PATTERNS IN STONE: MOBILITY AND THE DISTRIBUTION OF LOCALLY IMPORTANT LITHIC MATERIAL

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Native Americans used the best available lithic resources. Limited-quality stone resources were not exchanged over long distances, but played important roles in local flaked stone tool production. In contrast to patterns of exchange, distinctive moderate- to low-quality lithic resources with limited source areas can help identify patterns of direct procurement transport and mobility within small regions. The Lusardi Formation in the Poway region of San Diego County contains locally distinctive moderate-quality laminated black metavolcanic material that outcrops in a limited area. Using the distribution of this material and other local materials in the archaeological record, we can test models of regional mobility.

The Lusardi Formation in the Poway region of San Diego County (Figure 1) contains locally distinctive moderate-quality laminated black metavolcanic material that outcrops in limited primary and secondary source areas. This material was noted as locally distinctive in the past but has largely been ignored in more recent lithic material typologies in the area.

Native Americans used the best available lithic resources for flaked stone tool production based on suitability for production and the time and energy constraints of acquisition. Limited-quality stone resources were not exchanged over long distances, but played important roles in local flaked stone tool production. In contrast to patterns of exchange, distinctive moderate- to low-quality lithic resources with limited source areas can help identify patterns of direct procurement transport. In a region with multiple geographically and visually distinctive lithic materials, patterns of direct procurement can be used as proxy indicators of mobility and thus serve as tools for the reconstruction of mobility patterns. The distribution of Lusardi Formation volcanics and other moderate- to low-quality lithic materials in the archaeological record can be used to test models of regional mobility by looking at the direct procurement patterns of these materials as indicators of group mobility and territory.

As early as the 1940s, Malcolm Rogers of the San Diego Museum of Man recognized the black material from what was later identified as the Lusardi Formation as a distinctive lithic material used in the Poway region of San Diego County. One of Rogers' site forms notes, "In this area the San Dieguito people used a local blue and white banded quartzite to a great extent. It is greatly inferior to felsite for flaking, but is close at hand in the Woodson Mts." (Rogers ca. 1930s). Rogers' "blue and white banded quartzite" is laminated high-silica metavolcanic material from the Lusardi Formation, and his felsite is the fine-grained material from the Santiago Peak Volcanic Formation to the west.

The material has been variously described by a variety of other archaeologists who have noted that the material was distinctive. The material has most often been described as "black banded metavolcanic" (Day 1980a, 1980b). Kaldenberg (1976) recorded one of the first described quarry sites, although he simply referred to the material as andesite). In 1980 one of the quarry sources of the material was recorded and described as a large quarry for black banded metavolcanic. The lithic source was described as boulders strewn over a knoll top (Day 1980a).

Only a few archaeologists have paid enough attention to the lithic material in the area to recognize its distinctiveness. Heuett (1980:37), based on the notes of Rogers, called out "blue banded quartzite" as a distinctive lithic material during testing analysis of one of the sites in the region. Other archaeologists have

