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Refitting stone artefacts: why bother?

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The search for conjoinable prehistoric stone artefacts began over a century ago (Spurrell, 1880) but, except for Worthington Smith's remarkable work at Caddington (1894), this kind of research remained rather pointless. Later, reassembled artefacts helped to elucidate some technical questions, such as the significance of core rejuvenation flakes (Hamal-Nandrin & Servais, 1929) or microburins (Vignard, 1934). In recent years interest in refitting has grown, and it has become an integral part of the study of several prehistoric living sites (Cahen, Karlin, Keeley & Van Noten, 1980). This renewed interest reflects a new approach to stone industries, which instead of being viewed as 'fossils' are now seen as evidence of human behaviour. Such a change results from a new conception of prehistory, which stresses ethnological analysis rather than a preoccupation with chronology. The excavation and study of the open air Magdalenian site of Pincevent, which began in 1964, provides a good example of this change in emphasis (Leroi-Gourhan & Brézillon, 1966 and 1972).

The concept of refitting

The aim of conjoining artefacts is exactly the inverse of the prehistoric knapper, in that the intention is to reconstruct the original nodule from which flakes were struck. Conjoining has also been applied to other materials like pottery (Schietzel, 1975; Cahen & van Berg, 1979), bone (David, 1972; Poplin, 1976) or unworked hearth stones (Julien, 1972; Olive & Pigeot, 1982). When seen as a research strategy and not merely restoration, each refit establishes a spatial relationship between elements of the same block of material. The special nature of refitted stone artefacts results from the fact that their fragmentation is due to a technical, and thus intentional, process which establishes a strong relationship between the fragmentation itself and the dispersal of the fragments. Refitting of stone artefacts thus leads to the study of lithic technology, while the interaction of technology and spatial distribution of the refitted pieces yields more general conclusions relating to the economy, organisation of living areas, duration of occupation and reconstruction of activities and behaviour.

Some practical considerations

The search for conjoinable stone artefacts requires a basic knowledge of typology and technology, as it is necessary to assign the correct place to each piece within the three-dimensional puzzle. Indeed, random attempts to refit pieces would only result in endless frustration.

Particularities of the raw material such as texture, colour, veining, impurities and cortex can be useful guides in conjoining, and grouping pieces using these attributes can help in making the obvious joins. Problems can arise, however, since colour and texture can vary within the same nodule, and the patination and staining of artefacts can vary on the same site.

In addition to hints provided by the material itself, the archaeological context can be a useful guide to refitting, and artefacts from a given excavation unit or feature can be selected for conjoining. The progressive elaboration of refits can also help to suggest new directions for investigation or perhaps generate new hypotheses.

The efficiency and final results of a refitting project depend on the primary goal: if the goal is to examine the steps in a reduction sequence, this can be achieved without too much difficulty. If, however, the aim is the establishment of the pattern of spatial relationships or the internal chronology of a settlement then much more work will be required to reach a reasonable level of probability.

Refitting and lithic technology

If we agree that a study of lithic technology involves more than the simple statement that flakes are detached from a core, then the conjoining of artefacts constitutes a very powerful method of investigation, different from but complementary to flaking experiments. Conjoining shows how each individual artifact has been made and where each artefact fits in a sequence of operations, beginning with the search for and choice of raw material and ending with the abandonment of the utilised tool. Within a reduction sequence then, refitting allows one to distinguish between circumstantial factors, technical constraints and cultural choices, and to build up a technological pattern which may be peculiar to a site, a culture, or even an epoch.

The reassembling of the flint artefacts found in layer 4 from pit number 9 of the Linear Bandkeramik site of Place Saint-Lambert at Liège (Cahen, 1984) has demonstrated the existence of a very repetitive process of blade production. This material consists essentially of flaking waste and of the total of some 50 kg, nearly 80% has been refitted. This layer is not a primary context workshop but contains material dumped from such a workshop, after all the useable products had been selected.

The main characteristics of this reduction sequence are as follows:

- No discernible criterion for the choice of flint nodules: cylindrical, ovoid, conical and irregular shapes were selected, having only their rather large size in common.
- An intensive preparation with a hard hammer, yielding a pyramidal core with a single plain striking platform, achieved without regard for loss of volume or length (Fig. 1.2(*a*)).
- The face of the core (i.e. the surface where blades will be removed) may be prepared in three different manners:

1. Preparation of a crest by bifacial flaking, the length of which is usually shorter than the available length of the core. Indeed, most of the crested blades are shorter than the succeeding blades. The preparation of the crest always follows that of the flat striking platform (Fig. 1.1(*a*), (*b*)).
2. Preparation of a ridge by striking opposing flakes from the base and from the flat striking platform.
3. Preparation by cortical and semi-cortical flakes struck from the flat striking platform, creating a series of parallel ridges (Fig. 1.1(*e*)).

