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CORRELATING ETHNOGRAPHIC DATA WITH SPATIAL ANALYSIS OF ARCHAEOLOGICAL SITES: A CASE STUDY FROM CA-ORA-507 AND THE ALISO CREEK REGION

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A Thesis

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Applied Archaeology

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Approved by:

Amy Gusick, Committee Chair, Applied Archaeology

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ABSTRACT

Ethnographers in the early 20th century compiled notes and published reports and books concerning the cultures and life-ways of the California Indians. Among these are the Juaneño (*Acjachemen*) and Gabrielino (*Tongva*) peoples.

This study aimed to correlate ethnographic data with methods of spatial archaeology and GIS analysis to test if the privately owned resource collecting areas and tribal boundaries described in the ethnographies could be seen archaeologically. Centered on CA-ORA-507 (an ancient chert quarry), the study shows that the boundaries between these resource areas are culturally derived as well as a part of the greater pattern of sites on the landscape and that the pattern of sites on the landscape conform to descriptions of the practices written at the turn of the last century.

ACKNOWLEDGEMENTS

There are many people who deserve my thanks for their assistance. A special thanks to Mr. Curt Duke of Duke CRM for your patience and wisdom. I thank Nick Hearth for asking the tough questions and providing feedback on my various thoughts. Special thanks go to the San Bernardino County Library System for providing a place to plug in and work. The staff at the Baker Family Learning Center in Muscoy, CA was exceptional.

Sarah Nava provided assistance with the GIS analysis that was invaluable, and my many conversations with Mark Mendez as we monitored construction at CA-ORA-507 were instrumental in piquing my interest in the *Acjachemen* people and educating me in their traditional ways.

Amy Gusick and Pete Robertshaw were both more than instrumental in guiding this work. I owe them many thanks for their tireless patience with my wild ideas and their willingness to help.

Most of all I want to thank my wife Shana and my children Abigail, Nathan, Emily and Aaron for your patience and your sacrifice. This thesis is as much yours as mine. I love you all.

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CHAPTER ONE

THE CROWDED LANDSCAPE

Introduction

In the climate of today's Cultural Resource Management industry, tribal traditional use areas are poorly defined and tend to overlap with only vague references to tribal borders or boundaries. The ethnographic literature concerning the Juaneño and Luiseño people paints a picture of property ownership and strict territoriality that is reflected in the prehistoric settlement pattern surrounding an ancient chert quarry along the banks of Aliso Creek in Orange County, California. The geographic region of the study is of particular interest due to the historically ascribed border between the Juaneño and Gabrielino peoples and the large number of archaeological sites in the immediate vicinity of the quarry. This thesis correlates pertinent ethnographic literature with those archaeological sites using principles and methods of spatial archaeology to investigate whether the cultural practices of property ownership, taboos concerning trespassing, and tribal borders can be visible archaeologically.

CA-ORA-507 was a prehistoric chert quarry in Orange County, California located approximately 12 miles from the coast of the Pacific Ocean, in the foothills of the Santa Ana Mountains, near the entrance to Santiago Canyon (Figure 1 below).The spatial distribution of archaeological sites in the immediate area of the quarry, site types and site locations, when viewed in a landscape context, may provide answers as to how the prehistoric inhabitants utilized the landscape and its resources, and may correlate with the historically written (and oft-repeated) descriptions of the people who inhabited the area.

The literature is replete with quarry sites and their importance. What is lacking in the literature is the connection between quarry and culture in a meaningful way. Lithic studies are invaluable for discerning reduction techniques and helping to establish trade routes and exchange patterns. The focus is rarely on the people immediately surrounding the resource. While the aforementioned studies follow the resource, this study aims at the source and the effect of a permanent resource on the landscape and the culture around it.

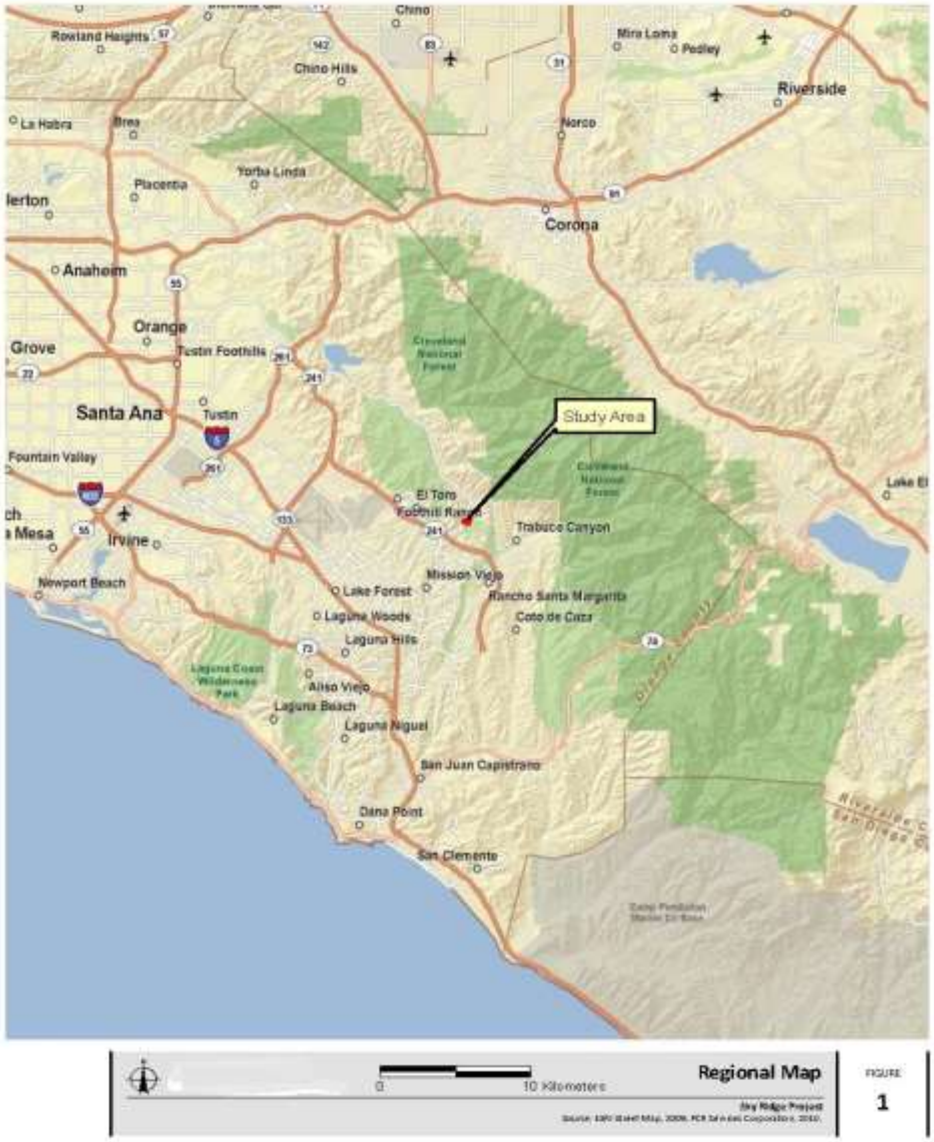


Figure 1. Regional Location

No longer extant, the CA-ORA-507 is known in the literature as “The Hoopaugh Site” (Van Horn, 1980). The site existed approximately 300 meters (m) southeast of Aliso Creek just outside the city of Lake Forest, California and was comprised of two main loci. The chert at CA-ORA-507 represents a very large deposit of extremely high quality tool stone (Van Horn, 1980). Over 100,000 artifacts came from a less than 1% sample of the site including debitage, biface fragments, bifaces, production failures, flake tools, tested material and flake cores. Artifacts were recovered from both loci of the site indicating that it was a quarry, lithic reduction, and tool production site (Hearth et al. 2016). Locus A is thought to be the lithic reduction and tool production area of the quarry. Locus B was found to contain a small habitation area evidenced by groundstone artifacts related to food processing (manos, metate fragments, and fire affected rock). There were artifact concentrations and features on the slopes above the two main loci of the quarry.

Within the study area's two-mile radius of ORA-507, Aliso Creek trends northeast to southwest. This effectively places sites either east or west of the creek, and they will be referred to as such. Located west of Aliso Creek (in traditional *Tongva* territory) in view of the quarry are two archaeological sites reported to contain little to no chert (Mark Mendez, pers. comm. 2015). Unfortunately these site records have not been filed with the South Central Coastal Information Center (SCCIC) and were unavailable for the study. It was the location of these two sites in relation to the quarry, the reported lack of chert within them, the unusual habitation locus at the quarry, and the sheer number of archaeological sites in the immediate vicinity of the quarry that began the line of questioning that resulted in this study.

Environmental Setting

Aliso Creek in Orange County, CA is part of the Santa Ana River watershed. It begins in the foothills of the Santa Ana Mountains and, in the past, emptied into the Pacific Ocean. In the area of ORA-507, the creek is bounded on both sides by steep river cut hills comprised mainly of Topanga formation granite and Vaqueros formation clays (USGS 1991). The environment immediately surrounding Aliso Creek is riparian with sycamore trees, poison oak, cottonwoods and pinon pines. Upslope from the creek the vegetation consists primarily of invasive grasses, Russian thistle, and white sage and is dotted by scrub oaks. The creek is bordered on the west bank by a rugged, steep water-cut bank that reaches approximately 100 feet high.

Due to the Vaqueros clays in the soil, the area is prone to landslides (Gayman and Edmonds 1980). Project related earth moving activity revealed several geologic episodes and rupture surfaces, with the largest landslide occurring sometime between five and twenty thousand years BP (Maes 2015, personal communication). It is thought that these highly mobile soils exposed chert nodules through geologic movement and erosional processes allowing the ancient inhabitants of the area easy access to the stone.

Archaeology of CA-ORA-507 and the Aliso Creek Drainage

CA-ORA-507 is a lithic quarry site with a small quarry-related habitation area. Based on the millions of lithic flakes located at the site, it is thought that the quarry was in use for a long period of time. The site was first encountered in the late 1970's prior to the construction of El Toro Road (VanHorn 1980) and was partially excavated as mitigation for that construction project in 1979. The associated materials are curated at the Cooper Center for Archaeology and Paleontology at CSU Fullerton (John D. Cooper Archaeological and Paleontological Center 1980). Later, El Toro Road was moved upslope to the east, and the site was further impacted (VanHorn 1986). The current project that necessitated testing and excavation of the remaining portion of the quarry is a residential home development subject to National Historic Preservation Act Section 106 due to a natural drainage on the property (Hearth, Duke and Lange, et al. 2016). Duke CRM was contracted to perform Phase I survey, Phase II testing, and Phase III excavations as well as controlled demolition of the site as mitigation. Geologic borings performed by LGC Geotechnical Inc. were also conducted at the same time and data from the borings were available for this study. Phase I redefined the site boundaries and recorded surface artifacts. Phase II testing confirmed the existence of multiple loci within the site and Data Recovery sampled the remaining third of the quarry. Mitigation began in September of 2014 and is ongoing.

The site stratigraphy was complex due to landslides; however there were distinct soil horizons in some areas. Cultural materials were excavated from the surface to a depth of 4 m (Hearth et al. 2016) and some material was contained within soils disturbed by landslides. Carbon samples were collected from many areas and levels of the site; no results are available at this time.

The quarry at ORA-507 is part of the Aliso Creek Drainage Archaeological District proposed by SRS, Inc. in 1977. SRS identified 118 archaeological sites along Aliso Creek as part of the district. There are 112 archaeological sites within a two mile radius of ORA-507, 55 of which fit the criteria for this study. It is the settlement patterns and proximity to known resources that are of interest to the current study.

Chert

The geologic formations in California that have chert deposits are few but widespread. The most well-known, the Monterey formation, is comprised mostly of shales and is of Miocene age (approximately 25-5 mya) (Arnold 1902). This formation occurs from San Diego to San Francisco and on the Channel Islands (Bramlette 1946). Indeed, Monterey Chert is found throughout southern California archaeological sites. Sourcing testing is ongoing to determine the ability to identify ORA-507 chert back to its source.

Chert is extremely hard and its desirability as a tool stone is due to its conchoidal fracture which produces a very sharp edge. In the lithic reduction process, these conchoidal fractures are created in a controlled manner to remove flakes and create useful items such as bifaces, bifacial flake cores, flake tools, knife blades, scrapers, and projectile points (Crabtree 1977). Chert was commonly heat treated by ancient peoples to improve this flaking characteristic (Lee 2016). Chert is the main focus of this study and its distribution on the landscape within the study area will be used to inform settlement pattern interpretation. This differs from trade and exchange studies that are common with tool stone resources, as the focus of the study is the local distribution of the tool stone near to the source rather than far removed from it.

CHAPTER TWO

THE ETHNOGRAPHIC LANDSCAPE

Ethnographic Setting

California Indian tribes are legion. The crowded cultural landscape is a factor that makes archaeology in California both infinitely rewarding and difficult to interpret. The ethnographic landscape of the study area is no exception. Figure 2 below shows the regional vicinity of the study area within the widely cited tribal boundaries.

Figure 2. Map 1925 After Kroeber

Juaneño (*Acjachemen*)

The territory of the *Acjachemen* is rather small compared to the Gabrielino, Luiseño and Cahuilla. The name Juaneño comes from the association of the tribe with the Mission San Juan Capistrano. *Acjachemen* historical tribal boundaries extend from Aliso Creek on the north to the coast and along the coast to the area south of San Onofre. From here the boundaries extend inland to the peaks of the Santa Ana Mountains (Kroeber 1925).

The *Acjachemen* spoke a dialect of the Luiseño language. This language was part of the Cupan group of the Takic language family and the larger Uto-Aztecan language stock, spoken by people who migrated west from the Great Basin. The *Acjachemen* shared this language with their neighboring groups to the north, east, and south (Shipley 1978).

Groups of *Acjachemen* lived in autonomous villages. Each village had access to hunting, collecting, and fishing areas (Bean and Shipek 1978). Access to these areas is of great importance to the current study. Villages were located in protected coves or canyons near water. Acorns were the most important food for the *Acjachemen*. Other important sources of food were grass and many other seed types, deer, rabbit, jackrabbit, woodrat, mice, ground squirrels, quail, doves, ducks and other fowl.

Typically, women gathered and men hunted, although work tasks often overlapped. Each village had a chief who controlled religious, economic, and warfare authorities. The chief had an assistant and an advisory council who assisted in important decisions and rituals. Each of these positions was hereditary, being passed down from generation to generation (Bean and Shipek 1978).

Gabrielino (*Tongva*)

The *Tongva* are one of the least known Native American groups in California. The name Gabrielino comes from the tribes associated with the Mission San Gabriel. Generally, their territory included all of the Los Angeles Basin, parts of the Santa Ana and Santa Monica Mountains along the coast from Aliso Creek in the south to Topanga Canyon in the north, and San Clemente, San Nicolas, and Santa Catalina Islands.

The environmental conditions within the territory of both groups are very diverse, including the following zones: interior mountains/foothills, prairie, exposed coast, and sheltered coast. Thus, marine resources can be expected in the study area.

The *Tongva* lived in villages year-round and utilized smaller camps from which they could hunt and gather, likely on a seasonal basis. Villages were almost always situated near water.

The *Tongva* spoke a dialect of the Serran or Cupan group of the Takic language family. This language was part of the larger Uto-Aztecan language stock which spoken by those who migrated west from the Great Basin. The *Tongva* shared this language with their neighboring groups to the south and east (Bean and Smith 1978, Shipley 1978).

Tongva families lived in domed, round structures with thatching made from local plants. Other structures included semi-circular, earth covered sweathouses, menstrual huts, and ceremonial structures. Villages were politically autonomous, while each village was led by a chief who would, at times, reign over several villages (Bean and Smith 1978). It is thought that acorns were the most important food for the *Tongva*; although the types and quantity of different foods varied by season and locale; common and important sources of food were acorn, piñon nuts, yucca, cacti, many varieties of seeds and grasses, deer, rabbit, jackrabbit, woodrat, mice, ground squirrels, quail, doves, ducks and other fowl, fish, shellfish, and marine mammals.

Information on *Tongva* cultural practices is limited, and there is much confusion in the literature concerning people from differing tribes being brought to each mission. It is known that *Tongva* were brought to the Missions San Juan, San Luis Rey, and vice versa making it difficult to take the ethnographic information at face value in light of this forced admixture of cultural identities.

The Ethnographic Boundaries

Linguistically the *Acjachemen* and the *Tongva* are distinct. Both the *Tongva* and the *Acjachemen* languages are members of the Takic group of the Uto-Aztecan language family. The *Tongva* language is considered a dialect of the Serran Takic (Johnson and Lorenz 2006) while the *Acjachemen* language is considered a dialect of Luiseño (Laylander 1985). When and where these languages diverged is a matter of debate; Linguistics is an imperfect science. It seems reasonable however, based on the historic writings, that this linguistic difference is the reason for the existence of the traditional boundary between them. The boundary described by the Spanish may not be a boundary that existed in prehistory. William S. Simmons in his work *Indian peoples of California* said, “When anthropologists and linguists speak of California "tribes," they generally mean language families or languages, not actual social groups with territorial boundaries and unifying political leadership” (1995: p77). We have become so used to the idea of fluid borders between groups that rarely are borders or boundaries questioned.

To further complicate matters the *Acjachemen* have at times been considered a separate tribe from the Luiseño to the south and at other times indistinguishable from them. Candace Cameron (1999) attempted to discern the boundary between the Luiseño and the *Acjachemen* through analyzing potsherds. She concluded that the *Acjachemen* were indeed separate from the Luiseño and agreed with Kroeber’s (1925) description of the border between those two groups.

