presence and direction of striations and the presence and shape of microscars have been taken into account.

[12] The choice of this magnification was determined by the fact that we worked on the lithic implements at the Argos Museum, where a metalographic microscope was not available. At the same time, the magnification we used was a compromise between lower-power and high-power techniques. The usefulness of this solution, in view of the fact that results obtained by means of these two techniques are not unequivocal, has been often emphasized in the literature on the subject (cf., e.g., Plisson and Van Gijn 1989).

Interpretation of use-wear traces (Table 4) has been attempted by taking into consideration the results and analysis of experiments carried out by V. E. Schtchelinski,[13] which referred to earlier work by S. A. Semenov.[14] The interpretation of use wear visible on obsidian artifacts, while more difficult, follows the direction already suggested in recent works. Most obsidian artifacts are well preserved and do not show post-depositional modifications on the surface. On some artifacts, however, post-depositional modifications can be identified as occurring naturally, making functional analysis impossible when they were more numerous than were signs of use wear.

Traces of organic residue are present, probably from resins used for mounting tools in hafts. Obsidian artifacts from Lerna are much better preserved than are the obsidian artifacts from the Franchthi Cave, whose functional interpretation turned out to be impossible.[15]

TABLE 4: Percentages of specimens from Lerna I with visible traces of use wear

	Flakes	Blades	Retouched	Splintered
Number of specimens with traces of use wear	22	29	21	17
Total number of specimens	56	45	22	25
Percent of specimens with traces of use wear	39.2%	64.4%	95.5%	68.0%

In agreement with our supposition, retouched tools show the greatest degree of use wear, whereas unretouched blades show the greatest functional differentiation (see Table 31). There is only one large flake (of chalcedony Ch1) which shows traces of use wear: it has a strong silica gloss and rounding on a section of the lateral edge (Fig. 3:1). On the ventral side there are oblique striations and on the dorsal side, triangular microscars that are earlier than the rounding of the lateral edge. This specimen was probably used for planing wood and subsequently as a knife for working hide.[16]

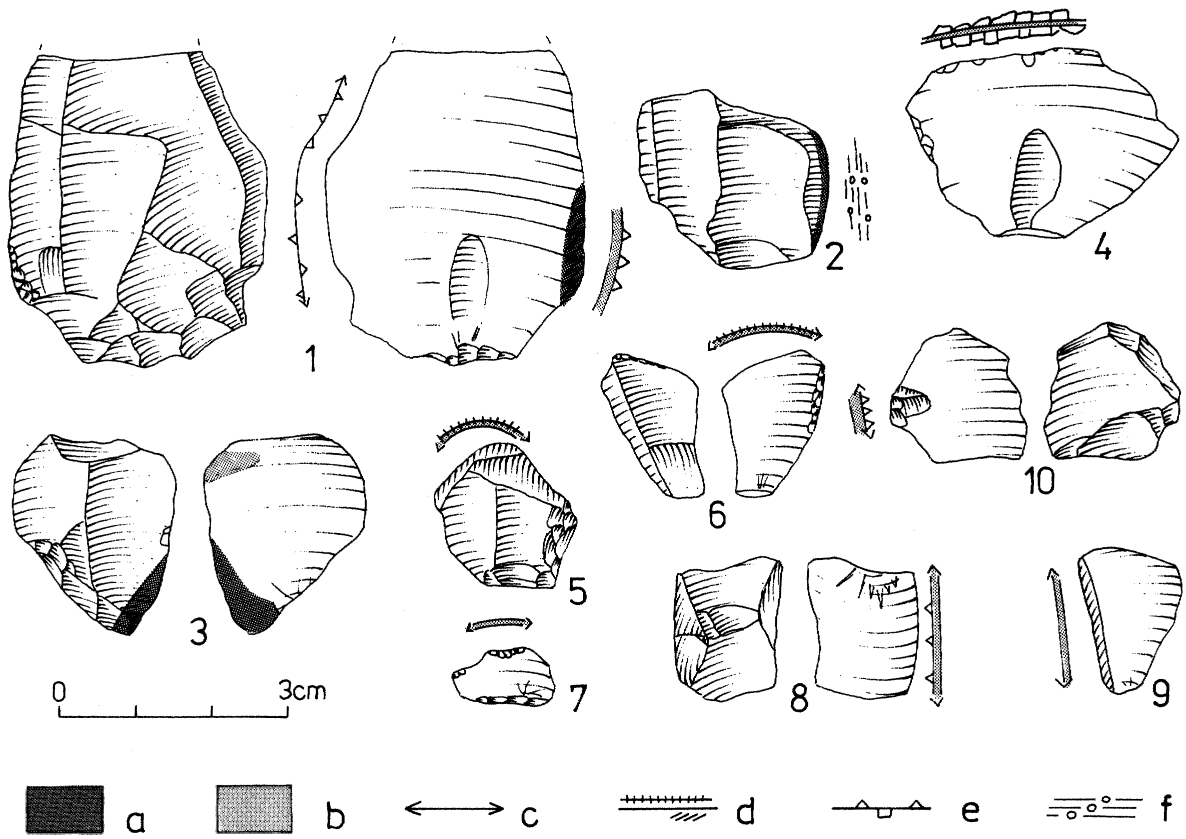
As a rule, medium-size flakes were used as sickle inserts. They were mounted in hafts either parallel to the haft edge (Fig. 3:2) or obliquely (Fig. 3:3). The specimen shown in Figure 3:3 has traces of polish on the ventral side of the distal part, which indicates that it was mounted in a haft. Silica gloss, on the other hand, is located on the proximal part, which protruded from the haft. The distal parts of flakes were also used as scrapers for debarking wood (Fig. 3:4) and possibly as lateral or distal-lateral knives for woodworking. Small flakes functioned as hide scrapers (Fig. 3:5–7), a use evidenced by the rounding of the distal edge, micropolish, and striations perpendicular to the edge. Traces such as polish, rounding, crushing, and triangular microscars, mainly on lateral edges (Fig. 3:8–10), indicate that small flakes were also used for cutting wood. Generally, unretouched flakes were used as knives for working wood, sometimes as hide scrapers, and, in individual cases, as sickle inserts or as tools for debarking wood or for crushing minerals.

[13] Schtchelinski 1983, and esp. Schtchelinski 1994; see also Plisson 1988.

[14] Semenov 1964.

[15] Vaughan 1990.

[16] For principles of this interpretation of use wear, see Schtchelinski 1994, pp. 87–122.

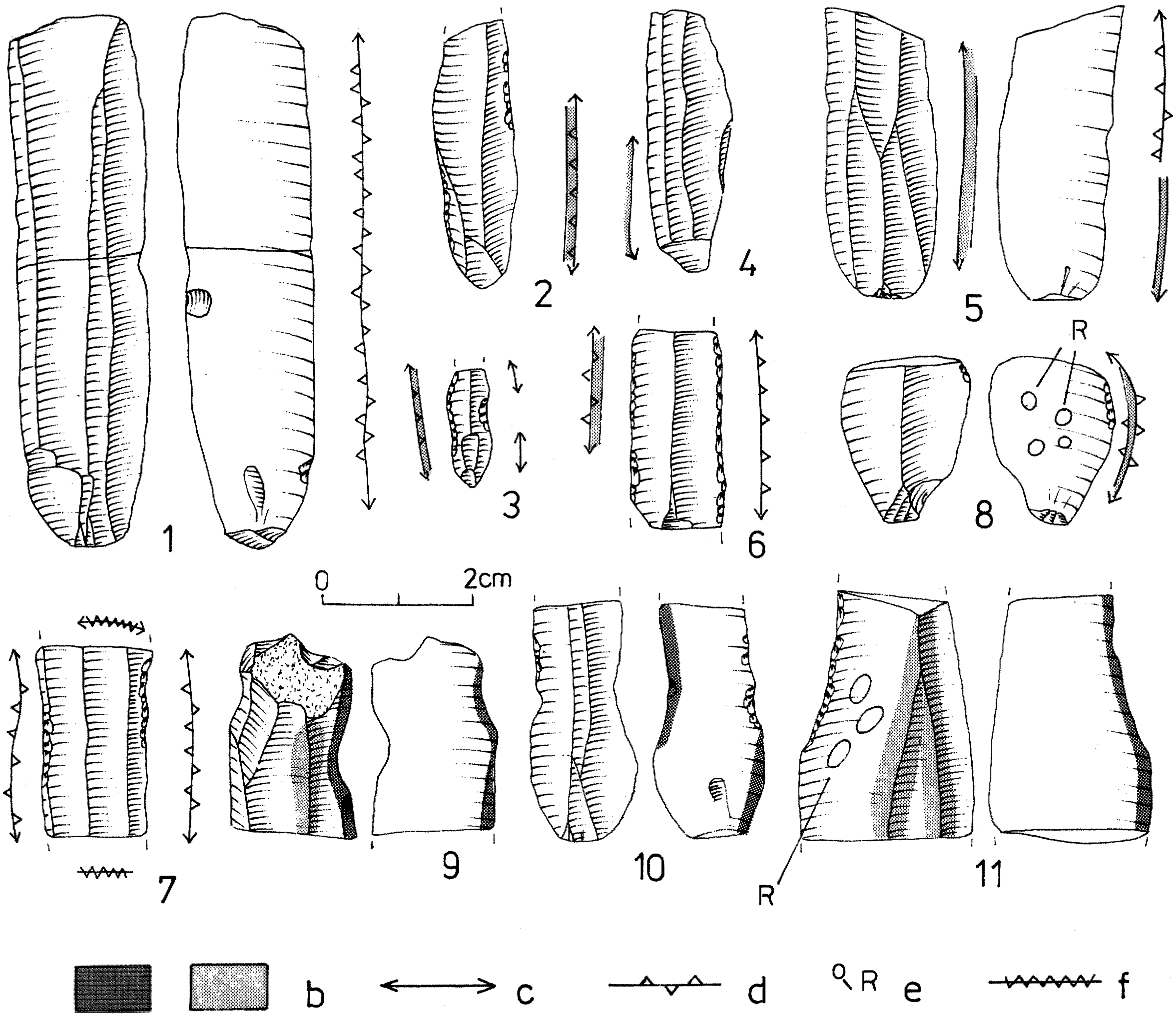


Key to schematic symbols of use wear: a. silica gloss; b. polish; c. edge rounding (arrows indicate abrupt termination of use-wear polish); d. striations (perpendicular or oblique to the edge); e. microscars; f. striations and craterlike depressions

FIG. 3. Lerna I. Unretouched flakes with use wear: chalcedony Ch1 (1); obsidian (2–10)

Blades were used for working wood or bone, primarily for cutting. These specimens typically show micropolish, together with microscars and occasionally crushing, located sometimes on one edge and sometimes on both (Fig. 4:1–6). There are seven obsidian blades and two of siliceous rocks. In some cases, besides use wear on lateral edges, traces of wear are present on transverse fractures. This suggests that, along with cutting functions, blades also may have been used for working wood, using the edges of transverse fractures (Fig. 4:7). On one of these specimens traces of resin or some other organic substance have been preserved on the ventral side (Fig. 4:8); together with arris abrasion on the dorsal side, these traces suggest that the blade was mounted in the haft for a second time, after breaking.

Traces of use wear indicating the use of blades as sickle inserts are present in almost the same proportion as are traces indicating woodworking. Inserts set parallel to the haft edge, which form a continuous cutting edge (Figs. 4:9–11, 5:1), are predominant. These inserts were frequently used on both edges consecutively. A band of silica gloss on the edges

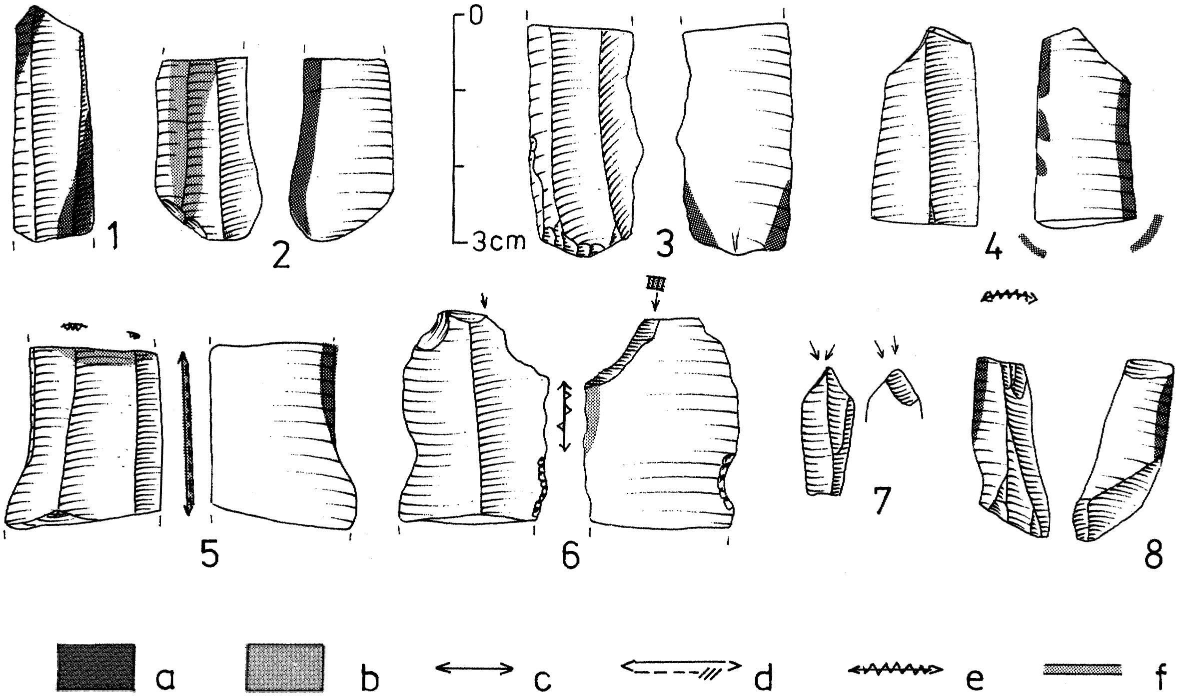


Key to schematic symbols of use wear: a. silica gloss; b. polish; c. edge rounding (arrows indicate abrupt termination to use-wear polish); d. microscars; e. organic residues; f. edge crushing

FIG. 4. Lerna I. Unretouched blades with use wear. Raw materials: obsidian (1–4, 7–11); flint (5, 6)

often occurs together with arris polish, indicating the pressure of the haft. In one case the boundary of the matt surface corresponding to the edge of the haft is oblique, whereas the narrow band of silica gloss is parallel to the edge (Fig. 5:2). This suggests that two methods of mounting inserts in hafts were used simultaneously. Two sickle inserts with oblique bands of silica gloss evidence their oblique placement in hafts similar to that of Karanovo sickles.[17]

[17] Georgiev 1961, pl. IV:9, 10.



Key to schematic symbols of use wear: a. silica gloss; b. polish; c. edge rounding; d. striations and micropolishes; e. edge crushing; f. edge rounding and polishing

FIG. 5. Lerna I. 1–7. Unretouched blades. 8. Fragment of splintered piece with use wear. Raw materials: obsidian (1–4, 6–8); flint (5)

The proximal part of one of these specimens was used twice (Fig. 5:3). A mesial fragment of a blade is noteworthy. It was formed by two breaks and subsequently used twice (on both lateral edges) as a sickle insert (Fig. 5:4).

At least four obsidian knives were used for cutting meat. They are characterized by smoothing of the lateral edge, a special type of micropolish, striations, and occasional rounded microscars. This type of knife may have served as a sickle insert after breaking (see silica gloss on lateral edge, Fig. 5:5). Blades used for other functions (Table 31) are less frequent. The distal part of a blade with a pseudo-burin blow is noteworthy. One lateral edge of this blade shows use wear typical of bone or antler working, similar to traces often found on intentional burins (Fig. 5:6). A spontaneous pseudo-burin scar can also be seen on the proximal part of an obsidian bladelet; these traces resulted from a blow when the bladelet was used as a projectile (Fig. 5:7).

The functions of retouched tools (Table 32) embrace a range of activities similar to that of debitage and blanks. End scrapers were most often used for scraping hide (Ill. 1:2, 3). Truncated pieces were used as sickle inserts mounted in the hafts both parallel and obliquely (Ill. 1:6). Laterally retouched blades show the greatest functional differentiation. They were usually used as sickle inserts after the blade had been fractured (silica gloss covers the fracture). Blade fragments were used as sickle inserts several times (Ill. 2:8–10). One specimen was first used as a knife for cutting meat and then, after breaking, as a sickle insert (Ill. 2:7). The possibility that other blade fragments used as sickle inserts are parts of different tools, and that earlier use wear was obliterated by lateral retouch, cannot be excluded. On individual specimens use-wear traces have been registered, indicating the working of wood, bone, or hide or the cutting of meat.

A retouched flake was used as a sickle insert (Ill. 2:12), a burin was used for incising bone and antler (Ill. 2:13), and a burin spall was used as a hide scraper (Ill. 3:1).

One artifact, morphologically classed as a tanged point, shows no use wear, but a small spontaneous scar at the point (which is the proximal part of a flake) may possibly be regarded as an impact fracture (Ill. 3:2). If so, the point could be defined as an arrowhead.[18]

The functional interpretation of splintered pieces causes the greatest difficulties. Strong crushing on poles of specimens makes their functional interpretation difficult. On the basis of the dimensions of the specimens it would seem that they were used only exceptionally in the production of bladelets or flakes. Their main function must have been the working of relatively hard materials, either by hitting against the opposite pole or by pressing the splinter mounted in the handle as a chisel.[19] The functions registered in Table 31 concern the specimens that were used for more specialized activities (e.g., planing wood, working hide), particularly when one of the poles was more pointed (perforators for hide, drills for wood; Ill. 3:16), only after the poles had been formed. Table 31 also lists the functions of flakes and blades before they were subject to the splintered technique (sickles, scrapers, or knives as identified from traces of use wear observable on the lateral edges of the specimens; Ill. 3:4, 8, 13). Some fragments of splintered pieces bear traces of use wear. Of interest is a fragment of a splintered piece detached using a technique approximating burin technique (this is some kind of a burin spall). The specimen shows use wear (micropolish, microscars), located on the edge of the transverse fracture on the ventral side (Fig. 5:8), of a type typically resulting from incising bone or antler.

Results of the use-wear analysis do not allow us to determine the main function of splintered pieces. In particular, it cannot be determined to what extent the splintered technique of distal or proximal thinning of flakes or blades was a kind of intentional retouch or the effect of the use of these specimens as chisels.[20] It should be emphasized that at Lerna splintered pieces are made on flakes or blades. Only one is made on a chunk, approaching the core. Nonetheless, among small flakes with use wear, there are some that could be a product of the splintered technique (Fig. 3:6, 9, 10).

[18] Fisher, Veming-Hansen, and Rasmussen 1984, p. 25.

[19] Keeley 1980; Caspar 1985, p. 61.

[20] Vaughan 1985 (see description of splintered pieces from Cassegros site in France); Rodriguez Rodriguez 1993, p. 68.

LERNA I/II

General Structure of the Assemblage

The assemblage contains a total of 172 artifacts. Blades predominate (72 specimens, or 41.9%). Nearly all of them are of obsidian (70). Flakes and flake fragments come next (46 specimens, or 26.7%). They, too, are almost all of obsidian. Among tools (45 specimens, or 26.1%) the proportion of raw materials other than obsidian is slightly greater (7 specimens). There are 21 splintered pieces, all of obsidian, just as in the Lerna I set. Small flakes and chips are few (only 7 specimens, 4.1%); there is a core fragment and an unworked fragment of flint F4.

The raw-materials structure of major technological categories (Tables 12 and 13) yields the following conclusions: (1) The predominance of blades and similar indices of retouched tools and flakes suggest that local processing of raw materials was less important than it was in Lerna I, with a larger ratio of blades and, possibly, ready tools being brought to the site. (2) The proportion of siliceous stones is distinctly smaller. They are represented by extralocal flints (Ch1: 2 implements; Ch3: 1 blade; F6: 1 blade and 2 tools made of burnt flint) and mesolocal radiolarites (R1: 1 flake fragment and 1 tool; R2: 1 flake, 2 tools). Thus, whatever the distance traveled, these stones were brought to the site as ready blanks. A curious exception, in view of this, is the presence of an unworked chunk of extralocal F4 flint. Obsidian was partially worked at the site; considering the absence of cores and the type of flakes found, it appears that only partial reduction of cores was carried out at Lerna. These cores were not discarded on site.

Flakes

There are 31 complete flakes and 15 fragments from Lerna I/II, i.e., a total of 46 specimens, almost all of obsidian. There are 6 flakes with cortex: 1 fully cortical, 1 with cortex on the lateral edge, 1 with cortex on the distal part, and 3 with cortex covering less than one fourth of the surface. This situation suggests that the flakes come from nodules already decorticated. The directions of scars are as follows: 12 specimens with parallel scars, 3 specimens with convergent scars, 7 with opposite direction of scars, 7 flakes with perpendicular scars. In addition, there is 1 flake with a fragment of a trimming edge. The dorsal pattern indicates that the flakes come from core rejuvenation in the course of exploitation (Table 14).

As in the Lerna I set, flake platforms were usually formed by a single blow (10 specimens) or are linear (11 specimens) and were only occasionally faceted (4 specimens). Only 1 flake has a cortical platform. This confirms the relation of flakes to core rejuvenation, although flakes with linear platforms may come from splintered pieces. Hinged flakes (8 specimens) were probably formed during platform rejuvenation. Some of the flakes exhibit abrasion of the overhang (6 specimens). The angles are within the range of 90 to 100 degrees (only 4 flakes have an angle of more than 100 degrees).

The platforms are small, and all give indication of direct percussion with a soft hammer. On the other hand, the frequent occurrence of well-defined bulbs (11 specimens) and points of impact (13 specimens) suggests that the direct percussion technique with a hard hammer was also used during core rejuvenation. Flake dimensions are given in Tables 5 and 6.

TABLE 5. Flakes from Lerna I/II: dimensions

	Mean	Std Dev	Minimum	Maximum	Number
Length	21.33	6.70	11.00	38.00	27
Width	17.58	5.00	8.50	28.00	30
Thickness	4.56	2.23	1.50	10.00	31
Width:Length	0.91	0.35	0.43	2.00	27
Thickness:Width	0.27	0.13	0.11	0.62	30

TABLE 6. Cortical flakes from Lerna I/II: dimensions

	Mean	Std Dev	Minimum	Maximum	Number
Length	22.00	10.55	11.00	32.00	4
Width	15.90	7.30	8.50	28.00	5
Thickness	3.25	1.47	1.50	5.00	6
Width:Length	0.81	0.34	0.53	1.27	4
Thickness:Width	0.19	0.05	0.11	0.24	5

BLADES

Out of a total of 72 specimens only 6 blades are complete and 16 almost complete. Obsidian blades predominate (70); only 2 blades are made of siliceous stones (Ch3 and F6). All the blades are decorticated, and the majority come from single-platform cores (62). Five specimens show opposing scars, which suggest that they were obtained from double-platform cores; another 5 blades have partial crests. This is an indication that the crests were removed in several episodes by successively detaching blades. Only the final blades from this operation have been preserved among the recovered finds (Table 21).

As a rule, the blades have a trapezoidal cross section (38 specimens, or 52.8%) or a triangular one (23, or 31.9%), which is similar to the situation in Lerna I. Moreover, the shapes of the blades approximate those of Lerna I: blades with parallel sides dominate (49, or 68.1%), but there is also a considerable proportion of irregular specimens (14, or 19.4%). Blade profiles are basically straight (61, or 84.7%), although specimens with convex profiles are slightly more frequent than in Lerna I (9, or 12.5%).

