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8

Solutrean Laurel Leaf Point Production and Raw Material Procurement During the Last Glacial Maximum in Southern Europe: Two Examples from Central France and Portugal

Thierry Aubry, Miguel Almeida, Maria João Neves, and Bertrand Walter

The variability in laurel leaf point morphology and the shaping and sharpening techniques utilized on them are examined. Both intra- and inter-regional Solutrean group differences are studied, using data obtained from recent excavation projects in Central France and Portugal. Models are proposed to explain similarities and disparities in the production, function, and discard of laurel leaf points at a regional level in the two study areas.

Lithic industries from southeastern Europe, which contain foliated points and which have been associated by radiometric dates to the Last Glacial Maximum, are examined. Archaeological research on the Solutrean techno-complex has been privileging caves and shelters in sedimentary regions where settlements are easier to detect for a long time. It is only in the past decade that this bias has been overcome and more systematic survey and excavation projects undertaken, which have looked for open air Solutrean settlements (Vialou and Vilhena-Vialou 1990; Rasilla Vives 1994; Aubry 1998).

The archaeological sample studied in this chapter consists of lithic assemblages recovered from the Solutrean levels of sites located on the extremities of the Solutrean techno-complex site distribution area in southwest Europe and which appear to belong to two different regional groups. Although the quality and quantity of chronological information available for these two groups is uneven, all the radiometric dates fall within the Last Glacial Maximum (Zilhão 1997; Rasilla Vives and Rodríguez 1994; Strauss 1983; Duarte et al. 1999).

The northern group, located on the southern margin of the Paris sedimentary basin at the border of the Massif Central, consists of five archaeological sites—Monthaud, excavated at the beginning of the century; Les Roches d'Abilly, excavated during the 1950's, the Fritsch shelter, excavated during the 1980's; and two ongoing excavations, Fressignes and Les Maitreaux—plus three isolated superficial finds (Figure 8.1). The only available radiometric date for Abri Fritsch, from level 8d at 19,180 B.P. (Gron - 5499), places it during the late Solutrean (Allain 1976). Similarities to lithic assemblages from sites on the southwest border of the Massif Central in Aquitaine, which have been radiocarbon dated,

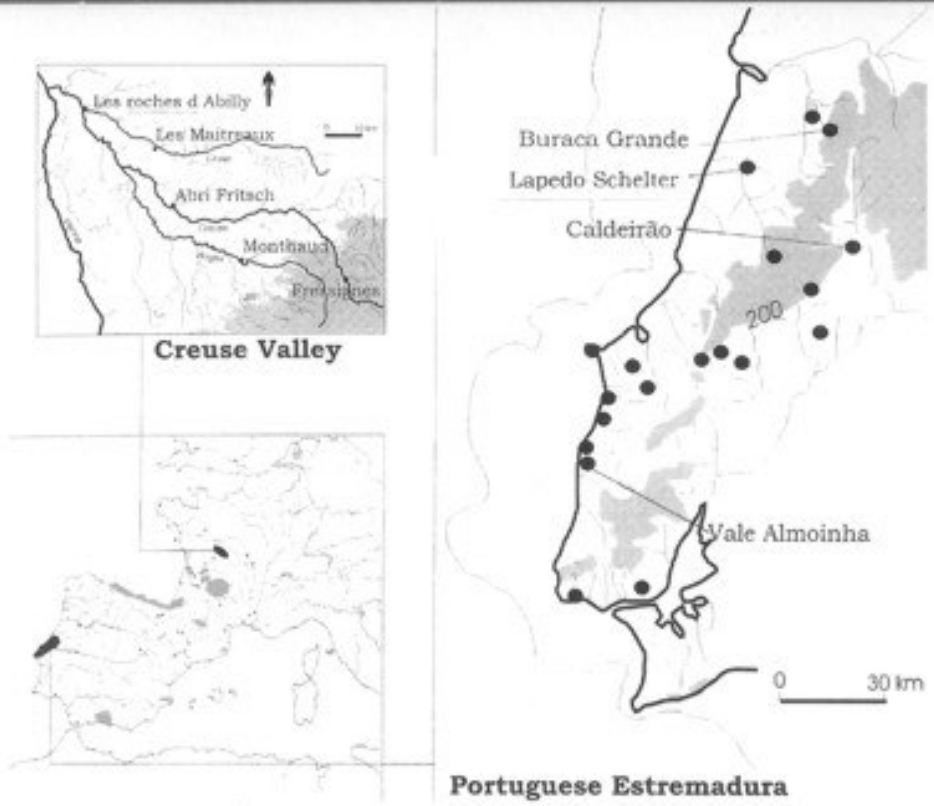

Figure 8.1 Distribution map of Solutrean sites in southern Europe and location of the two regional groups studied.

indicate that this site was occupied between 20,000 and 19,000 B.P.(Geneste and Plisson 1986).

The second group consists of sites in the Portuguese Estremadura (Figure 8.1) located in the drainage basins of the Tagus and Mondego rivers and theirs tributaries (Zilhão 1997).These sites are situated on Mesozoic and Cenozoic sedimentary rocks. The radiocarbon dates available (Zilhão 1997; Duarte et al. 1999) indicate they were occupied between 20,500 and 18,000 B.P., which is congruent with dates available for the rest of Iberia (Strauss 1983; Rasilla Vives 1994). It should be noted that the Solutrean lithic assemblages that do not contain shouldered points all seem to be older than 20,000 B.P.

Various paleoclimatic models (Climap 1976; Zilhão 1997; Ellwood et al. 1998) have shown differences in climatic parameters that would have influenced the faunal resources available in the two regions during the Lower Glacial Maximum (Cardoso 1992; Bayle 2000). This may be contrasted with the high degree of similarity apparent in the lithic assemblages of the two regions, including the morphology of lithic foliate points and the specificity and complexity of technical procedures for their manufacture. Coupled with the climatic and faunal differences, these similarities have been used to argue in favor of the cultural unity of the regions and against the possibility of technological convergence having occurred as the result of environmental constraints (Smith 1966; Bordes 1969; Tiffagom 1998).

The similarities and differences that have been observed in the movement patterns of the raw materials used to manufacture laurel leaves in the two regions are discussed. The production processes for these tool types and their discard contexts will also be examined. Functional analyses of laurel leaf points, such as the experimental protocol developed to study microscopic use wear traces on the Solutrean shouldered points from Combe-Saunière cave, will not be discussed (Geneste and Plisson 1993; Chadelle et al. 1991).