The two last methods are more common for cylindrical nodules. Minor reshaping of the core usually takes place immediately after the removal of the first blades. The aim of such a preparation is to create a core ready for the removal of a large series of rather regular blades. The first blades, including the crest, are usually considered preparatory waste and are thus discarded. Such a rigid conception contrasts with the more opportunistic blade technology of the Upper Palaeolithic. The removal of the blades is done with a soft hammer. The platform, which is invariably plain, and the lack of abrasion of the platform overhangs or previous blade negatives strongly suggest the use of a punch. Indeed, direct percussion would have been useless or even dangerous since the hammer would have hit the platform in several places (Fig. 1.1(*d*)).

The progress of the flaking is controlled by three methods:

1. The removal of core rejuvenation flakes, or 'tablets', modifies the angle between core platform and face and may eventually move the flaking orientation to another side of the core. In Linear Bandkeramik industries such core tablets are rather characteristic, being thick, tabular slices of the core, usually struck off in series (Fig. 1.2(*b*), (*c*), (*d*)).
2. The removal of axial flank flakes ('*flancs axiaux*'). Such flakes are characterised by the presence, on their dorsal aspect, of blade scars parallel to the flake percussion axis. Their aim is to restore the curved profile of the core face, when the face becomes too flat (Fig. 1.2(*a*)).
3. The removal of side-struck flank flakes ('*flancs lateraux*'), whose dorsal surfaces have scars left by blades detached perpendicular to the flake's percussion axis. They are intended to restore the keel of the core, its curve along a sagittal section. When struck off in series, they may prepare a unilateral crest (Fig. 1.1(*c*)).

These three methods may be utilised casually to bypass some flaws within the raw material or some flaking accident. The final products, the blades, are rather standardised both in size and shape. Their length lies between 8 and 12 cm. They are broad and robust and flat and blades with two dorsal ridges are preferred. The reduction sequence is stopped when the core no longer allows the removal of such blades.

Besides the reduction of flint nodules, blades were also produced by the flaking of cores made on flakes. Usually, such flakes result from the preparation of the striking platform of the nodules. The blank is oriented according to its greatest length and this side is shaped as a crest by unilateral retouch, while a platform is prepared by a concave truncation. Like a burin spall, the crested blade has an asymmetrical triangular cross-section while the next blades have a rectangular or trapezoidal cross-section (Figs. 1.3 and 1.4).

The reduction of cores made on flakes does not seem to have been very successful at the Place Saint-Lambert site. However, as there is an obvious lack of large flakes, one may venture the hypothesis that such flakes have been selected, before dumping, for further flaking. Several Belgian Linear Bandkeramik sites contain more cores made on flakes than on nodules and the latter are often reused as hammerstones. Indeed, in the material studied, almost half of the reconstructed nodules lacked their core (Fig. 1.1(*c*)). These observations suggest that the preparation of blades, directly from the nodule, was a specialised craft while the flaking of cores made on flakes was a much more generalised, perhaps 'domestic', operation.

In a rather similar perspective, continuing research conducted on the four Magdalenian open air sites in the Paris Basin (Pincevent (Karlin, 1972), Marsangy (Schmider, 1978; 1982), Etiolles (Pigeot, 1982) and Verberie (Audouze, Cahen, Keeley & Schmider, 1981)) has shown that these sites share the same basic technology of blade production. However, each site presents its own characteristics and further investigation and a closer comparison of these similarities and differences will perhaps elucidate which elements result from a shared cultural tradition and which are related to local constraints (availability, morphology, quality of the raw material) or to the peculiarities of each human group, or different activities.

Refitting and spatial analysis

The pattern of spatial relationships established by the conjoining of artefacts constitutes a basic frame for the study of the spatial organisation of a dwelling place. With few exceptions all reassembled items are contemporaneous as they result from the same activity. However, the interpretation of this pattern differs greatly according to whether the dispersion of artefacts is mainly vertical or horizontal.

