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# A Nested Hierarchy of Contexts: An Approach to Defining Significance for Lithic Scatters

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*The lithic scatter is perhaps the most common type of prehistoric site in California and many other parts of North America. Lithic scatters typically lack many of the attributes found in other types of sites, making their significance difficult to define for both research and cultural resource management purposes. It is herein proposed that lithic scatter significance is more readily defined by viewing these sites at several distinct and hierarchically related contextual levels, ranging from internal structure to regional and subcontinental relationships. The viewing of a site at these different levels generates new questions at each level, which in turn helps define significance.*

**T**HE lithic scatter is a type of site that occurs widely in California and other parts of the western United States. It is defined as a locus at which there occurs on the surface a concentration of debitage, with few or no other site attributes present. According to Jackson (1988a:230), "flake scatters are archaeological sites where the predominant evidence for human occupation is the presence of lithic flakes (debitage) produced during tool production and maintenance, and tools or tool fragments." By definition, those characteristics of sites which provide traditional contexts for debitage, such as occupation midden, stratigraphic deposits, activity features, temporally or functionally diagnostic artifacts, or food remains, are absent at lithic scatters. The lithic scatter thus poses considerable difficulty in understanding, and traditionally has drawn relatively modest interest in archaeological analysis compared to other types of sites. This lack of interest may reflect, in part, a general tendency among many archaeologists to pay relatively little attention to small sites (but see Glassow 1985).

Whatever the reasons, however, the tendency to neglect lithic scatters and to regard them as having little significance is unfortunate. Among other things, the lithic scatter is an extremely common site type, possibly the most abundant type in California. It therefore represents a significant

portion of the prehistoric archaeological record and needs to be taken into account for a full understanding of past cultural patterns. In addition, lithic scatters, by their very simplicity, provide unique representations of certain types of past behavior, particularly (but not only) lithic reduction, with fewer obscuring variables than in more complex sites. Some kinds of regional behavior patterns, such as raw material exchange, may be studied especially economically through lithic scatter analysis. For these and other reasons, then, the lithic scatter is a type of site whose significance deserves greater attention.

In recent years, several authors have tried to grapple with problems in the study of lithic scatters (e.g., Talmage et al. 1977; Jackson et al. 1988; Hall and Jackson 1993). A great deal more, however, can be done to help advance this objective. This paper attempts to add to the discussion by suggesting some other approaches to the assessment of their significance that may benefit their research and management potential.

The lithic scatter has been reported widely in the Sierra Nevada (e.g., Jackson 1988a; Markley and Day 1992; Bloomer 1993), though it occurs in other parts of California as well (e.g., O'Connell 1975; Theodoratus et al. 1979; Caputo 1991). An appropriate understanding of the lithic scatter as a form of prehistoric remains is important from both

a research and management perspective. From the research perspective, any form of site that occurs abundantly over time and space reflects some significant aspect of past behavior which needs to be properly described and explained in the context of its relationship to a particular cultural system. From the management standpoint, the lithic scatter requires appropriate understanding for compliance with relevant federal and state laws and policies (e.g., the National Environmental Policy Act of 1969 [NEPA]; the National Historic Preservation Act of 1966 [NHPA]; the Archaeological Resources Protection Act of 1979 [ARPA]; the California Environmental Quality Act of 1970 [CEQA]). The poverty of attributes that has tended to make lithic scatters fail to attract much research attention has also presented difficulties for their effective management as cultural resources.

In spite of these difficulties, a modest but growing number of researchers has recognized the need to take greater account of lithic scatters in both research and cultural resource management. Jackson et al. (1988), for example, developed the California Archaeological Resource Identification and Data Acquisition Program (CARIDAP) to improve the recognition and management of lithic scatter sites (see also Hall and Jackson 1993). This paper does not attempt to replicate or modify their justly praised effort, but instead offers a somewhat different and, it is hoped, complementary perspective.

