DEFINING SITE STRUCTURE COMPLEXITY AND ITS IMPLICATIONS:

EXAMPLES FROM SITES IN THE SANTA YNEZ RIVER BASIN

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ABSTRACT

Unless manifested by clearly recognizable archaeological phenomena (e.g., features, houses), site structure complexity often receives minimal attention. Yet, as this research shows, analysis of even low-density sites without features can yield evidence useful in defining site structure complexity. The 23 sites analyzed in this study ranged from small, single-use locations to large, complex base camps. Intensive analysis of artifact distributions, post-depositional processes and chronological data from these sites revealed definable site structure patterns. Comparison of these patterns to ethnoarchaeologically derived models yielded useful inferences about site reuse and the intensity and duration of occupation.

INTRODUCTION

Site structure, in its most basic form, is the archaeologically defined distribution of cultural materials. From a behavioral perspective, site structure consists of the spatial organization of activities, structures, features, and refuse within a site. What will an understanding of site structure complexity provide and why did we consider it important? Binford (1978), O'Connell (1987), and others have established that different settlement-subsistence systems require and produce different sets of site types. Such differences are manifested in the systemic context by variations in the nature, organization, duration, and intensity of activities performed at sites. Combined, these elements produce site structure.

The site structure analysis conducted for the Union Project sought to categorize the 23 sites (see Figure 1) based on their degree of structural complexity. Using those categories, the analysis attempted to provide information on site function and ultimately contribute to a study of the mobility patterns and settlement systems operating prehistorically in the Santa Ynez River Basin.

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EXPECTATIONS

In pursuing this analysis, we recognized that questions about site structure complexity are rarely addressed at sites lacking houses, features, distinct activity loci, or dense cultural deposits. Since the Union sites generally lacked the traditionally sought evidence of site structure, and many contained moderate to low density cultural deposits, it was necessary to (1) identify attributes of such sites that contribute to site structure complexity, (2) develop sets of expectations about how these attributes would be manifested in the archaeological record, and (3) define what these manifestations reflected about the behavioral aspects of site structure complexity.

Fulfillment of these requirements required definition of the principal factors contributing to site structure complexity that could be measured archaeologically with data from the Union sites: (1) post-depositional processes; (2) the duration and intensity of site use; (3) spatial organization; (4) the range of activities performed at a site; and (5) the location and types of features. We recognized that the interrelationship among these factors produced differences among sites that varied along a continuum.

Post-Depositional Processes

Post-depositional processes transform the archaeological record, modifying site content, patterning, and structure. Recognition of these processes and their effects on the archaeological record is essential to identifying site structure. Based on stratigraphic data, the primary post-depositional processes affecting the Union sites consisted of faunalturbation, colluviation, and modern disturbances. Recognizing that these processes might affect the sites to varying degrees, the analysis focused on isolating the archaeological indicators of the processes in order to develop expectations about the nature and degree of their effects. In turn, these expectations served as explicit measures against which the observed influences of the post-depositional processes at each site were assessed.

Duration and Intensity of Site Use

The density of cultural remains provides an archaeological measure of both the duration and intensity of site use. A higher density of remains implies that activities were performed more intensely or longer during an occupation. In addition, differential densities within a site may suggest variation in the duration or intensity of the use of particular locations. Thus, we anticipated that sites manifesting low overall densities and limited intrasite density variation would reflect less site structure complexity than sites with high densities and distinguishable horizontal density variation.

Spatial Organization

Duration of occupation, site reuse, and the nature of the activities performed at a site all contribute to site spatial organization and how such organization is evidenced in the archaeological record. The effect of these factors tend to vary along a continuum (Binford 1978; O'Connell 1987). Short-duration use of a site might produce either undifferentiated or distinct spatial patterning, depending upon the nature of activities performed, the materials used in those activities, and the types of facilities (i.e., features) required. Ethno-archaeological observations suggest that "the longer a site is occupied, the more likely clusters of features and refuse will have begun to coalesce, gradually becoming indistinguishable as separated entities" (O'Connell 1987:90-91). As occupation continues and these variables change, spatial organization shifts as well. Yet, villages or other residential bases occupied for long durations by larger populations may show dedication of space for specific purposes as well as complex and well defined structure.

Based on the identified factors influencing site spatial organization, we anticipated that the Union sites would correspond to one of five configurations.

Configuration 1

The first configuration is a simple, single-component site created by one, short-duration use of a location. The clarity of the patterning of activity areas decreases as the length of use increases.

Configuration 2

The second configuration (see Figure 2) results from two or more use episodes at an identical location. In this scenario, sufficient time separates each use episode and permits the accumulation of intervening, sterile strata. Under such conditions, reuse of the same location will produce a site consisting of two or more horizontally overlapping but vertically distinct components. Occupations separated in this fashion generally retain their distinctiveness and form individual analytic units (i.e., components) in the archaeological record. However, faunalturbation and other post-depositional processes can (and do) obscure the distinctiveness of the components.

Configuration 3

The third configuration (see Figure 3) reflects use of an area adjacent to, but not overlapping, that encompassed by a previous use episode. This set of circumstances produces horizontally distinct loci, each with its own spatial organization. Each locus might also represent the product of different activities and settlement systems.

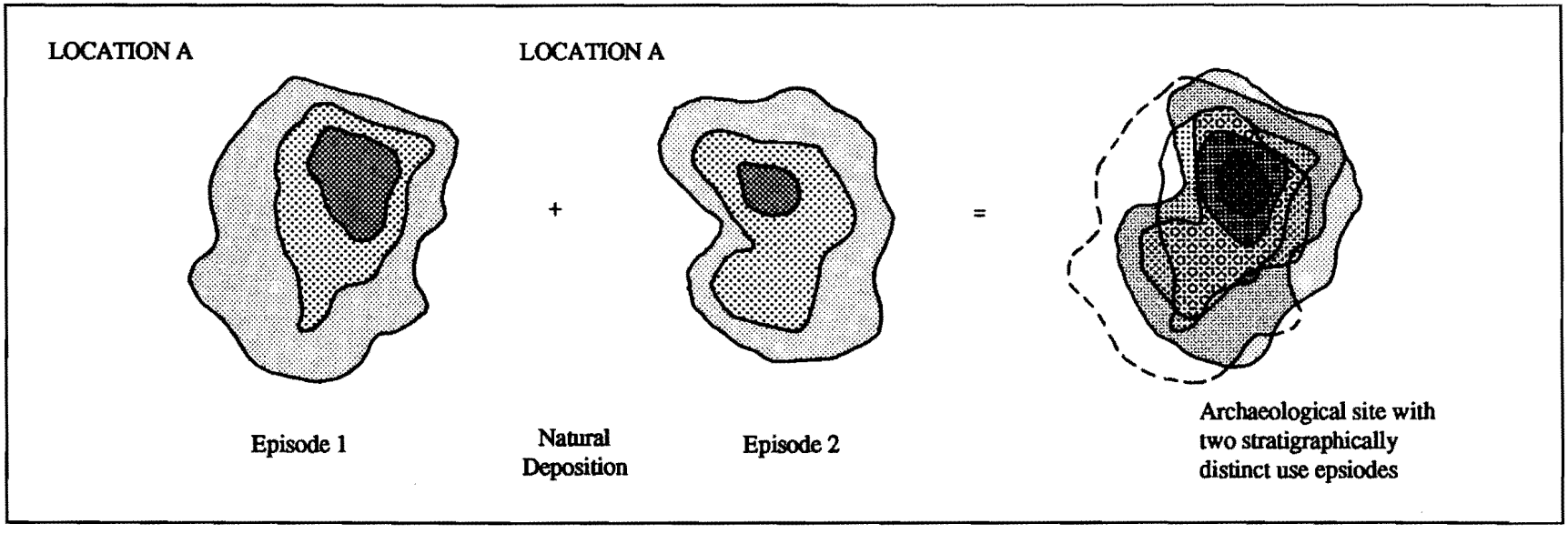

Figure 2. Use episodes at the same location separated by natural deposition.