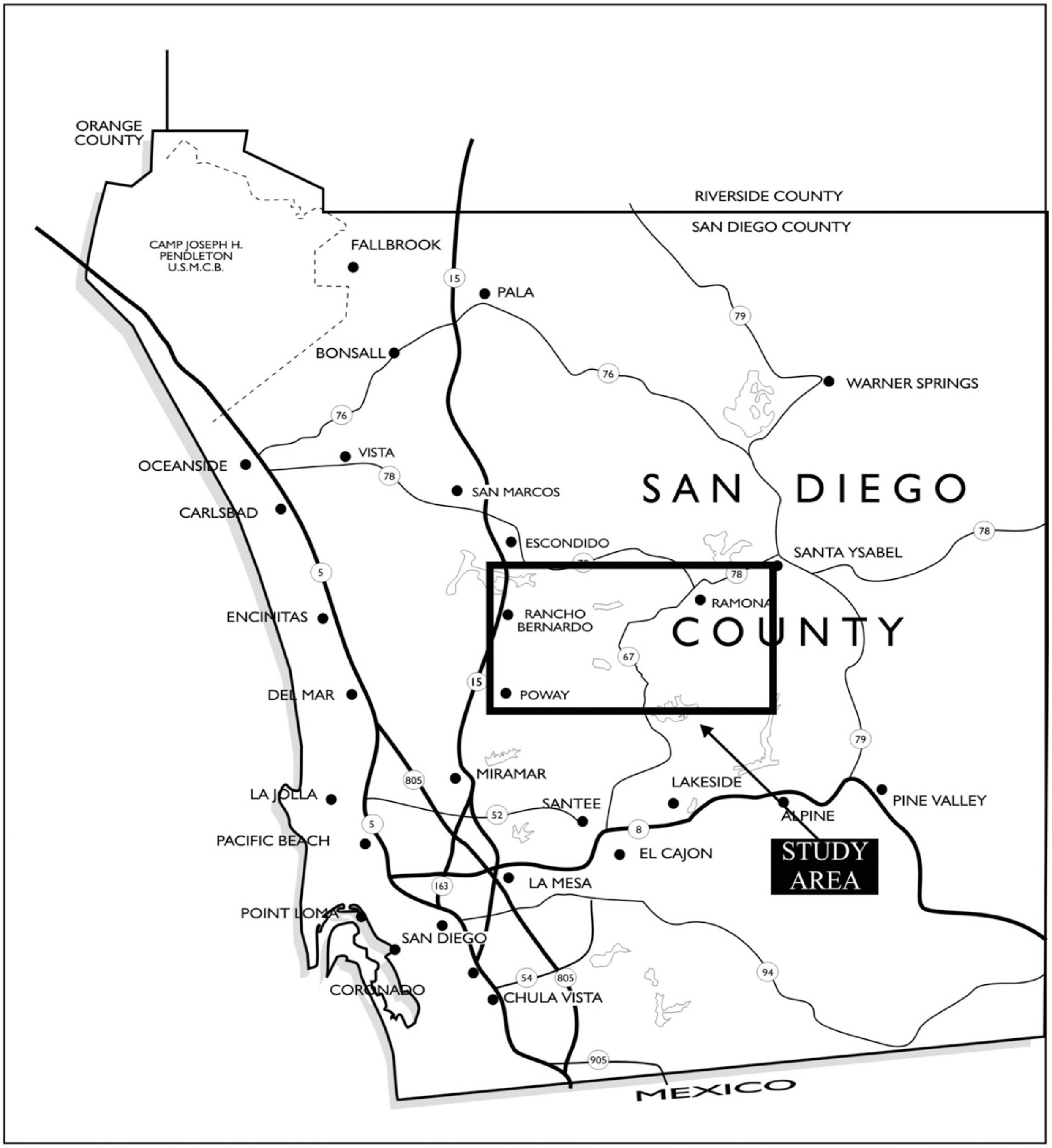

Figure 1. Study area.


Figure 2. Lusardi Formation volcanic.

variously described the material as dark metavolcanic, basalt, or black volcanic without recognizing a pattern. Only a handful of studies have recognized the material as locally distinctive.

Lusardi Formation

The Lusardi Formation was not well understood or described until the 1970s (Nordstrom 1970). The formation consists of a series of isolated terrestrial sedimentary deposits of Cretaceous age (Abbott 1999). They formed as a series of channels and fan deposits along the western flank of the early peninsular range. The Lusardi Formation remains in isolated locales in the Rancho Santa Fe, Carlsbad, Poway, San Vicente Reservoir, and Alpine areas of San Diego County (Abbott 1999). In most of these areas, higher-quality lithic material alternatives or small outcrop size limited prehistoric use of this material for stone tool manufacture.

In the Poway area, however, the material appears to have been a regionally significant source of tool stone. In this area, the Lusardi Formation remains as an elongated stream channel that represents a topographic reversal and now caps a ridgeline (Kennedy and Peterson 1975) (Figure 2). Exposures in this area are limited to a strip from Poway Valley to Iron Mountain and other isolated channel segments in the Fern Glen area and Barona Valley.

