THE BRONZE-AGE FLAKED-STONE INDUSTRIES FROM LERNA: A PRELIMINARY REPORT

(PLATES 98–100)

SINCE THE BEGINNING OF THE EXCAVATIONS IN 1952 Lerna has been appreciated as an important stratified Neolithic and Bronze Age site in the Peloponnese (Fig. 1).[1] Among the many objects recovered from these excavations are thousands of chert and obsidian artifacts from the Early and Middle Bronze Age layers. While these artifacts have received some preliminary analysis,[2] they are still under study for the final publication.[3] In view of the necessary delay before all the material can be made available, it may be useful to offer a brief overview of the successive Bronze Age lithic industries at Lerna. At the present writing, studies of collections of Bronze Age lithics from systematic excavations of stratified sites in Greece are rare, and virtually nothing is known of these industries.[4]

[1] For a description of the site and its history see J. L. Caskey, "Excavations at Lerna," *Hesperia* 23, 1954, pp. 3–30; 24, 1955, pp. 25–49; 25, 1956, pp. 147–173; 26, 1957, pp. 142–162; 27, 1958, pp. 125–144; "Activities at Lerna, 1958–1959," *Hesperia* 28, 1959, pp. 202–207, and "The Early Helladic Period in the Argolid," *Hesperia* 29, 1960, pp. 285–303.

[2] D. M. Van Horn, *Bronze Age Chipped Stone Tools from the Argolid of Greece and their Relation to Tools Manufactured from Other Materials*, diss. University of Pennsylvania 1976, University Microfilms International 77-887 (= Van Horn 1976). It should be noted that Van Horn was able to study only a part of the inventoried materials from Lerna, a total of some 755 specimens or less than 7% of the total collection of inventoried and uninventoried lithic artifacts. In almost all cases the conclusions reached by Van Horn are superceded by this paper.

Other references frequently cited are abbreviated as follows:

Torrence 1982 = R. Torrence, "The Obsidian Quarries and Their Use" in *An Island Polity. The Archaeology of Exploitation in Melos*, C. Renfrew and M. Wagstaff, edd., Cambridge 1982, pp. 193–221

Van Horn 1977 = D. M. Van Horn, "A New Greek Bronze Age Chipped Stone Tool Type: The Denticulated Tranchet," *JFA* 4, 1977, pp. 386–392

Van Horn 1980 = D. M. Van Horn, "Observations Relating to Bronze Age Blade Core Production in the Argolid of Greece," *JFA* 7, 1980, pp. 487–492

[3] The final report on the lithic artifacts will appear in volumes on the different settlements edited by Dr. M. H. Wiencke (Lerna III), Professor E. C. Banks (Lerna IV), and Dr. C. Zerner (Lerna V). The study of the artifacts was generously funded by a grant (44855) from the National Endowment for the Humanities. I would like to thank the aboved-named scholars, Professor J. Rutter, and Priscilla Murray, although without involving them in my errors, for valuable discussion and advice in the preparation of this paper. Priscilla Murray assisted in the preparation of Figures 4 through 17. I also thank Craig Mauzy for photography.

[4] In this paper the word "lithics" is used, following a widespread precedent, as a technical abbreviation of the term "lithic artifacts". The principal specialized studies of Bronze Age lithics in Greece are Van Horn 1976 as well as Van Horn 1977 and Van Horn 1980; R. Torrence, "A Technological Approach to Cycladic Blade Industries," *Papers in Cycladic Prehistory*, J. Davis and J. Cherry, edd., Los Angeles 1979, pp. 66–86 and Torrence 1982; H.-G. Buchholz, "Der Pfeilglätter aus dem VI. Schactgrab von Mykene und die helladischen Pfeilspitzen," *JdI* 77, 1962, pp. 1–58; N. Hartman, "Obsidian from Crete: Problems in Lithic Analysis," *Temple University Aegean Symposium* 3, Philadelphia 1978, pp. 36–42; I. Geroulanos, "'Αρχαιολογικὰ ἐυρήματα τραχώνων: Α'. 'Οι ὀψιανοὶ τῆς Συλλογῆς Τραχώνων," 'Αρχ 'Εφ, 1956 [1959], pp. 73–105.

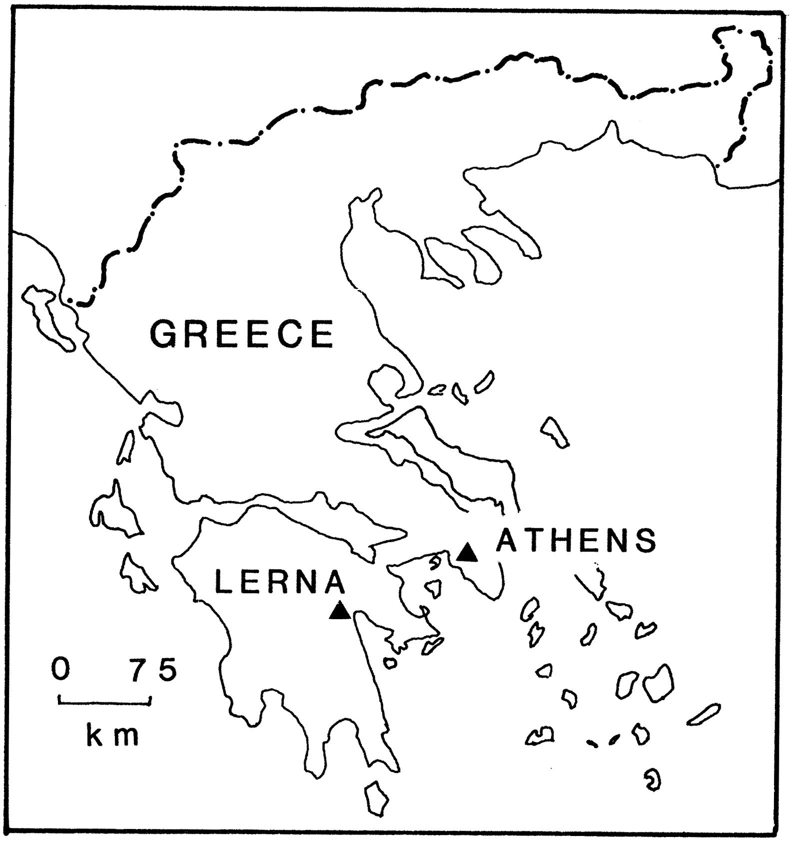

Fig. 1. The location of Lerna in the Argolid

What little is known may be summarized as follows. Bronze Age industries are characterized by the extensive use of obsidian, presumably from Melos,[5] to produce pressure-flaked blades from distinctive small, flat cores.[6] Tools of any kind are rare, but they include projectile points, notched pieces, scrapers, backed pieces, drills, geometrics, becs, sickle elements, and miscellaneous retouched pieces.[7] Chert (flint) was used with increasing frequency, reaching a peak in the Middle Bronze Age.[8] In the Late Helladic the use of flaked-stone tools in all materials declined, although lithics have been made and used in small quantities in Greece continuously from the advent of the Bronze Age to the present day.[9]

The Bronze Age site of Lerna has three major components represented by successive settlements: Early Helladic (EH) II or Lerna III; EH III or Lerna IV; and Middle Helladic (MH) or Lerna V. Lerna III was destroyed by fire and was followed in Lerna IV by a

[5] Torrence 1982.

[6] Van Horn 1980.

[7] Van Horn 1976, pp. 77–285.

[8] R. J. Howell, "The Origins of Middle Helladic Culture," in *Bronze Age Migrations in the Aegean*, R. Crossland and A. Birchall, edd., London 1973, pp. 73–99.

[9] Van Horn 1976, pp. 287–298; C. Runnels, "Flaked-Stone Artifacts in Greece during the Historic Period," *JFA* 9, 1982, pp. 363–373.

settlement considered by the excavators to belong to a different archaeological culture. There are fewer differences between Lerna IV and V, and the transition from one settlement to the other was apparently effected without violence.[10] All three of these settlements produced large samples of lithics. Altogether more than 11,200 lithic artifacts (Table 1) were recovered from the three Bronze Age settlements.

TABLE 1: Flaked-stone artifacts from Bronze Age Lerna: quantities by raw material

	Obsidian		Chert		Total
Phase	N	%	N	%	
Lerna V	2,518	87.8	384	12.2	2,902
Lerna IV	5,441	92.3	454	7.7	5,895
Lerna III	2,276	94.2	141	5.8	2,417
Total	10,235	91.3	979	8.7	11,214

N = number of specimens

ANALYSIS

The successive industries may be discussed under the following categories: raw materials, technology, typology, and use. Two of these categories require explanation. By "technology" is meant the sequence of debitage created by the manufacture of the particular products of each industry. It is assumed that the methods employed in flaking, along with the products consistently manufactured, were the result of deliberate choice by the flintknappers and were not imposed by the available raw materials or the intended uses of the tools. "Typological" features are the specific shapes of tools or morphological types that are defined by formal categories of retouched tools. The categories are in turn defined by recurring sets of associated attributes (e.g., blank, i.e., flakes and blades [Fig. 2], retouch, and placement of retouch). It is assumed that tool types were also dictated by cultural choice and intended use. In this analysis the three industries from Lerna (EH II, EH III, and MH) are described and compared in order to identify the major characteristics, and changes through time, of these industries in each of the four categories given above. It should be noted, however, that these categories are not necessarily independent; they are convenient abstractions to aid the analysis, and in some specific cases, i.e., sickle elements (see pp. 370–372 below), the lines between the categories are easily crossed.

Early Helladic II (Lerna III)

The majority (94.2%, Table 1) of the pieces are obsidian which resembles Melian obsidian in appearance and is presumed to be from that source.[11] The remainder of the collection consists of chert. The chert pieces vary considerably in color, texture, and quality. The

[10] See Caskey references, footnote 1 above.

[11] C. Renfrew, J. R. Cann, and J. E. Dixon, "Obsidian in the Aegean," *BSA* 60, 1965, pp. 225–247; Torrence 1982.

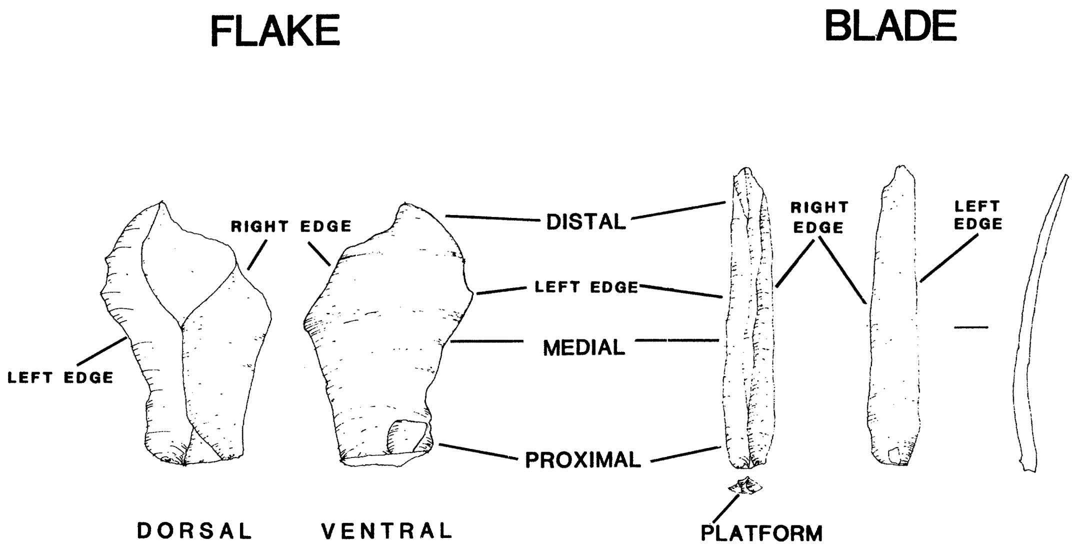

FIG. 2. Descriptive terms used in the text for blanks

colors, as recorded with a standard Rock-Color Chart, fall principally into the hues varying from 5R to 10YR ranging from a Moderate Orange Pink through a Dusky Yellowish Brown. They may be described broadly as brown to dark reddish brown. Lighter colors, such as Grayish Orange Pink (10R 8/4) or Grayish Orange to Yellowish Gray (5Y 7/2), appeared almost as white in some lights but were rare. Other colors, such as Gray (N) or Greenish Gray (5 GY), were represented by a few specimens (less than 5%). Color, even when recorded according to a standard reference, is of little use in establishing the identity or similarity of the sources of chert in the absence of chemical or physical characterization. Chert colors are quite variable even within a single source. That the majority of the Lerna cherts were not derived from local deposits, however, is indicated by an analysis of the waste products resulting from manufacture. Table 2 shows clearly that obsidian cores, cortical pieces (flakes and blades [Fig. 2] with natural cortex adhering), crested blades (e.g. Fig. 8: D), and debris are well represented in the collection, a fact which proves that natural nodules of obsidian were reduced at the site. Cortical pieces of chert, by contrast, are rare, and cores and crested blades are lacking. Yet the majority of chert tools (Table 3, 64.7%) were made on blades (Fig. 2). These blades are similar to the obsidian blades in their length, straight parallel edges, and general high quality (Figs. 5, 7). They are characteristic of blades produced by the pressure technique. The absence of chert blade cores or crested blades here, as in the Neolithic, attests that these blades were imported to Lerna as finished blades from an as yet unknown source(s).[12] Some of the small reddish brown flakes may

[12] C. Perlès, "Pierres taillées," in *L'Antre Corycien* I (*BCH*, Suppl. VII), Paris 1981, pp. 162–172, 245–248; C. Perlès and P. Vaughan, "Pièces lustrées, travail des plantes et moissons à Franchthi (Grèce) (Xième–IVième mill. B.C.)," in *Traces d'utilisation sur les outils néolithiques du Proche Orient* (Travaux de la Maison de l'orient, no. 5), Lyons/Paris 1983, pp. 209–224.

TABLE 2: Analysis of the flaking technology at Lerna by phase

Phase	Cores				Cortical Pieces				Crested Blades				Blanks				Debris			
	Ob		Ch		Ob		Ch		Ob		Ch		Ob		Ch		Ob		Ch	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Lerna V	19	0.7	9	0.3	433	14.9	17	0.6	29	1.0	2	—	1,856	64.0	331	11.4	181	6.2	25	0.9
Lerna IV	60	1.0	12	0.2	688	11.7	18	0.3	60	1.0	—	—	4,577	77.7	384	6.5	43	0.7	41	0.7
Lerna III	22	0.9	1	—	240	9.9	3	0.2	25	1.0	—	—	1,963	81.2	126	5.2	26	1.1	11	0.5

N = Number of specimens   % = Percentage of the total number of specimens in the sample

TABLE 3: Choice of blanks (products of debitage) for finished tools by phase

Phase	Blades				Flakes				Total
	Ob		Ch		Ob		Ch		
	N	%	N	%	N	%	N	%	
Lerna V	105	16.0	71	58.7	553	84.0	50	41.3	779
Lerna IV	107	25.4	41	42.7	314	74.6	55	57.3	517
Lerna III	40	52.6	33	64.7	36	47.4	18	35.3	127

have been produced locally, however, since such chert types are widely distributed in the Argolid.

The many obsidian cores and core pieces are uniform in type (Fig. 4). All but two are worked on one face only. Traces of cortex on some specimens point to the use of small nodules for the cores (e.g. Fig. 4: C). These nodules were flaked on all surfaces to produce a more-or-less flat rectangular core with one or more crested ridges defining the edges or the back of the piece (Fig. 4: A, C).[13] The cores average only 0.043 m. in length, but they are probably only the exhausted and discarded remainders of larger cores. The largest complete blade is nearly 0.08 m. long. A regression analysis, however, of the length compared to the width of 29 complete blades from Lerna III indicated that the width of broken blade segments could be used to predict roughly ($r^2 = 0.4$) the lengths of the unbroken blades (see Figure 3 for placement of measurements; all measurements used in the text are maxima). Based on such estimates the average blades were 0.048 m. long and thus only slightly larger than the surviving cores. The size of cortical pieces (Table 5) is another indication that very small nodules were used. The core platforms were faceted by flaking, undoubtedly to create a better flaking angle for the blade removals (Fig. 4: C, D). One crested blade was first pressured off from each corner, then plain blades were removed side by side across the face of the core. The complete cores have four to five blade scars remaining from the last removals.

[13] Van Horn 1980.