The value of adding to the discussion rests, at least in part, on the abundance of these scatters as a site type. No one has yet made a true census or a representative, sample-based projection of the number of lithic scatters in California. However, enough systematic surveys have been conducted across the state to suggest that the total is quite substantial, very likely in the tens of thousands or more. Lithic scatters may represent the single most abundant prehistoric site type in California. That status alone gives significance to lithic scatters as a major expression of past cultural activity and as a significant share of the prehistoric cultural heritage of the state.

Yet, policy and practice in the assessment of site significance under such statutes as NEPA and CEQA give particular emphasis to such site properties as uniqueness, antiquity, complexity, richness of remains, and ethnic distinctiveness. Their poverty of attributes makes lithic scatters particularly susceptible to failure to meet such standards, and therefore to being defined as nonsignificant. When this happens, lithic scatters as sites tend to suffer from reduced attention in research analysis and in management. In recognizing these problems, several archaeologists have called attention to the potential of lithic scatters to illuminate several kinds of research problems (e.g., Tainter 1979; Caputo 1991; Bloomer 1993). Yet, it is clear from recurring discussions that there remains a good deal of room for the development of a more comprehensive strategy to assess lithic scatters that is useful in the contexts of both resource management needs and research scholarship.

There should be no question that a variety of approaches or strategies could be developed to help meet this need. This paper explores one possible avenue, emphasizing that it is not the only possible direction that could be taken. This approach may be termed a "nested hierarchy of contexts" method.

### UNIT OF ANALYSIS

A lithic scatter is defined as a type of archaeological site composed of lithic debris distributed across a land surface and lacking other forms of archaeological remains. By definition, a lithic scatter possesses only two spatial dimensions, defining a planar surface that lacks depth. A lithic scatter therefore necessarily lacks a cultural deposit midden and a vertical structure or deposition. The lack of vertical deposition means that lithic scatters lack stratigraphy, so their elements cannot be organized chronologically according to vertical provenience.

Lithic scatters contain no internal structural features such as house remains, bedrock mortars, hearths, burials, or storage facilities. If any such features were present, the site would be placed in

a different category according to the feature. Additionally, lithic scatters generally contain few retouched or utilized artifacts, cores or core tools, ground stone implements, or other formal artifact categories. They therefore tend to be weak or lacking in obvious indicators of style or function. Since the qualities that lithic scatters lack are precisely those which have proved suitable to address those questions about cultural patterning in time and space that California archaeologists have traditionally asked, it is hardly surprising that lithic scatters have not drawn more analytical attention.

Lithic scatters are not wholly devoid of attributes, however, otherwise they could not be recognized, much less defined. Being on a planar surface, a lithic scatter can be analyzed both in terms of the composition of its assemblage and the properties of its context. Assemblage attributes include quantity of debitage, spatial distribution and density or patterning, raw material type and frequency, flake types, and stages of lithic reduction. In addition, some raw materials (and, presumably, more in the future) can be identified as to source, while obsidian also can be measured for hydration, making age estimates possible. Contextual attributes range from size, form, elevation, and location of the site surface to ecological properties of the surrounding habitats and spatial relationships of the site to other sites, to ethnic territories, and to sources of raw materials. In some cases, feature attributes may be defined when differential distributions of debitage on a surface produce statistically significant concentrations. It may be possible, for example, to reconstruct a single knapping or reduction event based on the spatial distributions of the debitage of one form of raw material.

### PATTERNS OF SIGNIFICANCE

The discussion to this point has suggested aspects of potential significance for a lithic scatter in terms that are generally familiar among California archaeologists. The following aims at creating a

more systematic ordering to the understanding of significance as it might be applied to lithic scatters.

This discussion assumes that the concept of significance, whether understood from a perspective of research or management, is not a unitary idea. It varies in meaning according to the perspective of the user's objectives, and it also varies according to referents. Significance can be defined only in relationship to something else, whether as an abstract value or a utilitarian objective. If this is the case, one way to improve the functional value of the concept is to bring more systematic order to the perspectives from which it can be applied.

