THE DISTRIBUTION OF PIEDRA DE LUMBRE "CHERT" IN THE ARCHAEOLOGICAL RECORD OF SOUTHERN CALIFORNIA

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ABSTRACT

Although the geology of San Diego County provided Native Americans with a variety of silicious rocks, microcrystalline forms of relatively pure silica were limited in occurrence. One of the most important local sources of microcrystalline silica is the Piedra de Lumbre "Chert" outcrop in northern San Diego County. This material is visually distinctive from other source materials in the region, at the hand specimen level, as well as by petrographic and trace element analysis. The distinctiveness of the material makes it useful for the examination and tracing of exchange and mobility patterns. This paper provides a brief summary of the research on Piedra de Lumbre Chert conducted during the author's thesis research, but focuses on the distribution of material in the archaeological record and the implications of this distribution for identification of mobility and exchange patterns. It also includes a preliminary discussion of variations in use of Piedra de Lumbre Chert through time as a potential indicator of changes in human behavior.

INTRODUCTION

The geology of San Diego County provided Native Americans with a variety of high silica volcanic and metavolcanic rocks for flaked stone tool manufacture. However, microcrystalline forms of relatively pure silica (or chert, which is the term used here) are limited in occurrence. Partially because there are few other sources of chert, and because of its distinctive geology, the Piedra de Lumbre "Chert" outcrop in northern San Diego County is probably the most important local source in the region. This material appears visually distinctive from other local sources, based on comparison at the hand specimen level, as well as by petrographic and trace element analysis. The distinctiveness of the material makes it useful for the examination of exchange and mobility patterns.

This paper provides a brief summary of some of the research on Piedra de Lumbre Chert conducted during the author's thesis studies. It focuses on the distribution of material in the archaeological record and the implications of this distribution for identification of mobility and exchange patterns.

THE NATURE OF PIEDRA DE LUMBRE CHERT

The only known source of the material (termed here Piedra de Lumbre Chert), is within Camp Pendleton Marine Corps Base in northern San Diego County. The outcrop occurs on a single ridge at the head of Piedra de Lumbre Canyon, hence its name. Piedra de Lumbre from Spanish meaning "stone of lumination" or "stone of light", may itself be named after the material.

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The chert outcrop occurs along the top of a ridge with a few secondary fragments present in the alluvium below. The outcrop occurs as a flat cap on a portion of the ridge, but several smaller, more irregular outcrops are also present. The silica material occurs in a somewhat irregular layer and grades into a sandstone-like material with orange and yellow colors suggesting a high iron content. Prehistoric quarrying evidence is heavy with an abundance of debitage present along with natural fragments of the material. A few biface preforms are present but most of the material consists of debitage and multifacial cores. Some gabbroic and granitic hammerstones are present as well. The site area can be divided into nine areas for descriptive purposes. Some of these areas reflect different outcrops while others include workshop areas or concentrations of cultural material located away from the outcrop itself. Quarrying included both bedrock outcrops and secondary chunks of material.

The chert itself is highly fractured, which is important in that core size and, therefore, artifact type, limits its use to smaller items. Unfractured chunks of the material are not generally longer than 10 to 15 cm. The material is highly variable in color but is most frequently a yellow-brown to grey. Other colors range from black, to bright red to white. Dark browns and greens are very rare but can be present. The most distinctive attribute of this material however is not its color but is the presence of angular quartz grains within a waxy typical chert matrix. Inclusions of any other materials observable at the hand specimen level are very rare to nonexistent. These angular quartz grains appear to be remnants of an original quartz-dominated rock with an appearance of sandstone.

