Geological Processes and Site Structure: Assessing Integrity at a Late Paleolithic Open-Air Site in Northern France

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The difficulty of reading the archaeological record of caves and rock shelters is becoming increasingly obvious to Paleolithic researchers. Although some open-air sites are thought to avoid such taphonomic complications, interpreting their archaeological record is less straightforward than assumed. Postdepositional processes may obscure structure in configurations of features and artifacts. Recently developed techniques for the excavation and analysis of Paleolithic cave sites can be applied to open-air sites before spatial patterning is interpreted for inferences about prehistoric social organization. Analysis of the orientation of elongated artifacts on the occupation surface of the late Upper Paleolithic site of Verberie, France, is employed for evaluation of the integrity of site structure. Results indicate spatial structure largely undisturbed by geological processes. The lack of disturbance in the configuration of archaeological materials allows for a behavioral interpretation of those remains. The proposition that Verberie was a hunting campsite for initial carcass processing is supported. © 2006 Wiley Periodicals, Inc.

INTRODUCTION: CAVES AND OPEN-AIR SITES

The history of Paleolithic archaeology has been largely written in the sediments of caves and rock shelters. From the earliest days of archaeological research on the antiquity of humans on Earth, data from such sedimentary contexts have been the driving force in the interpretation of our distant past. This has largely been a function of paradigmatic perspectives. Although Boucher de Perthes' excavations in the gravel terraces of the Somme Valley in northern France were the first to convincingly establish the antiquity of human occupation in association with extinct faunal species, those excavations were long ignored. Their significance was poorly understood due to a variety of provincial attitudes among learned societies. Even during paradigmatic transitions from unilinear evolutionary to cultural historical perspectives, mainstream archaeological research on the Paleolithic Period continued to be focused upon deep stratified deposits in caves and rock shelters, particularly in the incredibly rich sites of the Périgord in southwestern France (Laville et al., 1980). They are the loci of a sure-fire professional strategy for archaeologists to achieve the goals of their paradigms, where one could be assured of finding rich cultural and

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paleoenvironmental data, and the opportunity to investigate comparative change through the successive geological layers. Methods in caves and rock shelters were dominated by stratigraphic pits and trenches focused on representative samples of typologically defined artifacts in their correct stratigraphic sequence.

With the advent of radiocarbon dating in the latter half of the 20th century, there was the possibility of a greatly widened scope of archaeological research. For the Paleolithic of the Old World, typologically driven chronostratigraphic concerns were supplemented by quests for more information about prehistoric peoples' lifestyles and their economic and social organization. One way of broadening the perspective was to look for spatial organization in archaeological sites. A great deal of interest has been paid to site structure in Paleolithic contexts. Because the number of Paleolithic sites significantly decreases with the age, it has been imperative to maximize the information derived from each site. Paleolithic sites are relatively small, in comparison to villages or towns of later periods; much more effort can be justified in the detailed piece plotting of a greater proportion of the artifacts than is usually the case for the later, larger sites. Procedural emphasis shifted from vertical to horizontal excavation, continuing a trend for finer and finer stratigraphic control that had been used for stylistic and temporal determinations. The search for "living floors" gained greater precedence in Paleolithic archaeology. At first, this was carried out in the traditional places, such as caves and rock shelters, that were incredibly rich in artifactual material in well-preserved contexts. In contrast to French archaeologists who were trained as Quaternary geologists, American archaeologists were trained as anthropologists and thus sought richer anthropological meaning from the excavation of Paleolithic archaeological sites. Living floors of Upper Paleolithic levels of the Abri Pataud were interpreted as evidence of various schemes of band social organization, according to the size and placement of hearths in the rock shelter (Movius, 1966).

With changes of paradigms and excavation methods toward more detailed reconstructions of prehistoric behaviors at archaeological sites, studies of site structure or spatial analyses have sought to relate different activities or functional components of contemporaneous occupations within archaeological occupations. The difficulty of reading the archaeological record of caves and rock shelters is becoming increasingly obvious to Paleolithic researchers. The scale and duration of long-term accumulations in such time-averaged, or palimpsest, deposits render them inappropriate for most studies of site structure and subsequent interpretations of social organization. Thousands of specimens have accumulated over the long-term durations of geological and artifactual deposition. The very nature of time-averaged deposition is that the human behaviors responsible for the deposition of each object may have little or no relationship with the deposition of any of the other objects. This is not to say that the deposits in caves and rock shelters are disturbed, but that separating and deciphering short-term events within the time-averaged accumulations are very difficult or virtually impossible in many cases.

There may be other agents of accumulation or preservation that the objects may have in common, a question to be clarified through taphonomic research. If we seek to use the spatial organization of those objects to give us insight into the technological,

economic, or social organization of the occupants of an archaeological site, those accumulations are very difficult to sort out. Our eventual goal is to understand those aspects of human behavior that are intricate and integrated parts of human social and subsistence behavior, and that contribute to their adaptive and evolutionary success, but we need to determine if our data are appropriate for our theoretical goals.

Some have argued that open-air sites might be more propitious for studies of site structure and have developed methods for more comprehensive and integrated excavation and recording of surfaces rather than stratigraphic columns. One of the great advantages of open-air archaeological sites is that they frequently lack that landscape feature so attractive to prehistoric hunter–gatherers (i.e., the cave or rock shelter). Therefore, the deposits at many open-air sites might represent single-occupation events, rather than repeated accumulations upon relatively stable surfaces. As single occupations for often mobile hunter–gatherers in the Paleolithic Period, they tend to be short term in the duration of occupation. Additionally, because they are not so constrained by the physical barriers of cave or shelter walls, activities can be more spatially dispersed, rather than necessarily piled on top of one another. This may lend clarity to the organization of activities or patterns of disposal. Recognition of the patterning inherent in such a dispersed distribution of features and artifacts may require a considerably more extensive excavation to capture the real scale of occupation on an open-air site (O'Connell, 1987). Both of these factures can lend clarity to the spatial organization of prehistoric campsites preserved at such archaeological sites.