Blade platforms are most often either formed by a single blow (18, or 25%) or are linear (10, or 13.9%), although in comparison to Lerna I the proportion of faceted platforms is higher (11, or 15.3%). Flaking angles approximate 90 degrees (23 specimens). The point of impact can be seen on 22 platforms, more than in Lerna I. The bulb is well defined in eleven cases and vaguely defined in nine. Bulbar scars (8 specimens) and lip (11 specimens) occur more often than in Lerna I (Table 22). These data suggest that, just as in Lerna I, most blades were detached using direct percussion with a soft hammer. On the other hand, the fact that flaking angles of about 90 degrees are more numerous than are angles larger than 90 degrees might suggest that indirect percussion was used. J. Tixier[21] emphasized

[21] Inizan, Tixier, and Roche 1992, pp. 57–59.

that flaking angle is the main difference between indirect percussion and the soft-hammer technique in blade series. On the other hand, greater frequency of lipping is characteristic of the soft-hammer technique.

No distinct features of the pressure technique can be seen apart from parallel edges and arrises of blades. The typical features of the pressure technique, such as constant thickness, absence of ripples on the ventral side, or narrow butts broadening to the maximal width, are not evident.

The average blade length is slightly larger than in Lerna I (36.75 mm.), with a distinctly smaller standard deviation (9.33 mm.). The range of length becomes smaller (29–60 mm.), which is the consequence of using a more uniform raw material in the Lerna I/II set. On the other hand, the smaller specimens (less than 29 mm.), which are found in Lerna I, are missing in Lerna I/II (Table 7).

TABLE 7. Blades from Lerna I/II: dimensions

	Mean	Std Dev	Minimum	Maximum	Number
Length	36.75	9.97	29.00	60.00	8
Width	11.16	3.36	6.50	28.00	72
Thickness	3.05	1.12	2.00	7.00	72
Width:Length	0.30	0.08	0.21	0.45	8
Thickness:Width	0.28	0.09	0.07	0.65	72

The width of blades is also smaller than in Lerna I (11.16 mm.), with a smaller standard deviation (3.36 mm.). The average thickness is 3.05 mm., slightly higher than in Lerna I, with a smaller deviation (1.12 mm.).

Generally, the blanks in Lerna I/II are more standardized. The width distribution is a unimodal, skewed curve with the maximum between the values 8.1 and 10.0 mm., that is, within a more limited range than in Lerna I. Similarly, thickness distribution is also a curve with one mode within the range of 2.1 to 3.0 mm., that is, slightly narrower than in Lerna I (Tables 23–27).

Just as in Lerna I, distal and mesial-distal blade fragments are fewest. The number of mesial, mesial-proximal, and proximal fragments is more or less the same as in the Lerna I assemblage. There are essential differences, however, in the ways the blades were fragmented, especially in the case of proximal fragments, namely, in the Lerna I/II set the ratio of specimens with fracture, that is, dorsal and hinged fracture, is much higher than that of broken specimens (Table 29). This indicates that proximal parts may have been detached intentionally, although a possibility that some of the specimens with a hinged fracture were formed by the pressure on the blade side during use (both by the material worked and by the handle) cannot be excluded.

SMALL FLAKES AND CHIPS

Small flakes and chips account for only 4.1% of the debitage. They are most probably products of the splintered technique.

TOOLS

The set includes 45 retouched tools, including 19 complete splintered pieces and 2 fragments. The proportion of specimens made of siliceous raw materials is smaller than in the Lerna I set, namely, only 7 artifacts out of 24; all the splintered pieces are made of obsidian.

Besides splintered pieces there are eight artifact groups, which is more than in the Lerna I set:

1. End scrapers (3), including one on a blade of obsidian (Ill. 4:1) and two on small flakes of radiolarite R2, of which one is subdiscoidal (Ill. 4:2) and the other has an undulating scraping edge (Ill. 4:3).

2. Oblique truncated pieces (2): one, of obsidian, is proximal and inverse (the distal part is missing; Ill. 4:4); the other, of chalcedony, is distal and direct, but both the proximal and distal parts are broken (Ill. 4:5).

3. Blades with lateral retouch (7). The best preserved, which is of obsidian, has lateral inverse retouch, and the lateral edges are strongly rounded, probably from being used for cutting or scraping hide (Ill. 4:6). There are 2 proximal fragments, one with unilateral inverse retouch and the other, of obsidian, with bilateral alternate retouch (Ill. 4:7). Along the fracture of one of them traces of use wear can be seen on the dorsal side, indicating it was used for scraping bone (Ill. 4:8). There are 2 mesial fragments with unilateral inverse retouch made of burnt flint (Ill. 4:9, 10). One of the specimens has a Corbiac burin scar at one end and, at the other, a fracture produced by heating the dorsal surface. Two blades, one of obsidian and the other of chalcedony Ch1, have irregular, denticulated, ventral-dorsal retouch; the distal and mesial parts were both used as sickle inserts (Ill. 4:11, 12). The breaks visible on these specimens are earlier than the use wear from their function as sickle inserts. They were mounted in the sickle handles twice, each time obliquely.

4. Blade fragments with notches of a technical nature (4), that is, they were used for initiating a break. In three cases the breaks do not correspond to notches (Ill. 4:13, 15), and in the case of a small bladelet, the breaks from notches form a kind of trapezoid (Ill. 4:16). All are of obsidian.

5. Perforator made on an obsidian blade (1), formed by fine, steep retouch, without distinct use-wear traces under the low-power microscope (Ill. 4:17).

6. Typical double distal burin on a snap made on an obsidian blade (Ill. 4:18). Two obsidian burin spalls: a secondary specimen transformed from a burin on a snap (Ill. 4:19) and a primary specimen from a retouched lateral edge of a sickle insert (Ill. 4:20).

7. Straight-backed piece made on a partially crested obsidian flake. The asymmetrical crest was adapted as part of the blunted back. There are traces of retouch at the distal part (Ill. 5:1).

8. Retouched flakes (3): a radiolarite flake with a semisteep obverse distal retouch (Ill. 5:2), an obsidian flake with inverse distal retouch and an obverse lateral notch (Ill. 5:3), and a small obsidian flake with a lateral notch with flat retouch (Ill. 5:4).

The group of 21 splintered pieces includes 2 small fragments of indeterminate specimens. Most pieces are made on flakes (9) and include 6 small bipolar splintered pieces (Ill. 5:5–10), 2 small quadripolar pieces (Ill. 5:11, 12), and an unused specimen on a short flake (Ill. 5:13). Splintered pieces made on blades are next in number (7). This group includes 3 unused specimens (Ill. 5:14–16), 4 well-used specimens, of which one has lateral retouch (Ill. 5:17–19, 22), and 2 fragments (Ill. 5:20, 21). Moreover, 2 "core" splintered pieces, very small and well used, are present (Ill. 5:23). These may be the residual products of the splintering of flakes or blades, the original surfaces of blanks that have not been preserved.

LERNA II

Raw Materials

Obsidian is decidedly dominant in the investigated levels. It was used to produce more than 91% of the artifacts found (Tables 12 and 13). Its proportion is slightly lower only in the group of tools, where it accounts for 86.5%. Other raw materials are strongly differentiated and include thirteen different rock types. Some of the raw materials (Ch1, F3, F7, F9, R3) are represented only in the tool group, which suggests that these artifacts were brought to the site in their complete form. The great variety of siliceous rocks points to the diversity of the sources from which they were procured. The structure of the obsidian inventory (Table 13) approximates the general structure of the Lerna I and Lerna I/II levels, with a slightly higher proportion of flakes and a lower proportion of tools. It seems, therefore, that obsidian was supplied to the site as blanks, at least in part, or that its processing took place outside the habitation zone of the settlement.

The Lerna II set uncontaminated by Late and Final Neolithic material yielded a total of 523 chipped-stone artifacts. Blades are the dominant group in this inventory (215 specimens, or 41.1%). The proportion of tools is also high (31.3%), whereas flakes and their fragments account for only 19.9%. Inventory structure like this shows that the importance of local processing of raw materials was minimal. This is confirmed by the low proportion of unmodified chunks and cores (1.2%, of which 0.5% are typical cores). On the other hand, the presence of a number of small flakes and chips (5.1%) on the site indicates the local production or rejuvenation of tools. It is characteristic that obsidian predominates distinctly in the group of small flakes and chips (out of 27, 26 are made of obsidian). Thus, the supposition that obsidian tools were more often locally produced or transformed than were tools of other raw materials receives some confirmation.

Among 44 artifacts made of siliceous rocks 21 are tools and 13 blades. It was in the finished forms that artifacts made of raw materials other than obsidian were usually brought to the site.

Cores

The Lerna II series of 523 artifacts includes only 2 exhausted obsidian cores and 1 fragment. There are, in addition, 2 small obsidian pebbles that, because of their small size (12 × 10 × 3 mm. and 13 × 7 × 5 mm.), cannot be treated as part of a stock of raw material. Nor can a flat chunk of radiolarite R1, measuring 25 × 19 × 9 mm., and a small hornstone H1 fragment of similar size be treated as raw material.

The two obsidian cores: (a) A microlithic core with rounded flaking surface and an oblique platform (Ill. 6:1). The flaking surface extends onto the sides. It was first formed by preparation of the preflaking surface. The platform was probably rejuvenated several times. After the last tablet was detached from the back, the core was abandoned. In the final phase of reduction the use of the splintered technique can be seen. (b) A small, residual core made from a fragment of a larger core. The platform and the lateral sides are prepared; the flaking surface is narrow. Lateral preparation can also be seen on the back (Ill. 6:2). A fragment of a small, discoidal, residual core of obsidian is also present (34 × 13 × 40 mm.).

The low proportion of cores, the fact that they are well exhausted, and the evidence of repeated rejuvenations indicate that procurement of obsidian was difficult. Possibly some of the obsidian artifacts were supplied to the site already transformed into blades or tools.

Flakes

The series contained 105 flakes and flake fragments (Tables 11, 14, and 15), of which 99 were of obsidian. The majority are flakes from an advanced phase of core reduction. Fully cortical specimens constitute only 7.5% of complete flakes (6 specimens). Partially cortical flakes account for 21.9% of the total and 28.7% of complete flakes. Only some of the flakes come from the preliminary phase of treatment of nodules of raw material. The bulk were detached during rejuvenation, broadening of the flaking surface, or change of orientation of cores.

The frequency of dorsal scar patterns is given in Table 14. In the group of flakes without cortex (57 complete specimens), those with scars parallel to the axis are dominant. They must have been made in the preliminary and final phases of blade-core reduction.

The proportion of flakes with perpendicular scars is relatively high, indicating frequent change of the orientation of cores. Tablets account for only 6.2% of all flakes (Ill. 6:4). Therefore platform rejuvenation was performed fairly rarely, even if flakes with centripetal scars are also related to platform preparation. Platform angles are predominantly 90 degrees, confirming that most flakes come from the advanced phase of core reduction. There are 65 flakes with preserved platforms, which were usually formed by a single blow. Flakes with a cortical platform and with unprepared platform combined account for 10.6% of specimens. This confirms that partially decorticated nodules were brought to the site. In most cases irregularities have not been removed from the platform edge. The flakes have straight distal parts and visible bulbs. The use of the hard hammer caused most specimens to exhibit bulbar scars. Flakes detached from tools with flat retouch were also recorded in the inventory (Ill. 6:5).

Flake dimensions are small, ranging from 10 to 39 mm. in length and from 8 to 47 mm. in width (Table 8). The average length is 22.45 mm., with a standard deviation of 6.38 mm., and the average width is 20.41 mm., with a standard deviation of 7.53 mm. Cortical flakes are only slightly larger (Table 9): average length 23.57 mm., with a standard deviation of 5.25 mm., and average width 23.07 mm., with a standard deviation of 7.75 mm. Flake proportions are expressed by a width-length index of approximately one. The comparison of measurements of cortical flakes and noncortical flakes shows that the former are slightly longer, somewhat wider, and thicker than average values. In general, cortical flakes are heavier, though not sufficiently so as to be regarded as a product of preliminary preparation. It should be added that these flakes do not reach the dimensions of the largest noncortical specimens.

TABLE 8. Flakes from Lerna II: dimensions

	Mean	Std Dev	Minimum	Maximum	Number
Length	22.45	6.48	10.00	39.00	67
Width	20.41	7.53	8.00	47.00	74
Thickness	4.72	1.98	2.00	12.00	74
Width:Length	0.98	0.41	0.34	2.70	76
Thickness:Width	0.24	0.09	0.10	0.53	74

TABLE 9. Cortical flakes from Lerna II: dimensions

	Mean	Std Dev	Minimum	Maximum	Number
Length	23.57	5.25	15.00	33.00	21
Width	23.07	7.75	12.00	42.50	23
Thickness	5.70	2.17	3.00	12.00	23
Width:Length	1.01	0.36	0.50	1.80	21
Thickness:Width	0.26	0.10	0.13	0.53	23

SMALL FLAKES AND CHIPS

This group is represented by 27 specimens, accounting for 5.1% of the inventory. A few specimens were produced during retouching, but most are products of the splintered technique (12 specimens) or the final phases of core reduction. A few specimens were detached as a result of the Kombewa technique (see Glossary; Ill. 6:3). All but one of the specimens in this group are of obsidian.

BLADES

The investigated series contained 215 blades (41.1%), which is a high proportion, twice as high as the number of flakes and flake fragments. Blades made of obsidian predominate, accounting for 93.9% of the total. Thus, the proportion of obsidian is higher in the group of blades than it is in other artifact groups. The majority of blades are broken specimens; complete blades account for only 5.5% of the total. These blades come, in all likelihood, from an advanced phase of core reduction. Traces of cortex are present on 28 specimens, that is, 13.0% of the total number; 20 are lateral and 8 are distal specimens. Most of the blades were detached from single-platform cores (Ill. 6:6, 7). Only 20 specimens are from double-platform cores (Table 21). There are 5 crested blades and as many as 14 blades detached after the removal of the crested blades. This points to a very careful preparation of the preflaking surface.

Analysis of the platform angles of blades has shown that a straight angle is dominant. The cross section of blades is usually trapezoidal, and the sides are parallel, less often convergent. A relatively large number have irregular lateral edges. Platform types were analyzed on 96 specimens. Just as in the case of flakes, platforms formed by a single blow are predominant (Table 22). Punctiform-linear platforms are next in frequency, and faceted platforms come third. Several blades were detached by means of a technique which produced the punctiform-linear platforms. The edge of the platform is straight, and the point of percussion and the bulb are visible. Blades with straight profiles are most common, accounting for 74.8% of the total (Table 21). Specimens with convex profiles make up only 20.0%. The remaining blades have irregular, twisted profiles.

At a number of Neolithic sites where blades were detached from single-platform cores it has been established that the most strongly curved distal ends of specimens were broken off. The proportion of distal, that is, the most strongly curved, parts in the Lerna II set was found to correspond exactly to the proportion of blades with convex profiles (Tables 21 and 29). It may be inferred, therefore, that blades also frequently had convex profiles and that the distal parts were broken off in order to obtain specimens with straight profiles. The number of proximal parts (including proximal-mesial) is approximately equal to the number of mesial parts. The number of distal parts is distinctly smaller (Table 29). This allows us to draw the conclusion that the distal parts of most blades brought to the site had already been removed. As has already been mentioned, the majority of blades have been preserved in fragments. Blades were fragmented most often by snapping, less often by fracture. In the case of mesial parts we are dealing with blades broken twice or broken and then fractured (Table 29).

Fine blades predominate: the mean length is 33.9 mm. with a standard deviation of 15.1 mm.; the mean width is 10.95 mm., with a standard deviation of 2.96 mm. (Table 10). The mean thickness of blades is 2.8 mm., with a standard deviation of 1.02 mm. In addition to fine blades, there were individual longer blades (up to 73 mm.). Both the longer and fine blades are of obsidian.

TABLE 10. Blades from Lerna II: dimensions

	Mean	Std Dev	Minimum	Maximum	Number
Length	33.90	15.10	16.00	73.00	15
Width	10.95	2.96	5.50	21.00	202
Thickness	2.80	1.02	1.00	7.00	202
Width:Length	0.33	0.11	0.18	0.53	15
Thickness:Width	0.26	0.10	0.08	0.77	202

It should be stressed that the width of complete blades does not differ from that of broken specimens; there is therefore no ground for the supposition that only larger blades were broken. This confirms the hypothesis that we are dealing with intentional removal of distal ends in order to obtain straight profiles and not with the accidental breaking of larger specimens. In the group of unretouched blades, specimens with distinct sickle gloss are conspicuous (7 specimens). Three of these are made of siliceous stones (F1, R1, R2). Blades with sickle gloss were larger than average, that is, their width is larger than the average (the mean width is 15.1 mm., with a standard deviation of 4.4 mm.).

In four cases sickle gloss is parallel to the lateral edges of blades; in the three remaining cases it is oblique. This suggests that various types of harvesting tools were used. In addition to sickle gloss, the blades under consideration show crushing or nibbling along their lateral edges, created during work or by the pressure of the tool handle.

TOOLS

There are 164 retouched tools, including splintered pieces and fragments. The proportion of obsidian in the tool group is distinctly lower than the average for the complete assemblage (Table 13). The tools were more often made of siliceous rocks (flint F1: 7 tools, drawn from a total of 10 specimens; chalcedony Ch1, flint F9, and F7: only tools). The tools that are "exotic", that is, unique in the analyzed assemblage, were made of rare raw materials represented only by individual specimens: a triangular, bifacially retouched projectile point made of flint F9 and a fragment of a bifacial sickle insert made of radiolarite R3. Tools include specimens made from flakes and blades; in the case of splintered pieces it is often difficult to establish whether they were made from flakes, blades, or chunks.

Although there is some variety in the types of blanks used for tools, it is clear that Lerna II had a blade industry.

End Scrapers

The assemblage contains 5 blade end scrapers and 3 flake specimens.

Blade end scrapers: (a) Two slender end scrapers with rounded, semisteep scraping edges and discontinuous, fine retouch of lateral edges (Ill. 6:8, 9). (b) An end scraper with a rounded, semisteep scraping edge at one end and a notch opposite (Ill. 6:10). (c) A heavy blade end scraper with a rounded, slightly asymmetrical, semisteep scraping edge. Both lateral edges have retouch on two sides (Ill. 6:11). (d) A slender end scraper of chalcedony Ch1 with a low, steep scraping edge. On the lateral edge is a two-sided retouch earlier than the silica gloss (Ill. 6:13).

Flake end scrapers: (a) A microlithic end scraper with a rounded, slightly asymmetrical scraping edge and a notch near the base (Ill. 6:12). (b) A small end scraper with a rounded, steep, low scraping edge (Ill. 6:15). (c) A double end scraper. The scraping edges are low, with alternate retouch (Ill. 6:14).

Truncated pieces: (a) Three distal truncations, strongly oblique, convex. In one case the opposite end has a break with initial retouch (Ill. 7:1), in another case there is a fracture (Ill. 7:2), and one specimen shows a break with an attempt at shaping the opposite truncation (Ill. 7:5). In one example the lateral edge contiguous to the truncation shows nibbling and sickle gloss. This specimen was made on a broad blade of flint F1 (Ill. 7:2). (b) An oblique, straight truncated piece shaped on a break (Ill. 7:3). (c) A heavily retouched oblique truncation (Ill. 7:4). (d) An oblique, convex truncation showing traces of use as a bipolar splintered piece (Ill. 7:6). (e) A double oblique truncation with an obversely retouched distal end and inversely retouched proximal end. Both lateral edges are retouched (Ill. 7:7).

Retouched Blades

There are 53 blades with lateral and notched retouch, accounting for 32.3% of all tools. Most of these blades are broken or fractured. The length of complete specimens suggests that blanks larger than average were used for their production. This is confirmed also by a higher mean width of 14.5 mm. for retouched blades (with a standard deviation of 7.2 mm.), whereas the mean width of unretouched blades is 10.95 mm.

The group of retouched blades is not homogeneous. A number of subgroups can be identified by the location and type of retouch. But the classification of these tools is difficult, as they were repeatedly transformed and reused.

1. Blades with unilateral ventral retouch (5). Two unilateral specimens have broken distal parts and semisteep, inverse retouch on one lateral edge. The opposite edge has partial, discontinuous fine retouch (Ill. 7:8). One blade has semisteep retouch with weakly marked notches (Ill. 7:9). A distal part of a fine flint F5 blade shaped like a Corbiac burin (Ill. 7:11) and a proximal part of a blade with partial, unilateral retouch (Ill. 7:12) have also been assigned to this group. All the blades are fragments: in two cases there is a break and in three cases a hinged fracture.

2. Blades with both lateral edges retouched on the ventral side (5): (a) Two blades with flat, irregular, inverse denticulated retouch on both lateral edges, which were used as sickle inserts. In one case the retouch is later than the sickle gloss (Ill. 7:10), while the other blade had been retouched before sickle gloss appeared (Ill. 8:1). Both tools are made of extralocal siliceous rocks F1 and Ch1. (b) A slender blade and a fragment of an obsidian blade with flat, discontinuous inverse retouch (Ills. 7:13, 8:2). (c) The distal part of a chalcedony Ch1 blade with broad retouch on one lateral edge and the same retouch on a small section of the opposite edge. The distal part of the blade was thinned by a flat pseudo-burin blow (Ill. 8:5).

3. Blades with fine retouch of one lateral edge (5). The retouch is steep, covering the whole lateral edge; solely in the case of the mesial fragment is only part of the edge retouched (Ill. 8:4). This group contains one complete blade (Ill. 8:3) and a fragment of a blade with a small notch inversely retouched.

4. Two-sided obversely retouched blades (3). These were damaged by breaking. The retouch is regular, extending on both edges. The edges on the three specimens are as follows: one edge is straight, the second weakly concave (Ill. 8:7); one edge is convex, the other concave (Ill. 8:8); and the two concave edges on the last specimen are shaped by steep retouch (Ill. 8:9).

5. Blades with alternate retouch (5): (a) Blade with a broken distal part; one lateral edge has semisteep dorsal retouch, the other has flat ventral retouch. On both edges notches are weakly marked, with partial, bifacial retouch (Ill. 8:10). (b) Distal part of a fine blade with semisteep, alternate retouch (Ill. 8:11). (c) Proximal part of a broad blade made from flint F4. One of the lateral edges was shaped by obverse, continuous, semisteep retouch, which becomes steep near the platform; the second edge has inverse retouch. The distal part is shaped by a Corbiac-type burin, probably accidentally (Ill. 9:1). (d) Mesial segment of a blade with steep obverse and flat inverse retouch. Possibly the obverse retouch is postdepositional (Ill. 8:12), because of the differing states of preservation of the retouch scar surfaces, which were less weathered than was the whole dorsal surface of these artifacts. (e) Blade with a broken distal end. Semisteep retouch, on part of both sides of one of the lateral edges; the second edge is shaped by fine, inverse retouch (Ill. 9:3).

6. Blades with bifacial, marginal retouch (4): (a) Mesial segment of a slender blade with steep, marginal obverse retouch and flat inverse retouch of one edge (Ill. 9:4). (b) Blade with semisteep marginal retouch. One of the edges is modified by flat ventral retouch. The same retouch covers a small section of the second edge. On the proximal end there is a Clactonian notch (see Glossary; Ill. 9:5). (c) Distal end of a broad blade with scaled obverse retouch and fine inverse retouch on one lateral edge. The second edge has a flat, obverse

Clactonian notch on the distal end (Ill. 9:2). (d) Fragment of a blade of chalcedony Ch3. It shows silica gloss and, earlier than the gloss, bifacial marginal retouch. The proximal part was modified by splintered retouch, which is earlier than the marginal retouch (Ill. 9:6).