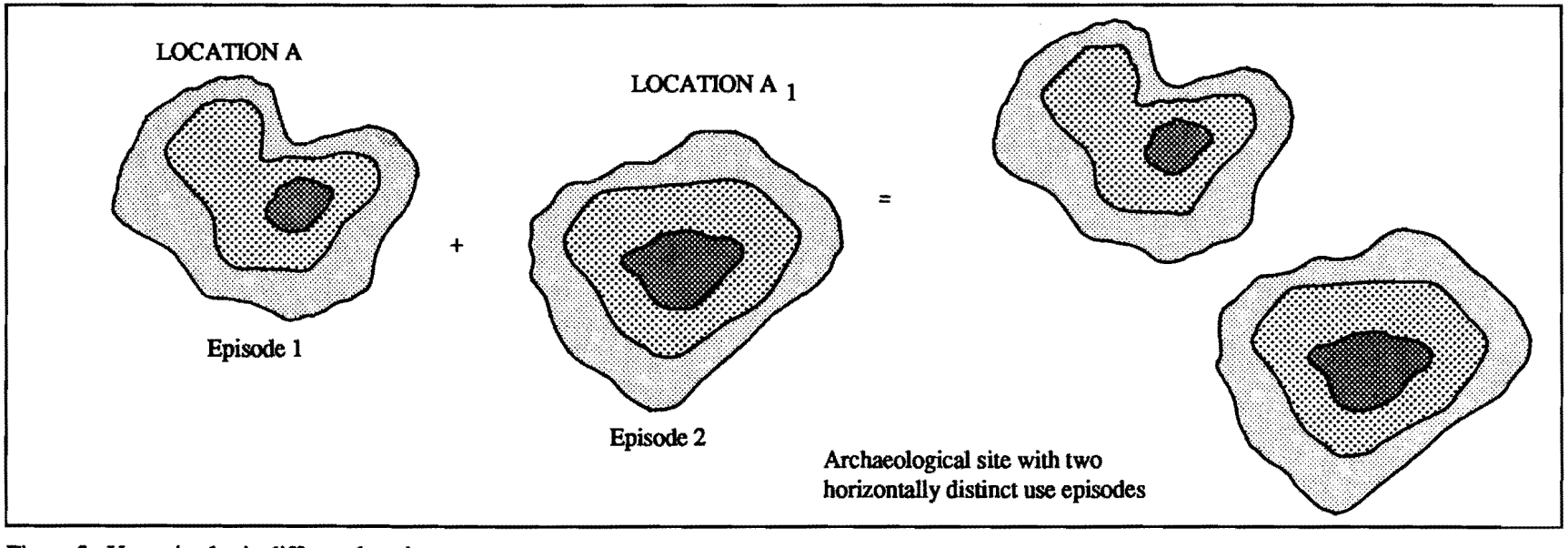

Figure 3. Use episodes in different locations.

Configuration 4

Use episodes separated by short periods of time or minimal natural deposition tend to mask the specific patterning of each episode; the degree of intermixing and homogeneity of patterning increases in proportion to the number and duration of reuse episodes (Carr 1984). The fourth site configuration (see Figure 4) represents the product of multiple overlapping use episodes wherein the same activities are performed at basically the same locations. This pattern of reuse potentially produces a core activity area with relatively dense homogeneous deposits. Such a pattern is common at small sites reoccupied seasonally (Binford 1978).

Configuration 5

Reuse of the same location for different activities yields an archaeological site (see Figure 5) similar to that described for configuration 4. Performance of different activities in the same location during several use episodes would produce an enlarged core characterized by dense and diverse cultural activities.

Range of Activities

The function of tools and their distribution throughout a site offers information on the different types of activities performed at the site. The diversity of materials present within a site forms another approximate measure of the range of activities. Greater diversity suggests a wider range of activities; more activities tend to equate to more activity area differentiation. We anticipated that sites with a wider range of tool functions or greater diversity of remains would exhibit either greater site structure complexity or evidence of reuse.

Location and Type of Features

Features compose pivots around which the use of space revolves, influencing and denoting site structure. The time and energy expended in constructing and maintaining features reflect their expected use-life and, in turn, the duration of site use. We expected that sites containing numerous elaborate features would manifest greater site structure complexity than sites lacking such features.

RESULTS

The sets of expectations discussed above provided the basis for analyzing the collected data for evidence of site structure. Analysis followed a multistage approach focused on identification of (1) post-depositional processes, (2) the vertical and horizontal patterning of cultural remains, (3) the general activities conducted at the site, and (4) the types and locations of features. Because the project investigated a range of sites that often required use of specific collection strategies