This was the perspective of André Leroi-Gourhan. In contrast to those Paleolithic archaeologists focused on stratigraphic relationships of Quaternary geological deposits, Leroi-Gourhan was trained as an ethnologist. He was interested in bringing a more anthropologically based perspective to archaeology, in many ways more in line with the theoretical perspectives of Anglophonic archaeologists. Influenced by his familiarity with Russian open-air sites excavated in the late 19th and early 20th century (Vasil'ev, 2004), he began to operationalize this perspective by implementing the excavation technique known as *décapage*, in which large horizontal surfaces were exposed, emphasizing the synchronic nature of an archaeological occupation, rather than a vertical profile emphasizing the diachronic aspects of successive occupations. It was preferable to be able to see the entire area of a single occupation, so that internal relationships would be visible. This procedure was based on an assumption that the excavated surface represented a relatively short-term occupation, one that was contemporaneous and contained internally integrated components of a single social group. He initiated excavation and planimetric photographic recording procedures at Arcy-sur-Cure (Leroi-Gourhan and Leroi-Gourhan, 1964) and fully developed it at the open-air site of Pincevent (Leroi-Gourhan and Brézillon, 1966, 1972). The goal of the *décapage* method is to define single-occupation surfaces and to record them as "living floors," which can be analyzed for spatial structure and eventually for what he termed *paleoethnology* (Audouze and Schlanger, 2004). While Leroi-Gourhan attempted to operationalize this method in the caves at Arcy-sur-Cure, depositional complexity made this a difficult task. When the finely stratified alluvial silts encompassing well-preserved features, artifacts, and faunal remains

were discovered at Pincevent in 1964, the cave deposits were immediately abandoned and a long-term program of excavation and detailed vertical photographic recording was initiated at Pincevent.

What was important in Leroi-Gourhan's case was the difference in the geological context between the caves at Arcy-sur-Cure and the nature of the alluvial sediments at Pincevent. The varve-like finely bedded sediments resulted from relatively gentle overbank flooding, probably due to ice dams just downstream at a valley constriction, when decrease in flow velocity dropped silts on top of riverbank surfaces that had been occupied by Magdalenian hunter–gatherers. A deep sequence of these silts preserved the well-separated short-term occupations at Pincevent, leaving the very clear spatial patterning of each occupation surface. This depositional sequence, punctuated by archaeological occupations, allowed him and succeeding generations of archaeologists to perform finely detailed analyses on technological and social behavior, notably refitting of flint, fire-cracked rock (Julien et al., 1992), and animal bones (Enloe and David, 1992; Enloe, 2004), which helped confirm the contemporaneity of integrated archaeological surfaces of short-term occupations, yielding fine-grained "snap shots" of those prehistoric campsite surfaces. The clarification of the archaeological record that resulted from the excavation and recording procedures at Pincevent contributed to the compilation of an extraordinarily rich and detailed database for secondary studies by other researchers. It has served as an exemplary case study for numerous mathematically based spatial studies (e.g., Enloe, 1983; Simek and Larick, 1983; Carr, 1984; Johnson, 1984; Simek, 1984a, 1984b, 1987).

Site structure has been one of the major sources of information about social structure of prehistoric humans. While Leroi-Gourhan derived his models of spatial structure and inferred social organization at Pincevent inductively, based on empirical observations of the patterning of the archaeological record, considerable effort has been directed to spatial structure in ethnoarchaeological research among modern hunter–gatherers (e.g., Yellen, 1977a, 1977b; Binford, 1978, 1982, 1990; Whitelaw, 1983, 1991; O'Connell, 1987; Janes, 1989; Simms and Heath, 1990; Gamble and Boismier, 1991). Regardless of the methodological means for attaching meaning to observed patterning or variation in the archaeological record, the key concept lies in the degree of preservation. Although many depositional details and intensive analytical techniques have confirmed the high level of resolution and low level of perturbation of the spatial patterning at Pincevent, very few open-air surface sites can claim the same level of preservation and direct interpretability of the spatial patterns, the so-called "Pompeii premise" (Ascher, 1961; Binford, 1981).

We need an independent assessment of the integrity of such archaeological sites. What needs to be investigated and demonstrated is the integrity of such preserved open-air deposits. Is the spatial configuration of archaeological materials a function of human behaviors or is it a function of a number of taphonomic and site-formation processes? Or do the observed spatial patterns result from a combination of all of these processes? This is the challenge that must precede anthropological analysis of the archaeological remains. Taphonomy has been an axis of research that has frequently focused on content, particularly the presence or absence of animal bones on archaeological sites. Site structure has been another axis of research focused on the

interpretation of configurations of artifacts and features. This study deals with one primary aspect of site integrity: configuration, or patterns of spatial distribution of artifactual specimens, relative to other specimens or artifacts and to archaeological features, such as hearths or shelters.

SPATIAL ANALYSIS AND SITE INTEGRITY

Archaeologists have used spatial information to identify activity areas, which reflect the organization of work and of society. In Paleolithic archaeology, it has often been used in an attempt to differentiate supposed forager-organized, Middle Paleolithic sites from logistical collector-organized Upper Paleolithic ones (Binford, 1980; Simek, 1987). Although there may be problems for their application to archaeological sites and remains from premodern hominids, we should be able to use soundly based ethnoarchaeological data for interpreting site patterns created by anatomically modern humans, such as the Magdalenian occupants of Verberie.

Many techniques recently developed for the excavation and analysis of Paleolithic cave sites can and should be applied to open-air sites previously considered to have undisturbed configurations. It is only after such analyses that spatial patterning can be analyzed and interpreted for inferences about prehistoric social organization. We cannot presume that, because there has been good preservation of faunal material, it follows that the spatial patterning of the distribution of artifactual materials in relation to features and other artifacts is undisturbed. This needs to be established prior to spatial analysis of the features and artifacts (Dibble et al., 1997; Audouze and Enloe, 1997).