7. Blades with fine, semisteep, irregular, and discontinuous retouch (4). On the ventral side there are individual scars resembling spontaneous nibbling (Ill. 9:8). One of the blades has partial inverse retouch near the butt. Another blade shows sickle gloss (Ill. 9:10).

8. Mesial part of a blade of chalcedony Ch1 showing sickle gloss parallel to the edge, which was subsequently modified by flat, irregular retouch. On the distal part there is a notch obtained by a single blow. The second lateral edge shows a burin blow (Ill. 9:11).

9. Blades with denticulated retouch (9). These blades have been isolated in one group based on the presence of denticulated retouch on either one or both lateral edges. The term "denticulated retouch" is rather imprecise and has been differently understood by various authors. In this group we place blades with retouch made up of individual concave scars merely touching one another, as well as blades whose retouch approximates the definition given by J. Tixier, M.-L. Inizan, and H. Roche:[22] a retouch composed of a sequence of notches.

In the group of unilateral specimens 3 blades have inverse retouch: fine (Ill. 9:7), discontinuous (Ill. 9:12), or semisteep and fairly thick (Ill. 10:1). One blade has fine, irregular, obverse retouch (Ill. 10:2), and another, alternate denticulated retouch, with the two notches on the lateral edge probably accidental (Ill. 10:4).

Among the blades with bilateral denticulated retouch, inversely retouched blades predominate.

One flint F1 blade (Ill. 10:3) has bifacial marginal retouch on the left edge; others have flat, inverse retouch (Ill. 10:5, 6). Only one blade has obverse retouch.

10. Notched blades (12). This is a highly differentiated group comprising the following specimens: (a) a blade with deep notches on one of the lateral edges (Ill. 10:7); (b) a blade with an inverse basal notch (Ill. 10:10); (c) a blade with a broad obverse notch in the distal end (Ill. 10:13); (d) a blade with several fine obverse notches on both edges (Ill. 10:14); (e) a blade with a basal inverse notch and multiple obverse notches on the opposite lateral edge (Ill. 10:12); (f) a bilateral notched blade (Ill. 10:8); (g) a lateral notched blade with an inverse distal notch (Ill. 10:11); (h) two bilateral notched blades of the *lame étranglée* type (Ill. 11:1); (i) three blades with lateral "technical" notches (serving to break blades as do the notches in the microburin technique; Ills. 10:9, 11:2, 3).

Perforators

In this group belong 2 tools: (a) A slender perforator with a weakly distinguished point on the proximal part of the blade. The mesial part of this tool has flat inverse retouch and traces of crushing (probably the effect of the handle pressure). From the break, flat retouch removed the inter-scar ridges (Ill. 11:5). (b) The point of a slender, asymmetrical alternate perforator (Ill. 11:4).

[22] 1980, p. 84.

Burins

There are 3 burins: (a) a double transverse burin of the Corbiac type, made on a blade (Ill. 11:7); (b) a flat burin on a snap, double at one end (Ill. 11:8); and (c) one of two spontaneous burins shaped on splintered pieces where the angle of the burin blow is perpendicular to the surface of the splintered piece (Ill. 11:6). The second specimen, with a different location of the pseudo-burin blow, will be discussed in the group of splintered pieces. There were also 4 burin spalls, 1 from a truncation burin (Ill. 11:9), and 3 from indeterminate burins, possibly spontaneous, produced by the splintered technique.

Retouched Flakes

In this group of 9 specimens are flakes with alternate retouch on both lateral edges (Ill. 11:10), flakes with fine obverse retouch on one lateral edge (Ill. 11:11), a flake with fine denticulated retouch, a flake with semisteep retouch (made from radiolarite R1), and two flakes with inverse retouch. There is also a flake with steep retouch on one lateral edge, perhaps initially an end scraper (Ill. 11:12), and a flake with steep retouch on one lateral edge and an obverse, distal notch (Ill. 11:13).

Backed Pieces

These are represented by 3 specimens: (a) A large blade of flint F1 with a convex blunted backed edge (Ill. 11:14). On the opposite edge flat retouch is partly earlier and partly later than the sickle gloss. (b) A backed blade with a straight blunted back. It shows flat, inverse, bilateral retouch (Ill. 12:1). The lateral edges show silica gloss indicating use as a harvesting tool. (c) An inversely retouched, arched backed blade (Ill. 12:2).

Shouldered Implements

There are 2 shouldered implements, both with silica gloss: (a) A broken specimen with a proximal, semisteep notch. Sickle gloss extends onto the opposite edge (Ill. 12:3). On the distal part, on the break, silica gloss can be seen, and on the proximal part the break is earlier than the silica gloss. (b) A specimen made from flint F1 with an inverse notch continued by lateral retouch (Ill. 12:4). This tool was transformed a number of times. It was made on a blade fragment used as a sickle insert, then it was transformed into a splintered piece, and finally, it was altered to become a shouldered implement.

Arrowheads

Two artifacts are possibly Neolithic arrowheads: (a) A triangular arrowhead, wholly bifacial. The thick retouch covering the entire surface is overlain by fine, parallel retouch, which gives the final shape to the base and the sides. This is the only artifact made from flint F9 (Ill. 12:5). (b) A tanged arrowhead of obsidian (Ill. 12:6). The tang is narrower towards the base, and the barbs are weakly distinguished. The transverse cross section is lenticular, the longitudinal, asymmetrical. The edges are shaped by denticulated retouch. This piece may be an intrusion from later levels since similar specimens were discovered in Lerna III levels.[23]

[23] Runnels 1985, fig. 11:a, b.

Bifacial Sickle Insert

A fragment of a bifacially treated sickle insert (Ill. 13:1). The lateral edge is denticulated and opposed to a blunted back. This specimen, of radiolarite R3, corresponds to artifacts from later levels of the site.[24]

Multiple Tools

These tools are represented by (a) an end scraper with a weakly rounded, semisteep scraping edge on a bilaterally retouched blade, with fine, regular, and fairly steep retouch on the blade (Ill. 12:7), and (b) a backed, arched blade combined with inverse, proximal truncation and, along the edge opposite to the blunted back, nibbling and sickle gloss parallel to the edge. This tool is of flint F1 (Ill. 12:8).

Splintered Pieces

This is a fairly large group (67). Nine pieces are made on blades, 19 on flakes, and 10 specimens are totally covered with scars from the splintered technique so that it is difficult to determine the nature of the original blank. In addition to the complete splintered pieces there are 29 fragments. All are of obsidian, with the exception of 4 made from other raw materials (Fl, F2, F7, Ch1).

Among flake splintered pieces, bipolar examples (Ill. 13:3) predominate, with the orientation parallel to the flake axis (17 specimens). There were only 4 quadripolar specimens. Blade splintered pieces are frequently damaged; all are bipolar. In this group splintered treatment transformed some previously retouched blade tools (e.g., the specimen in Ill. 13:2). During the splintered treatment accidental pseudo-burin blows sometimes occurred (Ill. 13:5).

The surfaces of 14.9% of the splintered pieces are covered almost completely by scars from the splintered treatment. One of the specimens was made on a fragment of a flat pebble of flint F2 (Ill. 12:9). The dimensions of splintered pieces are small; their length does not exceed 30 mm., with the exception of a splintered piece made on a blade of flint F1 (Ill. 13:4).

Functional Analysis

Unlike the assemblage from Lerna I, in the restricted Lerna II set use-wear analysis has been done only for retouched tools. Limited time did not permit us to carry out use-wear analysis for the debitage. Out of a total of 96 retouched tools, 45 specimens (that is, 46.9% of all retouched tools) showed no traces of use wear in low magnification. In Lerna I the proportion is similar: out of 47 retouched tools, 21 (44.7%) did not show use wear. Obviously, the number of working edges that were actually used is larger than the number of used tools, as some implements have two or three working edges. In some cases marks from various functions are superimposed on the same edge (Table 33). The functional structure presented here, based on retouched tools, is not equal to the general distribution of functions performed during Lerna II. As we demonstrated for Lerna I, numerous unretouched pieces were often utilized as tools. Unfortunately, the limited period during which we had access to the Lerna collections in the Argos Museum was insufficient for traceological studies of debitage from Lerna II.

[24] Runnels 1985, fig. 7:e.

In comparison to Lerna I the frequency of sickles for cutting cereals does not change (in both units this is the most frequent function of chipped-stone tools). The proportion of hide scrapers (the second most frequent function) also remains unchanged. The importance of tools for working wood or bone, or both, and knives for cutting meat is greater than in Lerna I. New functions for tools which appear in Lerna II are manifested by the presence of knives for cutting grass or rushes and drills for perforating shell and antler.

The functions of particular morphological types of retouched tools can be multiple. Thus end scrapers were used as sickle inserts (Ill. 6:13) or as hide scrapers (Ill. 6:14); truncated pieces were used laterally as sickle inserts (Ill. 7:12) or distally as tools for planing wood (Ill. 7:3, 4). Backed implements were used as sickle inserts (Ills. 11:14, 12:1) or as knives for working wood (Ill. 12:2). The most numerous group of the total, namely, retouched blades, demonstrates a wide range of functions. Retouched blades were used as sickle inserts (Ills. 8:1, 9:6, 10:3, 4), as knives for cutting reeds (Ills. 8:4, 9:4, 10), as knives for cutting meat (Ills. 8:5, 6, 7, 9:1), as tools for woodworking (Ills. 8:3, 10, 9:3), and, less frequently, as hide scrapers (Ills. 8:8, 9:5). It is interesting to note that in some cases a particular edge was used a number of times for different functions. For example, a working edge functioned as a scraper for hide and for cutting rushes (Ill. 8:9) or wood (Ill. 8:8). After breaking, some blades were used again as hide scrapers or for working wood. The unretouched, ventral edges of the break were used for scraping (Ills. 9:8, 10:5). In one case the tip formed between the break and the lateral edge was used as a drill for shell, antler, or bone (Ill. 8:12).

Notched blades show the least use wear. This would confirm a hypothesis that the notches had a technical function, making easier intentional breaking of blades on a principle similar to the microburin technique (see Glossary; Ills. 10:8–14, 11:1–3).

In the group of burins the distal end of a burin on a snap was used for incising bone or antler (Ill. 11:8). The remaining two burins show traces of pressure in the zone of burin spall detachment. This action, however, may have been spontaneous. Two burin spalls show numerous traces of use wear on the retouched truncation (Ill. 11:9) or on the primary distal end of a burin (in the case of a secondary burin spall).

In the group of multiple tools, a truncated backed implement was used as a sickle insert on its unretouched edge (Ill. 12:8) and the front of an end scraper made on a retouched blade was used as a scraper for hide (Ill. 12:7).

The problem of the reconstruction of the functions of splintered pieces in Lerna II is as complex as in Lerna I. Some of the blades exhibit use wear prior to their transformation into splintered pieces, indicating use as knives for cutting meat (1), as knives for wood (3), or as sickle inserts (1). Use wear on poles, other than crushing, is rare. This appears as polish resulting from contact with some unidentified soft material (2 specimens), traces from drilling materials such as shell or bone (1 specimen with a punctiform pole), and traces of use for incising bone or antler (1 specimen).

LERNA II WITH LATER INTRUSIONS IIc AND IId

Inventory Structure

The set of Lerna II artifacts with later (Late [IIc] and Final [IId] Neolithic) intrusions contained a total of 785 artifacts (the Lerna II material already considered plus an additional

262 pieces from Lerna II contexts contaminated by later IIc and IId finds). The major technological group structure is given in Table 11. On the basis of this data it can be seen that neither the method of production nor its output changed significantly in this enlarged Lerna II set. Raw materials procurement followed the same rules as did the system in the restricted Lerna II set. The proportion of non-obsidian raw materials drops slightly, to 8.1%. Small quantities of new types of raw materials appear, for example, F3, F6, and R4, represented primarily by blades. A more differentiated group of unworked chunks may be indicative of attempts to obtain new raw materials, but the small size of chunks must be considered.

When the proportion of obsidian in each major technological group is analyzed, a slight drop in the use of this raw material can be observed in the group of blades and some increase noted in the tool group (Table 13).

Cores

In addition to specimens recorded in the Middle Neolithic Lerna II set, in unit IIc a core from burnt flint was discovered. This is a small specimen with a single-blow platform; the specimen represents the residual phase of a change-of-orientation core; it has bilateral preparation of the back.

Flakes

The enlarged Lerna II set contained 159 flakes and flake fragments (Table 11), which accounts for 20.1% of the inventory. The importance of this group did not change in comparison to the sets described earlier in this paper. A certain decrease in the proportion of cortical flakes is noteworthy, namely, from 28.7% to 25.0%. This may indicate that chunks that were brought to the site had been more extensively decorticated than in previous periods.

Other features of flakes did not change: the size of flakes and the technology of their removal are similar. Cortical flakes are slightly longer, which suggests that they come from more advanced phases of processing.

Blades

In the latest Lerna II assemblage there are 320 blades, that is, 40.7%. In comparison to the uncontaminated Lerna II set, the proportion of single-blow platforms increases while faceted platforms decrease. This proves the greater importance of some core rejuvenation operations (e.g., platform rejuvenation by detaching a tablet). Generally, the technique of processing became more careful, an observation that is confirmed by fewer specimens with irregular lateral edges, indicating that the operation of removing irregularities from the platform edge was done more often (Table 22). Blade length is slightly increased (from 33.9 mm. to 35.39 mm.), but this is not a statistically significant increase (Table 23).

Chips and Small Flakes

The proportion of this group and its characteristic features remain the same as in the series analyzed above.

Tools

The group of retouched tools numbers 246 specimens. The majority are of obsidian. In addition to the specimens discussed in the previous chapter, the following tools have been recorded (Table 30):

1. End scrapers: 6 specimens, all obsidian. These are fine blade end scrapers: one with a steeply retouched, rounded scraping edge (Ill. 13:6); one with a strongly convex scraping edge (Ill. 13:7); one with a denticulated, rounded scraping edge and a retouched lateral side (Ill. 13:8); one with a rounded, slightly asymmetrical scraping edge (Ill. 13:9); a microlithic specimen with a steeply retouched, oblique scraping edge (Ill. 13:10); and, finally, a microlithic blade specimen, steeply retouched at both ends (Ill. 13:11).

2. Truncations: 4 specimens, all of obsidian. These are a microlithic specimen with inverse retouch (Ill. 13:14); a microlithic specimen with a straight, oblique truncation (Ill. 13:13); a specimen made on a flake with a straight, oblique truncation (Ill. 13:12); an oblique specimen with a weakly convex truncation (Ill. 13:15).

3. Retouched blades (26): (a) Blades with unilateral, inverse retouch (3). One of the blades is broken, and from the break a fine bladelet was detached on the dorsal side (Ill. 13:16). (b) Blades with bilateral, inverse retouch (3). In all these examples the retouch is denticulated and semisteep. One blade was of chalcedony Ch1 and also was used as a splintered piece (Ill. 13:17). (c) Retouched blades with obverse, semisteep, sometimes denticulated or denticulated-notched retouch (5). All the specimens have been preserved as fragments (Ill. 13:18). One is of burnt flint; the others are of obsidian. (d) A blade with bilateral retouch, made from flint F1. The obverse retouch is semisteep, notched, and discontinuous; the inverse retouch is flat with broad scars. The specimen has strong gloss (Ill. 13:19). (e) A blade with deep, denticulated retouch extending onto one lateral edge (Fig. 6:1). (f) Blades with lateral notches (10). The notches were obversely retouched. One blade shows a transverse burin blow on its distal part. Two specimens have "technical" notches, which make breaking easier, just as in the microburin technique (Fig. 6:2). (g) A blade with a transverse notch at the proximal part, with fine inverse, lateral retouch (Fig. 6:4). (h) A blade with lateral retouch, with a ventrally retouched distal end. (i) A trimming blade with a distal notch and ventral retouch. From the platform a spontaneous burin blow separates this part of the blade, thus transforming it into some kind of a burin spall (Fig. 6:3).

4. Perforators (7): (a) Two specimens with weakly distinguished, symmetrical points (Fig. 6:5). (b) A specimen with a weakly distinguished, slightly asymmetrical point. (c) A specimen with an asymmetrical point, alternately retouched (Fig. 6:6). (d) Three flake specimens of the bec type (see Glossary; Fig. 6:7).

5. Burins (7): (a) Truncation burin of chalcedony Ch1, made on a blade with inversely retouched edge (Fig. 6:8). (b) A transverse burin of chalcedony Ch3 (Fig. 6:9). The burin is from the notch on the lateral edge. Both lateral edges are covered with thick, semisteep retouch later than the silica gloss. (c) Two burins-on-a-snap, made with fine lateral retouch

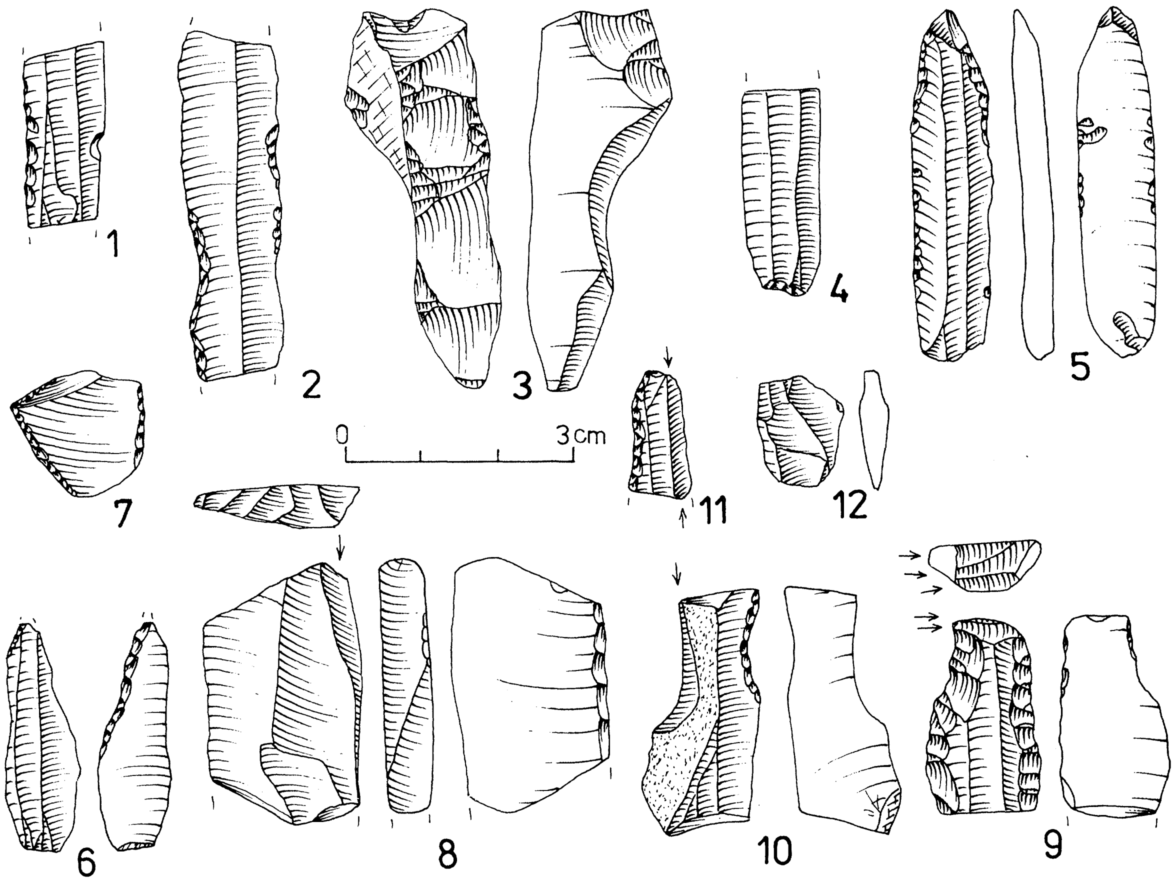


FIG. 6. Lithic implements from Lerna IIb and IIc (with Late and Final Neolithic intrusions): 1, 3. Retouched blades. 2, 4. Notched blades. 5–7. Perforators. 8–10. Burins. 11. Backed bladelet. 12. Splintered piece. Raw materials: obsidian (1–7, 10–12); chalcedony Ch1 (8); chalcedony Ch2 (9)

(Fig 6:10). (d) A single-blow burin on a fine flake. (e) A double, lateral truncation burin made on a fine obsidian blade. (f) A burin-on-a-snap made on a fragment of a trimming blade. In addition, a small burin spall was discovered.

6. Backed implement (2): (a) A small blade with a slightly oblique, straight, blunted back with silica gloss (Fig. 6:11). (b) A specimen with an undulating blunted back and inversely retouched lateral edge.

7. A flake with thick ventral retouch.

8. Splintered pieces: 12 complete specimens, including 4 made on small flakes (Fig. 6:12) and 6 made on blades, including one made from flint F1. The remaining splintered pieces are covered with so many scars that it is impossible to determine the form of the initial blanks. Just as in the series described above, this inventory, too, included numerous fragments of splintered pieces (16 specimens).

THE DIACHRONIC DEVELOPMENT OF NEOLITHIC STONE INDUSTRIES AT LERNA

The assemblages from the successive Neolithic levels at Lerna do not show essential differences in raw materials, techniques of blank production, or the basic tool kit.

Detailed comparison of data obtained from analyses of particular sets, from the point of view of diachronic development, has established the following tendencies:

(1) The proportion of obsidian in Lerna I/II in comparison to Lerna I increased from 83.1% to 92.1% (Fig. 7). Later, in the Middle Neolithic Lerna II set and in the Lerna II set with Late Neolithic intrusions, the proportion of obsidian is stable: 91.6% and 91.9%. At the same time the proportion of siliceous rocks drops from 11.9% to 7.5%. The extralocal chalcedony Ch1, which in level I came directly after obsidian in importance (7.9%), does not play a significant role in later levels (Fig. 7). The group of siliceous rocks in later levels is represented by individual artifacts from different deposits (e.g., Lerna II: 15 specimens of different rocks), without a particular preference for any of the rock types.