The French group from the Creuse Valley contains 128 tools that fit the definition of laurel leaves. The Portuguese tools consist of 131 preforms—entire pieces or pieces fractured during manufacturing or use. We can divide these groupings into two subdivisions.The first, which was called group J by Smith (1996), consists of tools with lengths exceeding 25 cm, whereas the second subgroup consists of pieces whose reconstituted length is less than 15 cm.

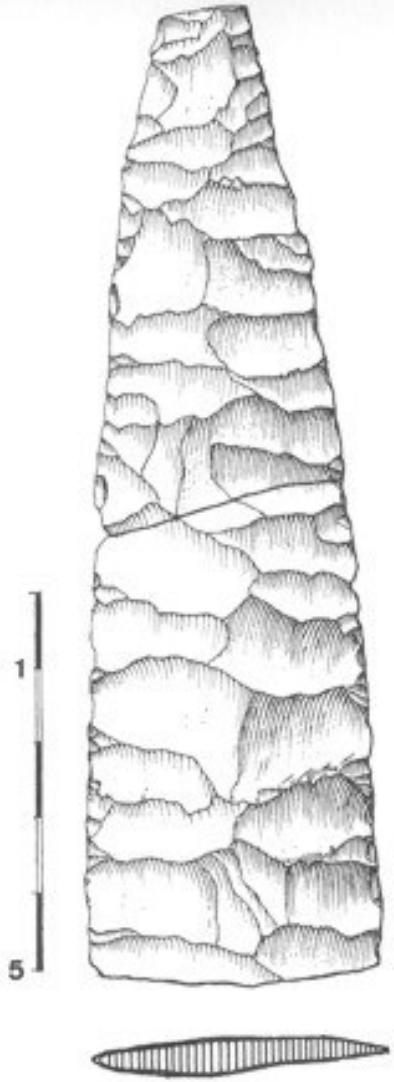

Figure 8.2

Large-sized Laurel Leaf Points

The larger tool subgroup shares similarities with laurel leaves found at Volgu (Smith 1966), which when complete range between 25 and 40 cm., characteristic of regional groups in the drainage basins of rivers arising in the French Massif Central. All the known pieces in this subgroup from the Creuse drainage basin are fragmented. It can be further broken down into two categories based on morphology and the type of retouch utilized for the final thinning of the pieces. The first category consists of narrow (4- to 5-cm wide) points less than 5-mm thick, with straight edges and parallel narrow serial flake removals (Figure 8.2).

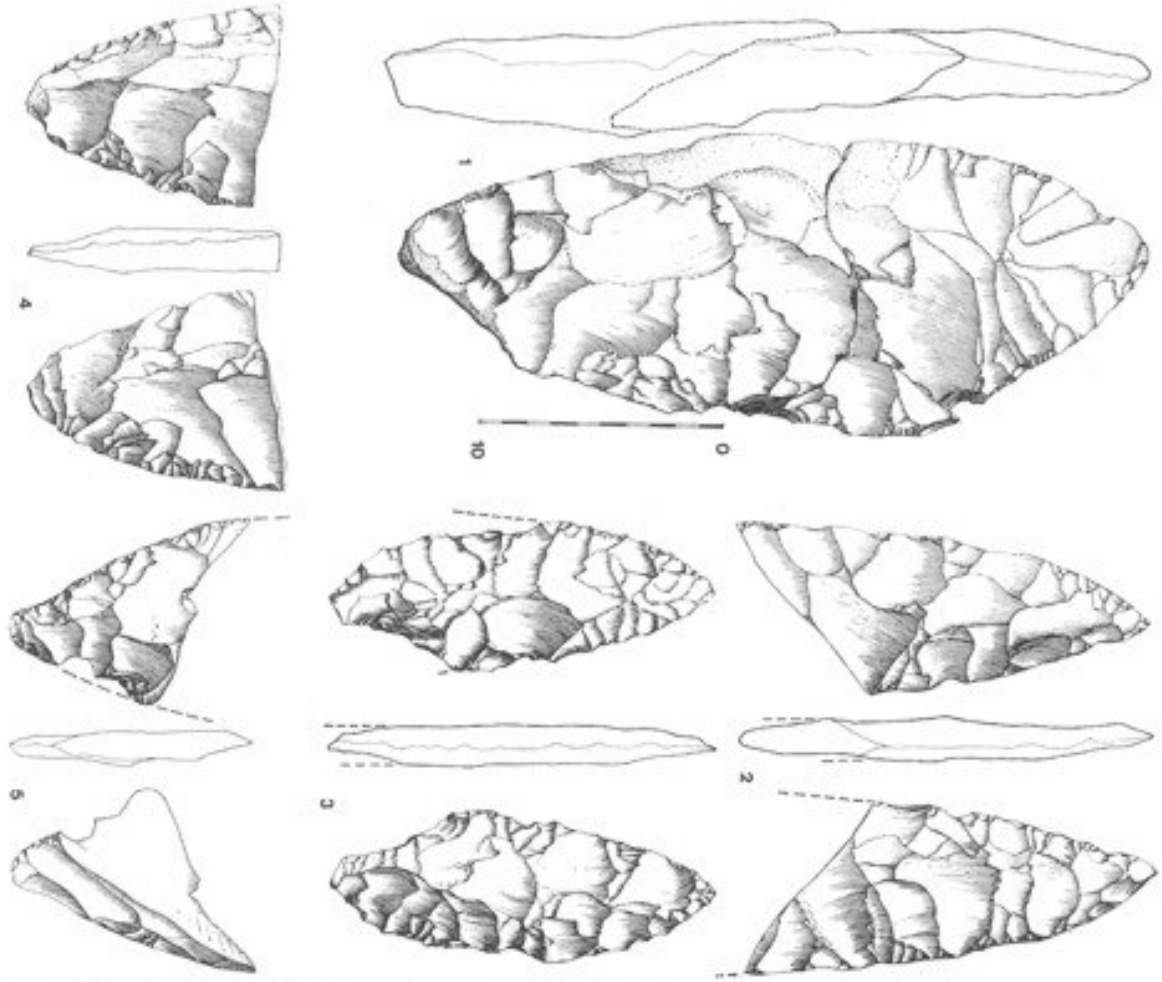

Figure 8.3 Preform and fragments obtained during the shaping of the second group of large laurel leaf points at Les Maitreaux (Indre-et-Loire).