Although certain open-air Paleolithic sites, such as Pincevent or Verberie, are thought to be free of the complications of taphonomically charged, time-averaged site-formation processes that are evident in long-duration cave and rock-shelter deposits, the reading of the archaeological record is probably less straightforward than assumed. A number of postdepositional processes may operate to obscure latent structure in the configurations of features and artifacts. This may be particularly true of open-air sites like Verberie, which have been well preserved because of the deposition of alluvial sediments soon after the archaeological occupation responsible for leaving the bones and other artifacts on the surface.

Although the alluvial silts may have preserved the organic materials, the fluvial processes responsible for their deposition may have compromised the integrity of the deposit in two ways, both related to the velocity of the stream flow. First, the moving water may have been responsible for the accumulation of the artifacts, assembling unrelated objects into a common geological context, creating a palimpsest deposit, or the flow of water may have differentially removed objects, depleting the remaining assemblage (Isaac, 1967; Bunn et al., 1980; Schick, 1986). Either of these would bias the content of the assemblage, according to specimen size, shape, or density (Hanson, 1980). Second, even if the velocity of water flow was insufficient to add or remove specimens, it might move them within the site and perturb the original spatial distribution that might have yielded useful information about human behavior.

Following the work of Isaac (1967), Schiffer (1972, 1983), Schick (1986), and others, assessment of the behavioral integrity of patterning in the archaeological material and the elucidation of site-formation processes have become major concerns of archaeologists. Spatial analysis of artifact distribution has been an important component of Paleolithic archaeology, usually referred to as analysis of "living floors." With growing awareness of the complexities of site-formation processes and their implications for recognition of occupation surfaces, archaeologists have been paying more attention to excavation and analytical methodologies, which will allow evaluation of degrees of presumed integrity (Audouze and Enloe, 1997).

ASSESSING GEOLOGICAL INTEGRITY: FABRIC ANALYSIS

One method of evaluating the integrity of spatial patterning is analysis of three-dimensional orientation, referred to as fabric analysis, a common procedure in geological studies (Benn, 1994). It is derived from measurements of "strike" (horizontal orientation) and "dip" (vertical orientation). Fabric analysis is increasingly employed for assessing archaeological levels at Paleolithic sites (e.g., Kroll and Isaac, 1984; Kluskens, 1995; Combier et al., 2002) for disturbance by stream flow (Dibble et al., 1997), movements on slopes (Bertran and Texier, 1995), pedoturbations by biological activity, or shrinking and swelling of clayey sediments (Lenoble and Bertran, 2004). The analysis of horizontal orientations on planar surfaces is the primary interest of the present analysis, concerning lenses of artifacts deposited upon and bedded within fine-grained alluvial sediments adjacent to a Pleistocene river channel. Elongated objects that have been subjected to linear flow in streams or to gravitational forces on slopes tend to orient themselves either parallel or perpendicular to the slope or flow (Kelling and Williams, 1967; Rick, 1976; Blatt et al., 1980; Dibble et al., 1997). The resultant spatial patterning, when displayed on a circular histogram or rose diagram, exhibits two major axes of orientation at right angles to each other, with much less orientation in any direction between those axes.

Dibble et al. (1997) employed a variety of means to evaluate the depositional integrity of the Lower Paleolithic site of Cagny-l'Epinette in the Somme Valley of northern France. They examined artifact dimensions and edge damage, presence or absence of butchering marks on faunal material, and horizontal and vertical spatial distributions and orientations of artifacts. They argued that the horizontal orientations of elongated artifacts were aligned with the direction of the river flow at the time of the deposition and with the direction of the terrace slope toward the river (Figure 1). These orientations were consistent between artifacts and naturally occurring objects in their excavations. Their conclusion was that virtually all of the material "was disturbed through stream action and thus not in the place of its primary deposition" (1997, p. 642). The largest lesson drawn from their project was the necessity of incorporating tests of a site's taphonomic history into the excavation strategy; it is necessary to integrate methodical observations of both the geological context and the archaeological materials in those procedures (1997, pp. 644–645), so as to determine the degree of postdepositional disturbance, rather than simply determining a

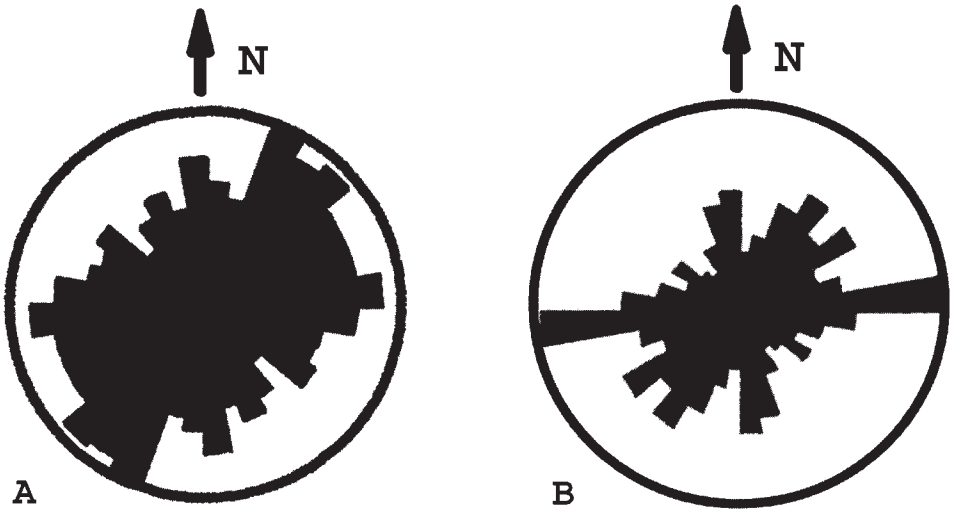

Figure 1. Orientation distribution of (a) artifacts and fauna and (b) natural objects at Cagny-l'Epinette; 10-degree classes (from Dibble et al., 1997, p. 646).

dichotomy between pristine and disturbed, a point emphasized by Audouze and Enloe (1997).

