QUINA PROCUREMENT AND TOOL PRODUCTION

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ABSTRACT

Quina Mousterian lithic variability is explicated as a consequence of interactions between the flexible Quina technology and the economic context in which it was employed. Quina technology was expressed somewhat differently in each assemblage as the needs of people in specific contexts led them to emphasize different possibilities of Quina flake and core forms. Variation in Quina tools was linked to blanks produced by the distinctive core reduction strategy as well as the intensity with which tools were maintained and transported. However, despite variation that exists in Quina assemblages, it is still clear that this expresses a common technological and economic theme. Quina strategies represent particular solutions to the problems of provisioning Neanderthal foragers in the Dordogne during the Middle Paleolithic. Transporting highly extendable packages of stone, usually in the form of thick flakes from which knapper's could remove large numbers of flakes for prolonged periods, either to maintain/create working edges and/or to produce the flakes themselves, formed the central strategy of Quina behavior. The nature of core reduction and flake retouching appears to have been efficient and appropriate for producing these packages, and the pattern and directionality of material transfers indicates the structure of economic needs rather than the intellectual capacity of Neanderthals. Nevertheless, the existence of a "Quina system" which integrated a variety of procurement and technological practices to create an economic structure that was suited to a specific environmental/economic context may indicate the presence of planning in Neanderthal foragers who developed and employed it.

Neanderthals are an extinct form of hominid, closely related to modern humans, who lived in Europe and the Middle East during the Pleistocene, until about 30 000 years ago (Green *et al.* 2006). The nature of their cultural systems has been much debated, and views about them have often been polarized around questions of their cognitive ability. Negative evaluations of Neanderthal cognition have been embedded in arguments about what they could not do: they were not capable of hunting large game, lacked capacity for long-term planning and organization (including social activities), lacked even the foresight of their own mortality, and did not have complex language (e.g., Binford 1989; Gargett 1989; Lieberman 1989, 1991; Stinger and Gamble 1993; Noble and Davidson 1996). More positive evaluations have been offered, but in the absence of representational art and elaborate bone and antler technologies researchers still concluded that Neanderthal were cognitively slightly less complex than modern humans (see Clark and Lindly 1989; Lindly and Clark 1990; Mellars 1996). Researchers have also employed evidence for the manufacture and transportation of stone tools as a way to reflect on the cognitive and social situation of Neanderthals, and particularly the notion that future planning was not a key characteristic of their lives. For example, studies of implement assemblages have been used to debate the existence and nature of regular tool designs in the European Middle Paleolithic (e.g., Binford 1989; Mellars 1996), while the scale at which stone was redistributed has been used as evidence of the nature of inter-group social interactions and the language/cognitive capacity of Neanderthals (e.g., Marwick 2003). While these debates have been productive we argue that interpretations of Neanderthal life are best built from an examination of the range of material residues of their behavior systems, rather than from evidence for single aspects of behavior treated in isolation. For instance, we suggest that the level of planning possessed by prehistoric hominids is difficult to assess simply from the maximum distance stones traveled. As Kuhn (2004: 446) explained, there is no need to interpret differences in the scale of raw material circulation in terms of cognitive capacities, including language use, since the transportation of stone is explicable as an economic response to patterns of mobility and site use. Distance to source is an imprecise measure of cognitive evolution and by itself cannot signal the nature of economies and social networks in the Paleolithic. Rather than base

reconstructions of Middle Paleolithic life-ways on a single trait of that kind, it is desirable to employ information on the patterns of material movements and the regularity of associated transportation and production behavior to yield a more coherent depiction of the ancient behavioral system. The task of reconstructing the behavior and cognitive patterns of tool production and use is difficult, but it begins to be possible in regions such as the Perigord where research has gradually developed robust descriptions of stone procurement and reduction.

