CHAPTER 12. SPATIAL VARIABILITY
VARIABILITY IN STRATEGIES ACROSS SPACE

Technological and typological analyses of lithic assemblages *in relation to* lithic raw materials utilized show patterns both at site and regional scales of analysis. These analyses help to explain assemblage variability across space and permit the formulation of hypotheses concerning the organization of prehistoric lithic economy. The six study sites were vary in terms of their raw material context: local flint sources (Zone 1), non-local flint sources < 40 km distant (Zone 2), distant flint sources (Zone 3). Thus, each zone is represented by two sites. It should be noted that other contexts are possible: in regions other than Belgium, notably in Eastern Europe, truly long-distance transport (>120 km) of flint has been observed (Schild 1987; Féblot-Augustins 1998). The raw material context is based on the location of a site in relation to the geographic distribution of flint sources and the sources actually used at the site.

This chapter presents an hypothesis for the organization of lithic economy during the Early Upper Paleolithic in Belgium, based on the results of analysis of the six study sites. It attempts to explain variability in lithic assemblages across space as the result of the selection of different strategies for procurement, transport, reduction and use from a pool of known strategies that constituted the lithic economy.

In chapter 2, a basic model adapted from economic models (Vita-Finzi and Higgs 1970; Higgs and Vita-Finzi 1972; Sheridan and Bailey 1981) and optimal foraging models (Winterhalder and Smith 1981; Smith and Winterhalder 1992; Bettinger1980, 1991) suggested that the main factors affecting choices of strategies within a lithic economy were quality of material and distances to sources, the second of which combines availability, accessibility and abundance.

Of the two factors, material quality – both for applicability of reduction techniques and effectiveness in tool use – appears to have been of primary importance during the entire European Paleolithic in general, because flint was the preferred material in the vast majority of cases. The quartz-based Mesolithic industry at such sites as Vidigal in Portugal may be an exception, although in these cases, as at Trou Magrite, local flint is lacking and the use of quartz may have been a strategic response to the raw material context (Straus and Vierra 1989). Even in cases where flint is found only as small pebbles (e.g., the Pontinian in Italy [Kuhn 1995]), flint is still used and it is reduction techniques that are modified to the material. So, one reasonable assumption of the hypothesis presented here is that, in general, relatively better-quality material (i.e., flint) was preferred. The implication is that more effort will be expended to obtain flint, even when relatively poorer-quality material is available closer to the site.

At this point, the second factor – distance to flint sources – comes into play. Depending on the degree of mobility of prehistoric groups and duration of occupation, there is a theoretical distance limit beyond which flint procurement costs become too great for its regular use, and alternative materials, closer to the site, are sought in place of flint. In Belgium, this threshold exists at the boundary between Zones 2 and 3, at approximately 50 km between site and nearest source.

For the Early Upper Paleolithic in Belgium, distance to flint sources appears to have been a limiting factor for flint procurement and alternative strategies were employed as distance to sources increased. In Table 2-1, a non-exhaustive list of potential strategies for all stages within a lithic economy (procurement, transport, reduction, use) was presented. It is appropriate now to evaluate the study sites in terms of the evidence their assemblages show to support the possible use of different strategies.

In Zone 1, at the sites of Maisières-Canal and Huccorgne, flint sources are local. At both sites, strategy 1 (procure and use local material) was employed almost exclusively, with Rank 1 materials overwhelmingly dominant: at Maisières-Canal, Obourg flint = 91.8%, at Huccorgne, Hesbaye flint = 92.2% and 99.9%, in the Otte/Straus and Haesaerts collections respectively. At both sites, rare series of other, non-local, materials were also present, transported as prepared cores and finished tools. The extremely low frequencies (< 10%) of non-local materials transported to these sites, where flint is available locally, suggests that one of the purposes of site occupation was flint procurement, with foreknowledge that flint would be available; otherwise, a more substantial active tool kit would be expected to have been transported to these sites.

Both are also open-air sites, both show evidence of hunting and butchery activity and both are strategically placed (fords, river valleys) in areas through which migrating animals would have been likely to pass. A logical interpretation would be that strategy 4 (embedded procurement) would have been employed, to take advantage of the availability of both subsistence and lithic resources. If so, one can also assume that prepared cores, blanks and tools were exported from the sites, leaving behind unsuitable blanks and tools used during occupation.