Lenoble and Bertran (2004) compared the open-air sites of Etiolles, another late Upper Paleolithic site in the Paris Basin, and Croix-de-Canard, a Middle Paleolithic site in the Périgord, to Caminade, a rock shelter with late Middle Paleolithic and early Upper Paleolithic levels in the Périgord. For the open-air sites, they found that pedoturbations were easily detected, but that the degree of disturbance or the integrity of the lithic assemblages was difficult to determine. The Caminade analysis indicated a complex succession of cultural and natural processes, making it very difficult to identify surfaces, much less evaluate their behavioral integrity.

Bertran and Texier (1995) investigated the preferred orientation of elongated artifacts by studying selected drawings of the excavations at Pincevent and Verberie, late Upper Paleolithic sites in the Paris Basin. Although the application of a chi-square test to the material from a sample of approximately 1.5 m^2 at Verberie did not reject the hypothesis of a random distribution, the same test applied to the orientation of ribs from a sample of 18 m^2 at Pincevent material resulted in a rejection of this hypothesis. They attributed that failure at Pincevent to bias introduced by "a tendency of the drawer to represent the objects parallel to the axes of the excavation grid" (1995, p. 527). It must be noted that the distribution and orientation of objects represented in the drawings selected for their analyses of the Verberie sample were derived directly from vertical photography (Figure 2a), which should not be subject to much interpretive bias in their renditions. Despite McPherron's (2005, p. 11) contention that their analysis of the Pincevent sample was drawn from orientations traced directly from vertical photographs and that

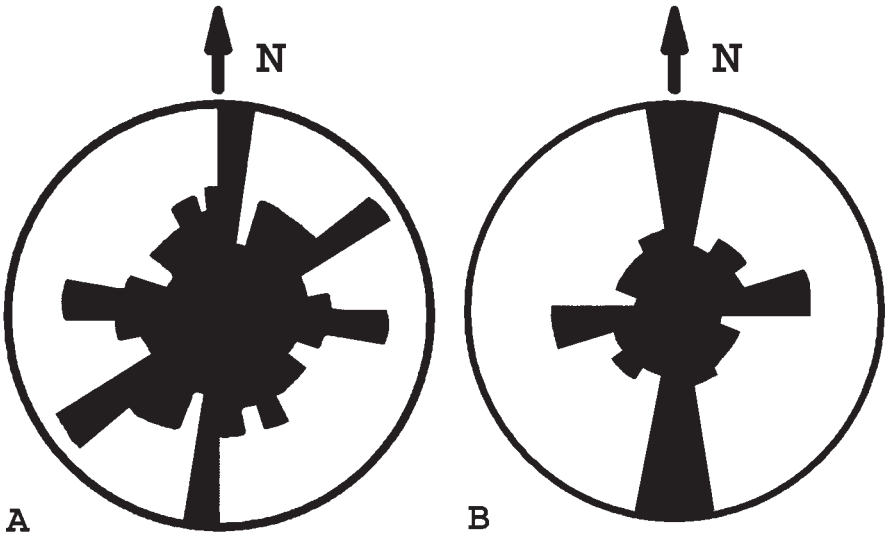

Figure 2. Orientation of elongated objects from (a) a ~1.5-m^2 sample of Verberie II_1; 10-degree classes, $N = 80$; circle = 9 (from Bertran and Texier, 1995, p. 527). (b) A sample of long-bone diaphyses at Section 36 of Pincevent. 20-degree classes, $N = 100$; circle = 25 (from Bertran and Texier, 1995, p. 528).

it correctly shows fluvial orientation of the artifacts, Bertran and Texier's (1995) analysis (Figure 2b) used a summary distribution schematic for long bones (Leroi-Gourhan and Brézillon, 1972, p. 174, Figure 94) rather than the much more accurately drawn (and less susceptible to interpretive bias) plans, which were derived directly from the vertical photographs and rendered at 7 times the scale of the summary schematic in the same publication. If their assessment of the source of error is, indeed, the second-hand representation of the orientations, then perhaps that can be avoided by using the primary measurements taken directly in the field. McPherron (2005) provides a detailed description of procedures for recording provenience and orientation with a total station and for analyses appropriate for assessing site integrity.

THE ARCHAEOLOGICAL CASE: VERBERIE

The point of these examples and the succeeding analysis is the evaluation of the spatial integrity of a late-Magdalenian hunters' campsite in the Paris Basin, for which ethnoarchaeological information has been used to infer human behavior from archaeological spatial patterning. The archaeological site of Verberie, le Buisson Campin, in northern France (Figure 3) has been preserved by gentle, overbank flooding of the Oise River (Enloe and Audouze, 1997; Audouze and Enloe, 1997). Beneath the plow zone, fine-grained Pleistocene sediments (silts and sands) encompassed multiple lenses of artifactual material, separated by sterile sediments. The overbank flooding, thought to be similar to that at Pincevent, appears to have resulted in extraordinary preser-

