ARTIFICIAL HABITATION STRUCTURES IN THE CHATELPERRONIAN: EVIDENCE FROM LES TAMBOURETS (HAUTE-GARONNE, FRANCE) WITHIN THE CONTEXT OF UPPER PALAEOLITHIC SETTLEMENTS IN EUROPE

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I. Introduction

One of the basic principles that has long guided archaeological research, in all areas of the world and for all time periods, is that the spatial patterning of artifacts on "living floors" reflects and therefore informs about activities that took place there. During the last decade or so, this hoary principle has been challenged and successfully qualified by long-overdue attention to the conditions of deposition and later disturbance (e.g., Wood and Johnson 1978) that distort the reflection of cultural activities provided by the artifact distributions recorded by the archaeologist. In no corner of the field have these correctives been applied more strenuously than in Palaeolithic archaeology. Information from sedimentology, taphonomy, ethnoarchaeology, and other specialties have made it clear that uncritical acceptance of concepts like "toolkit" (e.g., Binford 1982) and "living floor" (e.g., Bordes 1975) is not helpful and that a simple "what-you-see-is-what-you-get" approach to the results of excavation is a dangerous one.

All this having been said, it is important to remember that a closer attention to the role played in site formation by cultural activities and natural processes contributes to knowledge by helping us to understand why artifact distributional patterns are not solely reflections of cultural activities or why, if they are predominantly so, they cannot be correctly interpreted simplistically. The recognition of such problems does not mean that all is hopeless, that the archaeologist should not investigate intrasite functional variability through an analysis of spatial patterning, or that the basic paradigm of spatial/functional analysis is wrong. It may well be, in specific cases, that some culturally meaningful "signal" is contained in the data despite the high level of "noise". These matters are to be investigated, not assumed. The purpose of this paper is to report on efforts to extract from some rather "noisy" data useful information about occupational microstructure at Les Tambourets, an initial Upper Palaeolithic site in southwestern France, and to compare these findings with information from several other European sites.

II. The Situation at Les Tambourets

Les Tambourets (communes de Couladère et de Saint-Christaud, Haute-Garonne, France) is a large, open-air Châtelperronian (= Lower Périgordian) site located in the French foothills of the Pyrénées, on the right bank of the Garonne River. Early investigations by Méroc (1963; 1969) were followed by more extensive archaeological and paleoenvironmental research conducted under my general direction since 1973 (Bricker and Laville 1974;

Paquereau 1978; Clottes 1981; Méroc and Bricker 1984; Laville et al. 1985). Châtelperronian stone artifacts are found in situ in what is called Archaeological Level 1, the basal several centimeters of a loess body (couche B) overlying a weathered and eroded fossil soil (couche C). Organic materials that might serve as samples for chronometric dating are not preserved, but geochronologic data indicate that Archaeological Level 1 dates to the earliest phase of the Würm III, immediately following the mid-Würm interstadial.

It is certain that Archaeological Level 1 at Les Tambourets does not represent an undisturbed living floor. Three of the 3,791 catalogued objects recovered from Archaeological Level 1 in the Main Area are sherds of medieval and later historic ceramic vessels. Of far more quantitative importance is the fact that during the excavation scores of ancient and now filled mole burrows were recognized at the stratigraphic boundary between the bottom of Archaeological Level 1 and the top of the underlying couche C. At various times in the past some of the archaeological materials of Archaeological Level 1 were encountered by the burrowing animals and moved from their "original" positions--up, down, or laterally. Vertical movement is best shown by the existence of 171 objects in couche C, all of them formally indistinguishable from the Archaeological Level 1 assemblage sample and many of them found lying at a high angle in the lighter-colored fill of an animal burrow. It is clear, then, that post-occupational activities of both man and animals have introduced a certain amount of "noise" into the distributional pattern of the Châtelperronian artifacts.

It is, furthermore, extremely probable that Archaeological Level 1 is composed of cultural debris from multiple occupations rather than a single one. Although the archaeological level could not be successfully subdivided during excavation, the range of thickness of the artifact scatter--generally 4 to 8 cm.--suggests that the total duration during which artifact "deposition" occurred was not a brief one. Châtelperronian occupation took place at the beginning of the period of Würm III loess accumulation, but some Archaeological Level 1 artifacts rest directly upon the weathered and eroded surface of couche C whereas others are separated from couche C by one or several centimeters of the couche B loess. The strongest evidence in favor of multiple occupations over a long period (as opposed to a long single occupation) is provided by the lateral extent of the entire site. That surface indications of Châtelperronian occupation are found today over ca. 5 hectares and that over 24,000 artifacts assignable to the Châtelperronian have been collected from this surface in the last half-century (Méroc and Bricker 1984) make it highly improbable that the entire site should have been occupied at a single moment. It is far more likely that Les Tambourets, and the immediately adjacent Châtelperronian site of Rachat (Méroc 1963:65, 67), represent an area occupied, temporarily but repeatedly over a period of years, by people making Châtelperronian artifacts and that in the intensively sampled Main Area, the part of Les Tambourets with which this paper is concerned, Archaeological Level 1 represents a palimpsest of cultural debris from more than one

Châtelperronian occupation. The interpretation of the lateral distribution pattern of the archaeological materials must be attempted with this probability in mind.

Despite these considerations, there is good reason to believe that Archaeological Level 1 as sampled by the Tulane excavations is an appropriate candidate for a fruitful investigation of lateral distribution patterns of artifacts and of intrasite functional variability. The clearly visible traces of an artificial structure defined by linearly oriented gaps in the lateral distribution pattern of cultural debris (Structure 1, as discussed below in the following section) is an a priori demonstration for at least one part of the Main Area that the effects of post-occupational disturbance have not been very severe and that the occupational episode associated with the construction of the artificial structure made a major contribution to the overall patterning. The traces of a second artificial structure (Structure 2) are less clear, but much of the original patterning remains. With respect to these two separate and definable elements of Châtelperronian occupation at Les Tambourets, some of the "signal" is coming through in interpretable form despite the "noise".

III. The Artificial Structures

Although the principal archaeological objective of the Tambourets research project was the search for artificial habitation structures, the discovery of the traces of such structures took place in the laboratory in New Orleans rather than on the site itself. A lateral distribution map of all catalogued objects recovered from Archaeological Level 1 in the Main Area as of the end of the second excavation season revealed the presence of a distributional anomaly that had not been noticed during the excavation. It seemed most likely that the anomaly represented two wall-lines of an artificial structure, approximately half of which remained at that time unexcavated. The primary task of the final field season, in 1980, was the completion of the excavation of this structure, now called Structure 1. In the years following the 1980 excavation season, it became apparent that the less definite traces of a second artificial structure, Structure 2, could be recognized a few meters distant from Structure 1. The existence of Structure 2 had been suspected during its excavation in 1975, but its correct interpretation was made possible only by the much clearer information gathered later from Structure 1. Both structures are described in the following paragraphs, but the discussion of their relationships to different artifact classes is deferred until later sections.

Structure 1, which is located in squares III-A, III-B, IV-A, and IV-B (Figures 1 and 2), is defined by the anomalous lateral distribution of artifacts in Archaeological Level 1. The anomaly appears as a series of double alignments of artifacts, each pair of lines separated by a narrow zone in which artifacts are few or absent. In four places, the double alignments meet at approximately right angles to form a closed shape that is roughly trapezoidal. The nearly empty spaces between the alignments are

considered to mark the former locations of the walls of a structure, possibly a skin tent. Just how the lower edges of the walls were held in place is unknown. It is possible that Leroi-Gourhan's suggestion that tent walls at Pincevent were held in place by a low ring of earth (Leroi-Gourhan and Brézillon 1972:246) may be relevant at Les Tambourets. However they may have been anchored, during the time that the walls were in place, they impeded the dispersion of artifacts on the living floor, both outside and inside the structure. The alignments of artifacts on both sides of the empty spaces result, in part, from the fact that the structure's walls "trapped" artifacts and thus created lateral concentrations that reflect the shape of the structure's ground-plan. Once the walls no longer existed, having been removed by the inhabitants or having decayed away during a period of site abandonment, the structure's outline was preserved "in negative" by a systematic pattern of the absence of artifacts. This is one example of what Leroi-Gourhan (1976:662) has called the "wall effect" (effet de paroi).

The exterior dimensions of the longer walls of Structure 1 are ca. 2.75 m on the northwest side and ca. 3.25 m on the southeast. The southwest wall is ca. 2.50 m long, and the shortest wall, on the northeast, measures only ca. 1.50 m. The width of the empty zone, which records the former location of the structure's sides or wall coverings, varies from ca. 8 to 20 cm, with most parts being between 10 and 15 cm wide. The interior size of Structure 1, the area enclosed at ground level, is ca. 4.80 sq. m. An entrance ca. 1.20 m wide is located slightly to the right (northeast) of center in the long southeastern wall. The linear empty spaces that are clearly visible on either side of the entryway do not continue through it; rather, the artifact scatter in this area continues in uninterrupted fashion from the interior to the exterior, forming a "spew" of artifactual debris in front of the entrance.

The surface of couche C, which underlies Archaeological Level 1, is sloping very gently to the southeast in the immediate vicinity of Structure 1. The long axis of the structure is at an approximate right angle to the slope, such that the southeast wall is clearly the downslope wall and the northwest wall is the upslope one. The entrance to the structure opens downslope, therefore. Unlike the situation observed for Structure 2 (see below), the surface of couche C shows almost no traces of having been altered by the construction or the use of Structure 1. (The only exception, which may be a coincidence, is the existence of a very shallow linear depression in the surface of couche C located just upslope of and parallel to a portion of the back or northwest wall.) Neither the surface of couche C nor the vertical limits of the artifact scatter of Archaeological Level 1 shows any sharp change in elevation from exterior to interior across any wall line; the interior floor of the structure was neither raised nor semisubterranean.

The nature of the superstructure is completely unknown. The structural supports were apparently not large posts set deeply into the ground or

placed in previously dug holes. In spite of meticulous investigations during the excavation, no trace of a post-mold was found anywhere at Les Tambourets (dozens of suspected post-molds proved, when tested by sectioning, to be the filled tunnels of burrowing animals). There is no stone pavement within Structure 1 or surrounding it, and no large stones were found that might be interpreted as tent weights. There is, finally, no evidence that the structure contained a hearth.

Structure 2 is located primarily in square V-C, but it extends into parts of the adjacent squares IV-C, IV-D, V-B, V-D, and VI-C (Figures 1 and 3). Like Structure 1, its traces are recognized as linear empty spaces that meet at nearly right angles to define an almost regular rectangular shape. The exterior lengths of the two long walls, southwest and northeast, are the same, ca. 3.00 m. The northwest wall is ca. 1.50 m long, and the southeast one is only slightly longer, ca. 1.60 m. The width of the empty zone once occupied by the structure's wall coverings varies from ca. 9 to ca. 25 cm, but it is usually between 10 and 15 cm. The area enclosed at ground level is ca. 3.50 sq m. An entrance ca. 1.00 m wide is located slightly to the right of center in the southeast wall. Directly opposite this entrance, in the approximate center of the northeast wall, there is a zone ca. 1.00 m long in which the traces of the wall line cannot be recognized. On analogy with Structure 1, whose back wall is certainly continuous, I interpret the break in the back wall of Structure 2 as evidence of disturbance dating most probably to a time after the abandonment of the structure. It is, however, possible that Structure 2 had a second, "rear" entrance in the northeast wall.

The surface of couche C in the area around Structure 2 slopes gently but in a complex fashion. Both the northeast and northwest walls are upslope, whereas the other two are downslope. The entrance in the southwest wall opens downslope, therefore, just as does the entrance to Structure 1. A slight depression in the surface of couche C is generally congruent with the shape of Structure 2, suggesting that the microtopography of the existing ground surface was somewhat altered by the construction or use of the structure. This effect is most marked in the southern half of the shelter (Figure 3), where the -157 cm contour defines a rectangular depression having an orientation almost identical to that of the structure's walls. The differences in elevation are, however, very slight; the greatest relief on the surface of couche C, occurring along the back wall near the southeast corner, is only 4 cm in ca. 20 cm laterally, from -153 cm just outside the structure to -157 cm just inside the wall line. In no meaningful sense, therefore, is this a semisubterranean structure. In the absence of post-molds, the nature of the superstructure is unknown, and there is no evidence that Structure 2 contained a hearth.

A glance at the scatter-plot of all Archaeological Level 1 materials in the Main Area (Figure 1) appears to indicate that artifacts lying within the confines of Structures 1 and 2 are just as numerous or as densely concentrated as they are in the surrounding areas. It is, however, obvious

that information from a general scatter-plot, where one dot represents one artifact of any kind, is too coarse-grained to permit much further interpretation of the structure of Châtelperronian occupation in the Main Area at Les Tambourets. Further clarification requires the separate consideration of the lateral distribution patterns of the different artifact classes that contribute to the general scatter (the subject of the following section) and some analytically appropriate way of dealing with the high probability that Archaeological Level 1 is a complex occupational palimpsest (the subject of section V).

IV. Lateral Distribution of Artifacts

Although Archaeological Level 1 is almost certainly a palimpsest of more than one Châtelperronian occupation, and although post-occupational disturbances have altered the original positions of some of the objects, the early stages of the analysis of lateral distribution dealt with the Archaeological Level 1 sample as a unitary whole because it is only the tool scatter as a whole that has formal stratigraphic reality. Although some pieces come from near the top of the scatter and others from near the bottom, it was impossible to make consistent vertical separations during the excavation because the loess matrix in which the scatter lies is thoroughly homogeneous. In terms of the operational realities of stratigraphic excavation, Archaeological Level 1 could not be subdivided. Vertical backplotting done after the excavation on the basis of the Cartesian coordinates of each object permits a partial separation of lower (presumptively earlier) and higher (presumptively later) materials within the archaeological level (as discussed in section V, below), but the efficacy of such techniques is only partial, and even the best results represent a higher-order interpretation of or extrapolation from the basic data. The analyses discussed in this section, dealing with Archaeological Level 1 in a unitary fashion, are intended to provide a concrete, objective description of the final, somewhat disturbed palimpsest. It is such a description that poses further questions, the answers to which lead toward elucidation of occupational microstructure.

A variety of univariate, bivariate, and multivariate techniques were employed in the attempt to elucidate lateral distribution patterns in Archaeological Level 1. Although each contributed useful (and sometimes unique) information, only one--k-means clustering--is discussed in detail in this paper. The principal results of other analytic techniques are, however, first summarized here.

The variance-mean ratio test for random patterning (Dacey 1973) was applied to all artifact categories as tabulated in 1.00-sq-m quadrats. The total sample of all artifacts in Archaeological Level 1 is non-randomly distributed ($P < .05$), as are burins, splintered pieces, partially backed pieces, nuclei, burnt flints, artifacts lying at a high angle, and all unretouched débitage products. The other artifact categories do not have clearly non-random distributions in the palimpsest. These initial findings

made it prudent to investigate possible associations between category-specific patterns and the general pattern of all archaeological material. One technique used for this investigation was a series of contingency table tests for the absence of spatial association (Dacey 1973), using again counts of artifacts in 1.00-sq-m quadrats. The distribution patterns of nuclei, unretouched débitage products (flakes and blades, utilized and not), and artifacts found lying at a high angle are significantly spatially associated with the pattern of the general distribution of all artifacts (probabilities range from .04 to <.0001). The patterns of other artifact categories are not congruent with the general distribution (probabilities from .14 to .70). Because nuclei and débitage products combined account for the overwhelming majority of the total assemblage sample from Archaeological Level 1 in the Main Area--208 nuclei, 473 chunks, 1,675 flakes, and 395 blades out of a total of 3,791 catalogued objects, for a combined percentage of 72.57%--the general distribution pattern is what it is largely because the excavations happened to encounter a portion of the site in which chipped-stone tool production was a major contributor to the resulting archaeological record.

