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THE INTERPRETATION OF MIDDLE PALEOLITHIC SCRAPER REDUCTION PATTERNS

by

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INTRODUCTION

Bordes' typology of Lower and Middle Paleolithic stone tools, which is widely used in Europe and the Near East, recognizes sixty-three discrete types exclusive of bifaces (BORDES, 1961). Of these, more than one-third are various types of scrapers. Among the scrapers, four major classes can be discerned: 1) simple laterally-retouched single-edged side scapers (types 9-11); 2) double scrapers with two non-joining retouched edges (types 12-17); 3) convergent scrapers, which have two adjacent retouched edges that usually form a point on the distal end (types 8 and 18-21); and 4) transverse scrapers with retouch on the edge opposite the striking platform (types 22-24). These classes represent the most common types of scrapers in all Lower and Middle Paleolithic assemblages while scrapers in general represent, along with bifaces, denticulates and notches, one of the primary diagnostic features of those periods (BORDES, 1953; ROLLAND, 1977, 1981; JELINEK, 1984; GENESTE, 1985). Thus, variability among scrapers represents a significant portion of Paleolithic assemblage variability, the interpretation of which is a major question for Old World prehistorians (BINFORD, 1973; BINFORD and BINFORD, 1966; BORDES, 1961b; BORDES and de SONNEVILLE-BORDES, 1972; MELLARS, 1965, 1969).

This paper presents data from both France and the Near East that suggest that variability among scrapers is a function of reduction of the tool through continuous resharpening and remodification of the edges. Two distinct reduction sequences are suggested on the basis of replicative experiments. The first, illustrated in Figure 1, involves a sequence from single-edged side scrapers through double-edged side scrapers to convergent scrapers. The second sequence, illustrated in Figure 2, involves the continuing reduction of a single edge. Typologically, this sequence is represented first by the single-edged types which, as the reduction continues, can be transformed into transverse scrapers. Why one sequence or another is followed probably depends on the initial shape of the flake blank. But in either case, single-edged scrapers would represent the least reduced pieces while convergent and transverse scrapers represent those most reduced.

In order to investigate this proposed sequence, data were collected by the author from two sites with asemblages rich in scrapers of all types. The first of these is La Quina

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(Charente), represented by the collection housed at the Musée de l'Homme that was excavated by MARTIN (1923). The industry is Quina Mousterian. The second site is Tabun, located on the western edge of Mount Carmel in Israel. The collection analyzed for this study was derived from Beds 82B, 82BS and 82BI recognized during the recent excavation of that site by JELINEK (1981, 1982; JELINEK *et al.*, 1973). The industry represented in these contiguous beds is the Yabrudian, part of the Mugharan Tradition of the early Upper Pleistocene known from several localities in that area. All of the complete specimens available for study were included in the analysis.

ANALYSIS OF LA QUINA AND TABUN MATERIAL

Reference to Figure 1 suggests several morphological relationships which would be expected to occur in these scraper assemblages if reduction were operating.The first of these relationships to be examined involve the dimensions of length, width and thickness. For this study, length has been measured from the point of percussion to the most distal end of the tool. Width is taken perpendicular to length, and thickness at the point of intersection of length and width. All measurements were taken in millimeters. In terms of their length (see Table 1), the tools from both La Quina and Tabun are consistent with a reduction model. Thus, simple single-edged scrapers and double scrapers, types that would not be expected to loose length during reduction, have virtually the same mean length (La Quina: $\underline{t} = .1871$, $\underline{df} = 153$, $\underline{p} = .8519$; Tabun: $\underline{t} = .0708$, $\underline{df} = 166$, $P > .9$). Convergent forms are somewhat shorter, and transverse forms, as would be expected, are the shortest of all (La Quina: $\underline{F}$ 29.92, $\underline{df} = 3/365$, $\underline{p} < .001$; Tabun: $F = 7.69$, $\underline{df} = 3, 266$, $\underline{p} < .0001$). This reduction in length is paralleled by a reduction in average surface area (the product of length and width) of the tools (La Quina: $\underline{F} = 6.05$, $\underline{df} = 3/364$, $\underline{p} < .001$; Tabun: $\underline{F} = 5.39$, $\underline{df} = 3, 266$, $\underline{p} < .002$). However, no significnt differences are found among the scraper classes in terms of width (La Quina: $\underline{F} = 1.67$, $\underline{df} = 3/364$, $\underline{p} = .1711$; Tabun: $\underline{F} = 2.26$, $\underline{df} = 3, 267$, $P > .08$). The lack of difference in width among the different types suggests that, for both industries, the attainment of a particular width determines the stage in the reduction sequence at which a tool is discarded.