Piedra de Lumbre Chert has been recognized as distinctive by archaeologists as early as the 1970s and has been described as various types of welded tuff or chert (Cook 1978; Flower et al. 1979; True and Waugh 1981). Norwood (1982) played an important role in summarizing information on chert sources in the San Diego County region, and with information from Flower et al. (1979), correctly hypothesized that the source of the Silicate I (Piedra de Lumbre Chert) material was in northwestern San Diego County. The Piedra del Lumbre quarry was first recorded by Murray and Fenenga (1981) but was recorded again in 1982 by Dr.Paul Ezell who recognized the importance of the quarry as the source of material he had recovered from other archaeological sites in the region, particularly from his work at the Bonsall Site. Because two localities were identified by two different people, the site has been assigned two trinomials, CA-SDI-10,008 and CA-SDI-10,708.

Part of the thesis research was related to verifying that the material could be identified at the hand specimen level. Piedra de Lumbre Chert was compared to other source materials in the region by petrographic and trace element analysis. Thin sections of Piedra de Lumbre Chert and other local cherts and similar materials indicated that there is a consistent relationship of Piedra de Lumbre Chert groundmass with the quartz inclusions, which is not matched by other local materials. Thin sections were examined under polarized light, where the angular quartz grains contrast with the nearly isotropic or glass-like groundmass. Trace elements were also examined as a means of distinguishing Piedra de Lumbre Chert from other materials. Although not statistically significant due to the low amount of trace elements, the data did indicate observable differences in trace element proportions. The study supported Piedra de Lumbre Chert's identification to source, at the hand specimen level, because of the unusual character of Piedra de Lumbre Chert and the nature of other sources in the region. It is likely, however, that there is similar material elsewhere outside of southern California.

MODELS

Thesis research verified that Piedra de Lumbre Chert has been recovered from archaeological sites ranging in age from 8,000 B.P. to contact. The material has been identified in collections throughout a large portion of southern California

west of the peninsular ranges. Piedra de Lumbre Chert has been identified from the Newport Bay region in the north, to Hemet in the northeast, the Lake Henshaw region to the east, Descanso to the southeast and the Otay area near the international border to the south.

This large region includes several ethnographic Native American groups, including the Kumeyaay, Cahuilla, and Gabrielino, but the source itself is within Luiseño territory. Ethnographic literature was examined to develop hypotheses on the distribution patterns of this material. The ethnographic literature on exchange itself is very limited and focused on reciprocal ceremonial exchange with sporadic mentions of direct trade. Ethnographic information on mobility ranged from a discussion of strict ownership and defence of lithic resources and territories, to discussions of high mobility and weak territoriality. In terms of Early Period relationships the archaeological literature was particularly poor, but suggests high mobility especially during the San Dieguito Period.

A model, suggesting among other things that Late Period territoriality would be evident and that Early Period high mobility would also affect the distribution, was developed. This model included large Early Period foraging ranges and small Late Period territories with increased exchange along territorial boundaries. Figure 1 shows some of the effects the model might have on the abundance of Piedra de Lumbre Chert through time. The model proposed high material movement (and abundance in the archaeological record) due to mobility for the San Dieguito Period. Decreased abundance during the Archaic Period was due to increased sedentism and changes in ecological focus, and increased frequency during the Late Period was due to more developed exchange systems.

METHODS

In order to deal with a variety of collection sample sizes, abundance of Piedra de Lumbre Chert was examined as a percentage of the total flaked lithic assemblage. Because debitage size is weighted to the small end of the scale due to limited core size and the technology used, only samples from site deposits that had been screened through 1/8 inch mesh were used in the final analysis. Percent count, percent weight, and an abstract value representing both percent count and percent weight were examined as variables for measuring abundance of the material. The archaeological data came largely from direct examination of a variety of collections throughout southern California. Eighty sites were included in the initial sample.

An important problem that came to light during the data gathering process is that most technical reports do not provide all the data necessary for this type of study. In most cases examination of the archaeological collections was necessary for the study because the material was not always recognized as distinct, or measures of count and/or weight were not provided for some aspect of the flaked lithic assemblage. The data from at least three important sites could not be utilized because the collections had been reburied. In times of curatorial limits and limited collection of materials from small lithic scatter sites, it is important to remember that distinct sources of lithic material will continue to be identified.