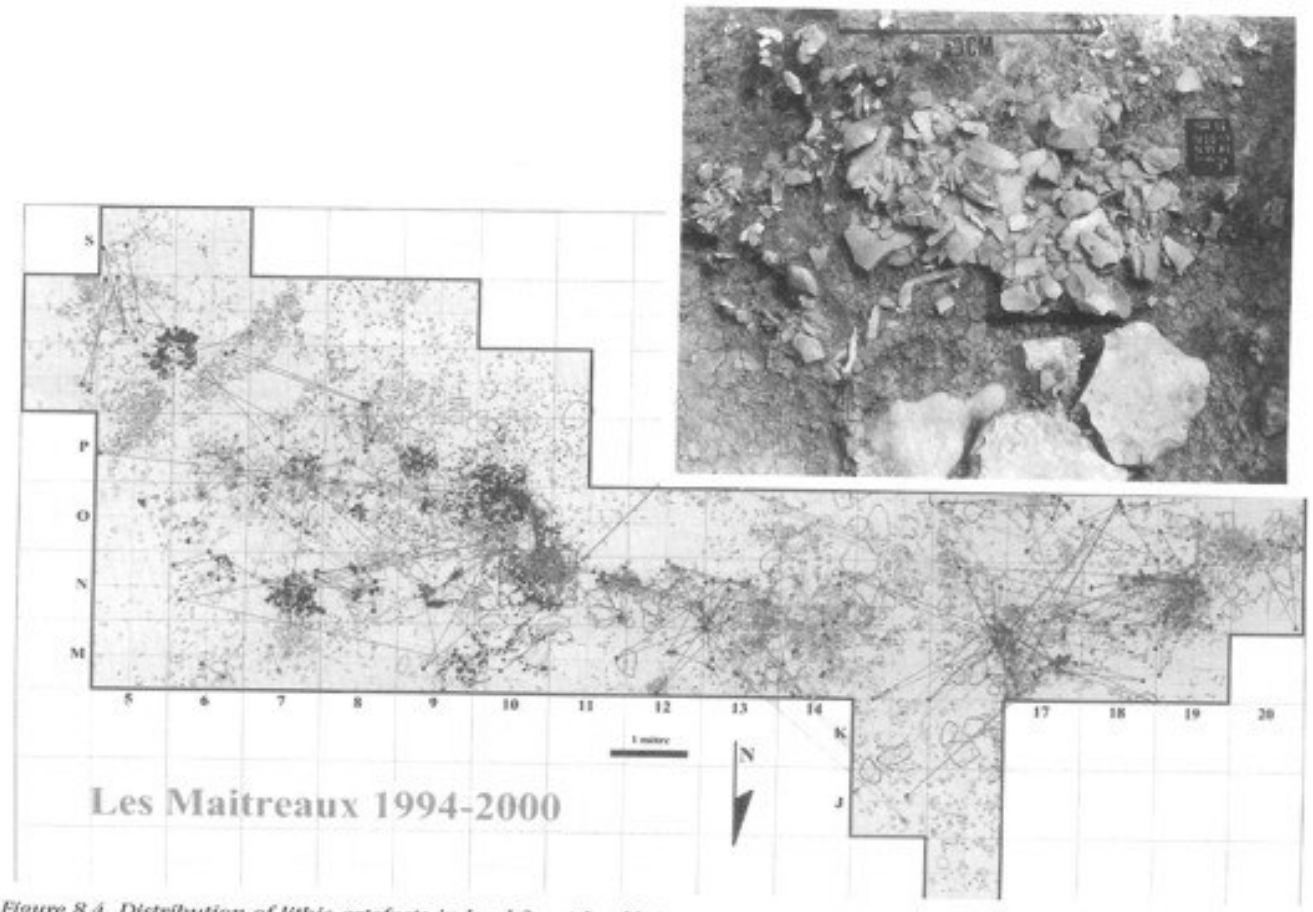

Figure 8.4 Distribution of lithic artefacts in level 2a at Les Maitreaux showing one of the concentrations of large flakes obtained during the shaping of large laurel leaves at this site.

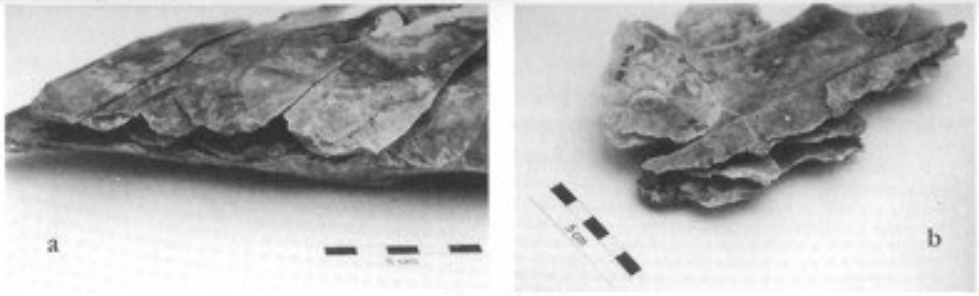

Figure 8.5

Although the retouch technique in the final phase of thinning has never been replicated experimentally, it was probably pressure retouch performed using a crutch or a lever. Where serial retouch completely covers both faces of the points, it is not possible to determine what technique was used during the first phase of thinning without doing refitting. The second category consists of larger laurel leaves covered by expanding removal scars, with divergent denticulated edges formed by the detachment negatives of short flakes (Figure 8.3).

Reconstruction of the Production Sequence

The second category of laurel leaf points has been replicated by Pelegrin (1981). Using red deer antlers of different weights, and pebbles and sandstone for grinding, Pelegrin found it was necessary to prepare each platform by isolating and grinding a spur in order to obtain a width/thickness ratio similar to the pieces from the archaeological sites. Using archaeological data, it has been difficult to confirm whether this was the actual procedure used during the Solutrean. The first step performed in thinning large laurel leaf points is usually missing in Solutrean assemblages as the fragments found were usually discarded after a complicated process of use.