While absolute dimensions are consistent with the reduction process, they do not directly test whether the transverse and convergent scrapers are the result of more retouching, or alternatively, that these types were originally made on smaller or differently shaped blanks. To judge how much *reduction* has taken place it would be more satisfactory to consider the final size of the artifacts *relative* to the original size of the blanks.

It has been shown on the basis of controlled experiments (DIBBLE and WHITAKER, 1981; DIBBLE, 1981; SPETH, 1972, 1974, 1975, 1981), that original flake size is, to a large extent, a function of certain characteristics of the stiking platform, including platform width and thickness. As Figure 2 illustrates, the reduction of a tool affects the flake surface area to a much greater extent than it does platform area. Therefore, the most appropriate statistic to investigate reduction of the tool from its original blank size is the ratio of remaining surface area to platform area. On the average, blanks that are more reduced will have smaller ratios of flake area to platform area than will blanks that are less reduced from their original size.

Table 1 presents the mean ratios of flake surface area to platform surface area for each of the four major scraper classes. These ratios show a gradation in amount of size reduction from simple side scrapers which are reduced the least (i.e. their ratio of flake area to platform area is the highest) through double scrapers to convergent and transverse forms. Over the four scraper classes these differences are significant (La Quina: $\underline{F} = 14.46$, $\underline{df} = 3/356$, $\underline{p} < .001$; Tabun: $\underline{F} = 6.15$, $\underline{df} = 3, 266$, $\underline{p} < .001$). At La Quina, the convergent and transverse forms were also found on thicker flakes $\underline{F} = 12.71$, $\underline{df} = 3/365$, $\underline{p} < .0001$), though a similar differentiation was not found at Tabun ($\underline{F} = .93$, $\underline{df} = 3, 267$, $\underline{p} > .4$).

For the Tabun material, data were also obtained for unretouched flakes which compliment the tool data. It is apparent that flakes not chosen for retouching are those that were already too small in terms of average width, length or surface area to allow for any reduction. Other indications that the originally larger flakes were selected for retouching are that the retouched flakes are thicker (F = 12.29, df = 4, 429, $p < .0001$) and that they have larger platform areas (F = 14.15, df = 4, 428, $p < .0001$) than the unretouched flakes.

Another observation of the scrapers that may reflect reduction is the intensity of the retouch. For purposes of this study, retouch intensity is judged according to four ordered categories: (1) light and/or discontinuous retouch which exhibits no more than one row of retouch and where the retouch scars extend no more than 2-3 mm. from the edge; (2) medium or "normal" retouch, either parallel or subparallel, with moderately invasive retouch scars; (3) heavy retouch, which is very steep and/or invasive); (4) stepped retouch, which is heavy retouch with the presence of stepped fractures, similar to Quina retouch. Assuming that intensity of retouch reflects the amount of material removed through repeated retouching, either in the course of one knapping episode or over a series of cycles of use and resharpening, then this scale provides some indication of the degree to which reduction has taken place.

Table 1 presents the median values of retouch intensity for the scrapers from La Quina and Tabun. At both sites, simple single-edged scrapers exhibit the highest frequency of light retouch, double scrapers have more heavily retouched pieces, and convergent and transverse scrapers have the highest proportion of heavy and stepped retouch. Using Kruskal-Wallis tests, these relationships are found to be significant at each site (La Quina: X^2 = 37.30, df = 3, p = .0001; Tabun: X^2 = 36.59, df = 3, $p < .0001$). This result, along with the measure of reduction based on the ratio of surface area to platform area, suggests that the final shape of the tools was obtained by the removal of significant amounts of material and therefore does not <u>solely</u> reflect the original shapes of the blanks.