The analysis of possible spatial association between and among specific artifact categories combined the use of Dacey's (1973) test on superposed distribution maps and an R-mode factor analysis. The concurrent use of the bivariate and multivariate techniques provided a useful balance of global and very specific information. The sample used for factor analysis was composed of frequencies (raw counts) of 12 categories of artifacts in each of 39 1.00-sq-m quadrats. Four factors were extracted, accounting for 64.52% of the total variance. The information derived from the factor analysis, including mapping of the factor scores back onto the quadrat grid, may be summarized very briefly as follows:

a) As indicated by other techniques, much of the spatial patterning in Archaeological Level 1 has to do with the débitage process rather than with very specific tool-use activities.

b) Nuclei and their unretouched products (débitage flakes and blades) "behave" somewhat differently in space; there are, likewise, some differences in the spatial distributions of blades and flakes. Further clarification of this finding was produced by the use of Dacey's (1973) contingency table test for the absence of spatial association between pairs of specific artifact classes. In brief, blades showing utilization damage (possible evidence of use as informal tools) tend to occur at site loci other than those containing nuclei, unmodified blades, and unretouched flakes (utilized or not).

c) An elongated area containing artifacts representing diversified activities, including flint-knapping and several kinds of tool use, extends diagonally across the Main Area, covering the locations of Structures 1 and 2 as well as much of the space between them. (It was this similarity between the area of Structure 1 and the zone to the northeast of it that prompted a re-examination of the artifact scatter-plot and the eventual recognition of Structure 2.)

d) Another locus, on the down-slope margin of the Main Area (centered on square V-A), is characterized by flint-knapping debris and tools representing what may be a less diversified range of other activities.

The kinds of analyses whose results were very briefly summarized above provide much information about the random or non-random nature of specific distributions and the extent to which combinations of specific distributions are significantly associated in space. However, they give only very generalized information on just where in the excavated area individual artifact categories are particularly frequent, even vaguer information on the location(s) of co-occurrence of specific categories, and, of course, no information at all on individual artifacts. It is necessary to supplement such analyses by defining, characterizing, and specifying the spatial limits of clusters of artifacts by techniques other than just visual inspection and intuitive interpretation of distribution maps. The kind of use to which Kintigh and Ammerman (1982) have put k-means cluster analysis is well suited to answer exactly this kind of need. Of particular utility here is the fact that this clustering technique uses as direct input the lateral coordinates of artifacts, measured to the nearest centimeter, rather than quadrat counts. The k-means clustering program used for the Tambourets analysis was the BMDPKM program (Engelman and Hartigan 1981) run on a DEC-2060 computer at the Tulane Computing Laboratory.

Although the k-means clustering technique is extremely helpful, its full potential is achieved only as a result of certain decisions made by the analyst about the relationships between alternative clustering results and the data being clustered. The first decision is into how many clusters to divide the total distributional pattern of the artifact category under study. Kintigh and Ammerman (1982:45) suggest the use of a quantitative criterion based on the graphic plotting of the efficiency of successive clustering stages in minimizing the sum of the Euclidean distance between each object in a cluster and the center of that cluster. However, the graphic plotting method provides unambiguous results only if a large number of successive clustering stages are produced and if the data points are distributed in tightly packed and sharply bounded clusters separated one from the other by large expanses of intercluster space containing few or no data points. In almost all cases, the distribution patterns of different artifact categories in Archaeological Level 1 at Les Tambourets do not exhibit such tight clusters. Accordingly, based on a series of trial runs with different artifact categories, an empirical context-dependent decision was made to group the total distributional pattern of each category studied into first five, then seven, then nine clusters. The final choice of cluster number--five, seven, or nine--for each artifact category was made by examining the distribution map for the category in question in light of the several clustering possibilities. The locus of each of the 21 possible clusters was plotted on a map overlay as a circle centered on the means of the north-south and west-east coordinates of the cluster members (the "centroid" of the cluster) and having as its radius the root mean squared deviation (RMS) of the cluster. RMS, a value used by Kintigh and Ammerman

(1982:41-42) in their analysis, is very easily calculated for each cluster from data produced by the BMDPKM program, because

$$RMS = \sqrt{(s^2_x + s^2_y)} \quad ,$$

which is to say that RMS equals the square root of the sum of the variance of the west-east (x) coordinates and north-south (y) coordinates of cluster members. With the three sets of clusters generalized to circular loci of the kind described above and plotted as an overlay to the actual distribution map of the artifact category under study, the question of which set does the most satisfactory job is answered on empirical grounds by considering the tightness of the clustering, the numbers of objects in each cluster, and--very importantly--the influence of the (irregular) shape of the excavated area upon cluster definition.

Once an optimum clustering stage has been chosen for each artifact category, the second major decision to be made is which ones of the resulting clusters will provide the most useful information about the lateral distribution of the artifact category. At first reading, the notion that some of the (five, seven, or nine) clusters are more useful than others may appear paradoxical or just simply wrong. There is, however, a real difference between using clustering techniques to deal with distance in a literal, spatial sense, as is done here, and using clustering to represent morphological distance, taxonomic distance, etc., as analogous to spatial distance. If, for example, scrapers from a dozen assemblage samples are clustered on the basis of variation in five attributes of the scraping edge, the entire results of the clustering are integrally informative about the "location" of the scraper samples in a multidimensional space. It is unlikely that the membership of, let us say, the Assemblage G scrapers in Cluster 2 is more or less important than the inclusion of the Assemblage C scrapers in Cluster 1. If all we wished to know about the Tambourets data were the spatial locations of the artifacts in two dimensions, clustering would be unnecessary, for the obvious reason that these locations are already specified by the map data that serve as input to clustering analysis. What we do need the clustering technique for at a site like Les Tambourets, where the noise-to-signal ratio in the lateral distributional patterning is assumed to be high, is to serve as a "noise filter". Appropriate use of the cluster analysis should permit a precise definition of the locus of artifact concentrations that rise above the background clutter. If the cluster analysis is to serve as such a filter or discriminant, it is apparent that we must ignore many of the clusters defined and concentrate the further analysis on only a few of them.

The most useful clusters for the present purposes are those that include the greatest number of artifacts in the smallest area. Some sort of balance between extremes is necessary. The greatest number of artifacts would be contained in a single cluster composed of the entire excavated area (which is, in fact, the starting point for the k-means clustering technique), but such a "cluster" is analytically useless. The smallest

area for a cluster (actually, the absence of area) would be obtained in a "cluster" of one artifact, which is seldom analytically useful.

In light of the need for some middle position, four criteria were used to choose those artifact clusters most salient in the overall distributional pattern of the artifact category concerned. Data for the sample of 208 nuclei are used to exemplify the use of the criteria (Table 1). Empirical considerations (as discussed above) suggest that the results of seven clustering stages produce the most useful fit with the distribution map of nuclei. The seven resultant clusters contain from 14 to 50 nuclei each; the radii (RMS) of the circles centered on the cluster centroids vary from 92 to 114 cm., corresponding to areas of from 2.66 to 4.08 sq. m. If the total nucleus sample were equally distributed among seven clusters, each cluster would contain about 14.29% of the sample. In fact, of course, some of the seven nucleus clusters contain more than 14.29% of the sample, and some contain less, as indicated in the "%" column of the table. The same reasoning that one would use in the construction of a binary map for contingency-table analysis leads to the criterion that a cluster should be retained for further consideration only if the percentage of the total sample it contains is greater than the average value. For the nucleus sample (Table 1), clusters 1, 2, 4, and 5 satisfy this criterion.

The second criterion uses a value, RMS divided by %, that relates the tightness of clustering to the number of pieces clustered. This value is the middle ground between the analytically useless extremes described above. The lowest values of RMS/% identify the clusters that include the highest proportion of artifacts in the smallest area. The first cluster chosen from among those meeting the first criterion is that with the lowest value of RMS/% (cluster 2 for nuclei), with additional clusters added in the order of increasing values of RMS/% (nucleus cluster 4, then cluster 5, etc.).

Because, however, the goal of this procedure is to limit consideration to the most salient clusters only, something less than 100% of the total sample of the artifact category should be considered; diffuse clusters and clusters that contain a very small percentage of the total sample--clusters that in both cases quite probably constitute the kind of background noise we are trying to filter out--should be excluded from further consideration. Accordingly, the third criterion specifies that we are interested only in the most saliently clustered half to two-thirds of the total sample. The greatest number of clusters is added such that the cumulative percentage of artifacts included is greater than 50.00% but less than 67.00%. For the nucleus data used as an example, the cumulative percentage after three clusters have been chosen is 56.25%; the addition of cluster 1, the next eligible based on criteria 1 and 2, would push the cumulative percentage to 70.67%, and it is not, therefore, added.

Finally, a fourth criterion is necessary for dealing with some of the less frequently occurring artifact categories (e.g., marginally retouched

pieces, N = 36). Only two clusters of seven meet criterion 1, but these two together account for only 38.89% of the total sample. In such cases, clusters not meeting criterion 1 are added, beginning with those having the largest value of %, until criterion 3 is satisfied; in the case of ties, those with the lowest values of RMS/% are added first.

The principal results of the k-means clustering analysis are shown in Table 2. The most salient clusters for each artifact category, identified by the application of the four criteria explained above, are specified in the penultimate column of the table. "A" is the most salient cluster, "B" is the next most salient, and so on; the last column records the cumulative percentage of the total sample of the artifact category that has been dealt with after the inclusion of the cluster in question. The locations of the salient clusters are shown graphically in Figures 4 and 5, where each cluster, labelled to conform with the data of Table 2, is plotted as a circle whose radius is the value of "RMS" for that cluster.

It is apparent from the table and the figures that there are real differences in the lateral distribution patterns of the different artifact categories. Some of the differences concern the intensity of clustering--for example, burins are somewhat more tightly clustered (55% of the sample in two salient clusters out of a total of seven) than are nuclei (56% of the sample in three of seven clusters). Most of the immediately apparent differences concern the locations of the clusters, however--for example, clusters of burins and splintered pieces occur in quite different places. Examination of all these locational differences leads to several generalizations:

a) The areas of one or both artificial structures and the area between them are loci of concentration of a wide variety of artifact categories. (This is, of course, the point made in a rather general fashion by the results of the factor analysis.) Continuous distribution within this broad zone is shown by utilized débitage products (flakes and blades) and burnt flints.

b) For other artifact categories, the most salient cluster loci coincide with Structure 1 (e.g., splintered pieces) or Structure 2 (e.g., Châtelperron points), but not both.

c) Side-scrapers and marginally retouched pieces are distinctive in that their salient clusters are associated with both structures but not the area between them.

d) The area to the southeast of the broad zone occupied by the structures is distinctively different (because of the irregular limits of the excavation, this area is somewhat artificially centered on square V-A). It is a locus of concentration of nuclei, unmodified débitage products, cracked cobbles, and flints lying at a high angle, but not for any other retouched tool class except burins and not for burnt flints.

Any attempt at functional interpretation of these patterns is severely handicapped by the absence of faunal debris, which would be so informative about the kinds of activities carried out in different places, but some

very general conclusions seem warranted. Within the very small part of the site represented by the Main Area, it was the broad "zone of the structures" that was the locus of most of the tool-making and tool-using during the Châtelperronian occupations that contributed to Archaeological Level 1. Moreover, it must have been this zone that contained the hearths--on the ground surface, not in excavated basins--that were used during the occupations; the data seem to suggest that the hearths were adjacent to the structures rather than within them. Many of the cracked cobbles were probably used in the hearth areas. Some of the flint artifacts found lying at a high angle are evidence of post-occupational disturbance (moles, etc.), but others certainly reflect conditions that obtained during the times of the Châtelperronian occupations. The fact that three of the four most salient clusters of such objects are centered on the upslope walls of the two artificial structures is generally consistent with the mode of formation of the physical traces of the structures that was suggested previously.

The "southeastern zone" centered on square V-A may have been an integral part of the area of tool production during the occupations, but it appears to have been to a far lesser extent an area of tool use. Having examined some early results of the analysis, J.-P. Rigaud (personal communication, May 1985) suggested to me that the southeastern zone, downslope of the structures, was similar in some ways to the "dump" area identified in the Upper Périgordian occupation of Level VII at Le Flageolet-1 (Rigaud 1976). The abundance of the waste products of the débitage process, the concentration of cracked cobbles without strong evidence of surface hearths in that area, and the important cluster of flints lying at a high angle are all consistent with such an interpretation.

The technique of k-means clustering analysis has proved to be extremely useful. In combination with factor analysis and other techniques, it gives a clear and interpretable picture of the lateral distribution patterns of artifacts in the Archaeological Level 1 palimpsest in the Main Area at Les Tambourets. Because its results are based on some straightforward statistical techniques, they have a high degree of replicability. By basing interpretation on the most salient clusters only, it is possible to use k-means clustering as a very effective filter to remove "background noise", concentrating on the strongest part of the "signal". This is particularly useful at Les Tambourets, where multiple occupations and post-occupational disturbance combine to obscure the patterning of any single occupational episode. However, the fact that techniques have been chosen to facilitate interpretation in spite of these problems does not mean that the problems have been removed. There remain two specific limitations to the validity of the interpretations of the k-means results. First, it remains true that one-third to one-half of the examples of each artifact category have been ignored by the analysis, and a cluster that is not quantitatively salient in the overall patterning may have qualitative significance for some briefly or infrequently practiced activity. Second, the existence of multiple occupations has been ignored, and the different

clusters of the same artifact category may result from activities that took place at quite different times. It is clear, then, that the k-means results and the rather broad-brush interpretations based on them describe for us only the most visible aspects of a complex palimpsest. Such analyses are invaluable, but their limitations must not be forgotten.

V. The Microstructure of Two Châtelperronian Occupations

Very fortunately, it has been possible to use stratigraphic data to dismantle parts of the Archaeological Level 1 palimpsest into vertical components. The resulting information, combined with some suggestions about the relative ages of the two artificial structures, produces a much more detailed picture of what we may call the microstructure of two discrete and sequential episodes of Châtelperronian occupation at Les Tambourets.

Although no vertical subdivision of the Archaeological Level 1 artifact scatter was possible during excavation, detailed backplotting of artifact locations to closely spaced section lines permits the partial definition of a high component and a low component of this scatter. Of specific relevance here is the vertical distance between the artifact in question and the surface of couche C, which underlies the couche B loessic sediment in whose basal centimeters Archaeological Level 1 is located. The surface of couche C was surveyed at 20-cm intervals along the four edges of each 1 m x 1 m square of the grid system and at 50-cm intervals along the two lines dividing each square into four quadrants. This means that any given artifact must be projected laterally a maximum distance of 25 cm in each axis of the grid to fall on a backplot line that shows the surveyed elevations of the surface of couche C. Most artifacts are subject to a projection of less than three times their total length; despite irregularities in the surface of couche C, this degree of control should produce generally valid backplotting results. Other factors that will either counteract or exacerbate projection errors (and will do so in an unpredictable fashion) include small survey errors in measuring the surface of couche C and/or the depth of a given artifact. In short, the data from Les Tambourets are good enough to justify vertical backplotting and to inspire confidence in the general patterns of the results even though error from several sources will certainly cause the misassignment of some individual pieces.