In the Perigord current interpretations of Mousterian assemblages reflect the history of archaeological research (Figure 17.1). Before exploring the central point of this chapter it is valuable to briefly review the research which led to the identification and description of the Mousterian. The Lower and Middle Paleolithic of Europe covered considerable time and space. Confronted with the diversity and volume of evidence it was necessary to create structures with which to understand these ancient periods; structures which reflected the intellectual perspectives of the researchers and depended on typological principals of tool analysis. In 1930 Denis Peyrony (1930: 176) advanced the culture hypothesis, that industrial differences signaled groups with distinct identities, a proposition later reprised and developed by François Bordes (1953, 1961, 1973) and Maurice Bourgon (Bordes and Bourgon 1951). Still later a different interpretative model explaining variability in the Mousterian was presented by Lewis and Sally Binford (1966, 1969, 1973, 1983). Their model attributed temporal and spatial patterns of tools to different functional contexts rather than to cultural differences (in the narrow sense of distinctive identities and traditions). From the same time Paul Mellars (1965, 1969, 1970, 1988, 1989, 1996) proposed, on the basis of evidence from key archaeological sites such as Combe Grenal, Pech de l'Azé, and Moustier, that there was a sequence of three Mousterian facies: Ferrassie, Quina, and Mousterian of Acheulian Tradition. He took each of these industrial units to be distinct cultural entities which succeeded each other over time, in that order. Beginning in the 1980s Harold Dibble (1984, 1987a,b, 1988a,b, 1991, 1995) developed the idea that the diversity of typological tool forms within the Mousterian was the result of different degrees of reduction; an idea since pursued by other researchers (e.g., Rolland 1988; Rolland and Dibble 1990; Gordon 1993; Holdaway *et al.* 1996).

Figure 17.1 Map of the Dordogne, France, showing the location of sites mentioned in the text and the major rivers of the Perigord.

In France lithic analyses have proceeded along different lines. Since the 1950s they have increasingly focused on technology, especially the concept of the *chaîne opératoire* (Bordes 1947; Leroi-Gourhan 1956, 1966; Tixier 1978; Tixier et al. 1980), and since the 1980s French analysts have pursued studies of modes of lithic production in preference to typological studies (e.g., Geneste 1985; Boëda 1986). These studies were often pursued by researchers replicating ancient technologies, such as Tixier, Bordes, and Pelegrin. In this approach the sequence of technical events creating the artifacts was constructed and integrated with lithic sourcing studies to yield a new understanding of geographical dimensions to past economies (Turq 1977; Demars 1980; Geneste 1985). This step towards a techno-economic characterization of lithic assemblages was seen as providing a powerful framework for analyzing lithic material, not as privileging a particular explanatory model. The outcome of this approach has been to shift archeological

concerns away from industrial classifications towards detailed explorations of the constraints and conditions in which prehistoric techno-economic choices were made and repeated. This is the viewpoint employed here.

Investigations of the preserved artifact assemblages have identified regional and chronological differences in hominid behavior. For more than a century archeologists have recognized a series of different Mousterian archeological patterns, and attempts to understand what each pattern means in terms of Neanderthal life-ways continue. This chapter examines one such pattern, the Quina Mousterian of the Dordogne in France, and presents an interpretation of lithic procurement and production as it is now known.

Quina assemblages are conventionally described as having very high frequencies of thick scrapers with convex retouched edges, notably transverse scrapers and those with distinctive "Quina" retouch and little evidence of Levallois core reduction (Bordes 1953,

1972, 2002; Turq 2000: 24). These lithic assemblages are consistently associated with reindeer-dominated faunal assemblages and pollen sets with little arboreal signal (Chase 1986). This indicates that they were created during colder, periglacial conditions, probably the final part of OIS4 and the start of OIS3, but perhaps also at earlier cold phases (Bordes et al. 1966; Mellars 1969; Dibble and Rolland 1992; Turq 1992, 2000: 312). However the absolute chronology for Quina industries is currently poorly defined and Quina assemblages are not necessarily synchronous at all sites in the Perigord.

MATERIAL PROCUREMENT

The Perigord region, dominated by the valleys of the Dordogne and Vezere Rivers, contains a remarkable variety of flints. Middle Paleolithic hominids living in the region employed these flints as materials on which to make tools, and transported artifacts as they moved across the landscape. It is possible to identify the general source of many flint artifacts found in archeological sites because there is a well-defined pattern of geological outcrops and the flints which come from each source are often distinctive. The Perigord is the northeastern part of the Aquitaine Basin; it contains flint-bearing limestone formations of different ages (Jurassic, Cretaceous, and Tertiary), through which the main valleys have been cut. Fortunately the appearance of flint from each geological stratum is often visually distinguishable, and can be identified from inspections of color, texture, fossiliferous inclusions, cortex, and other features (e.g., Demars 1980; Morala 1983; Seronie-Vivien and Seronie-Vivien 1987; Turq 2000, 2005). Analyses of the sources of artifacts in archeological assemblages have identified patterns of Mousterian rock procurement and transport across the region (Geneste 1988, 1989; Turq 1988, 1989, 1992). These patterns can be summarized as follows:

- Flint was readily available on the ground surface, as colluvial or solifluction deposits adjoining flint-rich outcrops and deposits in the beds of rivers, and was probably collected without the need to excavate it from bedrock. Throughout most of the region these sources were for practical purposes unlimited (Turq 1988).
- In most assemblages the artifacts were made on flint obtained from the local environment, typically 95–99% come from localities within a 5 km radius of the site. In a flint rich landscape the use of locally

abundant stone resources, perhaps embedded in other economic activities, would have been an expected consequence of foraging.

- Small numbers of artifacts were carried much further, from sources up to 100 km away to the site at which they were discarded. The specimens transported over these distances were typically made only of high quality flint and they were retouched, an indication of careful selection of objects to be transported and maintained, and perhaps of rapid, logistical movements of people carrying tools (Geneste 1989) or even exchanges between neighboring groups of hominids.

- There is no evidence for transportation of stone more than 100 km in the Dordogne, even though greater transport distances are known elsewhere in Europe during the Middle Paleolithic (Féblot-Augustins 1993: 215). While this has sometimes been seen as an indication that Neanderthals in the Dordogne did not transfer material through exchange systems, it is more plausible that the maximum transfer distance is merely a reflection of the richness of this landscape in flint and that trading flint made little economic sense (Mellars 1996).

- Furthermore, the movement of material across the landscape is not random or haphazard. While some source areas were not only the origin of flint transported elsewhere but also contained sites that received non-local flint, other source areas gave material to but did not receive it from the surrounding region. These patterns reveal not only a complex set of movements across this landscape but also that the redistribution of raw material was repeatedly carried out according to a regular system which existed for millennia.

- Artifacts that were transported substantial distances, more than 20 km, were mainly flake blanks and tools that had great potential for reworking. Cores were not regularly relocated, but were reduced close to their occurrences to produce portable flakes. This process involved testing nodules by removing a few flakes and then transporting them to sites where they could be reduced. It was the distinctive Quina flake blanks that were carried over long distances and intensively resharpened and recycled (Meignen 1988).

These observations are not consistent with a simple, opportunistic pattern of resource exploitation. Instead, they indicate a highly structured system of resource use that involved regular, well-defined selectivity of items to be transported, and repeated transfers of blanks and tools across the landscape in the same directions. The most plausible interpretation

of material redistributions in this region is that they were a consequence of a system of seasonally semi-permanent occupation in the Perigord, with seasonal forays to other regions and perhaps occasional exchanges with neighboring groups (Turq 2000). The regularity of archaeological evidence for transportation of flint indicates that this foraging pattern, and the system for procuring and redistributing rock, was relatively stable over a long period. Additionally the system was well adjusted to supplying tools in the environmental context in which foragers were operating. A similar image of an elaborate and well-structured economic system has been obtained from investigations into the ways in which flakes for

FLAKE PRODUCTION

The flake production typically associated with Quina Mousterian assemblages differed from the Levallois and discoidal strategies associated with some other Mousterian industries. Quina core reduction technologies often involved the flaking of large, thick flakes from cobbles in a way that allowed cortex to be retained on many of the dorsal surfaces of many flakes, a process that has sometimes been described as "clactonian." Many of the flakes removed from Quina cores were also asymmetrical in cross-section. The regularity with which thick, asymmetrical flakes bearing cortex along a margin were created indicates the existence of systems of core reduction.

The shapes and dimensions of raw materials imported into sites varied. Some were rounded nodules, others were angular, thermally fractured pieces, while others were humanly manufactured flakes. The consequence of this variety of material forms was the production of heterogeneous collections of large flakes which share the same morphological characteristics and result from similar strategies of core reduction. Diversity in core forms and flake products stems from not only differences in the initial raw material but also from the knapping actions applied to each piece of rock being worked. However, the variation in core forms masks strong similarities in core reduction. To understand patterning in the variable forms found in assemblages, archaeologists such as Turq (1988, 1989, 1992, 2000) and Bourguignon (1997) examined the knapping actions and patterns of fracture: the selection of hard hammers, the use of the hammers, the direction

in which blows were applied, and the arrangement of blows to different surfaces as alternative or successive. Examinations of the angles between surfaces and their effect on the symmetry of artifacts obtained (Bourguignon 1997) has led researchers to conclude that Quina core reduction obeys a specific logic of volumetric production, producing thick flakes with cortex, resembling Clactonian systems of core reduction (Ashton et al. 1992, 1998; Ashton 2000), trifacial systems (Boëda 1997) and SSDA (*système par surface de débitage alternée*) (Forestier 1993). This basic format of this core reduction is illustrated in Figure 17.2a.