These perspectives may be regarded as contexts into which archaeological remains are placed in order to define their meaning. Although there can be a host of possible contexts for such perspectives, the discussion below draws upon five which tend to be frequently used in archaeological thought. In both a conceptual and a spatial sense, these contexts can be seen to be related to each other such that larger-scale perspectives incorporate the units of smaller-scale perspectives within them. In this sense, the contexts can be seen to form a hierarchy. They not only are hierarchically related to each other in a taxonomic sense, they may be said to nest within one another, since the more general contexts incorporate the more specific ones spatially. This approach, then, can be regarded as one of a nested hierarchy of contexts.

Any site, including a lithic scatter, may be understood from a variety of scales or perspectives; five are emphasized here. The first is the site as a composition of its constituent elements, in which the relationships among the internal elements are emphasized. The second concerns the site as a unitary whole, in which its collective properties are emphasized. The third involves relationships between the site and its surrounding landscape, in which the properties of the site are analyzed in terms of their possible relationships to external resources and features. The fourth re-

flects relationships between the site and a larger geographic arena which might be seen as a cultural unit or ethnic territory. In this perspective, the nature of the site can be interpreted as an element in a total cultural system. The fifth perspective takes an even more comprehensive scope, seeing the site in relation to a larger, multiethnic region as an element shaped by multicultural interactions across a broad and ecologically diverse region. Other perspectives might certainly be suggested, but these five offer a wide range of scales. They therefore allow exploration of some of the implications for viewing any one site and its attributes from a variety of perspectives.

Each of these perspectives can be understood as a context within which the significance of a site and its attributes can be defined. The understanding used here is that sites and their attributes do not possess inherent significance, but that significance is defined in terms of relationships to other phenomena. The significance of any particular attribute can be constructed differently as the context of its relationship to other phenomena changes. Put another way, more than one aspect of significance can be defined for any attribute, so the nature of the significance of an attribute can vary depending on the context in which it is viewed. It follows that a statement about the significance of a site will (or should) specify the context within which that significance is being defined.

One purpose for identifying a series of contextual types, then, is to systematize to some extent some concepts of significance. This allows them to be applied in comparable ways under different cases. The following discussion expands on the categories of contexts named above. To help illustrate them, some hypothetical cases are offered. These cases are meant to be heuristic devices, but they also are intended to reflect actual possibilities as much as possible. Where applicable, actual cases will be cited in support. The ideas underlying the hypothetical models, however, are intended to stand on their own merits. These models are presented in hierarchical relationship to

each other, starting with context at the lowest level, or site-internal attributes, and proceeding to the largest level, or comparative regional analysis.

### **Level 1: The Within-Site Context**

This level refers to the perception of significance in terms of variation and patterning within the site when relationships among elements of a site are considered. All archaeological deposits possess internal variation and patterning. Even such amorphous and attribute-poor types of sites as lithic scatters can be studied as to the nature of the distribution of remains within the site.

There can be many objectives of a study of within-site variation, only a few of which can be reviewed in any brief discussion. For example, if each piece of debitage within a lithic scatter was identified and mapped as to precise location, several possible determinations could follow. If the debitage was analyzed in terms of stages of lithic reduction, the plotting of locations of flakes on the site surface might reveal patterns of past tool-making activities. If debitage was analyzed for type of raw material, the mechanics of reduction using different materials could be indicated. If it could be determined which flakes of the same material came from different sources, both the forms of work done on materials from different sources and the relative significance of different sources could be compared. In some cases, it could be possible to isolate flakes generated by single episodes of flaking, so that the toolmaking task could be reconstructed with a clarity not possible in more complex sites.

Lithic scatters may be places where the archaeology of such individual actions can be reconstructed. For example, Jackson's (1988b) analysis of the movement of large nodules of obsidian across the Sierra Nevada identified several sites in which single large blocks of obsidian were recovered. Some of the present author's work at Sierra Nevada sites where obsidian reduction took place, while not revealing large blocks, did uncover peripheral site work areas where low flake density



made it possible to suggest that single chipping events might be reflected (Chartkoff 1990).