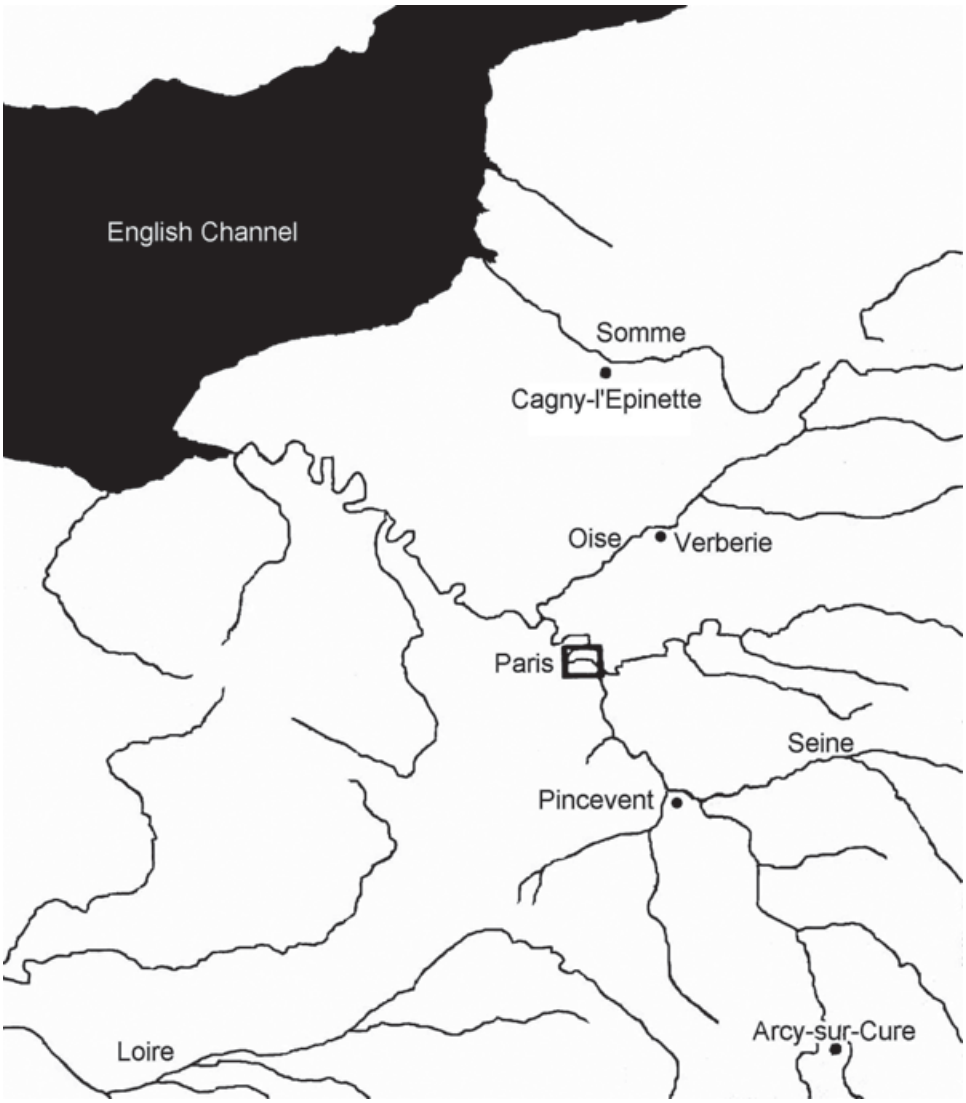

Figure 3. Locations of the archaeological sites in the north of France, including Verberie, Pincevent, Cagny-l'Epinette, and Arcy-sur-Cure.

vation of faunal material and of spatial structure, including the layout and organization of the campsite. These lenses constitute what have been interpreted as archaeological occupation surfaces, consisting primarily of hearths, flint debris, and animal bones, arranged in varying configurations across the excavated area. Almost all (98%) of the faunal remains are attributed to reindeer (*Rangifer tarandus*) on all of the levels. The relatively high proportion of identified faunal specimens (NISP = 4522, 71%

of 6,411 specimens on level II_1) argues for good preservation. Although individual bone specimen preservation appears to be very good at first glance, a taphonomic assessment is in order prior to investigation of the spatial structure.

Beginning in 1976, over 250 m^2 were excavated in the area, which yielded apparently sufficient preservation for analysis of fauna and structure. The latest occupation, labeled II_1, with an AMS date of 12,430 $\pm$ 120 yr B.P., was excavated over the largest portion of that surface, and is separated by about 2 cm of sterile sediment from the underlying level II_2. Excavation was carried out by the classic *décapage* method developed by Leroi-Gourhan and Brézillon (1966, 1972) at Pincevent. At Verberie, all archaeological objects of an appreciable size ($>$ 2 cm) were excavated and left in place. Those are the objects that conform to the minimum size most amenable to fabric analysis (Lenoble and Bertran, 2004). Deposition of artifacts at Verberie was essentially flat, with little evidence of size sorting. Minor bioturbation appears restricted to vertical movements of the smallest objects in root and burrow disturbances that could easily be seen by differences in sediment color. The positions of large, horizontally placed artifacts were used to define an occupation surface, which was then vertically photographed to record their spatial positions, and finally removed, numbered, and curated. From 1991 to 2002, additional locational information was obtained using an electronic theodolite, or total station, to record three-dimensional coordinates of every mapped object, following methods elaborated by Dibble (1987). Among those items mapped with the theodolite, certain objects, such as flint blades or long bone diaphyses, were significantly elongated. Because fabric strength is highly dependant on elongation (Drake, 1974; Kjaer, 1998), Lenoble and Bertrand (2004) recommend that length-to-width ratios of greater than 1.6 be used for determining preferred orientation. At Verberie, items for which two measurements were taken significantly exceeded this ratio. Since 1991, there were 1,296 objects in level II_1 and 2,574 objects in level II_2 measured by the total station, yielding three-dimensional coordinates. Elongated pieces make up approximately 17.5% and 20.4% of those totals, respectively.

RESULTS

The fabric analysis focuses on the planar or horizontal organization of the artifactual items on the occupation surfaces at Verberie. Bertran and Texier's (1995) fabric analysis at Verberie concerned an area of only 1.5 m^2, primarily in square F19 level II_1. This study is intended to increase the area and the sample size of observed orientations to increase the strength of the evaluation of the spatial-pattern integrity to be interpreted for prehistoric technological, economic, and social organization. Two measurements were taken on clearly elongated objects, such as flint blades or long bone diaphyses, recording their end points for evaluation of dip and strike. The strike orientations are presented in rose diagrams, or circular histograms, which allow us to visualize the dispersion or clustering of orientations. The data are presented bidirectional over 180 degrees, with half of the diagram as a mirror image of the other half. The north axis is perpendicular to the paleochannel of the Oise River at the time of the Magdalenian occupation.