Figure 17.2 Summary of Quina core reduction. (a) Schematic cross-section of the basic format of Quina flake removal from cores, (b) Representations of inferred variation displayed in Quina core reduction [based on proposals by Turq (1988, 1989) and Bourguignon (1997)], and (c) Drawings of two cores from Combe Grenal Layer 17 (Drawings by Jean-Philippe Faivre).

Turq (1988, 1989, 1992, 2000) described some of the variations of this Quina core reduction system, singling out three strategies which together accounted for the range of flake forms observed in excavated assemblages such as Roc de Marsal where raw material occurred in elongate blocks. These strategies are schematically illustrated in Figure 17.2b, and can be summarized as follows:

- The first is the application of a series of powerful blows to the center of the natural surface of a block to remove a series of parallel flakes that progressively truncate one end of the nodule. Turq (1988, 1989, 2000), following Boursin (1907) and Cheynier (1953), described this metaphorically as a "salami slicing" strategy, and it yielded large, thick, flakes with cortical platforms and steep cortical edges on both lateral margins.

- The second scheme also involves the application of blows to the natural surface of cobbles, but in this case they are positioned towards one side of the platform, to take advantage of prominent ridges on the core face formed by the junction of large flake scars and unflaked cortical surfaces. The result was large, thick flakes with cortical platforms that were asymmetrical in transverse cross-section and had cortex only on the steep angled lateral margin, a pattern which Turq referred to as a "cortical-backed" strategy.

- The third scheme involved stripping cortex from the platform as well as portions of the core face with a series of large flakes removed along the nodule length as well as across its end, prior to again focusing blows down ridges created by the junction of cortical and flaked surfaces. The flakes produced were often also large and thick, often asymmetrical and with cortex on one margin, but typically with a conchoidal platform. Turq (1992) named this a "covering" strategy for producing flakes with cortical backs.

Other schemes of Quina core reduction have also been proposed. For example, Bourguignon (1997) described procedures in which flakes were alternately struck from two or three platforms (Figure 17.2b). This system is suited to blocks of raw material that are roughly equi-dimensional, and could maintain similar core shapes during reduction. The flakes produced are again thick with large platforms, and with cortex on a lateral margin or distal end.

Although the strategies defined by Turq and Bourguignon represent varied procedures of core reduction they share several features. The flakes produced are often thick, with large platforms, substantial

amounts of cortex on the dorsal face, and frequently have an asymmetrical transverse cross-section in which the cortex is located on the steep angled margin and the opposing low angled margin is formed by two conchoidal surfaces (Turq 2000: 318). Typical examples are presented in Figure 17.3a. As discussed below it was this conchoidal margin that was typically retouched (Turq 2000: 314). These patterns are extremely regular. For example, at sites such as Roc de Marsal and Combe Grenal as much as 70–80% of retouched flakes have cortex on their dorsal surface and the majority were often made on flakes between 1 cm and 3 cm thick, and rarely thinner than 0.7 cm. The consistency with which flakes of this form were struck from cores contributed to the standardization of tools being produced.

The core reduction strategy applied in particular cases was probably chosen to be appropriate to the size

Figure 17.3 Examples of Quina flake selection and retouching from Combe Grenal (layers 17 and 20). Arrows show the sequence of reduction. (a) Unretouched flakes removed from cores, (b) Similar flakes with retouching, (c) Smaller flakes struck from retouched flakes of the kind portrayed in b, and (d) Small flakes from c that have subsequently been retouched. (Drawings by Jean-Philippe Faivre.)

and shape of the raw material nodules at hand. For instance, the salami slicing version was suited to slab- and cylinder-shaped blocks and was less commonly employed on more spherically-shaped blocks, where other strategies such as cortical-backed, covering, and recurrent alternative strategies would have been more successful. Figure 17.2b schematically depicts one dimension of the relationship between core reduction strategy and raw material form. Examples of discarded cores are shown in Figure 17.2c.