Both sites are also Gravettian, dated to 24-28,000 BP, and up to now, no similar open-air Aurignacian sites have been found (apart from surface finds near Braine-le-Comte, some 20 km from the Obourg source [Fourny and Van Assche 1992] and Lommersum in the German Rhine valley [Hahn 1977, 1987, 1989]). In Belgium, flint was clearly procured from sources in the Hainaut Basin and on the Hesbaye Plateau during the Aurignacian, evidenced at the numerous Aurignacian sites in Zone 2. The cave site of the Grotte du Docteur, located in Zone 1 at local flint sources in the Méhaigne valley on the Hesbaye Plateau, contains an Aurignacian level (Otte 1979; Miller *et al.* 1998). It is probable that similar open-air Aurignacian sites have not yet been discovered, being deeply buried on the loess-covered plateaux (Maisières-Canal and Huccorgne were only discovered as a result of modern construction activity: a canal and a railway and road, respectively). It is, however, also possible that procurement strategies were different during the Aurignacian, with ephemeral camps that left little trace.

The majority of Belgian Early Upper Paleolithic sites are found in Zone 2: the study sites Spy and Goyet, as well as cave sites along the Meuse and its tributaries: Grotte du Prince, Grotte de la Princesse, Trou Al'Wesse, and Grotte Walou. This is due in part to systematic exploration and excavation of caves during the 19th century, but may also reflect the actual settlement distribution during the Early Upper Paleolithic, when caves would have been necessary for adequate shelter, especially during the colder seasons.

For the two study sites, Spy and Goyet, the nearest flint sources are at least 25 km distant, on the Hesbaye Plateau (east of Spy and north of Goyet). Interestingly, while Spy shows a relatively higher percentage of phtanite (25 km away) than at the other study sites, the Rank 1 material comes from Obourg, around 50 km distant. This might reflect a territorial range for occupants of Spy, that concentrated on the western part of Belgium. For both Spy and Goyet, local materials included chert and quartzite cobbles, available on the terraces of the Orneau and Samson rivers respectively, but these poor materials were only very rarely exploited.

The raw material structures of the Spy and Goyet assemblages differ from those that are observed at Maisières-Canal and Huccorgne. The Rank 1 materials, while dominant, are not overwhelming: 31% for Obourg flint at Spy, 67.5% for Hesbaye flint at Goyet. Referring to Table 2-1, this suggests the regular provisioning of the site during occupation, either via strategy 3 (logistical trips) or 4 (embedded procurement). Either strategy would have been possible, since flint sources are less than 40 km distant and the time and energy expense for logistical trips would not have been too great. However, considering that the flint sources are

located on the Hesbaye and Brabant Plateaus, it is probable that lithic procurement was embedded in subsistence procurement activities. For Goyet, the nearest flint source was exploited. For Spy, Obourg flint was not the nearest, and is actually at the limits of Zone 2. It should be noted that closer sources (phtanite, gray flint possibly from the Hesbaye Plateau) were also exploited and the percentage of Rank 1 material is half that at Goyet. One interpretation is that the Spy occupants obtained Obourg flint in quantity, stocking up, as it were, just prior to occupation at Spy, and a range of closer sources, rather than a single source, were subsequently used.

The Rank 2 materials are better represented at Spy and Goyet than at Maisières-Canal and Huccorgne – present in greater quantity, with evidence of reduction activity at the sites. This suggests the use of strategy 2 (transport of material from a previous site), here a number of prepared cores already in active use, with both primary and secondary reduction occurring prior to further reduction at the study sites. This is suggested by their reduced size in comparison to Rank 1 cores, although their original size is not knowable.

It is likely, too, that Rank 2 materials included blanks and tools in active use. As will be suggested below, Rank 2 materials may represent an active tool kit, for use in day-to-day activities en route to an occupation of longer duration, as well as at a new site, until a new supply of flint could be obtained.

The relatively higher quantity of Rank 2 materials, in comparison to those at Zone 1 sites, suggests that the lack of strictly local flint sources in Zone 2 was known, just as their presence *was* known in Zone 1. The transport of an active tool kit, then, apart from meeting daily needs, can be seen to reflect a degree of planning and familiarity with the landscape and raw material context.