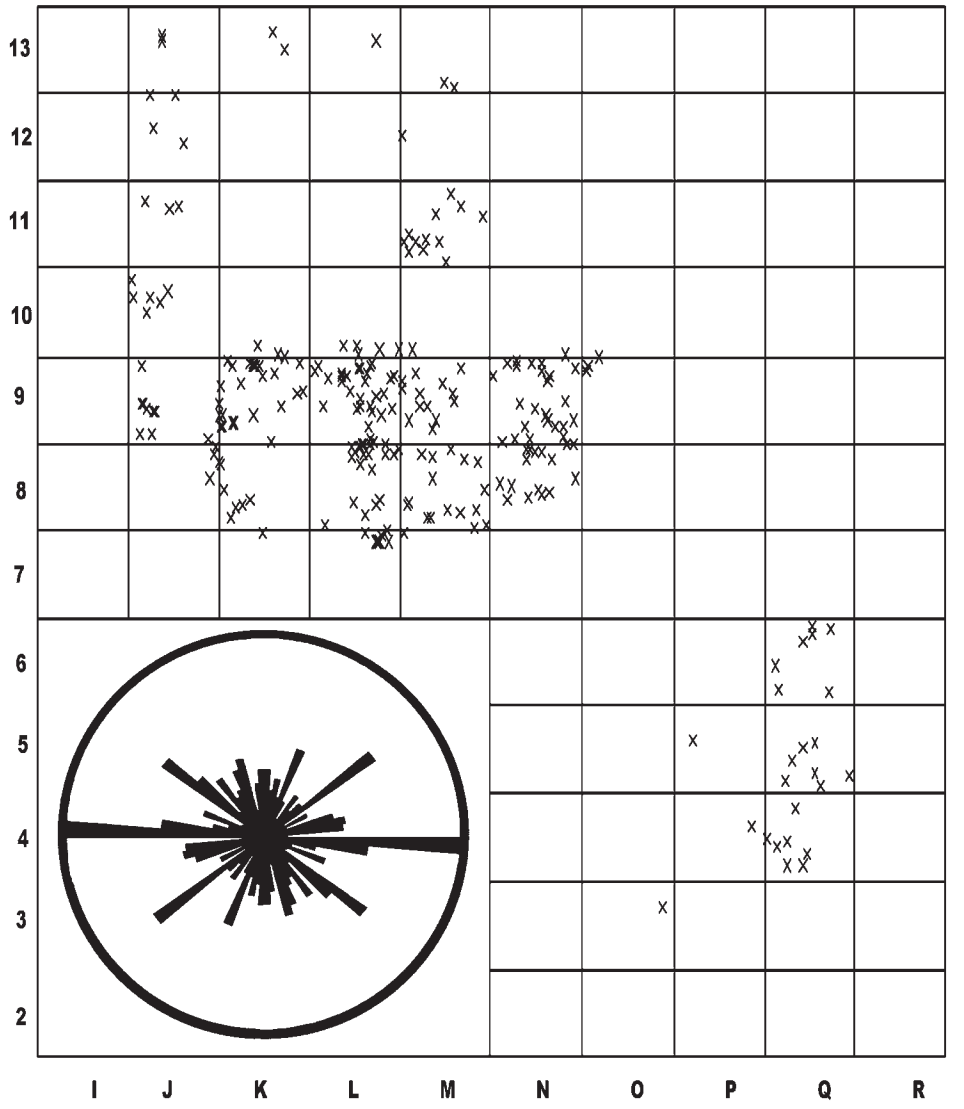

Figure 4. Grid locations and orientation of elongated objects from level II_1 of Verberie; 5-degree classes, $N = 227$; circle = 10.

Because much of level II_1 had been excavated prior to the inception of this procedure, only a limited sample of those elongated artifacts was available to be recorded in this manner. A total of 227 elongated objects from 34 m^2 in level II_1 (Figure 4) with measurements from two end points was subjected to two-dimensional orientation analysis, using the Rose version 7 program (RockWare, 1995). The orientations were derived directly from the millimeter measurements in the