The Lusardi Formation consists of poorly sorted, angular to well-rounded clasts that range in size from sand to boulders more than 3 m in diameter (Kennedy and Peterson 1975). The largest and most abundant clasts are granitic. This rock, with minor amounts of aplite and vein quartz, constitutes about 60

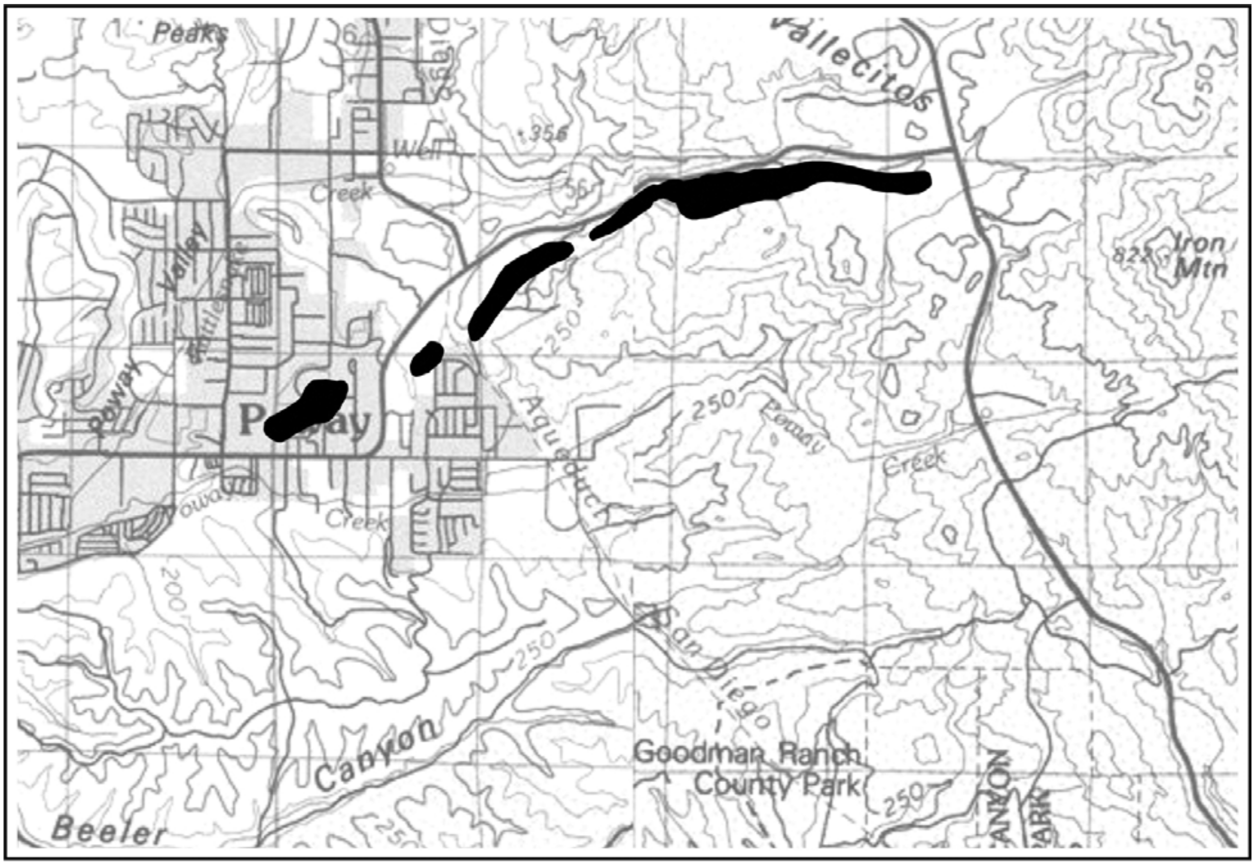

Figure 3. Lusardi Formation outcrops.

percent of the clasts. The remainder of the clasts include a variety of very fine-grained, greenish-gray, and dark gray metamorphosed tuff (Figure 3). Some of the most abundant of these clasts have finely crenulated flow banding on weathered surfaces and can be very fine-grained, dark, and sometimes structureless on fresh surfaces (Kennedy and Peterson 1975). It is the material with the flow banding preserved that corresponds to Rogers' "blue banded quartzite." This material outcrops as small cobbles to boulders and it has been quarried at several known locations along the exposure of the formation. Based on topography, drainage patterns, and a variety of personal visits to the area, fragments of this material in secondary deposits were available in only a slightly wider area than the formation exposure itself.