The results show that the morphology of scrapers from both La Quina and Tabun are very consistent with the reduction sequence proposed here. This interpretation is also supported by the microwear work of BEYRIES (1984) who found little use variation among various types of scrapers from six sites in France. In the reduction sequence outlined above there would also be little reason to have the function change as reduction continued.

There is also a high degree of agreement between La Quina and Tabun in terms of the absolute dimensions of the pieces at each stage of the reduction process. The fact that there is such a close correspondence between the French and Israeli material in itself suggests that the tool morphology is primarily affected by very basic technological considerations. These two scraper assemblages are quite distinct from each other in terms of space and, probably, time. It would be unlikely, therefore, that they were made by culturally-related people. Yet in terms of the process of tool reduction and the absolute forms of the discarded pieces, they are virtually identical.

REDUCTION SEQUENCE OF ZAGROS MOUSTERIAN INDUSTRIES

Recent analysis of Middle Paleolithic material from two sites in the Zagros region of Iran (DIBBLE, 1984a, b; 1986) has shown that the reduction sequence followed in this area is different from that seen at the previous sites. The two sites are Bisitun, excavated by Coon in 1949 (COON, 1951; DIBBLE, 1984a) and Warwasi, excavated in 1960-61 by Howe (BRAIDWOOD, HOWE and REED, 1961). Both yielded Mousterian industries rich in scrapers of all sorts with the exception of transverse forms, which are fairly rare. Thus, on typological grounds it is clear that both of the reduction sequences described above are not being followed at these sites.

However, that the first of the reduction sequences – from single to double to convergent scraper types – is being followed is clear upon examination of retouch intensity. From Table 2 it is possible to see that retouch intensity does increase across these three scraper classes. Data on tool dimensions from Bisitun (not yet available for Warwasi) are also consistent with the reduction sequence. As was the case with the scrapers from La Quina and Tabun, scraper width is the same across all categories, again suggesting that reduction continued until a minimum width was attained (Table 3).

DISCUSSION

Based on observable morphology of scrapers from four different sites, it appears that a sequence of reduction through resharpening can account for the presence of the different type classes. Two sequences are noted. The first, which is present at all four sites, reflects the use, remodification and reduction of two lateral edges, resulting in a continuum from single to double to convergent scrapers. The second, present at La Quina and Tabun, reflects the use and reduction of a single edge, resulting in the production of transverse scrapers from what were originally laterally retouched side scrapers.

The results presented above suggest that many aspects of scraper morphology reflect a continuum of reduction of one or more edges of flake blanks. According to this view, typological variability within the scrapers is a measure of intensity of reduction. Thus, industries that yield mostly simple side scrapers could be interpreted as reflecting less intense reduction, and therefore less intense utilization of the scrapers. Industries with large numbers of either convergent or transverse forms would therefore reflect more intense reduction and utilization of scrapers. It will be important to determine in the future whether these patterns of reduction continue to be evident at other sites and, if so, to relate differences in reduction to other behavior/cultural parameters, such as climate, raw material availability and subsistence or other activities.

If correct, the reduction model presented here would help to clarify the meaning of Bordes' scraper types in terms of specific aspects of prehistoric behavior. This model does not weaken the typology. In fact, the accord between the reduction model and his typology only serves to strengthen the use of the latter as an analytical tool in interpreting Paleolithic assemblages as they relate to intensity of utilization. It is clear, then, that while we are still far from a comprehensive explanation of Mousterian variability, the descriptive foundation laid by Bordes will continue to provide the basis for our understanding of these industries for many years to come.