1. *Vertical dispersion.* Recently Villa (1982) has analysed the implications of conjoining artefacts for the study of site formation processes using examples provided by the sites of

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Fig. 1.1. Linear Bandkeramik site of Place Saint-Lambert, Liège, Belgium. Pit number 9, layer 4. (*a*) Reassembled nodule showing platform and crest preparation. (*b*) Reassembled nodule showing the exhausted core, platform and crest preparation. (*c*) Reassembled nodule, the core itself is lacking: side-struck flank flake. (*d*) Series of (broken) blades with their flat, unabraded platforms. (*e*) Reassembled nodule with no crest preparation at the first stage of the reduction sequence; presence of crest preparation after the removal of the first cortical blades.

Fig. 1.2. Linear Bandkeramik site of Place Saint-Lambert, Liège, Belgium. Pit number 9, layer 4. (*a*) Reassembled nodule showing platform and base preparation and the exhausted core: axial flank flake. (*b*), (*c*) and (*d*) Series of core rejuvenation flakes.

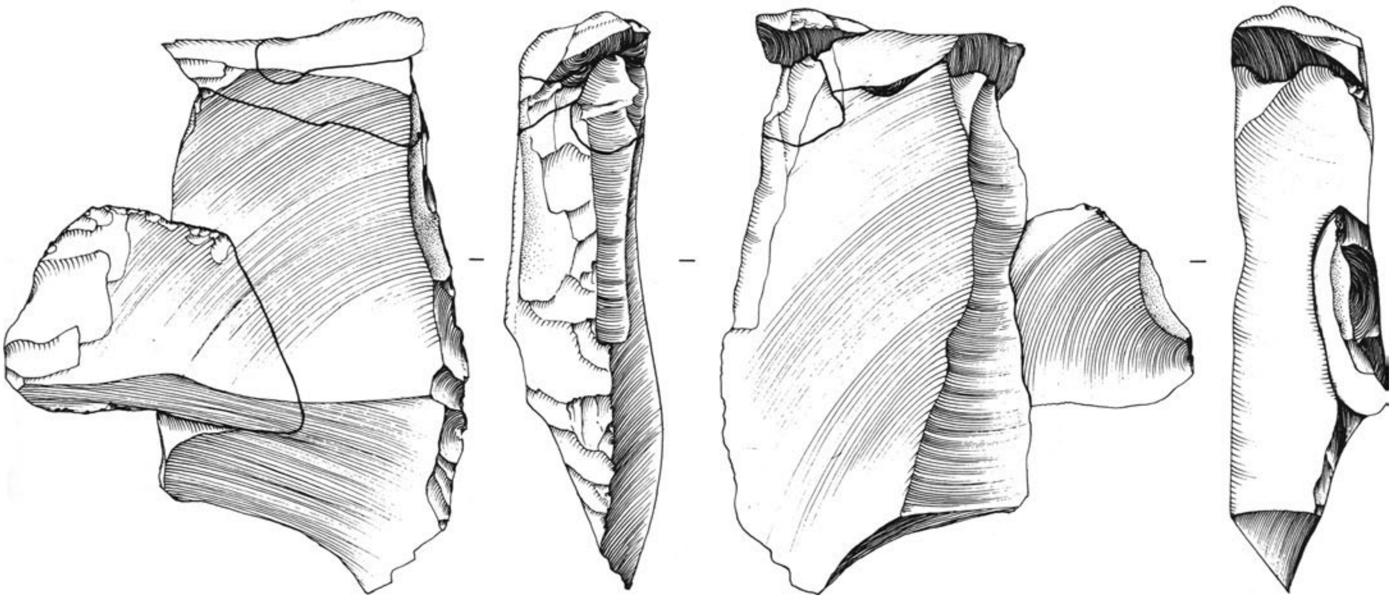

Fig. 1.3. Linear Bandkeramik site of Omal, Belgium. Pit number 3. Core on flake, with some preparatory flakes conjoined.

Gombe Point, Zaire (Cahen, 1976; Cahen & Moeyersons, 1977), Meer, Belgium (van Noten, 1978), Terra Amata, France (Villa, 1976) and Hortus Cave, France (Lumley, 1972; Bordes, 1975). In all these sites, conjoinable pieces were scattered at various depths, within a homogeneous sediment in the first two instances and within various stratigraphical units in the two latter cases. At Gombe and Meer, the vertical dispersion could not be explained by a reuse of older artefacts during a new occupation, as there was no difference in the physical state of the pieces, nor any correspondence between the sequence of removals and depth. In such cases, refitting suggests the existence of post-depositional disturbance not visible during the excavation. In stratified sites like Terra Amata and Hortus, the stratigraphic division is perhaps excessive and probably masks some severe disturbance. In such cases, some critical doubts concerning the homogeneity of the assemblage should be raised and the relevance of the ethnological reconstructions should be questioned.