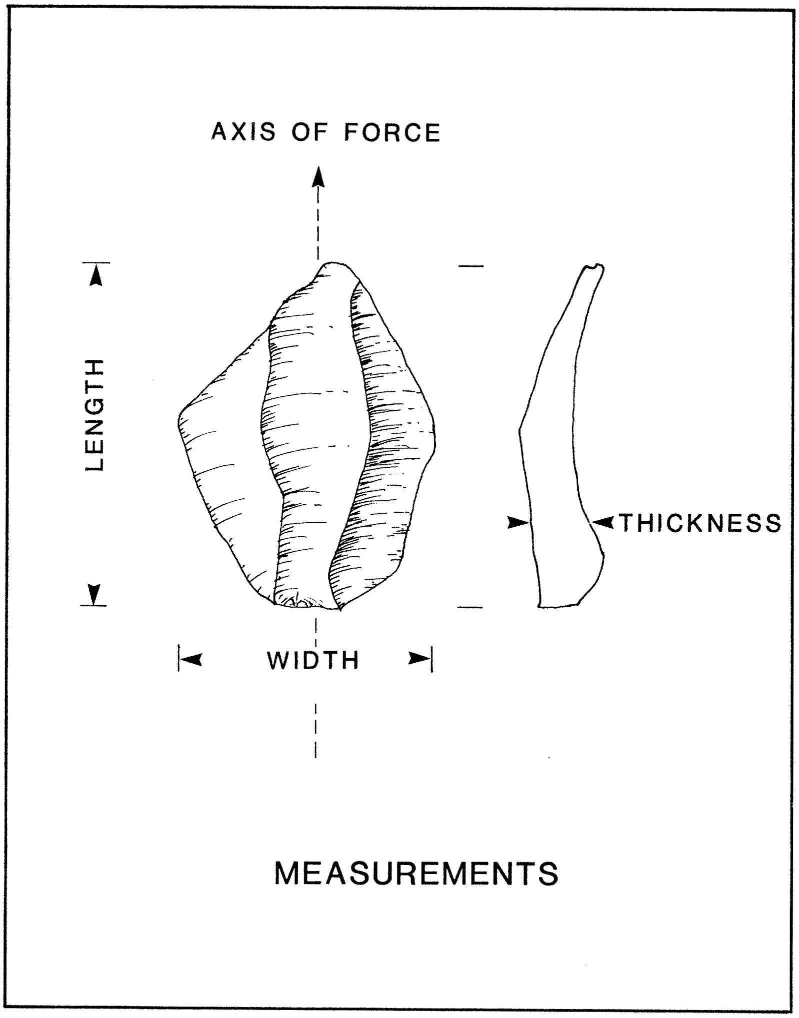

FIG. 3. The placement of measurements for both blanks and finished tools. Where the direction of force is unknown, orientation is arbitrary

There was little waste in this industry. More than 80% of all the preserved pieces (Table 2) consisted of flakes or blades (i.e., blanks; Fig. 2). A low rate of error is verified by the small number of pieces of debris.[14] The output of the knappers consisted of two kinds of

[14] Sieving was not employed at Lerna, yet collection of quite small pieces in some areas was very careful. On the other hand, the excavators were not always sure of the differences between debris and worked pieces; thus there was little critical selection of the specimens in the field. Yet some bias in the collection of raw material (the workmen were paid for obsidian) may have been present. The sample, once collected, was not subsequently sorted nor were pieces discarded. For these reasons, namely the lack of sieving and the presence of probable sample bias, the degree to which the sample described here is representative of the EH II industry at Lerna cannot be determined. This paper outlines the characteristics of the sample *as it exists* in the excavation storerooms, and caution must be used in extending the conclusions of this study to other sites or in drawing cultural conclusions.

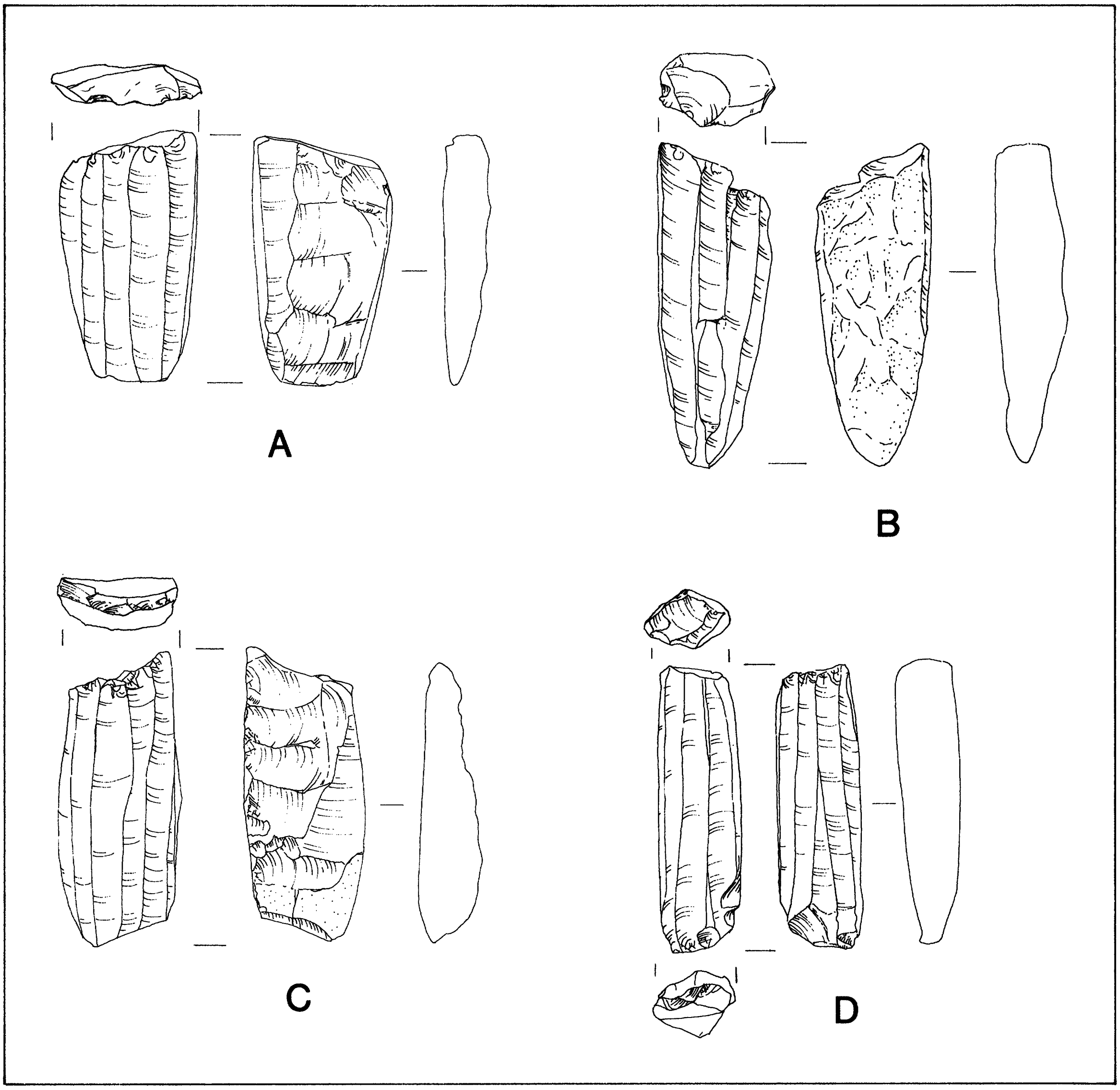

FIG. 4. Lerna III, obsidian cores: A, L7.200; B, L7.277; C, L5.682; D, L4.773. Scale 4:5

products: blades and flakes (Table 4) in approximately equal proportions. Most of the blades are represented by segments, and the number of whole blades would have been somewhat smaller than shown in Table 4. Most are proximal segments, however, each representing an individual blade. The medial and distal fragments are fewer in number, but many could not be matched in size or shape to the proximal fragments and thus probably represent other blades. A safe estimate may require the reduction of the total number of original blades by about one third. It can be concluded that most of the flakes were produced during the shaping of the cores because no flake cores have been identified. The blades themselves were struck from the flat cores by means of pressure and are highly regular

Table 4: The percentage of obsidian blades and flakes by phase

Phase	Blades N	Blades %	Flakes N	Flakes %	Total
Lerna V	394	28.4	995	71.6	1,389
Lerna IV	1,309	33.9	2,556	66.1	3,865
Lerna III	959	51.7	897	48.3	1,856

Table 5: Dimensions of cortical pieces by phase

	Length				Width			
Phase	$\bar{X}$	SD	CV	N	$\bar{X}$	SD	CV	N
Lerna V	0.023	0.007	30.4	44	0.020	0.007	35.0	44
Lerna IV	0.025	0.009	36.0	46	0.021	0.008	38.0	46
Lerna III	0.031	0.011	35.5	31	0.021	0.008	0.38	33

$\bar{X}$ = mean SD = Standard Deviation CV = Coefficient of Variation $CV = \frac{100 \times SD}{\bar{X}}$

Table 6: Dimensions of plain blades by phase

	Width				Thickness			
Phase	$\bar{X}$	SD	CV	N	$\bar{X}$	SD	CV	N
Lerna V	0.0099	0.0028	28.3	189	0.0029	0.0009	31.0	189
Lerna IV	0.0098	0.0029	29.6	462	0.0027	0.0008	29.6	462
Lerna III	0.0096	0.0024	25.0	318	0.0026	0.0007	26.9	318

$\bar{X}$ = mean SD = Standard Deviation CV = Coefficient of Variation $CV = \frac{100 \times SD}{\bar{X}}$

(Fig. 5). From the broken segments an estimate of their average length (*ca.* 0.048 m.) was made. It was also assumed, however, that the widths and thicknesses of the blades would show whether they were carefully and regularly made or not. Table 6 shows that the mean width and thickness are quite small (the width averages less than 0.01 m.), and the coefficient of variation (CV) shows the degree to which values are clustered tightly around the mean. The CV indicates consistency and skill, an observation consonant with the low quantities of debris. No certain flaking tools have been identified at Lerna. Copper-pointed pressure tools such as those seen in Egyptian tomb paintings or antler-tipped tools such as used

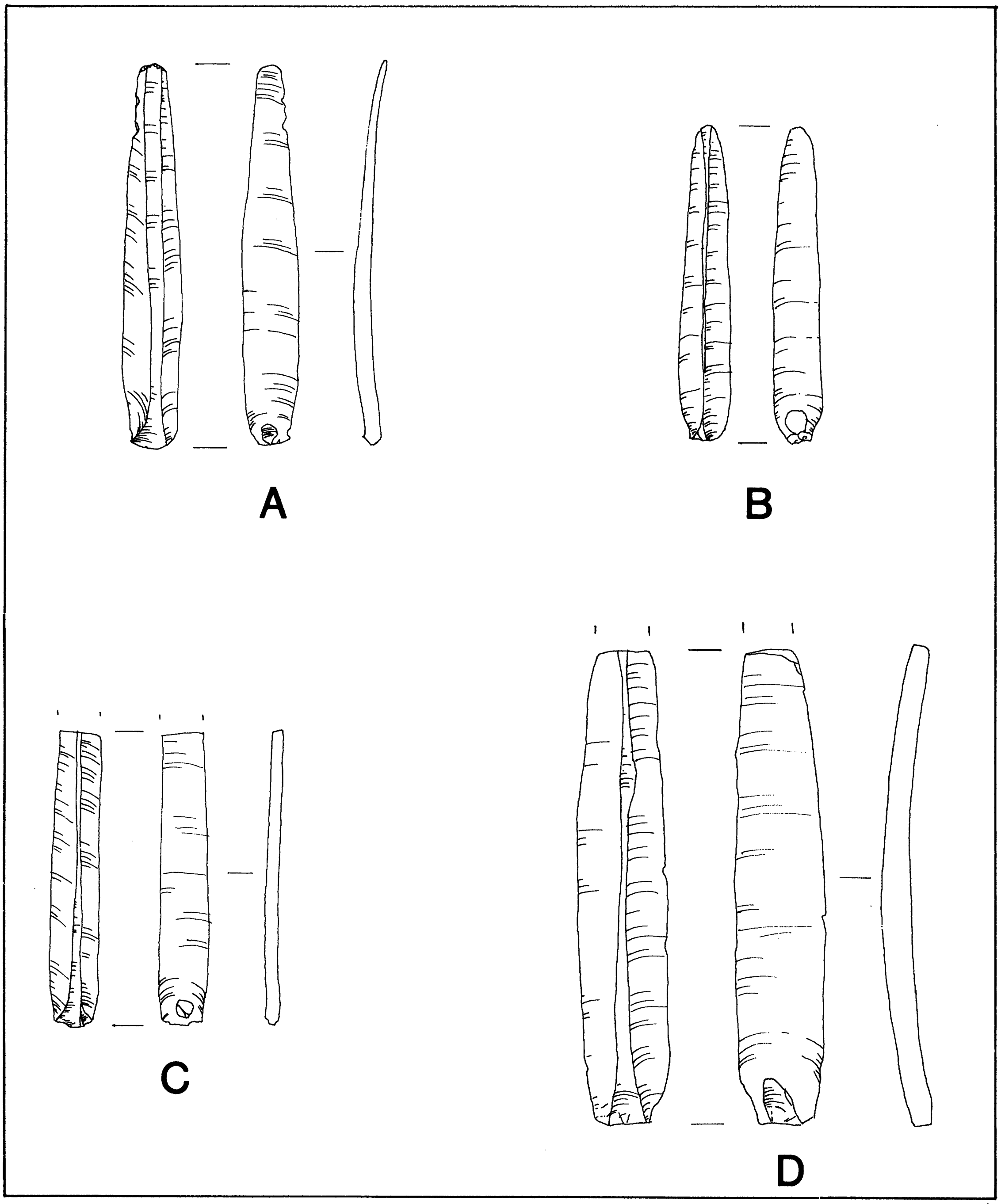

FIG. 5. Lerna III, obsidian blades: A, L7.440; B, L7.260; C, L7.454; D, L7.244. Scale 1:1

TABLE 7: Analysis of the products of debitage and their uses from Lerna by phase (tools are presented in Table 13)

Phase	Flakes						Blades					
	Obsidian		Chert		Utilized		Obsidian		Chert		Utilized	
	N	%	N	%	Ob	Ch	N	%	N	%	Ob	Ch
Lerna V	995	87.9	137	12.1	8.6	2.2	394	97.8	9	2.2	22.1	—
Lerna IV	2,556	92.2	215	7.8	10.9	14.4	1,309	98.3	23	1.7	41.0	47.8
Lerna III	897	94.0	57	6.0	5.1	12.3	959	99.2	8	0.8	7.0	12.5

TABLE 8: Tools shown by phase

Phase	Obsidian		Chert		Sub-Total	Sample Size	% of Collection
	N	%	N	%			
Lerna V	467	73.0	173	27.0	640	2,902	22.1
Lerna IV	672	82.3	145	17.7	817	5,895	13.9
Lerna III	159	72.9	59	27.1	218	2,417	9.0

TABLE 9: Percentage of tools by raw material and by phase

Phase	Obsidian			Chert		
	Number of tools	N	%	Number of tools	N	%
Lerna V	467	2,518	18.5	173	384	45.1
Lerna IV	672	5,441	12.4	145	454	31.9
Lerna III	159	2,276	7.0	59	141	41.8

N = Number of specimens

by experimental flintknappers were possibly employed in the manufacture of the blades.[15] The pressure tool would have exerted tremendous force upon cores less than five centimeters long and one centimeter thick. Some vise or clamping device of wood or lead may

[15] For Egyptian techniques see G. Griffith, "The Manufacture and Use of Flint Knives," in *Beni-Hasan*, Memoir no. 5, part 3 (Egypt Exploration Society), London 1896, pp. 33–35. For Mesoamerica, J. E. Clark, "Manufacture of Mesoamerican Prismatic Blades: An Alternative Technique," *American Antiquity* 47, 1982, pp. 355–376. Experiments reported by J. E. Clark ("Platforms, Bits, Punches, and Vises: A Potpourri of Mesoamerican Blade Technology," *Lithic Technology* 14, 1985, pp. 1–15) and duplicated by the author at Stanford University show that almost any material, including antler, bone, stone, or even wood can be used to tip a pressure tool for removing good blades. Even quite small cores can be held in the feet as blades are pressured off, and the smallest cores could have been held in the hand.

have been necessary to hold these small cores, and it is possibly for this reason that they were given a rectangular shape. The cores which are nearly complete show only four or five blade scars left from the last series of removals. To handle such small cores and to remove the blades by pressure together show the high degree of skill used to produce blades of the consistency and quality seen at Lerna. Contemporary experimental flintknappers, some with time-consuming academic schedules, have attained the requisite level of skill to duplicate these blades. Although a high level of skill is assumed, no conclusion about the degree of employment of the craftsmen (i.e., full or part time) can be made.

