LITHIC MATERIAL USE IN LATE PREHISTORIC SAN DIEGO COUNTY

JOHN DIETLER

Previous research has suggested that lithic material preference in San Diego County was directly related to resource availability throughout all periods of prehistory. The Late Prehistoric period witnessed a dramatic increase in the use of materials not available locally, such as obsidian and cryptocrystalline silicates. This study examines the frequency of lithic materials at Late Prehistoric sites throughout San Diego County. The county is divided into ten zones defined by geography and cultural affiliation. Up to ten previously tested sites are selected to represent each zone, and the percentage of seven broad material classes present at each is quantified. It is shown that in all parts of the county, the closest usable material at hand dominates a site's assemblage. Small percentages of more desirable, non-local materials were imported through direct procurement or trade. Linguistic boundaries appear to have been impediments to the movement of some materials, especially Piedre de Lumbre chert.

Most studies in lithic technology in San Diego County to date have looked at the assemblage at one or two sites, or the distribution of one type of material over a defined area. In this paper, I attempt to examine the "big picture" in San Diego County. The goal of this study was to characterize lithic material distribution in the Late Prehistoric period and the factors that shaped it. I began by dividing the county into ten regions defined by geography and ethnographic cultural affiliation.

METHODS

The county can be divided into four general geographic regions based on elevation: coast, foothills, mountains, and desert (Figure 1). From west to east, the coast rises from the sea to 1000 feet above mean sea level, the foothills are between 1,000 and 3,000 feet; the mountains are over 3,000 feet; and the desert is the area in the rain shadow east of the mountains, below 3,000 feet (after Pryde 1976). Each of these regions has a unique set of lithic resources. The area's prehistoric inhabitants probably exploited lithic materials in each region differently (Cardenas 1983). Four cultural groups, defined largely by language, were present in the county at the time the Spanish arrived. The Kumeyaay (also called Diegueño, Ipai, Tipai, or Kamia) occupied the southern two-thirds of the county, the Luiseño (also called Juaneño) lived in the northwestern corner, the Cahuilla occupied the northeastern corner, and the Cupeño controlled a small region between the other three groups (Hedges 1975, Kroeber 1925 and Shipek 1995). The combination of these two geographic factors (environmental and cultural) produced ten zones in the county, such as Kumeyaay coast and Luiseño foothills. Ten tested sites, or as many as were available, were selected to represent each zone, and the percentage of seven broad material classes present at each is quantified.

In order to have as uniform a data set as possible, all the sites chosen for this study are Late Prehistoric temporary camps or villages that had been subjected to controlled testing or data recovery. Sites with arrow points, ceramics, bedrock mortars, and/or radiocarbon dates after 1000 B.P. were considered to date to the Late Prehistoric period (Moratto 1984). Quarries and sites with fewer than 100 flaked artifacts were avoided when possible to minimize sampling bias. As most of the data used in the study was taken from CRM gray literature, available information was limited for the less developed parts of the county. With these constraints, 62 sites were selected from eight zones. Counts of all flaked artifacts, including debitage, cores, and tools, were used in calculating the percentages of lithic materials present at each site.

The extremely varied lithic materials used in the San Diego County were divided into seven categories: volcanics, quartz, cryptocrystalline silicates (CCS), obsidian, Bedford Canyon metasediment, quartzite, and other/unknown. General material categories were necessary because of inconsistent typologies and skill levels in the gray literature. Many different categories were used, some very broad or poorly defined, and therefore only the broadest categories could be used to compare the data.

It should be kept in mind that these categories are wholly artificial and strictly the result of the work of many late Twentieth Century American scientists. Late Prehistoric period Kumeyaay, Luiseño, and