The implications of these results for the interpretation of the Mousterian of France should be clear. It is becoming increasingly apparent that many factors are responsible for the kinds of variability seen among Mousterian assemblages and therefore it is not simply a question of style *versus* function. In fact, it remains to be shown that these latter two factors are even primary considerations once the effects of other parameters are taken into account. Also, the assumption that these and many other lithic types reflect any kind of mental templates can be seriously called into question. In turn, this raises doubts as to the reconstruction of mental abilities involved in the manufacture of these pieces (see, for example, ATRAN, 1982; GOWLETT, 1984; WYNN, 1979, 1981). Given this, it would not be surprising to see a major theoretical shift in Old World Middle Paleolithic studies over the next few years that reflects new interpretations of lithic variability and recognizes the simple nature of this technology. There may also be some important implications of these kinds of studies for the interpretation of lithic assemblages from other parts of the world and from different periods of time.

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TABLE 1

Summary statistics for dimensions, dimension ratios and retouch intensity for complete scrapers by scraper class. Data for La Quina material taken from DIBBLE (1986a)
(Differences between Tabun and La Quina: * = p < .05, ** = p < .01)

		LENGTH		WIDTH		THICKNESS		SURFACE AREA		PLATFORM AREA		RATIO OF SURFACE/ PLATFORM AREA		MEDIAN RETOUCH INTENSITY	
		Tabun	La Quina	Tabun	La Quina	Tabun	La Quina	Tabun	La Quina	Tabun	La Quina	Tabun	La Quina	Tabun	La Quina
SINGLE	mean	59.37	60.86	36.46	35.85	12.63	10.17**	2213	2229	281.19	246.41	14.26	19.48	2.50	2.59
	std	12.00	13.48	9.38	8.75	4.35	4.28	922	925	211.69	200.41	18.99	24.35		
	N	152	117	153	117	156	117	152	117	156	117	152	117	153	120
DOUBLE	mean	59.53	61.51	38.71	34.99	13.31	9.88*	2358	2228	319.60	173.49*	11.48	19.73	3.37	2.71*
	std	7.96	13.58	12.94	9.62	4.00	4.69	1067	1181	218.44	152.15	8.01	9.74		
	N	16	35	16	35	16	35	16	35	16	35	16	35	10	35
CONV.	mean	54.43	52.81	34.04	35.99	13.73	13.07	1893	1923	368.03	328.89	7.87	9.69	3.60	3.22
	std	13.15	10.93	8.24	8.59	4.04	4.38	823	724	208.61	276.44	7.09	8.73		
	N	33	71	33	71	33	71	33	71	33	71	33	71	33	74
TRANS.	mean	51.55	47.31*	33.71	38.08**	13.43	13.27	1759	1816	506.17	570.80	5.38	7.30	3.11	3.31
	std	11.36	12.58	8.84	11.28	5.16	13.27	690	780	329.04	380.29	4.89	13.28		
	N	69	137	69	137	69	137	69	137	68	137	68	137	69	140
FLAKES	mean	51.25		33.93		10.03		1835	N/A	251.45	N/A	15.44	N/A	N/A	N/A
	std	14.76		11.35		4.15		1190		243.26		22.46			
	N	160		160		160		160		160		160			

TABLE 2

Median Retouch intensity for scrapers from Bisitun and Warwasi by scraper class.
Low values indicate lightest retouch, high values indicate more heavy and stepped retouch.

		BISITUN	WARWASI
SINGLE	median	**1.96**	**1.82**
	N	295	178
DOUBLE	median	**2.35**	**2.32**
	N	242	96
CONVERGENT	median	**2.78**	**2.54**
	N	173	63

TABLE 3

Summary statistics for dimensions of complete scrapers from Bisitun
by scraper class. Data taken from DIBBLE (1984)

		LENGTH	WIDTH	THICKNESS
SINGLE	mean	**52.68**	**24.44**	**5.58**
	std	12.93	6.45	3.75
	N	116	116	116
DOUBLE	mean	**55.56**	**24.84**	**5.54**
	std	12.07	6.77	1.82
	N	68	68	68
CONVERGENT	mean	**48.86**	**22.68**	**5.48**
	std	12.86	5.82	2.74
	N	66	66	66