About one half of the tools (Table 3) were made from these blades, the rest from flakes, yet the tools only account for about 4% of the blades. Only 7% of the blades were utilized in any way[16] (Table 7), and the majority of the blades were evidently not used at all. Obsidian was used for three quarters of all the tools of this period (Tables 8 and 9), but this represents a small percentage of all the obsidian (7%). Yet the chert tools (Table 3) were produced mainly from blades (64.7%), and a much larger percentage (41.8%, Table 9) of chert blanks was converted to tools. In short, many blades were being produced, possibly by specialized flintknappers, but few of these in our sample were ever used. Why, then, were they produced? Two hypotheses to account for this pattern could only be tested by comparison with other Bronze Age lithic samples. With the first hypothesis large quantities of the blades were produced by full-time specialist knappers working under the control of a central authority. These blades were stored (perhaps in the containers bearing sealings which were affixed in the House of the Tiles) for later use. With the second, but corollary, hypothesis the obsidian blades could have been traded to other communities much as the finished chert blades found their way to Lerna. Obsidian blades could have been traded to those settlements where the chert blades were being manufactured.

The many difficulties encountered in any attempt to distinguish "craft production" from "craft specialization" or "mass replication" in the archaeological record have been discussed for a long time by archaeologists.[17] A continuum existed surely in antiquity from part-time, low-output, but highly skilled craftsmen, producing for themselves and for trade within a small circle of others, to the full-time craft specialist who produced large numbers of highly standardized "units" for exchange within an integrated and commercialized economic system. But where does Lerna belong within this continuum? It is difficult to judge, so long as the extent of the trade in chert blades and the pattern of use of both chert and obsidian by contemporary communities in the Argolid and adjacent regions remain unknown.[18] The degree of skill required by the obsidian-blade makers must not be overestimated. Modern flintknappers have demonstrated that a high degree of technical skill and efficiency in blade

[16] Utilization, as opposed to deliberate retouch, was identified with a 10 X lens and consisted of small areas of minute patterned flake scars. Utilization is the modification of the edge of the blank by use rather than that resulting from the shaping of the over-all blank to a predetermined form, which is the purpose of retouch.

[17] See, for a useful summary and discussion, R. Torrence, *Obsidian in the Aegean: Towards a Methodology for the Study of Prehistoric Exchange,* diss. University of New Mexico 1981, pp. 175–255.

[18] A preliminary regional analysis of the use of obsidian in the Southern Argolid will be presented in M. H. Jameson, T. H. van Andel, and C. N. Runnels, *A Greek Countryside: The Southern Argolid from Prehistory to the Present Day* (in preparation).

TABLE 10: Tool types: diversity by phase

Phase	Number of Tool Types: Obsidian	Chert	Total
Lerna V	15	14	29
Lerna IV	13	14	27
Lerna III	14	9	23

TABLE 11: Tool types by phase: obsidian

Types	III N	III %	IV N	IV %	V N	V %
1. Retouched pieces						
a. blades	9	5.7	16	2.4	43	9.2
b. flakes	19	11.9	10	1.5	104	22.3
2. Scrapers						
a. end	2	1.3	20	3.0	14	3.0
b. other						
3. Notched pieces						
a. blades	3	1.9				
b. flakes	4	2.5				
4. Points (perçoirs and becs)	5	3.1	22	3.3	16	3.4
5. Sickle elements						
a. blades	19	11.9	14	2.1	5	1.1
b. flakes	1	0.6	8	1.2	13	2.8
c. unknown			1	0.1	2	0.4
6. Truncated pieces						
a. blades	5	3.1	23	3.4	21	4.5
b. flakes	5	3.1	3	0.4	14	3.0
7. Geometrics						
a. trapezoids	4	2.5	9	1.3	4	0.9
b. triangular						
c. unknown					4	0.9
8. Burins			2	0.3	1	0.2
9. Projectile points						
a. tanged	3	1.9	2	0.3	2	0.4
b. concave based	1	0.6	5	0.7	18	3.9
10. Miscellaneous bifaces					1	0.2
11. Pièces esquillées	77	48.4	529	78.7	195	41.8
12. Other	2	1.3	8	1.2	10	2.1
TOTAL	159		672		467	

TABLE 12: Tool types by phase: chert

Types	III N	III %	IV N	IV %	V N	V %
1. Retouched pieces						
a. blades	3	5.1	3	2.1	1	0.6
b. flakes	10	16.9	3	2.1	34	19.7
2. Scrapers						
a. end			3	2.1	4	2.3
b. other			6	4.1		
3. Notched pieces						
a. blades						
b. flakes	2	3.4			1	0.6
4. Points (perçoirs and becs)			1	0.7	3	1.7
5. Sickle elements						
a. blades	28	47.5	62	42.8	40	23.1
b. flakes	3	5.1	16	11.0	53	30.6
c. unknown	7	11.9	5	3.4	12	6.9
6. Truncated pieces						
a. blades	1	1.7	3	2.1		
b. flakes	2	3.4	2	1.4	2	1.2
7. Geometrics						
a. trapezoids					1	0.6
b. triangular			1	0.7		
c. unknown					1	0.6
8. Burins					1	0.6
9. Projectile points						
a. tanged	1	1.7	1	0.7		
b. concave based			3	2.1	6	3.5
10. Miscellaneous bifaces			6	4.1	4	2.3
11. Pièces esquillées	2	3.4	23	15.9	6	3.5
12. Other			7	4.8	4	2.3
TOTAL	59		145		173	

production can be acquired and maintained by part-time craftsmen. The shift from part-time to full-time craft production is more likely to be a function of the level of demand for the product. The demand for the blades produced at Lerna, whether at the site or elsewhere, cannot be presently estimated. The pattern of occurrence, however, of large quantities of obsidian, both waste and finished tools, at some mainland EH sites may nevertheless indicate partially centralized control of obsidian production at this time by a relatively small group of regional centers.[19]

[19] The large quantities of obsidian concentrated at Lerna are paralleled at, to give but two examples, Ayios Kosmas in Attica, see G. Mylonas, *Agios Kosmas. An Early Bronze Age Settlement and Cemetery in Attica*, Princeton 1959, and in the Southern Argolid at the site of F32, see Van Horn 1976, pp. 68–76.

Typologically less than 10% of the lithics (Table 8) can be classified as "tools" (i.e., blanks modified by deliberate retouch to predetermined and recurring shapes). No more than 23 separate tool types may be distinguished (Tables 10, 11, and 12), and some of these are simply variants of others. Some, like the pièces esquillées (splintered pieces), which have been included among the tools, are not necessarily deliberately shaped but may be fortuitous products of use.[20] The principal tool types in obsidian (Table 11) include the following:

1. Retouched pieces: blades and flakes with one or both margins shaped by discontinuous or continuous small retouch. This category may include pieces that were utilized as "implements" only (i.e., as blanks modified by use-retouch, or use-wear, only).

2. End scrapers:[21] scrapers on the ends of flakes or blades.

3. Notched pieces: blades and flakes with one or at most two notches retouched on the margins (Fig. 6: G).

4. Pointed pieces (perçoirs, or "drills", and becs, or "gravers"): generally blades with points formed by retouched edges which are convex, concave, or both, in outline. These pieces show macroscopic traces of crushing and rounding from use as drills, piercing tools, or gravers (Fig. 6: D).

5. Sickle elements: principally blades bearing clear traces of silica (or "plant") gloss,[22] on one or both margins, or denticulations formed by the removal of small lunate flakes in a series by pressure exerted straight down on the edge from the dorsal or ventral face (Fig. 7: D). The identification and classification of sickle elements was based primarily upon the presence of the "silica gloss", the highly lustrous sheen or deposit that is found on the edges of tools used to cut siliceous grasses (Pl. 99). Thus this class is one based upon use-wear traces rather than patterns of retouch alone. Sickle elements have distinctive characteristics (*viz.*, denticulation, truncation, or backing) that make them easy to identify even when the gloss is not present. A small number of pieces which had been classified as sickle elements on the grounds of form were examined microscopically in 1980 by Dr. Patrick Vaughan,

[20] Names in English for tool types are arbitrary and do not imply any particular function, since types and particular uses are known to overlap. Thus the term "scraper" refers to a type of tool formed by a specific kind of retouched edge. Microscopic examination by Dr. Patrick Vaughan of some selected tools from all three levels did confirm that some of the tools identified as "scrapers", "drills", "sickle elements" had indeed been used as such. Where not confirmed, the ascription of a specific usage to a particular tool type is open to question. The definition of tool types follows M. Brézillon, *La dénomination des objets de pierre taillée (Gallia Préhistoire,* Suppl. IV), Paris 1971.

[21] The so-called "Lerna end scrapers" described in Van Horn 1976, pp. 165–171, are extremely small and are not included in the counts as tools (see Fig. 5: A). Dr. Vaughan examined specimens microscopically and found no evidence of use. Van Horn suggested they were "trimmed" on the distal ends to allow the blades to be held in the hand and used as razors. Professor E. C. Banks suggests the flintknappers may have trimmed them to some standard length. A further possibility is that the "retouch" represents a phenomenon called "spontaneous retouch". If the cores were held with their distal ends against a support, the blade tips may have been pressed by the support against the distal end of the core and thus flaked. For "spontaneous retouch" see J. Brink, "Notes on the Occurrence of Spontaneous Retouch," *Lithic Technology* 7, 1978, pp. 31–33 and D. Healan and J. Kerley, "Edge Damage Induced by Core Immobilization in Prismatic Blade Manufacture," *Lithic Technology* 13, 1984, pp. 1–10.

[22] For a discussion of the formation of this gloss see the papers in *Traces d'utilisation* (footnote 12 above). Such glosses are formed when the tools are used to cut a wide variety of plants and grasses, including reeds and cereal crops, and may form quite rapidly.

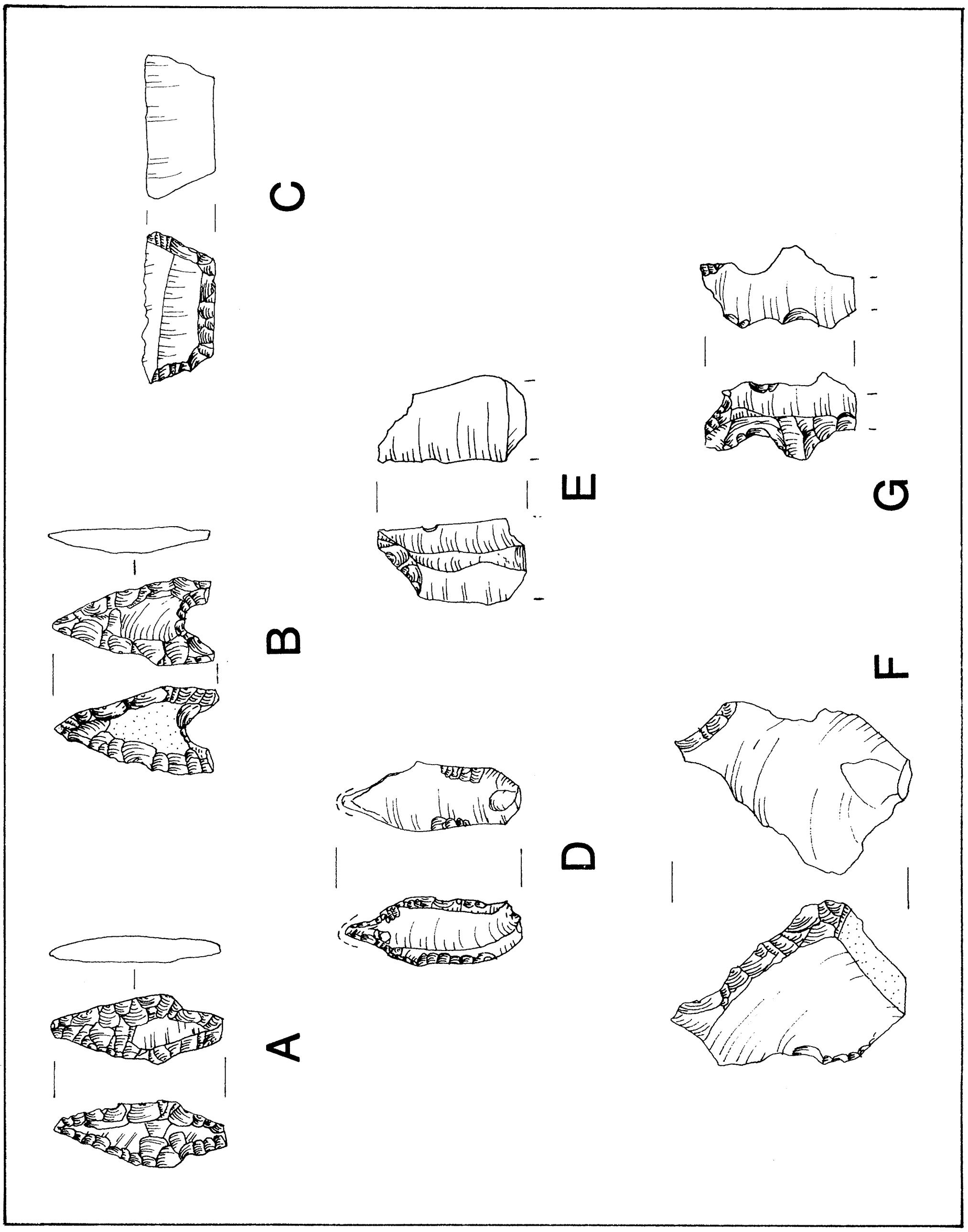

FIG. 6. Lerna III, obsidian tools: A, L8.78; B, L7.199; C, L7.496; D, L7.504; E, L7.549; F, L4.850; G, L7.551. Scale 1:1

and gloss was found on some of these examples.[23] It is possible, too, that some of the objects may have had other uses. Even those pieces with gloss may have been used before they were converted to sickles or vice versa. They are all made on blades, and the denticulation retouch may be on one or both edges and either direct or inverse. Only one specimen has a truncation. All but one have gloss on one edge only.

6. Truncated pieces: blades or flakes with the distal or proximal ends removed by direct or inverse retouch. This is a procedure different from the breaking or snapping away of one or both ends of a blank. The fractures resulting from snapping cannot be distinguished from accidental damage (Fig. 6: E).

7. Geometrics: segments of blades with double truncations (at both ends), here having a distinct trapezoidal or rectangular outline. Two specimens have one backed (steeply retouched) edge (Fig. 6: C).

8. Projectile points (arrowheads): blanks shaped by bifacial pressure retouch and having one pointed end; only four specimens were identified. Three have projecting tangs, and one has a concavely retouched base (Fig. 6: A, B).

9. Pièces esquillées (splintered pieces): typically rectangular or square flakes which have direct percussion on both faces and from both ends (though usually only in two directions), giving them a splintered and battered appearance (Fig. 12: E).

Chert was employed (Table 12) only for retouched pieces, notched pieces, sickle elements, truncated pieces, two pièces esquillées, and one tanged projectile point. Sickle elements on blades formed the majority of the tools. These were identical to the obsidian specimens. Five of the chert sickle elements had single truncations, and two pieces were backed (Fig. 7: A–C, E). The placement of the denticulations was highly variable. Four pieces had gloss on both edges.

The small number of types and small percentage of retouched or utilized pieces indicate that the range of uses was limited in this phase. The large number of razor-sharp obsidian blades, whether stored as blanks or intended for trade, could have served as a stock of ready-to-use cutting implements or as supports for new tools as needed. Yet if half the tools and most utilized pieces (Tables 3 and 7) are flakes, why bother to make blades at all? One is tempted to suppose they were indeed used as razors, as already suggested by Van Horn.[24] Pressure blades were certainly used in this manner in Mesoamerica, and one wonders if the Lerna inhabitants had the contemporary Egyptian taste for clean-shaven faces and heads.

The retouched pieces, truncated pieces, notched pieces, and points were used for cutting, scraping, and drilling. The few end scrapers are of Lerna IV or V type (see below) and are possibly intrusive. The three tanged projectile points resemble Late Neolithic types, but the concave-based type is well known in the later Bronze Age.[25] The presence of such points in all three Bronze Age levels under consideration may indicate that these points continued to be made after the Neolithic (Fig. 6: A, B). In any case, arrowheads are rare in the Early

[23] See footnote 20 above.

[24] Van Horn 1976, p. 170.

[25] J. Cherry and R. Torrence, "The Earliest Prehistory of Melos," in *An Island Polity*, C. Renfrew and M. Wagstaff, edd., Cambridge 1982, pp. 24–34; Van Horn 1976, pp. 265–285; S. Diamant, "A Barbed and Tanged Obsidian Point from Marathon," *JFA* 4, 1977, pp. 381–386.