John Dietler Tierra Environmental Services dietler@earthlink.net

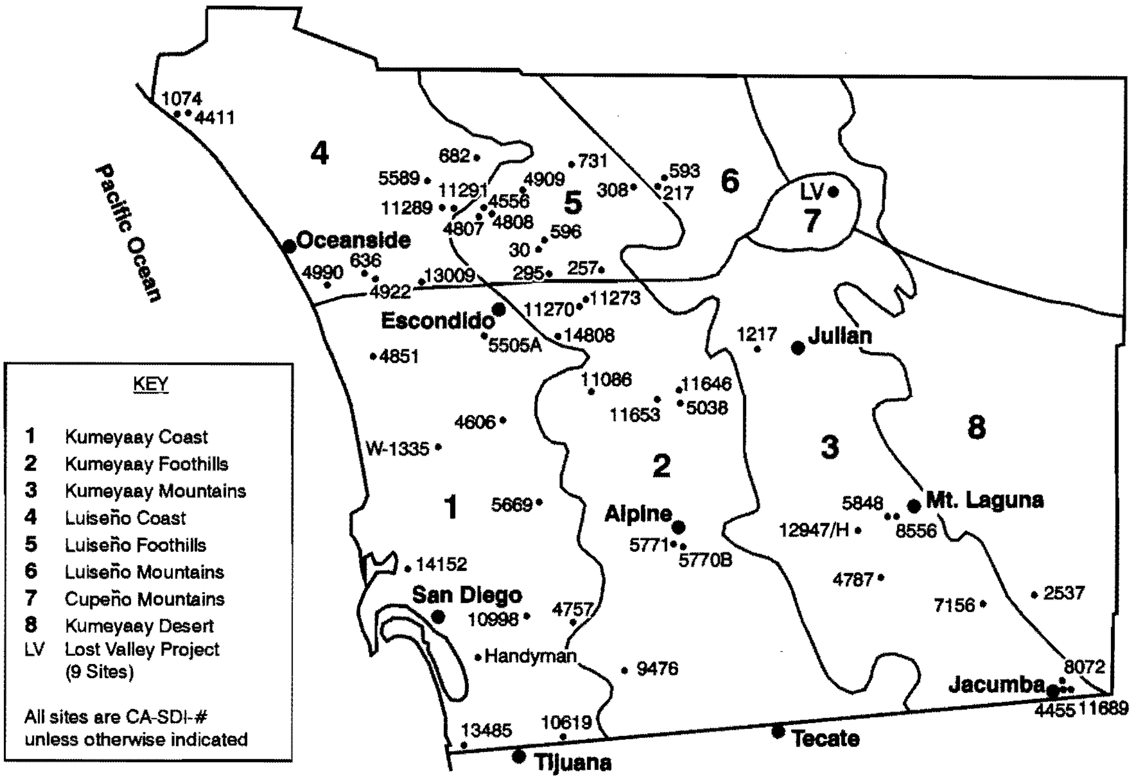

Figure 1: Sites and Zones Used in Study.

Cupeño flintknappers without a doubt had different systems of classification for lithic materials, if and when they even consciously thought about the issue at all. An ethnographic study focused on lithic material classification and naming among the Kumeyaay in present day Baja California revealed that while no distinction was made between volcanic and cryptocrystalline silicates materials, clear, milky and crystal quartz were considered to be separate materials and to have different values (Hohenthal 1950). Therefore, recovering any vestige of the relationship between the patterns archaeology can perceive in the record today and those intentionally created and considered important by the people we study is difficult at best.

RESULTS

Volcanics

The most commonly used lithic materials in San Diego County during the Late Prehistoric period were volcanics, comprising almost half (47.63%) of the flaked stone at the sites included in the study (Table 1). These include andesite, basalt, dacite, "felsite", rhyolite, and metavolcanics. Volcanic material occurs in the county in both primary tabular deposits and secondary cobble deposits. The oldest and most dominant primary deposit is the Santiago Peak volcanic formation. This formation is Jurassic in age and has undergone varying amounts of metamorphism since it was created, increasing its silica content and increasing its ability to be flaked (Pigniolo 1996). The formation outcrops along the peninsular range and foothills from the Santa Ana range in Baja California to Orange County, but is most common in the vicinity of Otay Mountain (Figure 2). This material varies widely in color, from light gray-green (sometimes incorrectly identified as felsite) to black.

Most of the secondary cobble volcanics derive from alluvial terrace deposits comprising the Poway and La Jolla groups. These cobbles of rhyolite, andesite, basalt, quartzite, and other volcanic materials from several igneous formations in Sonora, Mexico, and were transported to their current location by the Ballena River during powerful Eocene floods (Abbott 1999). They are generally well rounded and coarse grained, and form a major component of the coastal mesas across the length of the county.

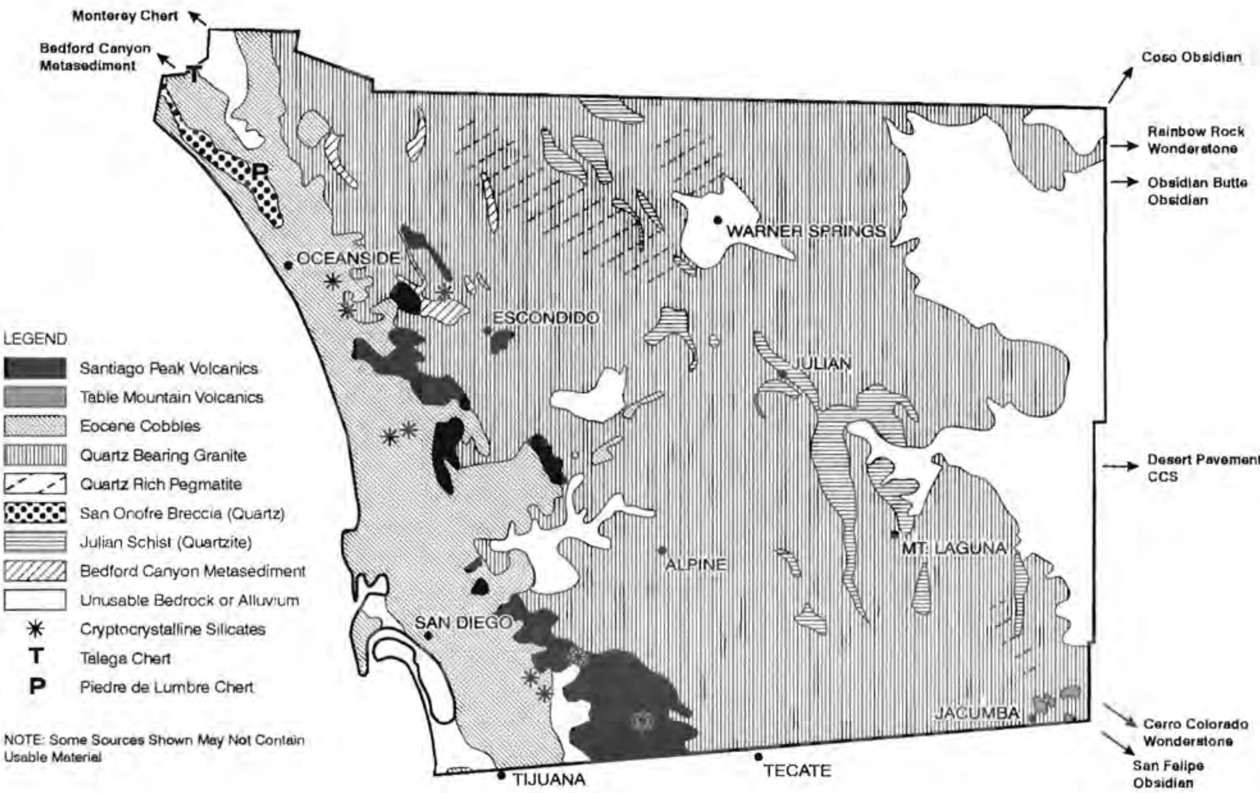

Figure 2: Lithic Material Sources in and Around San Diego County.