Another indication of the adjustment of reduction strategy to circumstances is the production of tools blanks from very large retouched flakes rather than cores, a reduction stage Bourguignon *et al.* (2004) term "Production 2". Reduction of large flakes to generate flakes which were used as tools and/or retouched took place in several ways. One approach was the use of a Kombewa technique (Tixier and Turq 1999), which involved striking the proximal end to remove a flake which had the bulb of the original flake on its dorsal surface. The resulting flakes typically have asymmetrical cross-sections, conforming to the pattern of Quina flakes struck from cores, although the asymmetry is often longitudinal rather than transverse. A Kombewa technique is particularly suited to stone materials with irregular form, such as the local chalcedony used to manufacture many artifacts at Combe Grenal, where it was emphasized in preference to some of the core reduction strategies (Turq 1989: 251). Other strategies for striking tool blanks from large flakes have also been observed in Quina industries, such as by notching scraper edges, has been suggested Bourguignon *et al.* (2004), revealing that there were multiple options for the production of blanks from large flakes. These options form part of what has been described as a "ramified" production system in which there are not only multiple strategies within a production system but also recursion of operations at several points in the production history, so that flakes serving as tool blanks were produced on cores, on flakes removed from cores, and so on (Bourguignon *et al.* 2004) – see Figure 17.3.

Quina blank production not only employed regular flaking strategies that were matched to the forms of raw material available, it also appears to have been highly efficient. One expression of flaking efficiency is the amount of core mass converted into tools. Although this is difficult to accurately measure, because tools are difficult to identify even with detailed studies of wear/residues, Turq (1992: 76) provides evidence that indicates efficiency was high in Quina industries in

the Dordogne. His experiments suggested that Quina strategies yielded between twice and six times as many suitable blanks as the Levallois techniques by allowing successive removals of tool blanks without intensive core preparation between them. Furthermore, he concluded that between half and three-quarters of flakes were retouched into implements, a frequency that indicates a high rate of converting core mass into tool mass. The efficiency and economy implied by those patterns is also reflected in the treatment of tools.

QUINA IMPLEMENTS

Quina assemblages are dominated by dorsally retouched "scrapers" with a single, long retouched edge (Figure 17.3b). Approximately 40–90% of the typologically defined tools are single-edged scrapers. These scrapers have traditionally been separated into two groups: single-edged side scraper with retouch on one lateral margin (Bordes types 9–11), and transverse scrapers which have retouch across the distal end of the flake (Bordes types 22–24). Transverse forms are common in Quina assemblages, making up between a quarter and a half of all single-edged, dorsally retouched scrapers. Other implements are often recovered from Quina levels in small proportions, such as notched scrapers (Bordes types 42 and 43), abrupt pieces (Bordes type 48), and double and convergent scrapers (Bordes types 12–17, 18–21), but it is the numerical dominance and distinctiveness of single scrapers that are noteworthy of Quina retouching.

Quina scrapers typically have a long retouched edge, created by blows applied to the ventral face and removing scars from the dorsal face (Figure 17.3). In many instances these dorsal scars were created with direct soft-hammer percussion using antler, bone, and perhaps wood, and the resulting retouched surfaces contain regular invasive scars which expand away from the impact point and often terminate with small steps or hinges (Turq 2000: 331). Scars of different lengths can frequently be observed, with shorter, later ones superimposed over longer, earlier ones creating a pattern that has been described as four or more "lines" or layers of retouch forming the profile of a retouched edge (Figure 17.4). The expression of these characteristics on retouched edges reflect the interaction of several factors, including the thickness of the flake and the amount of retouch it had received (Verjux and Rousseau 1986). The majority of Quina scrapers have

Figure 17.4 Illustration of the multiple "lines" of retouch on Quina scrapers, after Verjux and Rousseau (1986: 406), with the cross-section showing the measurement of the Geometric Index of Unifacial Reduction (GIUR).

a retouched edge which is long relative to the size of the flake on which it has been made, and the retouched edge is often orientated parallel to the long axis of the specimen, irrespective of the location of the platform. The length of retouch and its location on each specimen varies in relation to the size and shape of the blank, but in most cases there was a clear preference for a large, regular, retouched edge that was smoothly curving in plan shape (Bordes 1961a; Dibble 1987a; Turq 2000: 314). This preference appears to reflect cultural rules of tool design.