The sections used in the backplotting were given grossly exaggerated vertical (y-axis) scales in order to facilitate the search for elevational differences. Several hundred such sections were prepared (with the aid of microcomputer graphics), usually a dozen or more for each artifact category. The two shown here as Figures 6 and 7 exemplify the techniques employed and the problems encountered. Figure 6 plots a relatively infrequent tool class, end-scrapers, along a north-south line in the middle of the eastern half of Trench V. This is one of the lines along which the surface of couche C was surveyed at 50-cm intervals, and the result is a

more-or-less regular slope from north to south except in square C, where the slight depression within Structure 2 is clearly visible. If the intention is to make a dichotomous division, eight of the nine artifacts plotted on this line can be unambiguously assigned to either a "high scatter" (n = 4) or a "low scatter" (n = 4). Two of the low-scatter pieces plot below the surveyed surface of couche C--2 cm in one case, 1.5 cm in the other. This is exactly the sort of small-scale anomaly introduced by localized topographic irregularity, projection error, or measurement error, but because the objects are known to have been found in Archaeological Level 1 (rather than in couche C), there is no hesitation about assigning them to the low scatter. The ninth end-scraper (the third from the right) is best regarded as indeterminate, not assigned to either scatter. Figure 7, a more complicated case, plots a more numerous artifact class, nuclei, on a west-east line (between squares C and B) along which the surface of couche C was surveyed at 20-cm intervals. Here the very localized topographic irregularities are all too apparent (but the greatly exaggerated vertical scale must be kept in mind). Most pieces can, nevertheless, be assigned without ambiguity; in several cases, the final assignment was made only after checking the position of the piece on the relevant north-south line. One piece, in the eastern half of Trench IV, remains indeterminate.

When separate horizontal scatterplots (maps) of high-scatter and low-scatter objects within a given artifact class are made using the backplot data, it is true in almost every case that the lateral distribution pattern of the earlier (lower) material differs from that of the later (higher). The interpretation of these patterns is dependent upon one's view of their relationships to the artificial structures. What is absolutely crucial here is the question of whether Structure 1 and Structure 2 were in use during the same or different occupational episodes; until some answer can be given to this question, the understanding of occupational structure in the Main Area cannot move beyond the generalizations of the k-means results.

Because the remaining traces of Structure 2 are less clearly visible and probably less complete than those of Structure 1, one might expect that Structure 2 has suffered greater post-occupational disturbance. This might be true in part because Structure 2 was built, used, and abandoned early in the total time span represented by Archaeological Level 1 and because its traces were partly effaced by the activities of later occupational episodes. This same line of thought suggests that because the traces of Structure 1 are so well preserved, its period of use must have ended rather shortly before the Main Area was abandoned by human occupants, allowing its minimally disturbed remains to be covered over by the accumulating loessic sediment of couche B. These are reasonable suppositions, but they are of limited value in the absence of stratigraphic documentation.

One approach to the microstratigraphic problem is the investigation of the relationship between the surface of couche C and the double alignments of artifacts that specify the locations of the structures' walls by

defining the linear empty spaces. Clear answers are unlikely, however, because it is precisely these structure-wall areas that are concentrated loci of flints lying at a high angle, a sign of disturbance (or, at least, complex site-formation processes). Because even small distortions resulting from projection error would be fatal here, map superposition rather than vertical backplotting was used. Points of comparison were limited to artifacts that a) actually define the interior or exterior limit of the wall line (empty space) of a structure and b) are located within 10 cm or less of a survey point for the surface of couche C. This reduces projection error to essentially nothing, but it creates very small samples--26 points of comparison for Structure 1 and 22 for Structure 2. The data for Structure 2 form a very irregular distribution, ranging from 7 cm above the nearest survey point on the surface of couche C to 5 cm below; the median deviation score is 0--i.e., the wall-defining artifacts are coincident with the surface of couche C. The Structure 1 distribution is less dispersed, ranging from 3 cm above to 3 cm below the surface of couche C, and the median deviation score is 1 cm above the surface. There is a suggestion here that artifacts defining the walls of Structure 2 tend to be slightly lower within Archaeological Level 1 than those defining the walls of Structure 1, but it is apparent that such small differences within such small samples do not allow one to rule out chance variation. The results of this stratigraphic test are suggestive but inconclusive.

The best evidence that the two structures are of different ages and that Structure 2 is older is provided by the clear stratigraphic fact that the topography of the surface of couche C reflects the shape of Structure 2 but not that of Structure 1. Although there are other possibilities, one probable explanation for this difference is that the occupational episode associated with Structure 2 occurred early enough in the period of loess deposition that any slight modifications of the existing land surface (trampling, levelling, scraping, cleaning, etc.) had an impact on couche C, whereas by the time Structure 1 was constructed and occupied such activities would have affected only the basal few centimeters of loess that had already buried couche C. If this explanation is correct, Structure 1 was constructed late in the time span represented by Archaeological Level 1, in an area where some artifactual debris from earlier occupation(s) already lay buried immediately beneath the surface.

Although the view presented above of the relative ages of the two structures cannot be proved conclusively, there are enough lines of suggestive evidence to make it the most probable working hypothesis and to use it as an integral part of a more general model of occupational structure. Another obvious part of the model specifies that Structure 2 and many or most of the artifacts in the low scatter are to be associated analytically as the common results of occupation early in Archaeological Level 1 times, whereas Structure 1 and the high-scatter artifacts are the remains of a late occupation. The utility and thus the plausibility of this model may now be assessed by applying to it the backplotting data and examining the results.

A series of scatterplot maps (for example, Figure 8), one for each of the artifact categories considered, shows the complete lateral distribution of that category within Archaeological Level 1 in the Main Area; different symbols are used for high-scatter objects, low-scatter objects, and indeterminate ones. Based on these raw data, a second series of maps was prepared at a much reduced scale (Figures 9 to 12) to show, for most artifact categories, how the major lateral concentrations in the low scatter (early occupation) are related to Structure 2 and those of the high scatter (late occupation) to Structure 1. These latter maps are high-level generalizations--my interpretations of the patterning shown in the scatterplots. (In the longer report of which this paper is a partial summary, all scatterplots are fully presented so that the reader may make some independent assessment of the validity of the interpretations, but space limitations dictate that only a single example can be included here.) The artifact concentrations shown in Figures 9 to 12 are very different in their nature from the salient clusters of the palimpsest defined in formal quantitative terms by the k-means analysis (Figures 4 and 5). As an example, the relationship between the two kinds of results is discussed below for one specific artifact category, end-scrapers.

End-scrapers (Figures 8 and 9) of the early occupation are concentrated in front of Structure 2, from the entrance itself southwest to the limit of excavation, and in a diffuse arc centered on the rear of the structure and wrapping around its ends. (The true extent of the latter is unknown because of excavation limits and the presence of a ditch of historic age.) Only two low-scatter end-scrapers are found within the confines of Structure 2. End-scrapers of the late occupation are concentrated in front of Structure 1 but clearly separated from its entrance and in a broad zone to the northeast of the structure. Only one high-scatter end-scraper lies within Structure 1. The k-means clustering analysis of end-scrapers produced three salient clusters, "k-clusters" A, B, and C, accounting for ca. 51% of the sample (Figure 4). K-cluster A is composed almost entirely of low-scatter pieces in front of Structure 2, but k-clusters B and C are complete mixtures of low- and high-scatter pieces. This is a specific example of the obvious points that the principal characteristics of the multi-occupational palimpsest are not identical to those of separate occupational entities and that the possibility of meaningful interpretation increases immediately if the palimpsest can be to any extent disaggregated. End-scraper distribution patterns differ in the two occupations, but the concentration of end-scrapers in front of the artificial structure is an element common to both.

Space limitations preclude a separate discussion here of each artifact class whose principal clusters are mapped, for each occupation, on Figures 9 through 12. Examination of these maps and their comparison with the maps of the most salient k-means clusters in the palimpsest (Figures 4 and 5) will, however, provide the reader with some documentation of the conclusions discussed below. (Unretouched débitage products are so numerous and

so widely distributed that the separation into low-scatter and high-scatter components does not produce map information that is significantly more useful than the results of the k-means clustering analysis, and I have made no attempt here to delimit discrete concentrations. Similarly, cracked cobbles of the low scatter are nearly ubiquitous, except that they are less numerous within Structure 2 and immediately surrounding it.)

The artifact distributional data summarized separately for the early and late occupational episodes in the Main Area at Les Tambourets show some clear structural similarities in the use of space. Discussion of these similarities requires a terminology that will avoid confusion with and thus permit explicit comparison with the best known model of French Upper Palaeolithic occupational microstructure, the model developed by André Leroi-Gourhan and others (e.g., A. Leroi-Gourhan and Brézillon 1972:239-256) for Magdalenian open-air sites in the Paris Basin. Leroi-Gourhan's model (which is discussed in more detail in the following section of this paper) is centered on the domestic hearth of each occupational unit. This hearth, defining his "space A", is a well preserved architectural feature whose location is immediately apparent, whereas the exact size and shape of the associated artificial structure cannot be determined so clearly. At Les Tambourets, on the other hand, it is the artificial structures whose locations are most clearly indicated. Accordingly, the microstructure of Châtelperronian occupation at Les Tambourets is discussed in terms of several numbered "zones" centered on "zone 1", the interior of the artificial structure.

The material remains of each of the two occupational episodes of the Main Area can be considered to be distributed among five zones (Figure 13), as follows:

Zone 1 (Interior): the space within the inner wall-line of an artificial structure, assumed to have been covered or roofed-over space. The two examples known from the Main Area have areal extents of ca. 4.80 and 3.50 m^2.

Zone 2 (Immediate front periphery): the space immediately in front of the artificial structure, extending outward a distance of ca. 1.50 m from the long wall containing the structure's entrance, and around the front half of the sides of the structure, immediately adjacent to its short walls.

Zone 3 (Immediate rear periphery): the space immediately behind the artificial structure and around the rear half of the sides. Excavation limits and post-Pleistocene disturbance prohibit an accurate specification of the lateral extent of zone 3, but it extends outward for at least one meter from the rear wall.

Zone 4 (Front activity zone): an extensive space in front of the artificial structure but separated from it by zone 2. In the early

occupational episode at Les Tambourets, zone 4 has an areal extent of between 10 and 15 m^2; zone 4 of the late occupation is artificially truncated by the limits of excavation.

Zone 5 (Side activity zone): the space to one side of the artificial structure but separated from it by zones 2 and 3. The excavation limits in the Main Area are so located that for both occupational episodes it is only the area on the right side of the artificial structure that is known.

For the early occupation only, some artifact categories are concentrated in what may be a sixth zone (Zone 6, unnamed) located to the side of zone 4, the front activity zone.

The different artifact categories that occur preferentially in one or more of the five zones have some distinct similarities in the two occupational episodes represented. Additional similarities are probable but uncertain because of small sample sizes for some artifact categories of the late occupation. Similarities and differences in artifact content are discussed for each zone in the paragraphs below.

Zone 1, the interior of the artificial structure, contains a significant portion of the total sample of only a limited range of tools. These include truncated pieces, marginally retouched pieces, Châtelperron points, perforators and becs, hammerstones, and, for Structure 2 only, the so-called category-D notched pieces (the pieces with large, retouched notches that are most likely to be independent tools, rather than fragments of other tools or products of accidental damage). Some nuclei and unretouched débitage products are found within both structures, and they are relatively more frequent within Structure 2. For neither occupation, however, can zone 1 be seen as a significant locus of flint-knapping. The preferential occurrence of hammerstones within the structures may well result from the storage in a "safe", enclosed area of artifacts whose acquisition and, in many cases, preparation for use required a significant expenditure of time (most of the Tambourets hammers are complex, ground-stone implements [Bricker and Sieracki n.d.]). For both occupations, the paucity of burnt flints in zone 1 makes it extremely unlikely that hearths were located within the structures, a finding that makes sense in light of the very restricted enclosed space.

Zone 4, the front activity zone, contains the widest range of retouched tool classes. These include scrapers (of all kinds for the early occupation, end-scrapers only for the late one), burins, marginally retouched pieces, splintered pieces, denticulates, category D notched pieces, and (for the early occupation only) hammerstones. Nuclei and unretouched débitage products are extremely frequent; zone 4 is a major locus of flint-knapping for both occupations. The abundant presence of both burnt flints and cracked cobbles makes zone 4 a very probable locus of some of the hearths used during both occupations. All the indications are that zone 4 was the major, general-purpose activity zone for each occupa-

tional unit. The quantity and variety of occupational debris, especially the nuclei and unretouched débitage products, make it likely that this zone was in part an area of discard and trash accumulation, but the indications that it contained major hearths as well makes it very unlikely that it was just a discard area.

Zone 2, the immediate front periphery, exhibits a mixture of the characteristics of the more clearly defined zones 1 and 4. It contains some tool classes characteristic of the interior of the structure (e.g., Châtelperron points), some characteristic of the front activity zone (e.g., end-scrapers), and some found in both (e.g., marginally retouched pieces). The main justification for recognizing the immediate front periphery as a separate zone is the tabulation of what it does not have: it does not have as full a range of tool classes as the front activity zone, it does not have very many nuclei, and it does not have good evidence that hearths were located within it.

The tool classes of zone 3, the immediate rear periphery, include most of those characteristic of the structure's interior, but there are in addition end-scrapers (early occupation only), side-scrapers, burins, splintered pieces, and denticulates. Burnt flints are numerous in zone 3 behind the northeast or left rear corner of Structure 2 (early occupation), but cracked cobbles are almost absent in that region. Exactly the same circumstances obtain behind the left rear corner of Structure 1 (late occupation). This is an important observation, because if the presence of burnt flints indicates the presence of small surface hearths in zone 3, they were of a different nature from the hearths of zone 4, the front activity zone. Unretouched débitage products are present throughout zone 3 in both occupations, but nuclei are not particularly common except behind the left rear corners of the structures, more-or-less coincident with the burnt flints.

The characteristics of zone 5, the side activity area, seem to be somewhat different in the two occupations. This may be a real difference in occupational microstructure, or it may simply be a result of the fact that much of Archaeological Level 1 in what was the early occupation's zone 5 was removed by the excavation in historic times of the ditch in trenches VI and VII. For the late occupation, the tool classes prominently represented in zone 5 include end-scrapers, burins, truncated pieces, marginally retouched pieces, and splintered pieces. The abundant presence of both nuclei and unretouched débitage products suggests that this zone was a major locus of flint-knapping, of no less importance than the front activity zone, zone 4. For the early occupation, the only retouched tool classes that can be firmly assigned to zone 5 are end-scrapers and burins, but the samples of nuclei and unretouched débitage products are large enough to indicate a major locus of flint-knapping in this zone, probably centered in the area subsequently disturbed by the ditch. For both occupations, zone 5 contains spatially coincident concentrations of burnt

flints and cracked cobbles, suggesting the presence there of the same kinds of surface hearths found also in the front activity zone.

Zone 6, recognized for the early occupation only, contains significant numbers of only three retouched tool classes--burins, marginally retouched pieces, and denticulates. Nuclei and unretouched débitage products are, however, very abundant. Cracked cobbles are numerous, but burnt flints are almost completely absent; this suggests that zone 6 was a locus of hearth-debris discard rather than of the hearths themselves. Indeed, zone 6 may have functioned primarily as a dump area for the early occupation. An analogously located area for the late occupation would lie beyond the limits of excavation.