The excavation, beginning in 1994 (Aubry et al. 1998), of a Solutrean settlement at Les Maitreaux, has helped to overcome this sampling problem to some extent and provided data that aided in reconstructing the entire production sequence of these pieces. The site, discovered by Walter during a superficial survey, lies along the bank of a small tributary of the Claise valley that cuts through Upper Turonian limestone (Figure 8.1). The clay layers produced by the weathering of this limestone yield flint nodules of excellent knapping quality, some being more than 1-m long and less than 10-cm thick. Excavation of more than 60 square meters of this site produced 23,400 lithics (coordinated pieces of more than 1.5 cm), which were found lying in concentrations (Figure 8.4) within a wind deposited silty shale (Aubry et al 2000). Technological and spatial studies conducted through refitting showed that these concentrations consisted of preparation flakes, cores, blades (either not selected for shouldered point manufacturing or selected and fractured during retouch), bifacial shaping flakes, and laurel leaves fractured during manufacturing. The association in each concentration of shouldered points and backed bladelets with the two morphological categories of laurel leaves previously defined demonstrates that they were contemporaneously produced. Only a few retouched pieces (61 out of a total of 23,400 pieces) have been found in the concentrations: blades with traces of use, scrapers, burins, and perforators. A use wear study performed by Plisson on 6 scrapers and 6 blades confirmed that these pieces were used as tools, leading to the dismissal of the hypothesis that they had been manufactured but not selected for use.

Examination of a refitted series of shaping flakes proved that thinning of large laurel leaves was performed exclusively by soft-hammer percussion (Figure 8.5), with the thickness being reduced to less than 1.5 cm. The first step of thinning was to detach a series of covering flakes on one edge after grinding the entire edge. These flakes were frequently overshot. The platform for each removal was carefully prepared, with a spur created by removing small flakes and grinding, as described by Pelegrin (1981). As we previously hypothesized (Aubry et al. 1998), thinning was not performed symmetrically and alternatively on the two faces. Instead, the choice of one face for thickness reduction permitted the conservation of the sub-cortical part of the blank, which was homogeneous, finer in grain, and more suitable for flaking (Figure 8.6). The relative rapidness with which the first step of shaping was performed could explain the higher frequency of breakage during this phase. The analysis of large-sized laurel leaf preforms and fragments shows fractures that are similar to fractures created at the point of impact during shaping in experimental knapping of such pieces or which could be the result of raw material flaws or weaknesses (Figure 8.3).

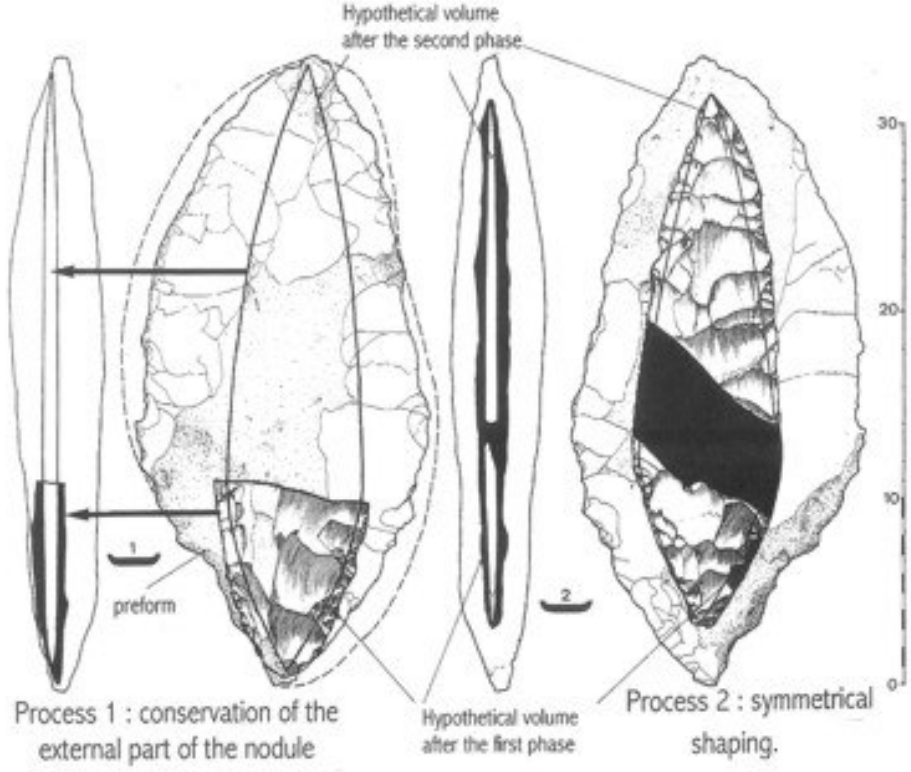

Figure 8.6 Hypothetical reconstruction of two solutions for the shaping of large nodules based on the preforms and fragments of laurel leaf points recovered at Les Maitreaux.

Table 8.1 Sites with Solutrean Levels

Small Size

Sites		distance from raw source	P	M	MS	EN	B	M	D	F
Les Roches	C3c-1	0 km		2						
	C3c-2	10 km								1
Les Maitreaux	C3c-1	0 km	1	13						
	E7b	0 km								1
Fritsch Shelter	C3c-1	15 km			1					
	C3a-1	50 km					1			
	J2/1	5 km					1		1	
	J2-4	20 km	1							
	E7b	10 km							1	
Les Riaux	C3a-2	45 km						1		
Monthaud	C3c-1	40 km					2	1		
	C3c-2	40 km				1		1		
	C3a-1	60 km					1		1	
Monthaud	J1	0 km	56 entires and fragments							

Large Size n1

			P	M	MS	EN	B	M	D	F
Fritsch Vignaud	C3c1	15 km								1
Fritsch c9	C3c-4	15 km								1

Large Size n2

			P	M	MS	EN	B	M	D	F
Les Roches d'Abilly	C3C-1	0 km	1	2						1
	C3C-2	10 km			1					
Maitreaux	C3C-1	0 km	7	21						3
Fritsch Shelter	C3C-1	15 km								
	C3A-1	50 km			1					
Monthaud Shelter	C3A-1	60 km			1					

P=Preforms; MS= mesial fragment resharpened; EN=entire; B= basal fragment with projectile use stigmatas; M= mesial fragment related to projectile uses; D= distal fragment related to projectile use; F= non diagnostic fragment