Cameron (1974, cited in Cameron 1999) apparently disputed the notion that Aliso Creek was the border between the *Acjachemen* and the *Tongva* in a paper presented to the Southern California Academy of Sciences at California State University, Fullerton, titled “Aliso Creek: The Great Divide?” In citing her own work, she doubts Aliso Creek was the border based on the notion that a tribe would normally claim territory on both sides of a creek.

Ideas of territory, property ownership, resource access and control pertinent to this study come from the early ethnographic literature regarding the Luiseño, of whom the *Acjachemen* have been regarded at times to be a part of. The position of the *Acjachemen* in the larger Shoshonean picture is a matter for other research and will not be addressed here.

What is important is the practices that each family or band owned their own resource areas and by at least one account (Sparkman 1908) were very protective of them to the point of violence. This territoriality may have, whether unconsciously or purposely, produced boundaries or borders that can be seen archaeologically. The ability to find and interpret these boundaries has the potential to increase our knowledge of settlement and subsistence behaviors of the people who created them.

One of the cultural taboos of the Luiseño, according to Sparkman (1908) was that of trespassing. On the subject, he wrote,

“Each band seems to have guarded its allotted territory with the greatest jealousy, and more quarrels are said to have arisen over trespassing than from all other causes combined.” (Sparkman 1908: 191).

Boscana (1812-1826) wrote,

“Again, if an Indian of one place stole anything from one of another place, although it might be so trifling a thing as a rabbit, a squirrel, or ornament of some kind, it was sufficient among them to cause a war" (Boscana, in Robinson 1846: 306-309).

From Bean and Shipek (1978:551), "Nevertheless, delineated hunting, collecting, and fishing areas in various ecological zones belonged to sedentary and autonomous village groups".

These passages accentuate a culturally organized territoriality and the possibility that the quarry at ORA-507 may have been a coveted resource. The chert may have been a commodity for trade and exchange; at the very least it would have been a highly desired tool stone.

The proximity of a neighboring group to a resource area may have led to patterns of behavior that were manifested on the landscape. This proximity between groups could have been the causal agent for archaeological patterns that reflect how those resources were used, protected and shared.

Little study has been done on possible borders between groups. I can speculate that this is the case for many reasons. First, archaeological evidence and perhaps even a theoretical framework in which to examine the evidence are lacking. How does one, archaeologically, find something that could be invisible and evidenced by a lack of artifacts and other cultural modifications? Catchment analysis might provide some answers, but in the case of the Aliso Creek drainage, most of the native vegetation has disappeared, making it difficult to ascertain which resources were actually available, and where, to the region's population. Indeed, modern Cultural Resource Management practices assume that the traditional use areas of most tribes in Southern California have a great deal of overlap, essentially ignoring any borders that may have existed.

As a result, one expected outcome of this study is to find that in prehistory these fluid borders were the norm and that only the most suggestive of patterns may have formed on the landscape. Further study may find that ideas of property ownership and borders were a result of either the Numic Expansion, as suggested by Bettinger (2015) or perhaps even contact with Europeans and the resulting impact on the culture and lifeways of the California Indians.

CHAPTER THREE

THEORY AND RESEARCH DESIGN

Theory

Seeking a theoretical background in which to build the framework for the study, I turned to spatial archaeology. Mid-range archaeological theory of the type formulated by Binford (1980) attempts to link more general human behavior with specific testable hypotheses. In the past 40 years, two archaeological theories both used for this purpose have emerged: (1) systems analysis and (2) archaeological patterning.

The systemic approach, as formulated by Binford (1980), seeks to identify differences in external organization of formally differentiated elements present in the archaeological record in order to understand the dynamics of the cultural adaptation system from which the elements originated.

Aside from understanding this theory as a view of an adaptive system, the key to understanding this approach is to identify the relationship of the elements - which in this case are archaeological sites - the landscape which holds them, the ethnographic literature, and possibly less easily identifiable characteristics, such as spatial relationships among the elements. The theory of archaeological patterning is more easily applied to this study.

Archaeological patterning has been discussed by Schiffer (1972, 1976) and also by Binford (1972), who basically agree on this theoretical avenue. More simplistic than a systems approach (Binford 1980), archaeological patterning employs the theoretical perspective that culture groups produce cultural material that, when deposited at a site, leaves evidence for patterns of social behavior. Where Binford and Schiffer disagree about archaeological patterning is in relation to the degree of correlation between these behaviors and the physical deposition, curation, recovery, analysis, and interpretation of cultural material from a given cultural deposit (Duke et al. 2015).

Because this study has to rely on the observations, the measurements, the recording accuracy, and the interpretations of archaeologists using differing theoretical approaches and parameters for investigation, the simplicity of archaeological patterning becomes a dominant force for analysis.

Spatial Archaeology

Questions of cultural organization are at the heart of anthropology. The matter particular to this study are the descriptions of territoriality, land division and the ethnographically ascribed boundary along the Aliso Creek drainage in Orange County.

Landscape studies can include Least Cost Path Analysis and Catchment Area Analysis, two very useful statistical tools that consider economic efficiency when modeling how human beings may acquire food and move through and upon the landscape. Unfortunately in the case of the Aliso Creek watershed, those areas thought to be travel routes are now covered by modern roads. Because creation of modern roads can change the elevation and morphology of the landscape, conducting Least Cost Path analysis to determine effective prehistoric travel routes along these corridors would be an exercise in futility.

Likewise with Catchment Analysis, due to modern development little remains of the natural biology of the prehistoric landscape. Invasive species of plants have largely crowded out native species to the point that it becomes impossible to evaluate the resources that would have been available to the prehistoric inhabitants without an extensive and expensive geoarchaeological or paleoethnobotanical study. Floral and faunal remains in the archaeological record are sparse due to preservation issues, further restricting that avenue of investigation.

It is for these reasons this study relies on methods of Spatial Archaeology. At the heart of this study is the important economic resource of chert from ORA-507. It is assumed that this chert would have been an extremely valuable commodity, worthy of protection that would have consigned the inhabitants to particular uses of the landscape that harbored it. Simply put, cultural practices and behaviors would have created patterns of archaeological sites and other physical alterations on the landscape. It is theorized that these patterns can be revealed by analytical methods. From these patterns inferences can be made and then compared to the ethnographic literature for correlations.

Research Questions

As excavation and data collection at CA-ORA-507 progressed, discussions between archaeologists at the site aided in the formation of the research questions integral to this study. Conversations regarding the habitation area at the quarry and the proximity of other sites raised questions of resource access and settlement decisions made by the ancient inhabitants.

1. *How do the numerous archaeological sites in the area relate to the quarry and to each other?*
2. *Does the pattern of sites on the landscape match the ethnographic descriptions of Kroeber and others concerning Acjachemen culture?*
3. *Will these patterns indicate family or band size resource area ownership?*
4. *Will the patterns reflect the taboo of trespass and leave significant gaps in the settlement pattern that are perhaps indicative of culturally ascribed boundaries?*
5. *Will the settlement pattern reflect the boundary between the Acjachamen and the Tongva?*

The spatial positioning of archaeological sites along the Aliso Creek watershed may help answer some of these questions. Evaluations of relationships between sites may reveal patterns in landscape use that will indicate relationships between and among the people who were a part of the landscape.

Research Design

In designing the research for this thesis I was presented with several challenges, the first of which is the sheer number of archaeological sites present in the Aliso Creek drainage. Numbering 112 in the two-mile study area, one of the goals of this study is to classify archaeological site types and place them in relation to one another on the landscape. It would be logical to focus sampling efforts toward those sites that have been excavated and contain a large body of quantifiable data. This however, would preclude the majority of sites in the water shed from the study. Only 27% (n=55) of the sites included in the study have been excavated.

Therefore, this research must rely on some basic assumptions and create an analytic framework based on available data. It is admitted that data recordation of archaeological sites is not consistent. Each site is recorded as a snapshot in time based on the interpretation of the recorder. Subsequent surveys may provide substantial discrepancies in the site data. Artifacts on the surface may not be indicative of subsurface deposits or prehistoric activity actually taking place in any particular site. There are issues of erosion, bioturbation, and collecting activity that may alter the landscape and the sites on it. This study seeks to evaluate the evidence that is available and to make inferences from it. The study assumes that data were collected in the field in a reasonably consistent way and that artifact and material descriptions are essentially accurate.

For the purposes of this study, the framework needs a consistent set of criteria to apply to sites rather than the opinion of the recording party in the field. When viewed in context of the sites around them, the site types can be very different from what a survey crew sees when the sites are viewed one at a time. This is similar in form to the suggested relative chronology of the region put forth by SRS Inc in their proposal for the region as an archaeological district (SRS 1977). The relative chronology was based loosely on the artifact types being found in the different sites rather than C14 dating. Carbon dating results in the region are few, which makes a discussion of chronology worth having.

Landscape use is not passive. Patterns of human behavior and the resulting alterations to both humans and landscape become entrenched with time. To use a metaphor, a carbon date provides a snapshot or photograph, while this study is examining the entire album and therefore a strict chronology is both impossible to produce and would be a detriment to an overarching view of the formation of patterns. History of place is cumulative. It builds and grows with time, events, and human memory. A snapshot in time ignores the *process* of the creation of those patterns as well as the changes in them that may have come after their long use and disuse.

CHAPTER FOUR

METHODS AND RESULTS

Methods

Record Search

The initial data for the study was taken from the DUKE CRM record search information for the Skyridge Project (Duke CRM project number C-0113) which included 50 mapped archaeological sites within a one mile radius of ORA-507. This record search was conducted in 2013 ahead of planned testing of the quarry prior to development.

A record search was also conducted at the SCCIC at California State University, Fullerton. Along with site records, the Historic Property Data File and the Archaeological Determinations of Eligibility file were examined for useful data. Site records were copied for further evaluation. Reports and Survey coverage of the region were recorded.

Study Site Identification

All sites within the two mile radius were mapped and site records copied. Site records were examined to determine which sites within the study area met the general data requirements of the study (discussed below). Those that met the criteria for inclusion in the study were recorded in a Microsoft Excel Database for later analysis. The portion of the study devoted to building the database from which analysis can be performed is documented in this thesis as Data Preparation.

Data Preparation

Data preparation is broken into three parts. In the first part, each site record was evaluated as follows for inclusion in the study:

- Must be prehistoric in age;
- Must not be an isolated artifact;
- Must contain a UTM coordinate or USGS Topographic Map to document location;
- Must contain an estimate of total area of the site or measurements that allow that area to be calculated;
- Must contain a description of the artifacts and/or features present;
- Must contain an elevation AMSL.

Sites that did not meet these criteria were noted in the database, but excluded from the study.

The author notes that extending the radius of the study area would incorporate more sites and by default, contain more data which may change the patterns which emerged. In order to be effective, a model must be tested. The results can be interpreted and variables adjusted to increase the accuracy of the output. Future studies should rely on larger data sets and a wider search radius, and with the benefit of this study, they have a framework on which to build.

Data from the 55 site records were entered into the Microsoft Excel database. Categories of the database include the following columns;

- Primary Number;
- Trinomial Number;
- Resource Name;
- Cross-references;
- Resource Type;
- Age (Prehistoric, Proto-Historic, Historic;
- Infobase (Survey, testing, excavation, etc.);
- DPR attribute codes;
- Resource Notes (ADOE, etc.);
- Location as recorded (UTM, Lat/Long);
- Location converted to NAD 83 UTM;
- UTM Source (Site Record, Mapped);
- Distance from ORA-507 (entered as kilometers);
- Direction (from ORA-507);
- Nearest neighboring site (entered as ORA#);
- Distance to nearest site (entered in meters);
- Nearest source of water;
- Distance to water source (entered in meters);
- Site size in area (entered as m^2);
- Site size in meters;

- Site size category (Small, Medium, or Large based on evaluation criteria explained below;
- Site type (as determined by the study evaluation criteria explained below);
- Elevation Above Mean Sea Level (AMSL) (entered in meters);
- Type of terrain (Hilltop, Ridge top, Valley bottom, Slope of hill, Creek bottom;
- Chert presence or absence.

The second part of the data preparation required evaluating each site on a set of criteria to determine site type and then creating a key for mapping.

Site size - While not an indicator of site function, principles of demographic archaeology state that sites with large area footprints had either a larger population or longer time depth than smaller, more ephemeral sites (Hassan 1981). Horizontal deposition can be a sign of multiple occupation events by a single group or occupations by multiple group units. Geologic processes can alter the surface area of archaeological sites as can human activity.

Each site was evaluated as Small, Medium, or Large using the following arbitrary criteria: Small (0-7500m^2), Medium (7500-15000m^2), and Large (< 15000m^2).

Due to the various environmental factors that can alter site size over time, the site size data were used only very generally to aid in evaluations.

Site type- The different activities taking place at different sites may be an indicator of site function. While not a hard and fast rule, site types can give us a general idea of the reasons a site was placed on the landscape in a particular location.

For the purposes of this study, a site typology had to be created in order to evaluate how the landscape was used. It is recognized that these site types may be in error; they are based on available published site data and not the result of intensive analysis of the sites and their assemblages. The simplicity of the framework using general attributes to assign sites to types ensures that all the sites are evaluated using the same criteria. When assigning a site type in the field the recording party usually does not have enough data to evaluate site type in the context of the geographic region as a whole or with other sites. Future studies may result in a finer resolution of data that may shed light on glaring errors in the typology used for this study.

Sites were typed using the criteria listed below and then assigned a color code for use in the Geographic Information System (GIS) portion of the analysis.

In order to assign a site type, there first must be a standard typology used to avoid confusion and misidentification. It is hoped that one result of this study will be widespread use of the site typology. It may provide a common set of terms that would be useful to archaeology as a whole rather than the current non-standard terminology being used. For the purposes of this study, I began with Erlandson and Glassow's simple site typology (1997). It was applied to the Santa Barbara coastal region and was modified for this study to include non-coastal site types (portions in italics added by the author for this study).

Based on the ethnographic data stating that the *Acjachamen* and the *Tongva* both had marine resources at their disposal and moved seasonally into the interior of the region, this typology is appropriate for this study.

Site Types

Primary Village. Residential base with relatively permanent structures or features associated with them (*Large sites with multiple bedrock milling features. Can be rock shelters; contain site furniture boulders and display groundstone and flaked stone artifacts as well as faunal remains. May contain evidence of structures. May contain charred floral and faunal remains. May contain fire affected rock (FAR) or fire hearths and lithic debris. Artifact assemblages will represent a wide spectrum of activities.*)

Secondary Village. Residential base with evidence of less intensive occupation, but displayed the wide range of activities found at the Primary Village sites. (*May be smaller in area than the Primary Village with a diverse artifact assemblage including metates but lacking multiple bedrock milling features. May contain evidence of structures. May contain charred floral and faunal remains. May contain FAR or fire hearths and lithic debris*)

Lithic Site. Occupations dominated by chipped and groundstone tools, including hammers and flaked stone tools. Organic remains such as bone and shell are rare or absent altogether (*Larger lithic scatters generally lacking artifacts associated with food processing. These sites will be larger than a Flaking Station and too substantial to be a flake scatter. May contain raw nodules* *of lithic material not in situ and may contain lithic tools or projectile points that were broken during production*).

Temporary Campsite. Brief occupation focused on resource processing, often of shellfish, located where a narrower range of seasonally abundant resources could be obtained. (*Non-coastal sites will lack evidence of marine resources. Other forms of resource processing may be evident. May contain fire hearths or FAR in smaller quantities than secondary or primary villages*. *May display a narrower range of activities than Secondary Villages. May contain evidence of food consumption.*)

For the purposes of this study the below site types were added to include the known archaeological sites in the study area.

Quarry. A site where intact cobbles or beds of lithic material are found in situ along with tested cobbles, flake cores, waste flakes and other lithic artifacts. Artifacts associated with food processing may be lacking. May contain fire hearths or FAR.

Flaking Station. Site containing numerous stone flakes, hammerstones, and possibly production failure tools. (*Will be smaller in area than a Lithic Site. May have a boulder that acts as site furniture. Generally lacking groundstone artifacts. Groundstone artifacts with evidence of percussion scars will be counted as hammerstones unless other food processing artifact types are present*.)

Flake Scatter. Very small, ephemeral site that contains low numbers of waste flakes and minimal amounts of lithic artifacts. Evidence of single use event.

Rock Shelter. May be typed as a temporary camp, Flaking Station, or other site type depending on artifacts found in context.

Milling Station. May contain one or two bedrock milling features. May contain a portable metate or mortar. May contain groundstone artifacts. Will display a complete or nearly complete lack of flakes and flake tools.

Table 1 below lists the color codes for each site type. Because no sites in the study area were evaluated as a Primary Village, it is not listed in the table.

Table 1. Color Code for Site Types

Color	Site Type
Red	Quarry
Green	Lithic Site
Dark Blue	Flaking Station
Yellow	Temporary Camp
Brown	Flake Scatter
Pink	Core Cache Site
Orange	Secondary Village
Black	Milling Station
Light Blue	Rock Shelter

In order to evaluate the sites for type, data from the site records were compiled in an Excel database (Appendix A) and evaluated based on over 50 attributes. The database also allowed for calculation of average distances and tabulation of site characteristics.

Artifacts and features found at each site were recorded by presence/ absence. The goal is not to quantify artifacts, but to record each artifact or feature type. Only 15 sites in the study area have been excavated. The assemblages from these sites, if quantified, would create data skew weighted toward those sites with greater numbers of artifacts. The way to prevent this bias is to evaluate each site by the same standard while omitting artifact counts. Thus, in a general way, sites can be potentially typed according to the behaviors or activities represented in the artifact assemblages regardless of numbers of artifacts. Presence/Absence is noted by the following method: 0=absent, 1= Present. The presence or absence of the following list of attributes is compiled for each site.