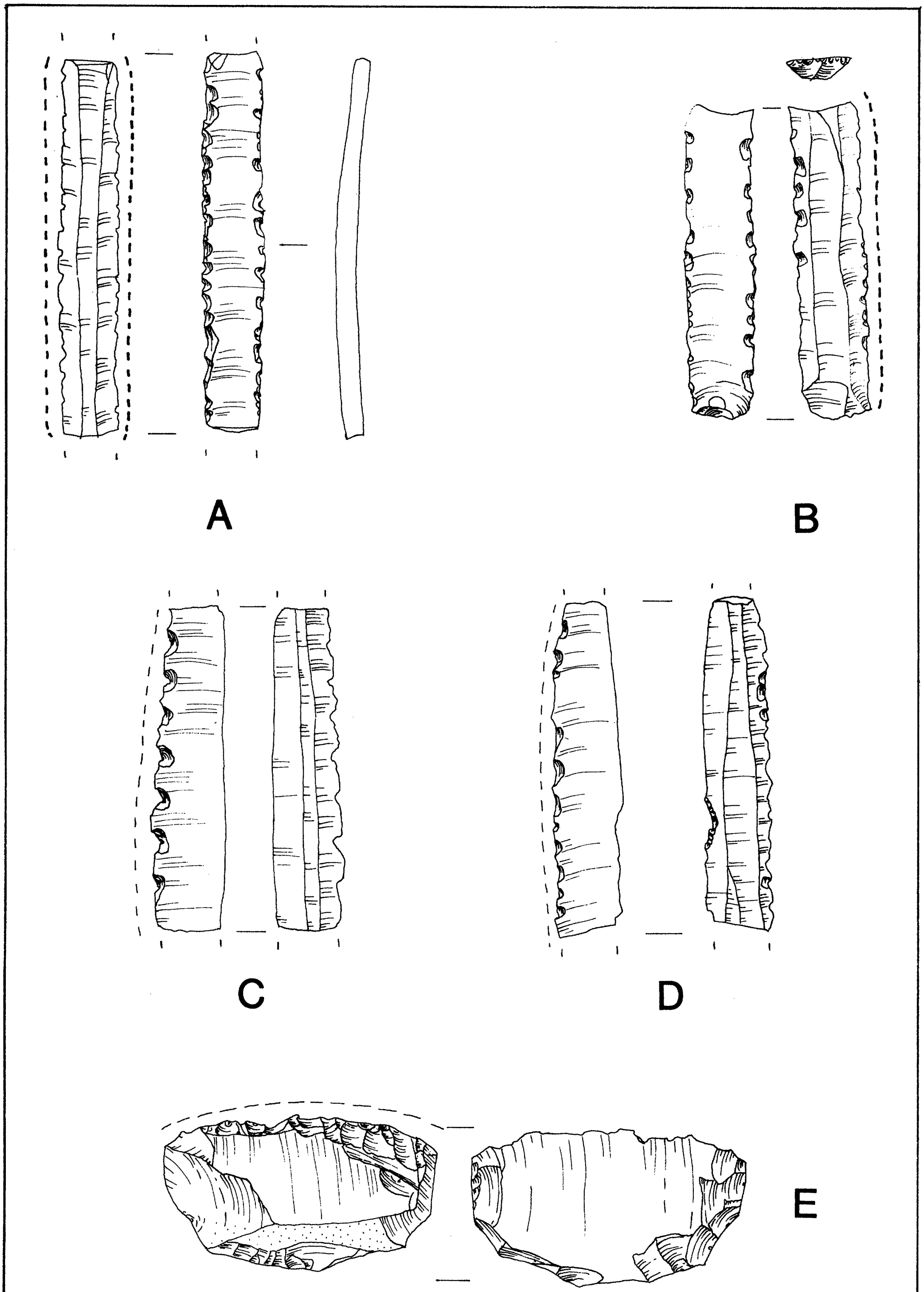

FIG. 7. Lerna III, sickle elements: obsidian, D, L4.496; chert, A, L4.493; B, L4.495; C, L8.70; E, L7.460. Scale 1:1

Bronze Age, even if the geometric pieces are included in this class. That geometrics (Fig. 6: C) were used as projectile points in the Near East and Egypt at this time has been determined from use-wear studies and the discovery of examples hafted as arrows in Egyptian tombs. Only the sickle elements had an undisputable use.[26] Hafted in wood or bone handles, they were effective reaping tools to cut plants, whether cereals, thatch, or reeds, for construction or basket-making. The pièce esquillée, the tool type found in the largest quantity, is also the most enigmatic. No certain uses are known for these tools, but they may have been cores, wedges (or some other intermediate tool), or they may possibly have been "tinder-flints" for making fire.[27] One may object to this last hypothesis on account of the large numbers of pièces esquillées. If one considers, however, that the tinder-flint would be rapidly reduced by direct percussion against the strike-a-light, it is evident that even a small community of, say, 30 families using an average of three tinder-flints a month would require more than 1,000 tinder-flints per year.

Early Helladic III (Lerna IV)

The largest sample of lithics was obtained from this settlement. The sample continues to be dominated by obsidian, but there is a significant increase ($X^2 = 9.0$, ldf., $p<0.005$) in the use of chert as a raw material (Table 1). Although the range of chert colors remains much the same as before, an increase in the number of cores and cortical pieces verifies that chert tools were increasingly manufactured on the site (Table 2). The number of unretouched chert blades in Lerna IV increased slightly (Table 7, 1.7%; Pl. 98:b, c), but for tool manufacture there was a clear increase in the use of flakes as supports for most tool types (Table 3). Fine "imported" chert pressure blades, however, decrease slightly in number, and percussion blades and flakes of possibly local manufacture are used in greater quantities.

Cores identical to those of Lerna III are found in large numbers (Table 2) but are represented mostly by extremely small fragments (Figs. 8: A, B, 15: B). Although there is no change in the technique of blade manufacture, there is a slight increase in the quantity of

[26] For Egyptian arrowheads see J. Clark, J. Phillips, and P. Staley, "Interpretations of Prehistoric Technology from Ancient Egyptian and Other Resources. Part I: Ancient Egyptian Bows and Arrows and their Relevance for African Prehistory," *Paléorient* 2 1974, pp. 323–388. For the identification of use wear on projectile points see P. Anderson-Gerfaud, "A Consideration of the Uses of Certain Backed and 'Lustred' Stone Tools from Late Mesolithic and Natufian levels of Abu Hureyra and Mureybet (Syria)," in *Traces d'utilisation* (footnote 12 above), pp. 77–105.

[27] Pièces esquillées were perhaps used in the manufacture of bone and antler tools and ornaments. Objects of these materials are numerous in Lerna IV; see E. Banks, *The Early and Middle Helladic Small Objects from Lerna*, diss. University of Cincinnati 1967, University Microfilms International 67-15948, pp. 263–684. The wedging or splitting of bone and antler could have required wedges. Another possibility is that the pieces were used as tinder-flints for striking fire, see Brézillon, *op. cit.* (footnote 20 above), p. 288. This possibility, first suggested in 1909, seems to me the most plausible explanation. I have experimented with eight flakes of chert and obsidian (Melian) and a modern iron strike-a-light from Greece to test the ability of pieces in both materials to strike sparks. Chert and obsidian flakes both strike sparks easily when struck on the strike-a-light at a 45° angle. The crushing action of the strike-a-light against the edge of the stone does create, in a matter of minutes, quite respectable pièces esquillées (as well as notches and other kinds of retouched edges). The experiment does not of course prove that the pièces esquillées were used as tinder-flints, only that they could have been so used. Pieces of ferruginous stone that show traces of abrasive wear similar to a modern strike-a-light were found in all levels of the site.

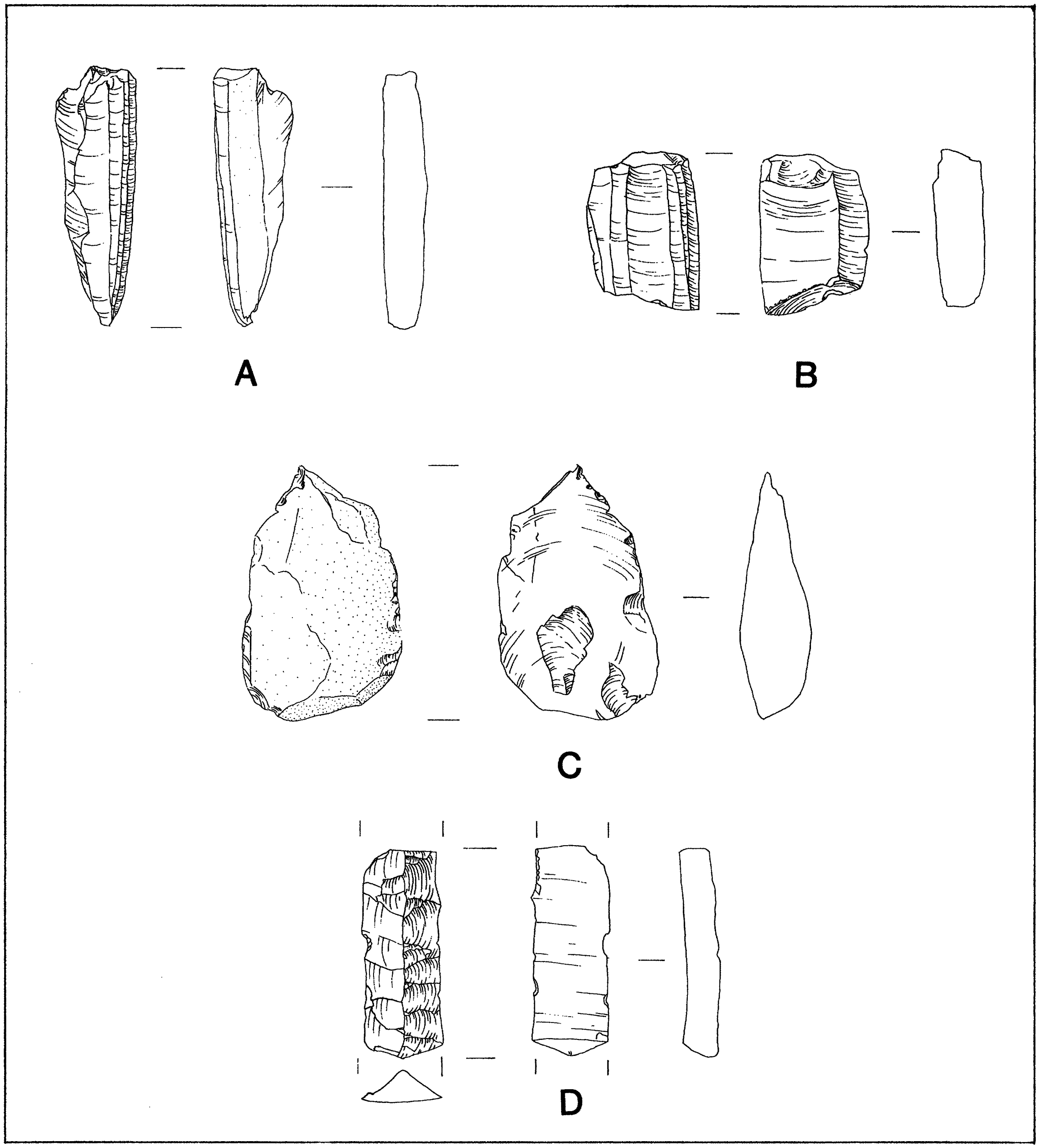

FIG. 8. Lerna IV, obsidian cores and blanks: A, L7.404; B, L4.531; C, L4.759; D, L6.840. Scale 4:5

cortical pieces at the expense of plain flakes and blades (i.e., blanks; Table 2, to 11.7%; Fig. 8: C), and blades are no longer the principal output of the industry. The use of blades for tools drops dramatically (Table 3, from 52.6% to 25.4%), and the over-all number of blades drops to only 33.9% of the blanks (Table 4). The blades tend to be slightly larger, and a higher coefficient of variation (Table 6) results from a wider spread of values about the

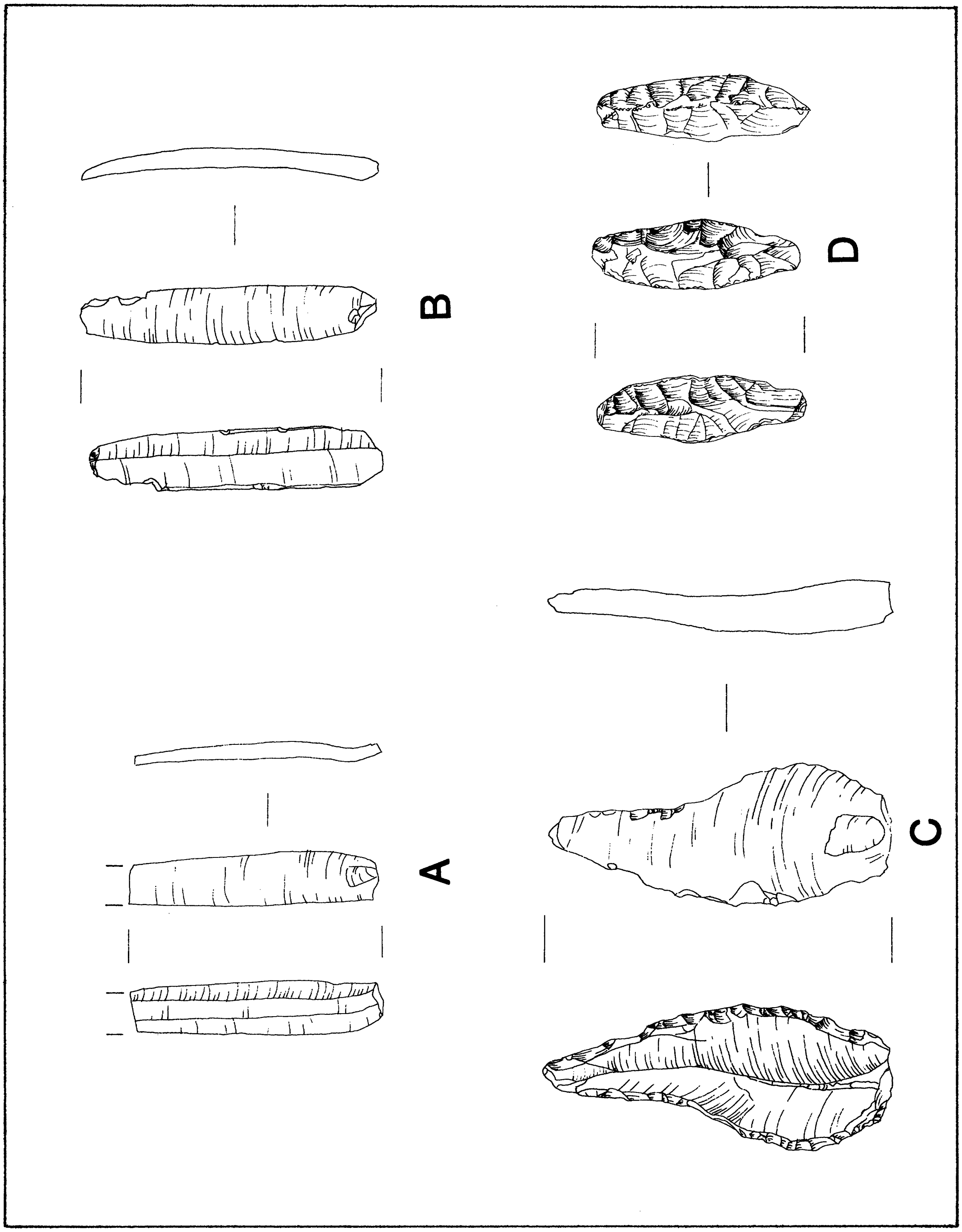

FIG. 9. Lerna IV, blades and tools: obsidian, A, L5.627; B, L5.710; C, L7.464; chert, D, L7.495. Scale 1:1