Rank 3 materials are present at Spy and Goyet in very low percentages and are represented only by blanks and finished tools (apart from a single jasper core at Spy). No reduction activity is evidenced: these blanks and tools were prepared and shaped prior to arrival at Spy or Goyet. There are several possible interpretations for Rank 3 materials, but it is not possible, with the data currently available, to support one or another of these interpretations. First, they could reflect the use of strategy 8 (increased intensity of tool use). Second, the supply of blanks could be an anticipatory strategy, along the lines of Rank 2 materials, to have suitable blanks on hand which could be shaped into appropriate tools as needed. Third, such tools, often whole, may have been curated tools, saved for specific needs or simply seen as valuable, much as an American archaeologist guards his/her personal Marshalltown trowel. Fourth, some of these artifacts could have been kept for non-functional reasons – aesthetic, symbolic, a reminder of certain flint sources, etc. – because of characteristics of the material or because of the technical skill invested in the tool. This last could be the case for the chalcedony and jasper at Spy, these being materials not found at other sites.

Briefly then, for Zone 2 sites, the two study sites seem to show the use of multiple strategies. The nearest flint source was exploited, rejecting local poorer quality materials, to provision the site during occupation. A more substantial active took kit was transported to the site, perhaps anticipating the lack of local flint sources. Finally, certain blanks and tools were curated long after the materials on which they were made had ceased to be reduced.

In Zone 3, with Le Trou Magrite as the main example, the structure of the assemblages shows some similarities with Zone 2 sites, but there are some significant differences. For the first time, material other than flint is Rank 1. Referring to Table 2-1, strategy 1 (procure and use local flint) was used, but at Le Trou Magrite substituting poorer quality black limestone for flint. It appears that the distance threshold for flint procurement had been passed and it was no longer cost-effective to obtain flint from non-local sources, either via logistical or embedded procurement. This suggests, in addition, that the catchment territory around a site was not greater than 50 km and was probably in fact even more restricted. This limit would affect lithic

procurement decisions, evaluating the costs of obtaining distant flint versus the use of local, poorer-quality materials.

The Rank 2 material is non-local flint, at Le Trou Magrite it probably came from the Hesbaye Plateau in already greatly reduced form. Most flint artifacts are very small and the material reflects the use of strategy 5 (increased intensity of reduction). The number of trimming flakes (30.6% in Stratum 2 and 38.8% in Stratum 3) suggests the use of strategy 8 (increased intensity of tool use). Ranks 3 and 4 show limited attempts to use other local materials, such as chert and quartzite, as well as the transport of rare phtanite, Spiennes and gray flints. As in Zone 2, these latter non-local materials are represented by curated blanks and tools.

Briefly stated, the case of Le Trou Magrite attests the strategic responses to a raw material context which imposes limitations on choices. Since flint sources lie beyond the distance threshold, they cannot be exploited to provision the site. The remaining supply of flint, transported as an active, but diminished tool kit, is maximized via increased intensity of reduction, producing smaller blanks which were nevertheless used, as well as by means of increased intensity of tool use, substantial resharpening of tools which were transported and shaped at the site. Local limestone was exploited to provision the site, complementing the limited supply of flint.

To emphasize the point that raw material contexts are time- and space-dependent, in this same region, there is a series of Late Upper Paleolithic sites (Chaleux, Trou Abri, Trou Da Somme, Trou des Nutons, Trou du Frontal, Trou Reuviau). These sites were adequately supplied with flint, probably from the Hesbaye Plateau, with no use of local limestone. In some cases, notably Trou Da Somme, silicified limestone coming from the Champagne region, upstream on the Meuse, was also exploited. Such a pattern serves to demonstrate that changes in mobility patterns and procurement strategies made it possible to adequately provision sites in Zone 3 with flint, overcoming the limitations which were insurmountable during the Early Upper Paleolithic. Distance thresholds could thus change: during the Late Upper Paleolithic, procurement and transport strategies were adequate to provision Magdalenian sites in the Lesse Valley, permitting occupation in regions further from flint sources (e.g., Roc-la-Tour near Charleville-Mézières, Champagne region, France [Rozoy 1987]). Long-distance migrations, perhaps seasonal, were possible, and evidence from the Belgian Magdalenian (fossil shells from the Paris Basin found in several Belgian sites) supports the idea of either long-distance exchange or migration between the Paris Basin and Belgium.

Couvin, also in Zone 3, shows a completely different pattern and it is suggested that this is due to differences in site function. The assemblage is composed almost exclusively of non-local flint, probably from the Spiennes source. In contrast to the other study sites, core reduction activity is almost absent, with only a few cores present which were reshaped into tools. Almost half of the assemblage is composed of trimming flakes, supporting the use of strategy 8 (increased intensity of tool use). In comparison with the other study sites, *all* of the material at Couvin is comparable in structure to Rank 3 elsewhere. That is, Rank 3 materials elsewhere are typically represented only by transported blanks and tools, with little or no reduction activity, while Ranks 1 and 2 materials reflect regular reduction activity. At Couvin, it appears that only blanks and tools were transported to the site, with the only reduction activity being tool shaping or resharpening.