Table 1: Material Type Percentages for San Diego County.

Material	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Weighted Averages
Bedford Canyon metasedimentary	0.00	0.02	0.00	0.00	0.00	0.00	0.46	0.00	0.07
Obsidian	3.65	2.95	4.40	0.77	1.54	3.20	2.14	4.60	2.62
Quartz	7.26	42.41	20.40	19.95	50.46	56.45	93.83	50.60	38.70
Quartzite	8.37	8.88	3.66	2.36	1.12	0.00	2.09	4.30	4.38
CCS stone	1.27	2.72	6.08	12.83	9.38	9.60	0.54	23.10	5.89
Volcanic	79.46	43.01	63.24	62.97	37.01	27.20	0.96	16.90	47.63
Other	0.01	0.01	2.23	1.12	0.47	3.55	0.00	0.50	0.71
Totals	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

A second, far smaller source of cobble volcanics is the Table Mountain Gravels in the Jacumba Valley. This sandstone formation is the remnant of an extensive fluvial deposit and contains clasts of local granite as well as "low-grade green metavolcanics and metasedimentary rocks and quartzites that are not found locally." These are similar to and often confused with Santiago Peak volcanics, but are generally of lower quality and rarely exist in clasts larger than 30 cm (Minch and Abbott 1973). Volcanics will be discussed as a group because of the absence of more specific sourcing in the data.

Volcanic materials occur in every Late Prehistoric assemblage in the county, and dominate assemblages where volcanic sources occur nearby, especially in the southern portion of the county. This indicates that the material was considered at least adequate, and possibly superior, for everyday tasks. A cultural preference for a material can be inferred by its presence in an area where alternative materials are abundant, an idea I will return to in a moment.

Quartz

Quartz is the second most commonly used lithic material in the Late Prehistoric period, accounting for nearly 40 percent of the total lithic assemblage (Figure 3). It occurs as secondary fragments in the San Onofre Breccia Formation and as primary outcrops within pegmatite dikes in the granitic Peninsular Ranges batholith. These deposits are more common in the northern portion of the county, with the pegmatite dikes being most prevalent around Pala. The quartz ranges in quality from the glass-like crystalline variety to highly fractured milky quartz (Pigniolo 1996).

Quartz is most prevalent in archaeological sites in the northeastern portion of the county, accounting for up to 98 percent of the sites' lithic inventories. It falls off regularly to the southwest, and is almost nonexistent farthest from potential sources, in southwestern San Diego County. This pattern at first appears to represent a slightly irregular monotonic decrement pattern; quantities decrease as distance from the source increases (Renfrew 1977). However, by comparing figures 2 and 3, it can be seen that quartz is used most heavily not simply everywhere it outcrops, but rather where it outcrops and volcanic materials do not. Where they are both available, volcanics are clearly preferred over quartz.

This preference can be seen at two sites southeast of Ramona, SDI-5038 and SDI-11,646, where quartz makes up only 5 and 8.8 percent of their lithic assemblages, respectively. They stand out as anomalies when compared to SDI-11,653, less than two miles away and having 32.3 percent quartz; and SDI-11,086, less than six miles away and with an impressive 94 percent quartz (Table 2). The apparent anomaly is explained by the fact that the first two sites are very close to the Ballena Gravels, a formation with volcanic Poway Conglomerate cobbles.

It may be argued that Late Prehistoric people were simply using more of the material closest at hand, the cobble volcanics and quartzite, because it was more expedient. However, just the opposite happens at the Buckman Springs site (SDI-4787), in Zone 3. Here, although a vein of high-quality quartz is present on the site itself, the lithics consist of 53 percent volcanics and only 34 percent quartz (Gross 2000).

Further evidence of the preference of volcanic materials over quartz can be seen in sites in parts of the Kumeyaay mountain zone where no usable outcrops exist for either resource. As seen in Table 3, sites in Laguna Mountain, Pine Valley, and McCain Valley are closer to quartz-bearing pegmatite veins than to the Table Mountain or Santiago Peak volcanic outcrops, but volcanic percentages are double and triple the quartz percentages at these sites.

There is little evidence in this study for the cultural preference that D. L. True (1966) suggested of the Luiseño for quartz. While quartz is more relied upon within Luiseño territory than in Kumeyaay territory, neither compares to the Cupeño's use of quartz. When the lithic material type distribution is examined by cultural group for all sites in this study, quartz accounts for only 23 percent of the Kumeyaay lithic artifacts, 37 percent of the Luiseño artifacts, and a whopping 94 percent of the Cupeño artifacts. If there is a cultural preference for quartz, clearly it is with the Cupeño, not the Luiseño.