- Bedrock Milling Features;
- Midden Soil;
- Hearths;
- Fire Affected Rock (FAR) Present;
- Portable Metates (or fragments);
- Portable Mortars or stone bowls;
- Handheld Groundstone Artifacts (Includes Manos, Pestles, Ground Axes);

- Chert Cobbles;
- Flake Cores;
- Chert Flake Cores;
- Hammerstones;
- Multifunction Tools Present (Manos used as Hammerstones);
- Tools or Bifaces (Scrapers, Choppers, knife blades, Projectile points);
- Chipping Waste;
- Marine Shell

It must be noted that excavations at ORA-507 recovered dozens of groundstone artifacts that displayed battered ends indicative of use as hammerstones. In the region around the quarry it must then be recognized that the presence of a mano or manos cannot always be a sign of food processing, depending on the context of the find. For this reason, sites that have manos and chipping waste without other food processing associated artifacts may be classified as lithic sites or flaking stations rather than temporary camps, depending on site size and other factors.

Another behavior must be taken into account. There is evidence that the inhabitants were heat-treating the chert to improve flaking characteristics. Thus, a fire hearth or FAR is not necessarily evidence of subsistence behaviors associated with temporary camps or villages. Fires for heat treating will be considered if other evidence of food processing or consumption is generally lacking.

In the course of examining sites for typology, an unaccounted-for site type appeared in the data. These sites are small, ephemeral sites lacking depth. They consist of only a few artifacts mostly comprising flake cores, very small amounts of chipping debris, and a mano or hammerstone. These sites display no evidence of fire hearths or FAR. There is not enough chipping debris to classify these sites as flaking stations or flake scatters. For the time being, I am calling them a Core Cache Site. Normally, the word Cache is used to refer to groups of artifacts buried together for some unknown reason. These sites present themselves as a place to store a flake core for future use. If ORA-507 was the source of the flake cores at these sites, a consideration would be travel time/energy. Perhaps you live in the area but do not want to travel all the way back to the quarry? These "isolated" flake cores could also have been trade or exchange items considering their proximity to ORA-507.

Additional attributes were also considered in the evaluation. The few listed below play an important role in how and where sites may have been located on the landscape in relation to site function.

Altitude. Elevation above mean sea level (AMSL) can be an important factor in site location choices.

Access to the Quarry. Sites belonging to groups that had access to the quarry should be evidenced by raw cobbles and flake cores of the chert from ORA-507 along with other chert artifacts. It is theorized that sites belonging to those with access to the quarry should display significantly more chert than those without access. It is also theorized that cobbles and large flake cores were not trade items, probably because they were too heavy to carry around in any great amount. Items for trade such as bifacial flake cores, bifaces, large scraper tools, and projectile points would have been “downstream” items that may be evidenced in any site.

Using this rationale, sites that have noted cobbles or large cores of chert will be evaluated as having direct access to the quarry. Sites with large numbers of chert artifacts will also be considered as having direct access to the quarry.

The Excel database was uploaded to ArcGis and merged with the map data to create additional attributes for analysis to be discussed later.

Graphic Data Compilation

Google Earth Mapping

The location of each archaeological site was entered as a waypoint identified by site number, and color coded for site type. The map plotting allows for general visual patterns to emerge and for the extraction of data to be entered into the Excel Database or exported to other GIS platforms. Information such as elevation, position in relation to a water source, the nearest site in meters, site types, and other variables become readily measurable. Those measurements can reveal information about the landscape’s effects on site pattern decisions that may have been based on topography or landform. The resulting .kmz file was then exported to ArcGis for further analysis.

Site Distribution Analysis

A cursory site distribution analysis was performed to illustrate concentrations of each site type on the landscape. Patterns or trends that emerge will be used to make inferences regarding site placement decisions of the ancient inhabitants of the study area.

ArcGis

Within ArcGis, the distance between each site in relation to other sites can be plotted using the Nearest Neighbor tool. The distances are automatically entered into a matrix or table for use in analyzing them using a variety of tools. While not an analytical tool, the distance matrix is a mathematical representation of the site map.

The average distance between sites was calculated. Neighboring sites below the average are considered to be related. Distances greater than the average create wider gaps between sites. This gap is theorized to represent the possible “buffer zone” between family or band size group resource areas. If a boundary along Aliso Creek it present, it should be shown as a continuous space that has distances between sites greater than the average distance.

The table is also used as the foundation for Fixed Buffer and Kernel Density analysis to graphically represent these clusters and gaps.

Mean Coordinate Analysis

The points on the map were measured against each other and a mean coordinate was calculated. This mean coordinate represents the statistical center of the group of points on the map. Point densities in the various quadrants of the maps weight the results. Theoretically the mean coordinate should be the point on the map that represents the center of attention on the landscape if a physical resource was the reason for settlement. If 90 percent of the sites were in the west half of the study area, the mean coordinate would be as well. If points are evenly distributed and random, the mean coordinate would reflect this by occurring centrally located and lacking association with any one map point.

Fixed Buffer Analysis

Fixed Buffer analysis is used to create buffers around points using specified distances calculated from the Nearest Neighbor matrix. Average distance between sites is used to calculate the size of the buffer. It is then displayed to show proximity-based relationships between sites.

When points are closer together than the average distance, their buffers intersect, and the overlapping lines of these intersections are removed to produce clusters that are very simply displayed graphically.

The distances between sites are important because they may be both culturally derived and a result of the landscape. Reason dictates that each family would camp within their own resource area. Repeated visits would produce a horizontal distribution that would remain within a resource area.

When these distances are compared to the average distance between sites, those sites neighboring below the average are considered a cluster. Distances between sites that are greater than the average produce gaps that would reasonably contain the “boundary” of each neighboring cluster. Lacking a better strategy, a line drawn equidistant between clusters can be loosely representative of the border between families or groups owned resource areas. Over time, any clustering would become evident, and gaps between each family and group would also become clear.

Kernel Density Analysis

Kernel Density analysis measures the density of specified points on a map and graphically represents the results as different colored bands around the areas of the map that contain the highest densities of points. This analysis could also be used on artifact density within a site to determine concentrations of artifacts. It is used here to determine concentrations of sites in relation to the overall distribution.

To this end, all 55 sites were selected, and a 1000m search radius was specified. The analysis determines which points on the map are of the highest densities in comparison to proximity with their neighboring points and creates polygons for those areas with the highest densities.

Results

Record Search

The record search identified 112 sites within a two mile radius of ORA-507. These include 81 prehistoric sites, 13 historic sites, 4 mixed sites, 12 isolates, and other records that are not part of the analysis. After examining the records for sites that met the study criteria, 55 sites remained eligible for inclusion in the study.

The record search also revealed that 99% of the study area has been surveyed, thus avoiding questions of survey bias. I do not contend that all resources in the area have been found, only that the decrease in site density outside the one mile radius is not the result of large areas of land having gone unsurveyed.

Differential preservation of sites was considered as a source of bias in the site distribution. The study area presents a wide diversity of site types existing upon all the available landforms. Factors that would induce preservation bias such as road building or residential construction were also considered. Many of the surveys that located the sites were conducted prior to major modern road construction or residential development. Ranching or agricultural activity does not appear to have been a source of preservation bias as these activities were limited in the often steep, rugged terrain of the foothills. The site distribution, then, does not appear to be a result of survey patterns or site preservation bias and should be representative of the social organization of the people who made them. In the case of this study, the wider patterns offered by a larger data set would offer a wider perspective. This study is meant to be a framework or starting point, and establishes a consistent, yet editable, set of criteria by which to evaluate archaeological sites. As such it must make certain assumptions about family size, group size, what constitutes a resource area, and a host of other factors.

The ethnographic literature does not describe individual resources within a family-owned resource area or resource area size. It is possible that families owned plots that were not contiguous. A “resource area” could be as large as a valley or as small as a stand of buckwheat. A stand of oaks may have had several “individual owners” within it, as would a stretch of creek bed. This study may help define or characterize these resource areas as ethnographic units that are visible archaeologically.

Google Earth Mapping

The map below (Figure 3) is the result of Google Earth Mapping. The color coded points were used for the Site Distribution Analysis and then imported to ArcGis for GIS analysis.

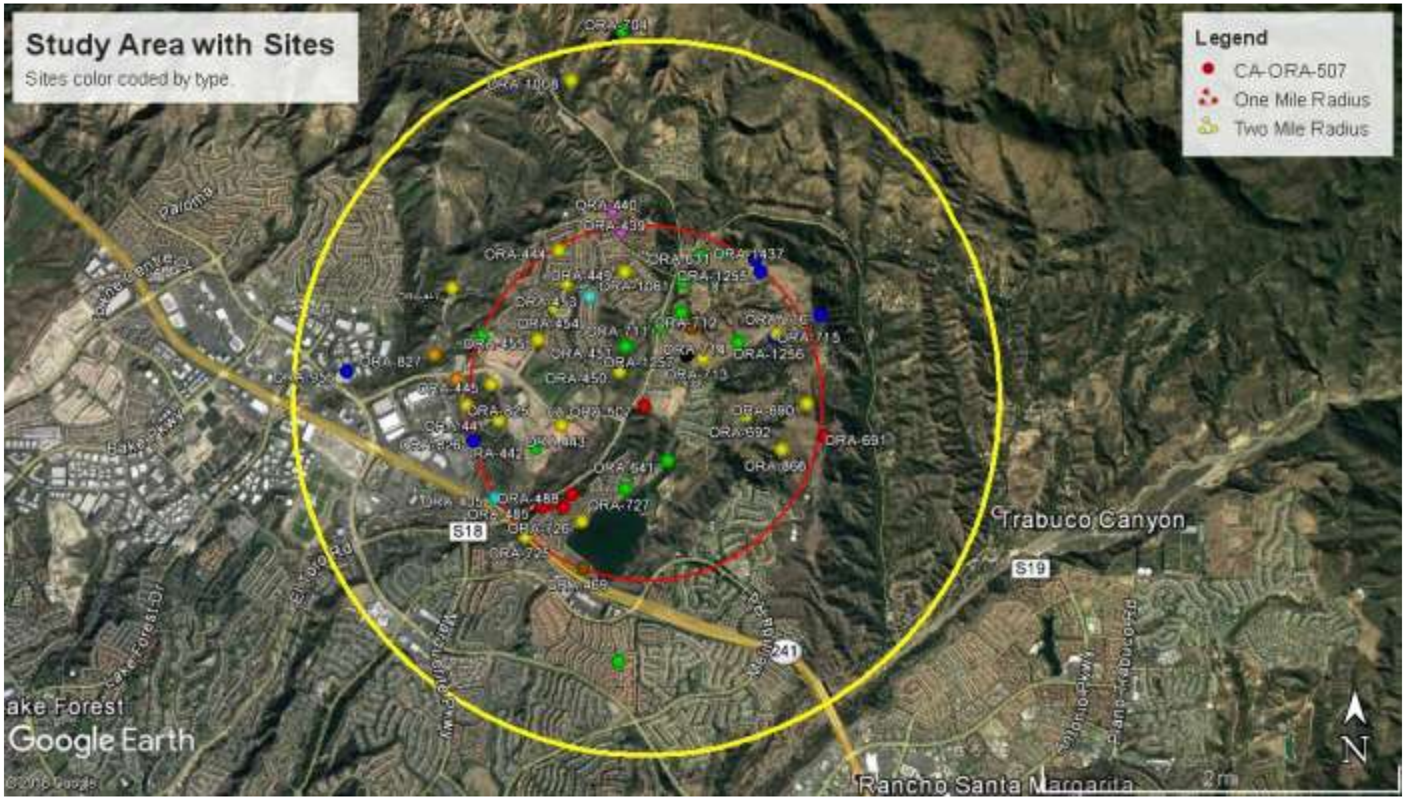


Figure 3. Study Area with Color Coded Site Types and Study Radii

It is immediately apparent that the sites in the study area are concentrated around the immediate vicinity of ORA-507. This will be explored further below.

<u>Site Distribution Analysis</u>

Site density remained constant within a one-mile radius at 16.13 sites per square mile. The area within the two mile radius has only five sites that met the criteria for the study, a density of .53 sites per square mile. The cause of this drop in site density is unexplained thus far. Of the 55 sites in the study area, 16 sites were identified as Lithic Sites, 17 as Temporary Camps, 8 as Flaking Stations, 6 as quarries and small numbers of other types (Figure 4).

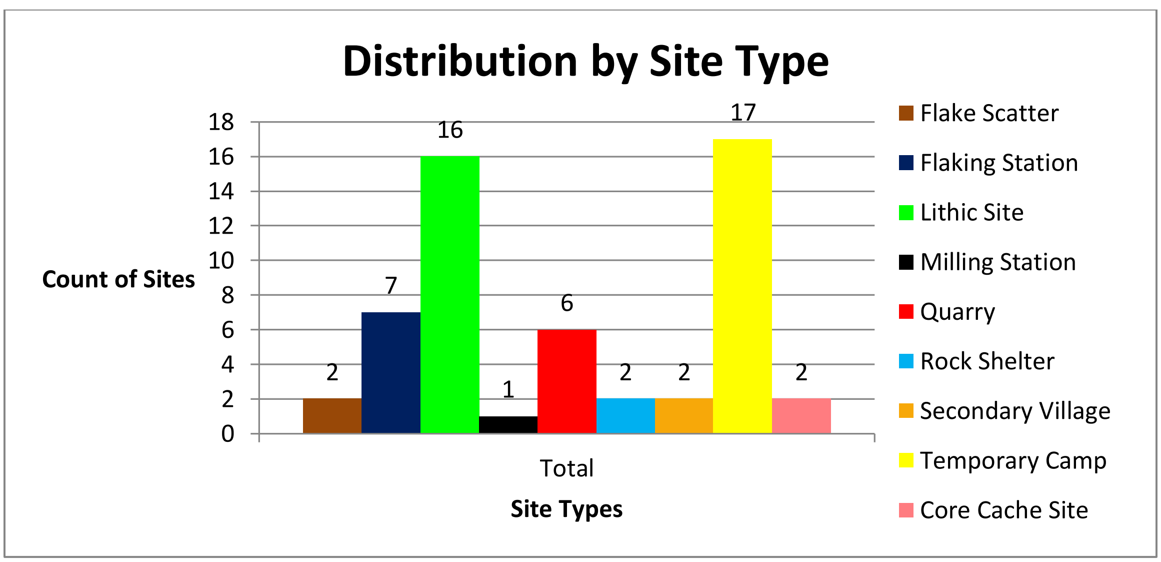


Figure 4. Distribution by Site Type

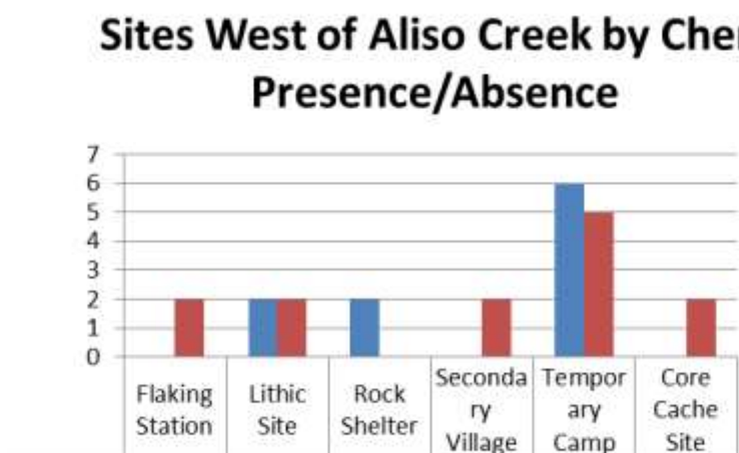
Interestingly there are six sites in the study area that can be considered quarries within the typology, although none of the five others compares with ORA-507 in terms of size and content. The millions of artifacts found at the ORA-507 are in stark contrast to the very small amounts of cultural material found at the other “quarry” sites.

The evidence at the other five quarry sites is minimal, indicating either very short-term use or very selective use by a small number of individuals. This suggests that the sites resulted from an individual’s testing the material eroding out of the creek bed. The fact that these resources were not utilized more suggests the inhabitants either did not need them because they had access to ORA-507 or because the chert from ORA-507 was easily available.

If small intact cobbles from any of the quarries were being transported, they should be found at other sites as they were moved away from the source. This does not seem to be the case in the study area. No intact cobbles were found at sites away from the known sources of chert. This suggests that smaller raw cobbles of chert were not being utilized as trade, exchange, or every-day use items, and in fact the five small quarries could have been simply discovered, tested for quality, and then not used as source material; they become a resource bank in case the chert at ORA-507 is depleted.

Western Sites

When Aliso Creek is viewed as a possible border the following distribution of site types appears. There are 23 sites west of Aliso Creek and 32 sites east of Aliso Creek in the study area. Figure 5 below represents the 23 sites west of the creek by chert presence/absence. More than half the sites west of the creek contain some amount of chert. In every case, the amount of chert recorded was very small, with artifact counts numbering in the tens or less.



	Flaking Station	Lithic Site	Rock Shelter	Seconda ry Village	Tempor ary Camp	Core Cache Site
Present		2	2		6	
Not Present	2	2		2	5	2

Figure 5. Sites West of Aliso Creek by Chert Presence

This distribution of chert is a good indicator that the people who made these western sites did not have direct access to any of the quarries east of the creek. The presence of such small amounts of chert in these sites indicates that there was probably some form of exchange between groups occurring across the creek, perhaps on an individual to individual rather than a group to group basis. The very small amounts of chert west of the creek may indicate that the material was being exchanged by individuals who were parts of groups numbering five or six people occupying a small resource area for temporary periods of time. This estimation of group size will be revisited.

There are 11 temporary camps, 4 lithic sites, 2 flaking stations, 2 rock shelters, and 2 core cache sites. From the numbers of temporary camps with multiple food processing artifact types one can infer that the primary resource focus of the sites west of the creek was not the chert at ORA-507. Further study would be necessary to determine what resources may have been a focus at these sites.