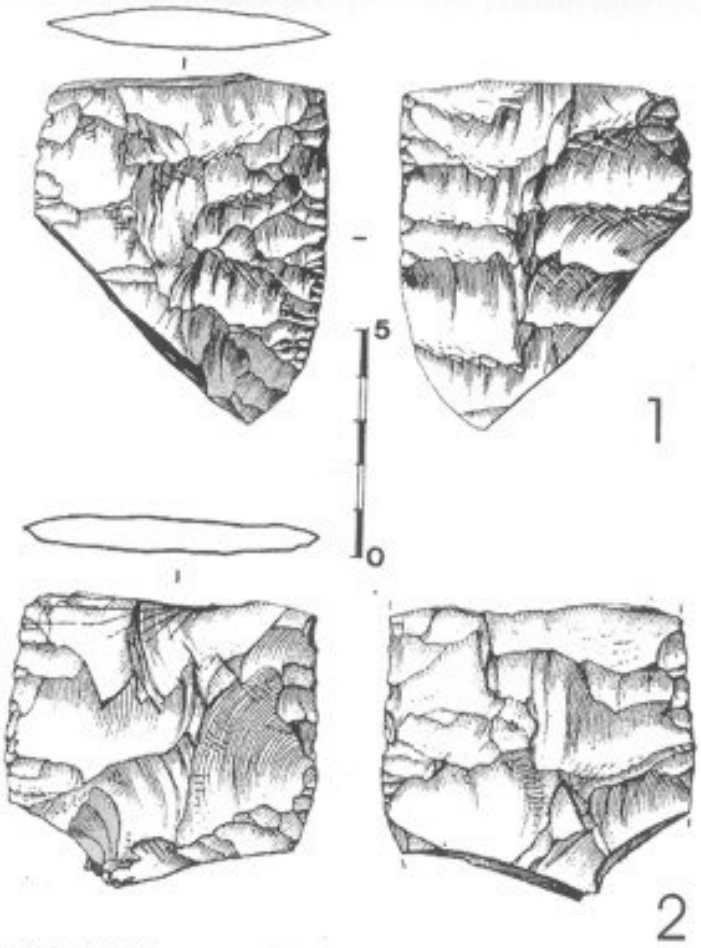

Figure 8.7 Mesial fragments of a large laurel leaf point with several detachments revealing resharpening after fracture. 1: Monthaud shelter, 2: Fritsch shelter level 9.

Use and Discard of Large Laurel Leaves

In the Creuse region, the type of raw material used for the production of large laurel leaves at Les Roches d'Abilly, La Guitière, Monthaud, and Fritsch points to the probable existence of similar workshops near the Upper Turonian and Low Turonian outcrops even though Solutrean sites are unknown at these locations (Table 8.1). Larick (1983) suggests that evidence for the transportation of unshaped nodules has not been found in the Perigord (Table 8.1) because of the high frequency at which breakage occurs during the complicated production sequence for this kind of tool. Analysis of non-local raw material in Solutrean assemblages shows resharpening of the edges after breakage, however, suggesting that these pieces were used after breaking (Table 8.1 and Figure 8.7). Turonian flint flakes found in level 10 at the Fritsch Shelter provide evidence in support of this hypothesis as the nearest outcrop is 15 km away. Flakes were produced during the final

retouch of pieces larger than 6 cm by a process that involved the use of spur platforms and grinding. This hypothesis should be tested by an examination of the raw materials used, the discard patterns, as well as use-wear analysis of the fragments. It would explain the carefulness evident in the final retouching of the edges with concave protected removals and the rarity of shaping flakes at campsites, such as level 10 of the Fritsch shelter.

Small Laurel Leaves

There is a cluster of small laurel leaves, consisting of those less than 15-cm long when complete, within the laurel leaf group categories (Figure 8.8 and Figure 8.9), which has been described by Smith (1966) and Zilhão (1997). There is little variability in their length. Geneste and Plisson (1993) have hypothesized that they are functionally equivalent to longer shouldered points. There is a high frequency of basal and medial fragments with hinge fractures and spall removals, which ar characteristic of projectile breakage.

In the Creuse basin, small- and large-sized laurel leaves (Table 8.1) were manufactured from the same raw materials, which had been transported from as far away as 60 (Aubry 1991), the same distance as in the Perigord (Larick 1983; Demars, 1996). Larick (1983) suggests that the presence of shaping flakes at Les Roches d'Abilly, Les Maitreaux and Monthaud shows that this kind of foliate point was produced near the flint resources. Their subsequent displacement may have been greater than 20 km, with the points being transported after being reduced in thickness, quite possibly in final form.

The production sequence was different for the large-sized group. In the Maitreaux assemblage, which was manufactured from Turonian outcrop raw material, and in the assemblage from Monthaud, which is located near a Bajocian flint source, the shaping flakes are cortical. There is evidence for soft hammer percussion in practically the entire reducing sequence as shown by fragments at the Maitreaux site (Figure 8.8) resulting from breakage in the final phase. Shaping and sharpening by pressure retouch was performed to a lesser extent on the laurel leaves manufactured from Turonian outcrop raw material based on examination of the fragments discarded after use as projectiles. In contrast, pressure retouch was used to modify the entire edge and the entire surface of the point in the group of smaller laurel leaves made from Bajocian flint in the Monthaud shelter area.

Evidence for heat-treating, seen first in the Perigord (Bordes 1969), was afterwards recognized in other regions, and recently in Solutrean sites in Southern Iberia (Zilhão 1997; Tiffagom 1998). This procedure makes the material more suitable for pressure retouching, but also significantly increases the fragility of the final point. In France, evidence regarding how extensively heat-treating was used is not available. Although this technique was known, it was not systematically employed in the Creuse basin. Only Cenozoic and Bajocian, coarse-grained varieties of flint whose suitability for pressure retouch can be dramatically improved by this procedure, were heat-treated. However, analysis of bifacial points from several Solutrean sites in Spain and Portugal has shown that heat treatment was used systematically there.