The functions of these tools has not been established, many more studies of residue and use-wear are required, but it is likely that they could have been multifunctional, providing edges for cutting and scraping of a variety of organic materials including hides, meat, and wood. In a detailed examination of side scrapers with Quina retouch at the site of La Quina Hardy (2004: 556) showed that they had been

used on a variety of materials including plant, animal, hard and soft materials (see also Hardy *et al.* 1997). Associations of scrapers with red deer and reindeer at Combe Grenal (Chase 1986) may also hint at the functional roles of these tools. Some of these scrapers were probably repeatedly resharpened, a proposition that has been supported by several studies (e.g., Dibble, 1984, 1987a,b, 1988a, 1988b 1995; Lenoir 1986; Meignen 1988). The multiple layers of retouch scars, as well as other characteristics such as different levels of patina on layers of retouched scars, have led researchers to the conclusion that some Quina scrapers were intensively retouched on successive occasions, and that the retouch changed the shape of the retouched edge.

In a series of papers Dibble (1984, 1987a,b, 1988a,b, 1995) and others (e.g., Gordon 1993; Holdaway *et al.* 1996) hypothesized that this reworking of scrapers was responsible for the differences between the typological classes, and that much of the typological distinction between industries is a consequence of the degree of resharpening to which tools had been subjected. Dibble and Rolland (1992: 17) concluded that in Quina assemblages the dominant scrapers were often intensively retouched and that the characteristics of Quina industries were a consequence of higher levels of tool maintenance that occurred in Denticulate or Typical industries. These conclusions were based primarily on the evidence Dibble presented for differences in the size of platforms relative to the size of remaining ventral surfaces on retouched flakes. Platforms of transverse and convergent scrapers were relatively bigger than those on single-edged scrapers, a pattern that Dibble (1995: 319) argued resulted from them having lost more of their ventral surface through retouching and therefore being more intensively reduced. In a similar way he interpreted the relatively large average platform size of scrapers in Quina assemblages as an indication that they were more heavily retouched than scrapers in Typical or Denticulate Mousterian assemblages.

The hypothesis that differences between typological categories of Quina scrapers, and the distinctiveness of Quina industries, resulted principally from the extent of retouching is not supported by other analyses. Two kinds of observations have demonstrated that intensity of reduction is probably a minor factor in the creation of typological patterning in the Mousterian. The first is a study of scrapers from a Quina layer (21) at Combe Grenal, using a more direct and precise method of

measuring the intensity of retouching: a version of Kuhn's (1990) geometric index of unifacial reduction. By comparing the height of retouched scars (t) to the thickness of an implement (T), as shown in Figure 17.4, it is possible to estimate the proportion of original flake mass that had been removed during retouching (see Hiscock and Clarkson 2005). The evidence showed that traditional implement types were not well-correlated with levels of retouching, and that each typological group contained specimens with both high and low levels of reduction (Hiscock and Clarkson 2008). Consequently the typologically different scrapers were largely a product of alternative retouching strategies; in general they were not a series of sequential stages in a single reduction process but a more complex and somewhat parallel reduction sequence of the kind shown in Figure 17.5. Direct measurement of the

extent of retouch in this manner is yet to be repeated in other Dordogne assemblages but the same conclusion had previously been reached by Turq (1989), who concluded that there was a morphological distinction between lateral and transverse scrapers in the Quina industries, and that this was a consequence of the particular relationship of implement types with blank form (see also Mellars 1996).

The second observation that is critical to understanding variations in implement types is that different retouch strategies appear to be associated with different flake blanks, and blank form had a strong and demonstrable influence on the distribution and intensity of retouch on many specimens. This proposition has been advanced for Mousterian assemblages in France (e.g., Turq 1989, 1992) and more broadly in Europe (e.g., Kuhn 1992). A number of relationships between flake blanks and retouch have been observed, including:

- Retouch was frequently positioned opposite a steep cortical margin, sometimes called a "natural back" (Turq 2000: 314).
- The position of retouch creating the long edge characteristic of Quina scrapers reflected the plan shape of the flake. On short but wide flakes the optimal way to create a single long retouched edge is to retouch the distal end; whereas on long flakes the creation of a long retouched edge requires retouch to be positioned primarily on one of the lateral margins. This observation implies the relative frequency of lateral and transverse scrapers in Quina assemblages is a result of the form of the available flake blanks (Mellars 1992).