It was stated earlier that a principal task of the analysis was to test a specific model of occupational microstructure against the data obtained from artifact backplotting. The model specified that the two artificial structures in the Main Area are of slightly different ages, that Structure 2 and most low-scatter artifacts result from an early occupational episode, and that Structure 1 and most high-scatter artifacts result from a late occupational episode. The results of the test have now been summarized in the preceding paragraphs and the accompanying figures. These results give a picture of great internal coherence with respect to both a) the spatial relationships between the artificial structures and distinct zones of artifact concentration and b) the content of these zones. The structural similarities between the two occupational episodes called for by the model are both numerous and detailed, and that structure itself is a complex one (not a simple concentric or clinal pattern). If the test results had produced very different structural patterns for the two artifact scatters, the plausibility of the model of two successive occupational episodes would not be great (although it still might be correct!). The fact that the test results produce two examples of what is quite clearly the same occupational structure even though they are quite differently oriented and stratigraphically superposed means that the model is very highly plausible. The partial data available on artifact refits and rejoins support the stratigraphic reality of the two principal artifact scatters and supply an additional reason for confidence in the interpretation.

Although there will always be "noise" in a complex palimpsest like Archaeological Level 1 in the Main Area, there can be little doubt that the analytic techniques employed have permitted the recognition of the principal characteristics of the microstructure of two Châtelperronian occupational episodes at Les Tambourets. How this information compares to information gained at other European Upper Palaeolithic open-air sites is the subject of the final section of this paper.

VI. Comparison and Interpretation

As a result of recent research, most of which has been done during the past two decades, there is now a solid body of data on occupational microstructure at European Upper Palaeolithic sites that can be used to place the new information from Les Tambourets into a comparative context. The discussion deals first with the artificial structures themselves and then with the general patterning of the use of space, of which the structures make up only one element.

Any attempt to compare the artificial structures of Les Tambourets with those of other sites must deal first with the astonishing variety of artificial structures now known--a formal or typological variety that reflects a much less well understood heterogeneity in the functions served by such structures. In order to focus the comparison on contextually similar examples, the artificial structures at Les Tambourets may be described as a) located in the open air rather than in a rockshelter or cave, b) superficial rather than semisubterranean, c) lacking interior paving of cobbles or slabs, d) of quadrilateral rather than round, oval, or other shape, and e) of small size. Several other characteristics important to comparison are functionally related to the small size of the structures: f) there are no internal divisions or architectural components (walls, benches, etc.); g) associated hearths are outside rather than inside; and h) the artifact scatter is predominantly outside. The nature of the wall coverings (skin, vegetal material?) is unknown, but some other characteristics of the superstructure may be inferred from the absence of post-molds and "tent-weight" stones: i) the structures apparently had peripheral support members only, like a dome or tipi, rather than relying on axial poles or other internal support members as well (this is most likely another functional consequence of small size); j) although their nature is unknown (wood, bone, tusk?), it appears that the support members rested on the ground surface rather than being implanted; and k) the structures had wall anchors of earth or osseous material rather than of stone.

Compared with other known artificial habitation structures of the European Upper Palaeolithic, those of Les Tambourets are near the small end of the range of enclosed area, less than five square meters. Leroi-Gourhan is of the opinion that the Magdalenian tents at Pincevent had an enclosed area of no less than seven square meters (Leroi-Gourhan and Brézillon 1972:247). Gaussen's (1980:217-227) interpretation of the artificial structure at the Magdalenian site of Plateau Parrain envisages a tent enclosing ca. 18 m^2 of floor space and, perhaps, one hearth set on a cobble pavement. Much larger, multi-hearth habitation structures are known from the Upper Palaeolithic of Central Europe--for example, a two-hearth superficial structure at the "Gravettian" site of Lubná in Czechoslovakia with an enclosed area of ca. 32 m^2 (Banesz 1976:22-23), or the huge semisubterranean Structure 3 at the Czech late Aurignacian site of Barca I with seven interior hearths and an enclosed area of ca. 120 m^2 (1976:15-16). Of course the major variable here is the proportion of the total

"living floor" that is located within the artificial shelter or the proportion of the total range of habitational activities that took place inside vs. outside. At a site like Barca I, interpreted as a winter dwelling in a very harsh climatic context, the interior of the capacious pit-house was certainly the locus of the majority of domestic activities, including flint knapping (occupational debris is found only within the structure). At other sites, the enclosed area was used for only a small part of the total range of domestic activities and could therefore be much smaller. An obviously extreme case is the use of artificial structures primarily as sleeping shelters, and the very small structures at Les Tambourets must belong close to this end of the continuum. Structures this small, though rare, have been reported from other sites--for example, a semi-subterranean structure at the Czech Upper Palaeolithic site of Žakovska with an area of ca. 3.5 m^2 (Banesz 1976:23). Examples from southwestern France include Tent 1 at Corbiac with an area of ca. 4.2 m^2 (Bordes 1968:252) and, if they are indeed tent foundations, Structures 1 (ca. 4 m^2) and 2 (ca. 3 m^2) at the Magdalenian site of Le Breuil (Sackett and Gaussen 1976:65; Gaussen 1980:175-191). At the Magdalenian site of Marsagny (Schmider 1984), further north in France, tents enclosing areas of 9 to 10 m^2 are divided into several functionally different zones; the clearly defined sleeping spaces have areas of between 3 and 5 m^2, equivalent to the total areas of the Tambourets structures.

The artificial structures at Les Tambourets are quadrilateral in shape, approximately rectangular in the case of Structure 2 and trapezoidal in the case of Structure 1. Such shapes are well documented at other European Upper Palaeolithic sites. Structures that are generally rectangular, with two or more clearly defined corners, occur, for example at Lubná and Žakovska in Czechoslovakia (Banesz 1976) and at Guillassou, Plateau Parrain, Le Cerisier, and Le Breuil in southwestern France (Sackett and Gaussen 1976; Gaussen 1980). A specifically trapezoidal shape is rarer for the Upper Palaeolithic, but several examples are reported by Banesz (1976) from Czechoslovakia: Structure 1 at the early Aurignacian site of Barca II, the structure at the "Gravettian" site of Barca-Svetlá III, and a Magdalenian habitation structure at Kvící u Slaného.

One very distinctive characteristic of the structures at Les Tambourets is that the "wall effect" is a double artifact alignment enclosing linear empty spaces that are nearly free of cultural debris. I have located only one example in the literature that is similar. At the Terminal Palaeolithic site of Orp in Belgium (Vermeersch et al. 1984), the very partial outline of what may be a circular tent shows up as a narrow (ca. 25 cm), arcuate line of less dense artifact scatter between the denser interior and exterior scatters, and this probable wall line is interrupted by the structure's entrance (1984:198-199, Figs. 4 and 5). These traces are, however, not as clear as those at Les Tambourets because they are not as free of debris.

It is quite expectable that artificial structures as small as those at Les Tambourets should have peripheral supports only, not internal ones. What is less easy to accept is the absence of any evidence of those peripheral supports--postmolds and/or wedging rocks. The certain absence of postmolds at Les Tambourets could mean simply that such evidence, once present, has not been preserved, but the "Early Gravettian" site of Dömös in the loess lands of north-central Hungary (Gábori-Csánk 1984) provides a rare example of a structure with peripheral supports only whose wooden support poles rested on the surface of the ground rather than being embedded in it. The Dömös structure is larger than those of Les Tambourets (ca. 10 m^2 of enclosed space) and round instead of quadrilateral, so the analogy is not a close one, but the unusual conditions of preservation (1984:252-253) provide valuable evidence that the absence of postmolds sometimes means that there never were any.

That the walls of the artificial structures at Les Tambourets were in contact with the ground surface, thus impeding the free movement of debris on the living floor, is clearly indicated by the linear empty spaces that define the structures' locations. There is, however, no positive evidence about how the bottoms of the wall coverings were anchored. Confronted with the same lack of evidence at Pincevent, Leroi-Gourhan suggested that the anchoring device could have been a low bead or rim of earth packed against the bottom of the tent walls, and an experiment conducted on the site with a canvas tent demonstrated the efficacy of the technique (Leroi-Gourhan and Brézillon 1972:246 and fn 75). In addition to the comparative example from the German Epipalaeolithic cited by Leroi-Gourhan (1972:246, fn 74), an earthen bead used as a wall anchor is known from the Czech site of Barca-Svetlá III, but here the bead is up to 30 cm high, stratigraphically quite visible (Banesz 1976:21). A thick bead of earth surrounds a semisubterranean Upper Périgordian habitation structure at Vigne Brun in eastern France (Combier 1976:145), but it is not clear whether this served as a wall anchor. Despite the reasonableness of the suggestion, stratigraphic evidence of an earthen wall anchor is not found at Les Tambourets (or, indeed, at Pincevent), and we are left in total ignorance about the mechanisms of the superstructure.

The comparisons between the artificial structures from Les Tambourets and those known from other European Upper Palaeolithic sites lead to the following general conclusions:

a) None of the individual characteristics of the Tambourets structures is unique. Considered separately, the defining traits of size, shape, and other features have analogues widely distributed in Upper Palaeolithic Europe.

b) The combination of characteristics has not yet been reported from other sites. That the Tambourets structures should have no known exact duplicates is not surprising given the great formal and functional variation already documented by the archaeological record.

The best developed and best documented model of occupational microstructure in the French Upper Palaeolithic is that defined by André Leroi-Gourhan on the basis of his research at the open-air Magdalenian site of Pincevent in the Paris Basin (Leroi-Gourhan and Brézillon 1972). This model has proved very useful for the analysis of other open-air Magdalenian sites of north-central France--for example, Etiolles (Essonne) (Taborin 1984), Verberie (Oise) (Audouze and Cahen 1984), and Marsagny (Yonne) (Schmider 1984)--and its general principles have been extended to the interpretation of rockshelter occupations of different ages in different regions--for example, Flageolet-1 (Dordogne) (Rigaud 1976; Simek 1984). There is, then, good reason to compare the far more limited data from Les Tambourets with this model, whose general utility has made it the base-line for such studies in western Europe.

The main outlines of the Pincevent model (Leroi-Gourhan and Brézillon 1972:239-256) are sufficiently well known to require only a brief summary. Each habitation unit is thought of as being composed of three general kinds of space, each functionally different--domestic activity space, sleeping space, and discard or trash-accumulation space. More specifically, the domestic activity space is centered on a hearth, space A, which is located somewhere in front of the sleeping space or "espace retiré", space C. That part of the domestic activity space lying between the hearth and the sleeping space is called the interior activity space (espace intérieur d'activité), space B1, which is distinguished functionally and spatially from the activity space lying on the other or outer side of the hearth, the exterior activity space (espace extérieur d'activité), space B2. Continuing further out from this central core of the occupational area, one encounters a series of trash-accumulation spaces (espaces d'évacuation), D, E, F, and G, in which cultural debris becomes progressively scarcer, to the point where (in space G) there are only very isolated finds. This general model admits of many variations, of course, one of the most important of which for the study of open-air sites is how much of the central core (spaces A, B, and C) was roofed over by an artificial habitation structure. Leroi-Gourhan's preferred interpretation for Pincevent (1972:254, Fig. 174-V) assumes that spaces C and B1 were roofed, A was in the center of the entrance to the habitation structure, and B2 was immediately outside the entrance. Another variable feature of the model concerns the number and location of hearths; in addition to the central "domestic hearth" (space A), a habitation unit may contain one or more "satellite hearths", which differ functionally from the domestic hearth and are located at some remove from it.

It seems obvious that what has been called zone 1 at Les Tambourets, the interior of the artificial structure, corresponds most closely with space C of the Pincevent model, a covered sleeping area in which the debris scatter is significantly less dense than in the activity area(s). At Les Tambourets, however, certain activities other than sleeping seem to have taken place in zone 1 (especially activities accounting for the presence there of Châtelperron points, becs, etc.). This should perhaps be under-

stood in terms of the fact that the covered area at Pincevent is up to twice as large as that at Les Tambourets. A larger structure permits a degree of spatial segregation not feasible in a smaller one even when inclement weather, for example, forces some normally "outdoor" activities to be moved "indoors".

At Les Tambourets as at Pincevent, a major domestic activity area that includes a hearth is located in front of the sleeping area, but the two patterns differ in detail. Whereas at Pincevent the main hearth around which the domestic activity space (B1 and B2) is disposed is located in the very doorway of the tent, the probably analogous hearth at Les Tambourets is located well in front of the artificial structure, separated from its entrance by several meters. There is, furthermore, no exact correspondence of zone 2 with space B1 and zone 4 with space B2, except for the fact that nuclei are clearly less numerous in zone 2 (Tambourets) and space B1 (Pincevent) than in zone 4 and space B2. We can say only that zones 2 and 4 together seem to be functionally analogous in a general way to the Pincevent model's space B (and perhaps also spaces D and E, the limits of excavation at Les Tambourets rendering this uncertain).

The Pincevent model offers no precise analogy for the Tambourets zone 5 (side activity area). For at least one of the tents at Pincevent (V105), there is a concentration of lithic debris and retouched tools at the side of the tent, but for several reasons, including its distance from the single domestic hearth, this concentration is considered to be part of the trash accumulation space, not domestic activity space (Leroi-Gourhan and Brézillon 1972:117-123). Perhaps the incomplete nature of the Tambourets data, especially the absence of faunal remains, have led to an erroneous interpretation of zone 5, or perhaps one should expect a differently patterned use of space around circular and quadrilateral structures. What seems to be an undoubted departure from the Pincevent model is the clear importance of the immediate rear periphery, zone 3, at Les Tambourets, which differs functionally from any of the zones in front of or beside the structure. Zone 6, recognized only for the early occupation at Les Tambourets, may well correspond to one of the trash-accumulation spaces (E?) at Pincevent.

Information about hearths at Les Tambourets is disappointingly vague, but the much fuller data from Pincevent offer some suggestions that may be useful for interpretation. All of the large "domestic" hearths at Pincevent, which are located in excavated basins, contain large numbers of heat-altered rocks, whereas the smaller "satellite" hearths, whether in basins or on the ground surface, contain very few or no such rocks (Julien 1984:161). As agents of heat storage and transfer, hearth rocks can be important for several kinds of cooking techniques, the radiant heating of interior space, and some steps in the manufacture and repair of hafted tools and weapons. Even though the cracked cobbles at Les Tambourets are relatively few, small, and scattered, their spatial coincidence in zones 4 and 5 with burnt flints, which would have been altered accidentally by the

heat of fires built on the littered ground surface, is the best available evidence for "domestic" hearths at the site. The (possibly only occasional) use of hot cobbles taken from an outside hearth to heat the inside of a structure would be particularly relevant at a site like Les Tambourets, whose small structures lack interior hearths, and, of course, cooking is relevant at any habitation site. Whether the generally similar hearth areas in zones 4 and 5 had more detailed functional differences cannot be determined from the evidence available. Some of the satellite hearths at Pincevent are associated with piles of débitage debris and relatively numerous burins, whereas others are associated with piles of faunal debris and relatively numerous end-scrapers (Julien 1984:164-166). The closest thing to an analogy from Les Tambourets is the concentration of burnt flint without cracked cobbles in zone 3, behind one corner of the artificial structure. Faunal associations are, of course, unknown; stone artifact associations include nuclei for both occupations and, more tenuously, end-scrapers for the early occupation and burins for the late occupation.