It is too simplistic to assume that the more quartz a group used, the more they preferred it. Why, however, is quartz so prevalent in the north-central portion of the county? The simplest explanation is that it is easier to learn to work a somewhat difficult material than it is to transport a heavy load of rocks even a relatively short distance for everyday use. The prehistoric people in the north-central part of the county likely considered quartz their best option using the materials at hand, but did not necessarily believe that it was a superior material.

Cryptocrystalline Silicates

Cryptocrystalline silicate (CCS) stone, also known as microcrystalline quartz, is chemically identical to

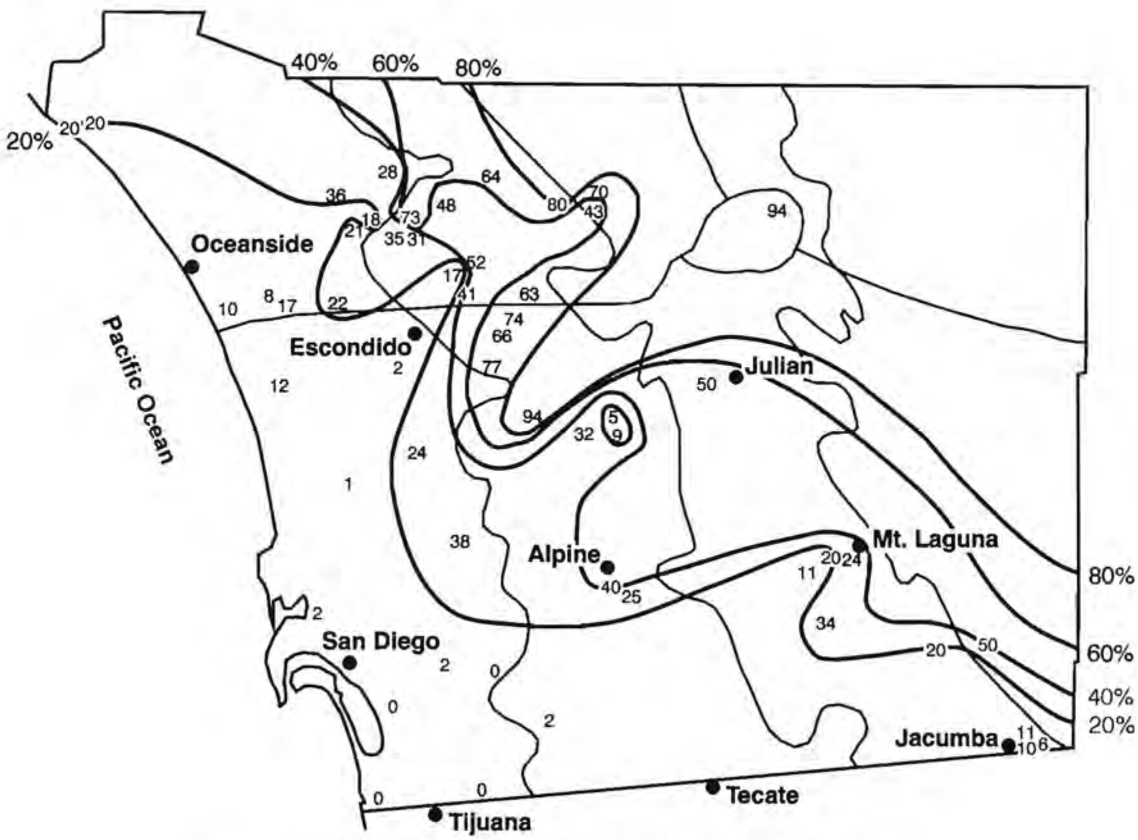

Figure 3: Quartz Distribution in Late Prehistoric San Diego County.

Table 2: Quartz and Volcanic Percentages in Four Zone-2 Sites.

Material	SDI-5038	SDI-11,646	SDI-11,653	SDI-11,086
Quartz	8.8	5.0	32.3	94.0
Volcanic	58.4	55.0	36.9	5.9
Totals	**67.2**	**60.0**	**69.2**	**99.9**

Table 3: Quartz and Volcanic Percentages in Three Zone-3 Sites.

Material	SDI-5848	SDI-7156	SDI-12,947/H
Quartz	20.3	20.4	10.8
Volcanic	67.3	61.8	81.8
Total	**87.6**	**82.2**	**92.6**

quartz with the exception of trace elements and impurities, which gives it distinctive colors. Also known as agate, chalcedony, chert, flint, jasper, and silicified (petrified) wood, CCS stone is one of the most popular flaked stone materials worldwide (Andrefsky 1998). It is one of the less commonly occurring materials in San Diego County, however, and makes only about 6 percent of the archaeological lithic material recovered from Late Prehistoric sites in the areas studied.

High quality CCS stone commonly occurs as float material in desert pavements to the east of the county. These desert deposits formed a major source of CCS material during the Late Prehistoric period. Another commonly used material, known as wonderstone, occurs in two localities east of San Diego County: the Rainbow Rock source directly to the east, and the Cerro Colorado source to the southeast. Wonderstone is a sometimes banded, hydrothermally-altered, silicified sediment exhibiting a wide range of colors (Pigniolo 1995). Although few sites in the desert portion of the county were examined for this study, the Indian Hill rockshelter (SDI-2537) can be used as an example. This habitation site is typical of large sites in Zone 8, the Kumeyaay desert. The Late Prehistoric-period horizon of this site contained 23 percent CCS material. The CCS stone, like most of the materials used on the site, was available nearby. Obsidian and wonderstone were imported, however.