A rather similar example is provided by the site of Hengistbury Head, England, where Barton & Bergman (1982) have reassembled numerous artefacts found at various depths, within a sandy homogeneous sediment. Moreover, they have conjoined artefacts which were previously attributed on typological grounds to separate occupations including a 'Mesolithic' burin and its 'Upper Palaeolithic' burin spall. The Linear Bandkeramic site of Place Saint-Lambert at Liege, discussed earlier, illustrates a slightly different case. The material found in layer 4 of pit number 9 has been repeatedly refitted with artefacts from higher and lower layers of the same feature. As layer 4 corresponds to the rubbish from a workshop, it is obviously impossible that a blade found in layer 8 (the lowest one) could have been utilised at this level before it was struck off at the level of layer 4, where the core, other blades and waste were found. In such a case one may conclude that the stratigraphic sequence in this pit is due to a succession of human activities and is not simply a straightforward accumulation of sediment due to natural processes.

2. *Horizontal distribution.* The search for conjoinable artefacts is most rewarding when these are found in undisturbed and well-excavated living floors. In such instances the gradual recognition and recording of the spatial patterning of the core reduction sequence provides a dynamic approach to the understanding of the organisation of the dwelling place. The limited number of sites that have been studied in this way prevents us from examining more than a few aspects of this type of investigation, but such work holds great promise for the future. Here we comment on results from the available studies.

Two of the four Magdalenian open air sites of the Paris Basin, Pincevent Habitation 1 (Leroi-Gourhan & Brézillon, 1966) and Verberie (Audouze *et al.*, 1981) have rather similar typology and organisation. Blades were apparently produced around the domestic hearth, which is surrounded by a concentration of flint artefacts including tools and waste. Some large accumulations of waste are found further away, while the cores have been removed (perhaps thrown) towards the periphery of the living site. The various different elements of the reduction sequence do not have the same distribution. While the waste, either in primary, manufactory, or in secondary, dump, context has a *collective* story (see Karlin & Newcomer, 1982), blades and tools seem independent and each artefact has an individual life-history (Cahen *et al.*, 1980). Their scatter must be interpreted with regard to factors such as function, hafting and to the location of activity and dumping areas, but seems unrelated to the place where the blanks were removed.