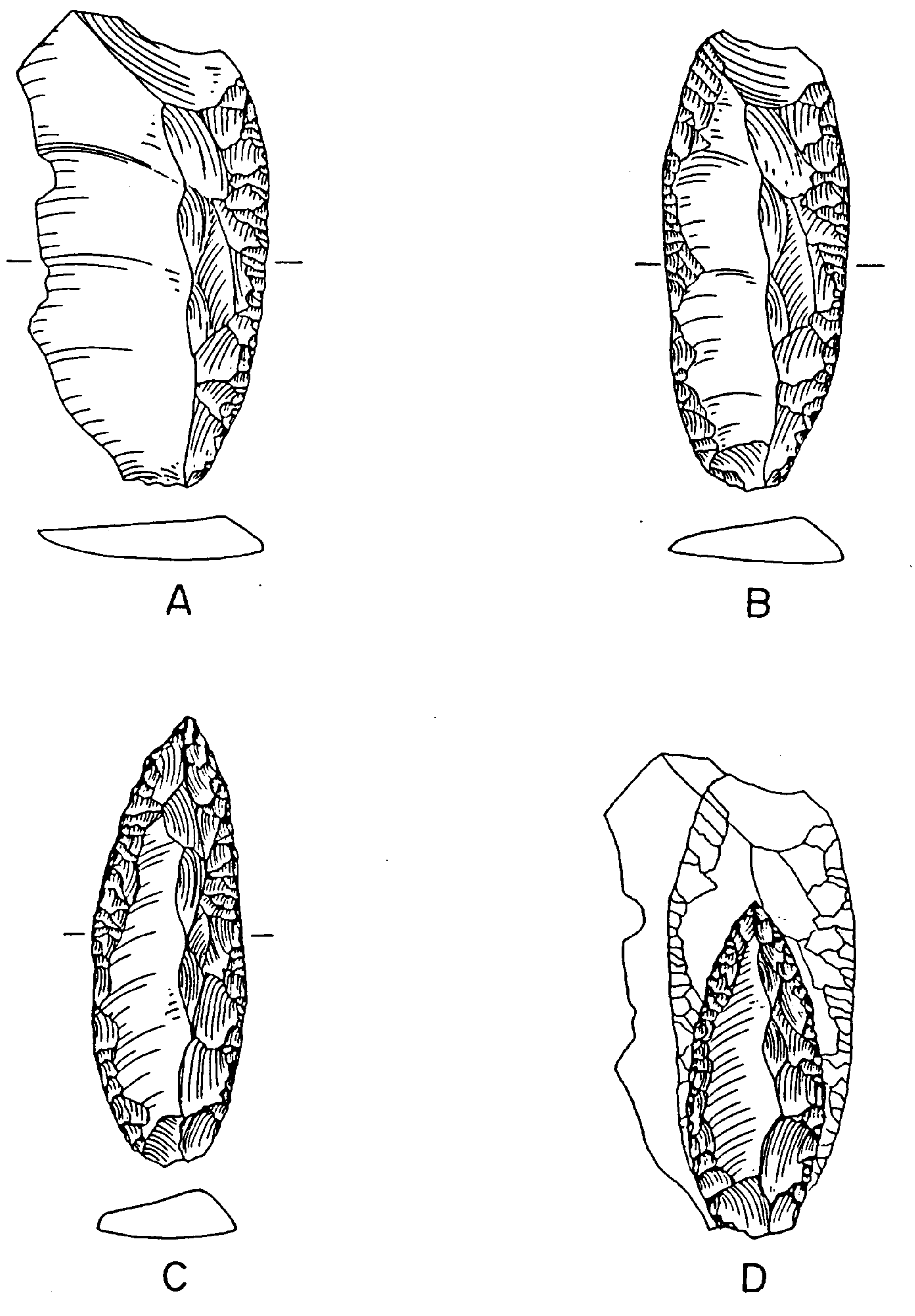

FIGURE 1

Reduction of a single blank through repeated retouching of two lateral edges. The same blank may pass through three distinct typological classes, including single scraper (a), double scraper (b), and convergent scraper (c).