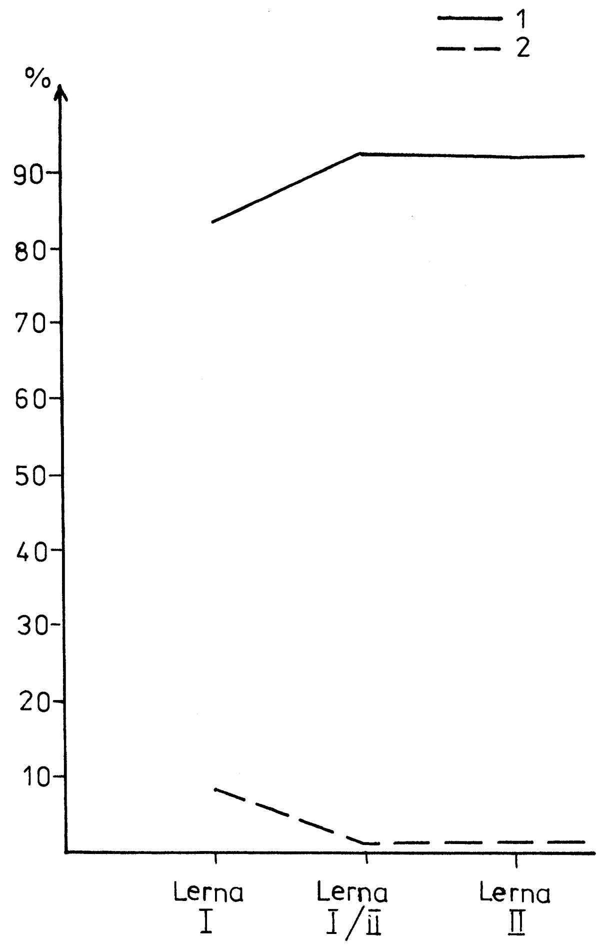
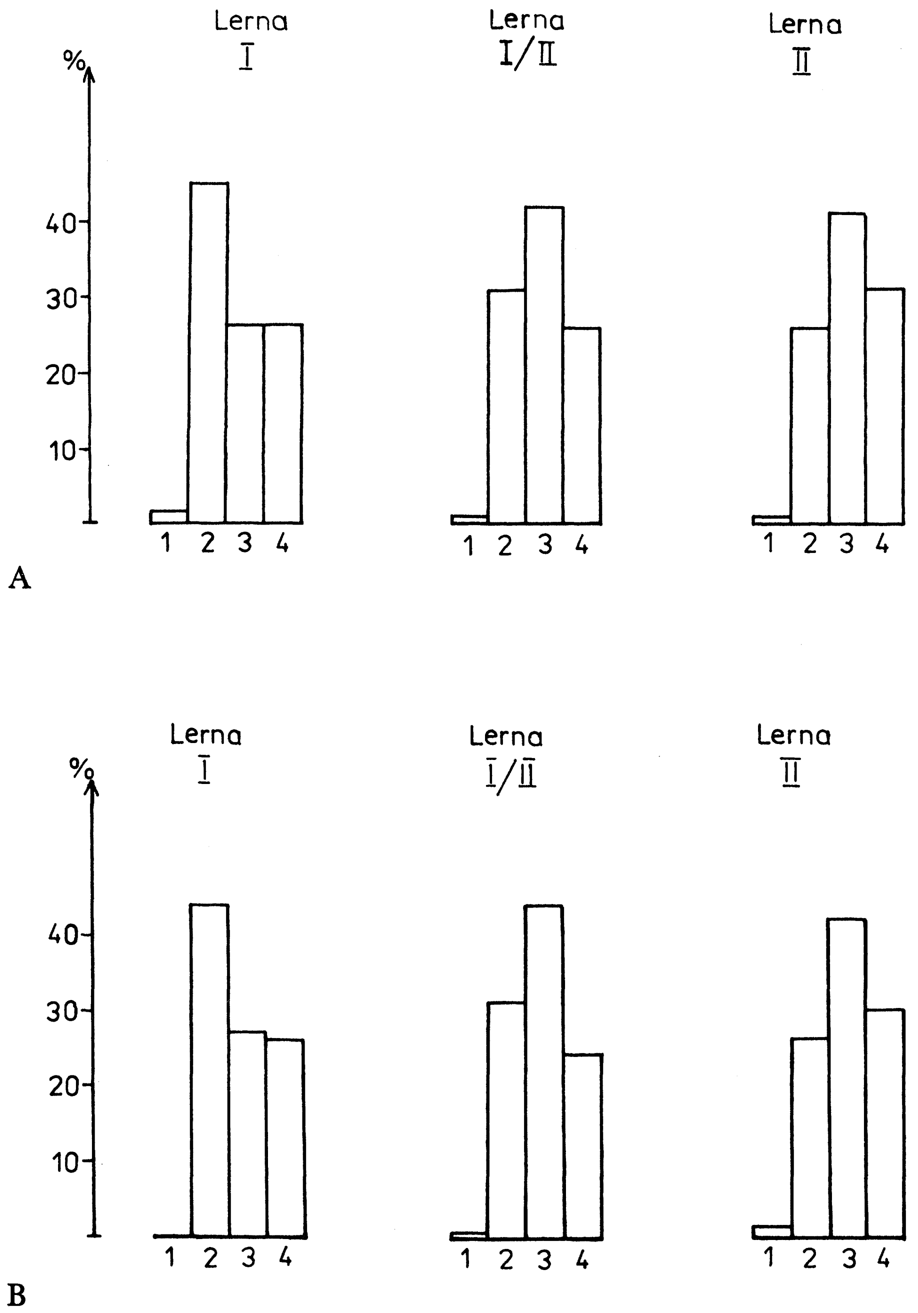


FIG. 7. Frequency of obsidian (1) and chalcedony Ch1 (2) in the Neolithic layers of Lerna



Key to technological groups: (1) cores; (2) flakes; (3) blades; (4) retouched tools

FIG. 8. Quantitative structure of major technological groups in Neolithic layers of Lerna: A. All raw materials. B. Obsidian only

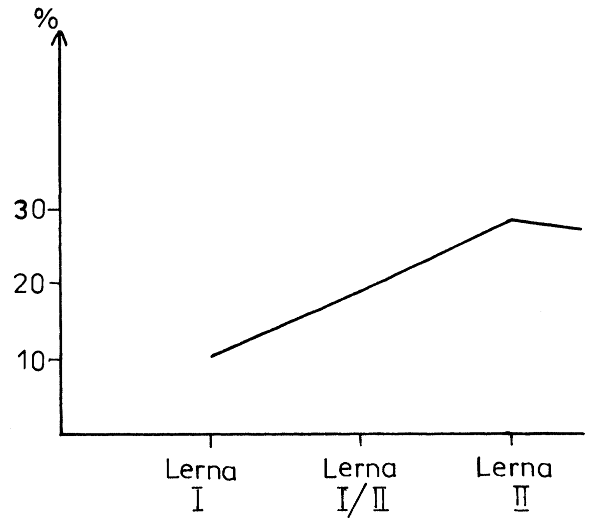
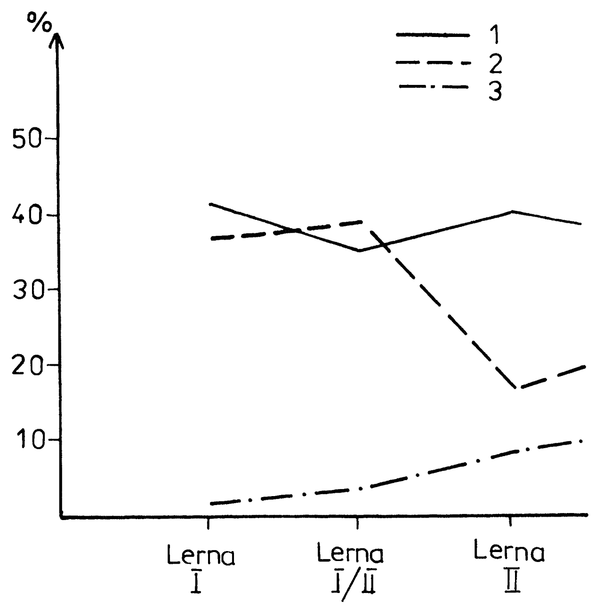
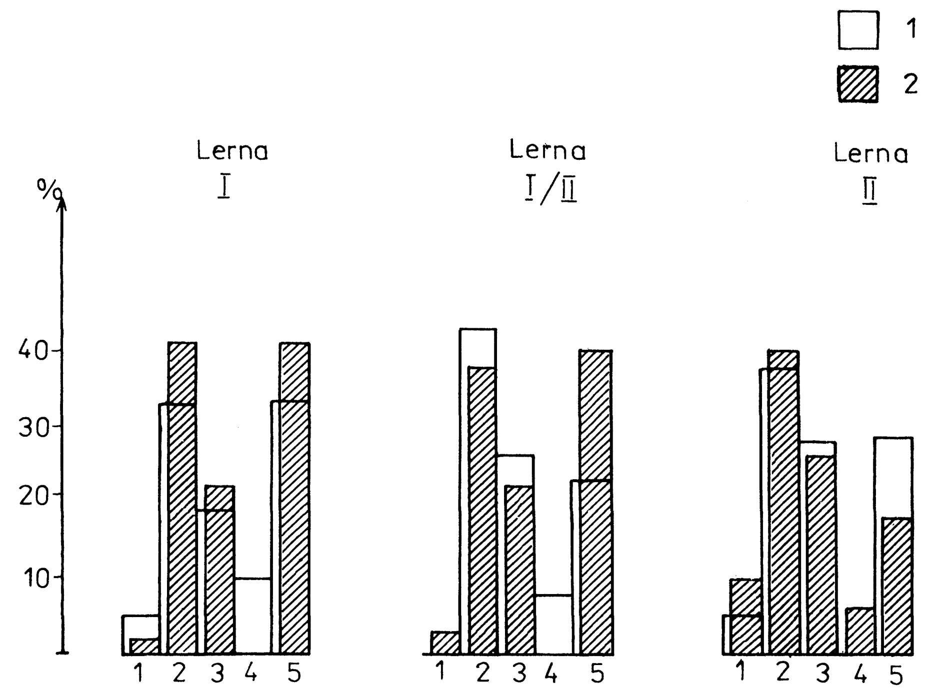


FIG. 9. Frequency of obsidian cortical flakes in the Neolithic layers of Lerna



Key to platform types: (1) formed by single blow; (2) punctiform or linear; (3) cortical

FIG. 10. Frequency of platform-type flakes in the Neolithic layers of Lerna



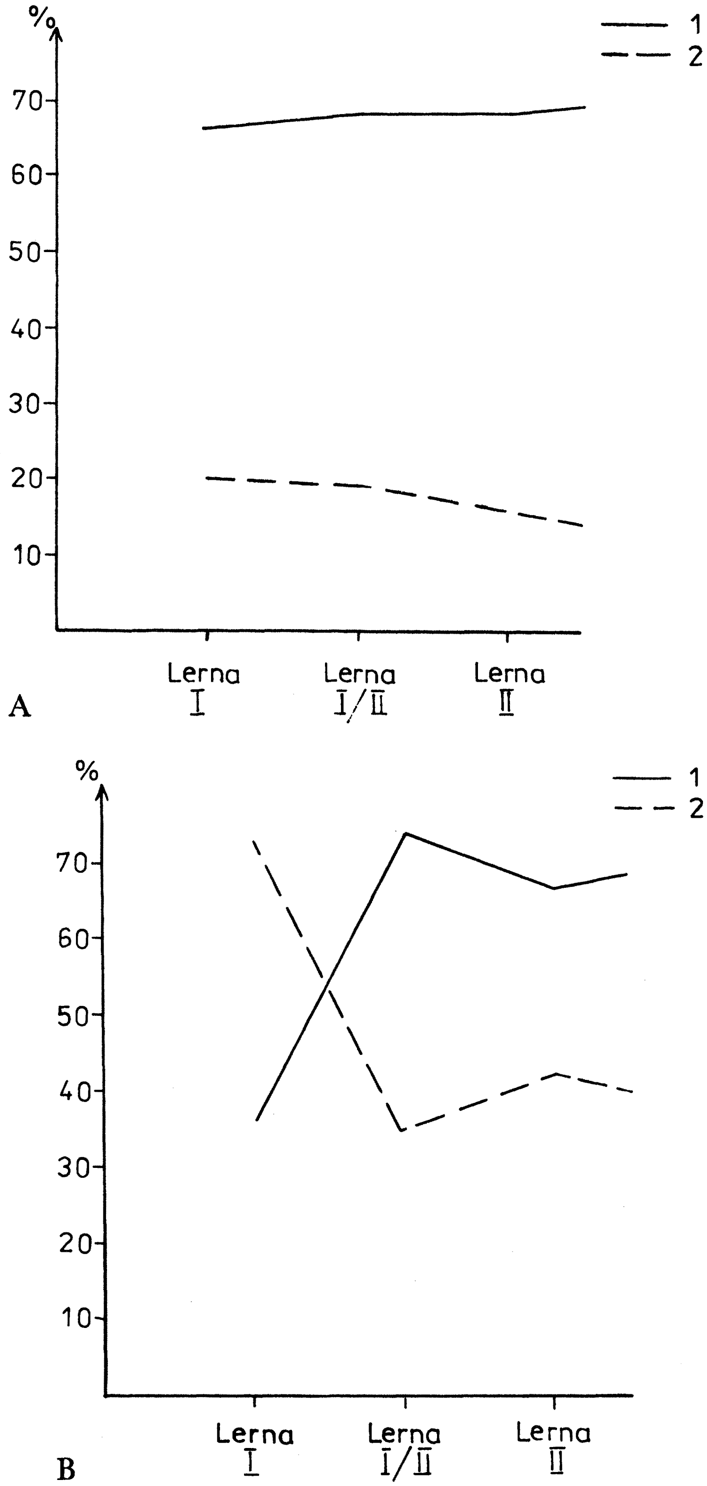
Key to platform types: (1) cortical and unprepared; (2) formed by single blow; (3) faceted; (4) dièdre; (5) punctiform and linear

FIG. 11. Diagram showing frequency of platform-type blades (1) and flakes (2)

(2) The obsidian inventory structure found in Lerna I/II and later levels is different from that recorded in Lerna I (Fig. 8:B). In Lerna I there is a distinct predominance of flakes over other major categories, and the proportion of blades and tools is almost equal, whereas in later levels the proportion of flakes drops sharply, and blades are most numerous (Table 11). Starting from level I/II the proportion of retouched tools grows, but it never exceeds that of blades. This means inhabitants of the earliest level obtained only partially decorticated cores whose subsequent preparation, reduction, and rejuvenation was performed in the vicinity of dwellings. In the later levels, on the other hand, fully preformed cores were exploited. It is thus probable that decortication and core preparation took place directly at the deposits, or at least outside the habitation zone of the settlement.[25] The possibility that a portion of the blades was brought to the settlement already formed cannot be excluded.

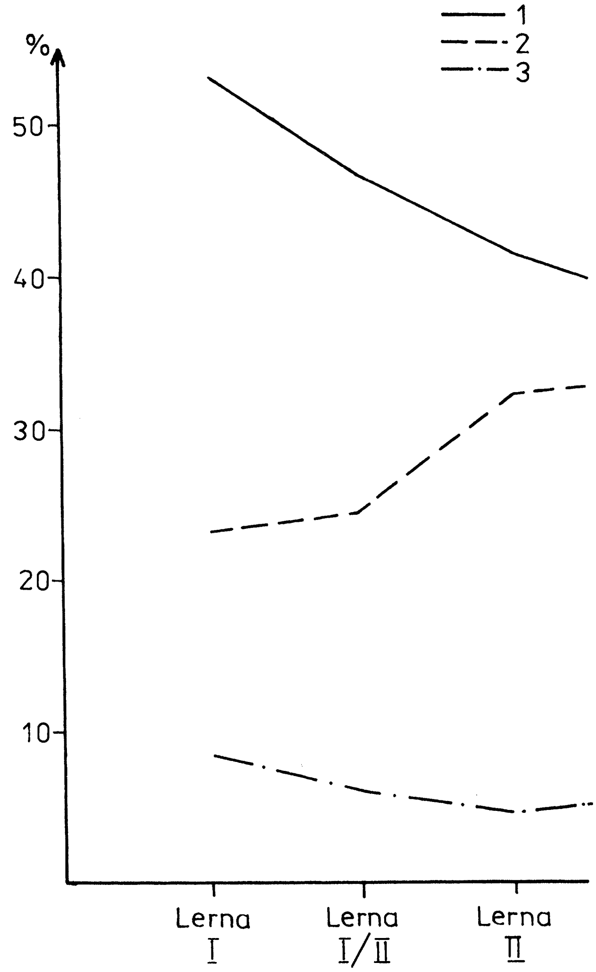
(3) The thesis presented here is not totally consistent with the increase in the proportion of partially cortical flakes (Fig. 9) and flakes with cortical platforms (Fig. 10) that is recorded after Lerna I. This discrepancy can be explained by the difference of core types, namely, from

[25] The problem of the division of labor along the production chain, from workshops at extraction points to workshop zones at settlements, has been discussed many times in publications on Neolithic chipped-stone industries (cf., e.g., Kaczanowska and Kozłowski 1986, pp. 105–108; Lech 1990, pp. 51–59; and Torrence 1986).



Blade edges: A. (1) parallel; (2) irregular. B. Platform edges: (1) regularized or abraded; (2) unmodified

FIG. 12. Morphological and technological features of the Neolithic blades from Lerna



Key to tool categories: (1) end scrapers; (2) retouched blades; (3) splintered pieces

FIG. 13. Frequency of the most important tool categories in the Neolithic layers of Lerna

predominantly specimens with decortication of the whole surface of the nodule to specimens with preparation extending mainly on the pre-flaking surface, leaving cortex on core sides and back. In the advanced or final phases of processing, when the flaking surface was being broadened, blanks with partially cortical surfaces were removed.

(4) Dimensions of blade blanks did not undergo essential transformations. Obsidian blades were fairly small. Artifacts made from siliceous rocks were distinctly longer. In particular, chalcedony Ch1 played an important role in Lerna I, while flint F1 was found mainly in the Lerna II set.

(5) Blade and flake blanks were taken from cores with similar preparation. This is corroborated by the approximate frequency of platform types (Fig. 11). The similarity between flakes and blades is greatest in the Lerna II set, least in Lerna I. Thus, flakes

were not removed when a pre-core or core was formed, but rather they were an accidental by-product of blade production or core rejuvenation.

(6) An increasing proportion of blades with parallel lateral sides, and a decreasing number of specimens with irregular lateral sides, can be observed in the sequence (Fig. 12:A). At the same time, the proportion of blades with platform edges from which irregularities had been removed grows dramatically from Lerna I to remain at the same level in the Lerna II sets (Fig. 12:B). This bears witness to the application of pressure technique and to progressively more standardized blade blanks. The application of these techniques required greater specialization, exceeding the potential of on-site production directed at meeting the demands of a single settlement.

(7) In the group of tools a steady drop in the numbers of end scrapers and splintered pieces can be observed, whereas the ratio of blades with lateral retouch grows (Fig. 13). The lesser importance of splintered pieces and the splintered technique is confirmed by the decreasing proportion of flakes with punctiform and linear platforms. As far as the tool kits are concerned the greatest differences have been recorded between Lerna I and Lerna I/II.

Summing up the above remarks we can say that the transformations of lithic industries on the site at Lerna, in the analyzed levels, oscillate only slightly, and no drastic changes could be observed. The most conspicuous changes in respect to the use of raw materials, raw-materials economy, methods of blank exploitaton, and typical tool kits can be seen between the Early Neolithic of Lerna I and the transition to the Middle Neolithic of Lerna I/II. Subsequent development of industries in the Middle Neolithic did not introduce any substantial changes.

LITHIC INDUSTRIES FROM LERNA COMPARED WITH THOSE AT OTHER NEOLITHIC SITES IN GREECE

The intersite comparisons of Neolithic industries in the vicinity of Lerna are hindered by the limited exploration so far carried out in the eastern Peloponnese and by the fact that much of the excavated material has not yet been published. This is the case, for example, for the nearest sites in the Argolid and Arcadia, namely, Dendra (investigated by E. Protonotariou-Deïlaki), Tiryns, Ayioryitika, Nemea,[26] and possibly Lorka.[27] The very important finds from a well-explored sequence in the Franchthi Cave in the eastern Argolid have been exhaustively described by C. Perlès, yet the full publication deals only with the Palaeolithic and Mesolithic levels.[28] The Neolithic levels, on the other hand, are known only from general works concerned with raw-materials economy in the Greek Neolithic[29] and with the Neolithization of Greece.[30]

Comparisons of the raw materials and technology and, to a lesser extent, the typology of the Lerna and Franchthi chipped stone can be attempted. But the initial Neolithic (*phase lithique X*) cannot be taken into account. At Franchthi 70% of the artifacts from

[26] Blegen 1975.
[27] Hansen 1992, p. 244.
[28] Perlès 1987a, b, 1990a, 1992.
[29] Perlès 1990b; Binder and Perlès 1990.
[30] Perlès 1987a, b, 1989, 1992.

this phase continue Mesolithic traditions, mainly of microflake technology unknown at Lerna. Important similarities can be observed only with the Early Neolithic chipped stone at Franchthi, unfortunately unpublished so far.

The raw-materials composition of the Early Neolithic from Franchthi is comprised of three groups: local jaspers used to produce flakes for sickle inserts, obsidian imported from the island of Melos for the production of blades and bladelets usually used without retouch, and flint (*silex blond*, according to Perlès) imported as completed blades from sources as yet unidentified (these blades were used mainly as sickle inserts). The raw-material structure from Franchthi described above differs from that at Lerna, where local raw materials were not processed and the importance of mesolocal raw materials was much more limited. But at both sites obsidian was the most frequently used extralocal raw material.

The technological structure of Early Neolithic obsidian artifacts at Franchthi shows considerable similarity to that of Lerna I. Blades and bladelets are more numerous at Franchthi than are noncortical flakes, waste from core rejuvenation, and cortical flakes.[31] In the Lerna I set, on the other hand, flakes, notably flakes from core rejuvenation, are more numerous than blades and bladelets. In both inventories splintered pieces came just behind the group of blades and bladelets; at Franchthi, however, they are more numerous than flakes, whereas in the Lerna I set splintered pieces are fewer than flakes, which in that set form the largest group.

Perlès suggests that in the Early Neolithic, cores were supplied to the site at Franchthi as *nucléus performés* (fully shaped pre-cores).[32] In the case of the Lerna I set, however, it can be assumed that they were brought to the site as decorticated nodules only. Obsidian blades were produced at Franchthi using pressure technique. It is likely that in the Lerna I assemblage direct percussion was used for core preparation and rejuvenation, whereas most blades were detached using the soft hammer.

If we make the assumption, which still requires confirmation by mineralogical-petrographical analysis, that *silex blond* from Franchthi is identical with our chalcedony Ch1 and Ch2 (see p. 296 above), then the structure of major technological groups made from these raw materials both at Franchthi and Lerna is clearly dominated by blades and blade tools. This extralocal raw material reached the two sites as completed blades which functioned primarily as sickle inserts. Because the Early Neolithic from Franchthi is not published, a comparison of the structure of the Franchthi retouched tools with those from Lerna I is not possible. It should be stressed that flakes, blades, and blade tools were used as splintered pieces in the final phase of their utilization. This technique fulfilled various roles in stone working. Splintered pieces could be formed from (a) the effect of using pieces of flint as wedge-type tools or for other purposes; (b) a type of intentional retouch, thinning the distal end or bases of flakes or blades in order to make mounting in the haft easier or to obtain working edges; (c) use as a kind of bipolar core for the production of small flakes or bladelets. At Lerna flakes and bladelets of this type showed use wear, indicating that they were intentionally produced.

[31] Perlès 1990b, p. 13, histogram 11.

[32] Perlès 1990b.

There is more information about the Middle Neolithic chipped stone from Franchthi with which to compare the finds from Lerna II. When the group of obsidian artifacts is taken into consideration, the very beginning of the Middle Neolithic (*Néolithique moyen ancien F/A*) shows a certain increase in the frequency of flakes in comparison to blades and bladelets.[33] In Middle Neolithic proper (*Néolithique moyen F/A*) the situation changes, as blades dominate over flakes and cortical flakes become more numerous.[34] Perlès explains the change by assuming that cores in a less advanced stage of preparation were brought to the site, where the preparation was completed and the whole process of blade exploitation was carried out. At Lerna the dynamics of changes in the location of particular phases of preparation and core reduction is the opposite. In Lerna I decorticated cores were supplied, and the whole process of preparation, core rejuvenation, and (most important) core exploitation took place on the site. Starting from Lerna I/II and in Lerna II, the drop in the frequency of flakes indicates that fully prepared cores were brought to the site. In some cases cortical surfaces may have been partly preserved, since cortex is present on blank dorsal surfaces. The surplus of blades as compared to flakes may result from change in the core morphology, making core rejuvenation less frequent in Lerna I/II and II.

Essential changes in obsidian processing took place at Franchthi at the transition from the Middle to Late Neolithic. At that time unworked or partially decorticated obsidian blocks begin to reach that site.[35] Late Neolithic is a period from which no homogeneous assemblages occur in the sequence from Lerna (there are only some admixtures of Late Neolithic diagnostic finds in the Lerna II material).