At a more general level, it may be seen that the identification and precise mapping of each flake in a lithic scatter can provide the definition of a variety of possible patterns within a site. Determination of such patterning for a number of sites would then allow determination of the degree to which sites shared types of patterns, which becomes meaningful at the fourth and fifth levels of analysis. At the first level, however, it also can be meaningful to learn whether a lithic scatter shares such patterns with other sites or possesses unique patterns of its own. Even if an assemblage in a lithic scatter was made up of raw materials and flake types found elsewhere, if the pattern of relationship among these elements was unique to one site, that fact alone would give the site a form of significance not otherwise appreciated.

### **Level 2: The Assemblage as a Whole**

While analysis at the first level emphasizes patterning and variation within the site, a perception of the site as a unit offers a second context for considering significance. If the assemblage of a flake scatter is summed, the nature of the whole assemblage becomes a definable and comparable entity, as opposed to a consideration of patterning within the assemblage. This modest shift allows different kinds of qualities to be emphasized than at the first level.

For example, a site might possess flake relationships and typology patterns found widely but displayed in a type of raw material not found in other nearby sites. Or, the raw materials might be widely spread, but at one site there might occur a type of debitage not found elsewhere, exhibiting a locally unique strategy of reduction. Here the characteristics of the assemblage as a whole are being emphasized rather than attributes stemming from internal provenience. These alternatives indicate that distinctiveness and commonality can emerge in different possible ways even when other variables remain constant. Furthermore, there can

emerge from such cases a variety of problems requiring explanation, depending on the patterning discovered. When a site can be used to define and help answer a question of broader application, that fact helps define significance for the site. As noted earlier, when the patterning emerges from the analysis of variation within a site, the context of significance is at the first level. In this instance, when it emerges from a consideration of the nature of the assemblage as a whole, the context has moved to a different level.

As stated above, it is possible to characterize an assemblage as a whole in terms of its types and percentages of raw materials, artifact forms, and stages of lithic reduction represented (e.g., Bloomer 1993). Sites can be compared in terms of these overall summations as well as in terms of patterning of internal composition. For example, it is well established that thousands of obsidian lithic scatters exist in the hills and mountains of northern California. Studies of the obsidian sources represented at sites have been done in many areas. They reveal, among other things, that sources have changed in popularity over time. A given site may reflect use of one source, or of more than one. Percentages of obsidian from different sources can vary among sites over time, over space, or both. Nearby sites of the same age may differ in source popularity. A given site may mark a boundary for the distribution of materials from a source, either for a specific time period or for multiple periods (e.g., Hughes 1992).

Assemblages can be compared usefully even on the basis of presence versus absence of constituent elements. For example, most lithic scatters in the Sierra Nevada will lack steatite, but a small percentage will contain it. Why a relatively scarce raw material occurs in some sites but not most others may be an important question. The problem may become more complex when steatite sources are considered, especially if a rare or distant source is represented (cf. Chartkoff and Chartkoff 1980). Pignolo's (1994) discussion of Piedra de Lumbre chert in coastal southern Cali-

fornia offers another example of how comparative assemblage constituents may define site significance at this second level. Again, the definition of patterning and variation gives rise to questions, which in turn helps define what makes a site significant (Goldberg and Moratto 1983).

### **Level 3: A Site in its Environmental Context**

A third level of context can be used when the relationship between a lithic scatter and its surrounding environment is considered. This context reflects on some other, established modes of analysis, as do contexts at other levels. For example, catchment analysis, which was considerably in vogue 10 to 15 years ago (e.g., Fagan 1981:396-400), emphasized the calculation of the resource potential of a site's surroundings and its implications for a group trying to pursue a particular subsistence strategy there. More recently, the concept of cultural landscape analysis has been proposed as a more holistic view of local, culturally used areas (e.g., Whatford 1994). Earlier approaches involving settlement analysis have tried to see relationships among sites within a landscape (e.g., Jackson 1988a).