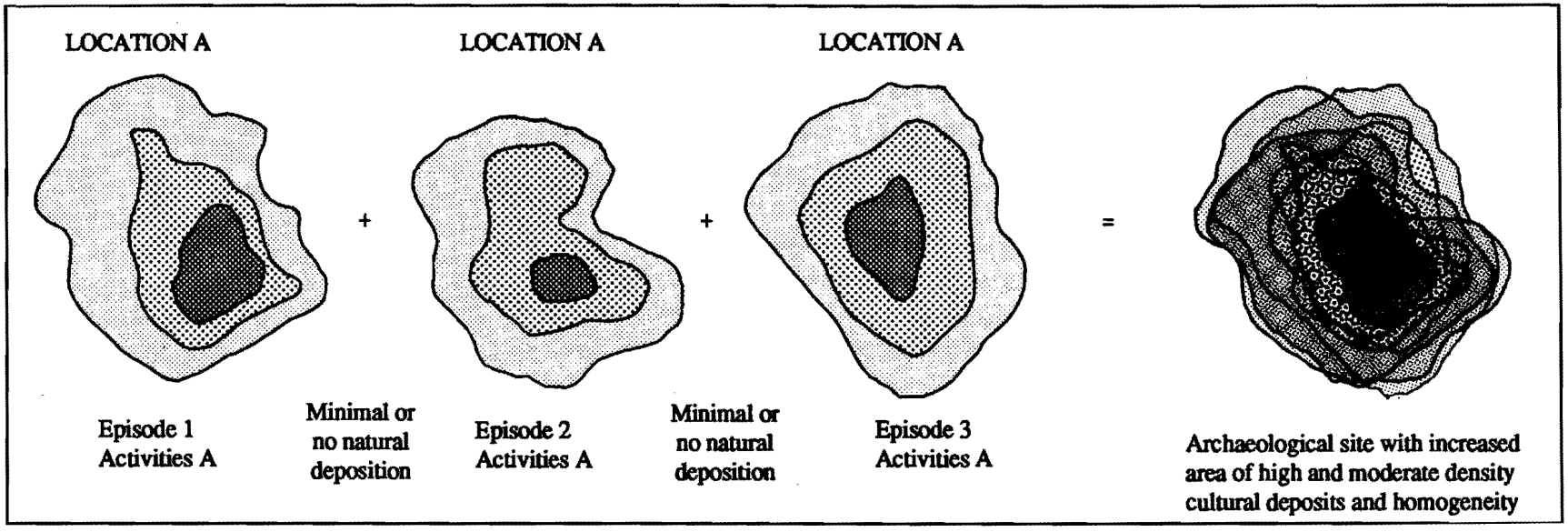

Figure 4. Use episodes at the same location for same activities separated by nominal or no natural deposition.

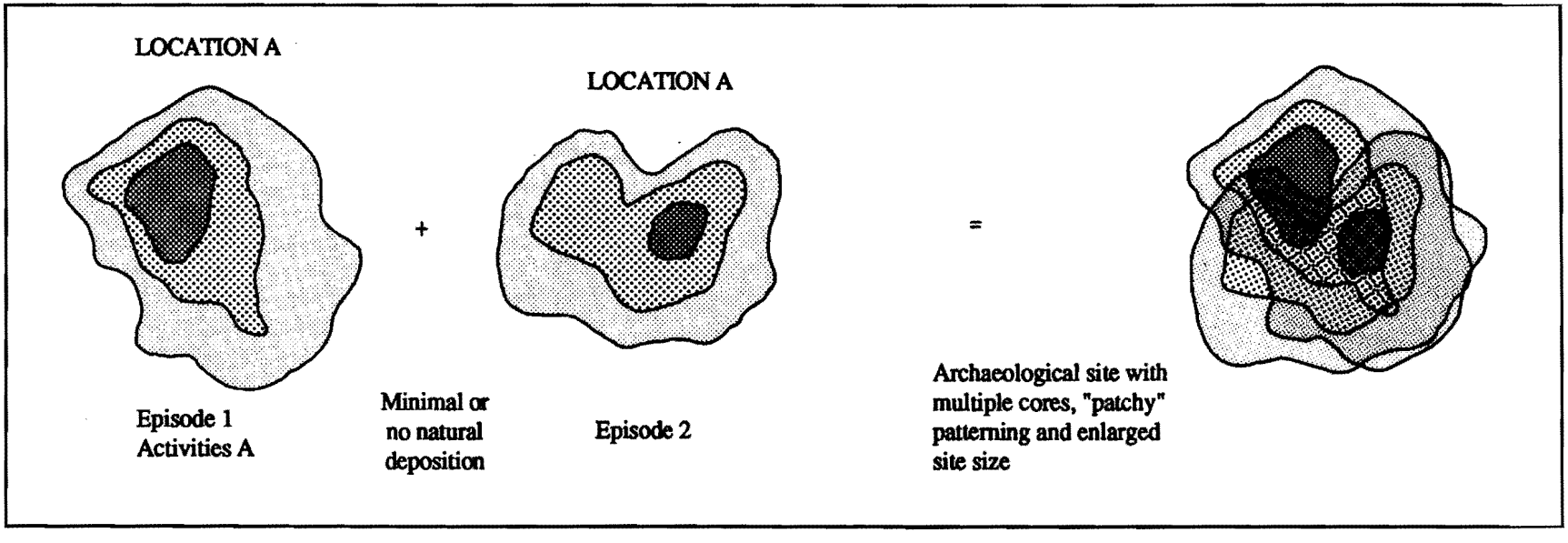

Figure 5. Use episodes at the same location with different activity area organization.

and procedures, analysis of the data required definition of a set of measures ensuring comparability of the analysis for all sites. For this reason, the analysis of site structure employed three fundamental guidelines: (1) use of data on cultural materials 1/4 inch or larger; (2) use of 0.2 m^3 and 1.0 m^3 as the standards for intra- and inter-unit comparison, respectively; and (3) inclusion of data from a maximum number of collection units at a site, including unit, backhoe trenches and shovel probes.

Identification of Post-Depositional Disturbances

Assessment of the nature and extent of post-depositional processes revealed that profound disturbance occurred at SBa-1910, SBa-1991, SBa-1992, and SBa-1993. At all of these sites, a graded fuelbreak transects and encompasses most of the site deposits. Construction and maintenance of the fuelbreak resulted in truncation, displacement, and homogenization of cultural deposits, thus precluding analysis of site structure.

In the other sites, faunalturbation formed the primary post-depositional process affecting the patterning of cultural materials. By assessing the proportion of matrix in existing krotovina, it was possible to estimate the volume of cultural deposits displaced by faunalturbation. These data, combined with data on out-of-sequence radiocarbon dates, formed a context in which the vertical distributions of cultural materials were evaluated. Significant emphasis was placed on these factors, especially at sites exhibiting apparent bimodal distributions.

This stage of the analysis illustrated that the influence of post-depositional processes should not be ignored, even at sites lacking obvious evidence of disturbance. Moreover, it showed that identifiable disturbances should not be used as the reason for cavalierly eschewing examination of site patterning.

Vertical Distributions of Constituents

Armed with the assessments of post-depositional processes, the analysis next focused on the vertical distribution of cultural remains manifested at each site. The analysis resulted in the identification of four basic types of vertical patterning based on the shape of the distribution -- even, unimodal, bimodal, and multimodal -- and the density of cultural deposits. Density aids in the definition of significant vertical variation. For example, an inter-level difference of three flakes per 0.2 m^3 reflects no meaningful variation, especially if none of the levels contain more than 10 flakes per 0.2 m^3. In contrast, a shift from 60 to 20 flakes per 0.2 m^3 represents a marked difference.

Even Distributions

Nonsignificant level-to-level density variation and very low quantities of artifacts characterize the even vertical distributions noted at five sites: SBa-913, SBa-1743, SBa-1762, SBa-1810, and SBa-1917. Figure 6 illustrates a representative example of this vertical patterning at SBa-1917. The evenness of the distribution suggests a consistent pattern of reuse wherein little time or natural deposition separated subsequent use episodes. The lack of radiocarbon dates from these sites prevents evaluation of the periodicity of reuse. Additionally, the very low quantities of cultural remains further suggest that the use episodes were short in duration.

Unimodal Distributions

Seven sites, characterized by higher constituent densities and a wider range of density variation than the sites with even distributions, manifested unimodal vertical distributions: SBa-1888, SBa-1896, SBa-1994, SBa-1996, SBa-2120, SBa-914, and SBa-689A (i.e., locus A of SBa-689). As indicated by the example in Figure 7 (SBa-1888), a single peak, usually near the surface, dominates the vertical distribution at these sites. Below this peak, the density of cultural remains decreases consistently. Minor peaks noted in deeper levels probably represent the products of bioturbation (cf. Erlandson 1984).