Together these relationships explain much of the typological variation in Quina assemblages. They also potentially explain the patterns of platform size that Dibble had observed. Transverse and lateral scrapers were made on different blanks (Turq 1988, 1989, 1992; Lenoir 1990), and experiments by Turq indicated that the short, wide flakes on which transverse scrapers were made typically had larger platforms, and hence their characteristics reflect the nature of the blanks selected rather than extent of scraper reduction.

However, even if reduction intensity does not account for differences between implement types there is little doubt that some scrapers were extensively reduced, as already mentioned. Multiple factors appear to underlay the variation displayed in scraper reduction. Given Quina scrapers were predominantly designed with a single long edge, the asymmetry of flake cross-section had a powerful effect on the potential of each specimen

Figure 17.6 Notional illustration of the relationship of blank cross-section and extent of reduction for dorsally retouched Quina scrapers (after Turq 1992: Figure 6.2).

Figure 17.5 (a) Representation of the staged reduction model proposed by Dibble (based on Dibble 1987b: 115). (b) Representation of the reduction history of Quina scraper types at Combe Grenal proposed by Hiscock and Clarkson (2008).

for extended reduction (Turq 1992). Thick flakes with highly asymmetrical cross-sections could receive more retouch without breaking than those with symmetrical cross-sections, as shown in Figure 17.6. Economic context was also a factor conditioning the extent to which the potential of blanks for reduction was exploited. For instance, evidence of tool recycling is more pronounced in assemblages from localities without easy access to abundant stone sources (Turq 2000: 343). Since the design of Quina scrapers is extremely suited to prolonged maintenance and recycling it is not surprising that in some economic contexts tools were more extensively reduced. The design of Quina scrapers and their extended maintenance, together with their dominance in assemblages, are all indications of the importance of these tools in Neanderthal subsistence activities.

THE QUINA SYSTEM

Lithic variability in Quina assemblages can be understood as a consequence of interactions between the flexible Quina technology and the context in which it was employed. All Quina knapping products offered their maker multiple opportunities. For instance, flakes could have been used or struck like a core to yield new flakes, as per Figure 17.3. Another example is the multipurpose quality of Quina retouched flakes,

which were transformed into different forms including scrapers, denticulates, or notches (Bourguignon *et al.* 2004). These possibilities reflect the way similar reduction processes permitted objects to be treated in different ways: as a tool, as a core, and so on. The range of artifact forms observed archeologically was expanded as knappers responded to the diversity of functional contexts represented in different environmental settings and different situations of occupation (cave, long-term specialized camp, open-air). The technology was expressed somewhat differently in each assemblage as the needs of people in each of context led them to emphasize different possibilities of the Quina forms. Variation in Quina tools was also an outcome of the intensity with which tools were maintained and transported. Some tools were substantially reduced, what (Binford 1977, 1979) called "curated" (see Bamforth 1986; Shott 1989, 1995; Kuhn 1994, 1996; Hiscock 2006). The most well-known examples of this are Quina scrapers or the heavily reduced bifacial pieces at the La Quina site, which have been successively and extensively modified through multiple stages, maintained over long periods and moved to distant places. These extensively maintained artifacts represent only one component of Quina assemblages. Whether occupations were short-term or long-term, most material was obtained locally, and artifacts made on these local materials were often employed in an expedient manner, used, and discarded locally.

Consequently, assemblage composition also reflects the different balance between maintained or expediently used tools in different contexts.

The technological emphasis revealed in different assemblages can be understood in terms of the length of occupation and economic context of each site. Quina production activities were suited to mobile foragers who transported personal equipment, comparable with Binford's (1979) concept of "personal gear" although the toolkits were dominated by general purpose tools in the sense of Kuhn (1995) and many objects had high potential for transformation and multifunctionality described above. This system provided tools or materials for flake production, depending on the needs of people in each context. Transporting and maintaining tools was an expression of the strategy Kuhn (1992, 1995) called provisioning of individuals. But as Costamagno et al. (2006) recently illustrated at Marillac, transported personal gear was usually minimal and foragers employed locally available lithic materials to supply their specific needs at each site. In many contexts, especially during long-term occupations when site activities were diversified, the consequence of minimal personal gear was that the needs for tools were efficiently fulfilled by the exploitation of local raw materials, comparable to the strategy Kuhn called provisioning of place. The use of local materials resulted in the introduction into assemblages of blocks of material, cores, and large flakes with the potential to be reduced. The contribution to assemblages of maintained or expedient tools, local or non-local materials, personal gear, or site provisioning varied with different residence and mobility patterns as well as with different functional contexts. This process underlies variation between Quina assemblages.