Although large amounts of CCS stone do not occur naturally in San Diego County, it is present in at least small quantities in nearly all of the sites sampled. Because of its superior flaking qualities, but often-small clast size, it was an ideal material for making fine tools. It appears to have been brought to many parts of the county specifically for this purpose. At SDI-10,998, a temporary camp in Spring Valley, CCS material made up only 1.2 percent of the debitage, but almost 30 percent of the bifaces. This indicates that the material was being imported almost exclusively for the production of bifaces, possibly in the form of prepared blanks (Schaefer et al 1997).

Sources of CCS stone in San Diego County tend to be small, highly variable in character and quality, and are widely dispersed. There are at least a dozen outcrops within the Peninsular Ranges in coastal San Diego County (Pigniolo 1992), most of them minor in size and prehistoric use (Figure 4). Most of the sites examined in the Kumeyaay coast and foothills (zones 1 and 2) had two percent or less CCS stone in their assemblages. The Handyman site in National City and the Pio Pico site (SDI-9476) in the Jamul Valley have 4.6 and 5.1 percent CCS toolstone, respectively. The people at these sites were likely exploiting the cluster of sources between them that includes the San Miguel and Dulzura jaspers and Otay and Proctor Valley silicates.

Monterey chert, a very commonly used material from Los Angeles to San Francisco, does occur in small quantities in San Diego County archaeological lithic assemblages. The Monterey formation extends south to the very northwestern boundary of the county, but contains little flakable material in these outcrops (Cooley and Carrico 1999). It is unlikely that Monterey chert occurs in any significant outcrops within San Diego County, and it appears to have been a very minor source of lithic material in general for the county's inhabitants.

A far more important source was Piedre de Lumbre chert, a fine-grained, high-quality material with variable color and containing distinctive subangular quartz grains. It outcrops in two places along the northern Luiseño coast (Zone 4), the first near the head of an eponymous canyon on what is now Marine Corps Base Camp Pendleton (Pigniolo 1992), and the second on the far northern border of the county in Talega Canyon (Apple and Cleland 1994). Because of its high quality, Piedra de Lumbre chert was used heavily near its source and was widely dispersed, appearing in archaeological sites as far away as Alpine. Although often not recognized or counted separately, based on sites examined by Pigniolo during his Master's thesis study of the material, it can be assumed that the bulk of the CCS material used in the vicinity of these sources (the northwest corner of the county) is Piedre de Lumbre chert.

The percentages of CCS stone near the quarry are elevated above those in the rest of the county, with sites containing 10 to 20 percent CCS material. The toolstone profiles at sites along the San Luis Rey River suggest that the Piedra de Lumbre chert was being transported eastward. An ethnographically known trail and trade route followed the river (Pigniolo 1992), and the movement of a valuable material along this route is not surprising. The material does not appear to have traveled in bulk into Kumeyaay territory to the south, however. While the mean quantity of CCS material in sites on the Luiseño side of the ethnographic boundary is nearly ten percent, it is less than two percent just across the border in Kumeyaay territory (Table 4). This fall-off to the south and lack of a corresponding fall-off to the east suggest that the Luiseño controlled the resource. The ethnographic literature supports this idea.