To provide an initial examination of the distribution of Piedra de Lumbre Chert, the abundance of the material at several geographically restricted areas with multiple sites was examined to identify variables which might affect the overall distribution. Because some sites contained the material while adjacent sites did not, it was clear that distance from source was not the only variable effecting the presence and/or abundance of Piedra de Lumbre Chert in the archaeological record. Beyond presence/absence the amount of the material within adjacent sites was also highly variable. Factors such as chronological association, proximity to exchange routes, site type, procurement focus, and cultural boundaries were suggested as possible variables affecting distribution.

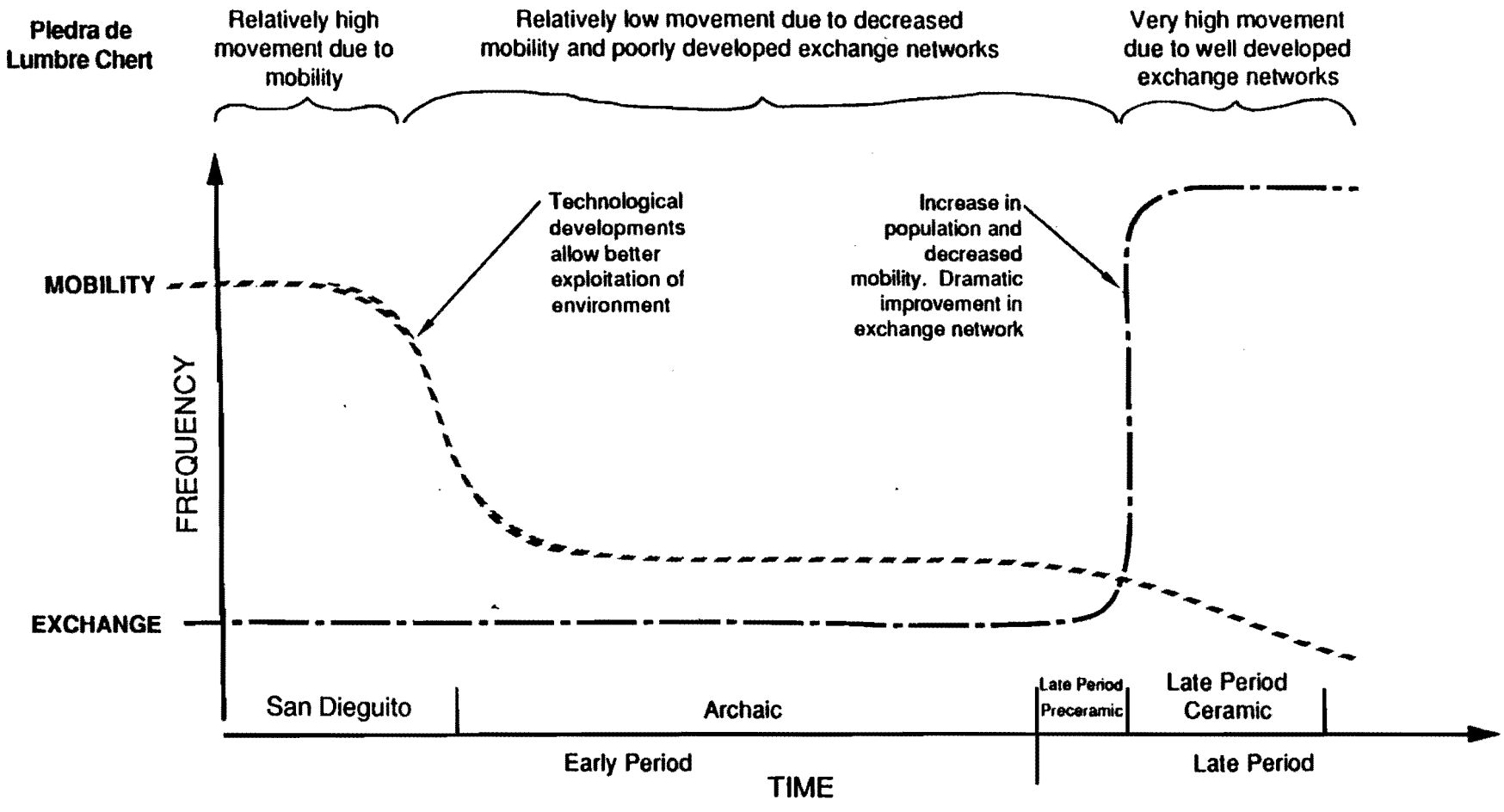

Figure 1. Model of Diachronic Change in Southern California Mobility and Exchange Patterns.

The next step of the investigation was to examine these and other variables, determine which were significant factors affecting the data, factor those variables out to the extent possible in order to examine the Law of Monotonic Decrement or distance decay theory, and hopefully say something about exchange and mobility. The raw data were examined for distance decay patterns, and the results suggested that other factors than mobility or exchange were affecting the data. A variety of variables were examined to determine their affect on the data. Variables included: effective distance, sample size, site type, chronology, competing sources of material, technological differences, and tools versus debitage. Time, sample size, and competing sources of material were determined to be the most important variables affecting the data. Several controlling factors were utilized to reexamine the data. The data were divided into Early Period and Late Period for examination, small samples were eliminated, and samples north of San Diego County were eliminated because of greater potential for competing source materials.

Finally, distance decay theory was reexamined. The methods used to examine the distance decay falloff curve were modified from Douglas (1987) and were basically a form of resistant line-fitting. The relationships of two variables were summarized with a linear function which can be divided into segments to examine the fit of the data to a curve rather than a line. The