The debitage and occasional obsidian cores at Franchthi make possible the reconstruction of *chaines opératoires* (operational chains) used in the processing of this raw material in the Middle Neolithic period. Just as at Lerna, cores were decorticated using the hard-hammer technique. Three crests were prepared using a punch, one on the front and two on the back. This method has not been recorded at Lerna, where blades and bladelets were produced from a prepared platform after the platform edge was abraded. Core rejuvenation was done by removing tablets and detaching blade-flakes from core sides for the purpose of *reprise du cintrage du nucléus*[36] (reestablishing the symmetry of the nucleus). At Lerna the knapper(s) achieved a narrow and symmetrical flaking surface by rejuvenation of lateral crests. This suggests that obsidian knappers at Lerna were less skillful.

On both sites the debitage products were transformed into splintered pieces in the final phase of the exploitation of a tool.

The Middle Neolithic levels at Franchthi yield numerous artifacts made from local raw materials described by Perlès as jasper and *chaille*. At Lerna II local raw materials were not worked. Mesolocal raw materials (flint F1) account for a very small percentage (2.0%) and were represented only by blades and retouched tools (see Table 13). At Franchthi, by contrast, flakes were obtained from local raw materials using a specific technique. These flakes were then used to produce specialized tools, mainly perforators for working shell. At both Franchthi and Lerna, the Middle Neolithic layers yielded artifacts made from siliceous rocks, defined as *silex blond et miel* at Franchthi and as chalcedony Ch1, Ch2, and Ch3 at

[33] Perlès 1990b, p. 12, histogram 6.
[34] Perlès 1990b, p. 12, histogram 7.
[35] Perlès 1990b, p. 14.
[36] Binder and Perlès 1990, p. 272.

Lerna. No flakes of flint *blond et miel* were recorded at Franchthi. At Lerna there was one small flake of chalcedony. It is likely that siliceous raw materials reached the sites as completed blades, much longer than obsidian blades. Both at Franchthi and Lerna, blades from siliceous rocks frequently have lateral retouch, often rejuvenated, and use wear from functioning as sickle inserts.[37]

The preceding analysis allows the conclusion that the production of chipped-stone implements in the Early and Middle Neolithic did not undergo significant changes at either Franchthi or Lerna. Production was based primarily on extralocal raw materials: obsidian and flint/chalcedony. The shape of the obsidian brought to Lerna and Franchthi changed somewhat differently at each site. The technology of processing and tool morphology remained basically unchanged.

Lerna provided some evidence concerning the controversial issue of the methods of obsidian procurement on the island of Melos. Some obsidian micropebbles (or gravel grains) in Lerna II (listed in Table 13 in the group of chunks), because of their size, which was unsuitable for processing, could have found their way to the site together with larger nodules brought in sacks or some other containers. This would suggest direct procurement from the deposits on the island of Melos, rather than redistribution of this raw material through intermediaries.

Another model of distribution should be suggested for chalcedony and *silex blond*, whose source is located outside the Peloponnese, possibly even outside Greece.[38] Unfortunately, no mineralogical studies have been performed on chalcedony from Lerna or on honey-colored flint from Franchthi. Similar raw materials were absent, until now, in all surveyed areas of Mesozoic outcrops in Greece. In this situation a very remote origin of these silicious raw materials is possible. The nearest known areas of occurrence of macroscopically similar flints or chalcedony are in northwest Bulgaria (in the region of Belogradchik). Siliceous rocks were worked in the vicinity of deposits in specialized workshops. From these areas completed blades were distributed to the Argolid, possibly by a systematic exchange network. This network included many Early Neolithic groups belonging to the Eastern and Central Balkans complex with monochrome, painted, and barbotine ceramics.[39]

It should be remembered that the Early Neolithic chipped-stone industry of Lerna I exhibits a number of parallels with the "pre-ceramic" Neolithic industries of Thessaly. Similarities include the raw-materials structure, technology, and morphology of lithic implements. The chipped-stone industry from the lowest level of the tell at Argissa has been well investigated.[40] The raw-materials structure of this industry is similar to that found in the Argolid: obsidian dominates the assemblage, although the obsidian deposits on the island of Melos are almost three times the distance from Argissa as from the Argolid. The group of obsidian artifacts shows a typical predominance of blades and relatively small quantities of flakes and waste from core rejuvenation. Products of the splintered technique are the next most numerous group after blades.[41] This assemblage is interpreted by Perlès as evidence that fully prepared blade cores were brought to the site, ready for the removal of blades

[37] Cf. Binder and Perlès 1990, figs. on pp. 274, 277.

[38] Perlès 1990b, pp. 9–10.

[39] Gatsov 1993.

[40] Milojcić, Boessneck, and Hopf 1962, pp. 6–11, pls. 18, 19; Perlès 1987a; Tellenbach 1983.

[41] Perlès 1990b, histogram 2.

and bladelets. Local raw materials, on the other hand, are represented at all phases of the full operational chain, from decortication of nodules to blade production.

Other extralocal raw materials at Argissa are represented by flints (*silex blond* and *silex brun-vert*), almost all blades with few flakes (made from flint *brun-vert*). These raw materials were imported as completed blades (*silex blond*, whose derivation is unknown) or partly as cores and partly as blades (flint *brun-vert* from the Pindus Mountains in western Greece or mountain massifs surrounding Thessaly).

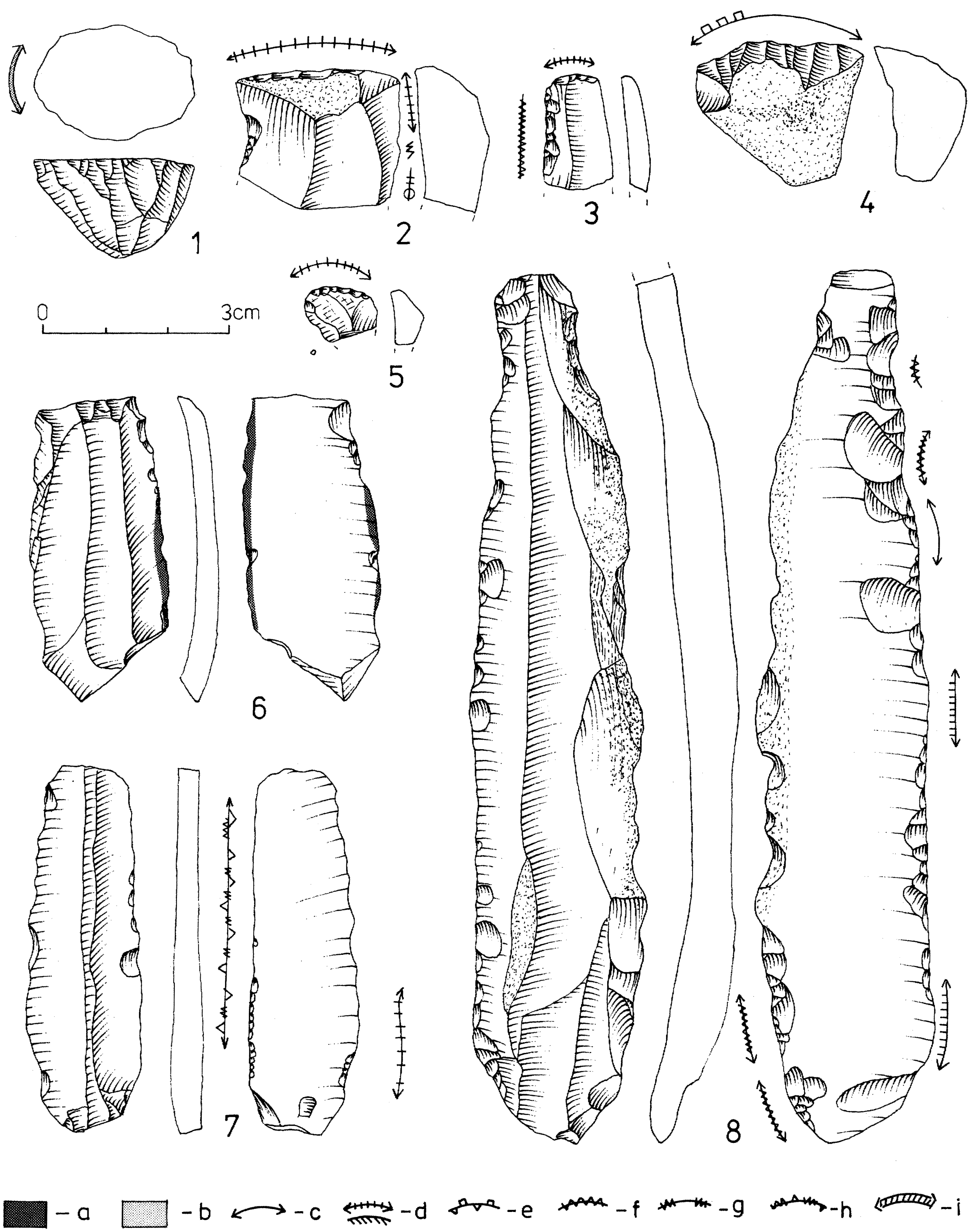
A similar structure of technology and raw materials is also typical of later phases of the Early Neolithic in Thessaly, which in terms of taxonomy is ascribed to the Proto-Sesklo and Sesklo cultures. The latter culture yielded a fairly rich series of chipped-stone artifacts at Achilleion. These artifacts were published, with great attention to detail, by Elster and were dated to the second half of the 6th and the beginning of the 5th millennium B.C., that is, to the transition from Early to Middle Neolithic.[42] The proportion of local raw materials (radiolarites) becomes slightly larger in the chipped-stone assemblage of this period, and the proportion of obsidian drops to 43–28%, depending on the settlement phase. Flints and chalcedony, deposits of which were tentatively located by Elster (after K. Gallis) in the area of Theoptera near Kalambaki, occur in smaller quantities (6.6% and 3.4%, respectively). The technology of blade production was similar to that of Lerna I but differed somewhat depending on the raw material. Obsidian was supplied as preformed cores. Retouched tools are few (only 7.5% of blanks are retouched) and are represented mainly by blades with lateral retouch.

There is less information about other sites in Thessaly, such as, for example, Sesklo or Prodromos. Materials from these sites have not been published. In her dissertation Moundrea-Agrafioti suggests that these sites repeat the Early Neolithic model of lithic industries known from Argissa.[43]

The examples given above point to an astonishing uniformity of raw materials and technology in the Early Neolithic period throughout Greece, from the Argolid in the south to Thessaly in the north. This uniformity not only concerns functional and technological requirements but is also deeply manifested in the style of debitage and the shaping of retouched tools. This stylistic uniformity could be seen as support for the hypothesis that in Greece the Early Neolithic derives from a single external (*allogeneon*) source as an effect of migration, probably trans-Aegean. This hypothesis has been reinforced by investigations into the origin of domesticated plants in Early Neolithic Greece.[44] At the same time, the homogeneity of the systems of raw-materials procurement in that period indicates that, when the settlement pattern in eastern Greece took shape in the 6th millennium B.C., an important network of raw-materials exchange was established in Greece and subsequently in the Eastern Balkans.

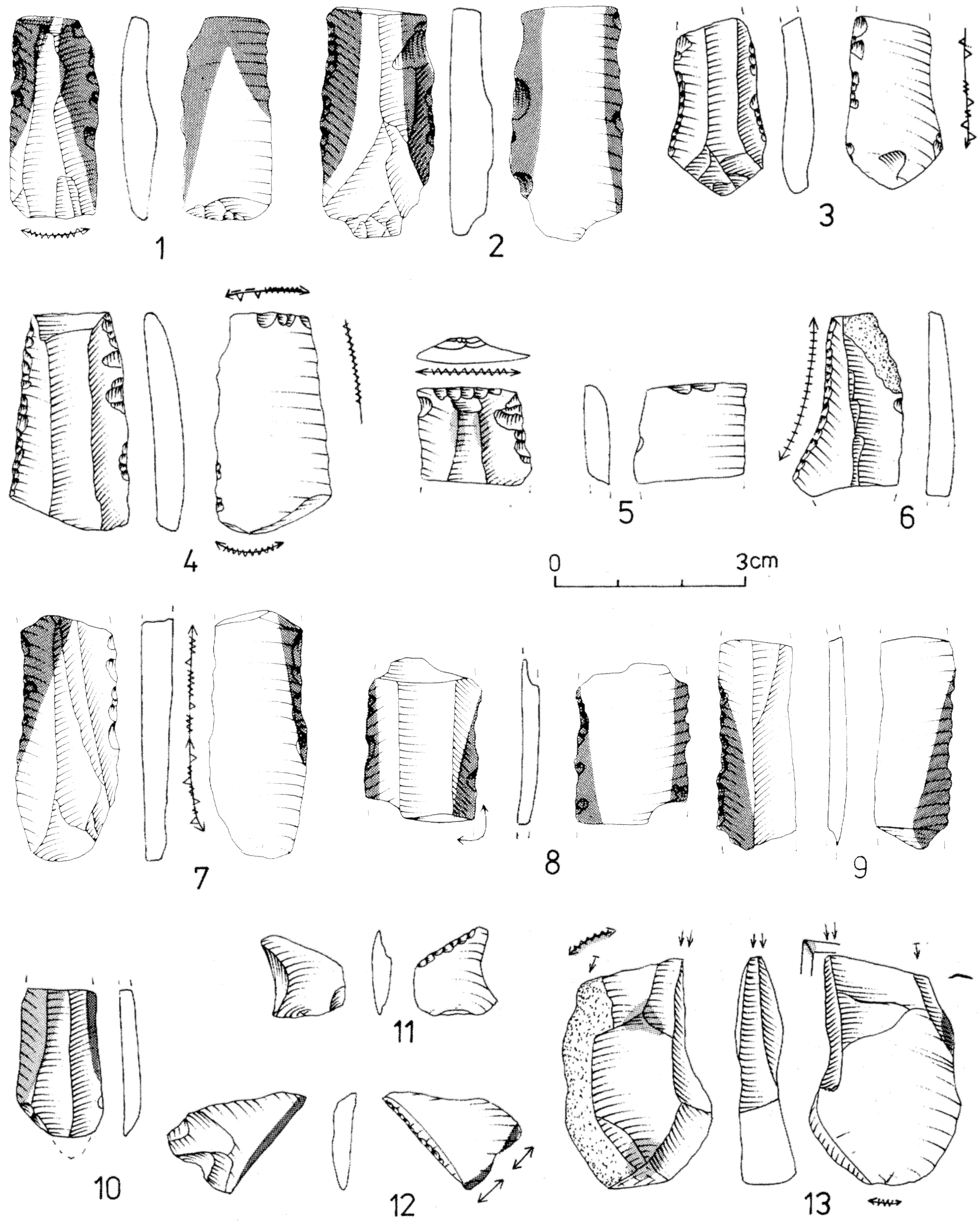
No significant changes in processing technology, tool morphology, or raw-materials procurement are detectable before the middle of the 5th millennium B.C.. Despite some variability at different sites in terms of which stages of production are represented, there are no consistent developmental trends observable at the sites so far well documented for the periods in question.

[42] Elster 1989, pp. 273–301.
[43] Moundrea-Agrafioti 1981.
[44] Hansen 1992.

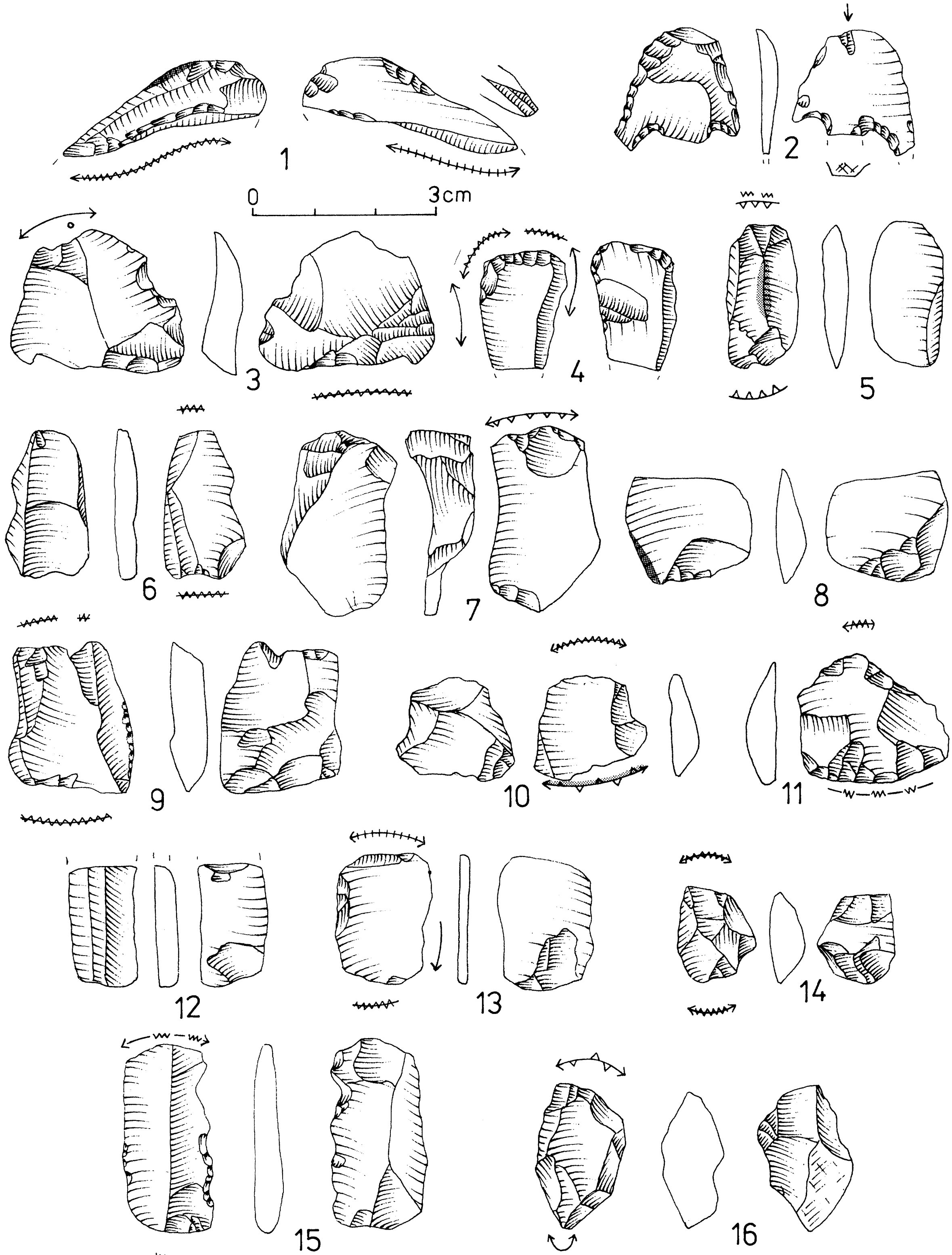


Key to schematic symbols of use wear: a. silica gloss, b. polish, c. edge rounding, d. striations (perpendicular or oblique to the edge), e. microscars (rectangular or triangular), f. edge crushing, g. edge crushing and rounding, h. microscars and edge crushing, i. edge rounding and polishing

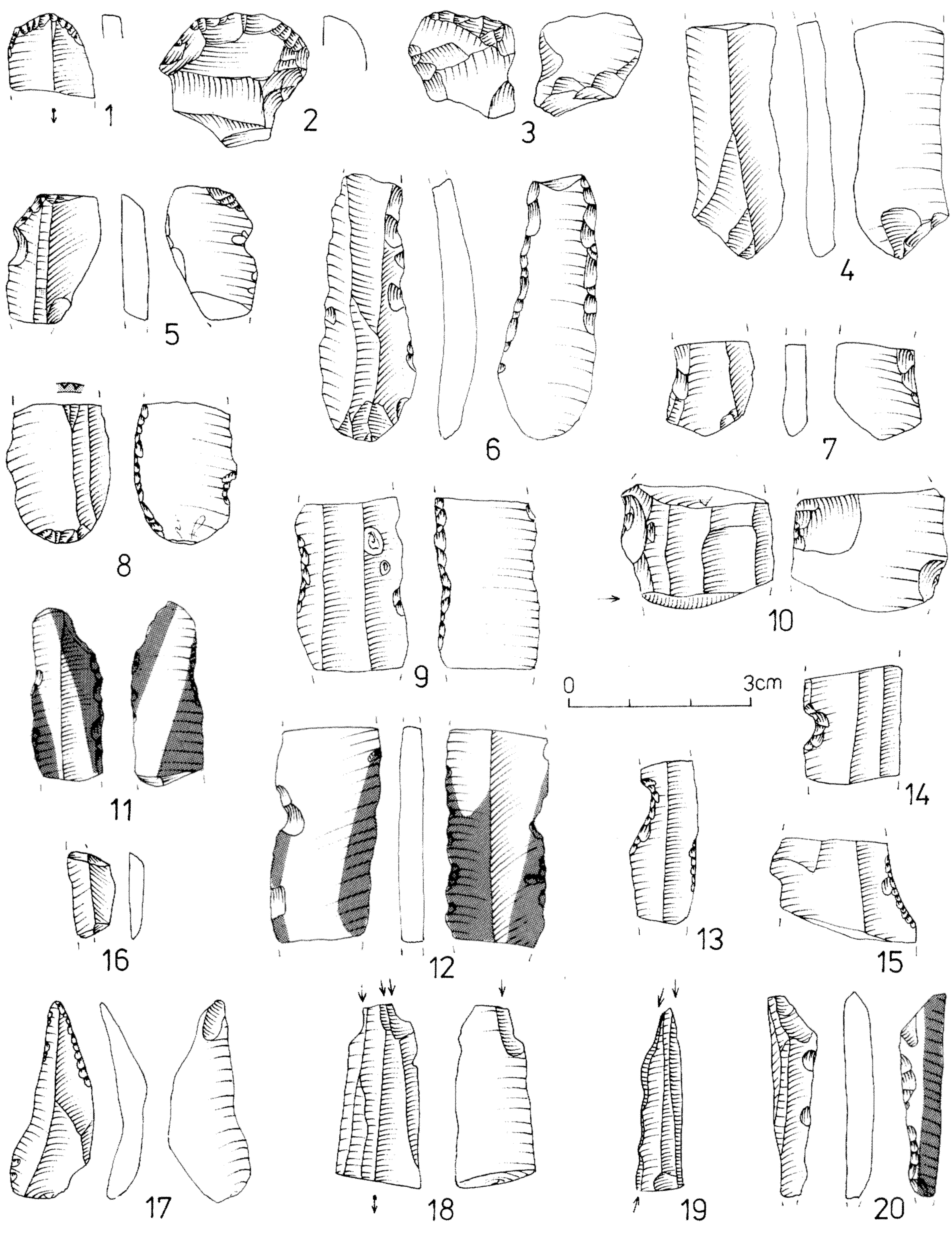
Ill. 1. Lerna I. 1. Core. 2–5. End scrapers. 6. Retouched truncated piece. 7, 8. Retouched blades. Raw materials: obsidian (1–3, 5); radiolarite R2 (4); chalcedony Ch1 (6–8)