Eastern Sites

In contrast with the sites west of the creek, nearly all the sites east of the creek contain chert, whether from ORA-507 or the small “quarry” sites south of ORA-507.

There are 12 lithic sites, 6 temporary camps, 6 quarries, 5 flaking stations, 2 flake scatters and 1 milling station east of Aliso Creek. Figure 6 below visualizes these numbers.

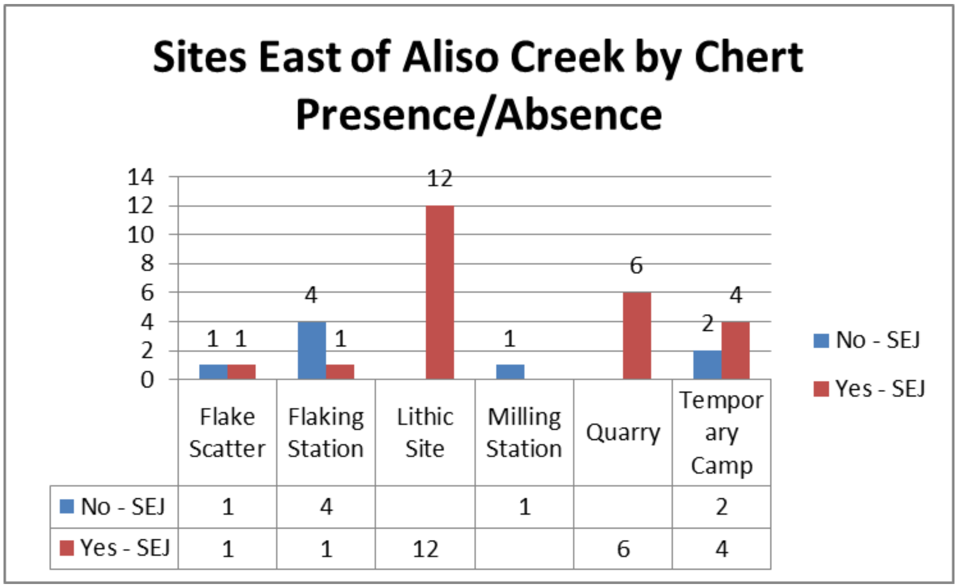


Figure 6. Sites East of Aliso Creek by Chert Presence

The single milling station in the study area is an anomaly with its double cupules. Cupules are small indentations pecked or ground into the surface of a boulder. Portable metates have been found, so it is reasonable to infer that food processing of some type was occurring, but the function of the cupules is undetermined at this time.

The geology of Vaqueros formation clays and decomposing Topanga formation granites may have necessitated some adaptation to the practice of creating grinding surfaces on bedrock outcrops. The Vaqueros and the Topanga rock was likely unsuitable for use as milling surfaces due to decomposition, and in fact, the metate fragments recovered from ORA-507 were of a schist common in the San Bernardino Mountains, rather than of locally sourced material. The presence of this schist also hints at trade or exchange relationships with the groups who resided in the San Bernardino Mountains. Another possibility is that the groups coming to the region were small and/or temporary and did not have need of the permanence of bedrock milling features.

During excavation at ORA-507 numerous river rolled cobbles were found to have been carried upslope to the quarry. These unmodified stones were classified as manuports. This shows that the creek was a source of lithic material other than chert, and it is assumed that most of the manos found in the region are sourced to the various creek beds.

Chert presence on the east side of the creek is by itself not an indicator of access to ORA-507. There are other quarries available for use. The amounts of chert and types of lithic artifacts are considered in attempting to determine if sites inhabitants had access to ORA-507.

It has been shown that the primary items being produced at the quarry were prepared cores, bifacial cores, and bifaces. It is thought that large expedient flakes and spalls would have also been taken away from the quarry as these items were under-represented in the assemblage at the quarry. These items should then be present in the artifact assemblages of the sites around the quarry and to an extent, they are. None of the artifact assemblages are of the magnitude of ORA-507, but there are substantial amounts of chert as indicated by both artifact counts and recordation of site sizes.

The spatial relationships between site types can be telling as well. The average distance from each site to its nearest neighbor is 457.9m. Sites that are closer together than this may have relationships that bear closer scrutiny. Analyses based on distances between sites were conducted. These will be discussed later. Figure 7 below demonstrates the distribution of lithic sites on the landscape.

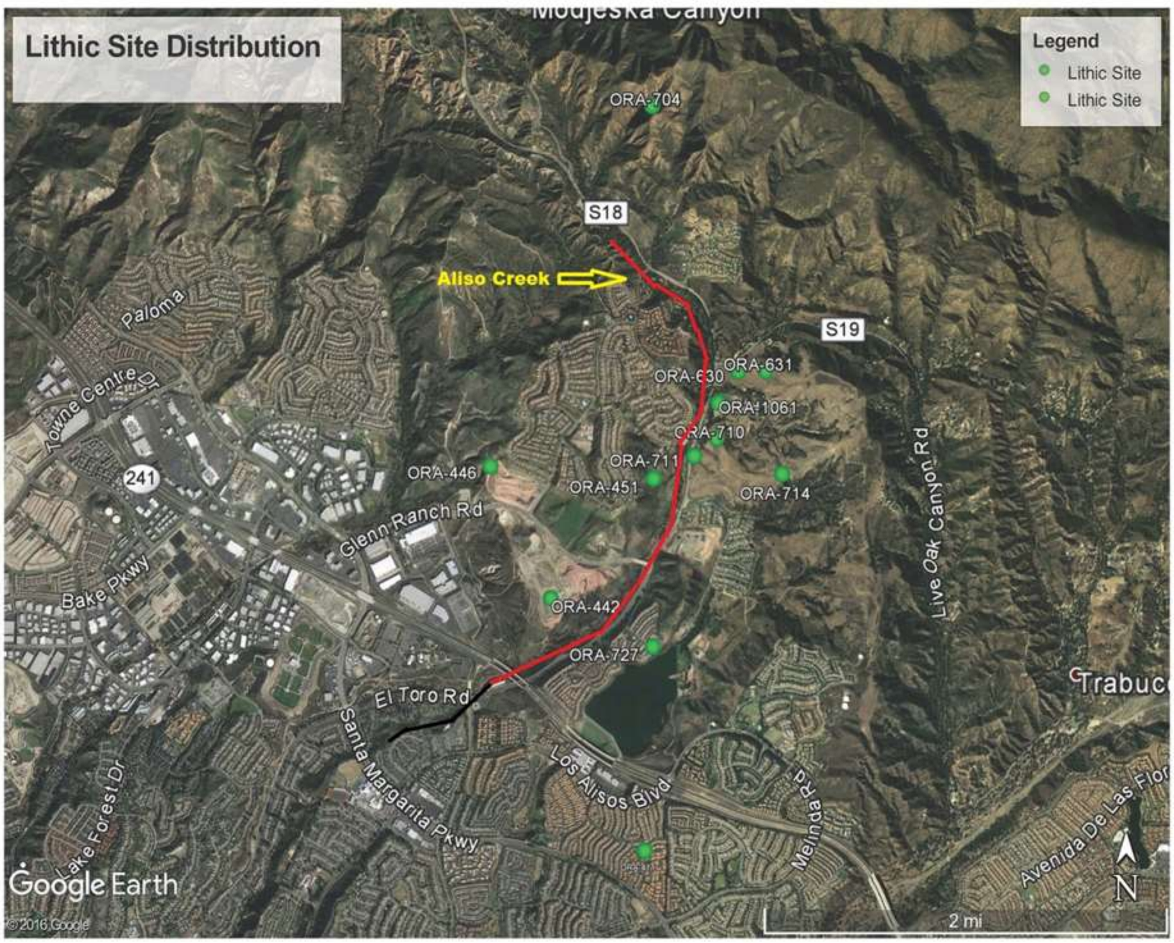


Figure 7. Lithic Site Distribution

The very apparent majority of lithic sites north of ORA-507 and east of Aliso Creek suggest that the inhabitants of that area had direct access to ORA-507. This is significant because ORA-507 chert has potentially been found at archaeological sites in Corona and Chino Hills, both to the north and east from the quarry; these are possible clues as to kin group relationships of the people who had access to the chert. The very small number of lithic sites west of Aliso Creek speaks volumes. It shows that the inhabitants of these sites did not have direct access to ORA-507 and that some other resource or activity was likely the reason for these sites location on the landscape. The geology west of Aliso Creek is predominantly Topanga formation granite, lacks the chert bearing Vaqueros clays, and contains a nearly completely different compliment of vegetation than east of the creek. The very small amounts of chert found in the western sites suggest a lack of access to the quarry. This can be interpreted that the sites east and west of Aliso Creek were made by separate groups. If all the sites in the study area were made by a single group, then any boundaries seen between clusters of sites should be almost strictly geographic or non-existent.

The distribution of temporary camps on the landscape and the lack of readily identifiable village sites in the study area agree with the idea that resources were gathered seasonally in this area by families who came from the coastal villages. Two sites in the study area have been typed as Secondary Villages; both could easily have been interpreted as large temporary camps based on the multiple activities represented by the artifacts found in them.

Neither of these sites had chert specifically described as a material type, which is curious due to the quantity of chert in the area.

One site (a rock shelter) that contained marine shell also implies that at least some of the visitors to the area had some type of access to coastal resources. Figure 8 below shows the distribution of temporary camps.

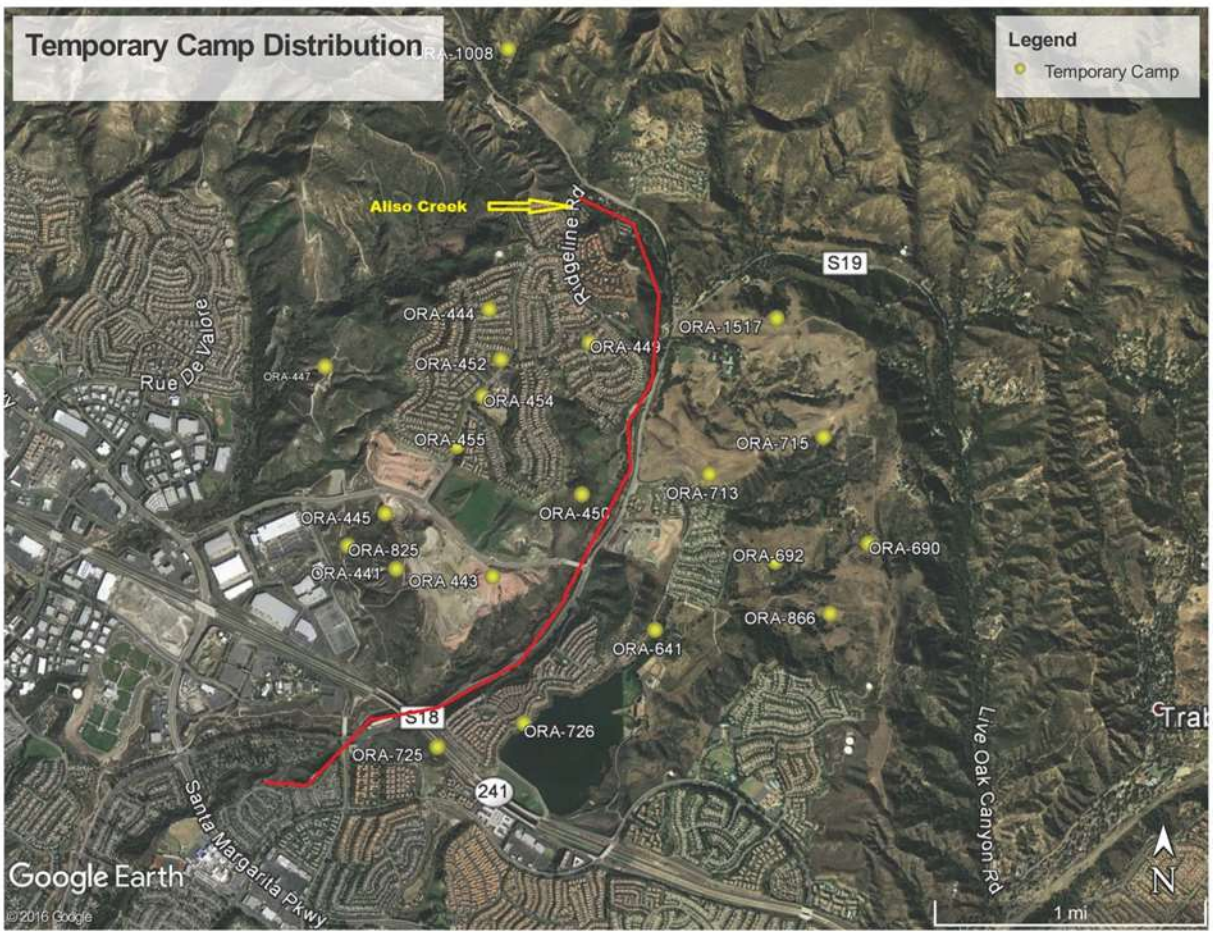


Figure 8. Temporary Camp Distribution

Temporary camps seem to be aligned loosely with water sources. Curiously, they average 357m from water which seems excessive when there were so many streams available in the region. It is reasoned that some distance from water would be preferred so as not to scare away wildlife or contaminate the stream with human detritus but there is another alternative. The inhabitants could have chosen any distance from water, yet chose to remain 357m away on average. If the stream beds were all access travel routes, it would be necessary to keep some distance between camps and streams to avoid trespassing. The creek bottoms, while rugged, still present the least cost path of travel in the area. The average distance away from that travel route, if it was one, would have provided a comfortable travel zone for all without fear of trespassing on someone else's territory.

As it relates to the taboo against trespass, allowing free passage along creeks could have been a solution to the problem of crossing the territory of others. In a culturally territorial landscape, the ability to monitor travel routes may have been an important consideration for deciding where to camp, hunt, collect resources or perform tasks such as toolmaking.

Flaking Stations in the study area are few. It was expected that there would have been more of these sites found in an area of intensive occupation such as the study area. That there are not more flaking stations indicate that the population of the study area was likely small. Figure 9 below shows the Flaking Station site distribution.

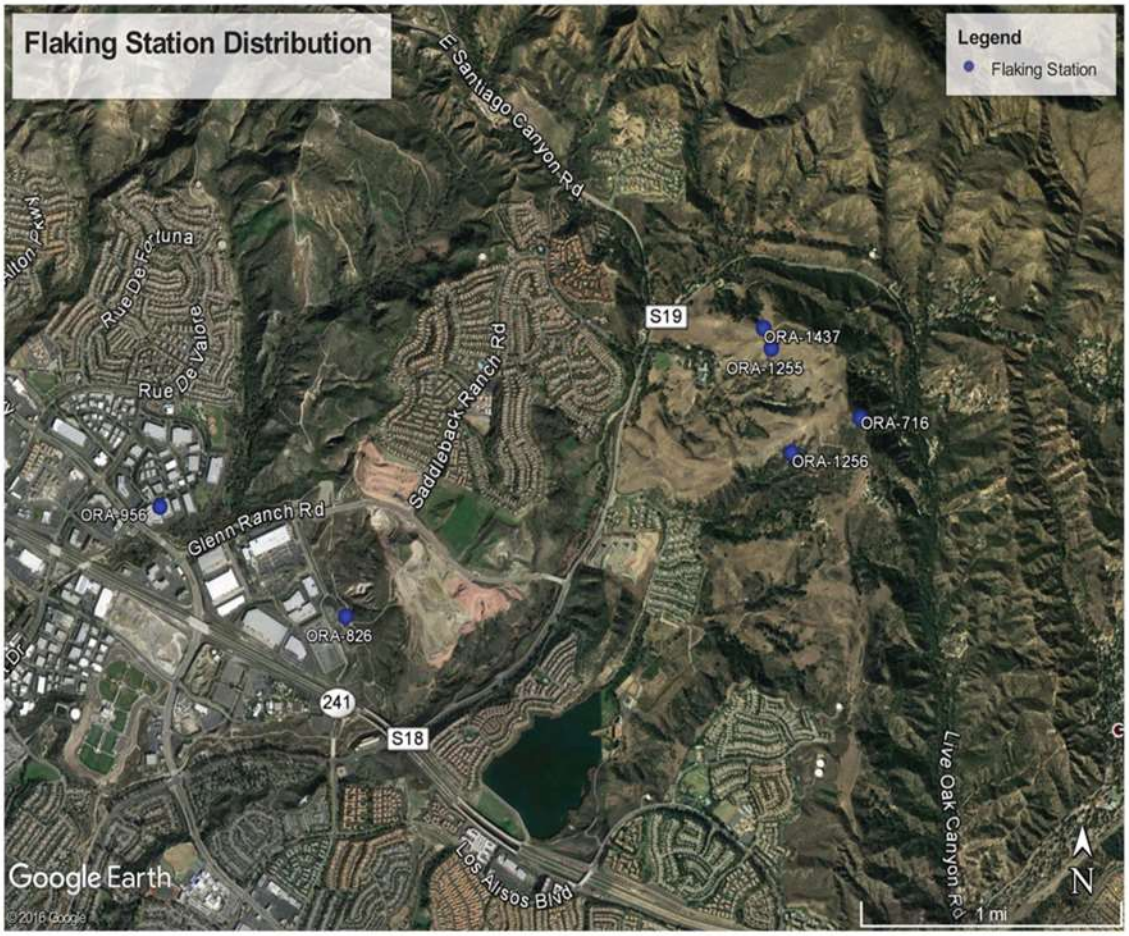


Figure 9. Flaking Station Distribution

That the majority of flaking stations are north of ORA-507and east of Aliso Creek is yet another indicator that the material from ORA-507 was moving primarily north from the quarry to points unknown.

ArcGIS Analysis

The KML file from Google Earth was imported to ArcGis and converted to a shapefile. The Excel Database was imported as a table and the data was joined to the points on the map. The immediate results of mapping in ArcGis produce finer resolution of data. Analysis tools were then applied to the mapped points.