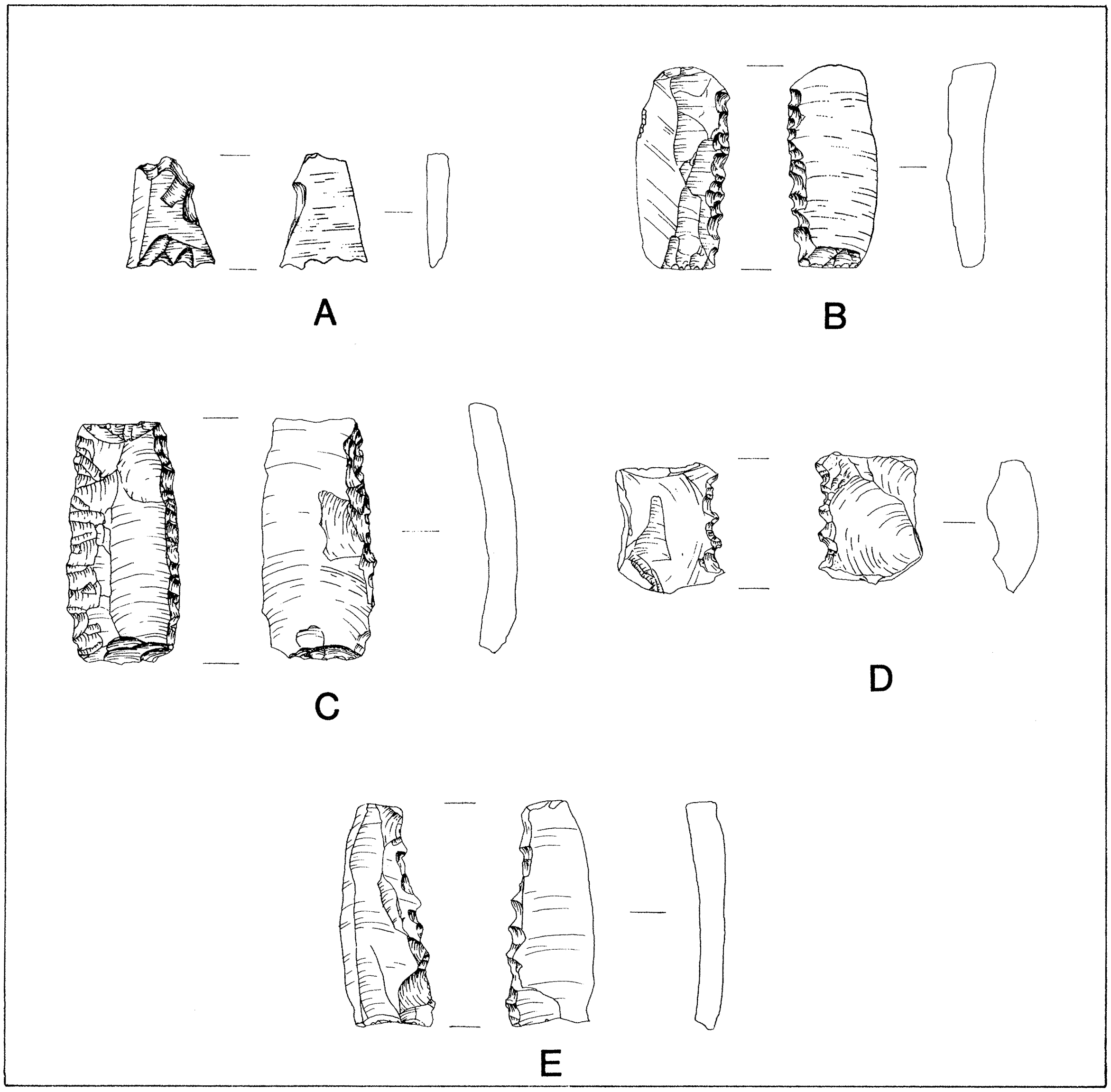

FIG. 10. Lerna IV, chert and obsidian sickle elements: chert, A, L3.264; B, L5.498; C, L4.686; obsidian, D, L5.946; E, L5.525. Scale 4:5

mean, i.e., the blades were made with less precision (Figs. 9: A, B, 15: C; Pl. 98:a). Obsidian flakes, both cortical and plain, were used in large quantities for tools (Tables 3, 8, 9). Not only were more tools made of obsidian but a larger proportion of the obsidian was devoted to this purpose. Flakes and blades of both chert and obsidian increase remarkably (Table 7) in the percentages that show traces of use-wear but were not retouched (Fig. 14: A–C). Indeed the over-all impression for both materials is of intensive utilization and reworking of all pieces.

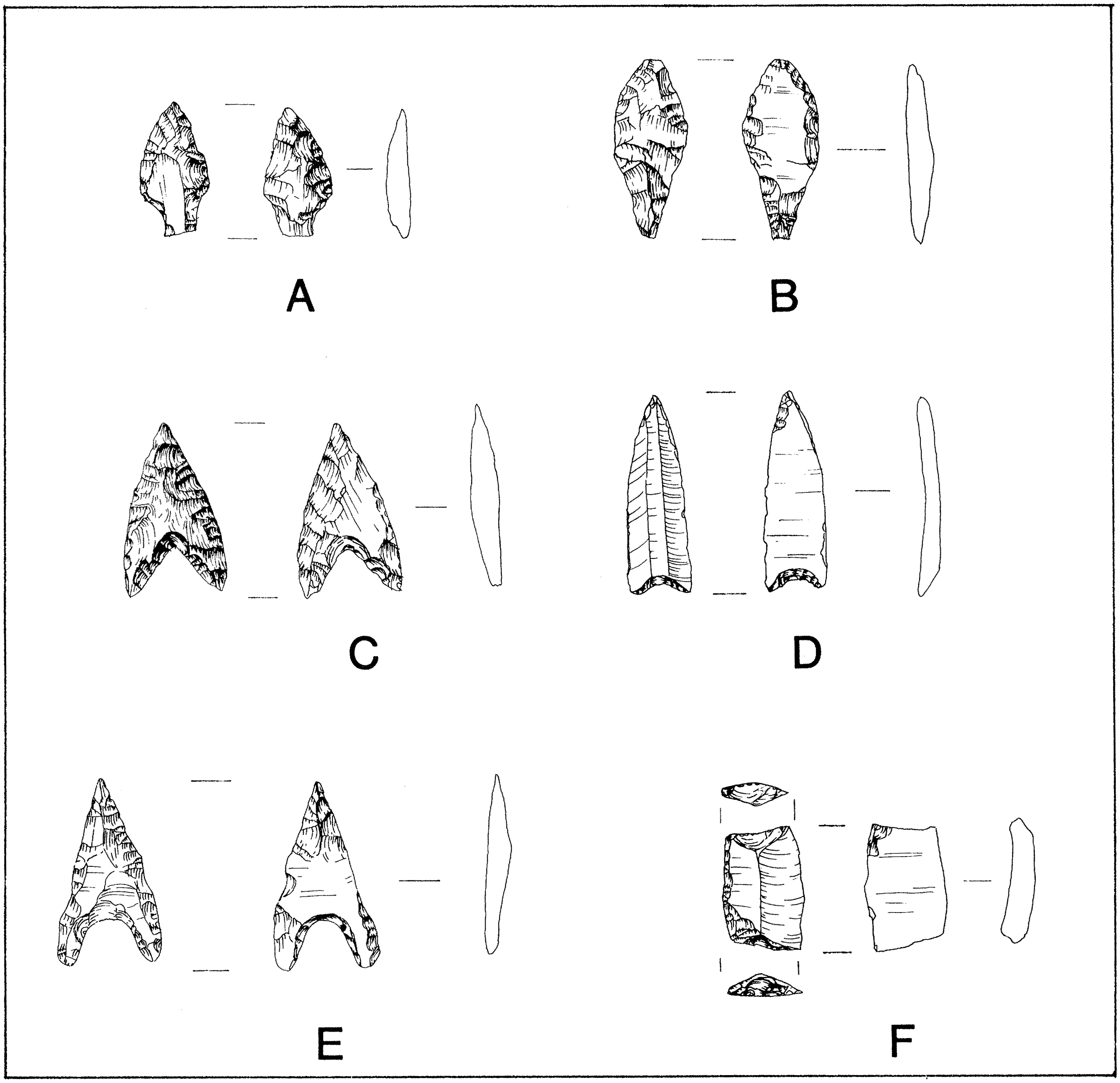

Fig. 11. Lerna IV, chert and obsidian tools: obsidian, A, L6.1622; B, L6.1323; C, L6.1291; D, L4.690; F, L6.1624; chert, E, L4.251. Scale 1:1

Nearly 14% of the sample consists of retouched tools (Table 8; Fig. 9: C). There is a slight increase in the number of tool types (Tables 10, 11, 12), but significant changes between the third and fourth settlements are few indeed. Turning first to the obsidian (Table 11) we see a decrease in the number of retouched pieces, an increase in the number of end scrapers, and drops in the numbers of notched pieces, sickle elements (Fig. 10: D, E; Pl. 99:b), truncated pieces, and geometrics (Figs. 11: F, 17: G). There are fewer tanged projectile points and more concave-based ones (Fig. 11: A–D; Pl. 100:b). Only the pièces

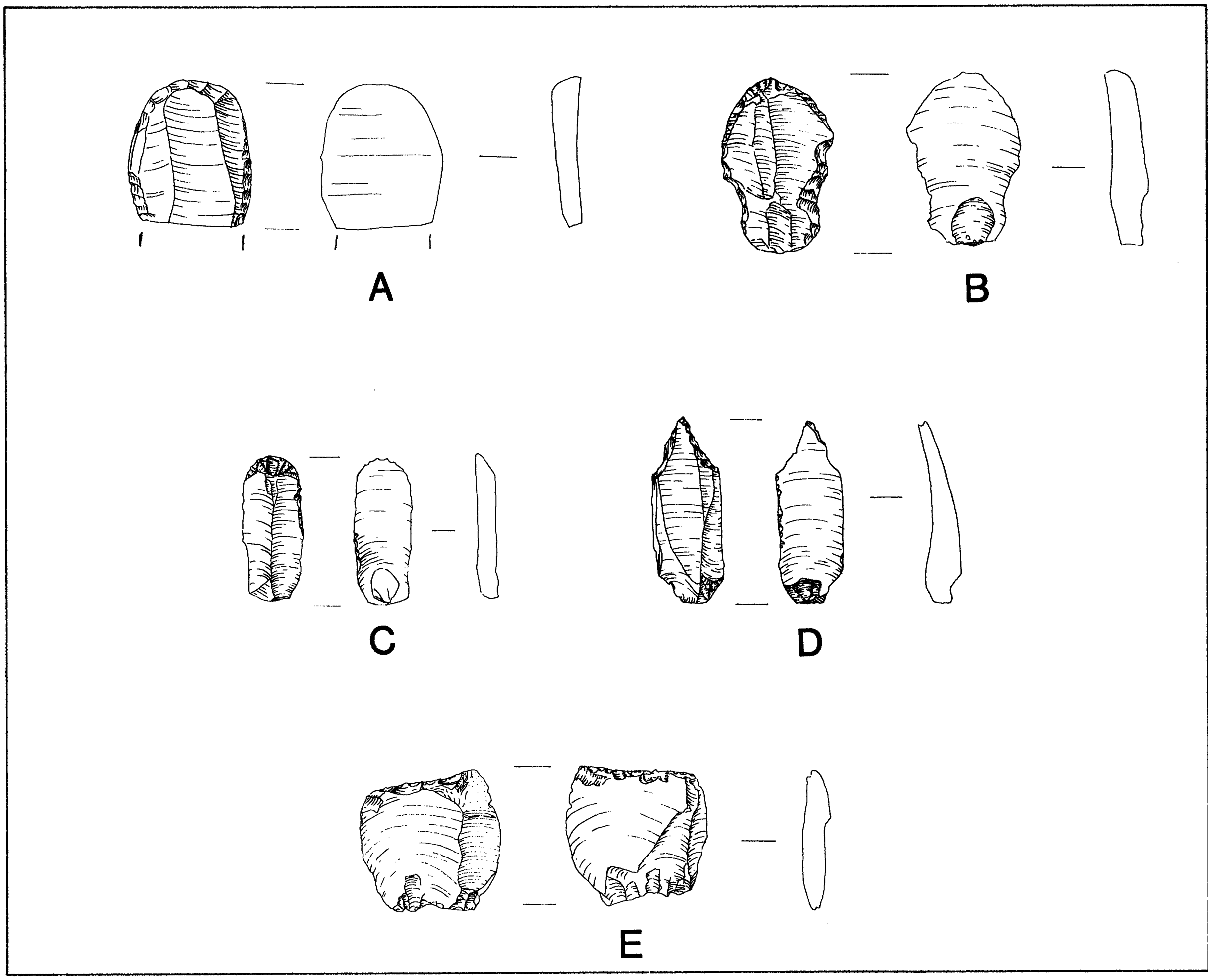

FIG. 12. Lerna IV, obsidian and chert tools: obsidian, B, L6.568; C, L5.595; D, L6.1569; E, L6.1626; chert, A, L4.724. Scale 1:1

esquillées (Fig. 12: E) show a marked increase (from 48.4% to 78.7%). The differences among the types are too few to be significant, and it would thus be difficult to assign an individual tool to one level or another based only on typological criteria. End scrapers in Lerna IV and notched pieces in Lerna III are the only tools that are specific to one period. The Lerna IV end scrapers (Figs. 12: B, C, 17: D) are fashioned on the distal ends of proximal blade fragments or small flakes, and one piece (L6.568) was supplied with a tang for hafting. At least three of the specimens were identified as scrapers, possibly used for working some soft material such as hide.[28]

In chert (Table 12) we see much the same pattern, the only changes again being in the retouched pieces, end scrapers (Fig. 12: A; Pl. 100), notched pieces, projectile points, and pièces esquillées. There is a slight increase in the use of chert flakes (Figs. 10: A, 13: D), as

[28] See footnote 20 above.

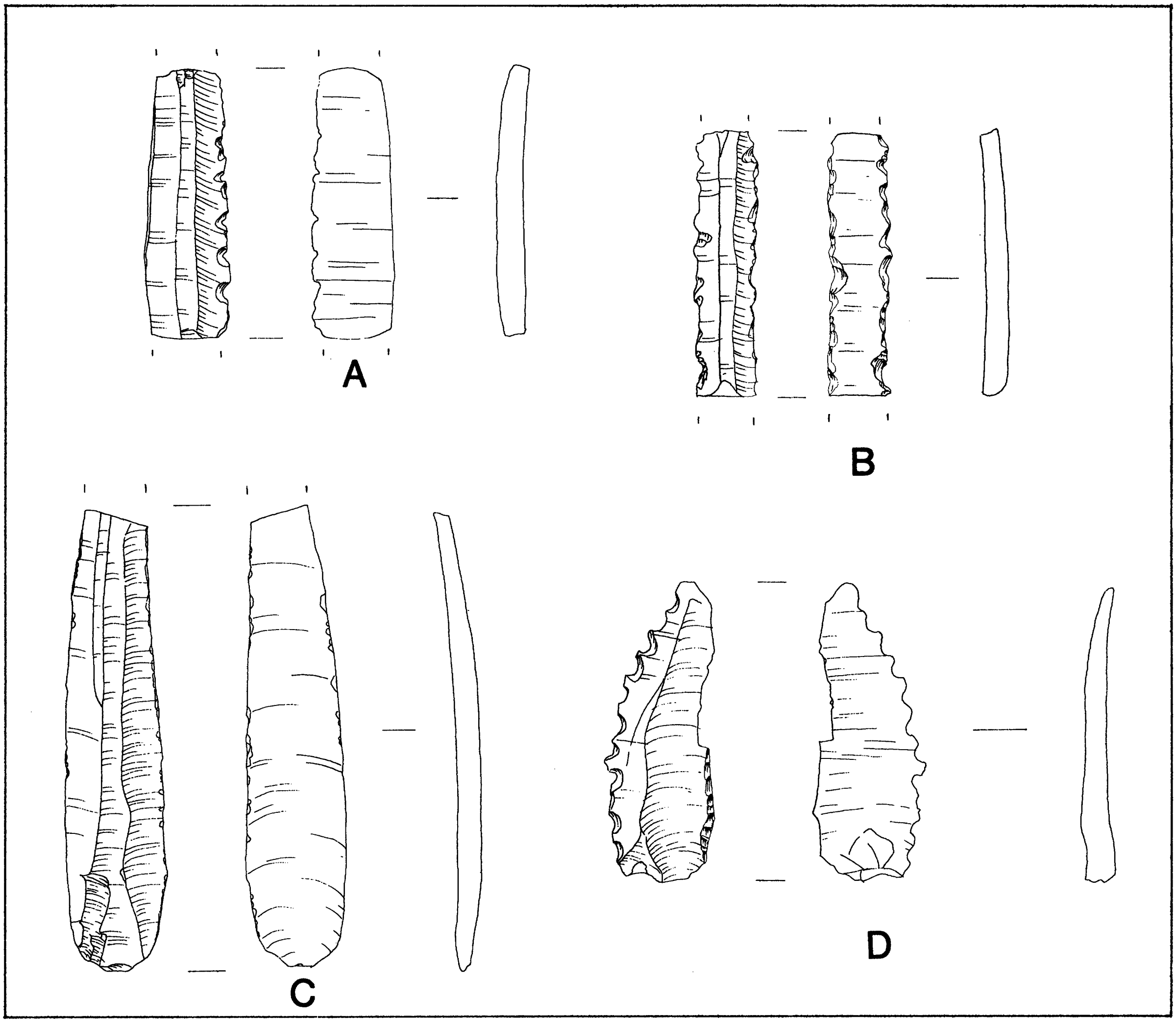

FIG. 13. Lerna IV, chert sickle elements: A, L4.700; B, L5.630; C, L4.532; D, L5.619. Scale 4:5

opposed to blades (Fig. 13: A–C), for sickle elements. The sickle elements show some typological differences. Nearly half have a truncation on one end (two thirds are blades) and there are two backed specimens (Fig. 10: B, C). Most of the retouched pieces have retouch and gloss on one edge only, although the placement of the retouch varies from piece to piece (Pl. 99:a). A larger number in this phase have retouch and gloss on both edges (*ca.* 25%). A significant number of blades (27%) have no retouch at all, only gloss (e.g. Fig. 13: C).