A high percentage of the volcanic material from the Lusardi Formation retains the distinctive flow banding and/or related blotchy gray color. This banding, in combination with the black to dark gray color, the often-grainy texture, and presence of lighter color patches, are the distinctive characteristics of this material at the hand specimen level. A small fraction of the Lusardi Formation volcanic material is not distinguishable from some varieties of Santiago Peak Volcanics at this level. This is especially true for small specimens and for unpatinated specimens. For the purposes of this study, samples have been excluded from the study when not distinguishable as to their geologic source.

Alternative sources of conchoidally fracturing material to the Lusardi Formation volcanics in this region are limited (Figure 3). Most of the area is dominated by granitic rocks, with only limited areas of pegmatite quartz dikes or metamorphosed Santiago Peak Volcanics without a usable conchoidal fracture. Other lithic alternatives include even coarser-grained Eocene-age porphyritic volcanic and quartzite cobbles of the Ballena Gravels. To the southwest, these cobbles are exposed in large areas of Eocene strata. To the west are sources of Santiago Peak Volcanic material that is locally abundant and often higher quality. To the north of the Ramona area are higher-quality quartz pegmatite dikes.

Throughout most of the region there are no major tool stone formations that would dominate stone tool manufacture, and all of the materials are of relatively poor quality. Although some of the Santiago Peak Volcanics are of slightly higher quality and may have been exchanged at a minor level with groups further inland, most of the material is of low enough quality that its distribution in the archaeological record falls rapidly with distance from source, suggesting that procurement was largely the result of direct travel to the source and not through exchange.

METHODS

Mobility Pattern Models

With a diverse lithic landscape of locally distinctive low- to moderate-quality lithic materials, the goal of this study is to both recognize the importance of locally distinctive low- to moderate-quality lithic materials and to look at the patterns of distribution of these materials in the archaeological record to examine patterns of direct procurement. Direct procurement patterns reflect where people are actually going to collect lithic materials. Thus direct procurement patterns are a reflection of group mobility and territorial access to resources.

Another goal of this study is to use patterns of direct procurement/mobility to test models of group mobility. The standard models of Late Prehistoric mobility in the region are those based on a seasonal round of resource gathering that often includes multiple ecological niches to buffer against resource failure in one niche. Some of the best examples of this model are described by True and Waugh (1981) for the Luiseño to the north as a bipolar seasonal round with essentially two major seasonal villages in different ecological contexts. These villages are used as bases. The fusion-fission aspect of settlement, where groups come together in seasonal villages and separate into smaller temporary camps to gather resources, is another aspect of the settlement model (Spier 1923). The model is also influenced by the general east/west trend of drainage systems in the region that provided easy corridors for mobility.

Lithic Materials and Sources

In order to look at direct procurement patterns, the regional geologic landscape was defined and lithic materials from sample sites were divided into major lithic categories based on source. The geologic landscape (Figure 4) includes four major formations or groups of formations that have visibly distinct lithic materials. One of these formations is the Lusardi Formation with its associated banded volcanic material. The Lusardi Formation volcanics form perhaps the most geographically limited material source, mainly on the east side of the Poway area.

Another category is the Mesozoic granitic and gabbroic plutons in the region (Kennedy and Peterson 1975). This terrain includes varieties of quartz and milky quartz that can be found in the pegmatite dikes in the plutonic rocks. Particularly abundant dikes are found in the region north of Ramona (Theodore G. Cooley, personal communication 2006) and in the Ramona mining district east of Ramona (Weber 1963).

The third category of lithic materials is the Eocene porphyritic volcanic cobbles and quartzite cobbles found in the Ballena gravels and the other Eocene-age sedimentary formations of the area (Kennedy and Peterson 1975). These are mainly located in the south and southwestern portions of the study area.

Finally, the Santiago Peak Volcanic Formation (Kennedy and Peterson 1975), which is located in the far western portion of the study area, provides a variety of good- to moderate-quality volcanic material. Materials other than these four categories, such as potential trade items like obsidian and chert, were excluded from the study. Materials that could not be classified into these categories based on their lack of distinctiveness or the poor description provided in reports have also been excluded from the sample in order to focus on materials that can provide some indication of provenience.