Nearest Neighbor Tool

Nearest Neighbor (NN) analysis contributes greatly to this study. NN calculates the distance between any given point and all other points creating a distance matrix. In the case of this study, analysis was conducted using all 55 sites. The distance matrix itself (Appendix B) is the result of using the Nearest Neighbor tool.

Mean Coordinate Analysis

In the case of this study, the mean coordinate is found to be nearly touching ORA-450, which is less than ¼ mile from ORA-507 (see Figure 10 below). This is a clear indicator that the pattern of sites in the study area is heavily influenced by the location of the quarry and that the quarry may have been the prime motivator for settlement of the area.

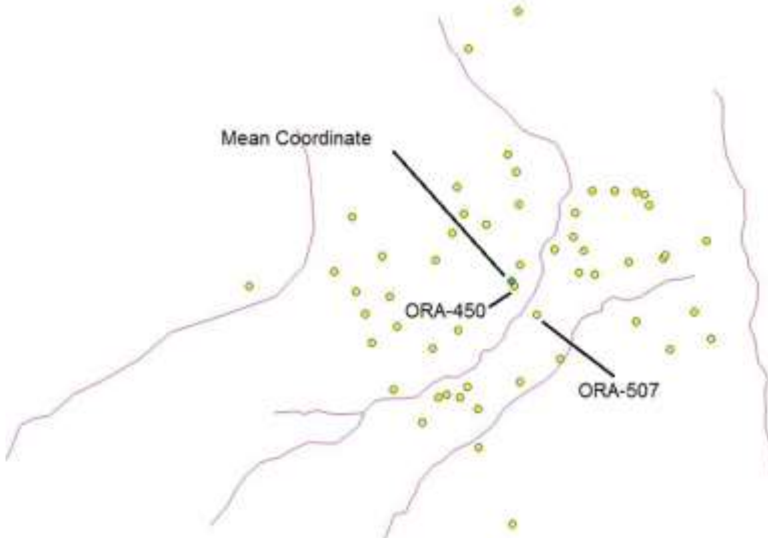


Figure 10. Mean Coordinate of Study Area

Fixed Buffer Analysis

The average distance between sites was plotted and determined to be 458m and was used to calculate the size of fixed buffer to place around each site. When tested using a 200m buffer, the resulting clusters appear (Figure 11).

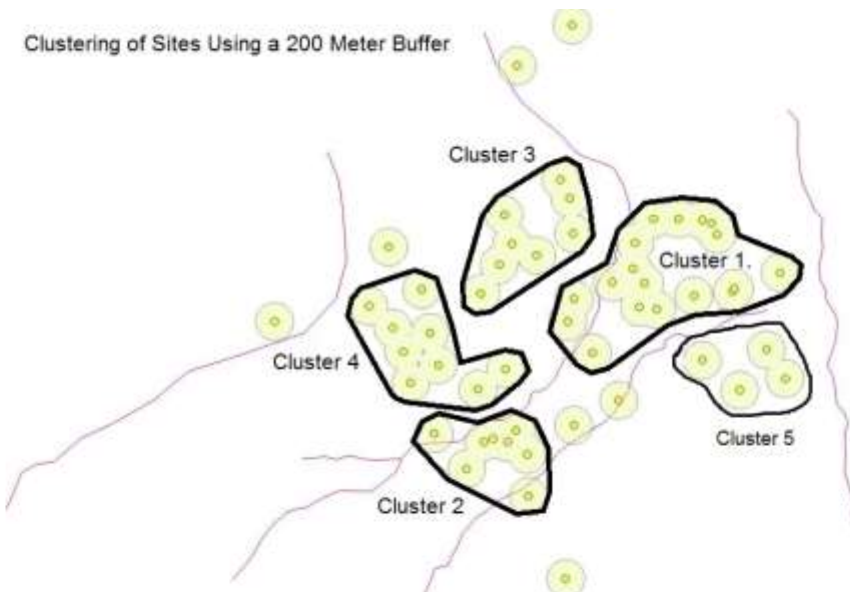


Figure 11. Clusters of Sites Using 200m Buffer

Each cluster of sites that belonged to one group or family should contain multiple site types representing the range of activities being performed, as well as be indicative of the major resources being procured in a given area. When a 229m buffer (half the distance of the average) is used, the results are more accurate than the 200m buffer test (Figure 12).

Working under the assumption that horizontal deposition of sites within each family resource area would produce a boundary or unoccupied zone between groups, the size of the buffer must reflect the centerline between points. If the distance between every site was equal, the result would be either a grid or a completely random distribution.

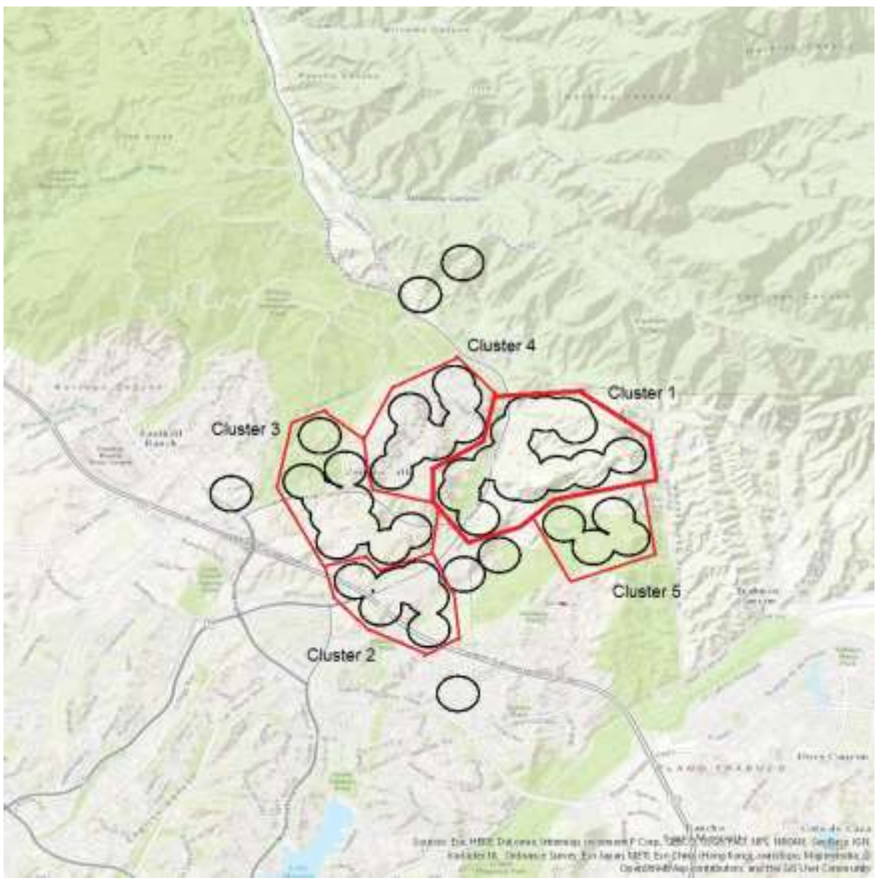


Figure 12. 229m Buffer Zone Around Sites.

Cluster 1 contains the following sites by type (Table 2).

Table 2. Cluster 1 by Site Type

CA-ORA #	Site Type After Evaluation	Cluster #
450	Temporary Camp	1
451	Lithic Site	1
507	Quarry	1
630	Lithic Site	1
631	Lithic Site	1
710	Lithic Site	1
711	Lithic Site	1
712	Flake Scatter	1
713	Lithic Site	1
714	Lithic Site	1
715	Temporary Camp	1
716	Flaking Station	1
1061	Lithic Site	1
1255	Flaking Station	1
1256	Flaking Station	1
1257	Milling Station	1
1437	Flaking Station	1
1517	Temporary Camp	1

Cluster 2 site types (Table 3) appear to be the work of a very small group.

Table 3. Cluster 2 by Site Type

CA-ORA #	Site Type After Evaluation	Cluster #
405	Rock Shelter	2
469	Flake Scatter	2
485	Quarry	2
486	Quarry	2
487	Quarry	2
488	Quarry	2
641	Lithic Site	2
725	Temporary Camp	2
726	Temporary Camp	2
727	Lithic Site	2

The site types in Cluster 2 are varied but food processing artifacts are few. This may be an indicator that these sites were created strictly because of the source of tool stone within the cluster. Further relationships will be discussed in the interpretations section.

Clusters 3 and 4 are dominated by temporary camps (Tables 4 and 5) while Cluster 5 (Table 6) could be interpreted as an extension of Cluster 1, but there are other alternatives as well.

Table 4. Cluster 3 by Site Type

CA-ORA #	Site Type After Evaluation	Cluster #
441	Temporary Camp	3
442	Lithic Site	3
443	Temporary Camp	3
445	Temporary Camp	3
446	Lithic Site	3
825	Temporary Camp	3
826	Flaking Station	3
827	Secondary Village	3
1430	Secondary Village	3

Table 5. Cluster 4 by Site Type

439	Core Cache Site	4
440	Core Cache Site	4
444	Lithic Site	4
449	Temporary Camp	4
452	Temporary Camp	4
453	Rock Shelter	4
454	Temporary Camp	4
455	Temporary Camp	4

Table 6. Cluster 5 by Site Type

CA-ORA #	Site Type After Evaluation	Cluster #
690	Lithic Site	5
691	Quarry	5
866	Flaking Station	5
692	Flaking Station	5

The 229 m buffer brings the clusters of sites into focus. The buffer of ORA-507 is now touching the main body of Cluster 1, and the sites within Cluster 5 have coalesced into a more discreet cluster.

The sites with touching buffers are closer to each other than the average, indicating possible relationships between these sites. It would be logical to assume that each cluster represents an owned resource area because each family or group is most likely going to stay in their own resource area and not camp in someone else's resource area unless they are kin or have permission. As has been previously established above, larger numbers of people would have created larger, well-formed sites that are not seen in the study area with the exception of ORA-507.

The clusters west of Aliso Creek are comprised predominantly of small or mid-size temporary camps. As previously stated this is a sign that the quarry was not the focus of these sites. The amounts and types of food processing artifacts at these sites suggest they were produced as the result of seasonal food collecting activities in the area. Cluster 3, the southern cluster west of Aliso

Creek, contains two sites that were initially considered as secondary villages in very close proximity to each other, a possible example of horizontal deposition.

Kernel Density Analysis

Showing relationships between sites is critical to understanding how the pattern on the landscape was produced. Displayed in Figure 13 below, the highest densities are darkest. The densities suggest that Cluster 1 and Cluster 2 share a pattern that may indicate the groups that created the clusters were related. This will be explored in the interpretations section.

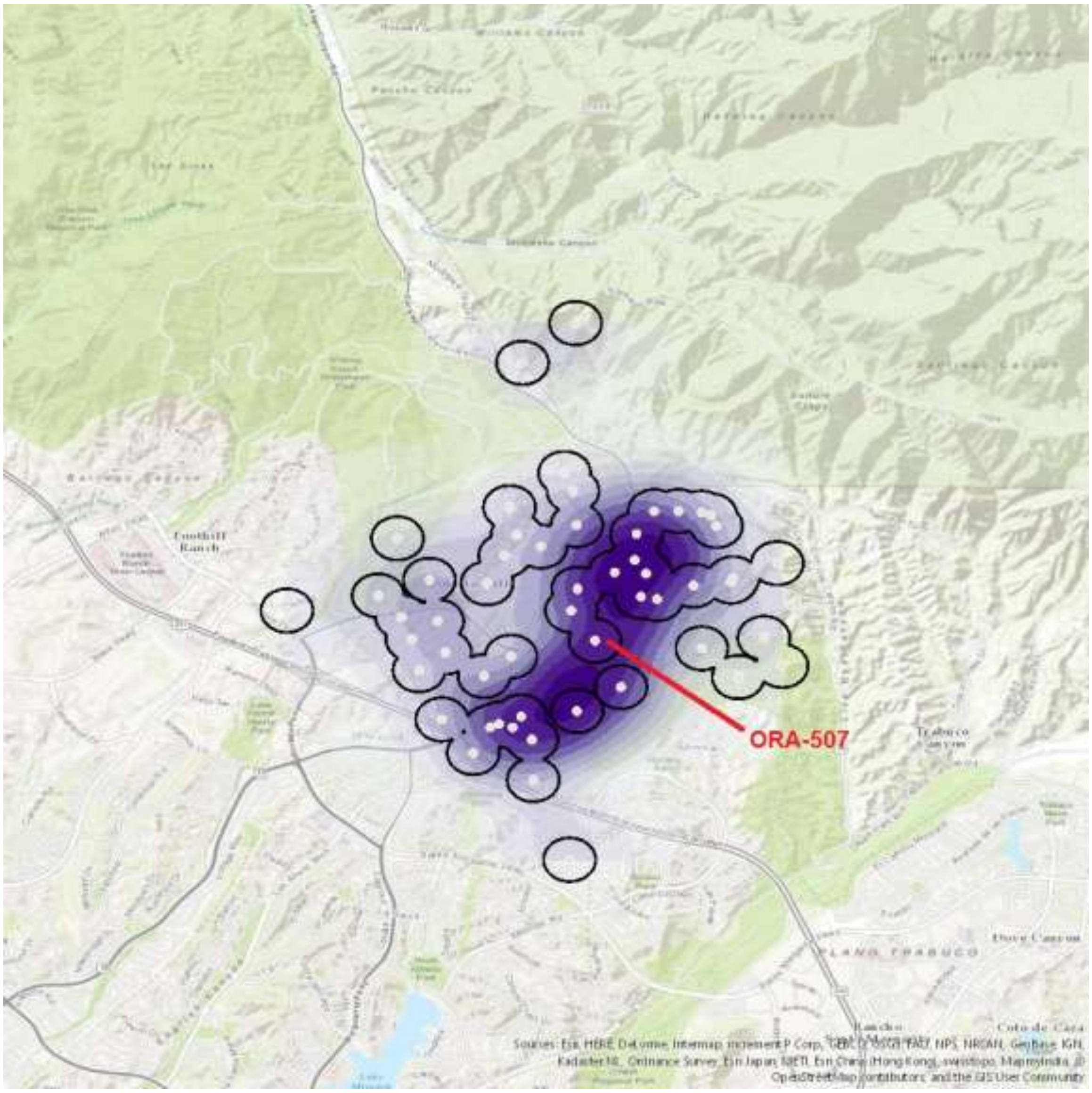


Figure 13. Kernel Density Results

The clusters west of Aliso Creek fall outside the heaviest density areas and are not, by proximity, related by density to the sites east of the creek. The density of these western sites is, on average, less than the density of the eastern sites. The two western clusters are also not related to each other by density, and may be interpreted as two family or band groups very distinctly separated by a gap between them that exceeds the average distance between sites. When site types are considered, Cluster 4 has secondary village sites where Cluster 3 does not. These two clusters could be the resource range of one group containing two or more families.

The smallest cluster east of the quarry is also not related to the larger groups by proximity or density and may represent a fourth, albeit smaller, family or group. Given that Cluster 5 contains a quarry and lithic sites but no temporary camps or evidence of food processing, this cluster is probably the result of exploratory forays to assess lithic resources in the area.

The densities seen in the analysis could also be the result of time depth. As a family group utilizes a resource area, a greater number of habitation events produce greater density of sites. This also indicates a relationship between Cluster 1 and Cluster 2.

CHAPTER FIVE

DECIPHERING THE DATA

Interpretations

The goal of this study was to answer the set of research questions posed earlier. This section treats each in the order they were posed

How do the numerous archaeological sites in the area relate to the quarry and to each other?

The analysis shows five distinct clusters of sites within the study area that potentially represent 3 to 5 individual groups of people. When viewed in context with the ethnographic accounts, these clusters would be indicative of family owned resource areas, and the chert at ORA-507 appears to have been the major cause of the settlement pattern seen east of Aliso Creek. Lithic sites are predominant in the eastern clusters and chert artifacts are recorded at 28 of 32 sites east of Aliso Creek indicating that these sites were created by the family(s) that owned or had access to the quarry at ORA-507.Cluster 1 and Cluster 2 appear to be related by proximity, suggesting a kinship tie as the placement of sites along the ridge between the clusters does not create a well-defined boundary between them. The ridgeline between them is a natural corridor and the gap between them is negligible.

The mix of site types in Cluster 1 north of ORA-507 indicates that the cluster was likely a family or band size resource area by virtue of the amounts of chert present and the predominance of lithic sites in the cluster. The temporary camps and the habitation area at the quarry provide evidence for a full range of resource procurement activities that would be necessary for extended or seasonal stays in the area. The amounts of chert and the habitation area at ORA-507, the full range of food and lithic processing sites, and the number of sites in the cluster indicate a long period of use, with occupations by a relatively small population.

The amounts of chert at any given site in these clusters would seemingly be greater if larger numbers of people were involved. Likewise the general lack of hearths, floral, and faunal remains in the region also indicate small numbers of people. Sites containing midden soils are few. A larger population would have produced well-formed midden soils at a greater number of sites. Preservation of floral and faunal remains is uncommon in many environments; however; more people simply produce more remains that then become available for preservation, increasing the likelihood of discovery.

Cluster 2 appears to be the work of a very small group or possibly even the group that created Cluster 1. The “quarries” in this area are puzzling. The sites are described as having chert cobbles or nodules eroding from the stream banks but the artifact assemblages at these sites are very small. If the chert is from the same formation of chert as ORA-507, it is likely that the nodules were remnants of chert beds broken up by landslides. If the evidence is taken at face value, these nodules were most likely discovered and used by one individual or a small group for a short time. A long use life would have produced significantly more flake artifacts at these sites. A larger group would have produced more artifacts. These sites could be the remnants of exploratory forays. That these outcrops were used at all indicates that the individual or group did not need direct access to ORA-507. The site types in this cluster are varied but food processing artifacts are few. This may be an indicator that these sites were created strictly because of the source of tool stone within the cluster.