The most significant change in Lerna IV is the increase in the percentage of pièces esquillées in chert and obsidian (Fig. 12: E; Pl. 100:a). This change is difficult to interpret without knowing the functions served by this class of tools. The pieces are quite small; the mean greatest dimension is 0.019 m., and some small specimens are only 0.01 m. long. The small size of some of these specimens makes it difficult to accept any of the explanations for

TABLE 13: Summary of tool types shown by material and phase

Types	III Ob %	III Ch %	IV Ob %	IV Ch %	V Ob %	V Ch %
Retouched pieces	17.6	22.0	3.9	4.2	31.5	20.3
End scrapers	1.3		3.0	2.1	3.0	2.3
Other scrapers				4.1		
Notched pieces	4.0	3.4				0.6
Points	3.1		3.3	0.7	3.4	1.7
Sickle elements	12.5	64.5	3.4	57.2	4.3	60.6
Truncated pieces	6.2	5.1	3.8	3.5	7.5	1.2
Geometrics	2.5		1.3	0.7	1.8	1.2
Burins			0.3		0.2	0.6
Projectile points	2.5	1.7	1.0	2.9	4.3	3.5
Bifacial pieces				4.1	0.2	2.3
Pièces esquillées	48.4	3.4	78.7	15.9	41.8	3.5
Other	1.3		1.2	4.8	2.1	2.3

this tool as applying to the entire class. Little can be said about the uses of the other tools. The decrease in the number of retouched pieces (Table 13; Fig. 9: C) is offset by the greater percentage of plain blades that are utilized (Table 7; Fig. 14: A–C). Both categories represent general purpose tools. Certainly the demand for unutilized and unretouched plain blades, for whatever purpose, has decreased in Lerna IV. The increases in the percentages of end scrapers, piercing tools (points; Fig. 12: D), projectile points, and geometrics may indicate an increase in hunting and in processing of animal hides. Nothing precludes the use of the projectile points, however, as arrowheads for war arrows[29] or the other tools from uses in the manufacture of textiles or basketry.

Middle Helladic (Lerna V)

This sample is considerably smaller in size than the preceding one. Since the extent of excavation did not differ greatly, a reduction in the use of lithics in this level is indicated. One change is the strongly significant increase in the use of chert (Table 1; X^2, ldf., $p<0.001$). Increases in the percentages of chert flake cores, cortical pieces, blanks, and

[29] It is a striking fact that the typologically distinct arrowhead in the Eastern Mediterranean, as opposed to the backed blade and microlith which are found throughout the Stone Age and which were also used as arrowheads, occur only in the Neolithic and Bronze Age levels. Indeed, after the introduction of domesticated animals in a time when hunting would presumably be on the decline, arrowheads become more numerous. They are especially common in the Later Neolithic and in the Bronze Age. Stone Age arrowheads are sometimes found lodged in human beings, e.g., A. M. T. Moore, "A Pre-Neolithic Farmer's Village on the Euphrates," *Scientific American* 241, 1979, pp. 62–70, rather than in wild quarry. One hypothesis for future testing is that the arrowhead was developed primarily for use in warfare and should not be considered an old-fashioned tool which lingered on into metal-using eras as a hunting weapon.

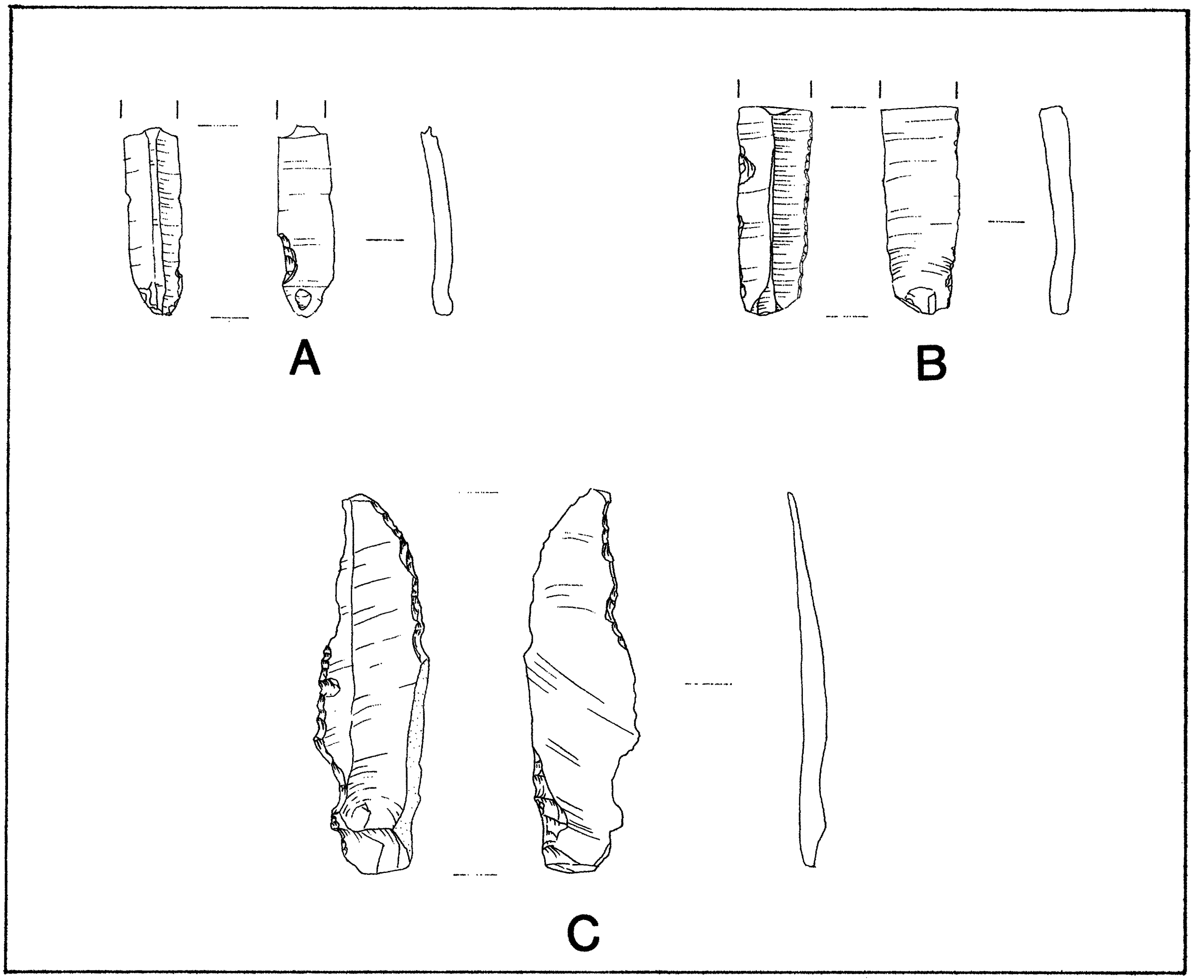

FIG. 14. Lerna IV, obsidian and chert tools: obsidian, A, L6.1390; C, L6.1114; chert, B, L6.1315. Scale 1:1

debris (Table 2) demonstrate clearly that chert tools were being manufactured on the site in greater numbers. This supposition is further supported by a decrease in the number of "imported" chert blades and a greater uniformity of chert color (principally a 10R 3/4–4/6 Reddish Brown to 10YR 2/2–4/2 Dark Yellowish Brown). There was some variation in the use of blades for tools (Table 3) with obsidian decreasing while chert increases, but there is a concomitant decrease in the use of chert flakes for tools.

The use of obsidian imported to the site from Melos drops in Lerna V as it had in Lerna IV. When the weight of obsidian (Table 14; only the inventoried pieces were measured) is regularized by converting it to a ratio of weight to number of pieces, we see a decline in the average size of the obsidian pieces through time. This contrasts with the weight of chert which can be seen in Table 14 to increase steadily to a peak in this period. The small fragments of blade cores show no change in percentage or in the technology of blade production (Fig. 15: A). A jump in the percentage of cortical pieces, when coupled with the

TABLE 14: Selected weight (grams) by phase
A. Obsidian

Phase	Cores	Flakes	Blades	Tools	a. Total Weight	b. Total No. Pieces	Ratio a/b
Lerna V	46.5	86.0	158.0	123.5	414.0	266	1.59
Lerna IV	57.0	176.0	178.0	162.5	573.5	371	1.55
Lerna III	157.5	152.5	227.5	89.0	626.5	339	1.85

B. Chert

Phase	a. Total Weight	b. Total No. Pieces	Ratio a/b
Lerna V	429.5	86	4.99
Lerna IV	637.5	164	3.89
Lerna III	180.0	56	3.21

decrease in the percentage of blanks and the substantial increase in debris (Table 2), points to a change in flintknapping. Cortical pieces are smaller than at any time before (Table 5), and in their coefficient of variation they are very consistent in size. The blades are wider, thicker, and show a variance around the mean similar to those of Lerna IV (Table 6). Although there was more "waste", i.e., cortical pieces, in Lerna V, a consistent product was still desired and produced. Blades, however, were less important in this period, and plain flakes show a marked increase (Table 4). Fewer blades were being used for tools than in Lerna IV (Table 3), and the over-all percentage of blades in the sample (Table 4) drops to a low of 28.4%, while the proportion that was utilized is half that of Lerna IV (Table 7; Fig. 17: E). The increasing percentage used for tools shown in Table 3 is certainly a reflection of the greater proportion of tools made on all types of blanks in the industry (up to 22.1%, Table 8), the highest of the three periods. The over-all impression is of an industry which was directed towards the consistent production of chert and obsidian flakes, a high proportion of which was converted to specific tool types with little expedient utilization of unretouched blanks. Although a greater reliance was placed upon "local" materials in Lerna IV, the industries of Lerna IV and V are quite similar.

The increase in the percentage of tools has already been noted (Table 8). The number of tool types is virtually the same as in IV, and no new tool types were identified (Tables 10, 13). Significant differences are, however, apparent within certain tool types (Tables 11, 12, 13). There is a marked increase in the retouched chert and obsidian pieces, although they do not conform to any particular types. End scrapers, points, and geometrics are roughly in the same proportion in V as in IV and of the same types (Figs. 15: D–F, 17: D, F, G). The number of obsidian sickle elements decreases to 16.0% (Table 15), and chert sickle elements show a concomitant jump in number (Fig. 16: A–F). Flakes are the preferred blanks for

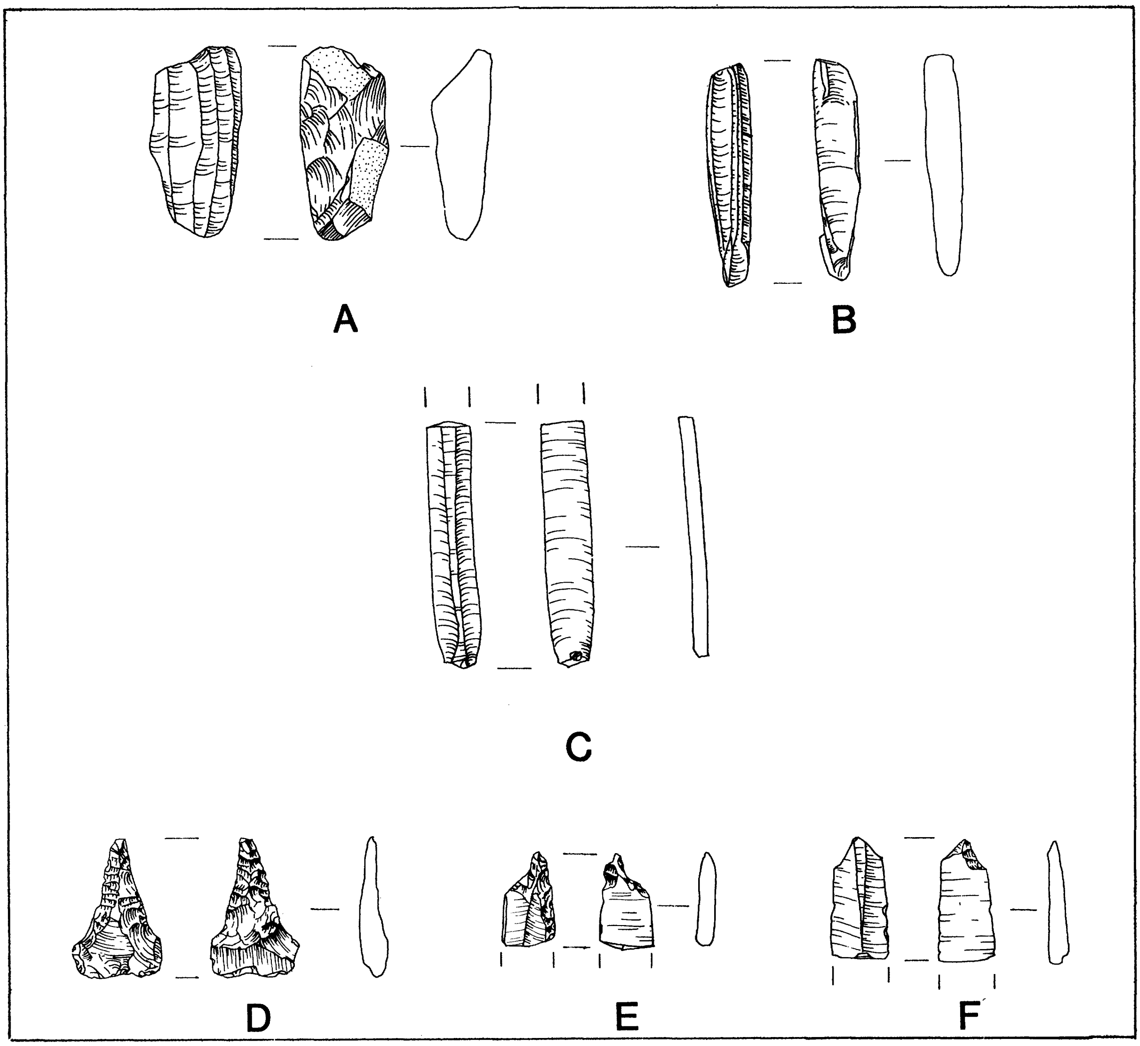

FIG. 15. Lerna IV and V, obsidian cores, blades, and tools: A, L6.1148; B, L4.811 (IV); C, L5.706 (IV); D, L5.943; E, L6.1555; F, L6.1562. Scale 4:5

sickle elements (Tables 11, 12). Half the obsidian and two thirds of the chert elements have been truncated on one or both ends, backed, or both. The typical Lerna V sickle element is a flake trapezoidal to triangular in outline (Fig. 16: F). The shape of the flake was modified by retouch, frequently by means of two converging truncations. The working edge was denticulated, usually with bilateral flaking (*ca.* 42%), and the overwhelming majority (*ca.* 80%) had but one edge with silica gloss. The obsidian elements were made less regularly, and the flintknappers often took advantage of fortuitously shaped flakes for modification (e.g. Fig. 16: A).