The unimodal vertical distributions suggest that the sites' cultural deposits represent the product of either a single occupation or multiple use episodes separated by minimal natural deposition. The first explanation appears most likely because these sites occupy a similar range of depositional contexts as those with even distributions, yet manifest markedly different vertical patterning. Also, the higher density of remains at these sites implies greater duration or intensity of occupation.

Bimodal Distributions

Bimodal distributions were identified at four sites -- SBa-687, SBa-1995, SBa-689, and SBa-931, each characterized by relatively abundant and diverse cultural remains. However, recently acquired radiocarbon data may indicate that bioturbation is responsible for the patterning observed at SBa-931 (personal communication, M. Glassow 1989).

Nevertheless, the vertical patterning defined at these four sites exhibited obvious upper and lower density peaks (see Figure 8). Because the peaks are vertically distinct from one another and contain consistently different proportions of remains, they appeared to represent the residues of horizontally overlapping, but separate occupations. The radiocarbon dates derived from these sites established that the upper and lower peaks comprised temporally distinct components (Peter 1988). The vertical distribution, radiocarbon dates, and high densities

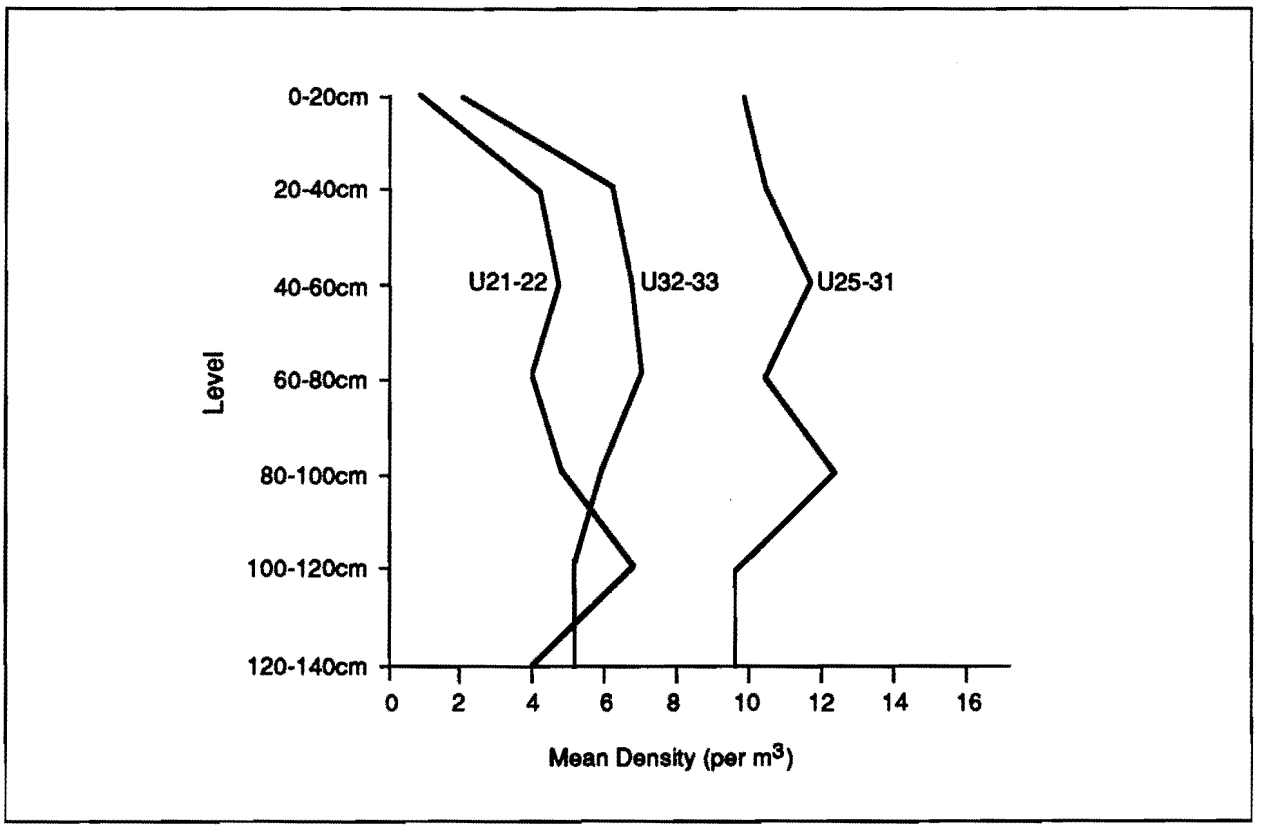

Figure 6. Vertical distribution of flakes (>.25 inch) in selected blocks of units (U), SBa 1917.