The creators of Clusters 1 and 2 could have been the same group, but the lack of a continuous large cluster refutes this idea, as does the lack of a geographic barrier between the two clusters.

In the course of investigations at ORA-507 I traversed the ridge between the quarry and ORA-641 in an attempt to relocate ORA-641. The ridge in fact is a natural travel route between the clusters that share the highest densities, further enhancing the idea that the two clusters are related and it can be inferred that the sites in the study area were created by relatively small numbers of people. The lack of diversity in site function makes each site type seem very deliberate. Given the magnitude of the quarry, it is not unreasonable to consider that many sites in the study area are task-specific and related to it.

The millions of artifacts at ORA-507 would likely have taken a small group of people generations to amass and the small size of the habitation area at the quarry suggests a small group of people at any given time. This lends time depth to the activity at the quarry and, by association, the sites around it as well.

It can be reasonably stated that the use life of the quarry was quite lengthy given the number of artifacts it contained and the depths at which they were found. Cultural material was found within landslide-disturbed soils at the quarry that geologist's estimate occurred some 5000-20,000 years ago based on soil growth, caliche growth, and other factors (Maes 2015). This is indirect evidence that the quarry was in use as early as 5,000 years ago. It cannot be stated that privately owned resource areas existed at that time; however, the pattern of clusters seen on the landscape and a lack of post-Spanish contact artifacts in the study area indicates that the practice has significant time depth.

Clusters 3 and 4 west of the creek appear to be arranged differently than Clusters 1 and 2, with temporary camps dominating the site distribution. The majority of sites west of Aliso Creek occupy mainly ridgetops and hilltops. This could be an indication that a resource other than the chert was the prime motivator for site placement. The general lack of lithic processing sites west of the creek is also an indicator that a resource other than the chert was the focus of these sites, and the landscape west of Aliso Creek lacks exposed chert bearing Vaqueros formation members. Artifacts associated with food processing are dominant in these sites, yet the density of these western sites on the landscape roughly equals the eastern sites and may be a recursive response to the site density east of Aliso Creek.

Site distribution suggests that these groups were probably small with no more than 5-6 people occupying a given site at once, lending weight to the idea of the family owned resource areas. Greater numbers of people would have produced significantly more archaeological material, and other than ORA-507, there are few well-formed sites in the study area containing large amounts of artifacts. The placement of Gap “A” well west of Aliso Creek and the general lack of chert at the western sites suggests they were a separate group from the creators of Clusters 1 and 2.

Cluster 5 sites are small and fairly ephemeral in terms of artifact counts. Cluster 5 lacks temporary camps, but they may also exist outside the study area. Oso Creek separates Cluster 5 from Cluster 1. Considering that creeks in this area may constitute travel routes, it is easy to assume that Cluster 5 is not related to Cluster 1 and does not share connection with any other clusters in the study area. Cluster 5 may be related to a cluster outside the study radius, but further research would be necessary to make that determination.

Access to resources and resource areas is another topic that must be addressed. If the pattern of seasonal round gathering is adhered to and families traveled from the villages to outlying resource areas, there had to be a cultural mechanism to prevent trespassing into the resource areas of others while travelling. Kinship ties with neighboring properties would help facilitate travel. Neutral paths between resource areas would be a solution as well. In the study area, the gaps between clusters follow loose geographic landforms and these would have been natural travel routes with the exception of the gap that roughly parallels Aliso Creek.

If the creek beds in the region are travel routes, theoretically this would mean crossing through several privately owned territories as one traversed the drainages. Each of these territories would have required permission from the owner to travel through them. Cooperation between groups would have been necessary, and this cooperation would be assured through kinship ties. The alternative to this suggestion is that the drainages, as travel routes, would be open and free for travel by all. This concept is shared by the Pomo of northern California in regard to access to obsidian for groups living as far as 100km away. They are allowed free access to travel corridors that take them across the territories of other groups (Basgall 1979).

Evidence of free travel access along the creek beds would be seen archaeologically as a discernable lack of sites within the travel corridors. In the study area, the gaps between clusters may be either borders or travel routes.

Gap “A” along Aliso Creek is west of the creek and the rough terrain along the path of the gap makes it seem quite unsuitable as a travel route. This is perhaps more evidence that Gap “A” is a culturally derived boundary between unrelated groups. The placement of this gap on the landscape would suggest it is the border between the *Acjachamen* and the *Tongva*, and not a travel route, thus it is inferred that the majority of travel along Aliso Creek proper would have been by families or groups with kinship ties and ownership of the resource areas east of the creek. While Gap “B” roughly follows Oso Creek, Gaps “C”, “D” and “E” do not follow creeks or obvious travel routes, suggesting they are culturally derived divisions.

While the quarry at ORA-507 was the primary resource east of Aliso Creek, gentle slopes or wide flat areas among the ridges were chosen for habitation, and work areas with flake scatters or flaking stations generally occur at higher elevations. The higher elevation sites do not appear to be placed on travel routes, but without viewshed analysis, further interpretations regarding altitude will not be made.

The inhabitants of Cluster 1 can be said to be the "owners" of the quarry based on proximity, artifact types and site types within the cluster. Cluster 2 can be said to be directly related to Cluster 1 by virtue of the kernel density analysis and could easily be the same group or family that owns Cluster 1. This would place almost all the chert deposits in the study area under the control of one group and the very small amounts of artifacts at these secondary quarries is an indication that the resources within them simply were not needed or they would have been utilized more extensively.

Does the pattern of sites on the landscape match the ethnographic descriptions of Kroeber and others concerning Acjachemen culture?

This study finds that the clustered pattern of landscape use indicates that the ethnographic data are accurate regarding family-owned resource procurement areas. Significant statements can be made concerning the pattern of archaeological sites on the landscape and the ethnographic literature. The quarry at ORA-507 appears to have been the major resource and focal point of the settlement pattern east of Aliso Creek. The pattern seen west of the creek, while not chert-focused, was certainly constrained by neighboring groups. The quarry was owned or shared by one and possibly two families who were most likely related by kin as evidenced by the trail leading from ORA-507 to Cluster 2. Metate fragments and hundreds of manos found at the quarry, along with the millions of flake artifacts, suggest the quarry may have been relatively permanently occupied and protected.

The clusters of sites are most likely a result of cultural rules pertaining to ownership, created by single families or groups returning to the same general area over time. The landscape did not constrain site location choices with any real geographic barriers. The inhabitants had many options when it came to site location and did not restrict them to any particular geographic landform when selecting campsites or work sites, evidenced by sites that exist in nearly every ecological niche available in the region from the tops of ridges to the bottoms of valleys.

Will the patterns reflect the taboo of trespass and leave significant gaps in the settlement pattern that are perhaps [?] indicative of culturally ascribed boundaries?

The study cannot say definitely that the gap west of Aliso Creek is the boundary between the *Acjachamen* and the *Tongva* groups. It shows clearly that the possible border between tribes was not a strict function of geology and is visible archaeologically as a gap between clusters of sites. The gap is far enough away from Aliso Creek to be conspicuous, and the topography within the gap precludes it from being considered as a travel route.

All the gaps between clusters lack variation in width. It is reasoned that if the gaps were a result of landform barriers, the width of the gaps would be more variable. Instead, each gap (both across the creek and between clusters) are fairly regular, only slightly wider than the average distance between sites. This is an indicator that the width of the gaps was intentional. Thus we are left with a cultural cause for the existence of the gaps. That access to the quarry was controlled is evident in the amount of chert artifacts found at various sites compared to others.

It is reasoned that the taboo concerning trespass and the consequences for it would have resulted in a quite pronounced territoriality and would have demanded that a resource area be monitored and protected. Open access to the quarry by all should have produced chert artifacts at nearly every site in the study area, but this is not the case. Two sites north of the quarry and one site south of the quarry display enough chert to indicate direct access to the quarry. Five sites display quantities of chert that indicate secondary access to large flake cores or cobbles taken from the quarry. Some sites west of the creek had no chert even in larger temporary camp or secondary village sites. This indicates no access to the quarry and only a small scale exchange relationship with the owners of the quarry.

Will the settlement pattern reflect the boundary between the Acjachamen and the Tongva?

In relation to the veracity of the ethnographic descriptions of Aliso Creek as the boundary, the results would indicate that the descriptions of the tribal boundary were referential and not literal, that is to say, describing an area rather than an actual geologic feature if the gap seen along the creek in the study area is that boundary.

The settlement pattern also makes clear a greater than average size gap running nearly parallel with Aliso Creek west of the creek itself. The gap roughly aligns with the prominent cliff or ridgeline that borders the west bank of Aliso Creek. If one attempted to use this gap as a travel route, it would be difficult at best due to extremely steep slopes and rocky terrain. The gap in fact crosses several geologic features that would create extremely difficult travel. Thus it can be reasoned that the gap is not the result of a free-access travel corridor.

The width of the gap is also important. If the gap is the result of the cliffs, rather than some cultural practice, it would be reasonable to think that placement of sites in proximity to the creek would be relatively equal east and west of it with little regard for the topography. The average distance of the sites in the western clusters to the creek is 392m while that distance east of the creek is 119m. If Aliso Creek itself was the boundary, average distances to clusters east and west should be roughly equal, yet there is an imbalance suggesting the actual boundary between the clusters is west of the creek. Cluster 1 has two sites within it that are west of the creek indicating that the creek itself was not a border as does Cluster 3.

The gap appears to be far enough west of the creek to indicate the creek and the cliffs were not the cause of the gap. If the gap is not the result of the environment the remaining process that would have created the gap would be cultural. If the ethnographic literature is accurate this gap would be either the tribal border spoken of by Boscana (1846) or a border between privately owned resource areas. Because the study area is restricted to a fraction of the length of Aliso Creek, similar treatment of the remaining watershed would be necessary to make definitive statements about a possible tribal border between the *Acjachamen* and *Tongva* peoples.

Of the 55 sites in the study area, 43 (78%) belong in one of five clusters. Each cluster is made up of various site types. This is expected, and shows that more than one activity was taking place within each cluster. The lithic processing evidence is overwhelming east of Aliso Creek. The temporary camps and the single cupule boulder in the resource area of the quarry owners indicate that habitation periods were long enough to require food processing activities.

Very little has been said regarding the rock shelters. The artifact types found within them offer very few clues as to their function. Based on their placement on the landscape, it is reasonable to think they may be territorial markers or even shrines, but there is simply not enough evidence to state this with any certainty. The marine shell fragments found within them does, however, imply a connection of some type with the coast which would be in keeping with the idea that families from the coastal villages traveled seasonally to the area for resource procurement. Along the same line of evidence, two pitted manos associated coastally with marine shell processing (Strudwick 1995) were found during controlled demolition of ORA-507(Hearth et al 2016).

The correlation is also seen indicating the lengthy history of land division in the region. Concerning the time depth of these land divisions, “when questioned as to when or how the land was divided and subdivided, the Indians say they cannot tell, that their fathers told them that it always had been thus. Many of the older ones remember how they were cautioned when young never to trespass on the land of others in pursuit of game or food without permission” (Sparkman 1908). The pattern of sites on the landscape is most likely the result of horizontal deposition over time, and evidence at the quarry suggests occupation as possibly as early as 5000 years ago. Granted, the site pattern could be considerably younger than that, but the description by Sparkman’s 1908 informant would indicate that the practice of property ownership certainly predates Spanish intrusion.

This study finds that the ethnographic descriptions of property ownership in the region are essentially correct and archaeologically visible. This pattern shows that the inhabitants were in fact territorial and had a great deal of social organization, contrary to what linguistics tells us. The site pattern on the landscape defines each group’s resource area (or areas) yet leaves room for fairly free travel through the region without the risk of trespassing. The effectiveness of the arrangement as a cultural practice is implicit in the possible time depth within the study area.

Conclusions

One of the shortfalls of the present study is the size of the study area. The two-mile radius was chosen quite arbitrarily. Expectations that the site density seen within the one-mile radius record search completed for the Skyridge project would continue proved to be ill-founded. There are other clusters of sites outside the two mile study radius that may provide a clearer picture of the regional settlement pattern if included in further study. That being said, a wider study radius would surely increase the possibility of survey bias that the current study does not suffer from.

With each family owning resource areas, a methodology based on distance or proximity is appropriate. Resource areas are finite and bounded by either a geographic or cultural boundary. The territoriality of the inhabitants would, by default, cause campsites or resource processing sites to accumulate within that boundary. It is reasoned, then, that distances between sites that occur in an owned area will be closer together than in a random distribution. Likewise, those same boundaries will produce unoccupied gaps between resource areas and still allow for travel through and within the region.

The GIS data supports the idea that divisions of land ownership can be seen archaeologically and that some cultural processes produce patterns. The clustered settlement pattern appears to be both the result of cultural rules and an effect of the topography. That cultural boundaries might loosely conform to geographic boundaries is reasonable considering identifiable landmarks would be necessary as guides to prevent trespass. The cliffs on the west side of Aliso Creek and the ridges throughout the study area would fit that description. In a culture that valued tradition and autonomy, these chosen landmarks must have been fairly permanent features on the landscape as an agreed upon boundary would have to be recognized by all parties concerned. As both clusters west of Aliso Creek have basically the same average distance from the creek, it can be interpreted that that distance was the effect of a cultural rule rather than an environmental barrier such as the cliffs or a ridgeline.

It must be made clear that this methodology may only be appropriate in regions with a high density of archaeological sites. In regions sparsely populated with sites, proximity would not be a valid basis for analysis of patterns and some other variables would need to be chosen. The site typology itself may be more helpful in these instances, but the basic framework of the study can be easily altered by adding criteria.

Unfortunately, it is recognized that the data used for this analysis are somewhat lacking and had to account for factors like historic collecting activity and erosion; the methodology employed was designed to take into account only the recorded data as if it were factual, final, and accurate. This also points out the strengths of the data. The categories of site types are editable to account for regional differences, and the simplicity of the presence/absence scheme removes much debate from the evaluation of the sites based on consistency of application. A typology based on artifact represented activity spheres can eliminate the biases produced by different sized assemblages and recording methods.

In addressing the matter of site visibility, if large areas of the study were un-surveyed, the site pattern could be a result of survey bias; however, 99% of the study area has been surveyed. While this does not guarantee the visibility of the entire cultural pattern on the landscape it assures that the pattern is significantly whole and not the result of survey bias.

While artifact quantification is lacking, the chert in the region is visually distinctive. It is fairly impossible to identify it as anything other than chert or one of its forms. This distinctiveness increases the likelihood that descriptions of materials in the site records are accurate to a necessary degree of confidence.

Theoretical Significance

Within systems theory, questions of settlement patterns and resource procurement are central to the study of hunter/gatherers as it relates to cultural complexity (Binford 1980). As both a product of, and a force upon, the natural environment, evidence of these cultural processes should be present in the patterning of sites on the landscape. This patterning then should allow me to make inferences pertaining to or correlations with, the ethnographic literature concerning the people who resided within the Aliso Creek watershed. This research will provide data integral to the study of settlement patterning, social organization, and the landscape use of prehistoric peoples. Settlement patterns on the landscape that result from cultural practices rather than environmental constraints should conform to certain general rules or models regarding the boundaries of resource procurement areas of small bands or family groups that would be applicable to other areas within California and possibly other parts of the globe.

Regional Significance

Traditional tribal use areas in California are typically ill defined. In the case of the Aliso Creek Drainage, the vicinity around the ethnographically described boundary between the Juaneño and the Gabrielino peoples is studded with archaeological sites which, when examined in the context of landscape use and ethnographic information, reveal patterns that infer family and band group dynamics in relation to a valuable resource and potential competition for that resource. I collected large amounts of data that can aid in understanding the social organization, resource procurement practices and intra-group relationships of an understudied population. The data from these sets will allow a more complete understanding of how these early people interacted with their environment and how that environment affected social organization, as well as determining the accuracy of historical ethnographies that are heavily used as sources in the literature.

The study thus far has been conducted with a great amount of help from members of the Juaneño and Gabrielino people in terms of sharing their knowledge about prehistoric and historic culture and practices. In some way, this study has the potential to, in turn, illuminate facets of Native American culture that have left a lasting impression on the landscape.

This is perhaps one of the most important goals of this study. Gaining knowledge for its own sake is not reason enough to continue this pursuit. Archaeology must be able to meet the needs of the regulatory environment and conduct landscape studies from an ethnographic perspective, incorporating current native knowledge. The ability to connect a living people with historical writings and their ancestors in a form of cultural continuity would be, for me, one of the more satisfying results of archaeological study.