Early Period data still showed no clear pattern and this may be due in part to internal chronological variability. The Late Period data had a linear distance decay pattern (Figure 2). Renfrew (1977), one of the significant formulators of distance decay theory, has suggested that linear decay implies direct procurement of material (essentially going to the source and collecting it).

RESULTS/DISCUSSION

The overall Late Period data suggest a general linear falloff of Piedra de Lumber chert abundance with distance San Diego County. Archaeological theory suggests that this means procurement was direct and not primarily through exchange, contrasting strongly with some of the ethnographic data on lithic resource ownership for the Luiseño. It should be remembered that this does not mean exchange did not occur or that territories did not exist, but rather that direct procurement provided the overriding influence on material distribution over time. Although the general falloff pattern is linear, examination of the Late Period data graphically suggests that the cultural boundary between the Luiseño and the Diegueño affected the distribution of the material. While the number of samples along this border area is not large enough to be statistically valid they do suggest that the cultural boundary may have had some effect on distribution, as might be expected.

In terms of the Early Period data, when the effects of chronological differences were initially addressed, the abundance of Piedra de Lumbre Chert within the radiocarbon dated sample (which was very small) was examined in relation to time. Figure 3 shows the relationship between the trade index, which is a measure designed to factor out the effects of distance, and time. The radiocarbon dated Early Period sample was far too small to be statistically valid but did support the initial model suggesting a change in mobility (or some change) may have affected the distribution of Piedra de Lumbre Chert within the Early Period. Personal observation of several sites, which appear technologically to be from the San Dieguito Period, suggests that the material may have been moved greater distances during this period. This is supported by Luedtke (1992) who suggests greater movement of materials during the Paleoindian Period. During the Archaic or La Jolla Period this material appears to be present in low abundance.