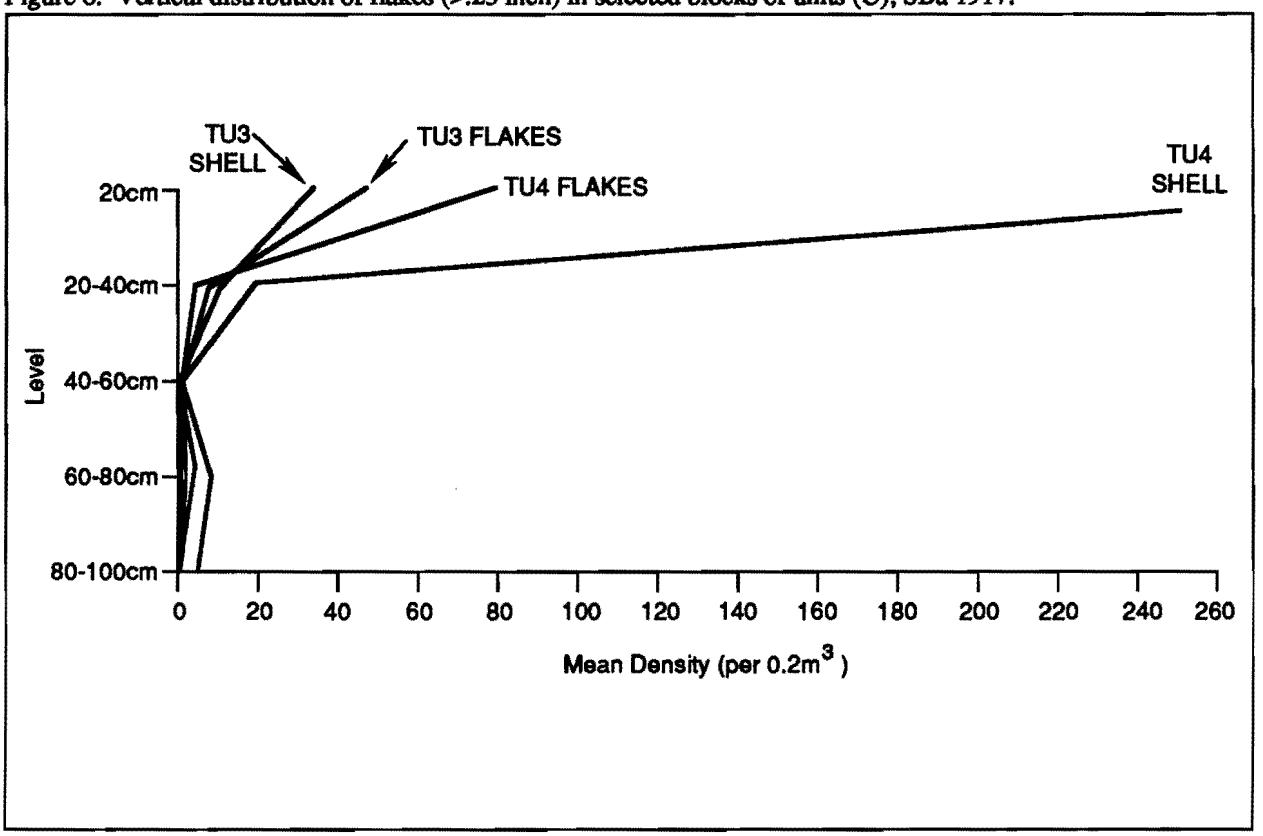

Figure 7. Vertical distribution of flakes and shell in test units (TU) 3 and 4, SBa 1888.

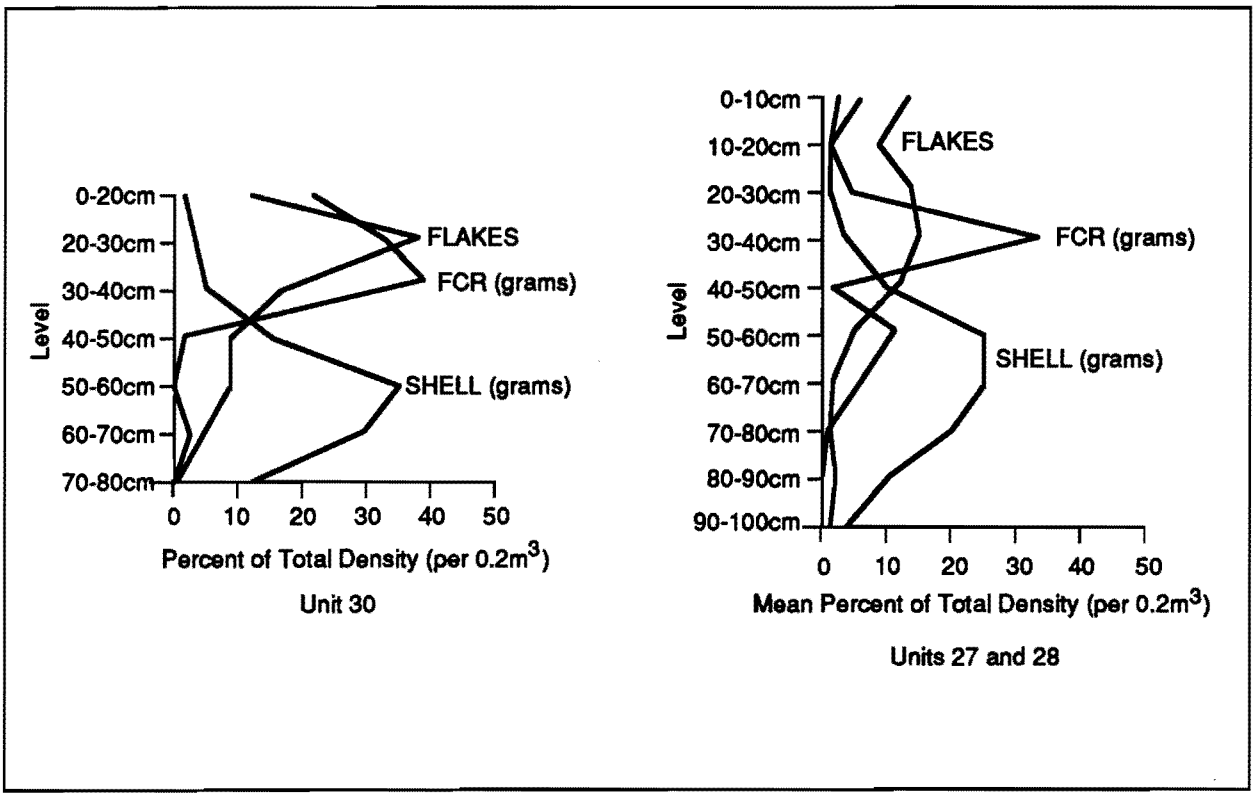

Figure 8. Vertical distribution of flakes, shell, and FCR in representative units SBa 689, (lower terrace, south of Terra Road).

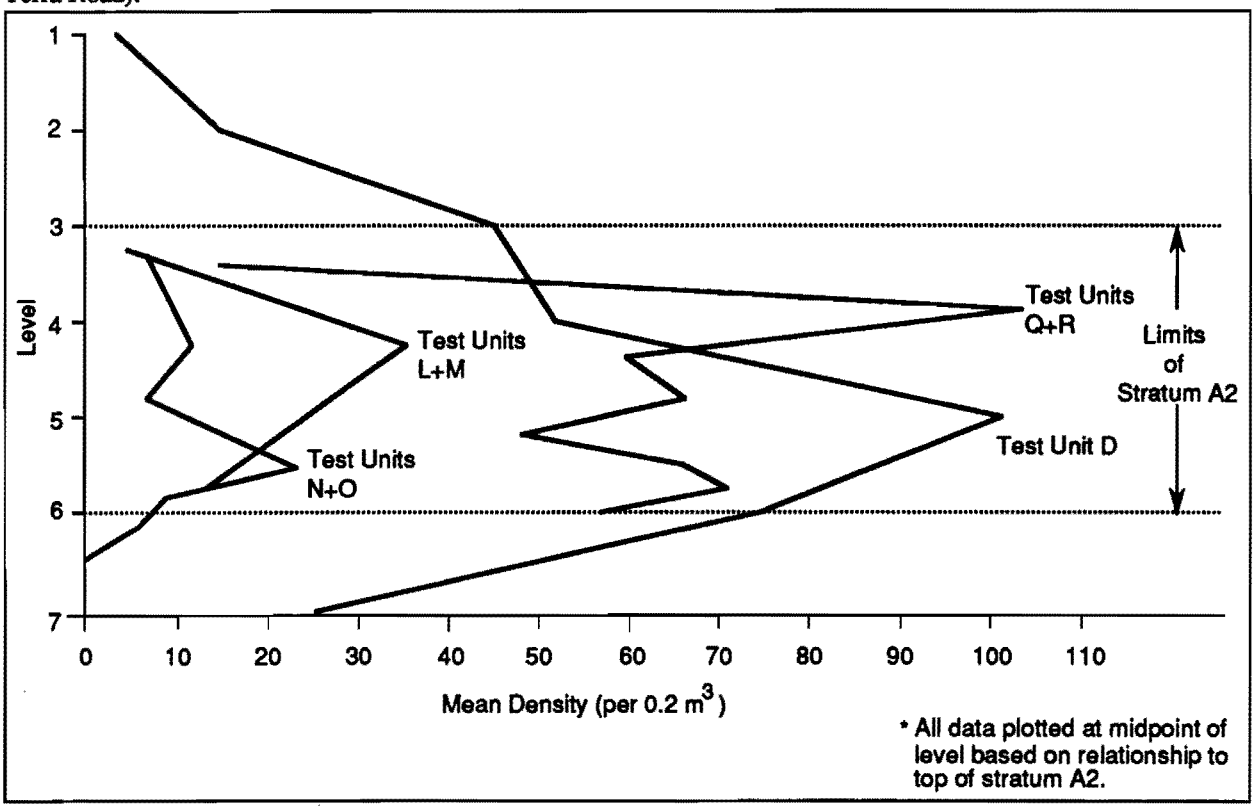

Figure 9. Vertical distribution of flakes at SBa 1742 in test unit D; test units L and M combined; test units N and O combined; and test units Q and R combined*.