The comparison of what is known about the occupational microstructure at Les Tambourets with the Pincevent model shows that whereas some elements of the model are general enough to have analogies at Les Tambourets, others are not. This is not at all surprising in light of the fact that to some extent (not understood in detail because of the incomplete data from Les Tambourets) different activities were being performed with different tools. These differences have their clearest expressions in the distributional patterns of specific retouched tool classes. For example, one major determinant of tool patterning at Pincevent (as well as at Verberie) is thought to be the hafting of several different kinds of tools, an activity carried out around the domestic hearth (Moss and Newcomer 1982, cited by Julien 1984:164; Audouze and Cahen 1984:154). That kind of patterning would not be produced at a site like Les Tambourets where hafting of flint tools must have been very infrequently practiced. In summary, then, although the Tambourets data have enough elements in common with the Pincevent model to reassure us that we are dealing with a generally familiar phenomenon, their principal value is that they give us a somewhat different picture, from the opposite end of the Upper Palaeolithic time span.

The final comments of this paper concern the comparison of occupational microstructure at Les Tambourets with data from other Châtelperronian sites. We do not expect to find here some distinctively Châtelperronian pattern that differs from an Aurignacian pattern or a Magdalenian pattern, because functional considerations may be expected to overshadow culture-traditional factors in determining occupational microstructure. What is of interest, rather, is the attempt to understand the range of variation within one cultural tradition, in this case one of the two major traditions of the initial Upper Palaeolithic of France.

What is still the richest information (including faunal data) on Châtelperronian habitation structures comes not from an open-air site, but

a rockshelter. Several artificial structures or "huts" are known from Levels IX and X at the Grotte du Renne at Arcy-sur-Cure (Leroi-Gourhan 1961; 1976:661, Fig.7; Hours 1965), the best preserved of which has an irregular oval shape, conforming in part to limits imposed by the contours of the shelter and fallen blocks. Although the exact layout of the structure, especially the location of the entrance and its relationship to the hearth, is less than certain because of modification and reuse, it is apparent that it contains a roughly circular central space of ca. 3.5 m^2, bounded by a ring of cobbles and small rock slabs. Interpreting a pattern of irregularly spaced post-molds most liberally, the central space may lie within a maximum covered area of ca. 8 m^2. One of the most interesting bits of information about this structure is the fact that its support elements were, in part at least, lengths of mammoth tusk, numerous fragments of which were recovered in excavation, having collapsed inward onto the structure's floor. The bases of the tusks were embedded into the sediments of the underlying Mousterian level, and in some cases wedging stones were used to help hold them in place. Because the structure was reused several times, the scatter of associated artifacts and faunal debris is a complex palimpsest, and we do not have the kind of detailed information on the microstructure of discrete occupational episodes provided by sites like Pincevent. In spite of this limitation, the data from the Grotte du Renne indicate that considerable organizational and technological complexity may be quite justifiably assumed in attempts to interpret open-air Châtelperronian sites.

It is unfortunately the case that very little comparative information about occupational microstructure is now available from open-air Châtelperronian sites other than Les Tambourets. A site that may be quite informative when its analysis and publication are completed is the open-air site of Canaule II (commune de Creysse, Dordogne) excavated by Guichard (Bordes 1970:501-503; Harrold 1978:211-214). In an excavated area of 67 m^2, a single, thin, archaeological level contains Châtelperronian flint tools and débitage products, often in clearly separated lateral concentrations (Bordes 1970:502, Fig.24). The abundance of chipping debris and the site's proximity to sources of high-quality flint suggest that it was a quarry or workshop site (Harrold 1978:214). Neither hearths nor architectural elements of artificial structures are known, and information derived from the patterning of different artifact classes has not yet been reported.

Some partial data are available from the open-air site of Le Basté at Saint-Pierre-d'Irube (Pyrénées-Atlantiques). Salvage excavations conducted by Chauchat (1968; 1970; Chauchat and Thibault 1968) during the time that the site was being destroyed by construction activities exposed ca. 16 m^2 of a Châtelperronian occupation level (Level 3bm). Three different patterns of artifact concentration are reported--one for nuclei, hammerstones, and débitage products (Chauchat 1968:Pl.XXIII), another for Châtelperron points, only partially coincident with the former (1968:Pl. XXIV), and a third, completely different one for cobble choppers (1968:Pl.XXV). The distributions of burins and scrapers are not localized.

No hearth is present in the small area excavated, and Chauchat reports no trace of anything that could be interpreted as an artificial structure.

Another open-air Châtelperronian site of which too little remained to provide much information on occupational microstructure is La Côte (Neuvic-sur-Isle, Dordogne). Most of the site having been destroyed earlier by highway construction, a small remaining portion (ca. 17 m^2) of a Châtelperronian level (Archaeological Level 3) was salvaged in 1971 and 1972 by Gaussen and Texier (1974; Gaussen 1980) just before a widening of the road completed the destruction of the site. Within the area excavated, the density of the artifact scatter varies greatly. Although the authors conclude that there are no spatial concentrations of any given tool class (Gaussen and Texier 1974:518), the publication of the complete artifact distribution map (1974:519, Fig.9) permits the observation of somewhat different patterning for different classes. For example, almost all truncated pieces and backed pieces are located in the southern half of the excavated area, part of the dense scatter of artifacts of all kinds found in that area of the site. Scrapers, on the other hand, are far more uniformly distributed, and they are the most numerous retouched tool class in the northern half of the excavated area. These kinds of differences are reminiscent of the differences among zones at Les Tambourets, but too little of La Côte was left to permit further interpretation.

Occupational microstructure within the Châtelperronian tradition remains very sparsely documented. For open-air sites of this tradition, the information from Les Tambourets stands alone at the present time.

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ARTIFICIAL HABITATION STRUCTURES IN THE CHATELPERRONIAN:
EVIDENCE FROM LES TAMBOURETS (HAUTE-GARONNE, FRANCE)
WITHIN THE CONTEXT OF UPPER PALAEOLITHIC SETTLEMENTS
IN EUROPE

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TABLES and FIGURES

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TABLE 1.--Characteristics of clusters of nuclei, based on seven stages of k-means clustering.

Cluster	n (Nuclei)	RMS (in cm.)	%	RMS/%	Clusters Chosen	Cum.%
1	30	92	14.42*	6.38		
2	50	114	24.04*	4.74	1st (A)	24.04
3	14	113	6.73	16.79		
4	32	94	15.38*	6.11	2nd (B)	39.42
5	35	107	16.83*	6.36	3rd (C)	56.25
6	18	96	8.65	11.10		
7	29	107	13.94	7.68		

N = 208; c = number of clusters (= 7 in this case); $\overline{\%}$ = (1 ÷ c) x 10 = 14.29; % = (n ÷ N) x 100
*: satisfies Criterion 1 (see text discussion)

TABLE 2.--Results of k-means analysis (cf. Figures 4 and 5).

Artifact Category	Cluster Number	n	RMS in cm	%	RMS/%	Cum.% for Plotted Clusters	
End-Scrapers	1	12	85	16.67*	5.10		
	2	1	0	1.39	0		
	3	11	65	15.28*	4.25	B	31.95
	4	8	98	11.11	8.82		
	5	14	95	19.44*	4.89	C	51.39
	6	8	80	11.11	7.20		
	7	12	63	16.67*	3.78	A	16.67
	8	4	87	5.56	15.66		
	9	2	51	2.78	18.36		
Side-Scrapers	1	2	45	7.14	6.30		
	2	3	99	10.71	9.24		
	3	2	41	7.14	5.74		
	4	5	71	17.86*	3.98	B	35.72
	5	5	70	17.86*	3.92	A	17.86
	6	4	85	14.29*	5.95	D	64.30
	7	2	70	7.14	9.80		
	8	4	76	14.29*	5.32	C	50.01
	9	1	0	3.57	0		
Burins	1	9	131	12.16	10.17		
	2	7	98	9.46	10.36		
	3	2	64	2.70	23.68		
	4	9	117	12.16	9.62		
	5	28	88	37.84*	2.33	A	37.84

(Table 2--continued)

Artifact Category	Cluster Number	n	RMS in cm	%	RMS/%	Cum.% for Plotted Clusters	
	6	13	116	17.57*	6.60	B	55.51
	7	6	104	8.11	12.83		
Châtelperron Points**	1	2	4	8.70	0.46		
	2	6	107	26.09*	4.10	B	43.48
	3	3	88	13.04	6.75		
	4	3	142	13.04	10.89		
	5	3	64	13.04	4.91	C	56.52
	6	4	66	17.39*	3.80	A	17.39
	7	2	27	8.70	3.11		
Marg. Ret. Pieces**	1	5	62	13.89	4.46	C	52.78
	2	2	51	5.56	9.18		
	3	5	92	13.89	6.62		
	4	5	102	13.89	7.34		
	5	6	106	16.67*	6.36	B	38.89
	6	5	70	13.89	5.04		
	7	8	90	22.22*	4.05	A	22.22
Splintered Pieces	1	8	120	13.33	9.00		
	2	9	101	15.00*	6.73		
	3	4	154	6.67	23.10		
	4	9	91	15.00*	6.07	B	51.67
	5	22	97	36.67*	2.65	A	36.67
	6	5	73	8.33	8.76		
	7	3	40	5.00	8.00		
Nuclei (see Table 1)							
Utilized Blades	1	17	73	7.02	10.40		
	2	48	101	19.83*	5.09	A	19.83
	3	10	66	4.13	15.98		
	4	34	146	14.05	10.39		
	5	46	114	19.01	6.00		
	6	38	94	15.70*	5.99	C	55.78
	7	49	107	20.25*	5.28	B	40.08
Unmodified Blades	1	29	131	18.95	6.91		
	2	15	100	9.80	10.20		
	3	4	67	2.61	25.63		
	4	24	82	15.69*	5.23	B	37.26
	5	20	149	13.07	11.40		
	6	28	105	18.30*	5.74	C	55.56
	7	33	88	21.57*	4.08	A	21.57

(Table 2--continued)

Artifact Category	Cluster Number	n	RMS in cm	%	RMS/%	Cum.% for Plotted Clusters	
Utilized Flakes•	1	79	96	14.21	6.76		
	2	92	101	16.55*	6.10	A	16.55
	3	32	64	5.76	11.12		
	4	109	133	19.60*	6.78	D	68.35
	5	65	125	11.69	10.69		
	6	91	101	16.37*	6.17	B	32.92
	7	88	100	15.83*	6.32	C	48.75
Unmodified Flakes	1	154	97	13.76	7.05		
	2	207	103	18.50*	5.57	A	18.50
	3	59	75	5.27	14.22		
	4	163	136	14.57	9.34		
	5	200	111	17.87*	6.21	B	36.37
	6	179	103	16.00*	6.44	C	52.37
	7	157	105	14.03	7.48		
Burnt Flints	1	27	108	14.84*	7.28	C	51.11
	2	27	101	14.84*	6.81	B	36.27
	3	6	65	3.30	19.72		
	4	22	89	12.09*	7.36	D	63.20
	5	39	80	21.43*	3.73	A	21.43
	6	24	119	13.19*	9.02		
	7	10	78	5.49	14.20		
	8	20	87	10.99	7.92		
	9	7	71	3.85	18.46		
Cracked Cobbles	1	15	123	11.54	10.66		
	2	22	102	16.92*	6.03	C	66.92
	3	7	143	5.38	26.56		
	4	31	98	23.85*	4.11	A	23.85
	5	9	102	6.92	14.73		
	6	34	122	26.15*	4.66	B	50.00
	7	12	96	9.23	10.40		
Flints at a High Angle	1	86	97	16.90*	5.74	B	35.96
	2	44	73	8.64	8.44		
	3	37	124	7.27	17.06		
	4	97	108	19.06*	5.67	A	19.06
	5	57	112	11.20*	10.00	D	59.93
	6	51	86	10.02	8.58		
	7	28	102	5.50	18.54		
	8	65	79	12.77*	6.19	C	48.73
	9	44	85	8.64	9.83		

*: % > $\overline{\%}$ **: Criterion 4 invoked •: Criterion 3 slightly exceeded

FIGURE CAPTIONS

Figure 1.--General scatterplot of all catalogued objects in Archaeological Level 1 in the Main Area at Les Tambourets. (Archaeological Level 1 had been removed by a ditch of historic age in portions of Trenches VI and VII.)

Figure 2.--Remains of Structure 1. Above: Traces of the wall lines superposed on a portion of the general scatterplot. Below: Outline of the structure superposed on a contour map of the surface of couche C; elevations shown are below site datum. Each named square--e.g., III-A--measures 2 m x 2 m (cf. Figure 1).

Figure 3.--Remains of Structure 2 (graphic conventions as for Figure 2).

Figure 4.--Locations of the salient k-means clusters of end-scrapers and other artifact classes superposed on the traces of the artificial structures. Each salient cluster is plotted as a circle whose radius is the value of "RMS" for that cluster.

Figure 5.--Locations of the salient k-means clusters of unmodified blades and other artifact classes (graphic conventions as for Figure 4).

Figure 6.--Example of a backplotting worksheet used in the definition of high-scatter and low-scatter artifacts (see text for detailed discussion).

Figure 7.--Second example of a backplotting worksheet (see text for detailed discussion).

Figure 8.--Scatterplot of end-scrapers in Archaeological Level 1 in the Main Area. Open triangle = artifact in the low scatter; solid square = artifact in the high scatter; open circle = artifact not clearly assignable to either scatter.

Figure 9.--Interpretation of the patterning revealed by backplotting (cf. Figures 6 and 7) and separate-scatter mapping (cf. Figure 8) for end-scrapers and other artifact classes. Above, in each pair of maps: Relationship of low-scatter artifacts to Structure 2. Below: Relationship of high-scatter artifacts to Structure 1.

Figure 10.--Interpretation of the pattern revealed by backplotting and separate-scatter mapping for Châtelperron points and other artifact classes (graphic conventions as for Figure 9).

Figure 11.--Interpretation of the pattern revealed by backplotting and separate-scatter mapping for splintered pieces and other artifact classes (graphic conventions as for Figure 9).

Figure 12.--Interpretation of the pattern revealed by backplotting and separate-scatter mapping for hammerstones and other artifact classes (graphic conventions as for Figure 9).

Figure 13.--Diagrammatic sketch of the six functional zones used to define the microstructure of Châtelperronian occupation at Les Tambourets (see text for detailed discussion).