Based on these observations, an hypothesis can be put forward to explain variability in lithic assemblages across space and the organization of lithic economy during the Early Upper Paleolithic in Belgium. Strategies of lithic economy are based on an economic model which balances quality of materials against time and energy expenses for procurement. Two factors that could affect economic decisions- quality of material and distance to sources – are considered.

According to the hypothesis, the ranking of materials at each site reflects an ongoing process of attrition and replacement of different materials as groups move across space. Following a single material through time, a material would start its history as Rank 1 at Site A. It would then be transported as an active toolkit to Site B, where it might become Rank 2 (due to attrition, reduction activity, decreasing inclusivity), depending on distance and the nature of raw materials found locally at Site B. Finally, it would then be transported as curated blanks and tools to Site C, where it becomes Rank 3. Theoretically, if one could observe the exact series of sites occupied, one would be able to see a sort of relay effect (Fig. 12-1). At Site B, a new material becomes Rank 1, which is transported to Site C as the active toolkit, etc.

Rank 1:	dominant material, nearest flint source exploited, used to provision a residential site, major reduction activity evidenced
Rank 2:	present in much lower percentages, active toolkit transported from a previous occupation Depending on raw material context, either replaced with a new Rank 1 material or more intensely exploited before being discarded
Rank 3:	rare pieces, represented by curated/transported blanks and tools, no reduction activity evidenced

The assumption is that quality of material will take precedence over distance to sources, up to a certain distance threshold. This means that non-local flint should nearly always be selected over poorer quality cherts and quartzites that are found in the proximity of the site, *within certain distance limits*. Once a critical distance threshold has been crossed, time and energy expenses to procure flint from non-local sources become too great and alternative materials will be utilized instead. This can be seen clearly at Trou Magrite, for both Mousterian and Aurignacian assemblages.

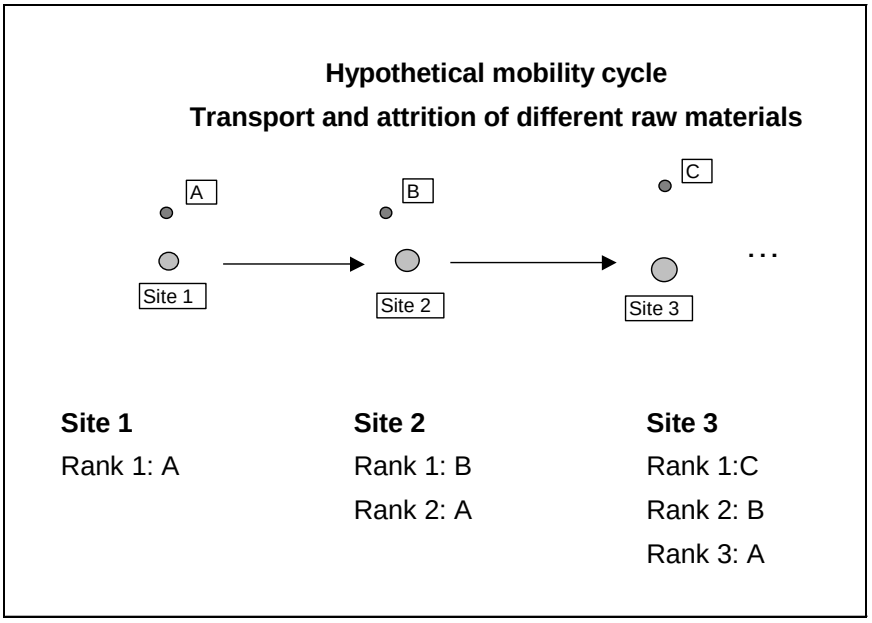

Figure 12.1. Hypothetical mobility cycle showing successive decrease in quantity and changes in reduction strategies as material is transported across space.