The context of a site in its environment allows definition of patterning and variation of different sorts than seen in the first two levels of context discussed earlier. Jackson's (1988a) analysis of some prehistoric site distribution patterns in the central Sierra Nevada, for example, noted the relationship between lithic scatter locations and the distribution of bedrock types. He also noted tendencies for the covariation of lithic scatters with bedrock mortar sites and/or with midden deposits. A wide range of other variables could also be considered, a few obvious examples of which might include relationships to local terrain gradient, plant associations, water sources, trail systems, or to raw material sources. Patterning and variation from such patterns can be calculated for each variable among a set of such scatters. A lithic scatter may be considered significant because it exemplifies a pattern, because it diverges from a pattern,

or in the way in which it diverges from a pattern. If multiple attributes are considered, a lithic scatter that is normative for one pattern may be nonnormative for others. Significant questions can be asked about how and why a lithic scatter is normative or nonnormative for any variable. Such questions can provide valuable guidelines for further research while also providing bases for defining site significance according to NEPA or CEQA criteria.

### **Level 4: Context of Cultural Systems**

A site can be placed into a variety of contexts larger than its immediate surroundings or catchment. One such context is the archaeological equivalent of the ethnic group. Archaeological patterns treated as past cultural systems may or may not coincide with actual ethnic groups in the ethnographic sense, but they provide definable units based on shared elements such as artifact style, subsistence practices, architecture, technology, and art patterns. If a group of sites sharing such attributes is defined as the pattern of a past cultural system, the set of sites provides an additional contextual level for assessing the possible significance of a lithic scatter that is part of the pattern. All the lithic scatters included within such a pattern form an element of that cultural system. The patterning and ranges of variation among the lithic scatters help to define ways in which individual lithic scatters either reflect those particular patterns or deviate from them. In either case, the significance of the individual lithic scatter is a result of considering its properties in the context of the sites at an ethnic group level of comparison.

As an example, several years ago, the author visited several lithic scatters near the Sonora Pass in the central Sierra Nevada. These lithic scatters were composed overwhelmingly of obsidian, predominantly from the Bodie Hills source to the east. This obsidian reflected part of the movement of the raw material in various stages of reduction to consumer sites at lower elevations to the west. Among the detritus were some nonobsidian flakes,

including the distinctive chert of the Sonora area (W. Woolfenden, personal communication 1980; Chartkoff 1990:25-33).

The occurrence of this distinctive material at a low frequency may suggest some sort of relationship with the ethnic group that occupied the Sonora area and moved up into the high country between Sonora and Sonora Pass each spring. It reflects the sort of settlement pattern described by Levy (1978:399-402) for the Eastern Miwok. In this system, a community lived for part of the year in a winter base camp at a low elevation, and then divided into smaller units each spring for dispersal while foraging at higher elevations. The territory of such a community might encompass 50 to 100 square miles or more, and would include a great deal of diversity in elevation, terrain, and resources. Neighboring communities followed similar seasonal movement patterns and created comparable settlement patterns. In most cases, neighboring groups spoke the same language, had some connections of kinship through exogamous marriage, and otherwise constituted a larger ethnic system. Levy (1978) identified more than 100 Eastern Miwok communities in the Sierra Nevada, whose collective territories incorporated over 5,000 square miles of core area and possibly a much larger peripheral area.

Whether the sites mentioned near Sonora Pass were part of Miwok territory at any time, lay outside the Miwok ethnic boundaries, or predated the emergence of the Miwok in the area cannot yet be said. High-altitude lithic scatters in the Sonora Pass region exhibit attributes that imply a connection with the Sonora area; a kind of connection that is not observed for otherwise similar lithic scatters occurring 50 miles up or down the Sierra Nevada at the same altitude in either direction. This point illustrates one way in which significance can be seen for lithic scatters at a contextual level of the ethnic group.

#### **Level 5: Context at the Regional Level**

An even larger contextual framework can be suggested, even for a lithic scatter, at the regional

level. The regional level as used here refers to an area much larger than an ethnic territory. By definition, it is multiethnic, so it is culturally more complex as well as geographically larger in scale. At this level, significance can be defined in terms of lithic scatter site attributes that are related to prehistoric interactions at the multiethnic, regional level.