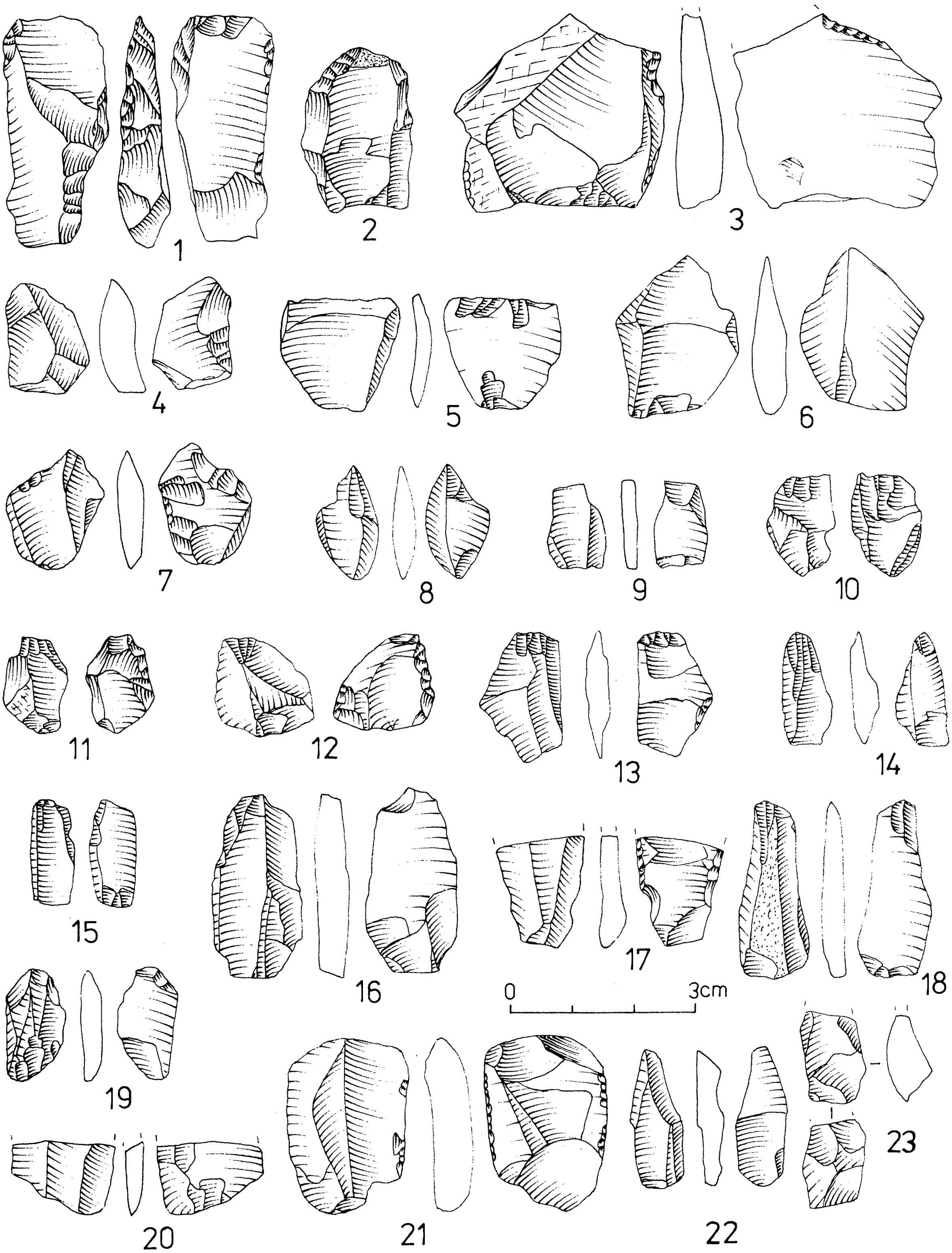
ILL. 2. Lerna I. 1–10. Retouched blades. 11, 12. Retouched flakes. 13. Burin. (For the key to schematic symbols of use wear see Ill. 1.) Raw materials: chalcedony Ch1 (1, 2, 7–9); obsidian (3–6, 10–13)



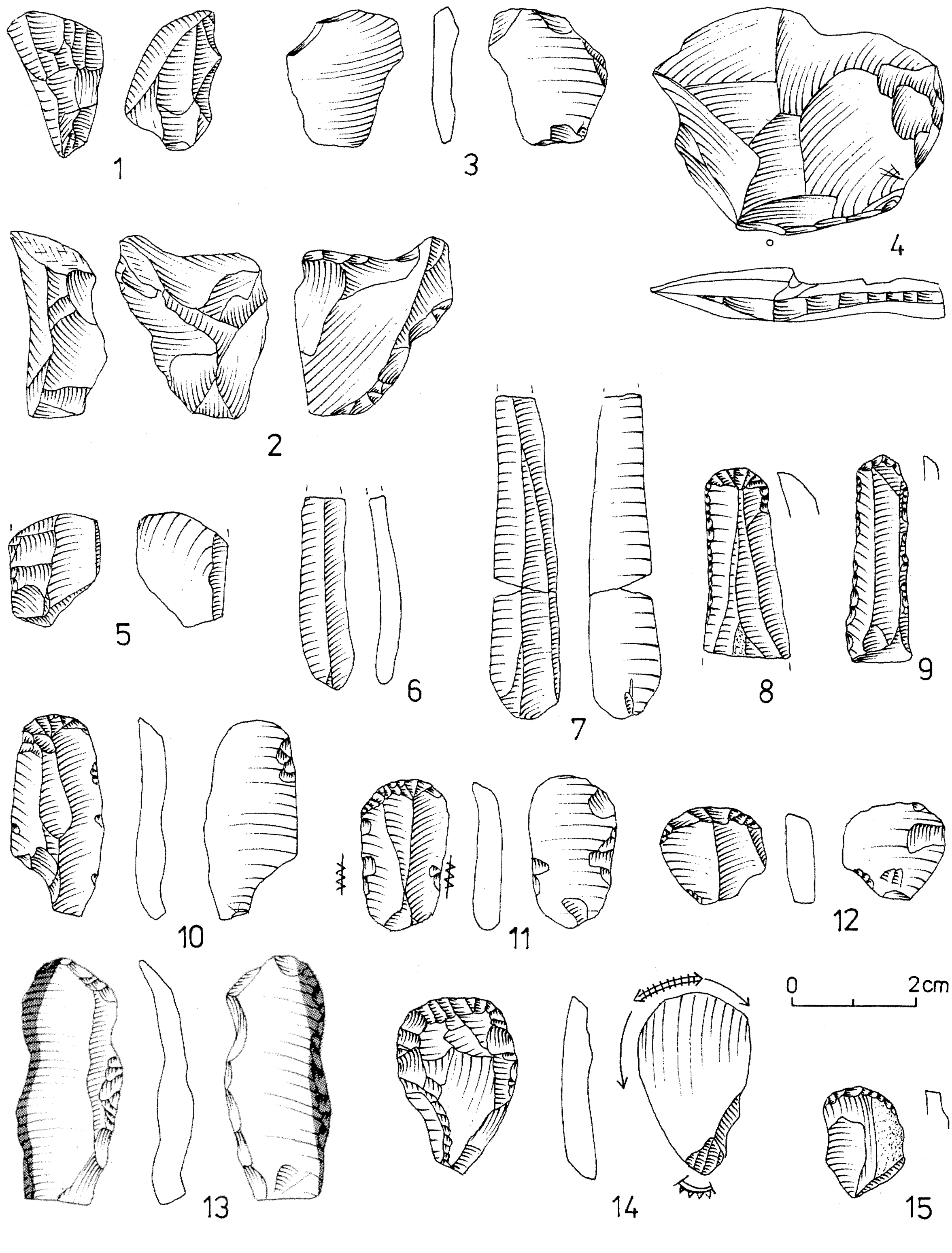
ILL. 3. Lerna I. 1. Burin spall. 2. Tanged point. 3–16. Splintered pieces. (For the key to schematic symbols of use wear see Ill. 1.) Raw material: obsidian (1–16)



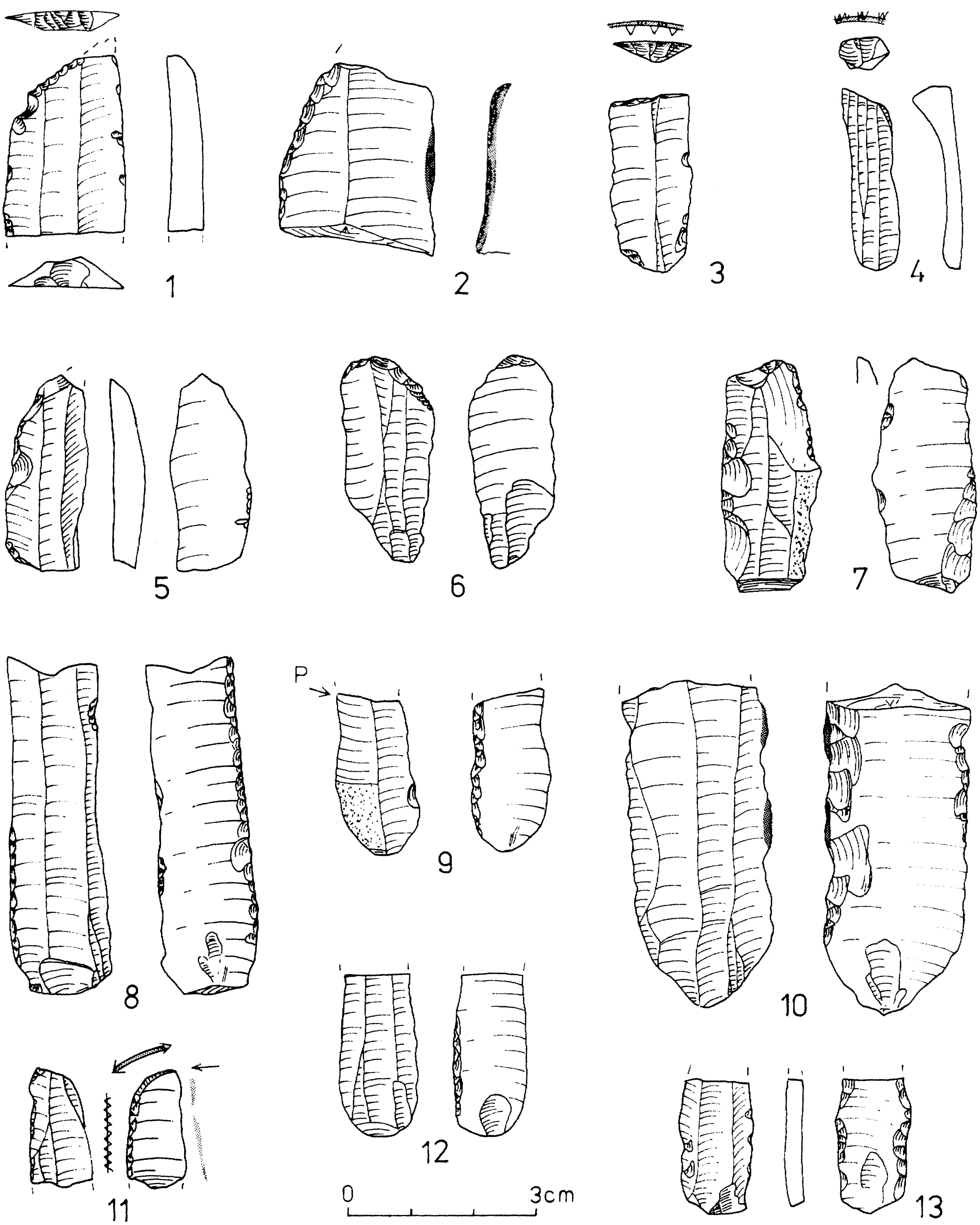
ILL. 4. Lerna I/II. 1–3. End scrapers. 4, 5. Retouched truncated pieces. 6–12. Retouched blades. 13–15. Notched blades. 16. Trapeze. 17. Perforator. 18. Burin. 19, 20. Burin spall. (For the key to schematic symbols of use wear see Ill. 1.) Raw materials: obsidian (1, 4, 6–8, 11, 13–20); radiolarite R2 (2, 3); chalcedony Ch1 (5, 12); flint/undetermined (9, 10)



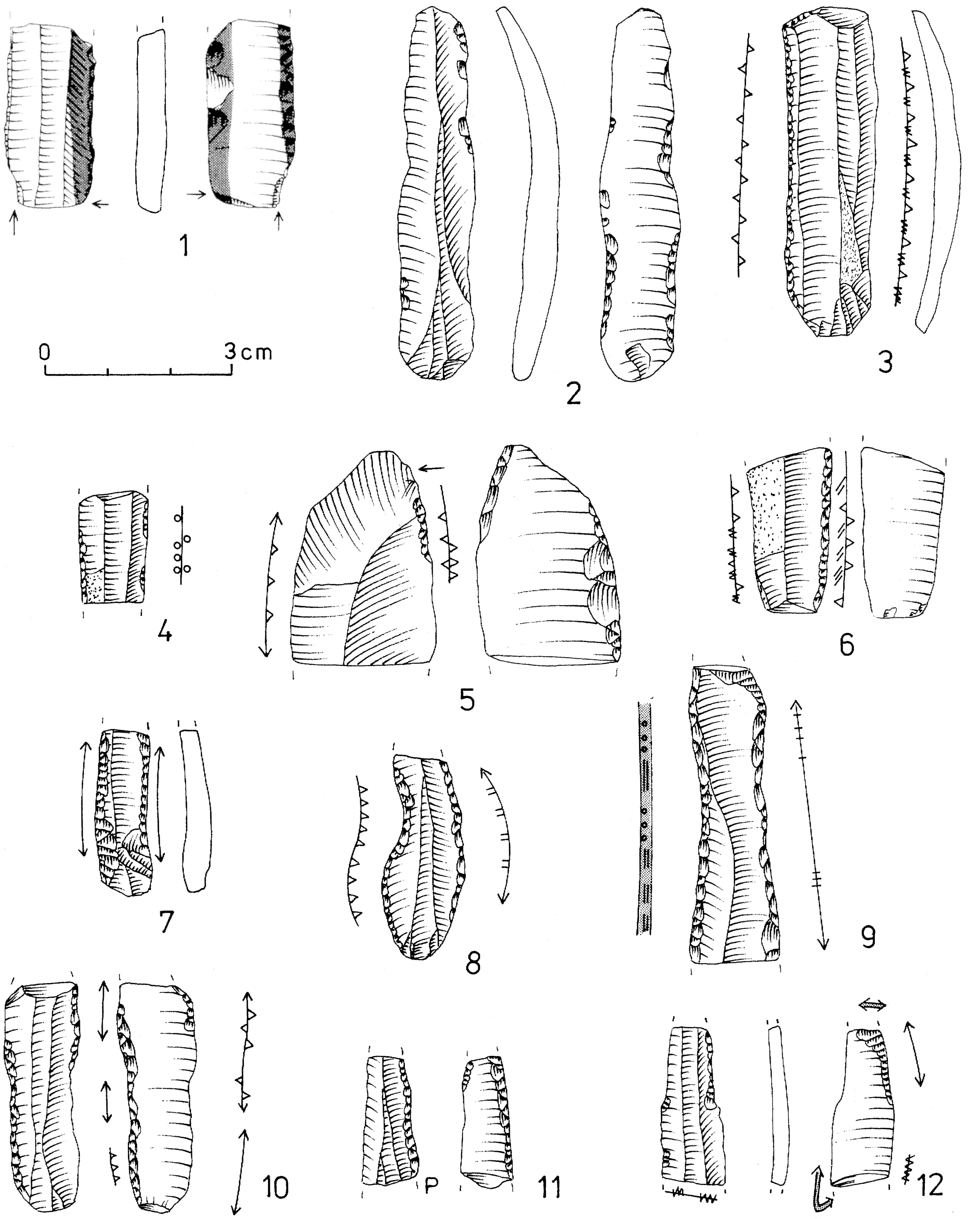
ILL. 5. Lerna I/II. 1. Backed implement. 2–4. Retouched flakes. 5–12. Splintered pieces. (For the key to schematic symbols of use wear see Ill. 1.) Raw materials: obsidian (1, 3–23); radiolarite R1 (2)



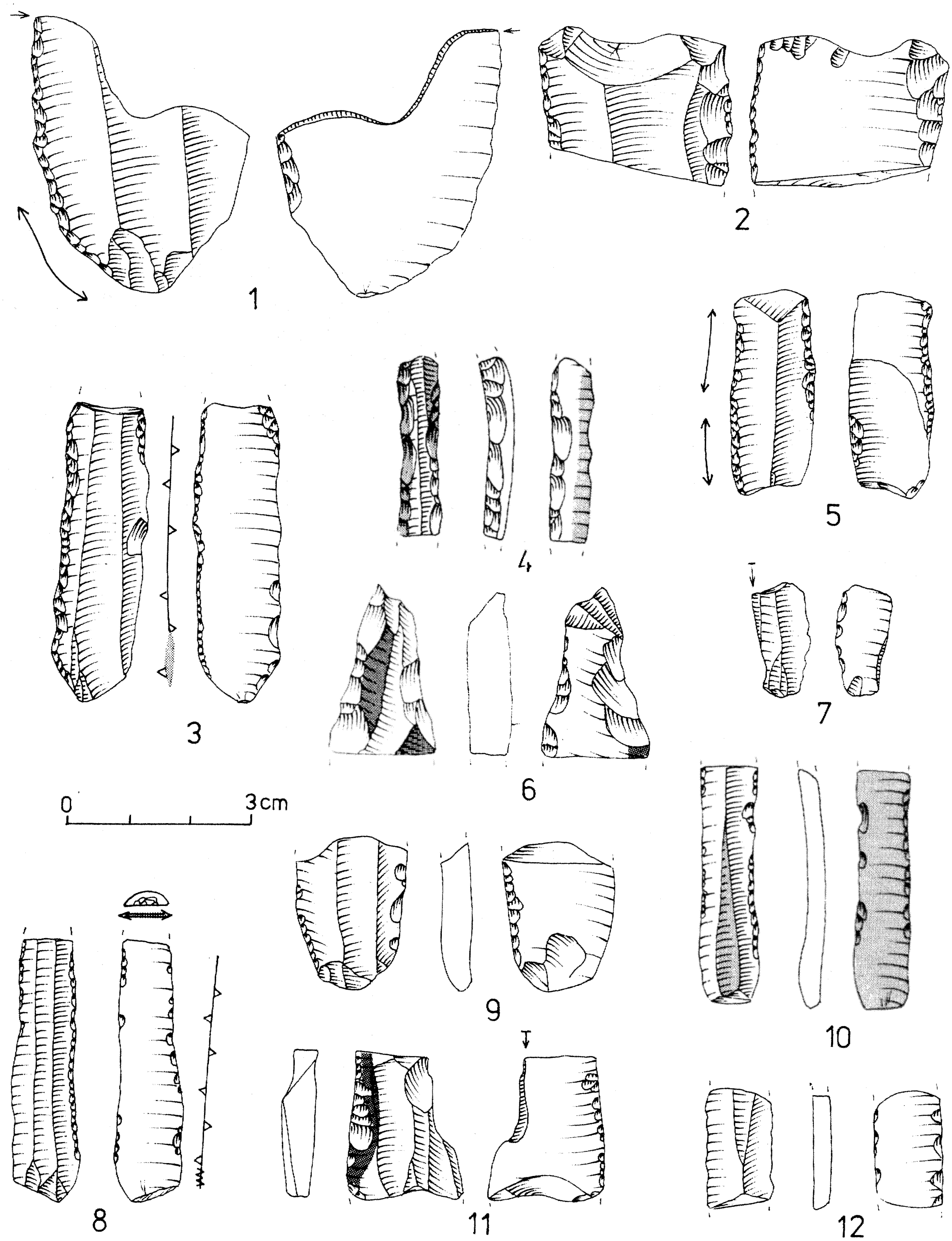
Ill. 6. Lerna II. 1, 2. Cores. 3. Flake from bipolar debitage. 4. Tablet. 5. Flake from retouched implement. 6, 7. Blades. 8–15. End scrapers. (For the key to schematic symbols of use wear see Ill. 1.) Raw materials: obsidian (1–4, 6–12, 14–15); burnt flint (5); chalcedony Ch1 (13)



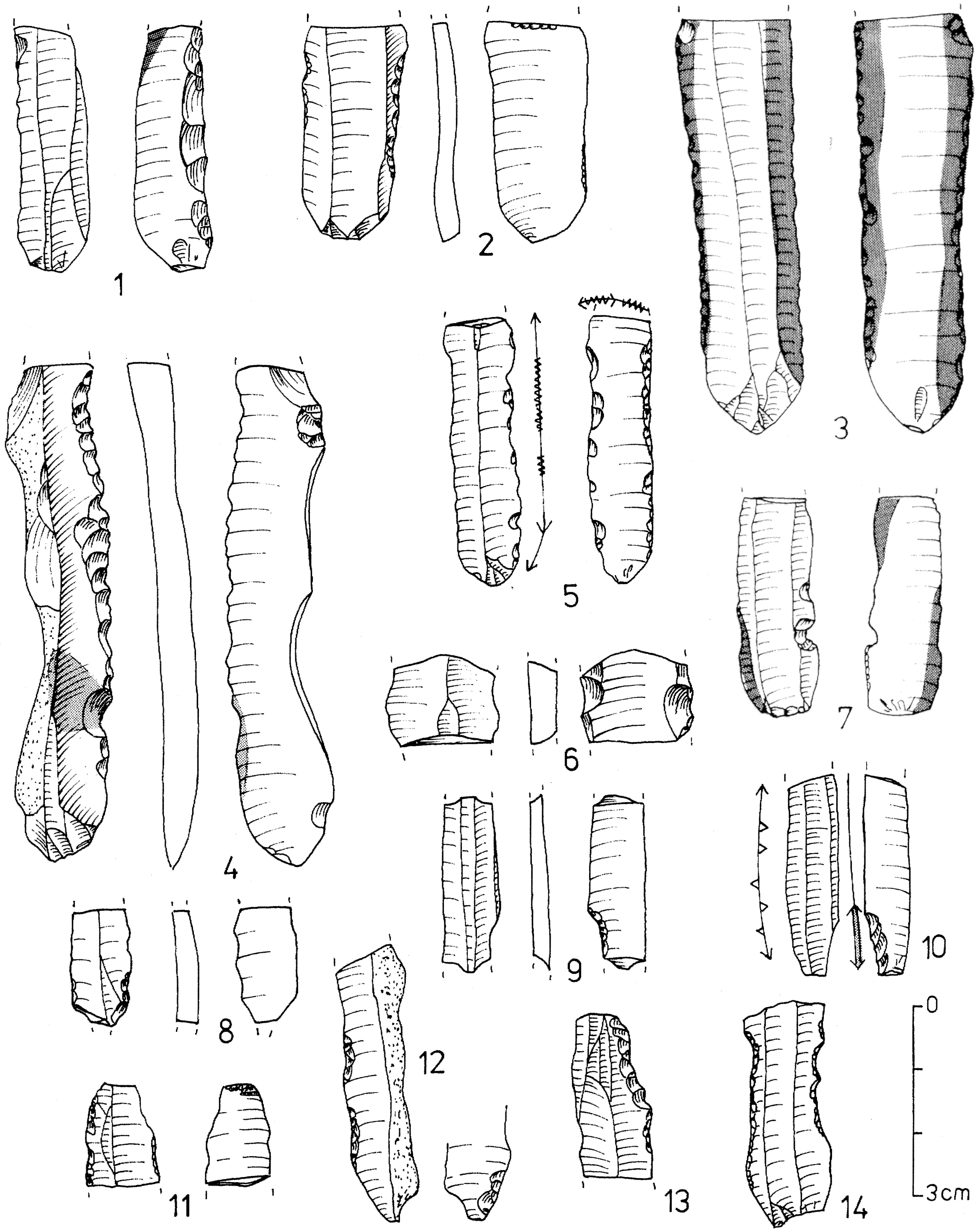
ILL. 7. Lerna II. 1–7. Retouched truncated pieces. 8–13. Retouched blades. (For the key to schematic symbols of use wear see Ill. 1.) Raw materials: obsidian (1, 3–9, 12, 13); flint F1 (2, 10); flint F5 (11)