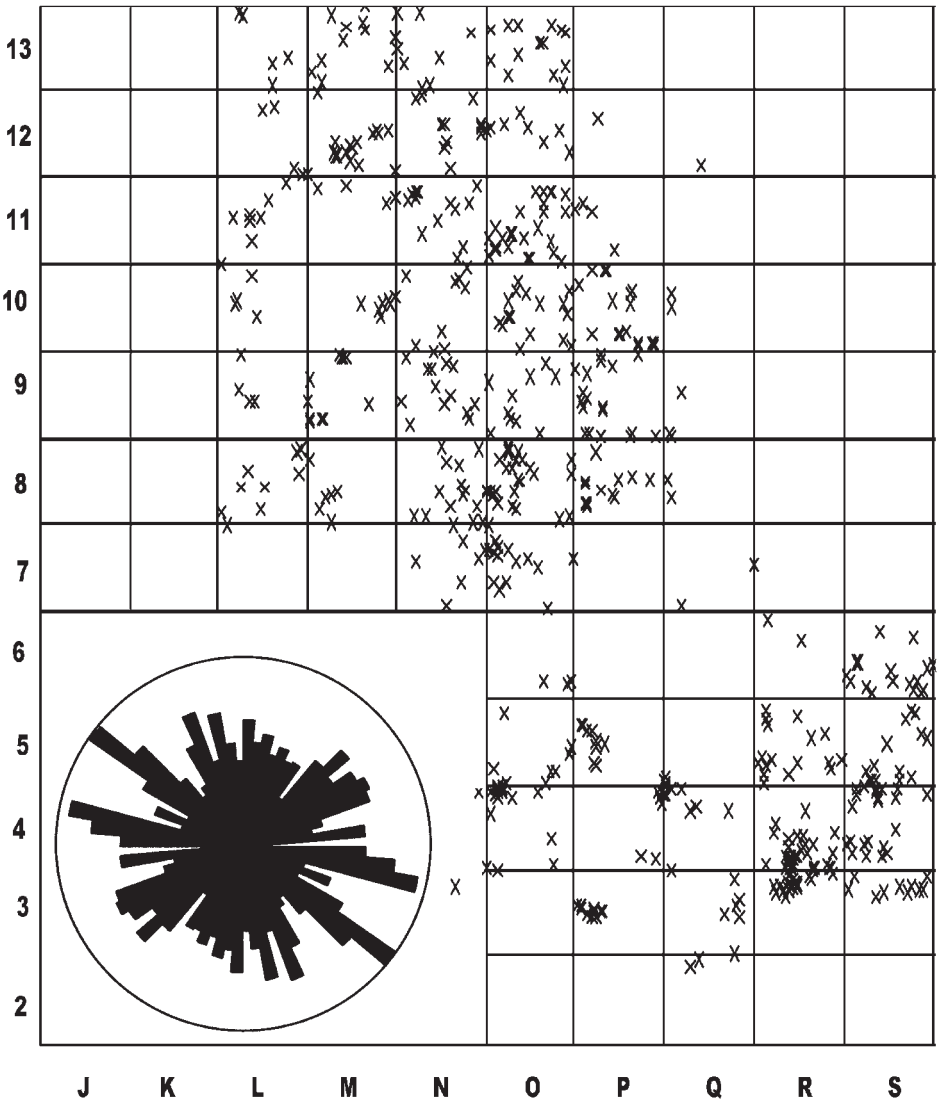

Figure 5. Grid locations and orientation of elongated objects from level II_2 of Verberie. 5-degree classes, $N = 525$; circle = 50.

field by the total station, as suggested by McPherron (2005), and transformed into orientations by the program, avoiding the interpretive drawing problems noted for the Bertran and Texier (1995) analysis of the Pincevent materials. The resulting rose diagram shows a substantially dispersed pattern of orientation. A larger sample size was available for level II_2, having been excavated more extensively because of initiation of the theodolite mapping program. The patterning (Figure 5) is even

Table I. Vectors, eigenvectors, and eigenvalues for distributions of orientations of elongated objects from levels II_1 and II_2 at Verberie.

Level	II_1	II_2
N	227	525
Mean vector	321.5000	337.7000
Mean vector length	0.6289	0.6513
Eigenvector 1	279.2000	308.5000
Eigenvector 2	9.2000	38.5000
Eigenvector 3	185.0000	180.3000
Eigenvalue 1	0.5072	0.5135
Eigenvalue 2	0.4926	0.4863
Eigenvalue 3	1.3802	1.2129

more robust for a sample of 525 elongated items from 66 m^2. The patterns of orientation can be statistically evaluated by eigenvectors and eigenvalues. For levels II_1 and II_2 of Verberie, these calculations were performed using StereoWin Version 1.2 (Allmendinger, 2002) and are presented in Table I. Eigenvectors indicate the axes of maximum clustering in the data (Benn, 1994, p. 910). Eigenvalues "represent the degree of clustering around three mutually orthogonal eigenvectors. . . . If the first two eigenvalues are roughly equal, then the data are planar (randomly oriented on a plane)" (McPherron, 2005, p. 1007). Both levels II_1 and II_2 have roughly equivalent first and second eigenvalues, indicating random orientations and no determination of orientation or spatial arrangement by fluvial action.

These two levels exhibit a significant contrast to the case at Cagny-l'Epinette (Dibble et al., 1997), where artifacts and natural objects were aligned along two major axes perpendicular to one another as would be expected with stream or slope influences on the orientation. Thus, the orientations of artifacts at Verberie do not appear to have been significantly disturbed by such geological and taphonomic agencies. Therefore, an argument can be made to attribute the spatial patterning to human behavior.

CONCLUSIONS

Models derived from ethnoarchaeology have been applied to open-air Paleolithic archaeological sites to investigate functional, economic, and social aspects of those settlements. Because of the presence of substantial numbers of articulated vertebral column segments, it has been proposed that Verberie represents initial butchering at a hunters' campsite (David and Enloe, 1992; Enloe, 2003). If this were accurate, there should be consistent patterning in the spatial structure that can be identified as relating to initial butchering.

Ethnoarchaeological research provides some information about signature patterns of certain kinds of activities that are the result of the organization of labor to perform those activities. Butchering is one such activity; given certain ranges in carcass size, this is a spatially extensive and quite messy activity, one which is not often