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FIGURE 1

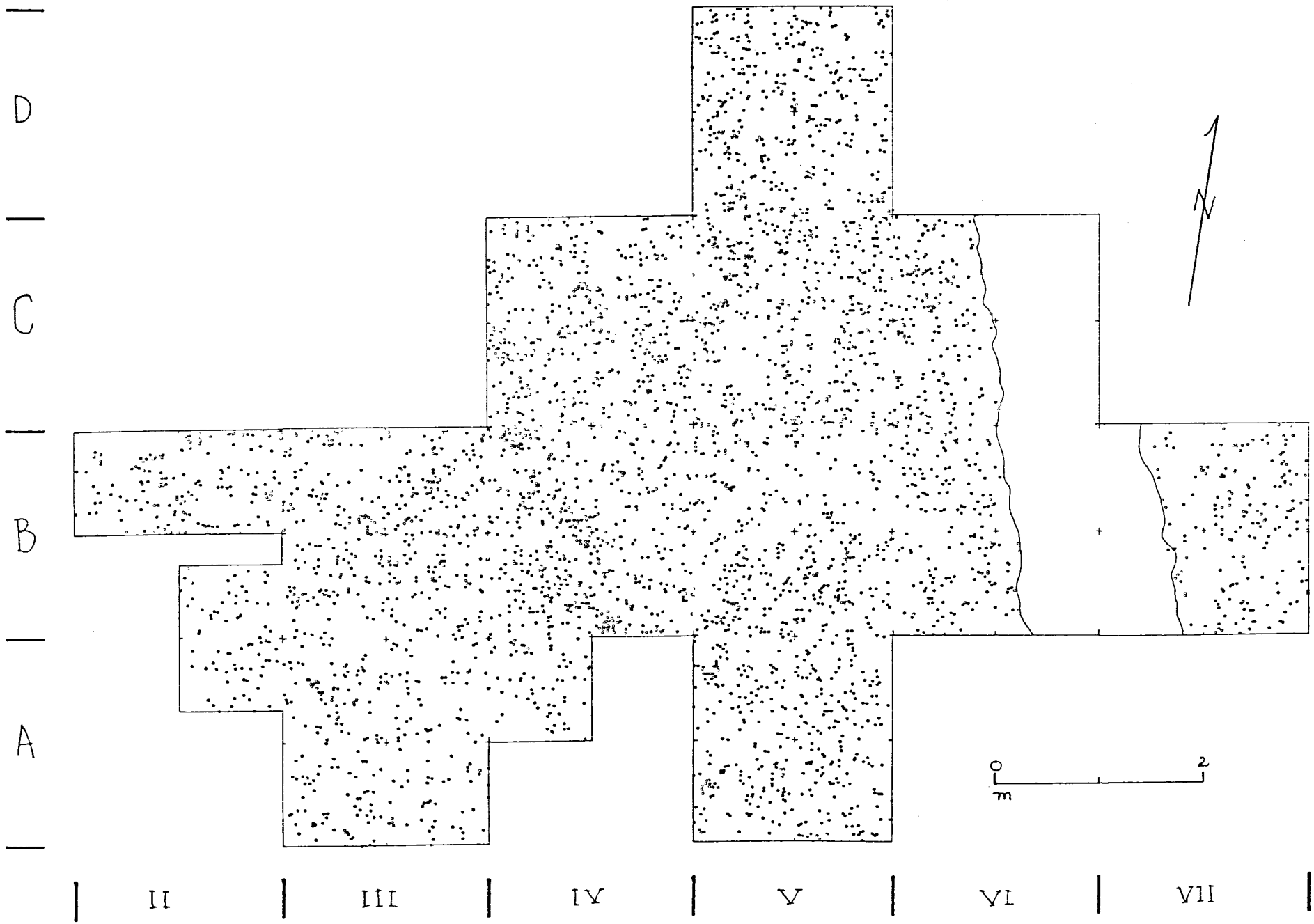

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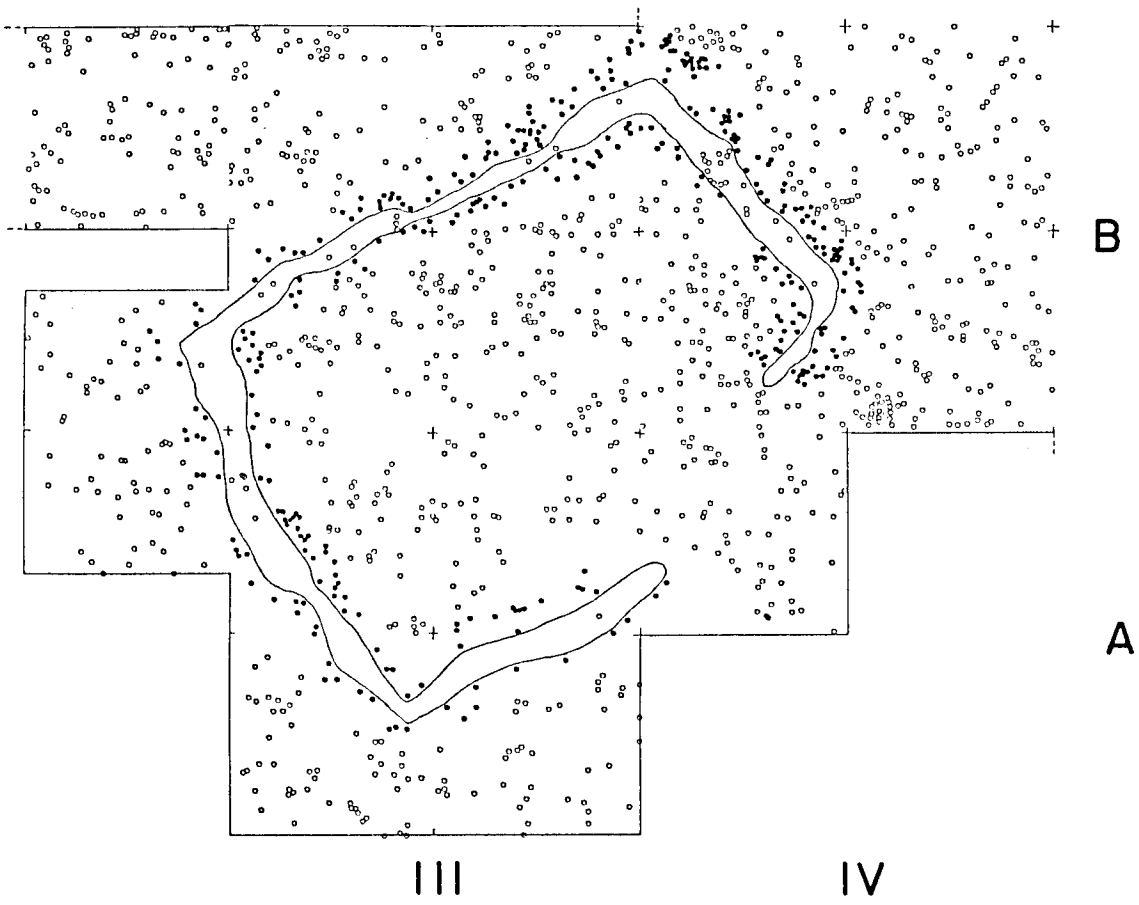
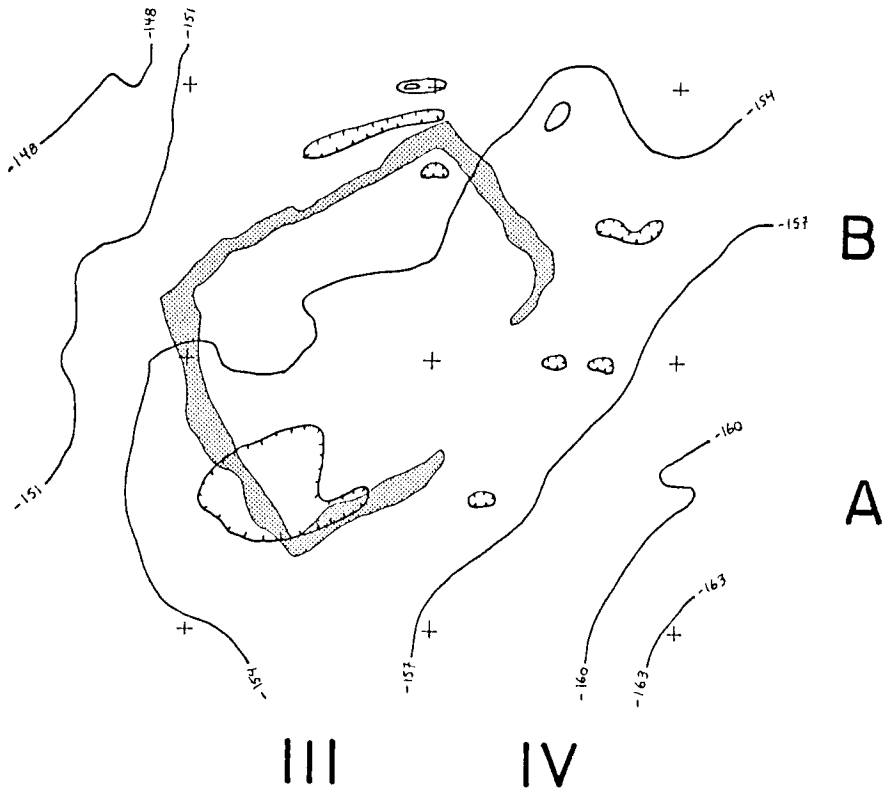
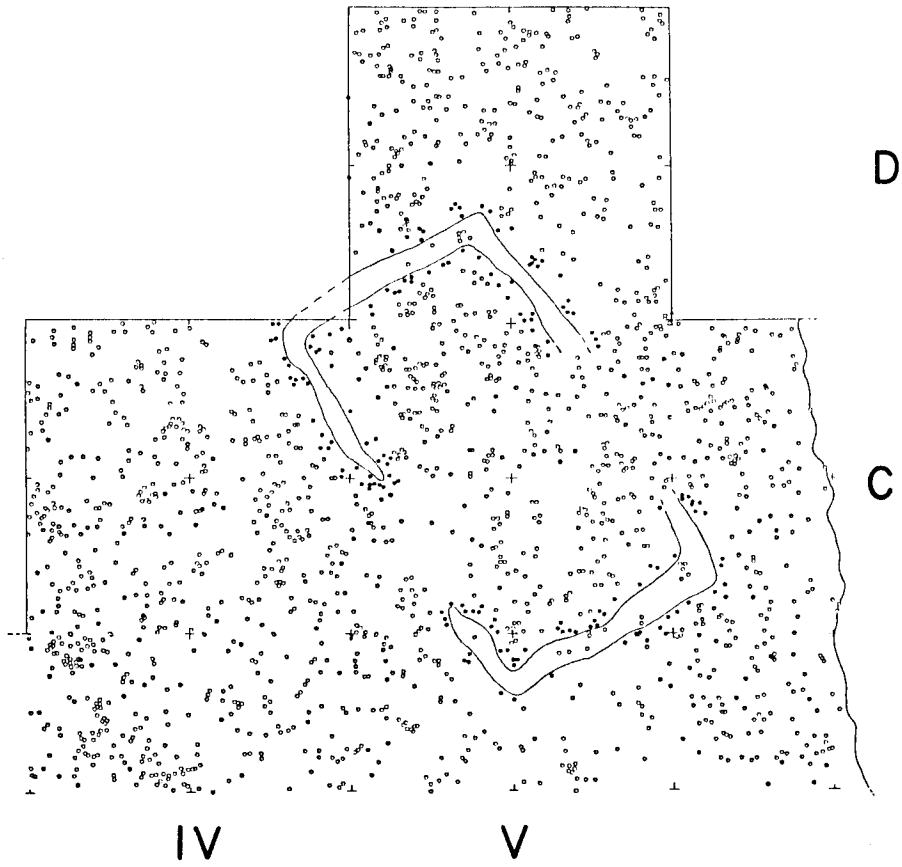
FIGURE 2





Bricker FIGURE 3



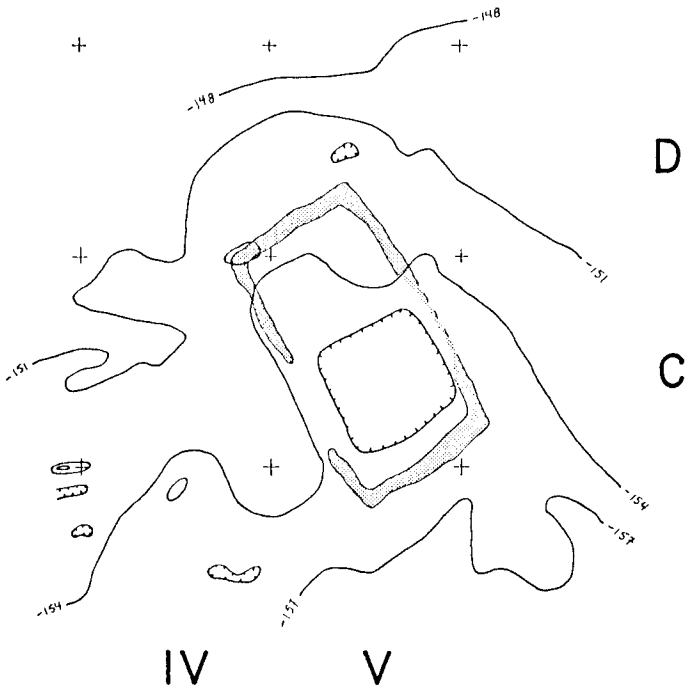


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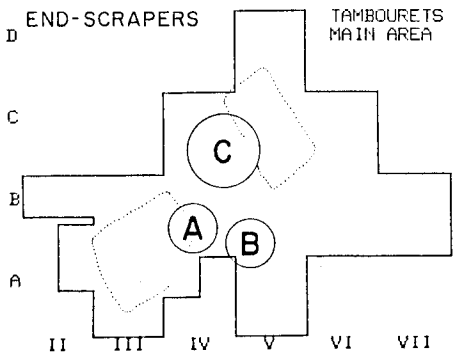
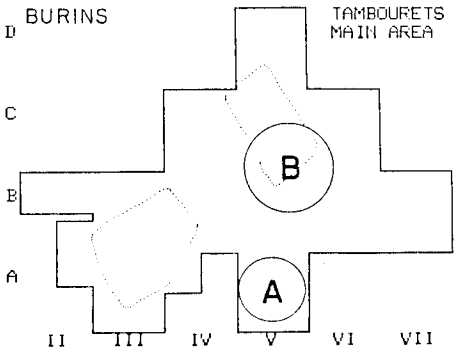
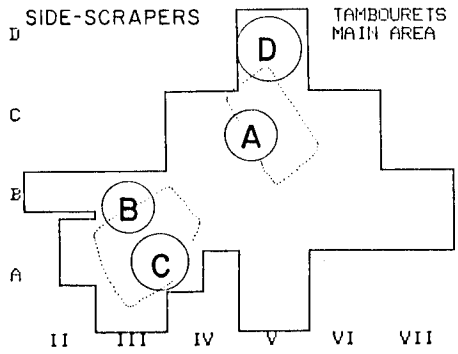
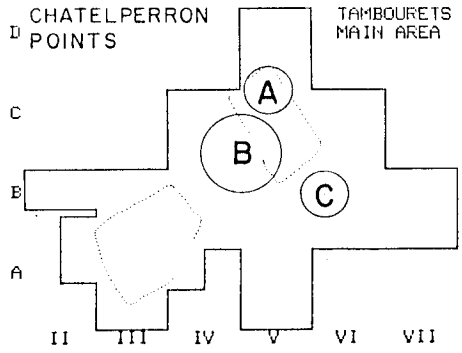
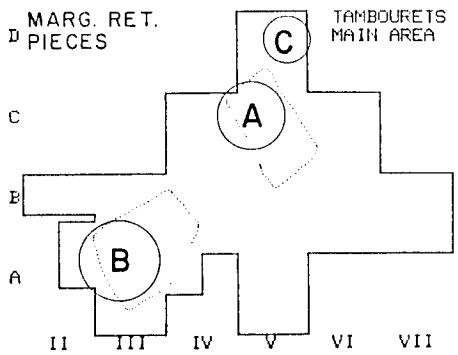
FIGURE 4