SUMMARY/CONCLUSIONS

Overall, this research utilized what appears to be a distinctive lithic material at the hand specimen level to examine human behavior in terms of mobility and exchange as modes of lithic procure-

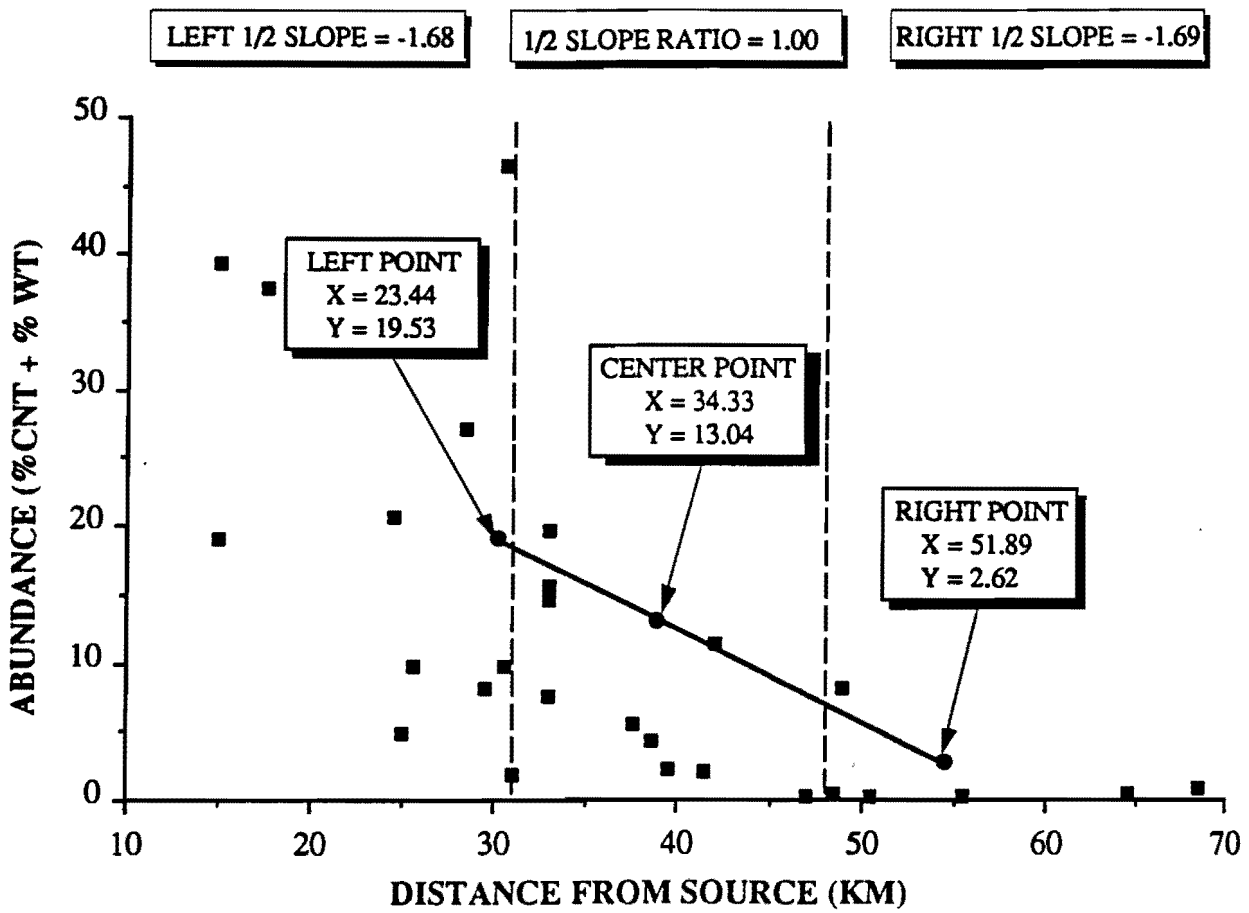

Figure 2. Scattergram of Corrected Late Period Data Showing Summary Points and Half Slopes.