This kind of organisation contrasts with that observed at

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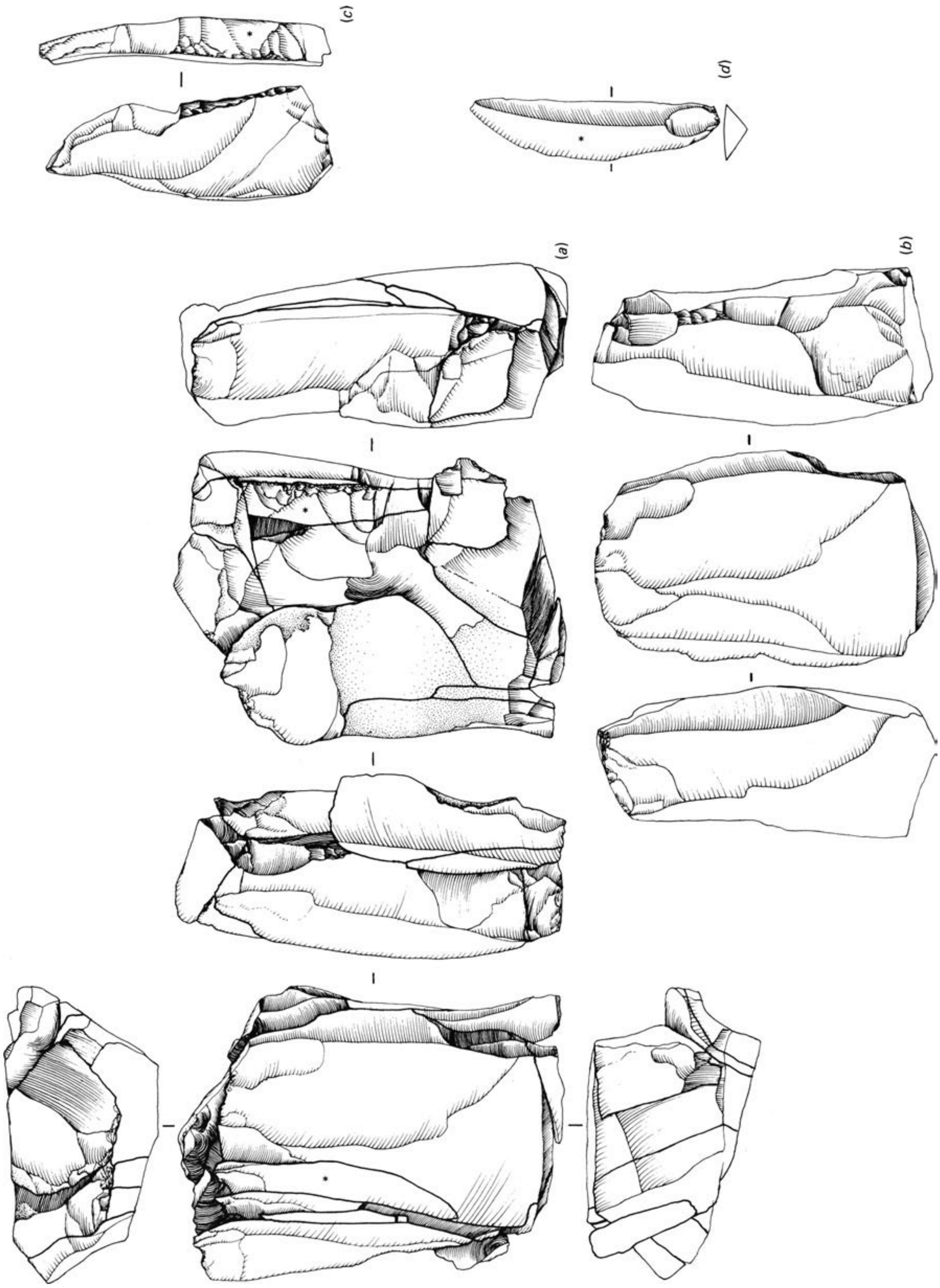

Fig. 1.4. Linear Bandkeramik site of Omal, Belgium. Pit number 3. (*a*) Reassembled core on flake. (*b*) The core alone. (*c*) and (*d*) Blades struck from this core.

the Tjongerian site of Meer, Belgium (Van Noten, 1978; Cahen, Keeley & Van Noten, 1979; Cahen & Keeley, 1980). There, it has repeatedly been observed that the reduction sequence was continuous from the flint nodule onward to the utilised and discarded tool. Tools were found with their manufactory and rejuvenation waste (retouch flakes, burin spalls) and with the preparatory waste of the core. Moreover, when several tools were made on successive blanks, they remain together and have been utilised for processing the same material.

At Pincevent and Verberie, a reserve of blanks is formed which can be utilised gradually according to future need, while at Meer tools are created as an immediate answer to a particular, existing, need. In the Magdalenian examples it was necessary to produce fairly standardised blanks to meet a large range of possibilities; in the Tjongerian case, the flaking and selection of blanks is oriented towards a particular goal. It is also not unreasonable to suppose that the Magdalenian tools were more systematically hafted than those of Meer (Cahen & Karlin, 1980).

Several factors may lead to the misinterpretation of spatial relationships. Such relationships are usually indicated on a plan by straight lines from artifact to artefact. Even if it is obvious that the line does not imply that the movement between two points was perfectly straight, it suggests at least a direct causal relationship. However, the fact that points A and B are linked by the conjoining of two or more artefacts found at these points does not imply a direct connection A–B or B–A in archaeological space. Indeed, such a relationship may be indirect, existing only with respect to a third point: C. At Verberie for instance, two opposite extremities (A and B) of the dwelling are repeatedly linked by the conjoining of tools made on successive blanks (Fig. 1.5). If direct, this relationship would imply that both areas are engaged in the same activity. However, as the tools each have an independent history, the spatial relationship between them exists only in relation to place C, where the blanks were struck off, probably somewhere near the hearth. The exact location of C remains unknown. At this site, most of the preparatory waste comes from another area, D, which appears to be an accumulation of dumped material. In this case the waste material has been removed from the place of production, C, to the dump area, D, while the tools were used independently in A and B (Fig. 1.5). It is also possible that the two blanks were kept for some time in a reserve, E, before being retouched. The problem is that if it is easy to point out areas like A, B and D, area C is more difficult to find while E, though likely, remains totally conjectural.