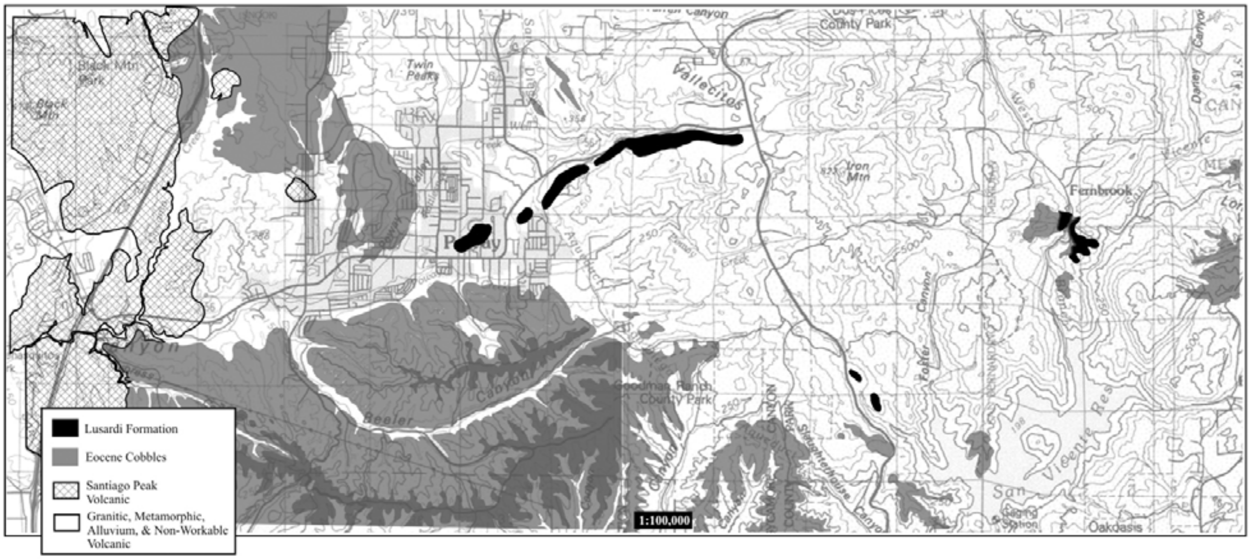

Figure 4. Regional geology.

Site Samples

The varied geologic landscape of the area and the direct procurement patterns of these materials in archaeological contexts can be used to test models of mobility. Four sites, or groups of sites, were examined to look at the direct procurement patterns of these materials. All of the sites selected were Late Prehistoric in age or predominately Late Prehistoric. Late Prehistoric sites were selected to avoid potential changes in material preference, based on changes in technology over time, and because it is the ethnohistoric and Late Prehistoric models of mobility that are being tested in this study.

One of the sites examined was the village of Poway (CA-SDI-4606) (Heuett 1980). Material categories were acquired from a testing program at the site by correlating the original material categories with the formation-based categories used in this study. The Oak Country Estates project provided another large Late Prehistoric site complex of 10 closely related sites from which the existing data provided in the technical report could be transcribed into the current lithic categories (Carrico and Cooley 2002). Direct examination was made of two collections (SDI-5492 and SDI-16793) from the Spitsbergen Property (Carrico and Cooley 2007) to help distinguish the Lusardi Formation volcanic material. The two sites on the Spitsbergen property are located in the Fern Glen region south of Ramona. Finally, the collections from four sites from the Montecito Ranch project were examined and the materials classified. Montecito Ranch is located on the north side of Ramona (Cook and Saunders 1995). The material percentages at the Montecito Ranch sites fell into two groups separated as Montecito A (SDI-9901 and SDI-12506) and Montecito B (SDI-12480 and SDI-12497).

RESULTS

The results of the data analysis are included in Table 1 along with approximate straight-line distance from the two most geographically distinct sources to the sites. The data suggest a variety of things about direct procurement and mobility.

Looking first at the data from the Poway site, several things are evident. What appears to be Lusardi Formation volcanic material dominates the assemblage. A sample of data from Unit 7 was used because complete data was not presented in the report. For the purposes of transferring Heuett's original categories into the current ones, her basalt category was excluded from the data because it could not be clearly

Table 1. Lithic Material Distribution.