APPENDIX A

SITE TYPOLOGY DATABASE

ID	PrimaryString	Xrefs	ResType
3	P-30-000405	None	Site
4	P-30-000439	Is an element of district 30-001728	Site
5	P-30-000440	Is an element of district 30-001728	Site
6	P-30-000441	Is an element of district 30-001728	Site
7	P-30-000442	Is an element of district 30-001728	Site
8	P-30-000443	Is an element of district 30-001728	Site
9	P-30-000444	None	Site
10	P-30-000445	Is an element of district 30-001728	Site
11	P-30-000446	Is an element of district 30-001728	Site
12	P-30-000447	Is an element of district 30-001728	Site
13	P-30-000449	Is an element of district 30-001728	Site
14	P-30-000450	None	Site
15	P-30-000451	Is an element of district 30-001728	Site
16	P-30-000452	Is an element of district 30-001728	Site
17	P-30-000453	Is an element of district 30-001728	Site
18	P-30-000454	Is an element of district 30-001728	Site
19	P-30-000455	None	Site
21	P-30-000469	Is an element of district 30-001728	Site
22	P-30-000471	None	Site
23	P-30-000485	Is an element of district 30-001728	Site
24	P-30-000486	Is an element of district 30-001728	Site
25	P-30-000487	Is an element of district 30-001728	Site
26	P-30-000488	Is an element of district 30-001728	Site
29	P-30-000507	Is an element of district 30-001728	Site
30	P-30-000630	Is an element of district 30-001728	Site
31	P-30-000631	None	Site
32	P-30-000641	None	Site
33	P-30-000690	None	Site
34	P-30-000691	None	Site
35	P-30-000692	None	Site
36	P-30-000704	Adjacent to Study Area	Site
37	P-30-000710	Is an element of district 30-001728	Site
38	P-30-000711	Is an element of district 30-001728	Site
39	P-30-000712	See also 30-001728	Site
40	P-30-000713	None	Site
41	P-30-000714	None	Site
42	P-30-000715	None	Site
43	P-30-000716	None	Site

44	P-30-000725	Is an element of district 30-001728	Site
45	P-30-000726	Is an element of district 30-001728	Site
46	P-30-000727	Is an element of district 30-001728	Site
47	P-30-000825	None	Site
48	P-30-000826	None	Site
49	P-30-000827	None	Site
60	P-30-000956	None	Site
61	P-30-001008	None	Site
62	P-30-001061	See also 30-001728	Site
67	P-30-001255	None	Site
68	P-30-001256	None	Site
69	P-30-001257	None	Site
70	P-30-001373	None	Site
71	P-30-001430	None	Site
73	P-30-001437	None	Site
77	P-30-001517	None	Site
108	P-30-001491	None	Site

Age	Datum UTM NAD 83 (East/North)	Distance from 507(miles)
Prehistoric	440774/ 3725061	1
Prehistoric	441942/ 3727455	0.8
Prehistoric	441868/ 3727643	1
Prehistoric	440809/ 3725764	0.8
Prehistoric	441149/ 3725513	0.6
Prehistoric	441387/ 3725717	0.5
Prehistoric	441382/ 3727387	1
Prehistoric	440743/ 3726093	0.8
Prehistoric	440673/ 3726529	0.9
Prehistoric	440397/ 3726960	0.75
Prehistoric	441971/ 3727087	0.76
Prehistoric	441919/ 3726196	0.19
Prehistoric	441975/ 3726425	0.4
Prehistoric	441447/ 3726996	0.75
Prehistoric	441656/ 3726873	0.65
Prehistoric	441337/ 3726781	0.75
Prehistoric	441180/ 3726490	0.75
Prehistoric	441573/ 3724419	1
Prehistoric	441890/ 3723574	1.42
Prehistoric	441198/ 3725977	0.8

Prehistoric	441277/ 3725011	0.75
Prehistoric	441395/ 3724972	0.65
Prehistoric	441471/ 3725087	0.6
Prehistoric	442142/ 3725884	0
Prehistoric	443729/ 3727326	0.8
Prehistoric	442867/ 3727238	0.8
Prehistoric	442289/ 3725360	0.19
Prehistoric	443654/ 3725921	0.8
Prehistoric	443769/ 3725605	0.9
Prehistoric	443009/ 3725831	0.5
Prehistoric	441974/ 3729220	2
Prehistoric	442479/ 3726728	0.5
Prehistoric	442303/ 3726596	0.4
Prehistoric	442578/ 3726585	0.4
Prehistoric	442759/ 3726491	0.38
Prehistoric	442989/ 3726516	0.56
Prehistoric	443343/ 3726528	0.75
Prehistoric	443733/ 3726685	0.9
Prehistoric	441047/ 3725706	1
Prehistoric	441563/ 3725845	0.8
Prehistoric	441962/ 3725141	0.5
Prehistoric	440516/ 3725903	1
Prehistoric	440576/ 3725580	1
Prehistoric	440359/ 3726176	1.23
Prehistoric	439419/ 3726216	1.7
Prehistoric	441505/ 3728805	1.87
Prehistoric	442496/ 3727000	0.75
Prehistoric	443200/ 3727080	0.75
Prehistoric	443324/ 3726494	0.9
Prehistoric	442531/ 3726340	0.28
Prehistoric	440077/ 3726037	1.29
Prehistoric	440426/ 3726141	1
Prehistoric	443152/ 3727139	0.8
Prehistoric	443062/ 3727847	1.33
Prehistoric	442481/ 3728263	1.5

Direction	Nearest Site (ORA#)	Distance (Meters)
SW	485	429
N	440	200
N	439	200
W	826	292
W/SW	443	315
W	442	315
NW	452	302
W	825	296
W	827	475
NW	446	531
N	439	364
N	451	760
N	450	240
NW	454	244
NW	452	242
W/NW	452	244
W	454	329
S/SW	726	425
S	469	895
SW	486	277
SW	485	277
SW	486	415
SW	487	450
Point	450	1252
N	631	709
N	1519	204
N	727	1500
E	691	335
E	690	335
E	866	438
N	1008	630
N	712	558
N	710	700
N	710	173
NE	1257	466
NE	1435	605
NE	1256	136
E/NE	715	420

SW	485	312
SW	487	699
S	641	1512
W	1430	258
W	441	290
W	1430	300
W	1373	685
N	704	630
N	630	948
N/NE	1437	124
E/NE	715	136
N	713	466
W	1430	363
W	825	258
N/NE	1255	124
N	1518	383
N	1517	720

Nearest Water Source	Distance to Water (Meters)	Site Size (m x m)
Aliso Creek	8	9.5x4
Unnamed Creek	1	375 x 150
Aliso Creek	297	160 x 65
Aliso Creek-Tributary	245	110 x 35
Unnamed Creek	548	190 x 50
Unnamed Creek	1000	180 x 45
Serrano Creek- Tributary	150	700 x 400
Serrano Creek- Tributary	1	200 x 160
Serrano Creek- Tributary	1	55 x 40
Serrano Creek	984	30 x 190
Unnamed Creek	1	200 x 150
Aliso Creek	675	150 x 100
Aliso Creek	650	100 x 75
Serrano Creek-Tributary	1	50 x 130
Serrano Creek- Tributary	1	180 x 75
Serrano Creek- Tributary	200	200 x 60
Serrano Creek-Tributary	1	120 x 50
Oso Creek	20	450 x 100
Intermittent Spring	1	100 x 300
Aliso Creek	469	80 x 60

Aliso Creek	536	150 x 100
Aliso Creek	908	60 x 60
Aliso Creek	474	100 x 100
Aliso Creek	454	300 x 200
Aliso Creek	620	185 x 75
Aliso Creek	410	30 x 30
Oso Creek	150	300 x 120
Oso Creek	370	75 x 50
Live Oak Creek	390	40 x 40
Oso Creek	350	10 x 10
Unnamed Creek	280	30 x 25
Aliso Creek	387	75 x 50
Aliso Creek	257	50 x 50
Aliso Creek	330	25 x 25
Oso Creek	965	100 x 100
Oso Creek	1169	50 x 50
Oso Creek	970	75 x 75
Live Oak Creek	325	50 x 50
Aliso Creek	285	400 x 60
Oso Creek	207	40 x 40
Oso Creek	114	100 x 50
Aliso Creek-Tributary	1	18 x 18
Aliso Creek-Tributary	294	260 x 40
Serrano Creek	290	`7.5 x 16.5
Serrano Creek	185	40 x 10
Aliso Creek	139	50 x 100
Aliso Creek	160	110 x 60
Aliso Creek	768	25 x 25
Oso Creek	855	30 x 5
Aliso Creek	1099	5 x 5
Serrano Creek	200	130 x 120
Aliso Creek-Tributary	150	12.5 x 9
Aliso Creek-Tributary	75	19 x 17
Aliso Creek	750	90 x 50
Aliso Creek	420	1 x 1

Total Area (m sq)	Site Size (S,M,L)	Site Type Recorded
38	S	Rock Shelter
56250	L	None Recorded
10400	M	Surface Scatter
3850	S	Lithic Scatter with Cairns
9500	M	Temporary Camp
8100	M	Resource Processing - Temp
280000	L	None Recorded
32000	M	Resource Processing - Temp
2200	S	Surface Scatter
5700	S	Surface Scatter
30000	M	Surface Scatter
15000	M	Secondary Village
7500	S	Possible Quarry Site
6500	S	None Recorded
13500	M	Rock Shelter
12000	M	Artifact Scatter
6000	S	Artifact Scatter
45000	L	Artifact Scatter
30000	L	Artifact Scatter
4800	S	Quarry Site
15000	M	Lithic Reduction Site
3600	M	Temporary Camp
10000	M	Temporary Camp
60000	L	Quarry
13875	M	Temporary Camp
900	S	Temporary Camp
36000	L	Lithic Reduction Site
3750	S	Flaking Station
1600	S	Flaking Station
100	S	Flaking Station
750	S	Flaking Station
3750	S	Temporary Camp
2500	S	Temporary Camp
625	S	Flake Scatter
10000	M	Lithic Reduction Site
2500	S	Temporary Camp
5625	S	Temporary Camp

2500	S	Flaking Station
24000	L	Temporary Camp
1600	S	None
5000	S	None
324	S	None
10400	M	None
288.75	S	None
400	S	None
5000	S	None
6600	M	None
625	S	Flaking Station
150	S	Flaking Station
25	S	Milling Station
12250	M	Seed Processing Station
88.4	S	Milling Station
253.7	S	Flaking Station
4500	S	Temporary Camp
1	S	Temporary Camp

Elevation AMSL (M)	Terrain	Chert Present
864	Bottom of Ridge	No
1346	Top of Ridge	Yes
1362	Top of Ridge	Yes
993	Top of Ridge	No
998	Slope of Ridge	Yes
1105	Top of Ridge	Yes
1400	Top of Hill	No
915	Top of ridge	Yes
1017	Slope of Ridge	No
1100	Top of Ridge	Yes
1180	Terrace	No
1005	Slope of Ridge	Yes
1126	Top of Ridge	Yes
1180	Top of Ridge	No
1200	Top of Hill	No
1158	Top of Ridge	No
1100	Slope of Ridge	No
980	Top of Ridge	No
1000	Bottom of Hill	Yes
851	Creek bottom	Yes

953	Creek bottom	Yes
1001	Slope of Hill	Yes
963	Top of Ridge	Yes
1005	Slope of Ridge	Yes
1121	Slope of Ridge	Yes
1160	Between Ridges	Yes
1177	Slope of Ridge	Yes
1291	Bottom of Ridge	Yes
1431	Slope of Ridge	Yes
1109	Top of Ridge	Yes
1800	Top of Knoll	Yes
1111	Slope of Ridge	Yes
1062	Slope of Hill	Yes
1185	Top of Hill	Yes
1318	Slope of Ridge	Yes
1360	Top of Ridge	Yes
1432	Top of Hill	Yes
1562	Top of Ridge	No
945	Top of Ridge	Yes
984	Top of Ridge	No
972	Slope of Ridge	Yes
888	Slope of Hill	Yes
900	Top of Ridge	Yes
920	Slope of Hill	Yes
880	Top of Knoll	Yes
1440	Flat	Yes
1112	Between Ridges	Yes
1389	Top of Hill	No
1428	Top of Ridge	No
1200	Top of Hill	No
960	Top of Hill	No
945	Top of Ridge	Yes
1449	Between Ridges	No
1240	Top of Ridge	Yes
1296	Top of Ridge	No

Side of Aliso Creek	FAR Present (0=N, 1=Y)	Metates Present (0=N, 1=Y)
W	0	0
W	0	0
W	0	0
W	0	1
W	0	0
W	1	0
W	0	0
W	1	0
W	0	0
W	0	1
W	1	0
W	1	1
W	0	0
W	0	0
W	1	0
W	0	1
W	0	0
E	0	0
E	0	0
E	1	0
E	1	0
E	1	0
E	1	0
E	1	1
E	0	0
E	0	0
E	0	0
E	0	0
E	0	0
E	0	0
E	0	0
E	0	0
E	1	0
E	0	0
E	0	0
E	0	0
E	0	0
E	0	0

E	0	1
E	1	0
E	1	0
W	1	0
W	0	0
W	1	1
W	0	0
E	0	1
E	0	0
E	0	1
E	0	0
E	0	0
W	1	1
W	1	1
E	1	1
E	0	1
E	1	0

Mortars or Bowls Present (0=N, 1=Y)	Groundstone Present (0=N, 1=Y)	Chert Cobbles Present
0	0	0
0	1	0
0	1	0
0	1	0
0	1	0
0	1	0
0	1	0
1	1	0
0	1	0
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0	1	0

Flake Cores Present (0=N, 1=Y)	Chert Cores
0	0
1	2
1	
1	
1	1
0	0
1	
0	0
1	
1	0
0	0
0	0
1	1
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1	0
0	0

Hammerstones Present (0=N, 1=Y)	Multi-Function Tools Present (0=N, 1=Y)
0	0
1	0
0	0
1	0
0	0
0	0
1	0
0	0
0	0
1	1
0	0
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0	0
0	0
0	0

Tools or Bifaces Present (0=N, 1=Y)	Chipping Waste Present (0=N, 1=Y)	Marine Shell Present (0=N, 1=Y)
1	0	1
1	1	0
1	0	0
1	0	0
1	1	0
0	1	0
1	1	0
0	1	0
1	1	0
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1	1	0
1	0	0
0	0	0
1	1	0
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0	1	0
0	0	0
0	0	0

Pitted Hammerstones Present
0
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Site Type After Evaluation	Access to 507
Rock Shelter	No
Core Cache Site	Yes
Core Cache Site	Yes
Temporary Camp	No
Lithic Site	Yes
Temporary Camp	Yes
Lithic Site	No
Temporary Camp	No
Lithic Site	Yes
Temporary Camp	No
Temporary Camp	No
Temporary Camp	No
Lithic Site	Yes
Temporary Camp	No
Rock Shelter	No
Temporary Camp	No
Temporary Camp	No
Flake Scatter	No
Lithic Site	Yes
Quarry	Yes
Quarry	Yes
Quarry	Yes
Quarry	No
Quarry	Yes
Lithic Site	No
Lithic Site	Yes
Lithic Site	Yes
Lithic Site	Yes
Quarry	Yes
Flaking Station	
Flaking Station	Yes
Lithic Site	Yes
Lithic Site	YEs
Lithic Site	Yes
Flake Scatter	Yes
Lithic Site	Yes
Lithic Site	No
Temporary Camp	No
Flaking Station	No
Temporary Camp	Yes

Temporary Camp	No
Lithic Site	No
Temporary Camp	No
Flaking Station	No
Secondary Village	Yes
Flaking Station	Yes
Temporary Camp	No
Lithic Site	Yes
Flaking Station	No
Flaking Station	No
Milling Station	Yes
Temporary Camp	No
Secondary Village	No
Flaking Station	No
Temporary Camp	Yes
Temporary Camp	Yes

Bedrock Milling Features Present	Midden Present
0	0
0	0
0	0
0	1
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
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Hearths Present	Cluster #
0	2
0	4
0	4
0	3
0	3
0	3
0	4
0	3
0	3
0	0
0	4
0	1
0	1
0	4
0	4
0	4
0	4
0	2
0	0
0	2
0	2
0	2
0	2
1	1
0	1
0	1
0	2
0	5
0	5
	5
0	5
0	0
0	1
0	1
0	1
0	1
0	1
0	1
0	1
0	2

0	2
0	2
0	3
0	3
0	3
0	0
0	0
0	1
0	1
0	1
0	1
1	
0	3
0	1
0	1
1	

APPENDIX B

DISTANCE MATRIX

Site #	CA-ORA-507	ORA 443	ORA-1008	ORA-1061	ORA-1255	ORA-1256
CA-ORA-507	0	0.008289	0.027241	0.010758	0.015687	0.013876
ORA 443	0.008289	0	0.027878	0.016633	0.023087	0.022034
ORA-1008	0.027241	0.027878	0	0.019496	0.024036	0.028659
ORA-1061	0.010758	0.016633	0.019496	0	0.007627	0.010039
ORA-1255	0.015687	0.023087	0.024036	0.007627	0	0.005455
ORA-1256	0.013876	0.022034	0.028659	0.010039	0.005455	0
ORA-1257	0.005869	0.013558	0.024857	0.005965	0.009819	0.008663
ORA-1430	0.018659	0.011044	0.026683	0.023623	0.031085	0.031417
ORA-1437	0.016048	0.023217	0.022984	0.007284	0.001144	0.006576
ORA-1517	0.015663	0.022657	0.02215	0.006511	0.001887	0.007108
ORA-405	0.016516	0.008869	0.03467	0.025498	0.031863	0.030379
ORA-439	0.014339	0.016767	0.013062	0.007266	0.014004	0.017271
ORA-440	0.016144	0.018121	0.011196	0.008928	0.015251	0.018837
ORA-441	0.014417	0.006239	0.02842	0.02132	0.028369	0.027903
ORA-442	0.011225	0.003155	0.029931	0.01976	0.026236	0.025066
ORA-444	0.015093	0.01416	0.013752	0.012299	0.019706	0.022152
ORA-445	0.015212	0.007727	0.025787	0.020587	0.027941	0.028068
ORA-446	0.016889	0.010626	0.022394	0.020112	0.027701	0.0286
ORA-447	0.021241	0.015547	0.020436	0.022667	0.030276	0.031892
ORA-449	0.011079	0.013931	0.016235	0.005719	0.013249	0.015571
ORA-450	0.003727	0.0072	0.023934	0.009526	0.015926	0.015382
ORA-451	0.005205	0.008998	0.022067	0.007639	0.014464	0.014564
ORA-452	0.012535	0.011553	0.016326	0.011317	0.018925	0.020758
ORA-453	0.010356	0.010819	0.017504	0.009131	0.016757	0.018323
ORA-454	0.011881	0.009612	0.01834	0.012654	0.020272	0.021596
ORA-455	0.011739	0.007322	0.021164	0.014914	0.02242	0.023128
ORA-469	0.014557	0.011884	0.039566	0.025298	0.029701	0.02656
ORA-471	0.020972	0.020049	0.047332	0.031538	0.034582	0.030493
ORA-485	0.013047	0.006971	0.034676	0.022974	0.028711	0.026678
ORA-486	0.012203	0.006475	0.034302	0.022225	0.027879	0.0258
ORA-487	0.011502	0.00672	0.034588	0.021786	0.027184	0.024903
ORA-488	0.01019	0.005758	0.033534	0.020472	0.025875	0.023653
ORA-630	0.013392	0.019351	0.01882	0.002738	0.006063	0.009873
ORA-631	0.014487	0.021035	0.02041	0.004538	0.003868	0.008335
ORA-641	0.004985	0.010812	0.032131	0.014594	0.017763	0.014453
ORA-690	0.015835	0.024043	0.03471	0.0156	0.011534	0.006188
ORA-691	0.017724	0.025715	0.037842	0.018636	0.014658	0.009348