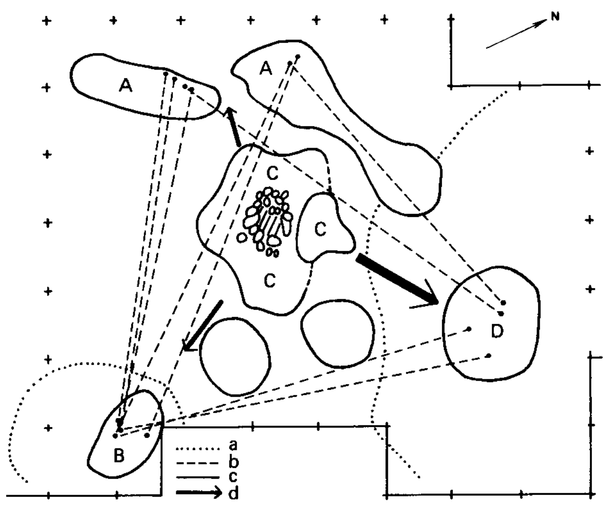

Fig. 1.5. Magdalenian open air dwelling of Verberie, Oise, France. A and B: location of tools. C: presumed location of blade production. D: accumulation of flint waste. (*a*) Limits of dumping areas (flint, bone, stone). (*b*) Conjoined artefacts (A–B or B–A: tool–tool or tool–blank; A–D or B–D: tool–blank-waste). (*c*) Limits of archaeological features. (*d*) Presumed relationships between some archaeological features (C–D: removal of waste; C–A and C–B: movement of tools).

Technique+space=time

In an archaeological deposit, the fourth dimension of human activities, time, can be approached in two ways. When the thickness of the deposit exceeds that of one artefact, the microstratigraphy of such an accumulation yields an objective but relative chronology which, however, gives no idea of duration (Pigeot, 1982). On the other hand, the reduction sequence, when reconstructed, arranges the artefacts in a technical succession, whose duration may be estimated, for instance, by comparison with experimental flint knapping. Microstratigraphy is strictly limited in space and relates primarily to the process of accumulation. Refitting concerns a particular set of artefacts related to an activity and is thus equally limited. However, both approaches are complementary and may be combined, thanks to the conjoining of accumulated artefacts. It then becomes possible to build up a more general chronology for the whole occupation, which may sometimes then be extended to allow several occupations within the same site to be recognised (Pigeot, Taborin & Olive, 1976; Baffier, David, Gaucher, Julien, Karlin, Leroi-Gourhan & Orliac, 1982; Audouze & Cahen, 1982).

Such time-consuming research may be considered unrewarding or anecdotal since the occupation itself, as a whole, represents only a very short moment compared to the prehistoric time scale. From this point of view, all the effort involved illuminates at best only a very short part of the daily life of a few individuals. However, if it is necessary to consider the period of occupation as a time unit, the establishment of its internal chronology yields some important and general conclusions. For instance, if it is possible to recognise the activities performed at the beginning and at the end of the occupation, respectively, and if one can demonstrate which elements have been brought to the site and which have been removed, the correlation of these two sets of data allows us to extend the interpretation beyond the limits of the site itself. At Pincevent, for example, the exotic cream-coloured flint present on the site probably represents equipment carried by the Magdalenians when they arrived. The repetitive pattern of this particular flint from habitation to habitation, indicates that the hunters always came from the same area (Leroi-Gourhan & Brézillon, 1972). At Verberie, on the other hand, two flint nodules, among the most carefully and skilfully prepared, were probably knapped right at the end of the occupation. None of the blanks removed from these nodules have yet been found. This suggests that the blanks were taken away from the site by the departing Magdalenians (Fig. 1.6; Audouze *et al.*, 1981: Fig. 16 and 15). Such results make it possible to consider a prehistoric site not as a single, isolated, unit but as a stage within a cycle of occupations and activities. From such a point of view, palaeolithic nomadism is no longer a theoretical model but a tangible reality.