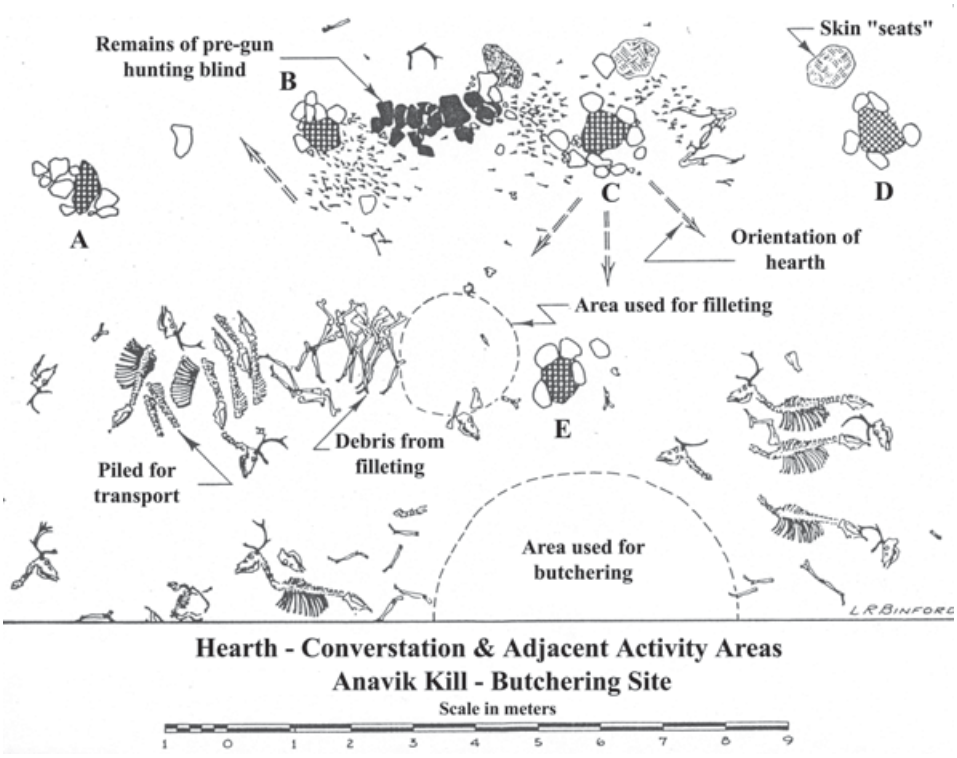

Figure 6. Ethnoarchaeologically documented spatial patterning derived from initial butchering activities among the Nunamiut at Anavik (from Binford, 1983, p. 123, Figure 61).

performed in the heterogeneous activity areas central to many open-air sites, such as those adjacent to hearths that provide heat and light for a variety of activities. Butchering of larger animals tends to take place away from other activities, and thus may often retain a rather clear pattern of the material deposition resulting from the process, one which is not distorted by other subsequent activities in the same place. Such patterning has been recognized by Binford (1983), consisting of a relatively empty circular area where the carcass was processed, surrounded by low-utility carcass parts, located away from the multiuse hearths. This pattern can be seen in Figure 6 (Binford, 1983, p. 123, Figure 61). Similar structural organization in faunal and lithic debris can be seen at Verberie in Figure 7, representing essentially empty spaces away from the main hearths of level II_1, surrounded by low-utility parts, such as vertebral columns, from which the meat had been stripped and adjacent to concentrations of flint blades that exhibited meat polish on their cutting edges (Audouze and Enloe, 1991, p. 66). In this case, the content and the configuration combine to support the proposition that level II_1 at Verberie is a hunting camp, from which resources were extracted and initially processed for limited consumption and transport to another residential consumption location of more importance.

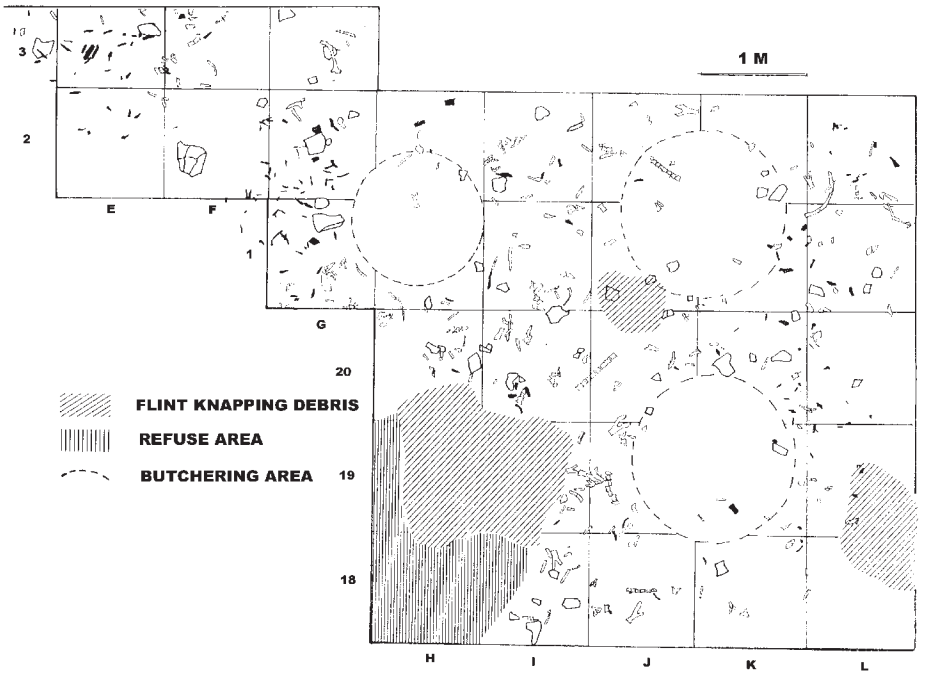

Figure 7. Archaeologically interpreted spatial patterning derived from initial butchering activities among Magdalenians at Verberie (from Audouze and Enloe, 1991, p. 66).

The results of this study reiterate Dibble et al.'s (1997) point about the necessity of integration methods for taphonomic evaluation from the beginning of excavation. A larger and more comprehensive sample of orientations of elongated objects over the entire excavated surface of each of the occupation levels would allow more accurate and precise assessments of spatial integrity or fluvial disturbance. This would allow us to identify smaller-scale perturbations across a spectrum of preservation states rather than merely identifying a dichotomy of preserved/disturbed.

In this case, the analysis confirms the integrity of the deposits. The configuration, the spatial distribution of artifactual materials, exhibits heterogeneity of orientations among elongated objects of flint and bone, which is consistent with a deposition that is not a function of, nor substantially displaced by, water flow. This permits an interpretation of such spatial patterning because of the organization of human behavior. The lack of disturbance in the content and configuration of the archaeological materials allow for a behavioral interpretation of those remains. The proposition that Verberie was a hunting campsite for initial carcass processing is supported.

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