Another distinctive tool type is the projectile point. The increase in the representation of concave-based obsidian pieces is remarkable (Table 11; Fig. 17: B) and is paralleled in

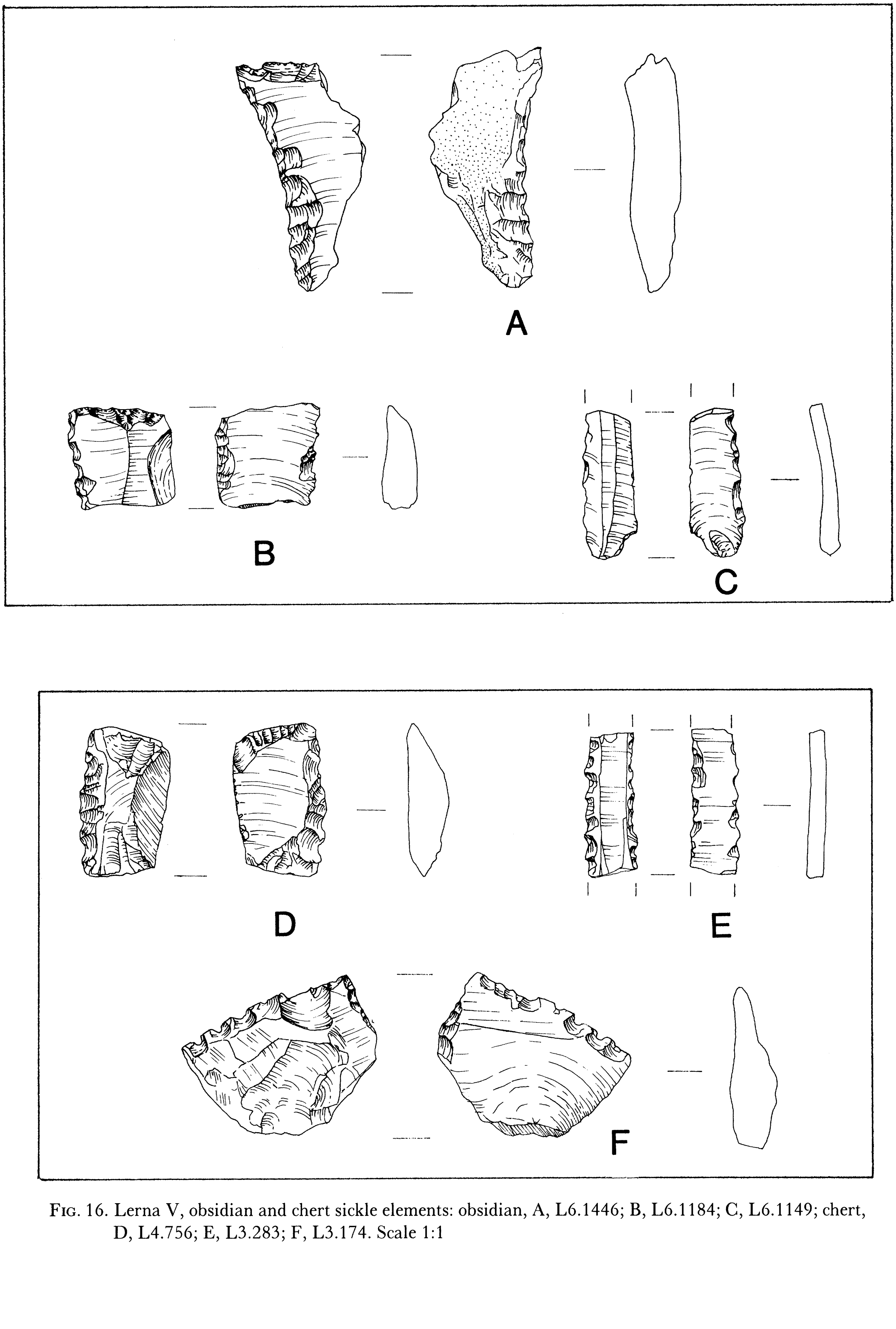

FIG. 16. Lerna V, obsidian and chert sickle elements: obsidian, A, L6.1446; B, L6.1184; C, L6.1149; chert, D, L4.756; E, L3.283; F, L3.174. Scale 1:1

TABLE 15: Sickle elements

Phase	Obsidian N	Obsidian %	Chert N	Chert %	Total
Lerna V	20	16.0	105	84.0	125
Lerna IV	23	21.7	83	78.3	106
Lerna III	20	34.5	38	65.5	58

chert. Geometrics in both materials show slight increases also. The two tanged arrowheads of Lerna V may be the last examples of a long-lived type or kick-ups from the Neolithic levels (Fig. 17: A, C), with which they are typologically identical. Pièces esquillées, those mysterious tools, drop in representation to the level found in Lerna III, far below the numbers found in Lerna IV. The number of truncated obsidian pieces (Table 13) increases (Fig. 17: F). The presence of end scrapers, piercing tools (points; Fig. 15: D–F), general retouched pieces, sickle elements, and pièces esquillées indicate as before tools useful to farmers and part-time craftsmen.

Discussion

The three samples of lithics from Lerna when viewed at the level of individual tool types or techniques of blade production do not differ greatly one from another. Isolated specimens of cores, pressure blades, and some tool types (e.g. concave-based projectile points) are readily distinguished as exclusively Bronze Age productions but cannot be assigned to any particular period. There are nevertheless patterns of change that are visible from one phase to another. The quantitative evaluation of the three industries reveals changes in raw material preferences and differences in tool typology, as well as the uses of the tools and blanks.

An explanation of these patterns of change is complicated by several factors. Could differences between the industries result from the hazards of excavation? The material from Lerna III came predominantly from the House of the Tiles and the fortifications; would household assemblages from the same level, if excavated, reveal patterns similar to those from the rest of the settlement or resemble the "household" assemblage of Lerna IV? Only part of the mound at Lerna (*ca.* one third) was excavated, and we know little about the distribution of materials over the site in any one phase. The chance discovery of the debris from a specialist flintknapper's workshop would differ greatly from the debris from that, say, of a basket-maker or a farmer. Such possible differences may have been compounded during the excavations. Sieving was not employed, and collection policies within the excavation units were not standardized. One is left then with lingering questions, e.g., was the collection of chert more careful in some levels than in others? All these potential sources of error could be compounded with others which are being raised by researchers studying site-formation processes.[30] The most serious impediment to interpretation is the movement of individual objects up and down within the site. The cutting of bothroi and graves by the

[30] See, for example, M. Schiffer, *Behavioral Archeology*, New York 1976, pp. 27–41.

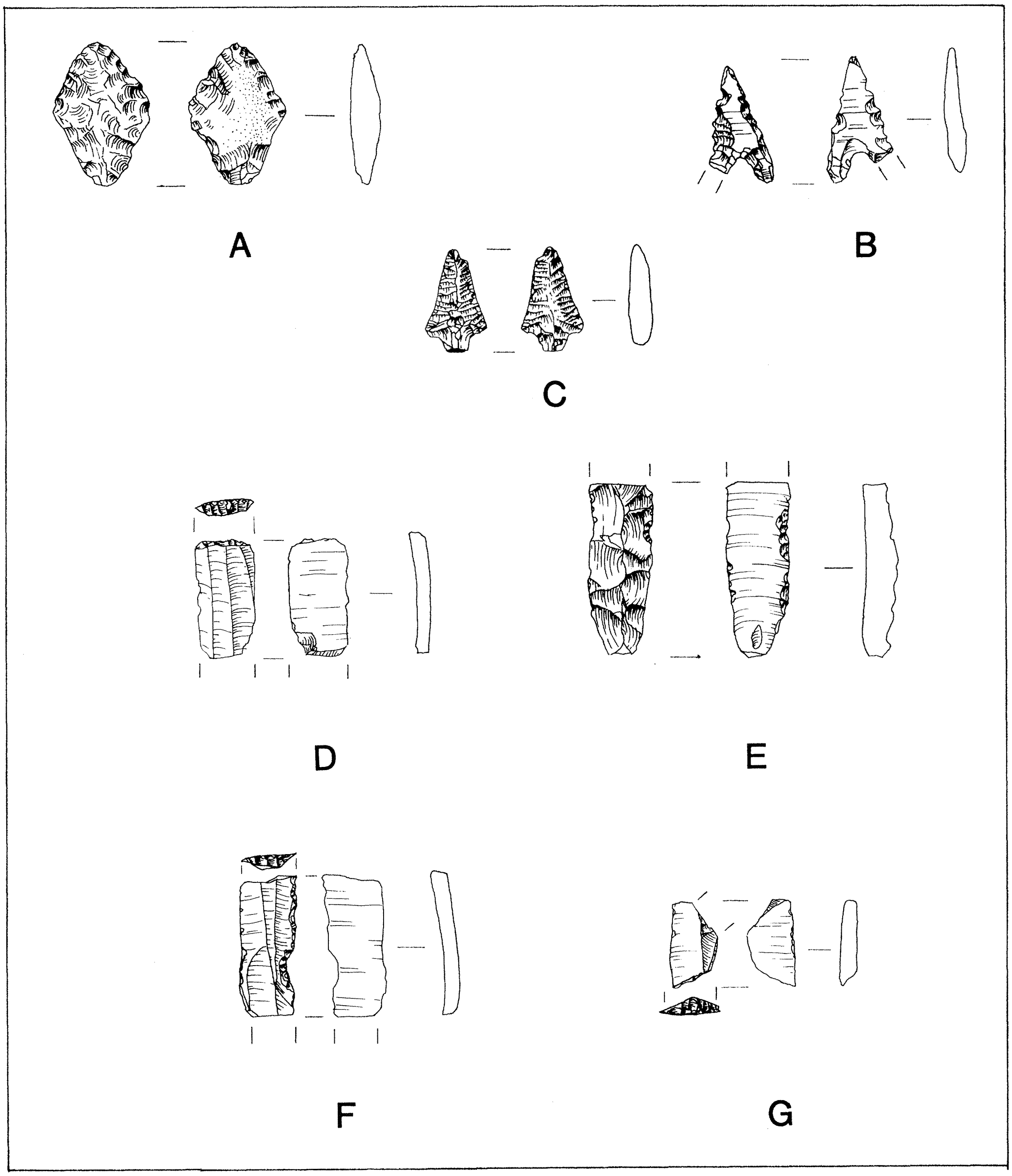

FIG. 17. Lerna IV and V, obsidian tools: A, L4.522; B, L6.1150; C, L6.1334; D, L7.540 (IV); E, L6.1467; F, L4.741; G, L4.816 (IV). Scale 4:5

inhabitants of Lerna IV and V and building activities at all times were responsible for serious mixing of materials from different strata. It is not possible here to solve these problems; it is only necessary that the reader bear in mind that the following conclusions are tentative. They are based on what can be observed in the preserved samples, and it is assumed throughout that the major trends of change at Lerna are due principally to cultural differences. Reliance upon isolated specimens of artifacts is avoided because of the danger of contamination. Instead, the focus has been on the patterns of change in whole categories of artifacts or their attributes.

The following general conclusions may be drawn: Lithics in considerable quantities were in use throughout the Early and Middle Bronze Age at Lerna. Obsidian blades, manufactured by means of a skillful pressure technique, were produced from small, flat cores with carefully flaked backs and platforms. Yet blades never represented more than one half the obsidian assemblage, and by Lerna V this had sunk to little more than one quarter (Table 4). The most common Bronze Age lithic artifact is thus the obsidian flake, the majority of which show no evidence of use at all (*ca.* 89.0%; Table 7). Chert, in the form of fine pressure blades, percussion blades, and flakes, was used in greater quantities in each successive settlement. Retouched tools of any kind made from these materials were always produced in small quantities (with a maximum representation of 22.1% in Lerna V; Table 11). The most numerous tools (Fig. 18) were pieces with simple retouched edges, sickle elements, and pièces esquillées (Table 13). Only the sickle elements show any important variations through time. The characteristic EH II sickle elements were made on denticulated pressure blades of obsidian and chert, both imported materials at the site. The EH III and MH sickle elements were principally made on flakes, and to a lesser extent blades, and were often truncated or backed or both in addition to being denticulated. Chert flakes, probably of local manufacture, provided the principal supports for sickle elements by the MH period. Pièces esquillées were most common in EH III. Notched pieces seem to be characteristic of EH II, while small end scrapers belong to EH III and MH. Projectile points also show some changes, with tanged points becoming rarer in later levels, while the concave-based type increases in frequency and is most common in the Middle Helladic period.

Variation over the period of time represented here in typology, technology, and raw materials is limited and subject to varying interpretations. It is possible, however, to posit some differences between the periods, which may be attributed to cultural change.

The cultural changes may be stated in the form of preliminary hypotheses which should be tested through further excavation and analysis of Bronze Age lithic industries. The use of "imported" chert pressure blades in Lerna III and an indigenous industry, specializing in the production of obsidian pressure blades, together indicate the activities of craft specialization and trade. The standardization of the lithics and the unused nature of many of the obsidian blades suggest craft specialization and the possible export of blades to other sites. This hypothesis is reinforced by the finding of "imported" chert blades which came to Lerna in exchange for the obsidian, or more likely, a range of other goods. We do not know the source of the chert blades, but in view of evidence of Aegean trade in, among other things, pottery, marble, emery, bronze, and precious metals at this same time, the source may have been quite distant.[31] Such activities are consistent with our view of the other materials from

[31] For trade in the Early Helladic period see C. Renfrew, *The Emergence of Civilisation: The Cyclades and the Aegean in the Third Millennium B.C.*, London 1972, pp. 440–455; other evidence of craft specialization and its economic setting is discussed in C. Runnels, "Trade and the Demand for Millstones in Southern Greece in the Neolithic and the Early Bronze Age," in *Production and Prehistoric Exchange: The Aegean and Eastern Mediterranean*, B. Knapp and T. Stech, edd., Los Angeles 1985, pp. 30–43.

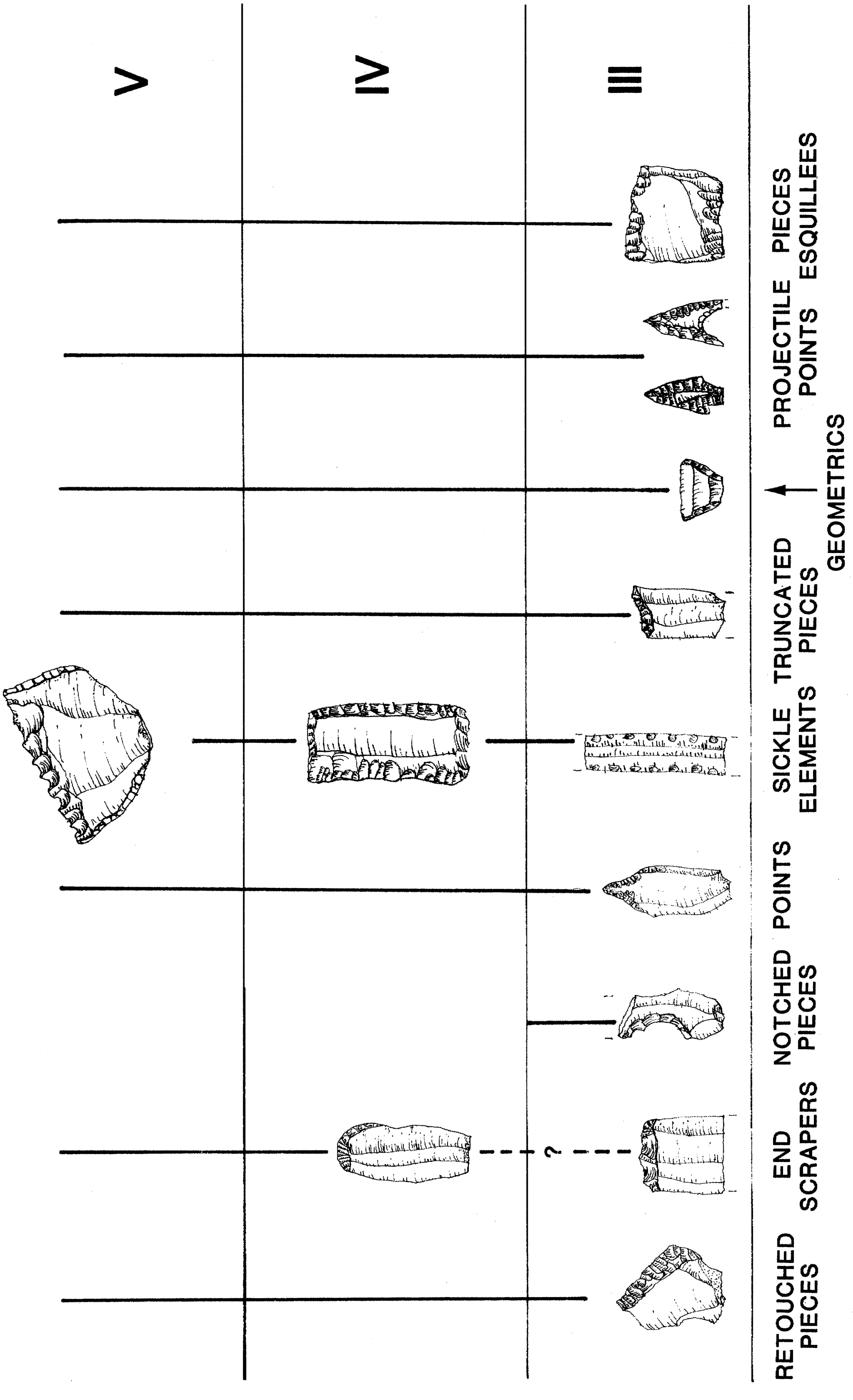

FIG. 18. Distribution of tool types

this settlement. For instance, the evidence of control and storage of goods offered by the monumental House of the Tiles with its many burned sealings points to a controlled, or at least centralized, economy.