One prototype for this perspective is the Hopewell Interaction Sphere, as defined by Struever (1964). As conceived by Struever, the Hopewell Interaction Sphere refers to a system of complex societies which represented a number of distinct polities that interacted with each other on a recurring basis in such matters as the exchange of high-status artifacts and exotic raw materials across a subcontinental region. These interactions created loose regional systems of interaction which can be recognized archaeologically through shared stylistic elements. In northwestern California, the sharing of the World Renewal religious system among the Yurok, Karuk, and Hupa peoples bound them together in an ideological interaction sphere (Kroeber and Gifford 1949), and in much of California, the shell money system linked many groups in regional exchange networks (Chagnon 1970).

The place of a lithic scatter in such a system of multiethnic regional interaction provides a very large-scale context within which the importance of a site can be defined. Perhaps no material better illustrates such interactions than obsidian, because specific sources can be identified so readily. Enough obsidian studies in California have now been conducted that regional, multiethnic patterns of movement and consumption of this resource can be documented in great detail (e.g., Hughes 1984; Moratto 1984, 1988; Meighan and Scalise 1988; Dowdall 1991). For a variety of reasons, the use of obsidian from specific sources can wax and wane over time. Lithic scatters, because of their high frequency and their relatively internal simplicity, can be especially valuable sources of information about changes over time and space in the significance of particular sources, or of sources



relative to each other (e.g., Ericson et al. 1989; Arnold 1990). Even when a lithic scatter assemblage contains no unique items, the statistical patterning formed by the assemblage can be valuable because of what it reveals about such things as changing ethnic boundaries or economic strategies. Each lithic scatter has a unique location in time and space relative to each source of exotic material in it. The data from each one is therefore spatially unique relative to those sources, no matter how many other lithic scatters occur in an area or how similar its assemblage may seem compared to that of any other lithic scatter.

On the other hand, a lithic scatter may contain unique elements that are particularly reflective of long-distance relationships. For example, Miocene banded chert occurs in the South Coast Ranges. It is occasionally found in sites at some distance from the sources; for example, in the southern California coastal region (e.g., Ruby 1966). If it showed up in sites in the northern Sierra Nevada, however, the significance would be radically different. Such unique, long-range movements are not unknown. At Los Melones Reservoir, for example, of 318 sourced pieces of obsidian, 97% was from trans-Sierran sources as expected, but one piece each was from the North Coast Ranges sources of Blossom Creek and Anadel, while five were from Napa Glass Mountain (Moratto 1988: 322). While those sourced flakes were not from lithic scatters, the potential certainly exists for similar identifications from lithic scatters if analyses were conducted on a regular basis. Again, it is precisely because of the large number of lithic scatters that their data on the patterning of the movements of rare as well as common commodities over long distances and across ethnic boundaries can be so revealing.

### DISCUSSION

Though the examples used here have been largely illustrative, they suggest several points of more general, empirical concern. The first is that the lithic scatter, like any other type of site,

possesses a wide range of research and cultural heritage significance. As is true of any type of site, the significance of a lithic scatter is not inherent, but is derived from the types of questions and problems that may be addressed with reference to the site. Some of the kinds of issues and problems which might be addressed through the study of lithic scatters are suggested above. Certainly many others can be conceived. Greater involvement by more researchers with lithic scatters will inevitably expand the range of research significance for this type of site beyond what any one individual can suggest. The most important point, however, is that the morphological simplicity of this type of site should not be taken as an indication of lack of potential significance, whether for research or for cultural resource management.

To help suggest an approach to structure for that value, the examples above also indicate some possible utility to a hierarchical conception of the idea of significance. As noted earlier, significance is not viewed as a unitary concept, but as a series of separate levels, each of which defines significance in a different way because the contextual referents differ. In this discussion, the various contextual levels used have been structured so that each lower level can be incorporated as a unit within the next higher level, thus creating a hierarchy of contexts. The hierarchy of contextual types creates a fairly systematic and constant series of referents for significance which could be applied in relatively parallel ways in many different areas. Any such hierarchical typology can be modified in many different ways. In whatever form it is used, however, it provides a systematic method with comparable outcomes to define site significance by a variety of criteria according to the contextual level used.