In Portugal, at the sites of Vale Almoinha, Caldeirão, and Buraca Grande, a wide variety of flint was observed to have been used in the manufacture of laurel leaves (Table 8.2). The technological study of the production sequence indicates the use of flakes as blanks for shaping, with systematic use of heat treatment in the reduction process before or after the first phase of shaping by percussion with a soft hammer (Table 8.2, Figure 8.10). The

Table 8.2 Buraca Grande Level 9a

Raw Material	Distances	M-1	M-2	F-1	F-2	F-3	F-4	PF
J2-1	0 - km	1	1	13	16	25	29	3
C2s-1	30 - km	0	2	11	0	2	4	0
C2s-2	30 - km	0	0	1	0	0	0	1
Mc - 1	unknown	0	0	1	0	3	0	0
Mc - 2	10 - km	0	2	0	0	0	1	0
H-3 1	45 - km	0	0	1	0	0	0	0

M-1 = fragment of point fractured before heat treatment
M-2 = fragment of point fractured after heat treatment
F-1 = shaping flake without heat treatment
F-2 = first shaping flake after heat treatment.
F-3 = flakes with the two faces showing heat treated aspect
F-4 = pressure retouching flakes
PF= fragment related to projectile use

platforms for shaping flakes don't appear to have undergone any special preparation or grinding, which probably explains why most of the breakage occurred in this phase. The first phase of reduction was sometimes followed by a second heat treatment, evidenced by the different appearance of the material on the two sides of the shaping flakes. The refitting of shaping flakes on a foliate point at the Parpallo site have shown that the process of heat treatment had been used more than once on this tool (Tiffagom 1998). The final shaping and sharpening was performed by serial pressure retouch on the entire edge.

Evidence for the transportation of flakes or preforms at these sites is provided by a translucent coarse-grained flint whose geological origin is 30 km away from Buraca Grande Cave (Table 8.2). Shaping and intermediate heat treatment were performed at the campsite and at least one point was broken during the shaping process. Twenty preforms shaped by percussion, in some cases after heat treatment, recovered from the Monte da Fainha open-air site (Zilhão 1997, Figure 8.9) provide evidence for reserves being stockpiled.

Conclusions

These preliminary results establish that a variety of shaping and sharpening techniques was used to produce the apparently morphologically uniform Solutrean bifacial points found in southern Europe. Futhermore, although French laurel leaves, on which the definition of the Solutrean techno-complex in the Upper Palaeolithic sequence is based, have been considered to be typologically and technologically uniform, they have probably served a variety of functions as projectiles and knives. Based on the technological examination of discarded fragments, this assertion should be tested by microscopic use wear analysis on archaeological remains recovered from recent excavations.

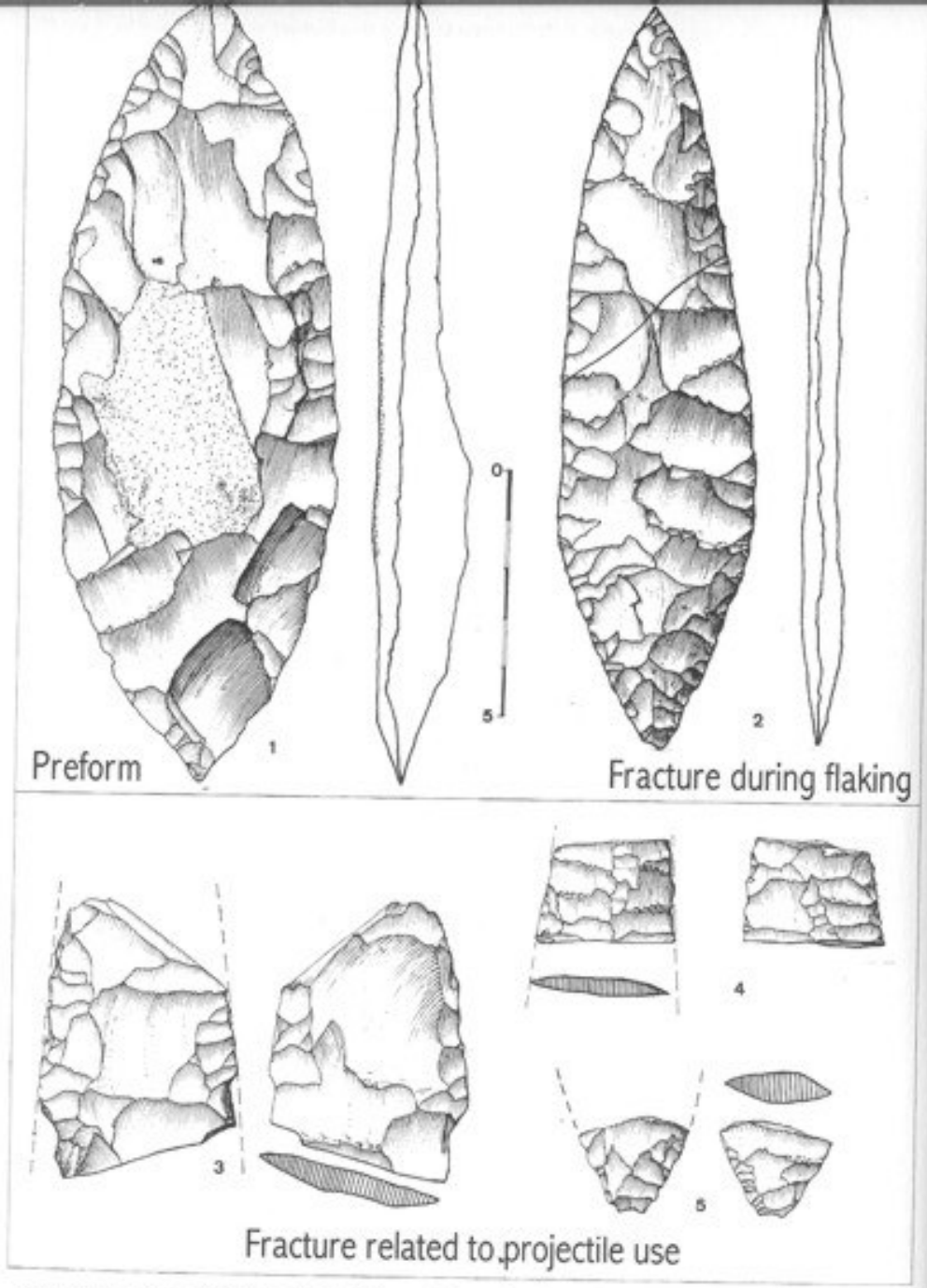

Figure 8.8 Small laurel leaf points from Creuse drainage basin settlements. 1: Preform from Les Maitreaux. 2: Points fractured during shaping by baton percussion, Les Maitreaux. 3 and 4: Mesials fragments related to projectile use, manufactured from upper Turonian flint, Montbaud Shelter. 5: Basal fragment related to projectile use made from lower Turonian flint, Fritsch shelter level 8e.