Acknowledging the variation that exists in Quina assemblages, it is still clear that they express a common technological and economic theme. The Quina system of artifact production and material transport functioned to supply stone for use as tools where and when it was required. Quina strategies represent particular solutions to the problems of provisioning Neanderthal foragers in the Dordogne during the Middle Paleolithic. Transporting highly extendable packages of stone, usually in the form of thick flakes from which knapper's could remove large numbers of flakes for prolonged periods, either to maintain/create working edges and/or to produce the flakes themselves,

formed the central strategy of Quina behavior. The nature of core reduction and flake retouching appears to have been efficient and appropriate for producing these packages, and the pattern and directionality of material transfers indicates the structure of economic needs rather than the intellectual capacity of Neanderthals. Consideration of this system raises several implications.

Inevitably the difficult question about the articulation of Quina retouching strategies and core production strategies is: which was the principal factor in the development of this system of behavior? Was the Quina approach to retouching merely a consequence of dealing with the blanks being produced, an argument that implies core reduction was the primary cause of the system, or was the approach to core reduction refined as a means of producing blanks appropriate for creating the preferred retouched implements? In addressing this question of causation Turq (1988, 1989, 1992, 2000) cited the evidence that blanks were chosen to be appropriate to the tools produced, and hypothesized that Quina core reduction strategies were deliberate and preconceived attempts to create flakes suitable for manufacture of Quina tools. His model implies that the fundamental conceptual shift represented by Quina industries involved the reliance on and investment in retouching to create regularity in tool form, whereas in many Levallois-based industries initial flake (blank) production rather than retouching was the mechanism creating regularity. Turq's insight also implies that requirements of tool design were primary considerations in the adoption of patterns of core reduction, a proposition that implies a high level of planning, but in an economic context in which tools needed to be highly extendable, through their capacity to have edges maintained or alternatively to be recycled.

The result was that Quina production was not only both efficient and adaptable to different situations of raw material, as discussed above, but also yielded implements of a regular form which were suited to multiple tasks and could be intensively maintained and recycled. These tools, together with the production and supply activities that supported their production, provided the technological basis for exploitation of the region during harsh climatic conditions, when it seems that foragers were encountering different prey in different seasons and at different locations within their territory (Chase 1987, 1989). In this context, where

the rigid use of activity-specific tools would frequently have required economically costly retooling and foraging uncertainty and may have made predictions of required toolkits dangerous because of the consequence of planning an inappropriate toolkit, a technological system dedicated to producing flexible, long lasting, multifunctional, portable tools might have been the better choice. In this context, the emphasis on highly extendable retouched tools, created on thick flakes, produced in a time-economizing way that did not tie foragers to particular outcrop areas, would also have been an advantageous strategy (see Turq 1992). In this way it is possible to recognize a "Quina system" which integrated a variety of procurement and technological practices to create an economic structure that was suited to the specific environmental/economic context in which hominids living in southwest France found themselves. This system was elaborate and coherent, traits which indicate the presence of planning in the Neanderthal foragers who developed and employed it.

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Chapter 18

THE IMPACT OF LITHIC RAW MATERIAL QUALITY AND POST-DEPOSITIONAL PROCESSES ON CULTURAL/CHRONOLOGICAL CLASSIFICATION: THE HUNGARIAN SZELETIAN CASE

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ABSTRACT

The Szeletian industry is a key component of models of the Middle to Upper Paleolithic transition in Central Europe. The acculturation model proposes that the co-occurrence of Middle and Upper Paleolithic artifact types in Szeletian assemblages, including “archaic” types such as notches and denticulates, is the product of interactions between Neanderthals and modern humans. In this chapter, the role of the Szeletian in transitional studies is re-examined based on new radiocarbon dates, a consideration of lithic raw material quality, and post-depositional processes.

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