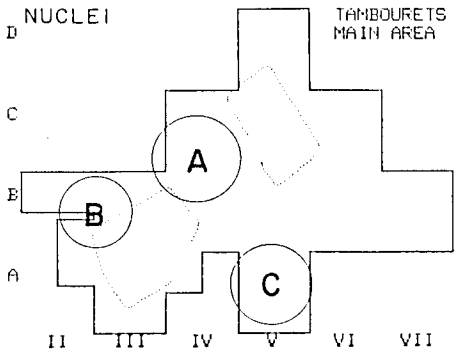


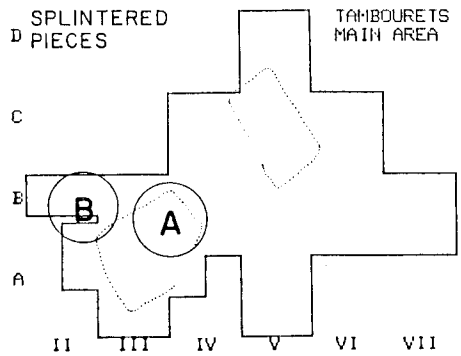


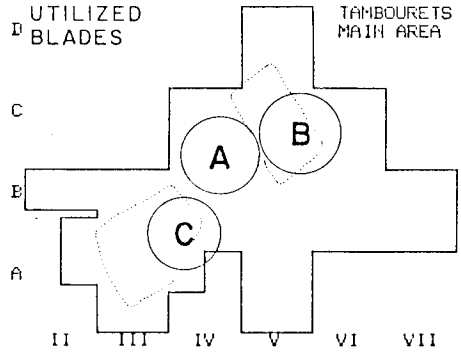






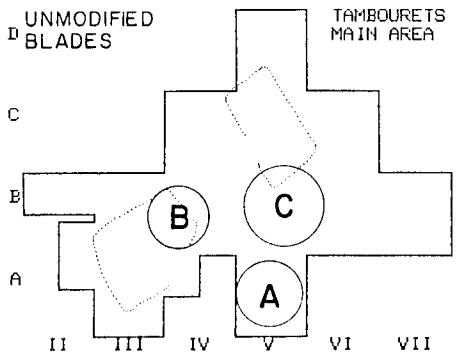


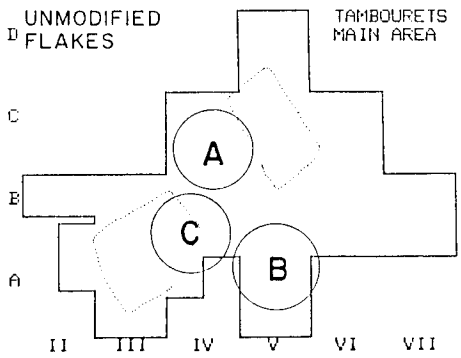


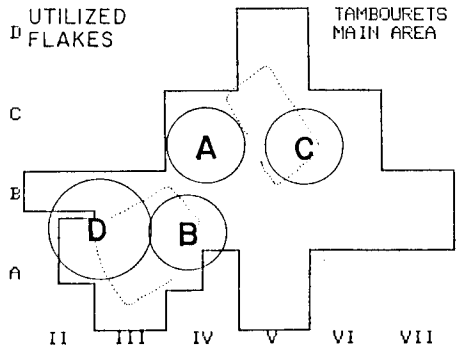


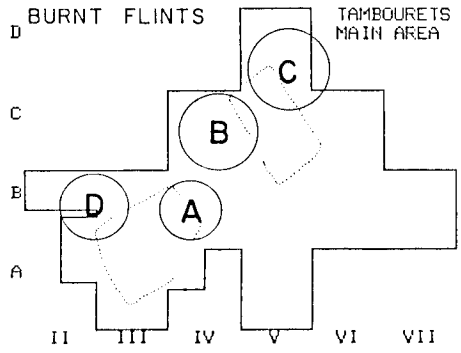
Bricker

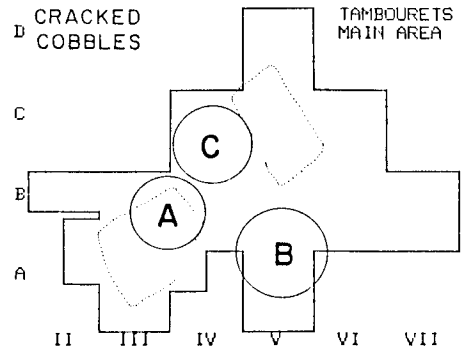
FIGURE 5

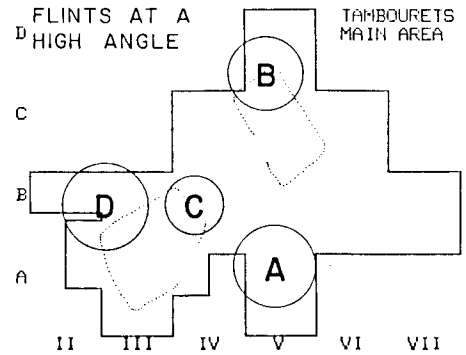






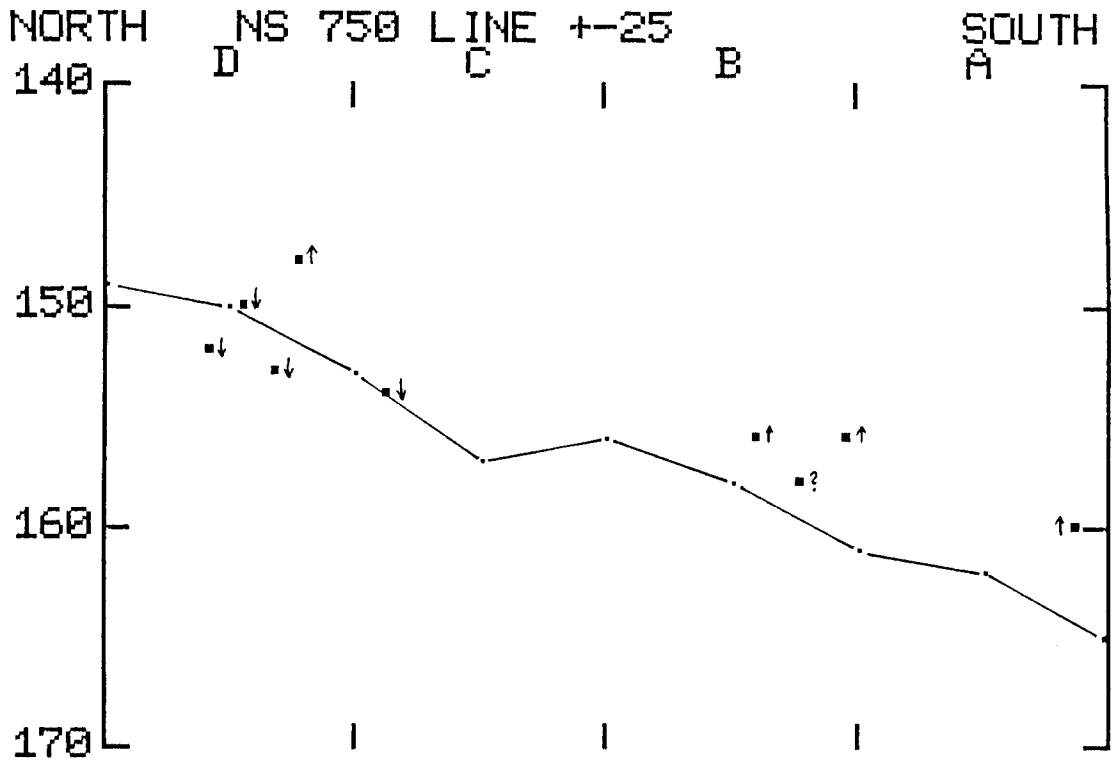






Bricker

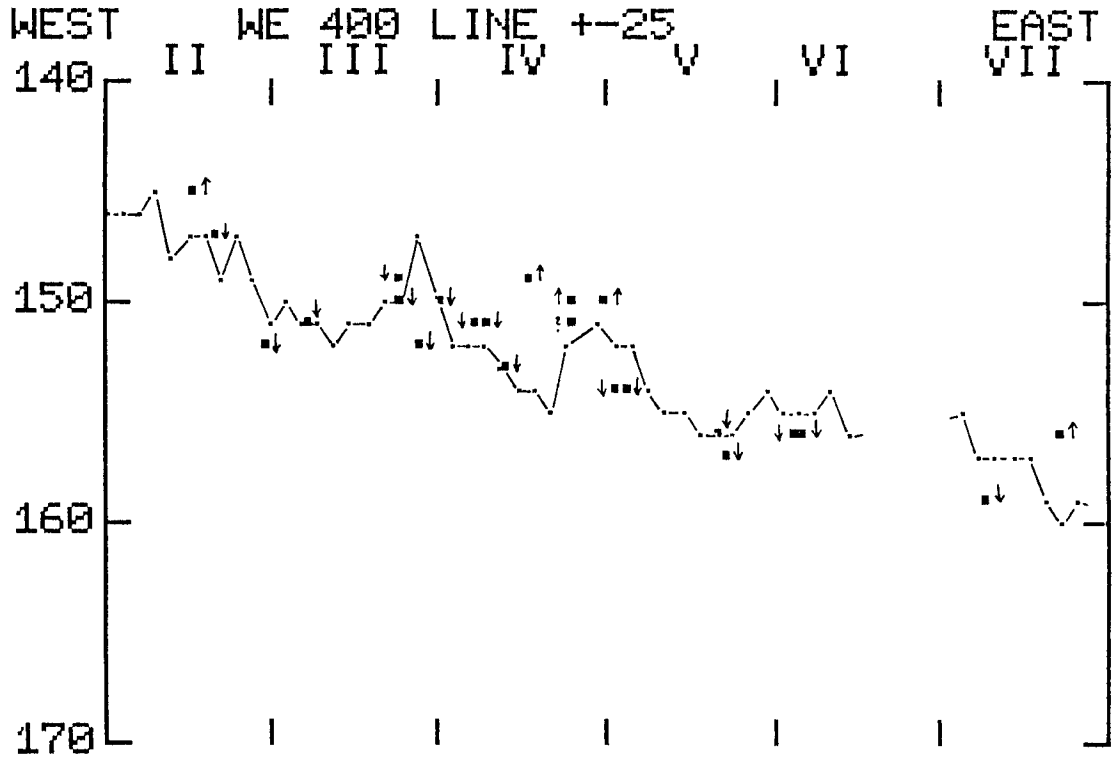
FIGURE 6



END-SCRAPERS / SURF. OF C. C

↑ = HIGH scatter
↓ = Low scatter
? = indet.

FIGURE 7

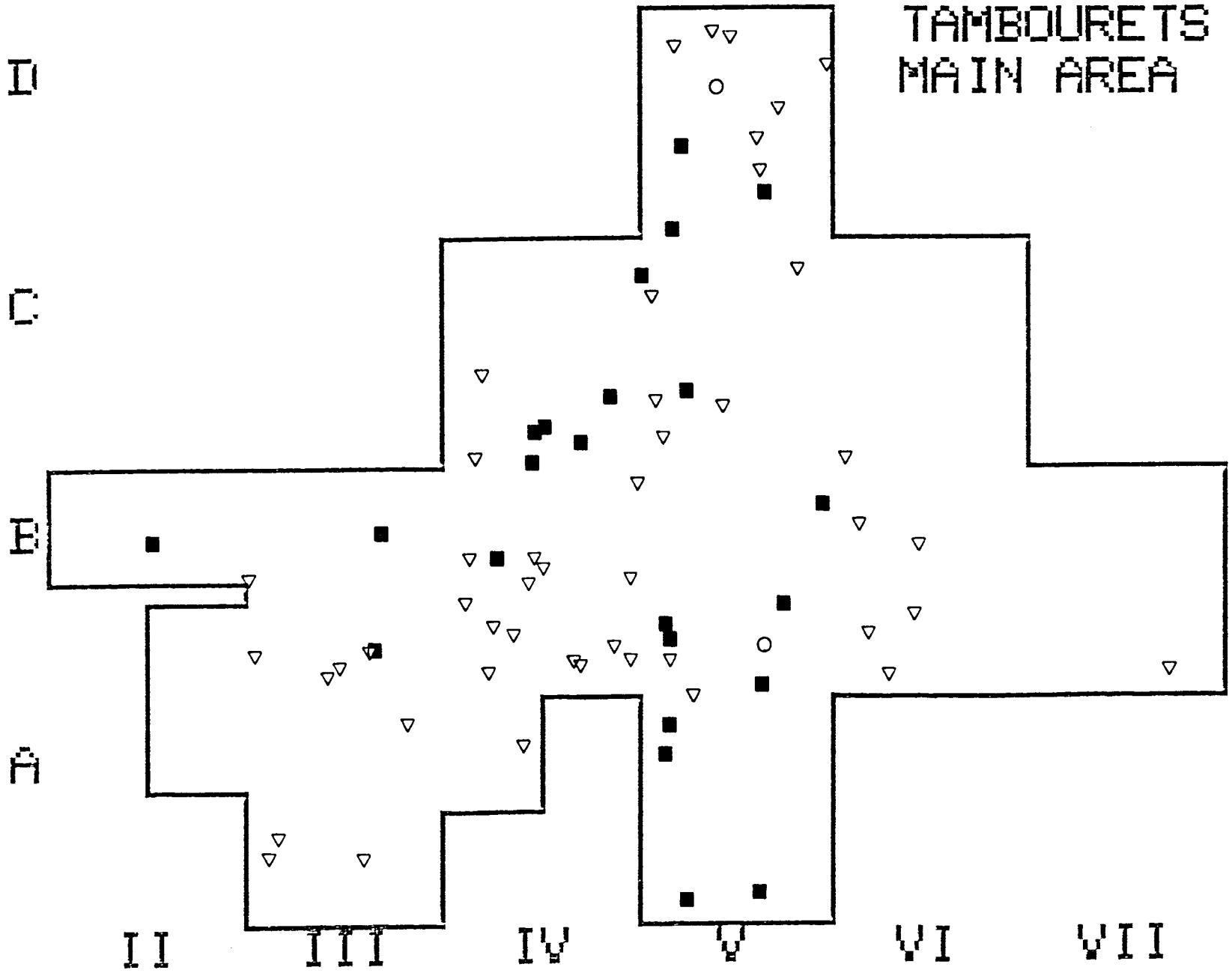


NUCLEI / SURF. OF C. C

↑ = HIGH scatter
↓ = Low scatter
? = indet.