A corollary to the existence of a distance threshold is that it effectively corresponded to the mobility range of a group, the catchment area exploited around a site during occupation. The inverse is also true: if flint sources are beyond the distance threshold and thus out of range for procurement, Zone 3 becomes the most distant zone which can be occupied by prehistoric groups. Beyond this point, the lack of raw materials and the extreme distance from flint sources creates a second distance threshold, beyond which even a transported active tool kit would be too reduced to support an occupation. The Ardennes in southern Belgium and the Grand-Duchy of Luxembourg have yielded few Early Upper Paleolithic sites (five sites in Luxembourg, and Trou Magrite as the site the furthest south in Belgium). This southern region, in addition to lacking flint sources, also lacks caves suitable for human shelter and therefore poor preservation and/or visibility of possible open-air sites.

Interestingly, surface surveys in Luxembourg (Ziesaire 1994) have yielded numerous Mousterian finds, albeit not in stratified context. Patterns of raw material use differ radically between the Mousterian and Aurignacian in Luxembourg: Mousterian tools are commonly made on poorer quality quartzite and quartz cobbles and on Devonian quartizitic plaquettes, while from the Early Upper Paleolithic on, these materials were replaced with flint and *chaille*, a poorer quality chert (Ziesaire 1994:35-36). The implication is that the poorer-quality local material was adequate for the flake technology of the Mousterian, but better quality flint (and *chaille*) was necessary for Upper Paleolithic blade technology. Consequently, Mousterian groups were able to better exploit the region of Luxembourg, while Aurignacian groups preferred, perhaps for multiple reasons, to usually remain closer to flint sources (i.e., they were, technologically, tethered to flint sources).

The principal idea then is that prehistoric groups during the Early Upper Paleolithic in Belgium practiced a form of lithic economy that was 1) largely based on minimizing transport costs of raw material procurement and 2) in part anticipatory of a potential lack of raw material in the regions that were exploited by people. Two potential strategies can be envisioned:

> Strategy 1: Partial reduction or core preparation at flint sources with transport of prepared cores to relatively long-term (perhaps seasonal) occupation sites. Blank production and tool preparation occur at these sites. Blanks and tools may be exported to short-term sites for use in specific activities, where the only reduction activity necessary would be tool resharpening.
>
> Strategy 2: Specialized workshops where blank production is carried out, with export of blanks and tools to deliberately provision long-term sites. At such long-term sites, then, there would be a high percentage of blanks and tools and a lesser degree of core reduction evidenced. Workshop sites would consist of large quantities of debris, unsuitable blanks, and cores.

Considering the first point, that the main concern was to minimize transport costs of procurement, it can be seen that the dominant material at all of the study sites (in the three different raw material contexts) came from the nearest flint source, or was replaced by local non-flint materials when the distance threshold was passed. Flint was transported to the site in the form of prepared cores (Strategy 1), although when the source was close, sometimes with a fair amount of cortex remaining. It was reduced at the site to provide blanks for tool production and use during occupation. Flint appears to have been preferred over other materials, such as quartzite and limestone, that may have been locally available, but of relatively poorer quality. Such flint, however, was obtained from the *nearest* flint source, not necessarily the flint source of highest quality, and beyond certain distance limits, was replaced by local material.

There is *no* evidence for bulk transport of prepared blanks and/or tools to sites in regions lacking flint sources (Strategy 2), which would reflect reduction and/or tool production elsewhere (e.g., at specialized workshops at flint sources) with export of blanks and tools to residential sites. In contrast, the materials for which only blanks and tools exist (i.e., no reduction activity) have the lowest rank at each of the study sites; such materials are often represented by only a few pieces. If blanks and tools had been deliberately imported to provision a site, then these materials, evidencing no on-site reduction activity, should comprise a more significant percentage of the assemblage. There is, however, evidence for transport of tools to short-term logistical sites, such as temporary hunting camps. Sites such as Couvin were outfitted with the tools necessary to carry out the desired activities there and little reduction activity other than tool resharpening is observed.

However, Gravettian sites such as Maisières-Canal and Huccorgne, located at or near flint sources, appear to have served as flint workshops, with a great deal of reduction activity evidenced by numerous cores, debris, and abandonment of potential flake and blade blanks. The relatively low frequencies of tools at these sites can be attributed to short-term occupation of the sites (with tools used for domestic activities during occupation) and to probable export of prepared cores, blanks and tools elsewhere. While such flint workshops clearly existed during the Gravettian at least, they did not form a part of a *systematic* strategy to directly and regularly provision other sites. If such a strategy were in place, one would expect to see much higher frequencies of such materials in long-term sites far from the flint sources, in Ardennes cave sites. A more parsimonious interpretation of Maisières-Canal and Huccorgne is that they were perhaps seasonally occupied for flint procurement. Under this scenario, in each season, a replenished toolkit (including prepared cores) would be transported to a more long-term site. Huccorgne, based on lithic refitting of a core by Guilbaud and Martinez (1994), evidences *at least* two separate occupations over the course of a relatively short period. As at Huccorgne, the quantity of material at Maisières-Canal (approximately 30,000 lithic artifacts) supports the idea of multiple occupations over short periods. Such multiple occupations, on a scale of years or decades (even centuries) are not archaeologically identifiable either by identification of separate occupation layers or by absolute dating, because the time scale involved is too short. However, at Huccorgne, two occupations separated by around 2000 years (an occupation at 28-26,000 BP and another at around 24,000 BP) may be distinguished; these levels are apparent in Haesaerts' excavation. Each occupation may have been a series of short-term, seasonal occupations.