Site	Lusardi Formation Volcanic	Santiago Peak Volcanic	Quartz	Quartzite/ Cobble Volcanic	Distance to Lusardi Formation Volcanic	Distance to Santiago Peak Volcanic
Poway	21%	6%	11%	6%	1.6 km	8 km
Spitsbergen	22%	12%	28%	15%	2.4 km	16 km
Oak Country	1%	51%	42%	5%	7 km	19 km
Montecito A	8%	48%	42%	3%	10 km	24 km
Montecito B	2%	16%	77%	3%	10 km	24 km

segregated between Santiago Peak Volcanic and Lusardi Formation volcanic. Checking the original specimens will be required to make a final determination, but it is likely that much of the basalt will fall in the range of variation of Lusardi Formation volcanic based on its description and a current understanding of the range of variation within this material.

What the data from the Poway site does suggest is that the Lusardi Formation, which represents the closest material to the site, dominates the assemblage, as would be expected. The next most frequent sourced material is quartz that would be available from pegmatite dikes to the east and northeast of the site. Santiago Peak Volcanics and Eocene cobble volcanics and quartzites are roughly equal in representation. The distance decay model of energy and material acquisition is supported at this site, with the dominant material being the most closely available. The more limited presence of Santiago Peak Volcanics in the assemblage suggests that the mobility range of the site's occupants included some areas of Santiago Peak Volcanics, but the dominance of quartz suggest that mobility was more strongly focused to the east. If we select the two dominant materials as representing the ends of a bipolar system, then the general trend would be seen as this site as the western end of a bipolar seasonal round, with the eastern end being in higher elevations to the east where quartz was more available.

The Spitsbergen sites show a similar pattern, with Lusardi Formation Volcanic being one of the dominant materials represented at the site. This material is available from an isolated outcrop less than 2.5 km from the sites. Quartz, available to the north and in nearby dikes, makes up the dominant material in the assemblage, however. This may reflect a north/south mobility pattern following the trend of drainages in the area. The higher percentage of quartzite and cobble volcanic at the site than at others in the study probably is a reflection of the close proximity of the outcrops approximately 3 km away from the sites. The moderate percentage of Santiago Peak Volcanics in the assemblage either suggests that this formation was occasionally visited by the inhabitants of the site or that some localized exchange of this higher-quality material was conducted.

Oak Country Estates provides an interesting contrast to the first two samples. While only approximately 7 km north of the Lusardi Formation volcanic source, this material is nearly absent from the assemblage. At the same time, Santiago Peak Volcanics at a distance of 19 km to the west, make up over 50 percent of the material in the assemblage. This suggests that directionality in mobility pattern is counteracting distance to source and energy models. The drainage pattern in the Oak Country Estates area trends east/west. If we view the Oak Country Estates sites as one end of a bipolar model, quartz that makes up 42 percent of the assemblage represents the material most available locally. As previously mentioned, quartz quarries are present nearby (Theodore G. Cooley, personal communication 2007). With Santiago Peak Volcanics being the other dominant material at the site, it is only logical to assume that the other end of a bipolar system would be somewhere to the west in the vicinity of Santiago Peak Volcanic outcrops.

Montecito A sites, slightly further east, reflect this same bipolar pattern of dominant lithic materials suggesting an east/west seasonal round with the western end in the vicinity of Santiago Peak Volcanics and the eastern end in the Ramona area near quartz sources. The Montecito B sites, however, suggest a different