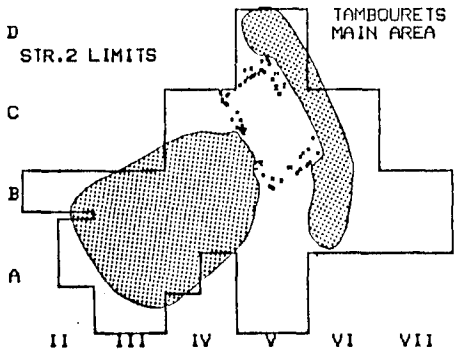
Bricker

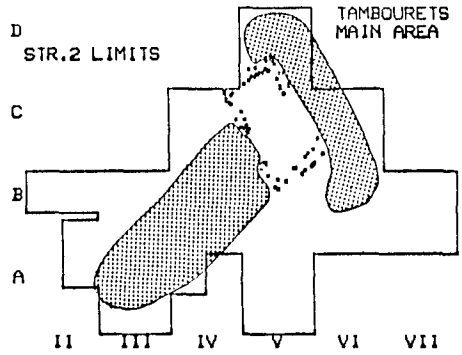
FIGURE 8

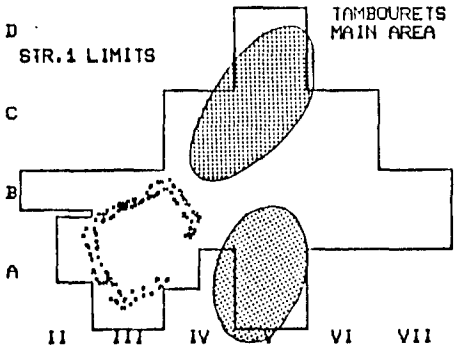


Bricker

FIGURE 9







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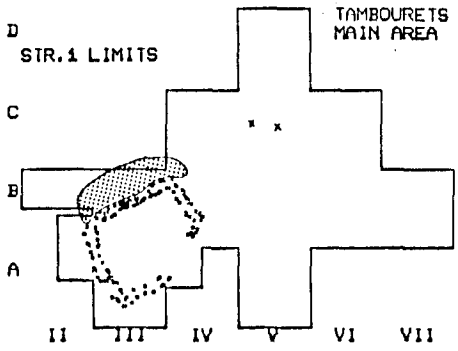
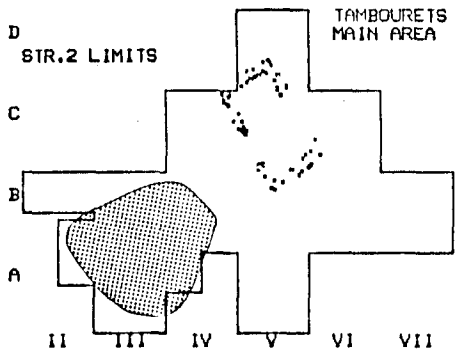
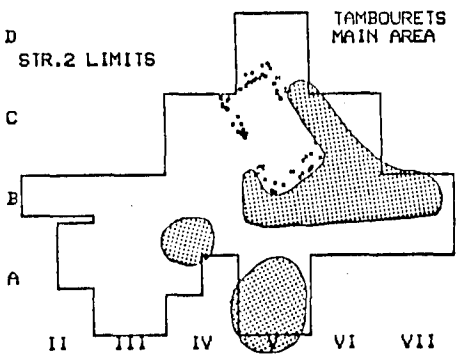
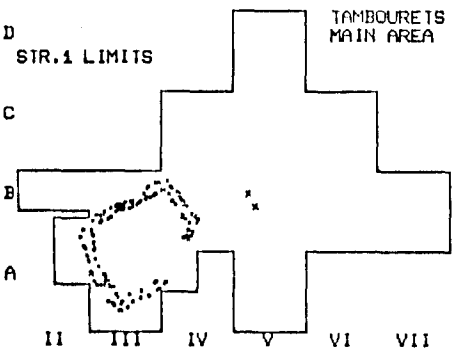


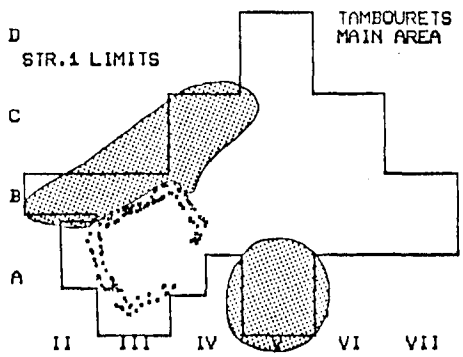
SIDE-SCRAPERS







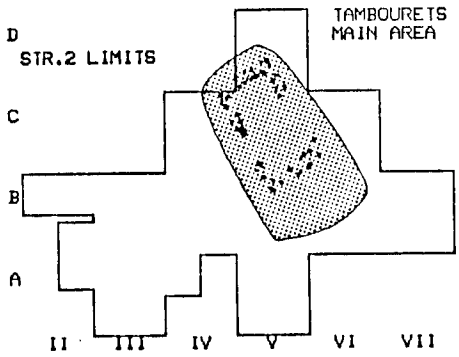
DISC. SCRAPERS

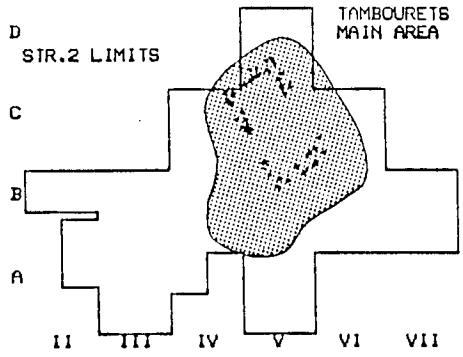


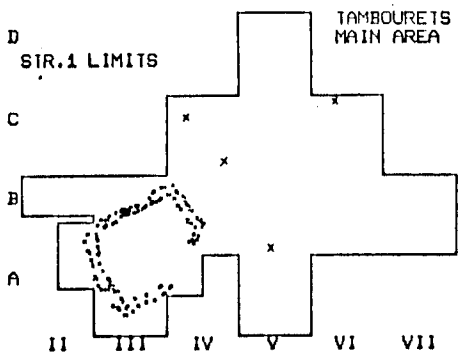
BURINS

Bricker

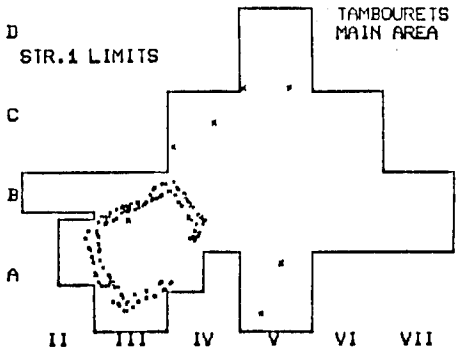
FIGURE 10



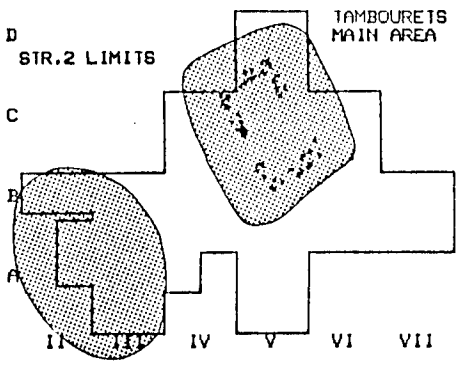


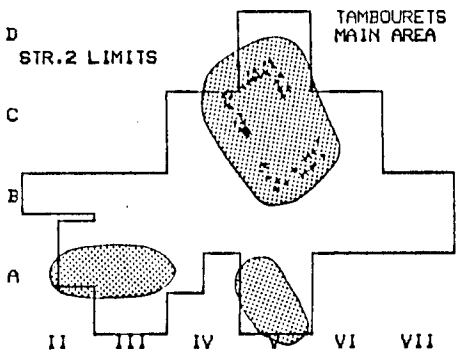


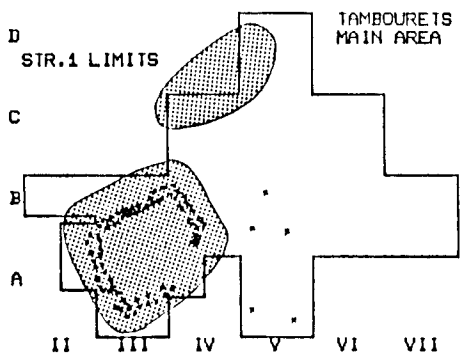
CHATELPERRON PTS.



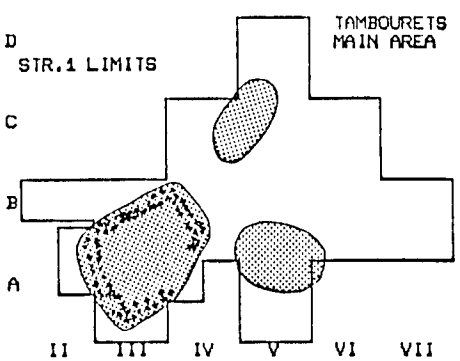
PERFS. / BECS







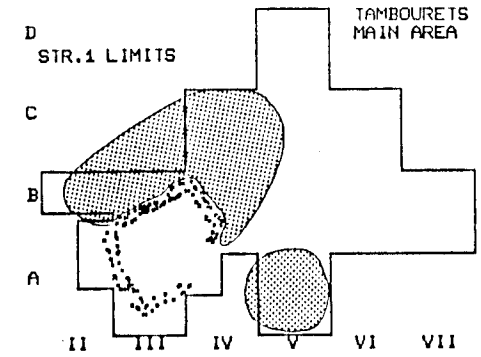
TRUNCATED PIECES

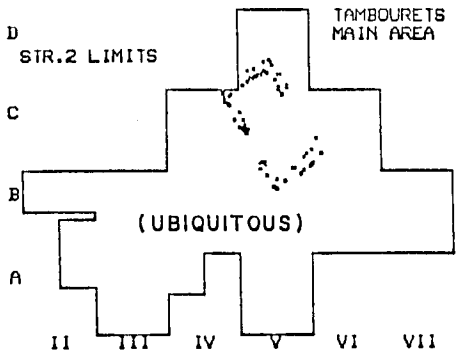


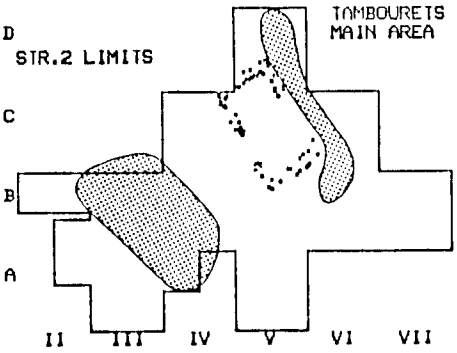
MARG. RET. PIECES

Bricker

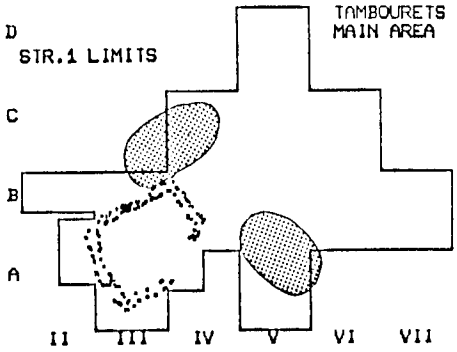
FIGURE 11



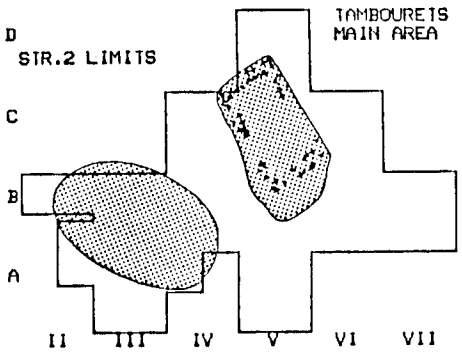


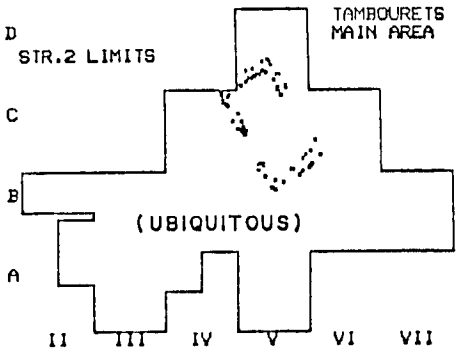


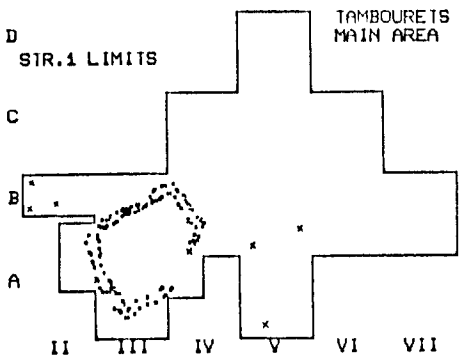
SPLINTERED PIECES



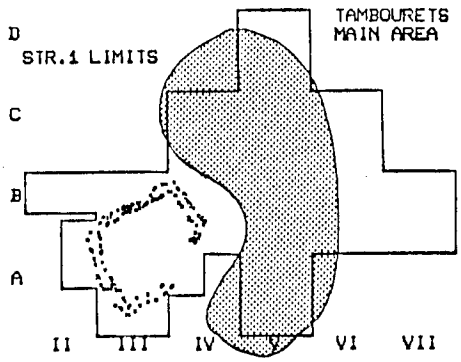
DENTICULATES







NOTCHES (D)



NUCLEI

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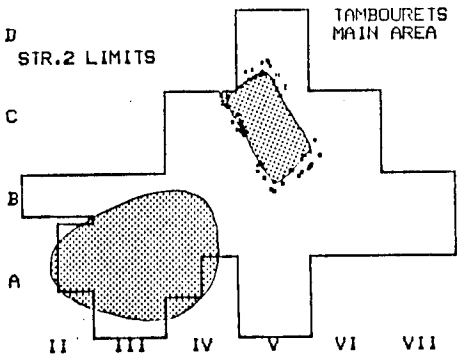
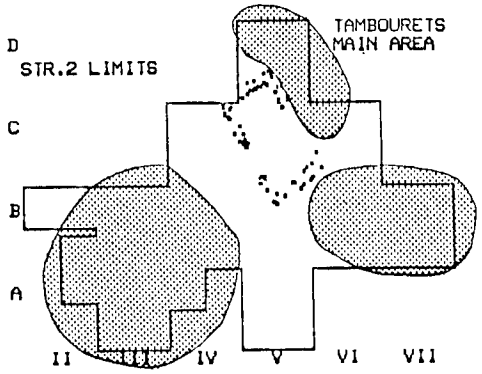
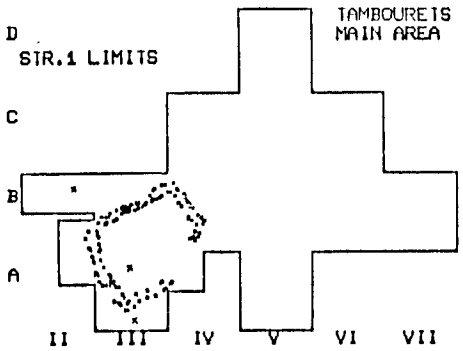
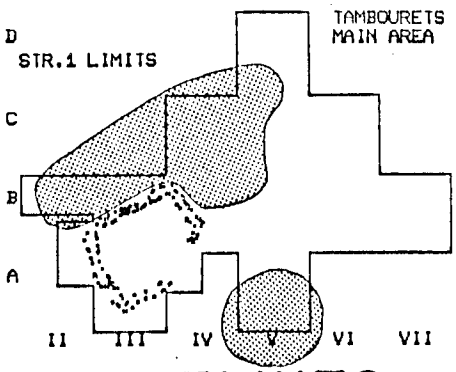
FIGURE 12



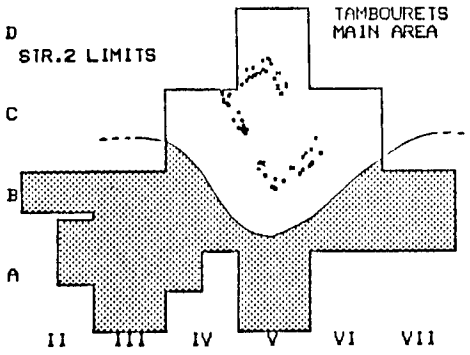


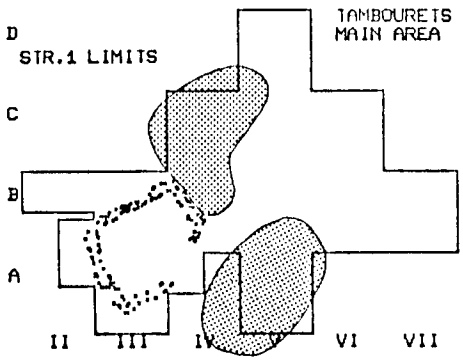


HAMMERSTONES



BURNT FLINTS





CRACKED COBBLES

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FIGURE 13