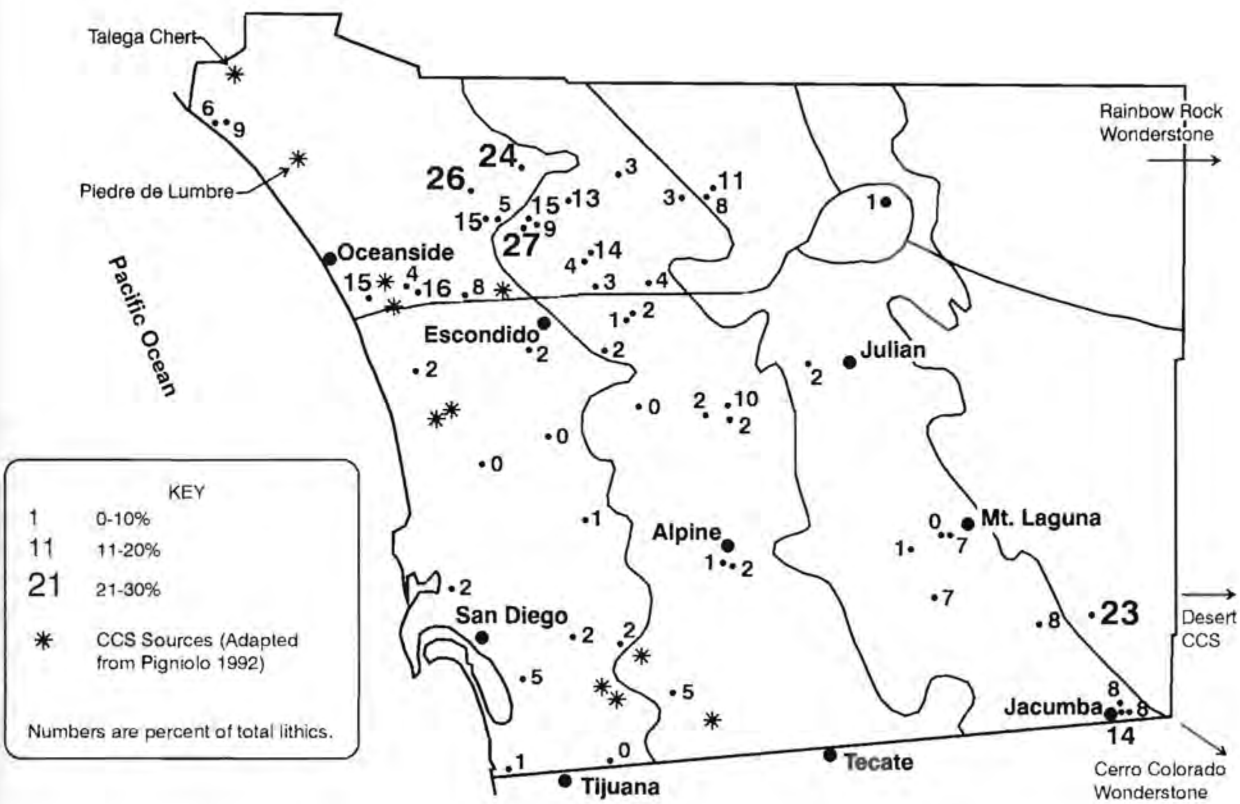

Figure 4: Cryptocrystalline Silicate Distribution in Late Prehistoric San Diego County.

Table 4: Cryptocrystalline Silicate Percentages Along the Kumeyaay/Luiseño Border.

Northwestern Kumeyaay Sites

Site	SDI-4851	SDI-5505A	SDI-14808	SDI-11270	SDI-11273
% CCS stone	1.5	1.6	1.7	0.9	2.4

Northwestern Kumeyaay average ***1.62***

Southwestern Luiseño Sites

Site	SDI-4990	SDI-636	SDI-4922	SDI-13009	SDI-295	SDI-257
% CCS stone	15.1	3.9	15.8	7.7	2.9	3.7

Southwestern Luiseño average ***9.82***

In contrast, the CCS material in the Kumeyaay area appears to adhere generally to the law of monotonic decrement from the eastern desert sources. Sites along the Kumeyaay coast average 1.3 percent CCS stone, the foothills average 2.7 percent, the mountains average 6.1 percent, while the single site sampled in the desert had over 23 percent. The quantity of the CCS stone more than doubles with proximity to the desert sources, suggesting that the small sources along the Kumeyaay coast and the Luiseño coast sources had little or no effect on Kumeyaay lithic assemblages.

Obsidian

Obsidian, a quenched rhyolite glass (Andrefsky 1998), was perhaps the most highly valued material prehistorically in San Diego County. Although there are no known sources in San Diego County, over 70 percent of the sites studied contain obsidian. The obsidian in the county has been chemically traced to at least three different sources. Most of the material used in the Late Prehistoric period originated at the closest source, Obsidian Butte (Hughes and True 1985), located on the southern shore of the Salton Sea in northwestern Imperial County. Obsidian was also obtained from the Coso and Casa Diablo sources in the Owens Valley area, and at several quarries near San Felipe, Baja California.

While there has been some debate about the availability of Obsidian Butte obsidian in earlier periods (Dominici 1984), it was almost omnipresent during the Late Prehistoric period. All of the sites sampled for this study that had sourced obsidian (N=14) had Obsidian Butte glass, and in all but one of these it formed the clear majority of the obsidian. All but two of the Kumeyaay sites with sourced obsidian contained exclusively Obsidian Butte glass. The two exceptions – SDI-12,947/H in Pine Valley and the Indian Hill rockshelter – were interesting, in that they had obsidian from all three known sources: Coso, Obsidian Butte, and San Felipe (Carrico *et al.* 1997, McDonald 1992). This suggests that the material was exchanged and not directly procured, as it seems highly unlikely that people from the site would travel such great distances both north and south in order to obtain a material that was readily available to the east. The Luiseño sites tended to be more varied, containing 20 to 40 percent Coso obsidian. The Cupeño sites fell somewhere between the Kumeyaay and Luiseño and contained primarily Obsidian Butte material, with small amounts from the Coso source.

Obsidian was brought all the way to the Pacific Ocean, and was obviously considered valuable enough to transport such large distances. Because it was brought the greatest distance from its documented sources and is present in so many sites, one can speculate that obsidian was the most valued lithic material to Late Prehistoric San Diego County inhabitants. At the very least, it fulfilled some specific function that closer materials could not. This high value is most likely tied to its superior flaking properties.

While obsidian is present in small amounts over nearly the entire county, its distribution is far from regular. Laylander and Christenson (1994) looked at the percent of obsidian in the debitage assemblages of 35 Late Prehistoric-period sites and site clusters in San Diego County. When these were plotted on the map, a general east-to-west gradient became apparent, but with the highest concentration of obsidian (>10%) not in the easternmost sites, but in the Kumeyaay mountains. To explain this deviation from monotonic decrement, Laylander and Christenson suggest that this area was a zone of exchange from groups east of the mountains to those to the west. The western flintknappers presumably reduced their newly acquired raw material into blanks and carried it back with them (Laylander and Christenson 1994). The current study confirms the trends noted by Laylander and Christenson, but shows that the distribution of obsidian is more irregular than they thought (Figure 5).

Metasediments

Quartzite is formed when sandstone is metamorphosed, producing a low-quality lithic material. Quartzite is relatively abundant throughout most of the county, and can be found among the Eocene cobbles and the Julian Schist formation. It forms only a minor part of most lithic assemblages, however. Where it does not occur naturally, such as in the northeast corner of the county, it was not utilized prehistorically. Therefore, just as obsidian and CCS material were considered valuable and moved far from their sources, quartzite was not considered valuable enough to use anywhere but where it was readily accessible.