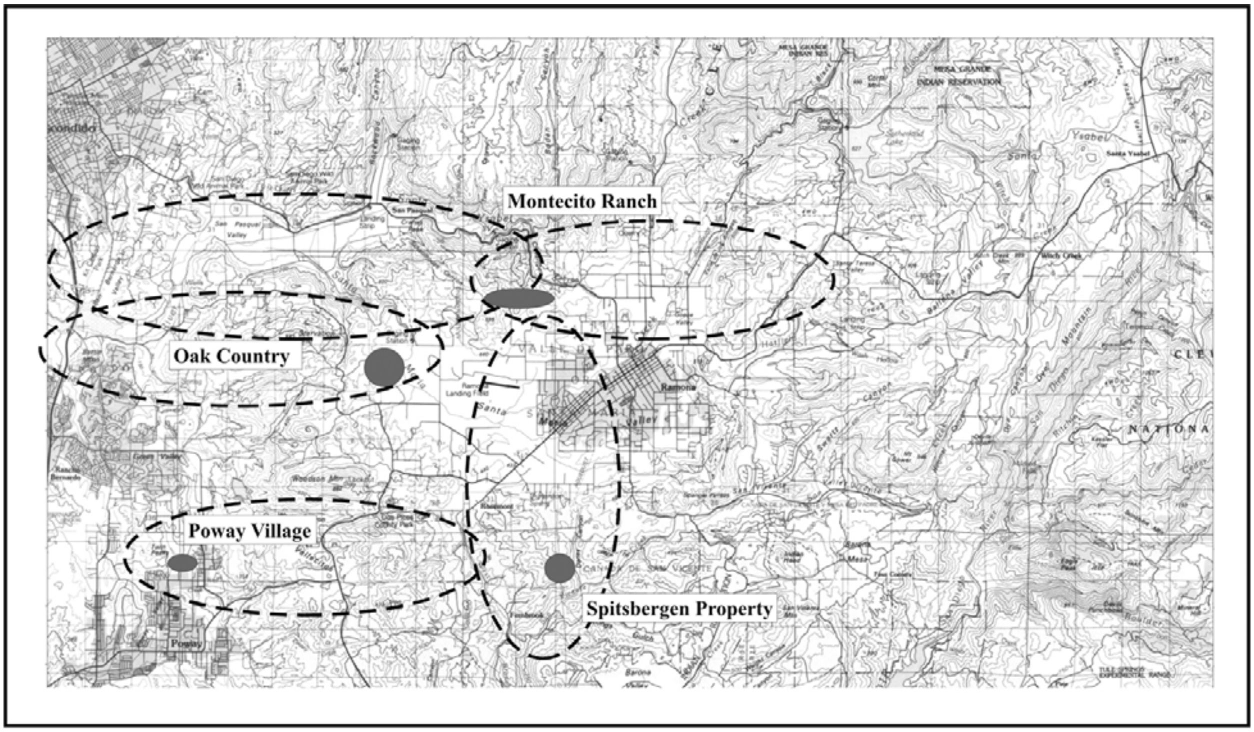

Figure 5. Mobility patterns.

pattern. The strong dominance of quartz at these sites suggests the possibility that these sites represent the western end of a bipolar system where the eastern end also had quartz as the primary lithic source. This would explain the strong dominance of quartz in the assemblage. The secondary presence of Santiago Peak Volcanics may again suggest some low-level exchange of this material or a more infrequent system of visits to resources further west.

SUMMARY

The goal here was to both re-describe the Lusardi Formation volcanics as an important locally distinctive lithic source and to show that local low- to medium-quality lithic materials can be important tools for reconstructing patterns of mobility and territorial access. Low-quality lithic material acquisition is largely a reflection of direct procurement. These direct procurement patterns in turn are indicators of group mobility and access. In areas of diverse and geographically distinct lithic materials, reconstruction of mobility patterns based on lithic direct procurement patterns can occur. In fact these procurement patterns may be our only way to reconstruct mobility patterns.

Examination of a small sample of sites in the Poway region of San Diego County can illustrate some of the information that can be obtained in this way. Figure 5 provides a summary of the general mobility pattern trends indicated by the lithic assemblages from the sites. Two types of lithic materials dominated most of the sites in the sample. One dominant type was the closest to the site and the most available to its inhabitants. The second dominate type was always the next most available, based on the trend of the drainage system in the area. In the case of Oak Country Estates, closer material was ignored in preference for material available along the trend of the drainage system. Another trend noted was that one-direction mobility seems to have been preferred, supporting a bipolar settlement model. Secondary dominant materials usually were present in a different elevation or ecological context, again supporting bipolar settlement. In the case of Montecito B sites, the lack of a distinctive lithic material to the east appears to have been reflected in the dominance of quartz (the only material available to the east) at the sites. Another trend noted was the presence of Santiago Peak Volcanics in sites farther from the source and in higher percentages than might be expected. This may be a reflection of low-level exchange and/or more extended fission movement to visit extended family in other regions. Further study along these lines can greatly add to our understanding of regional mobility patterns.

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