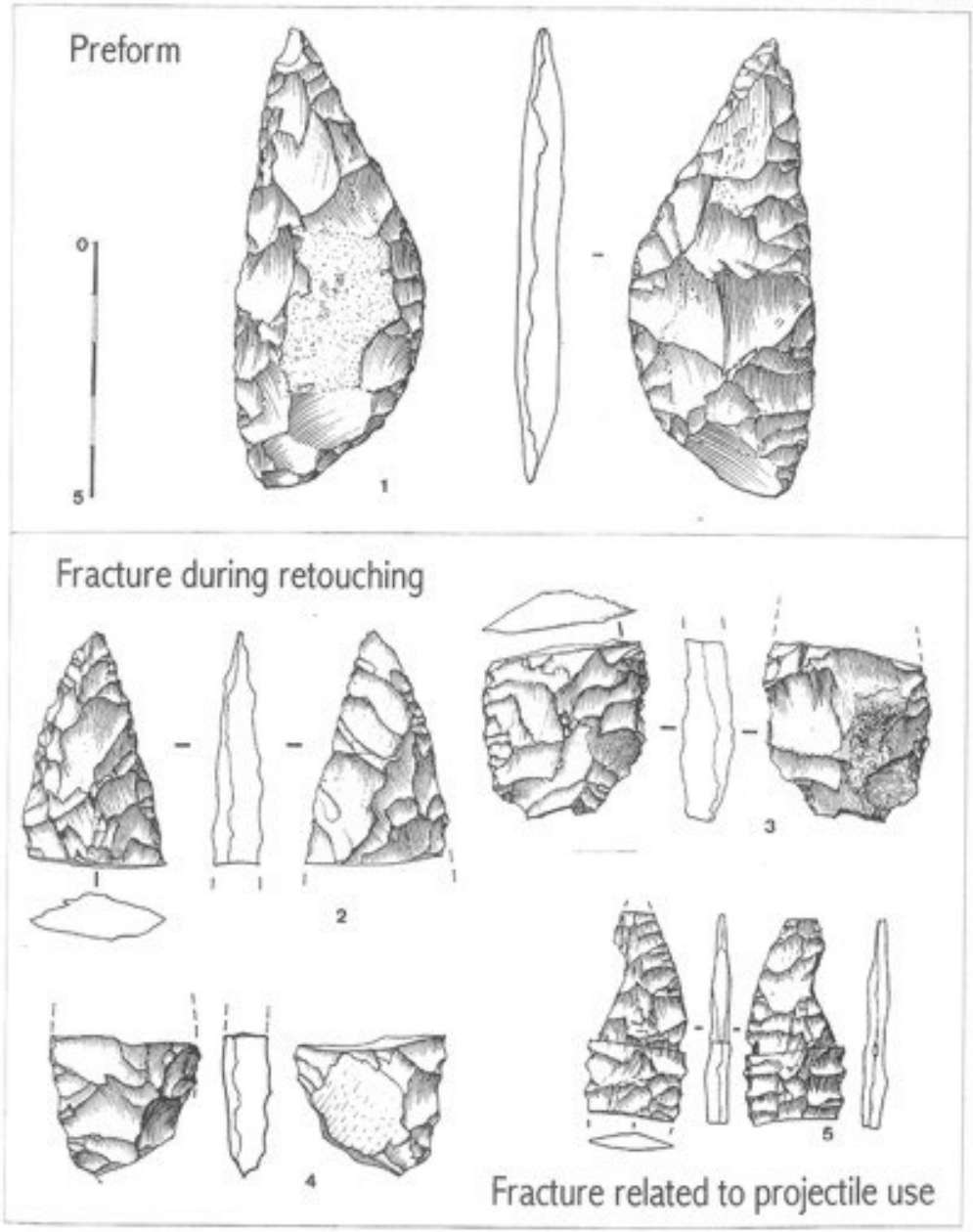

Figure 8.9 Small laurel leaves from Alentejo (1) and central Portugal (2-5). 1: Heat treated preform, Monte da Fainba. 2 and 3: Fragments obtained during pressure retouch after heat treatment, Lapedo Shelter. 4: Buraca Grande fragments obtained during pressure retouch after heat treatment. 5: Fragment related to projectile use, Vale Almoinba.