Perhaps the least common component of San Diego County lithic assemblages is Bedford Canyon metasediment. The portion of this formation used for flaked stone consists primarily of mudstones (meta-argillite) and meta-sandstones (quartzite). It is identifiable by its distinctive dark blue-gray to nearly black color. The formation outcrops in several places in the northwestern corner of the county, but often contains no flakable stone in this southern extreme of

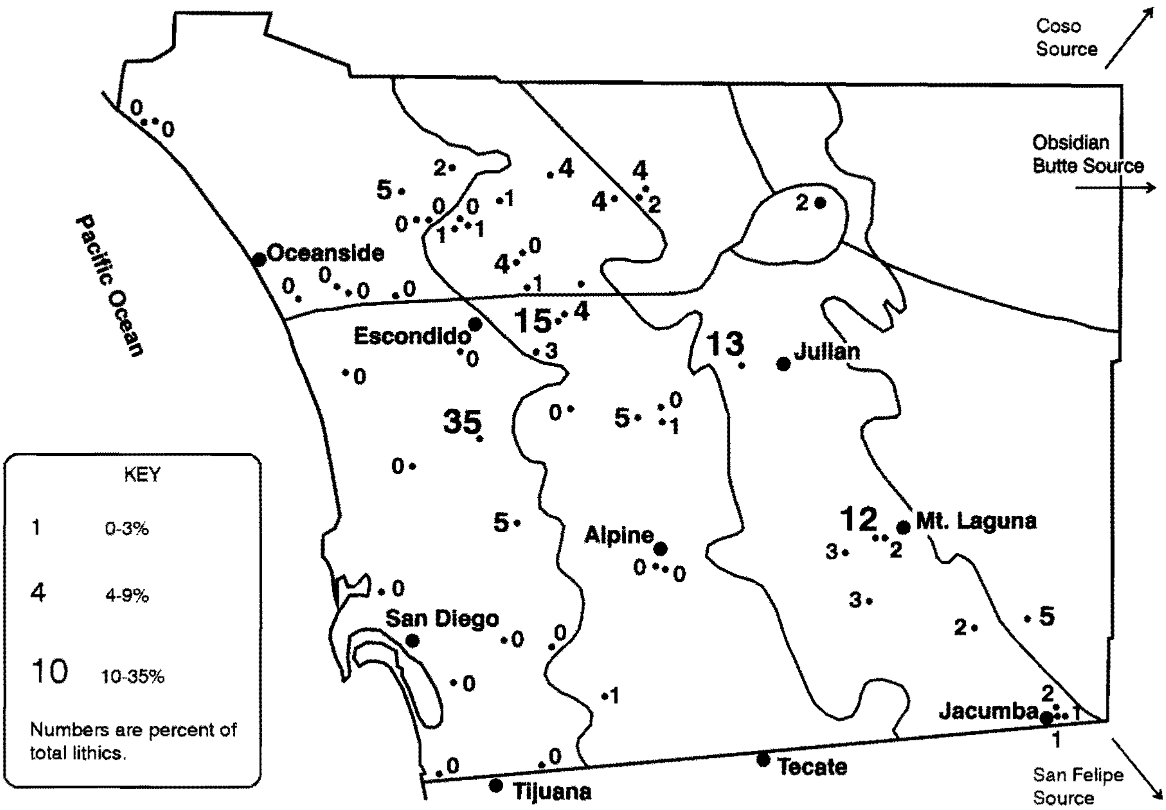

Figure 5: Obsidian Distribution in Late Prehistoric San Diego County.

its range due to insufficient metamorphism (Cooley and Carrico 1999). Archaeologists often misidentify this material as basalt due to its dark color, or other materials due to its rarity and simple unfamiliarity. In addition to the lack of very productive outcrops in the county, Bedford Canyon metasediment tends to be a relatively brittle material, and is difficult to use in the production of fine tools. For this reason it was probably not transported very far from its better sources north of San Diego County. All of these factors combine to make it fairly invisible in the archaeological record.

For that reason, only five of the sites used in this study were recorded as having Bedford Canyon metasediment in their assemblages. It is no coincidence that these collections were all excavated and analyzed within the last two years, as analysts have only recently begun to recognize and separate out the material. Due to this sampling bias, the distribution of the material indicated by this study can be stated only generally. The material was used as far away as Lost Valley in Cupeño territory to the east, and San Pasqual Valley in Kumeyaay territory to the south. Only further research reexamining collections from Luiseño territory and looking at new collections will be able to shed more light on the distribution of this often overlooked material.

Conclusions

Two important trends emerge from a characterization of Late Prehistoric-period lithic use in San Diego County. The main factors controlling lithic distribution appear to be value and availability. Late Prehistoric hunter-gatherers in San Diego County did not view all flakable lithic material as equal. They may have valued obsidian above all other materials, followed by cryptocrystalline silicates and then volcanics, only using quartz and quartzite if nothing else was immediately available. These highly mobile people exploited mineral resources much like any other resource, using most often the closest available material that fulfilled their needs. The competition between value and availability was decided by the fact that it was easier to use poor-quality local material that would meet their needs than to get high-quality imported material for everyday tasks. For this reason they did not carry large amounts of stone for any substantial distance. What they did carry were small amounts of high-value cryptocrystalline silicates and obsidian.

These relationships between value and availability have the greatest affect on lithic material distribution. They explain the abundance of low-value quartz in northern San Diego County, the high occurrence of volcanics in the Kumeyaay mountain zone, and the presence of high-value chert and obsidian far from their sources.

The other trend relates to cultural limits placed on this interplay of value and availability. At least some of the lithic materials used in the county were not available to all groups. Sources of material such as Piedre de Lumbre chert may have been owned and controlled by one group, and denied to another group in substantial quantities. Obsidian sources such as Obsidian Butte do not appear to have been culturally monopolized, however, and were used by all southern Californians.