The evidence from Lerna IV and V suggests a different economic context for the production and use of the lithics. The differences in the lithic industries between Lerna III and IV (Fig. 18) are not perhaps as profound as those detected in the architecture and other artifacts. The similarity in the technology of blade production and in tool types in all three settlements is too great to result from the mixing only of artifacts between the levels, and thus we may postulate a more or less continuous Bronze Age tradition of lithic technology at Lerna. Yet the over-all character of the industry in the later settlements (Lerna IV and V) is different. The high percentages of utilized pieces, tools, and worked pieces such as the pièces esquillées resemble less craft specialization than the domestic tool kit of a farming village. The decline in the use of "imported" chert may be the result of a loss of access to the material or from a decreased demand for the blades. It is of course likely that some of the obsidian may have been traded locally, and the tools could have been used in some craft production (e.g. basketry). Only a detailed microscopic use-wear study might resolve this question. The Lerna V industry strengthens the impression already gained from Lerna IV, for it, too, is dominated by pièces esquillées, sickle elements, and concave-based arrowheads, mostly on chert flakes.

In sum, the succession of industries at Bronze Age Lerna reveals a pattern with aspects of both continuity and change. To the well-known changes that accompany the destruction by fire of Lerna III at the end of EH II can now be added the apparent changes in the flaked-stone industry. Gone after the end of Lerna III is the predominance of fine, pressure-struck blades of imported obsidian and chert, perhaps manufactured by craft specialists. These types are replaced in the next settlements by tools and utilized flakes which came to be made more frequently from local chert. The presence of obsidian pressure blades and many of the same simple tool types shows clearly that the same basic flintknapping techniques were used throughout all three settlements. Future research will be profitably directed to the testing of two hypotheses to account for these facts. Flintknapping may have been an art practised by only a few skilled craftsmen throughout the time under consideration. Such skills may have been passed on to the newcomers, if such they were, who destroyed the EH II sites of the Argolid.[32] Perhaps the skills were transmitted by the survivors of the catastrophe in the person of craftsmen with skills useful to the new inhabitants. As an alternative, one may imagine that flintknapping techniques were widely known in the Aegean world of the Early Bronze Age and that the Lerna IV newcomers simply had their own stock of skills or craftsmen. At present we do not know to what degree the Early Bronze Age flaked-stone industries are derived from earlier, Neolithic, traditions, nor do we know how widespread the Lerna Bronze Age tradition may be in the Aegean. Although any conjecture based on our present state of knowledge must be tentative, I prefer the hypothesis that the industries of Lerna III, IV, and V represent only facies of a Bronze Age Aegean

[32] See Caskey 1960 (footnote 1 above) and J. Rutter, *Ceramic Change in the Aegean Early Bronze Age* (*Occasional Paper* 5, Institute of Archaeology, University of California), Los Angeles 1979, pp. 13–16 for a discussion of the destruction of EH II sites in the Argolid and the evidence for newcomers, some with affinities to Central and Northern Greece, the Cyclades, and as far afield as Western Anatolia, and for cultural survivals.

tradition. Thus I assume that the evidence of continuity of technique at Lerna results from the sharing of techniques among craftsmen of whatever ethnic or cultural background. I am inclined also to explain the differences between the Lerna III and the Lerna IV–V industries primarily by changes in economic activity, rather than by stylistic or technological changes. Elsewhere I have drawn attention to the problem of the survival of lithics in eras when metal tools were common.[33] It was concluded that stone tools will only be replaced by metal counterparts when the latter become sufficiently cheap to be economical. Until then stone tools will be desirable substitutes. The restricted use of stone-tool types and the preponderance of the plain chert and obsidian blades in Lerna III could reflect nothing more than that there were copper or bronze tools available to the inhabitants. Perhaps the shift in Lerna IV and V to the use of more local chert and plain obsidian flakes, as well as the overall increase in the number of stone tools, could result from nothing more than a decline in the availability of metal for everyday tools.

It is not possible to examine these hypotheses in the light of the evidence from Lerna alone, however tempting further speculation may be. The suggestions made above are intended only to serve as indicators of the possible knowledge to be gained from the detailed analyses of Bronze Age lithic collections. The goal of this paper will be achieved if interest is stimulated in recovering and analyzing lithics from sites of all periods in Greece.

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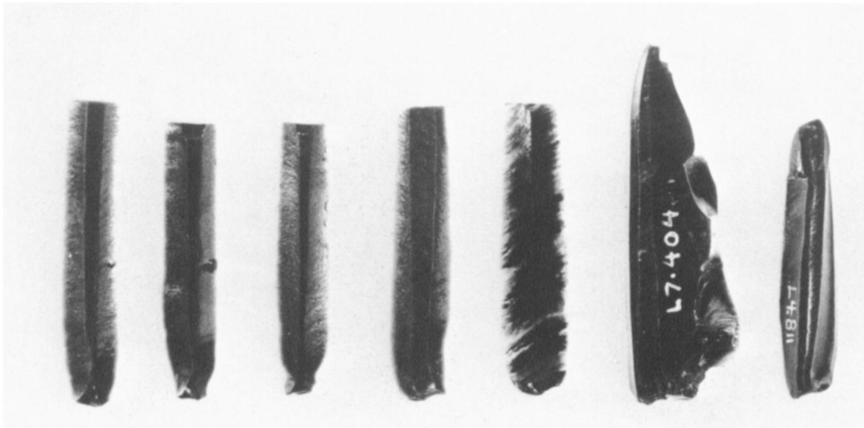
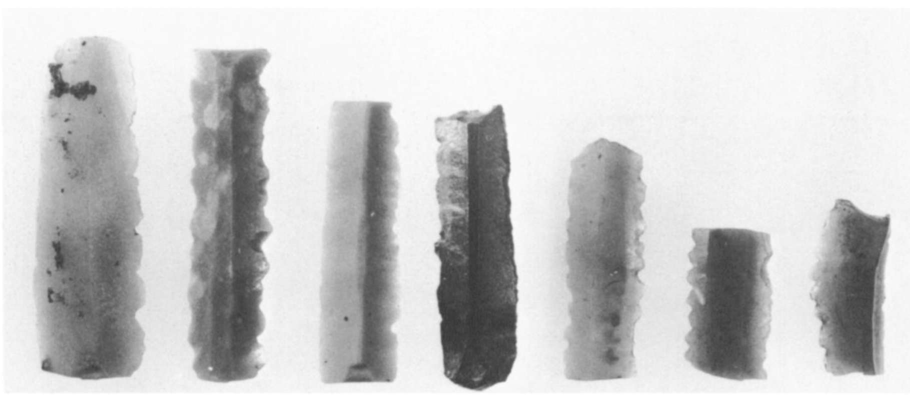
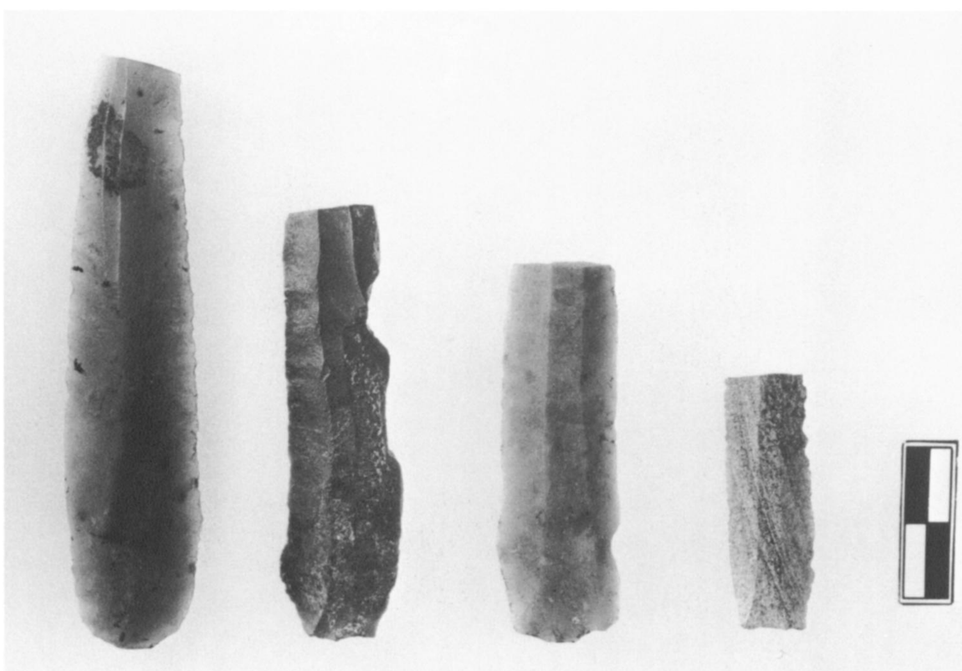
[33] Runnels, *op. cit.* (footnote 9 above).



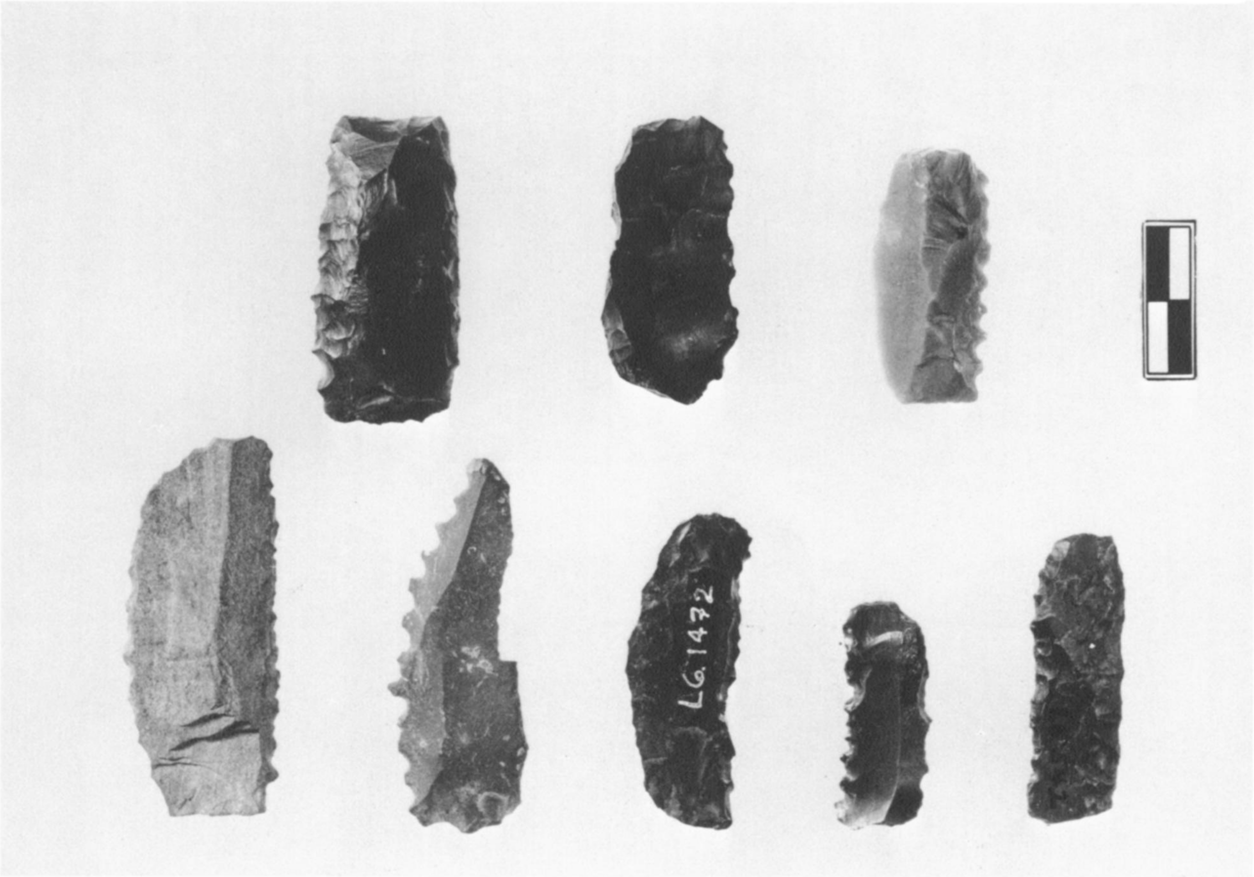
a. Lerna IV obsidian blades: L5.706, L4.723, L5.615, L5.627, L5.634, L7.404, L4.811. Scale 1:1



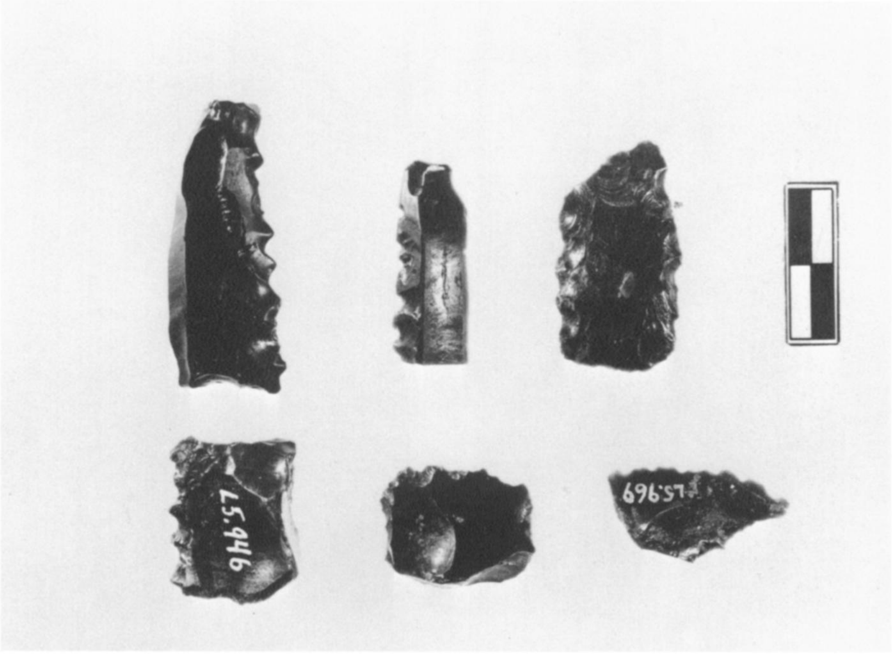
b. Lerna IV chert sickle elements: L4.700, L5.630, L5.532, L5.478, L5.694, L6.1325, L6.1475. Scale 1:1



c. Lerna IV chert sickle elements: L4.532, L5.470, L7.212, L5.503

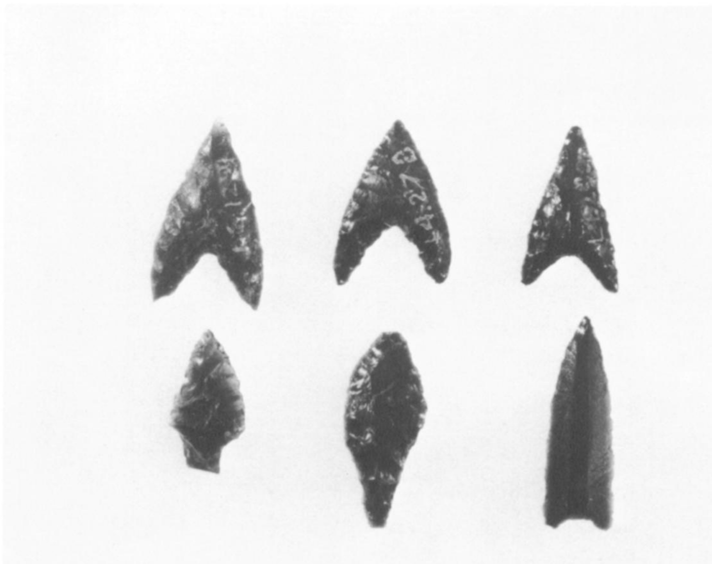


a. Lerna IV chert sickle elements: (above) L4.686, L5.642, L5.498; (below) L7.209, L5.619, L6.1472, L3.266, L5.542



b. Lerna IV obsidian sickle elements: (above) L5.525, L5.597, L7.539; (below) L5.946, L3.346, L5.969

a. Lerna IV chert tools: (above) L4.331, L5.516, L4.251, L6.1568; (below) L7.495, L6.1636, L6.1638



b. Lerna IV obsidian projectile points: (above) L6.1291, L4.278, L4.290; (below) L6.1622, L6.1323, L4.690. Scale 1:1