of constituents indicated that each component is representative of an intensive and longer duration occupation.

Multimodal Distributions

The fourth type of vertical distribution, multimodal, was detected at two sites: SBa-1742 and SBa-2126. From the evidence, it was inferred that the multimodal vertical patterning reflects multiple reuse episodes that differed in duration and intensity. In this example in Figure 9, the distribution shows multiple peaks at different depths within a single buried stratum. Since they are encompassed by the same stratum, these various peaks potentially correspond to residues from numerous different use episodes. The small number of radiocarbon dates from SBa-1742 were insufficient to establish the periodicity of the use episodes, yet they do demonstrate that the various peaks were not contemporaneous. That the peaks are separated by minimal deposition suggests that the use episodes all occurred within a relatively short time. In addition, the density of materials denoted by the peaks is consistent with short to moderate duration use.

The multimodal pattern differs significantly from the even distribution with regard to overall constituent density as well as level-to-level density variation. These differences imply greater intensity of use at the multimodal sites and suggest that the intensity varied through time.

Horizontal Distribution of Constituents

The sites and components derived through examination of the vertical distributions formed analytical units in which three types of horizontal patterning were identified: (1) core area; (2) patchy; and (3) discrete activity zones. Limited sample sizes precluded assessment of the horizontal distributions at two sites and two components.

Core Area Distribution

Nine sites or components exhibited a distribution characterized by a single core area containing markedly higher densities and surrounded by a zone in which density decreases with distance from the core. These included: SBa-687U (upper component), SBa-931U, SBa-1743, SBa-1810, SBa-1860, SBa-1891, SBa-1896, SBa-1917, and SBa-1996. Figure 10 illustrates the pattern typical to these sites; note the peak corresponding to the core area between unit 38 and unit 2. In contrast to this example, many of the sites manifested higher densities within the core area. From solely a horizontal perspective, a distribution of this type suggests a single use episode or occupation. However, if the vertical distribution of the core area reflects a pattern consistent with reuse, the horizontal distribution probably represents the product of multiple, overlapping use episodes.

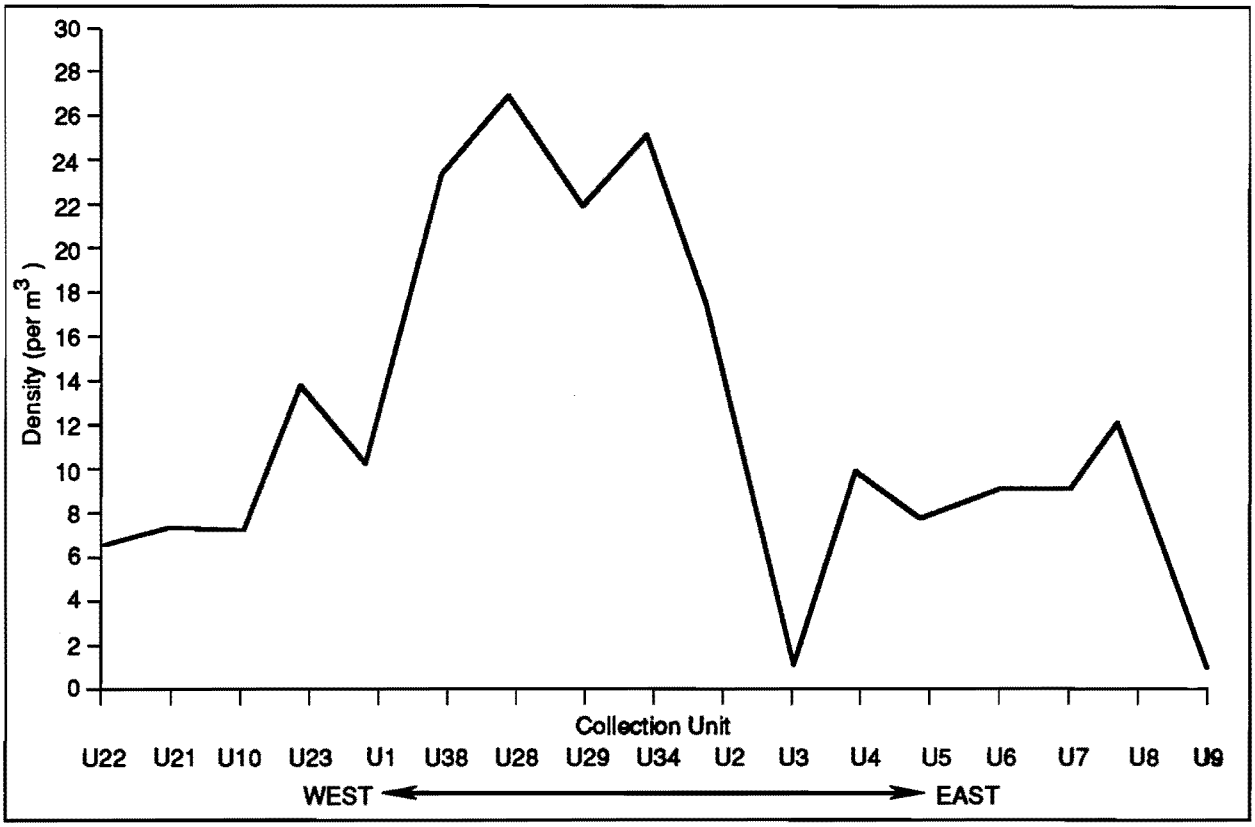

Figure 10. Horizontal distribution of flakes (> .25) across a west to east transect, SBa 1917.