As for spatial organisation, the interpretation of the temporal structure may be hindered by several factors. As blanks and tools have an individual history, independent of the collective one of the waste, for the most part they cannot be fitted into a precise chronology. Indeed, in the technical sequence, a platform preparation flake is surely earlier than the blade removed from this platform. However, this technical relationship does not imply any priority between the spots where this flake and this blade have been found. Similarly, a blank produced at the very beginning of the occupation may have been retouched, utilised and discarded only at the very end of the stay.

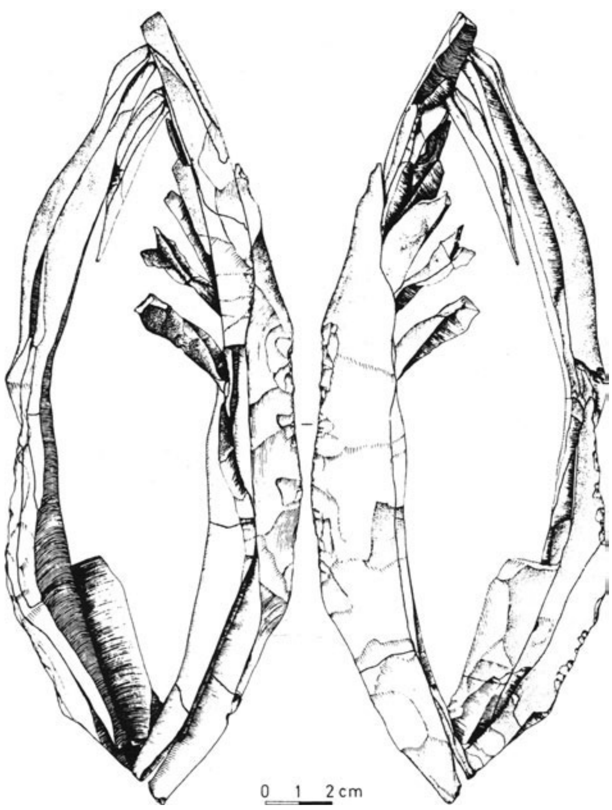

Fig. 1.6. Magdalenian open air dwelling of Verberie, Oise, France. Reassembled series of preparatory blades struck from opposite platforms. Neither core nor blanks have been found at the site.

The reconstruction of the reduction sequence does not imply that the sequence was continuous through time. Continuity or discontinuity of the sequence may have important implications for the interpretation not only of the chronology but also of the organisation of activities. A continuous sequence will usually be attributed to a single flint knapper. On the other hand, a discontinuity may perhaps indicate the participation of two or more craftsmen. Another question then arises: How can we demonstrate continuity or discontinuity within an archaeological deposit? Such a demonstration rests mostly on an assumption linking time and space: a spatial interruption within the reduction sequence (i.e. within the distribution of its elements) will be considered as a possible sign of discontinuity, especially if it corresponds to a technical break in the process. Thus, a change of location between the preparation of the core and the removal of the blades, or between two series of blades, indicates a discontinuity in the process, the length of which perhaps exceeds the time necessary to move from one location to another. But if this movement is not accompanied by a conceptual modification of the process, it remains rather difficult to assume that one or more flint knappers are concerned. C. Karlin provided a good example with core B. 22–159 from Pincevent Habitation I (Cahen *et al.*, 1980). This core was prepared and reduced near hearth II and afterwards modified and reprepared near hearth III. In such a case, the assumption that the change of location corresponds to a discontinuity of some length and even to a change of knapper appears reasonable. However, all these assumptions primarily relate to the waste material and not the blades or the tools.

Conclusion

The search for conjoinable artefacts is a time-consuming operation which immobilises an archaeological assemblage for rather long periods. Therefore, before entering upon such an analysis, it is necessary to evaluate carefully its purpose and value. The method is very helpful in providing a better knowledge of lithic technology and may also help us to understand the archaeological context. Furthermore, when circumstances are most favourable it may allow us to recognise an organisation through space and time within a prehistoric dwelling-place. Such results are not an automatic consequence of the method: even if one succeeds in refitting several artefacts found in a fluviatile deposit, this achievement does not turn this rather disturbed site into a primary context occupation. At best, it demonstrates that disturbances were limited in lateral extent.

Each method of study used in the analysis of prehistoric material offers certain possibilities and has its own limitations. Taken by itself, the refitting of prehistoric artefacts has little significance since the reconstruction of a block of flint has, taken alone, limited interest. However, there is no denying the feeling of closeness to prehistoric man, that is given by rejoining flakes that were struck apart thousands of years ago.

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