By moving from one level to another, a researcher can change the perspective by which the same data set can be viewed, and therefore can ask different sorts of questions systematically about the same data. The different levels, in turn, can help to clarify the kinds of observations which assessors

of significance may want to make about sites such as lithic scatters. If significance is sought at the first level, for example, one must determine the internal composition of the scatter, in terms of the kinds and frequencies of materials that comprise it, and the nature of their spatial distributions within the site. These data sets then become patterns which can be related to comparable patterns at other sites to determine degree of similarity or uniqueness, as well as other aspects of research or management significance. If a study fails to provide this information, it can be seen that significance at Level 1 cannot be assessed, whatever the objective of significance assessment may be.

The same data can be used to consider significance at other levels of context. At Level 2, for example, one would want to characterize an assemblage as a whole, as opposed to looking at internal patterning. In both cases, however, it is necessary to assess the types of objects composing the assemblage and their internal frequencies, even though internal spatial arrangement would not be a factor for Level 2 assessment. At both levels, it is important to know such things as the relative proportions of retouched, utilized, and unmodified materials, the types of raw materials present, the frequency distributions of raw materials according to category type and stages of lithic reduction, and the kinds of activities that might be reflected by each set. At Level 1, this information also can be used to suggest activity concentration patterning and the possible occurrence of identifiable incidents of lithic reduction.

Archaeologists are well aware of the importance of obsidian for source identification and hydration measurement. By extension, the identification of all exotic or rare raw materials in lithic scatters can be appreciated as well. These observations can be used to help define significance at other contextual levels. For example, if a raw material occurs within the catchment area of a particular lithic scatter, significance would be considered at Level 3. If the raw material occurred elsewhere in the cultural territory to which the

lithic scatter belonged, significance at Level 4 would apply. If the raw material were imported from another ethnic area, significance could be discussed at Level 5.

Identification of high-frequency raw materials can be just as valuable for assessing significance as low-frequency materials. If the source of a particular raw material is used as a reference point, it is important to track the flow of the material from the source in all directions, not just one or two. It is important to find where the flow levels are high, where they are low, and where they end. Such information helps to suggest where cultural and economic systems existed in the past and where their boundaries lay. The reconstruction of such patterns takes a large number of data sets, not just a few. Each lithic scatter exists at a unique point in direction and distance from each resource source represented (or not represented) at that site. Each such scatter thus constitutes a unique data set. The unique data at each lithic scatter cannot be recovered or adequately reconstructed by the study of a few lithic scatters considered to be representative. The concept of representativeness implies repetitiveness and predictability, and where data are unique, the concepts of repetitiveness and predictability are not adequately applicable. Such issues as the role a lithic scatter played in the overall adaptive strategy of a culture and the relationship between one lithic scatter and sites in other areas reflect significance at higher contextual levels, but employ the same sort of data used at the lower contextual levels of analysis.

### SAMPLING ISSUES

California archaeologists are still working to improve approaches to the study of lithic scatters in an age and environment of cultural resource management. The present discussion may suggest some kinds of data that can be sought, but it has not considered how it should be done. Some of the other studies cited earlier have also considered this problem, but it seems fair to say that the field is still working toward a consensus. How, then,

can lithic scatters be effectively and efficiently sampled to collect appropriate data when the vast majority of studies takes place in CRM compliance efforts?

At an epistemological level, it can be argued that there cannot be a uniform approach to this problem, if for no other reason than the issue of relevance. A sample cannot be judged adequately on its own. Its adequacy is related to the need for data to work on specific questions and to assess possible answers. If, however, a set of questions can be commonly pursued, it should be possible to determine what sort of sampling strategies would be effective and reliable. This determination may be easier to make for lithic scatters than for virtually any other kind of site because of the extreme simplicity of lithic scatters compared to any other type of site.

For example, the questions discussed earlier can all be approached if one knows the makeup and spatial distribution of the surface assemblage. This information can be determined by making a 100% recovery, in which every item is located and its position recorded in precise spatial coordinates, and then analyzed as to raw material, type of artifact, and other data sought.