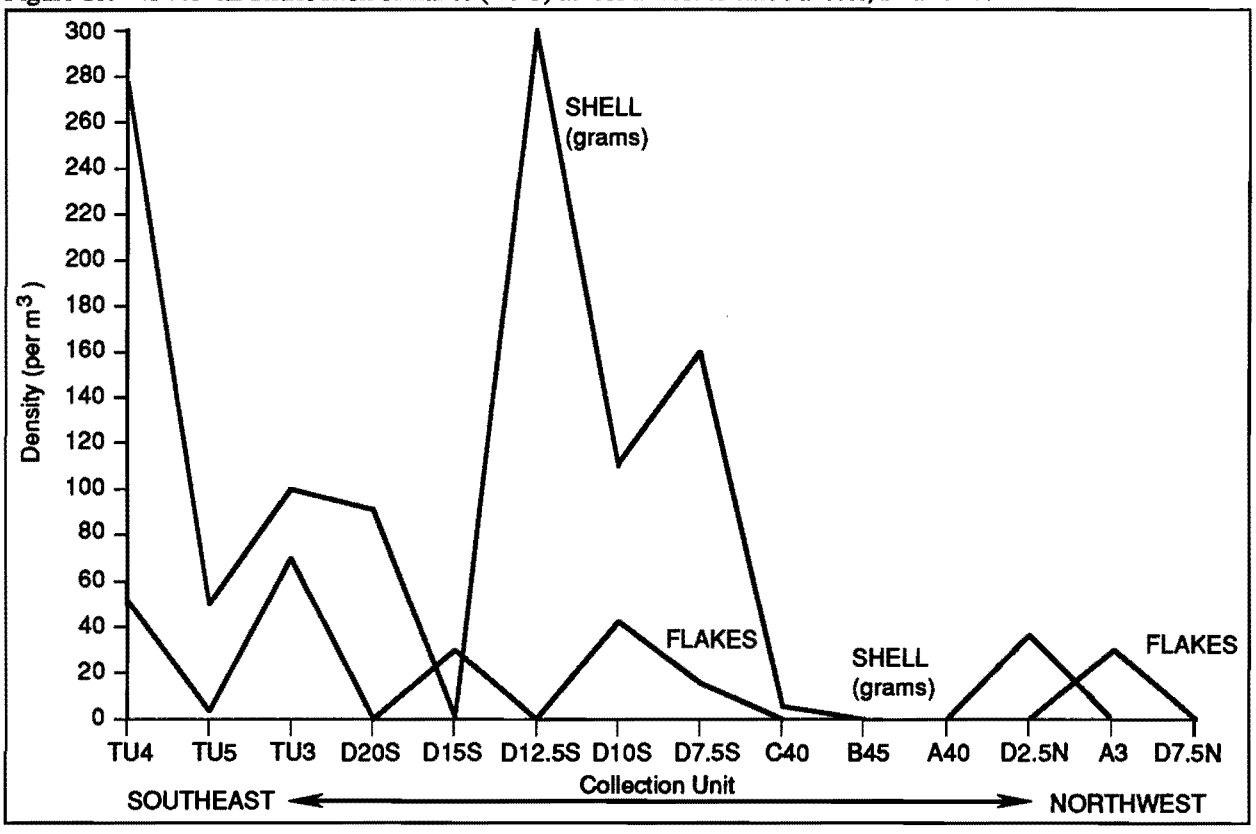

Figure 11. Horizontal distribution of flakes and shell, SBa 1888.

Patchy Distribution

Six sites -- SBa-913, SBa-689A, SBa-1742, SBa-1762, SBa-1888, SBa-2126 -- manifested a "patchy" horizontal distribution denoted by more than one discrete location containing similar sets of remains which vary in density among the locations (see Figure 11). From a horizontal perspective, this distribution can be explained in one of two ways: either each of the multiple locations represents a locus of activity or refuse disposal during a single occupation; or these locations consist of the remains of multiple use episodes in which the locus of activity shifted. The nature of the vertical distribution provides the key to identifying the correct explanation. For example, an even or multimodal vertical distribution and a "patchy" horizontal distribution suggests reuse of the same general site location with a shift in the placement of activity areas.

Discrete Activity Zones

The third category of horizontal patterning occurred at five sites or components: SBa-689U, SBa-689L (lower component), SBa-914, SBa-1994, and SBa-2120. Although all five sites or components exhibited differences in the complexity of patterning, each manifested readily discernable activity zones. SBa-2120 most clearly illustrates this type of distinct horizontal patterning (see Figure 12). The highest flake densities (31 to 70 per m^3) form a ring surrounding the center of the site, but FCR is most concentrated in the center. Beyond the limits of the zone with the highest flake density, both constituent classes are much less abundant. Although not shown, bone is much more abundant and smaller within the central portion of the site.

This horizontal patterning suggests that the central portion of the site may represent an activity zone kept clean of larger debris. The zone with higher flake densities potentially is the residue of both in-place activities and the disposal of secondary refuse from the central activity zone. Binford (1978) notes that "toss zones" of this type often surround or abut cleaned activity areas. O'Connell (1987) observed this patterning at briefly occupied camps used by family groups.

Whereas the horizontal patterning evidenced at SBa-914 appears similar to that at SBa-2120, the distribution of materials is far more complex at SBa-689U and SBa-689L. These distinct components reflect longer term and more intensive occupations wherein the activity zones represent dedicated space for specific functions (Peter 1988).

Range of Activities

To examine the range of activities manifested by the sites, this study adopted a simplistic approach involving cumulative scores for three measures of richness: the number of faunal