While cultural ownership and boundaries affect some materials, rules related to value and availability seem to dominate the Late Prehistoric lithic-distribution pattern. This may lead us to rethink True's Luiseño and Kumeyaay material distinctions and explore new directions of research when analyzing and explaining individual lithic assemblages in San Diego County.

Acknowledgements

This study would not have been possible without the use of Tierra Environmental and Mooney and Associates facilities, and the generous help of Mike Baksh, Tim Gross, Sara Frazier, Ted Cooley, Meg MacDonald, and especially Andrew Pigniolo.

REFERENCES CITED

Abbott, Patrick L.
1999 *The Rise and Fall of San Diego.* Sunbelt Publications. San Diego.

Andrefsky, William, Jr.
1998 *Lithics. Macroscopic Approaches to Analysis.* Cambridge University Press, New York.

Apple, Rebecca McCorkle, and James H. Cleland
1994 Archaeological Survey of Sierra I Impact Area and Foxtrot Firebreak, Camp Pendleton. Unpublished report on file at KEA Environmental, Inc., San Diego.

Cardenas, Sean
1983 Cultural Resource Data Recovery Program of the Proposed Miguel-Tijuana 230 KV International Interconnection Project. Unpublished report prepared for San Diego Gas & Electric, San Diego, California.

Carrico, Richard, Robert Case, and Carol Serr
1997 Cultural Resources Survey and Evaluation for the Chavez Lot Split, Pine Valley, California. Unpublished report on file at Mooney and Associates, San Diego.

Cooley, Theodore G., and Richard L. Carrico
1999 Talega Focused Data Recovery Program Conducted at Prehistoric Archaeological Site ORA-907, City of San Clemente, Orange County, California. Unpublished report prepared by Mooney and Associates, San Diego, California.

Dominici, Debra Ann
1984 *Calibration of the Obsidian Butte Hydration Rate and Its Implications Regarding Late Prehistoric Exchange.* Unpublished Masters Thesis, San Diego State University, San Diego.

Gross, Timothy
2000 Personal Communication. Affinis. El Cajon, California.

Hedges, Ken
1975 Notes on the Kumeyaay: A Problem of Identification. *The Journal of California Anthropology*, Vol. 2 (1):71-83.

Hohenthal, W. D., Jr.
1950 Southern Diegueño Use and Knowledge of Lithic Materials. *Kroeber Anthropological Society Papers* No. 2. Berkeley.

Hughes, R. E. and D. L. True
1985 Perspectives on the Distribution of Obsidians in San Diego County, California. *North American Archaeologist*, Vol. 6 (4):325-339.

Kroeber, Alfred L.
1925 *Handbook of the Indian of California*. Smithsonian Institution, Washington, D.C.

Laylander, Don and Lynne E. Christenson
1994 Corral Canyon and Late Prehistoric Exchange in Inland San Diego County, California. In *Proceedings of the Society for California Archaeology, Volume 7*. Judyth Reed, ed. Society for California Archaeology. San Diego.

McDonald, Alison Meg
1992 *Indian Hill Rockshelter and Aboriginal Cultural Adaptation in Anza-Borrego Desert State Park*. Unpublished PhD. Dissertation, University of California, Riverside.

Minch, John A. and Patrick L. Abbott
1973 Post-Batholithic Geology of the Jacumba Area, Southeastern San Diego County, California. In *Transactions of the San Diego Society of Natural History*. Vol. 17(11):129-136.

Moratto, J. R.
1984 *California Archaeology*. Academic Press, Inc. San Diego.

Pigniolo, Andrew
1992 *Distribution of Piedre de Lumbre "Chert" and Hunter-Gatherer Mobility and Exchange in Southern California*. Unpublished Masters Thesis, San Diego State University, San Diego.

1995 The Rainbow Rock Wonderstone Source and its Place in Regional Material Distribution Studies. In *Proceedings of the Society for California Archaeology, Volume 8*. Martin D. Rosen, Susan M. Hector, and Don Laylander, eds. Society for California Archaeology. San Diego.

1996 Lithic Material Types as a Chronological Indicator in the Archaeological Record of San Diego County. In *Proceedings of the Society for California Archaeology, Volume 9*. Judyth Reed, ed. Society for California Archaeology. San Diego.

Pryde, Philip R., ed.
1976 *San Diego: An Introduction to the Region*. Kendall/Hunt, Dubuque, Iowa.

Renfrew, Colin
1977 Alternative Models for Exchange and Spatial Distribution. In *Exchange Systems in Prehistory*. Timothy K. Earle and Jonathon E. Erickson, eds. Academic Press, New York.

Rogers, Thomas H.
1965 *Geologic Map of California, Santa Ana Sheet*. California Division of Mines and Geology, Sacramento, California.

Schaefer, Jerry, Robert Case, and Carol Serr
1997 Archaeological Investigation at CA-SDI-10,996/10,998: A Late Prehistoric Camp Site in Spring Valley, San Diego County, California. Unpublished report on file at Mooney and Associates, San Diego.

Shipek, Florence C.
1995 *Kumeyaay Tribal Boundaries Alta and Baja California*. Unpublished letter.

Strand, Rudolph G.
1962 *Geologic Map of California, San Diego-El Centro Sheet*. California Division of Mines and Geology, Sacramento, California.

True, D.L.
1966 *Archaeological Differentiation of Shoshonean and Yuman Speaking Groups in Southern California*. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Los Angeles.