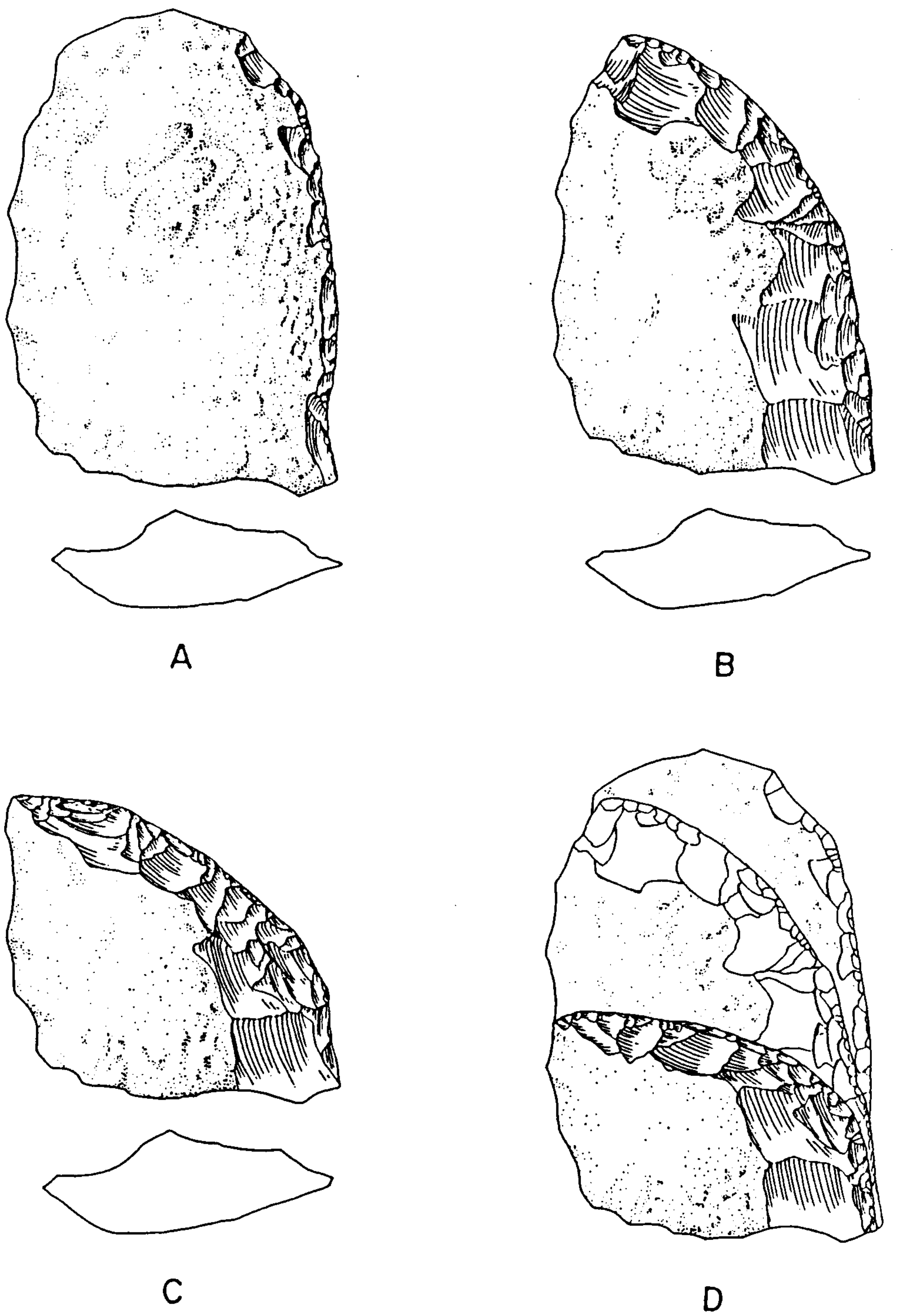

FIGURE 2

Reduction of a single blank through repeated retouching of a single edge. Two typological classes are represented including single scraper (a, b) and, eventually, transverse scraper (c).