As with other archaeological research, however, full recovery presents several problems. First, it is costly in time, labor, and money, especially relative to the information that will be recovered (although this may not be a problem for some small lithic scatters). Second, a diminishing returns effect always emerges when any set of data is collected from a population, although where the diminishing returns effect emerges remains to be discovered in new cases. It invariably turns out that samples far smaller than the total population can allow quite accurate prediction of the properties of the total population. In addition, full recovery is undesirable from a research standpoint because it destroys the site for future investigations, especially for a time when new methods of analysis are developed that allow the kinds of research to be conducted that cannot be predicted

today. It also is undesirable from a cultural resource management viewpoint, both because it destroys the resource to be managed and because it represents a less-than-optimal use of limited financial resources for which other management needs also compete.

Given these concerns, it follows that sampling is the desirable approach for most lithic scatters, but it remains to be discovered what size sample and what sort of sampling methods would be most useful for the study of particular kinds of questions. It would be particularly valuable to discover what sorts of sampling strategies could be used on lithic scatters that would be both predictively powerful and economical to execute in order to study the kinds of questions that interest researchers today and in the future. Given the high frequency of lithic scatters among the more than 100,000 prehistoric sites already recorded in California, the development of such sampling methods would seem very desirable. Given the structural simplicity of flake scatters, this development would seem to be feasible.

There are probably many ways to discover what sorts of sampling methods could serve well. What follows is only one possible approach, but it is one which seems satisfactory, economical, and workable. This approach would require a research project to undertake the total recovery, through mapping and micro-unit excavation, of a limited number of lithic scatters to be sacrificed for the purpose.

It seems possible, and not especially damaging to the overall archaeological record, to make complete recoveries, with precise spatial coordinates, of a few lithic scatters of different sizes and from different locations in the state. In this case, perhaps only five or six sites might need to be examined in this way to begin to establish a controlled model of the range of variation in structure and patterning. A complete study might involve removal of all surface vegetation prior to the mapping of each piece of debitage to the centimeter. After mapping, each piece would be re-

moved with provenience preserved. The site would be gridded into small units, perhaps no more than 10 cm. square. After the removal of all mapped surface pieces, each grid unit could be excavated as a shallow block and sifted through fine-mesh screen to learn what materials are systematically unrepresented or underrepresented in surface observations. All recovered materials could then be analyzed for type of raw material, artifact type, stage of lithic reduction reflected, metric values, source, hydration rind thickness, or other applicable information.

Once a collection of this sort is made, it should be quite feasible to computerize all results. Then computer simulations could be used to ask what the results would be for any type of sampling applied to that site, and in what ways the results would be biased compared to the structure and patterning for the collection as a whole. When several collections can be analyzed in this way, it should be possible to learn what sorts of samples would be likely to produce results with an acceptably high level of confidence based on the kinds of questions the investigator seeks to answer. Given the kind of study being sought, the objective would be to learn how many collection units of what size and what level of collection intensity would be required to provide a sample that is likely to represent the population as a whole at an acceptable level of probability. Computerization also can help to select among different strategies of randomization and stratification in the spatial sampling effort. This information would allow researchers to design effective and economical sampling strategies for the pursuit of different problems, while allowing managers to have a more informed basis to judge what sorts of fieldwork would be appropriate to satisfy management needs.

It is unlikely that lithic scatter sampling can ever rely on the standard of palynology, in which 200 grains seems to be sufficient to characterize a plant assemblage. Lithic scatter studies, for example, need to be able to characterize internal spatial patterning and variation. Yet, it still may be the

case that sufficient data recovery can be achieved with quite modest samples. Archaeology would benefit greatly from some controlled, experimental studies to gain empirical data in this area.

## CONCLUSIONS

If lithic scatters are not the most commonly occurring kind of prehistoric site in California, they are certainly among them. Regardless of ranking, however, all sites need to be seen as fundamentally important elements in the behavioral strategies of any past cultures that produced them. Lithic scatters represent patterns of activities which took place in particular times and places. The cultures which produced them cannot be fully understood without including the information contained in these sites. It therefore is essential that archaeologists keep developing strategies to better analyze and interpret these sites, if the past is to be better understood than it is today.

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