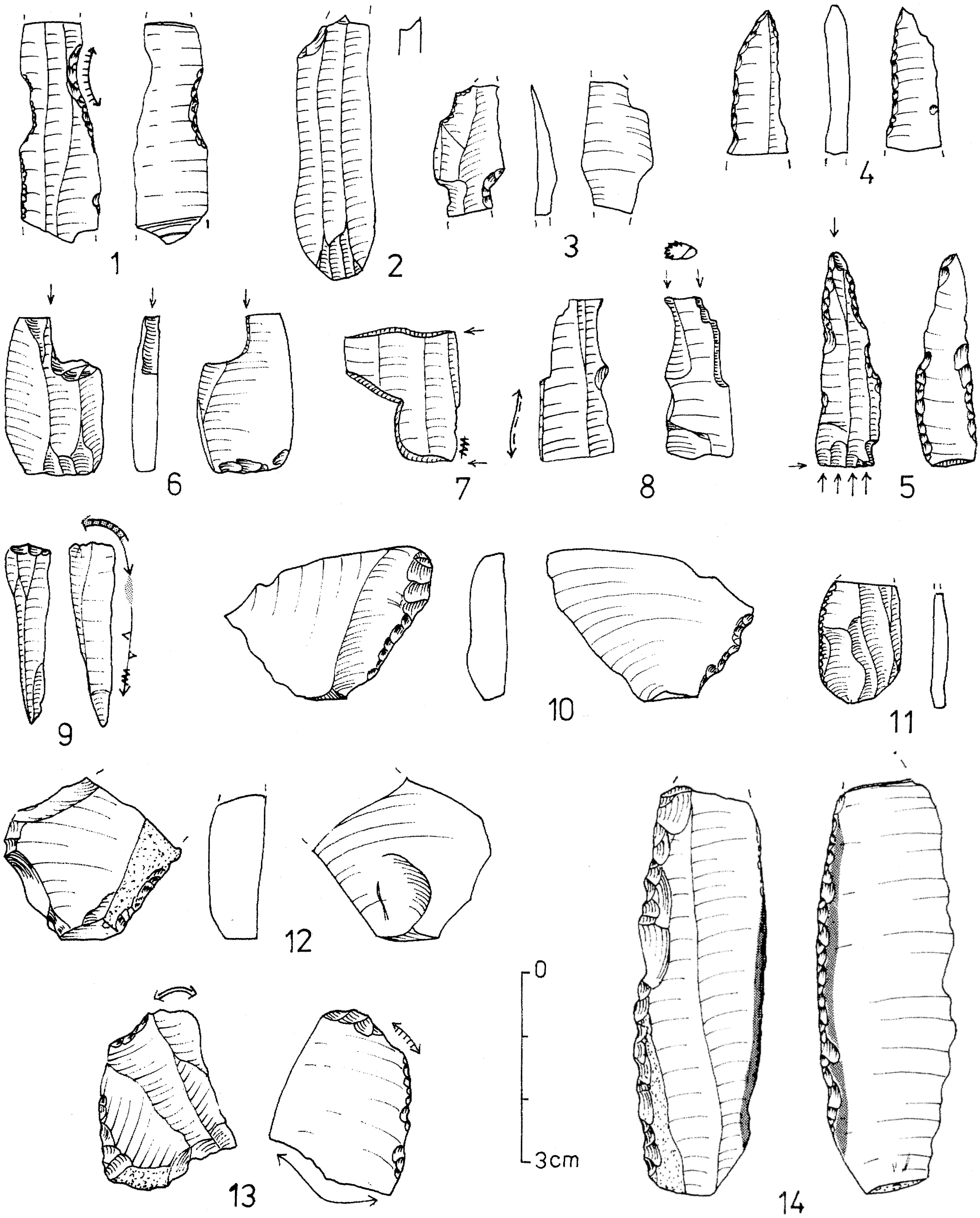
ILL. 8. Lerna II. 1–12. Retouched blades. (For the key to schematic symbols of use wear see Ill. 1.) Raw materials: chalcedony Ch1 (1, 5); obsidian (2–4, 6–12)



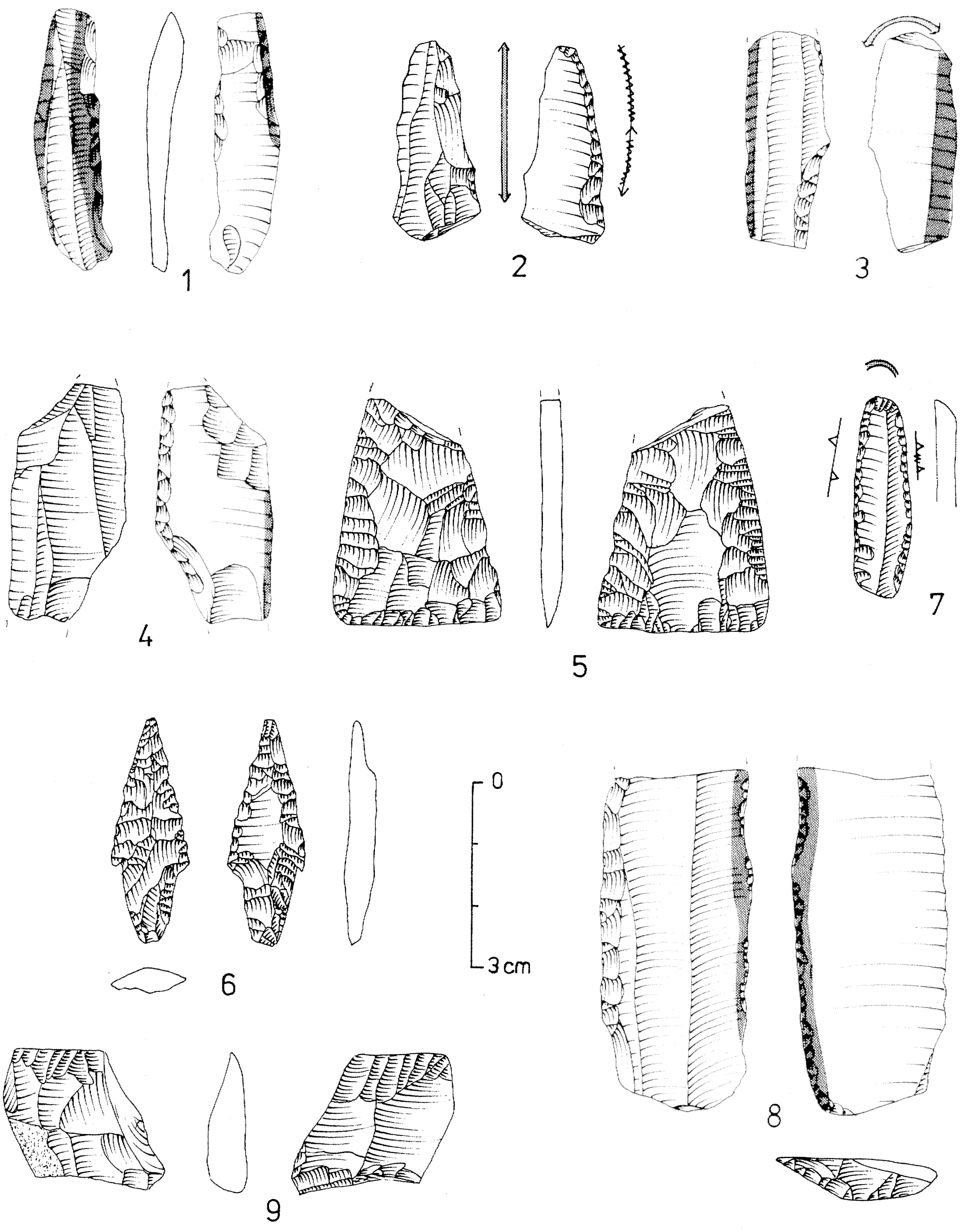
ILL. 9. Lerna II. 1–12. Retouched blades. (For the key to schematic symbols of use wear see Ill. 1.) Raw materials: flint F4 (1); obsidian (2–5, 7–10, 12); chalcedony Ch3 (6); chalcedony Ch1 (11)



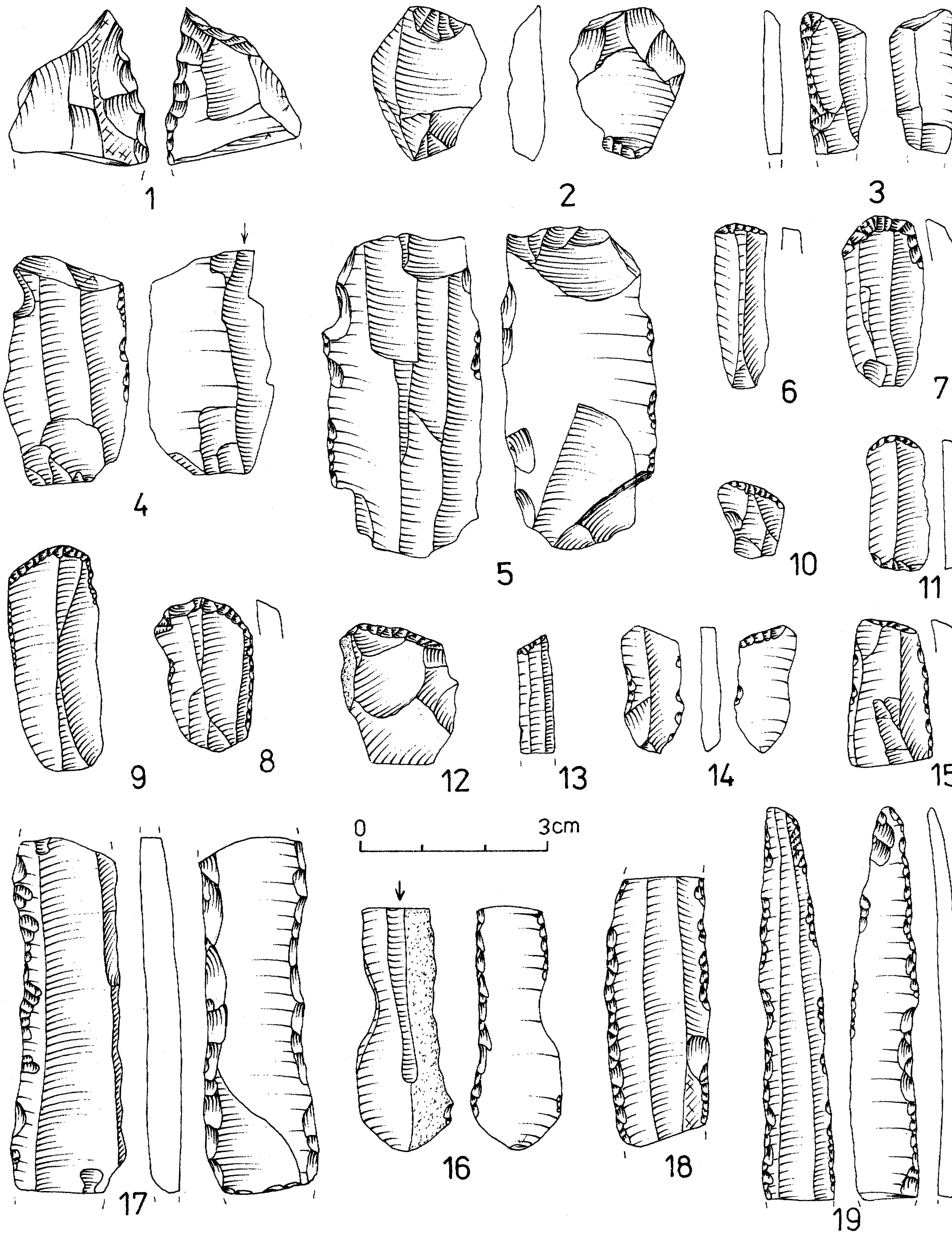
ILL. 10. Lerna II. 1–14. Blades with notched and denticulated retouch. (For the key to schematic symbols of use wear see Ill. 1.) Raw materials: obsidian (1, 2, 4–14); flint F1 (3)



ILL. 11. Lerna II. 1–3. Notched blades. 4, 5. Perforators. 6–8. Burins. 9. Burin spall. 10–13. Retouched flakes. 14. Backed implement. (For the key to schematic symbols of use wear see Ill. 1.) Raw materials: obsidian (1–13); flint F1 (14)



ILL. 12. Lerna II. 1, 2. Backed implements. 3, 4. Shouldered implements. 5, 6. Arrowheads. 7. End scraper on retouched blade. 8. Backed and truncated blade. 9. Splintered piece. (For the key to schematic symbols of use wear see Ill. 1.) Raw materials: obsidian (1–3, 6, 7); flint F1 (4, 8); flint F9 (5); flint F2 (9)



ILL. 13. Lerna II (1–5), Lerna II with Late and Final Neolithic intrusions (6–19). 1. Bifacially worked sickle insert. 2–5. Splintered pieces. 6–11. End scrapers. 12–15. Truncated pieces. 16–19. Retouched blades. (For the key to schematic symbols of use wear see Ill. 1.)

Table 11. Quantitative structure of major technological groups

	Lerna I				Lerna I/II				Lerna II				Lerna II and IIc, IId			
	Obs.	S.r.	Total	%	Obs.	S.r.	Total	%	Obs.	S.r.	Total	%	Obs.	S.r.	Total	%
Chunks	–	2	2	1.1	–	1	1	0.6	2	2	4	0.7	3	4	7	0.8
Cores	–	1	1	0.6	–	–	–	–	2	–	2	0.3	2	1	3	0.4
Core fragments	–	–	–	–	1	–	1	0.6	1	–	1	0.2	2	–	2	0.2
Flakes	49	7	56	31.5	30	1	31	18.0	75	5	80	15.2	110	6	116	14.7
Flake fragments	8	4	12	6.7	13	2	15	8.7	24	1	25	4.7	42	1	43	5.4
Blades and fragments	40	7	47	26.4	70	2	72	41.9	202	13	215	41.1	299	21	320	40.7
Chips and small flakes	9	1	10	5.6	7	–	7	4.1	26	1	27	5.1	42	1	43	5.4
Undetermined fragments	3	–	3	1.7	–	–	–	–	4	1	5	0.9	4	1	5	0.6
Tools total (with splintered pieces)	39	8	47	28.5	38	7	45	26.1	143	21	164	31.3	218	28	246	31.3
Total	148	30	178		159	13	172		479	44	523		722	63	785	
%	83.1	16.9	100		92.4	7.5	100		91.6	8.4	100		91.9	8.1	100	

TABLE 12. Raw-material structure

	Lerna I		Lerna I/II		Lerna II		Lerna II and IIc, IId	
Obsidian	148	83.1	159	92.4	479	91.6	722	91.9
Limestone	1	0.6	–	–	–	–	1	0.1
Hornstone H1	2	1.1	–	–	1	0.2	2	0.3
Serpentinite	–	–	–	–	1	0.2	1	0.1
Chalcedony Ch1	14	7.9	2	1.2	5	1.0	7	0.9
Ch2	–	–	–	–	3	0.6	5	0.6
Ch3	–	–	1	0.6	2	0.4	3	0.4
Flint F1	–	–	1	0.6	10	1.9	14	1.8
F2	–	–	–	–	4	0.8	4	0.5
F3	–	–	–	–	–	–	2	0.3
F4	2	1.1	1	0.6	1	0.2	1	0.1
F5	1	0.6	–	–	2	0.4	2	0.3
F6	–	–	1	0.6	–	–	1	0.1
F7	–	–	–	–	1	0.2	1	0.1
F8	1	0.6	–	–	–	–	–	–
F9	–	–	–	–	1	0.2	1	0.1
Flint burnt	4	2.2	2	1.2	2	0.4	4	0.5
Radiolarite R1	1	0.6	2	1.2	6	1.1	7	0.9
R2	4	2.2	3	1.7	4	0.8	4	0.5
R3	–	–	–	–	1	0.2	2	0.3
R4	–	–	–	–	–	–	1	0.1
Total	178		172		523		785	

TABLE 13. Raw-material structure of major technological groups

	Lerna I							Lerna I/II						
	Chunks	Cores	Flakes and chips, undet. frag.	Blades	Tools and splinter. piece	Total	%	Chunks	Cores	Flakes and chips, undet. frag.	Blades	Tools and splinter. piece	Total	%
Obsidian	–	–	69	40	39	148	83.1	–	1	50	70	38	159	92.4
Limestone	1	–	–	–	–	1	0.6	–	–	–	–	–	–	–
Hornstone H1	–	–	2	–	–	2	1.1	–	–	–	–	–	–	–
Serpentinite	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chalcedony Ch1	–	1	2	4	7	14	7.9	–	–	–	–	2	2	1.2
Ch2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ch3	–	–	–	–	–	–	–	–	–	–	1	–	1	0.6
Flint F1	–	–	–	–	–	–	–	–	–	1	–	–	1	0.6
F2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
F3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
F4	–	–	1	1	–	2	1.1	1	–	–	–	–	1	0.6
F5	–	–	1	–	–	1	0.6	–	–	–	–	–	–	–
F6	–	–	–	–	–	–	–	–	–	–	1	–	1	0.6
F7	–	–	–	–	–	–	–	–	–	–	–	–	–	–
F8	–	–	1	–	–	1	0.6	–	–	–	–	–	–	–
F9	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Flint burnt	–	–	2	2	–	4	2.2	–	–	–	–	2	2	1.2
Radiolarite R1	1	–	–	–	–	1	0.6	–	–	1	–	1	2	1.2
R2	–	–	3	–	1	4	2.2	–	–	1	–	2	3	1.7
R3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
R4	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	2	1	81	47	47	178		1	1	53	72	45	172	

	Lerna II							Lerna II and IIc, IId						
	Chunks	Cores	Flakes and chips, undet. frag.	Blades	Tools and spli-nter. piece	Total	%	Chunks	Cores	Flakes and chips, undet. frag.	Blades	Tools and spli-nter. piece	Total	%
Obsidian	2*	3	129	202	143	479	91.6	3*	4	198	299	218	722	91.9
Limestone	–	–	–	–	–	–	–	1	–	–	–	–	1	0.1
Hornstone H1	1	–	–	–	–	1	0.2	2	–	–	–	–	2	0.3
Serpentinite	–	–	1	–	–	1	0.2	–	–	1	–	–	1	0.1
Chalcedony Ch1	–	–	–	–	5	5	1.0	–	–	–	–	7	7	0.9
Ch2	–	–	1	2	–	3	0.6	–	–	1	3	1	5	0.6
Ch3	–	–	–	1	1	2	0.4	–	–	–	2	1	3	0.4
Flint F1	–	–	–	3	7	10	1.9	–	–	–	5	9	14	1.8
F2	–	–	–	2	2	4	0.8	–	–	–	2	2	4	0.5
F3	–	–	–	–	–	–	–	–	–	–	2	–	2	0.3
F4	–	–	–	–	1	1	0.2	–	–	–	–	1	1	0.1
F5	–	–	–	1	1	2	0.4	–	–	–	1	1	2	0.3
F6	–	–	–	–	–	–	–	–	–	–	1	–	1	0.1
F7	–	–	–	–	1	1	0.2	–	–	–	–	1	1	0.1
F8	–	–	–	–	–	–	–	–	–	–	–	–	–	–
F9	–	–	–	–	1	1	0.2	–	–	–	–	1	1	0.1
Flint burnt	–	–	1	1	–	2	0.4	–	1	1	1	1	4	0.5
Radiolarite R1	1	–	3	1	1	6	1.1	1	–	4	1	1	7	0.9
R2	–	–	2	2	–	4	0.8	–	–	2	2	–	4	0.5
R3	–	–	–	–	1	1	0.2	–	–	–	1	1	2	0.3
R4	–	–	–	–	–	–	–	–	–	–	–	1	1	0.1
Total	4	3	137	215	164	523		7	5	207	320	246	785	

* - obsidian micro-pebbles

TABLE 14. Cortical flakes: frequency and type of dorsal scar patterns

	Lerna I		Lerna I/II		Lerna II		Lerna II and IIc, IId	
Cortical flakes:								
1/1 cortical surface	1	1.8	1	3.2	6	7.5	7	6.0
lateral (1/2 cortical surface)	2	3.6	1	3.2	4	5.0	6	5.2
distal (1/2 cortical surface)	2	3.6	1	3.2	4	5.0	5	4.3
lateral+distal (3/4 cortical surface	1	1.8	–	–	3	3.7	4	3.4
less than 1/4 cortical surface	–	–	3	9.7	6	7.5	7	6.0
Flakes with cortex – total	6	10.7	6	19.3	23	28.7	29	25.0
Flakes without cortex	50	89.3	25	80.6	57	71.2	87	75.0
Total flakes	56		31		80		116	
Direction of scars:								
1. unidirectional	27	48.2	12	38.7	23	28.7	38	32.7
2. convergent	8	14.3	3	9.7	8	10.0	11	9.5
3. opposite directions	5	8.9	7	22.6	11	13.7	12	10.3
4. perpendicular	14	25.0	7	22.6	19	23.7	29	25.0
5. centripetal	–	–	–	–	4	5.0	7	6.0
6. tablet	1	1.8	–	–	5	6.2	7	6.0
7. Janus flake	–	–	–	–	2	2.5	3	2.6
8. crested flake	–	–	1	3.2	–	–	–	–
9. undetermined and fully cortical flakes	1	1.8	1	3.2	8	10.0	9	7.7
Total flakes	56		31		80		116	

TABLE 15. Flakes: type of butt and percussion features

	Lerna I			Lerna I/II			Lerna II			Lerna II and IIc, IId		
Type of butt:												
1. cortical	1	1.8	2.0	1	3.2	3.5	5	6.2	7.6	10	8.6	10.3
2. unprepared	–	–	–	–	–	–	2	2.5	3.0	2	1.7	2.1
3. prepared by single blow	21	37.5	41.1	10	32.3	37.0	26	32.5	40.0	35	30.1	36.0
4. faceted	10	17.9	21.6	6	19.4	21.4	17	21.1	26.1	21	18.1	21.6
5. dihedral	–	–	–	–	–	–	4	5.0	6.1	6	5.1	6.1
6. punctiform (linear)	19	33.9	37.2	11	35.3	40.7	11	13.7	16.9	23	19.8	23.7
7. missing	5	8.9	–	3	9.7	–	15	18.7	–	19	16.3	–
Butt edge:												
1. prepared	22	39.3	40.7	6	19.4	21.4	16	20.0	23.2	24	20.6	23.8
2. unprepared	32	57.1	59.2	22	71.0	78.5	52	65.0	75.4	76	65.5	75.2
3. strongly abraded	–	–	–	–	–	–	1	1.2	1.4	1	0.8	1.0
4. undetermined (broken)	2	3.6	–	3	9.7	–	11	13.7	–	15	12.9	–
Percussion point:												
1. visible	15	26.7	29.4	13	41.9	46.4	42	52.5	63.6	52	44.8	53.1
2. invisible	36	64.8	70.6	15	48.4	53.5	24	30.0	36.4	46	39.6	46.9
3. undetermined (broken)	5	8.9	–	3	9.7	–	14	17.5	–	18	15.5	–
Bulb:												
1. well defined	12	21.4	–	11	35.5	–	28	35.0	–	38	32.7	–
2. vaguely defined	18	32.1	–	9	29.0	–	12	15.0	–	20	17.2	–
3. invisible	12	21.4	–	8	25.9	–	16	20.1	–	18	15.5	–
4. "esquillements"	9	16.1	–	2	6.5	–	18	22.7	–	25	21.5	–
5. "levre"	4	7.1	–	–	–	–	5	6.2	–	8	6.8	–
6. detached by single blow	1	1.8	–	1	3.2	–	1	1.2	–	1	0.8	–