During the Magdalenian, a regional system encompassing flint procurement sites, residential sites and logistical sites is more clearly evidenced in the Lesse Valley and on the Hesbaye Plateau. The sites of Goyet (Stratum 2) and Chaleux appear to be residential sites, with the nearby sites of Trou des Nutons, Trou Magrite, Trou Abri, Trou du Frontal, Trou Da Somme, Bois Laiterie and Roc-la-Tour possibly serving as short-term logistical camps (see Otte and Straus (eds.) 1997, Otte (ed.) 1994, Rensink 1993, Charles 1994, 1998). Flint comes primarily from the Hesbaye Plateau and sites there, such as Orp and Kanne, may have served as specialized flint procurement sites with deliberate long-distance transport to provision the Lesse Valley. It should be noted that Trou Magrite is also found in the Lesse Valley, but the flint transported was replaced with local limestone, a strategy not employed here during the Magdalenian period.

The lithic economy appears to have been, at least in part, anticipatory of regions lacking flint sources. Rank 2 materials at a site could be interpreted as the remains of an active toolkit (cores in the process of being reduced, blanks, and tools) transported from a previous occupation. At sites such as Maisières-Canal and Huccorgne, Rank 2 materials are found in low quantities, while at Spy and Goyet, they are more substantially represented. As previously stated, such a pattern could reflect familiarity with the landscape, such that it was known that

there would be flint at Zone 1 sites and none at Zone 2 sites. The transport of a larger active toolkit would have served to provision the site until new material was obtained. At a previous occupation, such Rank 2 material would have been the dominant (Rank 1) material. The active toolkit would have been transported to the current site partly in expectation of a lack of flint, but also simply because it was still "active", i.e., in daily use by the group. At the current site, depending on the raw material context, the active toolkit would either be replaced by the nearest flint source (if a flint source is found within a certain distance range) or be more intensively reduced and conserved (if flint sources are too distant to exploit).

Similarly, Rank 3 materials could represent the last vestiges of a once-active toolkit, now reduced (literally) to a few blanks and tools. These few remaining artifacts are those that have been with the group for the longest time, either as tools used until exhaustion or the last pieces of a stockpile. The material represented has successively gone through Ranks 1 and 2 at earlier occupations - dominant (Rank 1) near the source, then an active toolkit (Rank 2) at a subsequent occupation - and has arrived at Rank 3.

Such Rank 3 materials do *not* in any way reflect *direct* long-distance transport of particular objects, with the considerable time that would be invested in transporting the artifacts directly from a source to the site in which they are found. Time and energy expense has been minimized by curating blanks and tools, transporting them from one site to the next, until they are finally used. My argument is that people did not go from the site in question to a distant source specifically to bring back a few tools. A round-trip such as this would be much too costly in time and energy for the minimal numbers of tools present.

In general, then, the pattern of EUP lithic economy as represented by the study sites is one of attrition and replacement of materials as prehistoric groups moved across the landscape. When the raw material context is "favorable" (i.e., flint available within certain short distance limits, argued in Chapter 4 to be up to 50 km, Zones 1 and 2), the transported active toolkit is replaced by the new nearest flint source. When it is "unfavorable" (i.e., flint sources are greater than 50 km, Zone 3), the active toolkit is more intensely used to maximize the flint on hand. It follows from this point that there is a distance limit from flint sources beyond which groups did not travel (except for short-term camps for specific subsistence-related activities). If a group arrived in Zone 3 (as, for example, evidenced by Trou Magrite), the active toolkit is intensely used and replaced by poorer quality local materials. However, the poorer materials, while adequate for use at the site, are not adequate enough to serve as an active toolkit to transport to regions even more distant from flint sources.