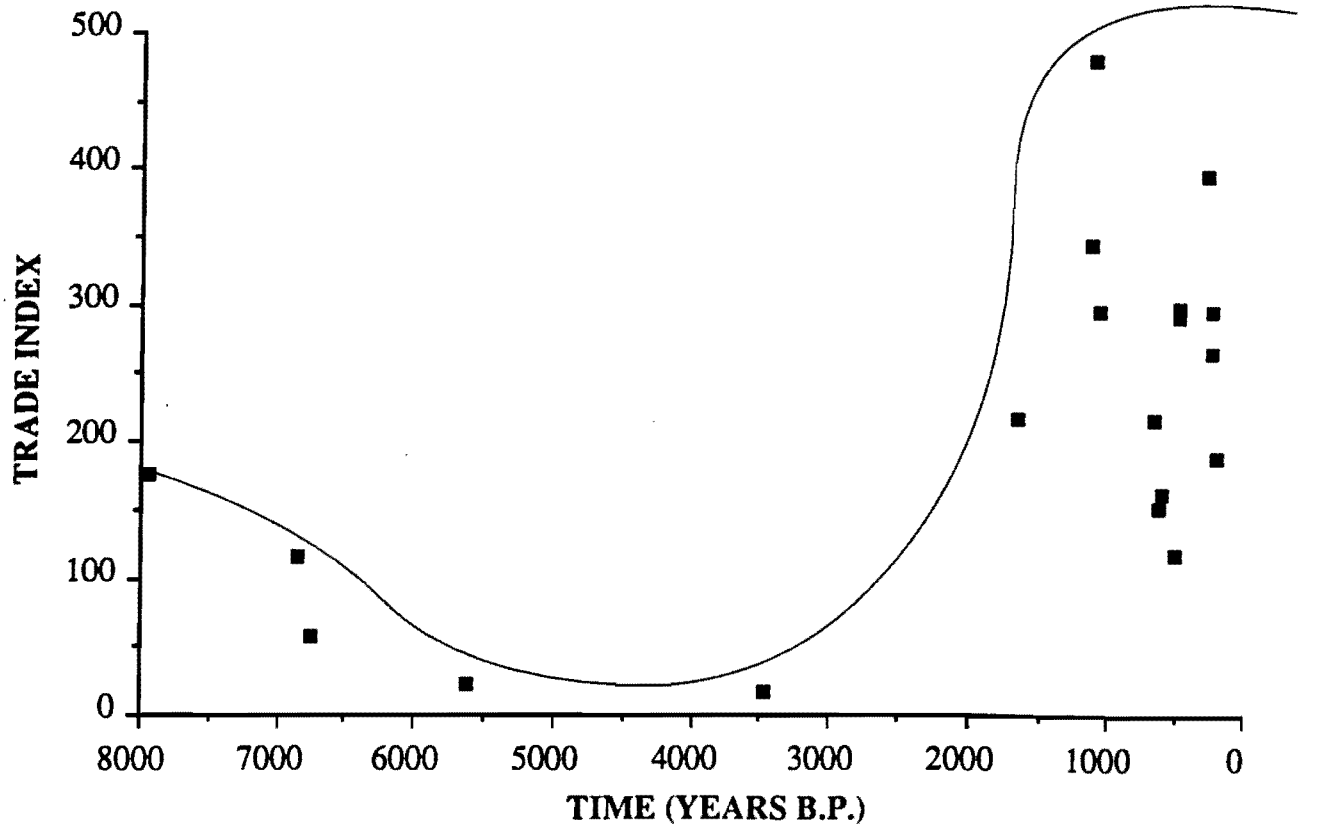

Figure 3. Smoothed Time versus Trade Index Data.

ment. The distribution of the material provided a test of and supported the Law of Monotonic Decrement. The fall-off pattern of its abundance during the Late Period suggests that direct procurement exhibited the greatest influence on its distribution, while exchange had little overall effect. With further testing this information can be used to modify our picture of prehistoric human behavior. It suggests that future hunter-gatherer material distribution studies in the region can be used to examine human mobility patterns. Source studies for lithic material other than obsidian are in their infancy. Other materials can be used to reexamine models and hypothesis such as those presented here.

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