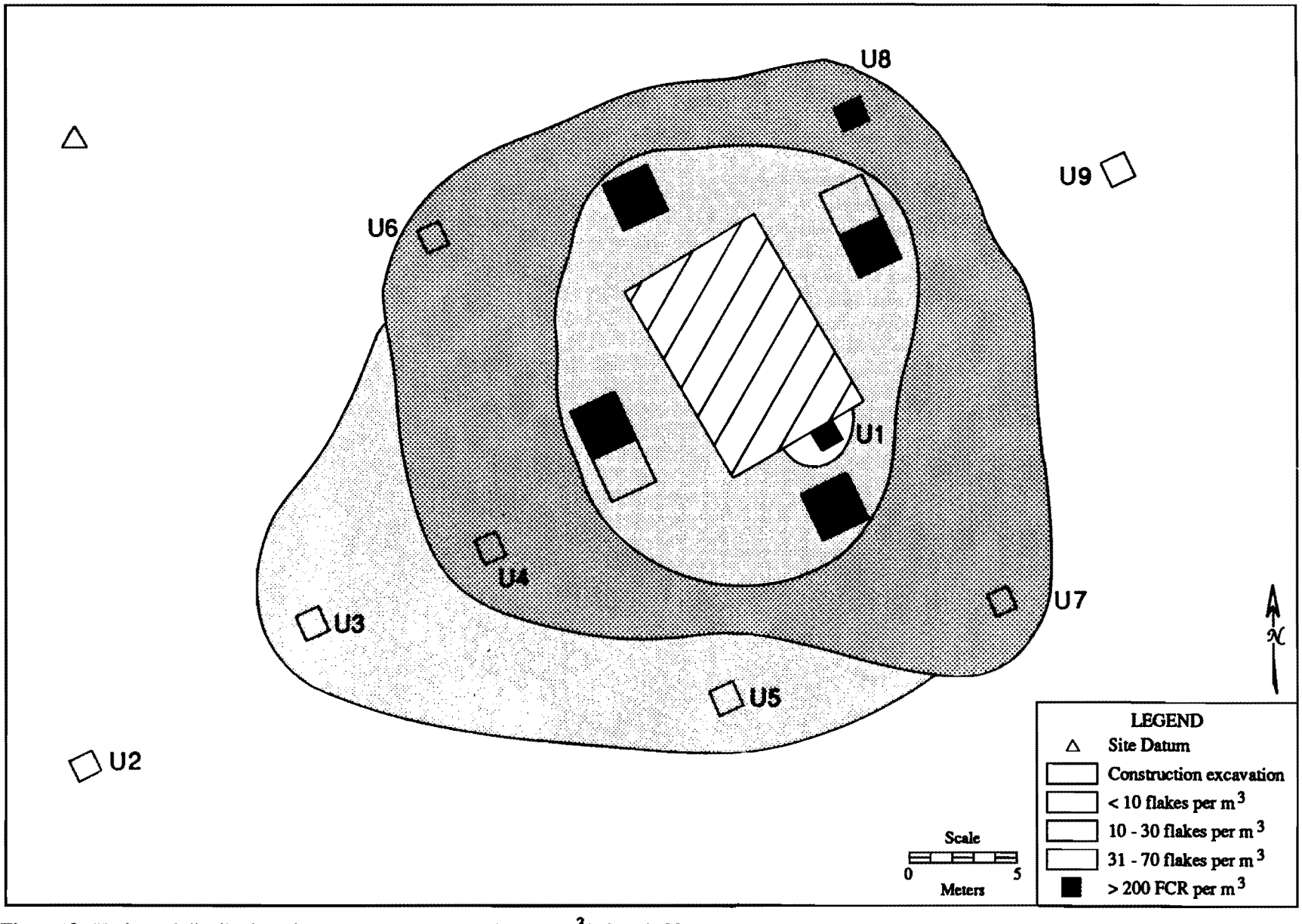

Figure 12. Horizontal distribution of flakes and FCR by density (per m^3), SBa 2120.

taxa, the number of tool classes, and the overall number of constituent classes. Table 1 presents these data for each site.

Seven sites and components clustered at the high end of the scale, seven clustered at the low end, and the remainder formed a group in the middle range. These results suggested that the sites with the highest scores exhibited greater richness, an attribute which often denotes greater duration of occupation or multiple, overlapping use episodes. Notably, the vertical and horizontal distributions of cultural remains at these sites show either intensive occupation or reuse. In contrast, low richness implies a shorter duration occupation, less intense use, and a limited activity range. All seven of the sites with low scores consisted of low density deposits and yielded no evidence of significant reuse.

Features

Using the data on vertical and horizontal patterning, the analysis next focused on determining the relationship of these distributions to features located within the sites. Unfortunately, only two sites or components included features (SBa-914A and SBa-1995). The two features exhibited characteristics indicating that their construction required a relatively small investment in time and energy and, in turn, a short expected use-life. Based on this evaluation and the low density of surrounding cultural deposits, we can infer that the occupations associated with the features were also brief.

SUMMARY OF SITE STRUCTURE COMPLEXITY

Overall, analysis established that the Union sites could be categorized according to their vertical patterning, their horizontal patterning, and the range of activities they manifested. Examination of the interrelationship of these characteristics and their behavioral implications permitted definition of four groups of sites and components based on their site structure complexity. Intergroup differences in site structure varied along a continuum from least complex to most complex. This continuum also reflects intersite differences in the duration and intensity of site use.

Two sites, SBa-2120 and SBa-1994, occupy the least complex end of the continuum. At these sites, a unimodal vertical distribution implies a single occupation, as does a well-defined activity zone surrounded by a refuse or "toss" zone. The clarity of the observed patterning suggests an occupation sufficiently long to require spatial differentiation of activities, but not long enough for those activity areas to coalesce significantly.

Although somewhat more complex, nine sites and components exhibited simple site structure generally characterized by low-density deposits, a unimodal vertical distribution, a horizontal

Table 1

NUMBER OF FAUNAL TAXA, TOOL TYPES, AND CONSTITUENT CLASSES IN THE SITES/COMPONENTS

Site/Component	Number of 1/4-Inch Faunal Taxa	Number of 1/4-Inch Tool Types	Number of 1/4-Inch Constituent Classes
SBa-687U	4	2	5
SBa-687L	2	3	4
SBa-689U	7	4	6
SBa-689L	11	3	6
SBa-689A	1	2	2
SBa-913	2	7	4
SBa-914A	2	2	5
SBa-914B	1	0	3
SBa-931U	9	2	5
SBa-931L	11	2	4
SBa-1742	5	8	6
SBa-1743	1	6	5
SBa-1762	2	0	3
SBa-1810	0	1	2
SBa-1860	2	1	3
SBa-1888	8	1	5
SBa-1891	2	2	5
SBa-1896	2	4	4
SBa-1917	6	6	5
SBa-1994	0	0	2
SBa-1995	4	2	4
SBa-1996	0	0	1
SBa-2120	8	2	6
SBa-2126	4	5	5

distribution defined by a core area, and low to moderate diversity. The sites and components include Sba-687U, SBa-687L, SBa-914A, SBa-914B, SBa-1860, SBa-1891, SBa-1896, SBa-1995, and SBa-1996. This relatively simple structure suggests limited site use, probably a single, short-duration occupation by a small number of people. However, the lack of clear activity patterning in these sites reflects a longer duration of use which engendered shifts in activity patterning and resulted in the coalescence of activity areas.

Nine of the sites exhibit blurred spatial patterning indicative of multiple, overlapping use episodes: SBa-689A, SBa-913, SBa-1742, SBa-1743, SBa-1762, SBa-1810, SBa-1888, SBa-1917, and SBa-2126. Most of these sites contained low to moderate densities of cultural remains. Yet high diversity was an attribute at more than half of the sites. The diversity represents a product of the varied activities performed during different use episodes. These sites are also some of the largest within the project area. Enlarged site size may have resulted from changes in site orientation during subsequent use episodes. Overall, these sites appear to have been produced by repeated, short-duration use episodes. Such repeated use of a specific location may indicate the importance of resources in the area and the attractiveness of specific attributes of the location.

At the highest end of the complexity continuum, SBa-689U and SBa-689L evidence dedication of space for specific activities and formal refuse dumps. This factor, coupled with the density and diversity of the cultural deposits, imply an extremely wide range of activities and complex site structure. Moreover, these characteristics reflect longer duration and greater intensity of use than noted at any other site.

In sum, this analysis demonstrated that site structure complexity principally reflects the nature, intensity, and duration of site use. Because these factors indicate the emphasis placed on different locations and how people organized activities at those locations, site structure complexity provides fundamental data on site function and settlement patterns. Combined with other analytical data, the study of site structure complexity suggests that most of the Union sites represent generalized campsites occupied by small groups of people for short periods of time. Multiple use episodes at a number of sites suggest repeated use of particular locations formed an important aspect of the settlement system.

We have all been confronted with interpreting small, low-density sites -- partially disturbed sites -- sites without clear cultural stratum. We have all sought to determine how many times and for how long such sites were used. This study provides a useful framework for addressing such problems in future investigations.

NOTES

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