TABLE 16. Flakes: length

Lerna	I		I/II		II		II and IIc,IId	
Length	number	%	number	%	number	%	number	%
5.1- 10.0	3	7.0	-	-	1	1.5	1	1.0
10.1- 15.0	7	16.3	5	18.5	9	13.4	12	12.4
15.1- 20.0	15	34.9	9	33.3	19	28.4	30	30.9
20.1- 25.0	12	27.9	7	25.9	17	25.4	25	25.8
25.1- 30.0	4	9.3	3	11.1	11	16.4	16	16.5
30.1- 35.0	-	-	2	7.4	8	11.9	10	10.3
35.1- 40.0	-	-	1	3.7	2	3.0	3	3.1
40.1- 45.0	1	2.3	-	-	-	-	-	-
80.1- 85.0	1	2.3	-	-	-	-	-	-
total :	43		27		67		97	

TABLE 17: Flakes: width

Lerna	I		I/II		II		II and IIc,IId	
Width	number	%	number	%	number	%	number	%
6.1- 8.0	-	-	-	-	1	1.4	1	0.9
8.1- 10.0	3	5.4	3	10.0	1	1.4	3	2.8
10.1- 12.0	4	7.1	2	6.7	5	6.8	8	7.4
12.1- 14.0	11	19.6	4	13.3	5	6.8	11	10.2
14.1- 16.0	5	8.9	5	16.7	10	13.5	11	10.2
16.1- 18.0	9	16.1	4	13.3	15	20.3	20	18.5
18.1- 20.0	7	12.5	3	10.0	11	14.9	16	14.8
20.1- 22.0	6	10.7	6	20.0	4	5.4	7	6.5
22.1- 24.0	3	5.4	-	-	6	8.1	10	9.3
24.1- 26.0	2	3.6	2	6.7	2	2.7	2	1.9
26.1- 28.0	1	1.8	1	3.3	5	6.8	5	4.6
28.1- 30.0	-	-	-	-	2	2.7	3	2.8
30.1- 32.0	1	1.8	-	-	2	2.7	5	4.6
32.1- 34.0	1	1.8	-	-	1	1.4	2	1.9
34.1- 36.0	2	3.6	-	-	-	-	-	-
38.1- 40.0	-	-	-	-	1	1.4	1	0.9
40.1- 42.0	-	-	-	-	1	1.4	1	0.9
42.1- 44.0	-	-	-	-	1	1.4	1	0.9
46.1- 48.0	-	-	-	-	1	1.4	1	0.9
76.1- 78.0	1	1.8	-	-	-	-	-	-
total :	56		30		74		108	

TABLE 18. Flakes: thickness

Lerna	I		I/II		II		II and IIc,IId	
Thickness	number	%	number	%	number	%	number	%
1.1- 2.0	4	7.1	3	9.7	5	6.8	7	6.5
2.1- 3.0	16	28.6	8	25.8	14	18.9	23	21.3
3.1- 4.0	10	17.9	7	22.6	19	25.7	27	25.0
4.1- 5.0	7	12.5	6	19.4	15	20.3	21	19.4
5.1- 6.0	5	8.9	1	3.2	10	13.5	13	12.0
6.1- 7.0	9	16.1	1	3.2	4	5.4	8	7.4
7.1- 8.0	2	3.6	2	6.5	2	2.7	4	3.7
8.1- 9.0	1	1.8	1	3.2	3	4.1	3	2.8
9.1- 10.0	1	1.8	2	6.5	1	1.4	1	0.9
11.1- 12.0	–	–	–	–	1	1.4	1	0.9
18.1- 19.0	1	1.8	–	–	–	–	–	–
total :	56		31		74		108	

TABLE 19. Flakes: width/length ratio

Lerna	I		I/II		II		II and IIc,IId	
Width:Length	number	%	number	%	number	%	number	%
0.31– 0.40	–	–	–	–	4	6.0	5	5.2
0.41– 0.50	3	7.0	1	3.7	2	3.0	4	4.1
0.51– 0.60	6	14.0	6	22.2	4	6.0	6	6.2
0.61– 0.70	6	14.0	2	7.4	9	13.4	13	13.4
0.71– 0.80	5	11.6	–	–	4	6.0	8	8.2
0.81– 0.90	–	–	5	18.5	12	17.9	13	13.4
0.91– 1.00	9	20.9	7	25.9	6	9.0	11	11.3
1.01– 1.10	2	4.7	1	3.7	4	6.0	7	7.2
1.11– 1.20	2	4.7	–	–	3	4.5	5	5.2
1.21– 1.30	1	2.3	1	3.7	5	7.5	6	6.2
1.31– 1.40	3	7.0	1	3.7	3	4.5	4	4.1
1.41– 1.50	1	2.3	2	7.4	5	7.5	6	6.2
1.51– 1.60	4	9.3	–	–	4	6.0	5	5.2
1.61– 1.70	–	–	–	–	–	–	1	1.0
1.71– 1.80	1	2.3	–	–	1	1.5	2	2.1
1.91– 2.00	–	–	1	3.7	–	–	–	–
2.61– 2.70	–	–	–	–	1	1.5	1	1.0
total :	43		27		67		97	

TABLE 20. Flakes: thickness/width ratio

Lerna	I		I/II		II		II and IIc,IId	
Thickness:Width	number	%	number	%	number	%	number	%
0.01– 0.10	1	1.8	–	–	1	1.4	2	1.9
0.11– 0.20	15	26.8	10	33.3	31	41.9	42	38.9
0.21– 0.30	26	46.4	13	43.3	26	35.1	40	37.0
0.31– 0.40	10	17.9	3	10.0	11	14.9	17	15.7
0.41– 0.50	3	5.4	2	6.7	4	5.4	5	4.6
0.51– 0.60	1	1.8	–	–	1	1.4	1	0.9
0.61– 0.70	–	–	2	6.7	–	–	1	0.9
total :	56		30		74		108	

TABLE 21. Blades: dorsal pattern, section, shape, and profile

	Lerna I		Lerna I/II		Lerna II		Lerna II and IIc, IId	
	number	%	number	%	number	%	number	%
Cortex:								
1. total	-	-	-	-	-	-	1	0.3
2. lateral	3	6.7	-	-	20	9.3	24	7.5
3. central	-	-	-	-	8	3.7	8	2.5
4. without cortex	44	93.3	72	100.0	187	86.9	287	89.6
Dorsal pattern:								
1. single direction scars	42	88.9	62	86.1	176	81.8	268	83.7
2. opposite direction scars	3	6.7	5	6.9	20	9.3	24	7.5
3. crested blade	2	4.4	5	6.9	5	2.3	7	2.1
4. secondary crested blade	-	-	-	-	14	6.5	20	6.2
5. undetermined	-	-	-	-	-	-	1	0.3
Section:								
1. trapezoidal	28	53.3	38	52.8	115	53.4	177	55.3
2. triangular/trapezoidal	-	-	-	-	6	2.7	8	2.5
3. triangular	17	37.8	25	34.7	58	26.9	84	26.2
4. multifaceted	1	2.2	7	9.7	21	9.7	32	10.0
5. irregular	1	2.2	2	2.8	15	6.9	18	5.6
6. undetermined	-	-	-	-	-	-	1	0.3
Shape:								
1. parallel sides	32	66.7	49	68.1	146	67.9	224	70.0
2. convergent sides	5	11.1	7	9.7	30	13.9	45	14.0
3. divergent sides	1	2.2	2	2.8	7	3.2	10	3.1
4. irregular	9	20.2	14	19.4	32	14.8	41	12.8
Profile:								
1. straight	42	88.9	61	84.7	161	74.8	231	72.1
2. convex	3	6.7	9	12.5	43	20.0	72	22.5
3. twisted	2	4.7	2	2.8	11	5.1	17	5.3

TABLE 22. Blades: butt and percussion features

	Lerna I			Lerna I/II			Lerna II			Lerna II and IIc, IId		
	number	(A)	(B)	number	(A)	(B)	number	(A)	(B)	number	(A)	(B)
Butt:												
1. unprepared	1	2.2	4.8	-	-	-	6	2.8	6.2	6	1.9	4.3
2. prepared by single blow	7	15.6	33.3	18	25.0	42.8	37	17.2	38.5	62	19.4	44.6
3. faceted	4	8.9	19.0	11	15.3	26.2	26	12.1	27.1	30	9.3	21.6
4. dihedral	2	4.4	9.5	3	4.2	7.1	-	-	-	-	-	-
5. punctiform (linear)	7	15.6	33.3	10	13.9	23.8	27	12.6	28.1	41	12.8	29.4
6. missing	26	53.3	-	30	41.7	-	119	55.3	-	181	56.5	
Butt edge:												
1. prepared	7	15.6	36.8	27	37.5	64.2	56	26.0	57.1	86	26.9	60.6
2. unprepared	12	26.7	63.1	15	20.8	35.7	42	19.5	42.9	56	17.5	39.4
3. missing	28	57.8	-	30	41.7	-	117	54.4	-	178	55.6	-
Percussion point:												
1. visible	11	24.4	44.0	22	30.6	56.4	53	24.6	55.8	82	25.6	59.8
2. invisible	14	31.1	56.0	17	23.6	43.6	42	19.5	44.2	55	17.2	40.2
3. missing	22	44.4	-	33	45.8	-	120	55.8	-	183	57.2	-
Bulb:												
1. well defined	10	22.2	45.4	11	15.3	26.8	34	15.8	35.0	51	15.9	36.4
2. vaguely defined	4	8.9	18.2	9	12.5	21.9	33	15.3	34.0	44	13.7	31.4
3. bulb-scars	4	8.9	18.2	8	11.1	19.5	19	8.8	19.6	29	9.0	20.7
4. lip	2	4.4	9.1	11	15.3	26.8	8	3.7	8.2	10	3.1	7.1
5. removed by single blow	2	4.4	9.1	2	2.8	4.9	3	1.4	3.1	6	1.9	4.3
6. missing	25	51.1	-	30	41.6	-	117	54.4	-	179	55.9	-
7. undetermined	-	-	-	1	1.3	-	1	0.5	-	1	0.3	-

A = % of total of blades
B = % of blades with proximal part preserved

TABLE 23. Blades: length

Lerna	I		I/II		II		II and IIc,IId	
Length	number	%	number	%	number	%	number	%
15.1- 20.0	1	20.0	-	-	3	20.0	3	15.8
20.1- 25.0	1	20.0	-	-	1	6.7	1	5.3
25.1- 30.0	1	20.0	1	12.5	2	13.3	3	15.8
30.1- 35.0	-	-	4	50.0	5	33.3	6	31.6
35.1- 40.0	1	20.0	2	25.0	1	6.7	1	5.3
40.1- 45.0	-	-	-	-	-	-	1	5.3
45.1- 50.0	-	-	-	-	1	6.7	1	5.3
50.1- 55.0	-	-	-	-	1	6.7	1	5.3
55.1- 60.0	-	-	1	12.5	-	-	1	5.3
65.1- 70.0	1	20.0	-	-	-	-	-	-
70.1- 75.0	-	-	-	-	1	6.7	1	5.3
total :	5		8		15		19	

TABLE 24. Blades: width

Lerna	I		I/II		II		II and IIc,IId	
Width	number	%	number	%	number	%	number	%
4.1- 6.0	2	4.4	-	-	7	3.5	9	3.0
6.1- 8.0	5	11.1	9	12.5	35	17.3	49	16.1
8.1- 10.0	6	13.3	27	37.5	56	27.7	93	30.6
10.1- 12.0	6	13.3	21	29.2	50	24.8	74	24.3
12.1- 14.0	6	13.3	7	9.7	31	15.3	46	15.1
14.1- 16.0	9	20.0	5	6.9	12	5.9	17	5.6
16.1- 18.0	4	8.9	-	-	9	4.5	11	3.6
18.1- 20.0	2	4.4	1	1.4	1	0.5	4	1.3
20.1- 22.0	2	4.4	1	1.4	1	0.5	1	0.3
22.1- 24.0	2	4.4	-	-	-	-	-	-
24.1- 26.0	1	2.2	-	-	-	-	-	-
26.1- 28.0	-	-	1	1.4	-	-	-	-
total :	45		72		202		304	

TABLE 25. Blades: thickness

Lerna	I		I/II		II		II and IIc,IId	
Thickness	number	%	number	%	number	%	number	%
0.1- 1.0	1	2.2	–	–	4	2.0	6	2.0
1.1- 2.0	15	33.3	16	22.2	69	34.2	102	33.6
2.1- 3.0	13	28.9	42	58.3	86	42.6	132	43.4
3.1- 4.0	13	28.9	6	8.3	29	14.4	45	14.8
4.1- 5.0	1	2.2	3	4.2	9	4.5	13	4.3
5.1- 6.0	1	2.2	3	4.2	3	1.5	4	1.3
6.1- 7.0	1	2.2	2	2.8	2	1.0	2	0.7
total :	45		72		202		304	

TABLE 26. Blades: width/length ratio

Lerna	I		I/II		II		II and IIc,IId	
Width:Length	number	%	number	%	number	%	number	%
0.11- 0.20	–	–	–	–	1	6.7	2	10.5
0.21- 0.30	2	40.0	6	75.0	5	33.3	7	36.8
0.31- 0.40	2	40.0	1	12.5	5	33.3	5	26.3
0.41- 0.50	1	20.0	1	12.5	3	20.0	4	21.1
0.51- 0.60	–	–	–	–	1	6.7	1	5.3
total :	5		8		15		19	

TABLE 27. Blades: thickness/width ratio

Lerna	I		I/II		II		II and IIc, IId	
Thickness:Width	number	%	number	%	number	%	number	%
0.01- 0.10	–	–	1	1.4	2	1.0	3	1.0
0.11- 0.20	22	48.9	8	11.1	54	26.7	84	27.6
0.21- 0.30	16	35.6	47	65.3	94	46.5	143	47.0
0.31- 0.40	6	13.3	11	15.3	38	18.8	58	19.1
0.41- 0.50	1	2.2	3	4.2	10	5.0	11	3.6
0.51- 0.60	–	–	1	1.4	3	1.5	4	1.3
0.61- 0.70	–	–	1	1.4	–	–	–	–
0.71- 0.80	–	–	–	–	1	0.5	1	0.3
total :	45		72		202		304	

TABLE 28. Blades: fragmentation

	Lerna I		Lerna I/II		Lerna II		Lerna II and IIc, IId	
	number	%	number	%	number	%	number	%
1. Complete blades	5	10.6	6	8.3	12	5.6	23	7.2
2. Fragments of blades	42	89.4	66	91.6	203	94.4	297	92.8
2.1 proximal	6		15		36		58	
2.2 proximal+mesial	14		24		44		63	
2.1 + 2.2	20	50.0	39	59.1	80	39.4	121	40.7
2.3 mesial	18	45.0	19	28.8	74	36.4	115	38.7
2.4 mesial+distal	1	2.5	4	5.5	12	5.9	19	6.4
2.5 distal	3	7.5	4	5.5	29	14.3	42	14.1
2.6 undetermined	–	–	–	–	8	3.9	–	–

Table 29. Fragmentation mode

	Lerna I		Lerna I/II		Lerna II		Lerna II and IIc, IId	
	number	%	number	%	number	%	number	%
1. Distal (and distal+mesial) fragments								
1.1 breaking	1	2.5	3	4.5	26	12.8	33	11.1
1.2 dorsal fracture	2	5.0	3	4.5	11	5.4	19	6.4
1.3 hinged fracture	1	2.5	2	3.0	4	2.0	9	3.0
2. Mesial frgments								
2.1 breaking+breaking	9	22.5	4	6.0	27	13.3	33	11.1
2.2 fracture+breaking	6	16.0	2	3.0	23	11.3	37	12.4
2.3 breaking+hinged fracture	–	–	8	12.0	6	2.9	14	4.7
2.4 fracture+fructure	2	5.0	4	6.0	9	4.4	13	4.3
2.5 dorsal fracture+hinged fracture	1	2.5	1	1.5	5	2.5	11	3.7
2.6 double hinged fracture	–	–	–	–	2	1.0	5	1.7
2.7 breaking from the notch+ dorsal fracture	–	–	–	–	1	0.5	1	0.3
2.8 Corbiac burin+breaking	–	–	–	–	1	0.5	1	0.3
3. Proximal (and proximal+me-sial fragments								
3.1 breaking	11	27.5	14	21.2	51	25.1	73	24.5
3.2 fracture	1	2.5	12	18.1	15	7.4	27	9.1
3.3 hinged fracture	6	15.0	13	19.6	14	6.9	20	6.7
3.4 breaking from the notch	–	–	–	–	–	–	1	0.3
3.5 undetermined	2	5.0	–	–	8	3.9	–	–
Total	42		66		203		297	

TABLE 30. Quantitative structure of retouched tools and splintered pieces

	Lerna I				Lerna I/II				Lerna II				Lerna II and IIc, IId			
	Obs.	S.r.	Total	%	Obs.	S.r.	Total	%	Obs.	S.r.	Total	%	Obs.	S.r.	Total	%
1. Endscrapers	3	1	4	8.5	1	2	3	6.6	7	1	8	4.9	13	1	14	5.6
2. Truncations	1	1	2	4.2	1	1	2	4.4	6	1	7	4.3	10	1	11	4.4
3. Retouched blades, slightly retouched sickle blades and blades broken from a notch	5	6	11	23.4	8	3	11	24.4	45	8	53	32.3	67	12	79	32.1
4. Perforators	–	–	–	–	1	–	1	2.2	2	–	2	1.2	9	–	9	3.6
5. Burins	1	–	1	2.1	1	–	1	2.2	3	–	3	1.8	8	2	10	3.9
6. Burin spalls	1	–	1	2.1	2	–	2	4.4	4	–	4	2.4	5	–	5	1.9
7. Retouched and notched flakes	2	–	2	4.2	2	1	3	6.6	7	2	9	5.4	8	2	10	4.0
8. Backed implements	–	–	–	–	1	–	1	2.2	2	1	3	1.8	4	1	5	1.9
9. Arrowheads	1	–	1	2.1	–	–	–	–	1	1	2	1.2	1	1	2	0.8
10. Shouldered points	–	–	–	–	–	–	–	–	1	1	2	1.2	1	1	2	0.8
11. Bifacially worked sickles	–	–	–	–	–	–	–	–	–	1	1	0.6	–	1	1	0.4
12. Combined tools	–	–	–	–	–	–	–	–	1	1	2	1.2	1	1	2	0.8
13. Splintered pieces:																
13.1 on flakes	9	–	9	19.1	9	–	9	20.0	19	–	19	11.7	23	–	23	9.0
13.2 on blades	4	–	4	8.5	7	–	7	15.5	7	2	9	5.4	12	3	15	5.8
13.3 "cores"	1	–	1	2.1	3	–	3	6.6	8	2	10	6.2	10	2	12	4.7
13.4 undeter. frag.	11	–	11	23.4	2	–	2	4.4	29	–	29	17.7	45	–	45	17.5
14. Tool fragments	–	–	–	–	–	–	–	–	1	–	1	0.6	1	–	–	0.4
Total	39	8	47		38	7	45		143	21	164		218	28	246	

TABLE 31. Functional structure of assemblage Lerna I

Functions	Flakes	Blades	Retouched tools	Splintered pieces	Total	%
Knives for cutting wood and/or bone	9	9	2	4	24	26.9
Knives for carving meat	–	4	1	–	5	5.6
Scrapers for bones	–	–	1	–	1	1.1
Tools for planing wood	2	2	2	3*	9	10.1
Sickle inserts:						
parallely hafted	1	7	4	3	15	16.8
obliquely hafted	1	2	4	–	7	7.9
Tools for incising bone or antler	–	1	1	2	4	4.5
Scrapers for treating hide	6	2	6	2	16	17.9
Knives for cutting hide	–	1	–	–	1	1.1
Arrow-heads	–	1	–	–	1	1.1
Perforators for hides	–	–	–	1	1	1.1
Drills for wood	–	–	–	2	2	2.2
Crushing minerals (probably dyes)	3	–	–	–	3	3.4
Total of functions performed	22	29	21	17	89	

* including one burin spall

TABLE 32. Functions of retouched tools

Function	End-scrapers	Truncations	Retouched blades	Retouched flakes	Burins* and others**	Total
Knives for cutting wood and/or bone	1	–	1	–	–	2
Knives for carving meat	–	–	1	–	–	1
Tools for planing wood	–	1	1	–	–	2
Sickle inserts:						
a) parallely hafted	–	1	2	1	–	4
b) obliquely hafted	–	1	3	–	–	4
Tools for incising bone or antler	–	–	–	–	1	1
Scrapers for treating hide	3	–	2	–	1*	6
Scraper for bones	–	–	1	–	–	1
Total of active uses of retouched tools	4	3	11	1	2	21
Retouched tools without traces of active use	1	–	1	1	1**	4
Traces of hafting	–	–	1	–	1	2

* including one burin spall
** tanged arrow-head

Table 33. Functions of retouched tools from Lerna II

Function	Endscrapers (8)	Truncations (7)	Retouched blades (39)	Notched blades and blades broken from a notch (14)	Perforators (2)	Burins (3)	Burin spalls (4)	Retouched and notched flakes (9)	Backed implements (3)	Shouldered points (2)	Combined tools (2)	Bifacially worked tools (3)	Total
Knives for cutting wood and/or bone			7	1					1				9
Knives for carving meat			5				1 before detaching		1				7
Tools for planing woods		2 on retruncation	2										4
Sickle inserts parallely hafted	1 after retouch	5							2	2	1	1	12
obliquely hafted		2											2
Tools for incising bone or antler						1	1 before detaching						2
Scrapers for treating hide	1		5	1				1			1		9
Scrapers for bone							1 before detaching						1
Knives for cutting reeds or herbs			4							1			5
Drills for shells or bones			1				1 after detaching						2
Transformed into splintered piece		1											1
Traces of hafting	1		3		1				1				6
Retouched tools without traces of active use	5	3	12	13	2	2		8				2	47

Double or triple use listed as 2 or 3 functions

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GLOSSARY

Bec: flake or blade with a protruding part, usually thick and wide, shaped by bilateral retouch.

Breaking or break: type of breakage that has not been produced by punctiform percussion or pressure on the dorsal or ventral face, or side, of the artifact. This term makes no assumptions as to the cause of breakage. In this sense it is opposed to fracture, which is an intentional (voluntary) breakage (see Tixier, Inizan, and Roche 1980, p. 77; Inizan, Tixier, and Roche 1992, p. 78).

Butt: a fragment of core platform removed from the core by detaching a piece of debitage.

Clactonian notch: the notch obtained by a single blow (Tixier, Inizan, and Roche 1980, p. 104).

Corbiac burin: transverse burin blow obtained by simple pressure or percussion on the unretouched blade or flake edge. It could be nonintentional or intentional (see Bordes and Crabtree 1969; Bordes 1970).

Kombewa technique: special technique of producing flakes with two ventral sides, or faces (see Tixier, Inizan, and Roche 1980, p. 55).

Kostienki knife: blade with thinning of the distal end from a transverse inverse notch by scars removing the arrises (inter-scar edges). For the original description see Belayeva 1977, pp. 117–126.

Microburin technique: technique of dividing bladelets (small flakes) by the "microburin blow" in order to obtain geometric microliths or to make a *piquant-trièdre* point. This technique produces "microburins", which are a special type of waste (for definitions see Breuil 1921 and Tixier 1976).

Platform: surface that is struck in order to remove a piece of debitage.

Scraping edge (Front): term used in this article to denote the retouched transverse edge of the end scraper.

Splintered technique: special type of treatment of pieces of lithic raw material by violent percussion on one edge opposed to the other edge, which is resting on a hard anvil. In the process of this treatment splintered pieces (sometimes called scaled pieces [see Marks 1976, p. 382], or *pièces esquillées*) and small flakes (called splinters) with a linear platform and heavy percussion waves are produced. Splintered pieces are usually bipolar, exhibiting bifacial scaling.

Tablet: flake removing the whole core platform.

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