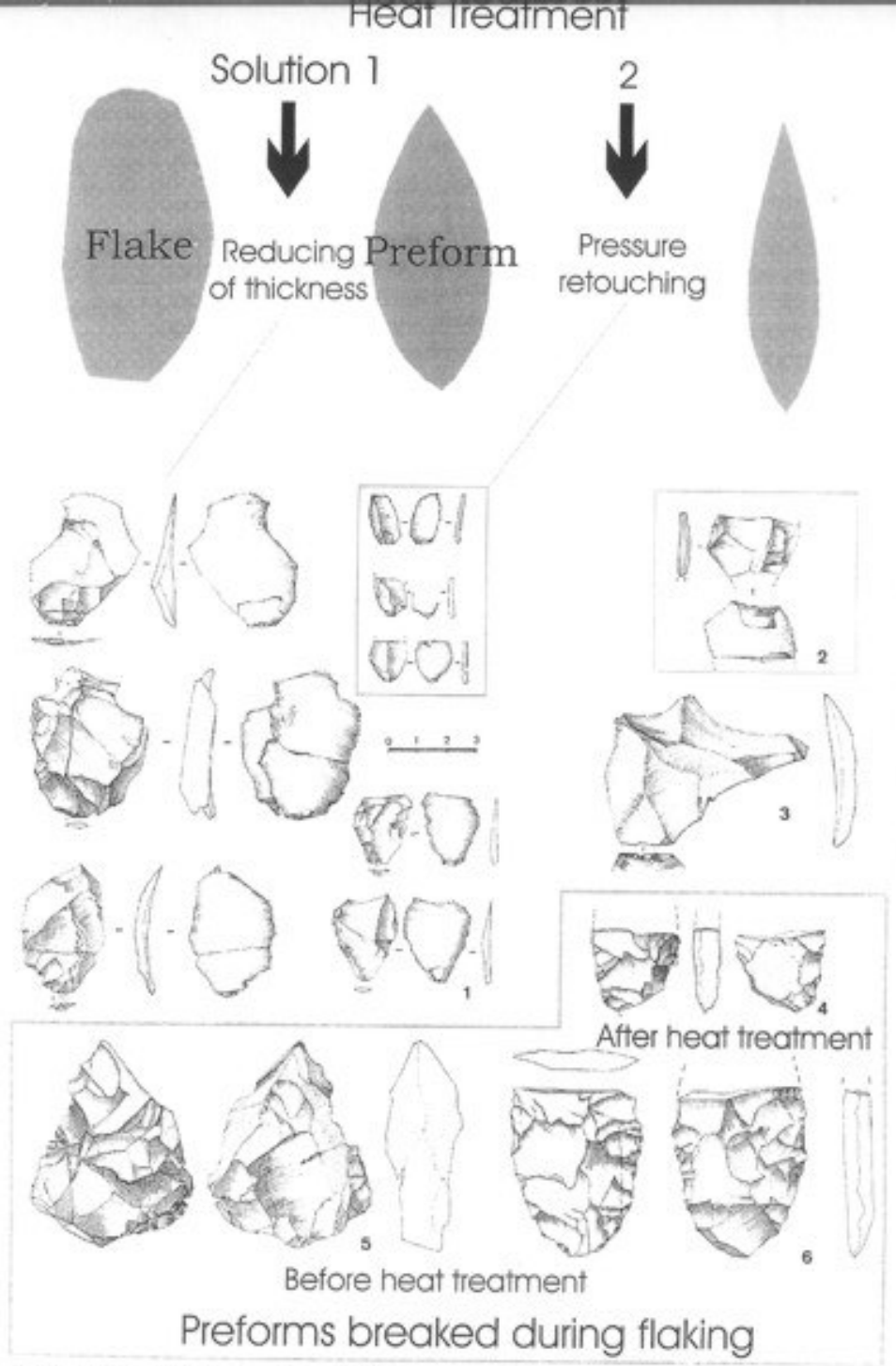

Figure 8.10 Use of heat treatment in the process of shaping and retouching of small laurel leaf points from Solutrean assemblages in Portugal. 1: Vale Almoinha. 2, 3 and 4: Buraca Grande level 9a, 5 and 6: Vale Almoinha.

Although there are differences visible between the two geographic areas examined in this chapter, there is also a high degree of homogeneity at a regional level. There is a strong similarity in production techniques and stages of manufacture among the sites on the edge of the French Massif Central. Also, the assemblages located in the Portuguese Estremadura bear a clear resemblance to those of the rest of southern Iberia. The geographic distribution of these homogeneities correlates with similarities in faunal resources. Similar regional trends, based on point typology and raw material supply territories, on the Cantabrian coast in Iberia, have been pointed out by Strauss (1977).

The role of environmental constraints on technological options remains difficult to define. The geographic distribution of large-sized laurel leaves is restricted to the regional groups on the border of the Massif Central and seems to comply with the constraints imposed by the availability of suitable raw material blanks with appropriate morphologies. This type of raw material exists in the Cretaceous and Tertiary geological formations of the Paris and Aquitaine sedimentary basins but seems to be rare elsewhere. However, this environmental constraint cannot entirely explain the variability in techniques because long blade production and large bifacial pieces created using pressure retouch are known from the Iberian Peninsula Chalcolithic (Forenbaher 1999). The systematic use of heat treatment in association with pressure retouch in the assemblages of Southern Iberia doesn't correspond to raw material availability, but rather to different strategies of seasonal group displacement and modalities of cave utilization in somewhat smaller territories in Iberia (Zilhão 1997; Ripoll Perello 1991).

Nevertheless, we must not downplay the consistency of behavior exhibited throughout the Solutrean techno-complex distribution area, as, for instance, in the selection of translucent varieties of flint among the available lithic resources. Such choices cannot be explained except by a network of long-distance social contacts extending beyond regional group limits. These preliminary findings need to be expanded upon through analysis of more assemblages to reduce the likelihood of bias being present in the available sample of Solutrean assemblages. In France, a high percentage of the archaeological sample available consists of sites where Solutrean points were discarded after hunting and short-term occupations of caves and rock shelters. Our perceptions of the resource exploitation modalities need to be improved by the detection and excavation of open-air sites associated with butchering and conservation activities and, most of all, knapping sites near flint resources.

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9

The Pitfalls of Using Bifaces as Cultural Markers

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Bifacial technology is the product of both cultural influences and convergence due to technological and environmental constraints. The effects of these two factors have not always been separated out in the literature. In homogeneous cultural contexts, traditional constraints justify the production of bifacial objects because it is a deeply codified stylistic expression. However, from one context to another, natural constraints (e.g., mechanical laws for the raw material) force the creation of similar forms: bifacial retouch of a point is only convergence. In the human sciences, it is up to us to identify the stylistic effects proper to a tradition and to isolate them from spontaneous "natural" effects. Only in this case can the bifacial tool have a traditional meaning.

Convergence

Pointed bifacial forms were produced by multiple independently developed technological processes across the time span of human history in which they were used. François Bordes (1968:230) has clearly demonstrated that many reduction processes, regardless of the type of support, used similar techniques to sharpen one end of the tool to form a point, thin the base, and create a symmetrical lenticular cross-section. The interaction between intention and technological constraints resulted in similarities in the final forms produced. Certain well-known, but incorrect, interpretations are actually based on the results of convergent processes. For example, although the "Proto-Solutrean" of Central Europe and the foliate point industries that appear at the beginning of the Upper Paleolithic are often linked together, they are in reality widely separated in both time and space (Freund 1952). However, it is possible to detect secondary stylistic variables and link them to specific cultural groups. These variables are discussed as they relate to the European Paleolithic.

Acheulean

Acheulean bifacial industries, prepared on nodules or cobbles, have precise geographic and chronological limits. They only appeared in Western Europe after 600,000 BP and never appeared in Central or Eastern Europe. In Asia, their distribution was limited to the center of Anatolia and to the vast southern region of China (Xie 1999). In other regions