ORA-692	0.00998	0.018112	0.031974	0.012496	0.011688	0.006903
ORA-704	0.030146	0.032211	0.006288	0.020811	0.023422	0.028604
ORA-710	0.008429	0.014889	0.021499	0.00246	0.008395	0.009361
ORA-711	0.006649	0.012663	0.021721	0.004193	0.010607	0.011054
ORA-712	0.007872	0.015039	0.02315	0.003848	0.008052	0.008091
ORA-713	0.006928	0.0149	0.025794	0.006485	0.008924	0.007183
ORA-714	0.01053	0.018572	0.026636	0.007304	0.006059	0.003567
ORA-715	0.014186	0.022327	0.028578	0.010089	0.005215	0.000368
ORA-716	0.018607	0.026763	0.030747	0.01365	0.006771	0.004733
ORA-725	0.015869	0.009817	0.037287	0.025903	0.031554	0.029352
ORA-726	0.011257	0.008106	0.035731	0.021876	0.026776	0.024105
ORA-727	0.006973	0.008107	0.033422	0.017717	0.021981	0.019078
ORA-825	0.01754	0.009535	0.028251	0.023523	0.030819	0.030746
ORA-826	0.017108	0.008823	0.030752	0.024332	0.03135	0.030752
ORA-827	0.02117	0.013861	0.025972	0.025178	0.032753	0.03348
ORA-866	0.013849	0.021632	0.036154	0.016662	0.014487	0.009087
ORA-956	0.02954	0.021704	0.032421	0.033939	0.041524	0.042206
Grand Total	0.735214	0.774915	1.403493	0.808139	1.011382	0.99827

0.005965	0.023623	0.007284	0.006511	0.025498	0.0072662	0.008928
0.009819	0.031085	0.001144	0.001887	0.031863	0.0140043	0.015251
0.008663	0.031417	0.006576	0.007108	0.030379	0.0172708	0.018837
0	0.022774	0.01019	0.009842	0.022179	0.0119129	0.013771
0.022774	0	0.030883	0.030133	0.010443	0.0201721	0.020611
0.01019	0.030883	0	0.00091	0.032039	0.0132817	0.014443
0.009842	0.030133	0.00091	0	0.0315	0.0123767	0.013533
0.022179	0.010443	0.032039	0.0315	0	0.0249827	0.026097
0.011913	0.020172	0.013282	0.012377	0.024983	0	0.001871
0.013771	0.020611	0.014443	0.013533	0.026097	0.0018711	0
0.019277	0.005351	0.028346	0.027689	0.00636	0.0195167	0.020417
0.016664	0.009635	0.026372	0.025811	0.005743	0.0194756	0.020706
0.015068	0.014591	0.019116	0.018232	0.021119	0.0062149	0.006142
0.019411	0.003447	0.027796	0.027075	0.009323	0.0178106	0.018492
0.020118	0.004394	0.027395	0.0266	0.013286	0.0160161	0.016333
0.023736	0.007458	0.029809	0.028955	0.017676	0.0172424	0.017011
0.009106	0.018753	0.012759	0.011908	0.02243	0.0032648	0.005071
0.00672	0.016113	0.016024	0.015457	0.016055	0.0113299	0.013036
0.006048	0.0169	0.014451	0.013819	0.01786	0.0092977	0.011048
0.013117	0.013436	0.018476	0.017633	0.018899	0.0067412	0.007387
0.010602	0.014811	0.016389	0.015578	0.018905	0.0060775	0.007307
0.013489	0.011391	0.019922	0.019114	0.016659	0.0089015	0.009647
0.014639	0.008718	0.022185	0.021425	0.013615	0.0119513	0.012763
0.020154	0.01987	0.030236	0.029966	0.010397	0.0276596	0.029244
0.025844	0.028003	0.035313	0.035222	0.017999	0.0349705	0.036664
0.018897	0.013407	0.029015	0.028566	0.004646	0.0237264	0.025092
0.018061	0.013717	0.028197	0.027758	0.005444	0.0231656	0.024569
0.01737	0.014856	0.027547	0.027142	0.006757	0.0231435	0.024613
0.016059	0.014755	0.026232	0.025824	0.007532	0.0219399	0.023438
0.008204	0.025975	0.005389	0.004502	0.02821	0.0079413	0.00924
0.008866	0.028113	0.003102	0.002206	0.029902	0.0101841	0.011387
0.008775	0.021839	0.018395	0.018231	0.017263	0.0191404	0.020977
0.012305	0.034418	0.012675	0.013268	0.031509	0.0228461	0.024526
0.014912	0.036381	0.015802	0.016414	0.032666	0.0258505	0.027561

0.007578	0.028633	0.012651	0.01287	0.025569	0.0192864	0.021107
0.026674	0.032381	0.022288	0.021588	0.039666	0.0159219	0.014266
0.003545	0.022761	0.008377	0.007774	0.023743	0.0087661	0.010573
0.003377	0.020652	0.010614	0.010011	0.021524	0.0086836	0.010554
0.002266	0.02355	0.008262	0.007814	0.023813	0.0104416	0.012249
0.001571	0.024307	0.009442	0.00922	0.023405	0.0129982	0.01483
0.005108	0.02785	0.006873	0.006964	0.027041	0.0145341	0.016229
0.008918	0.031653	0.006346	0.00691	0.030695	0.0172976	0.018842
0.013328	0.036	0.007772	0.008632	0.035103	0.0205558	0.021914
0.021734	0.014578	0.031882	0.031449	0.004355	0.0265831	0.027912
0.017043	0.016961	0.027222	0.026883	0.008745	0.0238905	0.025451
0.012423	0.018877	0.0225	0.022228	0.012844	0.0208719	0.022591
0.022083	0.002358	0.030704	0.029996	0.00809	0.0207736	0.021407
0.022163	0.005316	0.031342	0.030691	0.005145	0.0224054	0.02323
0.024909	0.002997	0.032462	0.031673	0.013197	0.0209697	0.021149
0.011978	0.032434	0.015573	0.015984	0.028397	0.0236058	0.025407
0.033597	0.010895	0.04122	0.040423	0.017957	0.0294094	0.029383
0.75514	1.026062	1.015473	0.99378	1.03458	0.8787099	0.938568

ORA-441	ORA-442	ORA-444	ORA-445	ORA-446	ORA-447	ORA-449
0.014417	0.011225	0.015093	0.015212	0.016889	0.021241	0.011079
0.006239	0.003155	0.01416	0.007727	0.010626	0.015547	0.013931
0.02842	0.029931	0.013752	0.025787	0.022394	0.020436	0.016235
0.02132	0.01976	0.012299	0.020587	0.020112	0.022667	0.005719
0.028369	0.026236	0.019706	0.027941	0.027701	0.030276	0.013249
0.027903	0.025066	0.022152	0.028068	0.0286	0.031892	0.015571
0.019277	0.016664	0.015068	0.019411	0.020118	0.023736	0.009106
0.005351	0.009635	0.014591	0.003447	0.004394	0.007458	0.018753
0.028346	0.026372	0.019116	0.027796	0.027395	0.029809	0.012759
0.027689	0.025811	0.018232	0.027075	0.0266	0.028955	0.011908
0.00636	0.005743	0.021119	0.009323	0.013286	0.017676	0.02243
0.019517	0.019476	0.006215	0.017811	0.016016	0.017242	0.003265
0.020417	0.020706	0.006142	0.018492	0.016333	0.017011	0.005071
0	0.004305	0.01505	0.003053	0.007048	0.011734	0.017345
0.004305	0	0.016192	0.006823	0.010501	0.015433	0.016794
0.01505	0.016192	0	0.012773	0.010253	0.011028	0.0066
0.003053	0.006823	0.012773	0	0.003997	0.00873	0.016028
0.007048	0.010501	0.010253	0.003997	0	0.004965	0.014907
0.011734	0.015433	0.011028	0.00873	0.004965	0	0.01705
0.017345	0.016794	0.0066	0.016028	0.014907	0.01705	0
0.012592	0.010355	0.011406	0.012719	0.013771	0.01785	0.0081
0.013907	0.012121	0.010079	0.013616	0.014078	0.017739	0.006043
0.013057	0.013752	0.002718	0.011123	0.009348	0.011352	0.005732
0.013532	0.013423	0.004767	0.012091	0.011045	0.013631	0.00395
0.010786	0.011612	0.004588	0.00891	0.007513	0.010302	0.007407
0.007666	0.008818	0.007507	0.005913	0.005481	0.009503	0.010128
0.01468	0.010889	0.025953	0.01757	0.021374	0.026276	0.024507
0.022916	0.019206	0.033906	0.025851	0.029684	0.034572	0.031731
0.008253	0.004865	0.020924	0.011208	0.015103	0.019938	0.020831
0.008464	0.004736	0.020557	0.011337	0.015162	0.020049	0.020224
0.009549	0.005564	0.02088	0.012329	0.016065	0.020992	0.020121
0.009405	0.005192	0.019867	0.012012	0.015604	0.020562	0.018888
0.02391	0.022469	0.013731	0.023037	0.022296	0.024488	0.007467
0.025852	0.024179	0.016028	0.025112	0.024506	0.026775	0.009738
0.016966	0.013014	0.020056	0.018467	0.020814	0.025453	0.015909
0.030236	0.026777	0.027119	0.030979	0.032196	0.03601	0.020717
0.031953	0.028271	0.029905	0.032935	0.034425	0.038425	0.023602

0.024325	0.020816	0.022619	0.025187	0.026642	0.030692	0.016645
0.033583	0.034582	0.018554	0.031147	0.028018	0.026495	0.019165
0.019986	0.018043	0.012874	0.019571	0.019562	0.022589	0.006399
0.017762	0.015815	0.01174	0.017419	0.017593	0.020859	0.005751
0.020453	0.018187	0.014385	0.020276	0.020555	0.023806	0.008002
0.02072	0.017972	0.016496	0.020931	0.021687	0.025301	0.010362
0.024375	0.021639	0.018968	0.024503	0.025059	0.028436	0.01247
0.028175	0.025367	0.022249	0.028311	0.028803	0.032055	0.01566
0.0326	0.029799	0.025949	0.032682	0.033037	0.036104	0.019362
0.009887	0.007357	0.023549	0.012939	0.016929	0.021577	0.023725
0.011631	0.007521	0.022124	0.014338	0.017986	0.022937	0.020766
0.013658	0.009406	0.020354	0.01572	0.018724	0.023619	0.017623
0.003399	0.007674	0.015582	0.002991	0.005891	0.009688	0.019019
0.003014	0.0062	0.017672	0.00497	0.008621	0.012665	0.020318
0.008344	0.012616	0.015009	0.006137	0.005079	0.005729	0.01998
0.02787	0.024098	0.027018	0.028994	0.030707	0.034893	0.021026
0.01555	0.019713	0.023277	0.014336	0.013827	0.012525	0.02866
0.901217	0.841876	0.887951	0.905744	0.949318	1.116774	0.787825

ORA-450	ORA-451	ORA-452	ORA-453	ORA-454	ORA-455	ORA-469
0.003727	0.005205	0.012535	0.010356	0.011881	0.011739	0.014557
0.0072	0.008998	0.011553	0.010819	0.009612	0.007322	0.011884
0.023934	0.022067	0.016326	0.017504	0.01834	0.021164	0.039566
0.009526	0.007639	0.011317	0.009131	0.012654	0.014914	0.025298
0.015926	0.014464	0.018925	0.016757	0.020272	0.02242	0.029701
0.015382	0.014564	0.020758	0.018323	0.021596	0.023128	0.02656
0.00672	0.006048	0.013117	0.010602	0.013489	0.014639	0.020154
0.016113	0.0169	0.013436	0.014811	0.011391	0.008718	0.01987
0.016024	0.014451	0.018476	0.016389	0.019922	0.022185	0.030236
0.015457	0.013819	0.017633	0.015578	0.019114	0.021425	0.029966
0.016055	0.01786	0.018899	0.018905	0.016659	0.013615	0.010397
0.01133	0.009298	0.006741	0.006077	0.008902	0.011951	0.02766
0.013036	0.011048	0.007387	0.007307	0.009647	0.012763	0.029244
0.012592	0.013907	0.013057	0.013532	0.010786	0.007666	0.01468
0.010355	0.012121	0.013752	0.013423	0.011612	0.008818	0.010889
0.011406	0.010079	0.002718	0.004767	0.004588	0.007507	0.025953
0.012719	0.013616	0.011123	0.012091	0.00891	0.005913	0.01757
0.013771	0.014078	0.009348	0.011045	0.007513	0.005481	0.021374
0.01785	0.017739	0.011352	0.013631	0.010302	0.009503	0.026276
0.0081	0.006043	0.005732	0.00395	0.007407	0.010128	0.024507
0	0.002125	0.008818	0.006714	0.008192	0.008398	0.016474
0.002125	0	0.007687	0.005313	0.007601	0.008597	0.018595
0.008818	0.007687	0	0.002515	0.002271	0.005391	0.023285
0.006714	0.005313	0.002515	0	0.003538	0.006182	0.022149
0.008192	0.007601	0.002271	0.003538	0	0.00312	0.02146
0.008398	0.008597	0.005391	0.006182	0.00312	0	0.019163
0.016474	0.018595	0.023285	0.022149	0.02146	0.019163	0
0.023641	0.025693	0.031202	0.029829	0.029506	0.027367	0.008318
0.013475	0.015502	0.018401	0.017789	0.016336	0.013648	0.006463
0.012751	0.014801	0.017994	0.017278	0.015976	0.013382	0.006233
0.012415	0.014509	0.018262	0.017369	0.016329	0.013891	0.005348
0.011123	0.013225	0.01722	0.016227	0.01535	0.013044	0.006127
0.012262	0.010353	0.013198	0.011252	0.014785	0.01726	0.027948
0.013856	0.012085	0.015469	0.013466	0.017004	0.019395	0.028978
0.008653	0.010173	0.017465	0.015334	0.016648	0.016065	0.012115
0.018445	0.018271	0.02536	0.02285	0.025791	0.026759	0.025688
0.020663	0.020722	0.028029	0.025514	0.028308	0.029052	0.025958

0.012887	0.013064	0.020557	0.018056	0.020664	0.021283	0.020287
0.027252	0.025208	0.020837	0.021437	0.023032	0.026052	0.043507
0.00769	0.00608	0.011398	0.008977	0.01233	0.014172	0.022985
0.005469	0.003857	0.009921	0.007418	0.010557	0.01215	0.021139
0.007909	0.00666	0.012759	0.010285	0.013507	0.015103	0.022321
0.008219	0.007619	0.014618	0.012103	0.015044	0.016208	0.020797
0.011828	0.011006	0.01741	0.014939	0.018134	0.019583	0.023894
0.015639	0.014784	0.020893	0.01847	0.021765	0.023335	0.026921
0.020044	0.019104	0.024826	0.022474	0.025864	0.027593	0.030959
0.016408	0.018436	0.02109	0.020605	0.018967	0.016151	0.006241
0.012802	0.014926	0.019452	0.018325	0.017645	0.015418	0.003835
0.009554	0.011581	0.01764	0.015973	0.016269	0.01482	0.007739
0.015363	0.01642	0.014063	0.015081	0.011873	0.008903	0.017594
0.015517	0.016895	0.015845	0.016472	0.013584	0.010475	0.01502
0.01837	0.018917	0.014377	0.016124	0.012592	0.010393	0.022837
0.017043	0.017383	0.024933	0.022438	0.02497	0.025429	0.021749
0.026979	0.027645	0.022984	0.024852	0.021314	0.019165	0.028351
0.704201	0.704782	0.810356	0.762348	0.794925	0.797945	1.086815

ORA-471	ORA-485	ORA-486	ORA-487	ORA-488	ORA-630	ORA-631
0.020972	0.013047	0.012203	0.011502	0.01019	0.013392	0.014487
0.020049	0.006971	0.006475	0.00672	0.005758	0.019351	0.021035
0.047332	0.034676	0.034302	0.034588	0.033534	0.01882	0.02041
0.031538	0.022974	0.022225	0.021786	0.020472	0.002738	0.004538
0.034582	0.028711	0.027879	0.027184	0.025875	0.006063	0.003868
0.030493	0.026678	0.0258	0.024903	0.023653	0.009873	0.008335
0.025844	0.018897	0.018061	0.01737	0.016059	0.008204	0.008866
0.028003	0.013407	0.013717	0.014856	0.014755	0.025975	0.028113
0.035313	0.029015	0.028197	0.027547	0.026232	0.005389	0.003102
0.035222	0.028566	0.027758	0.027142	0.025824	0.004502	0.002206
0.017999	0.004646	0.005444	0.006757	0.007532	0.02821	0.029902
0.03497	0.023726	0.023166	0.023143	0.02194	0.007941	0.010184
0.036664	0.025092	0.024569	0.024613	0.023438	0.00924	0.011387
0.022916	0.008253	0.008464	0.009549	0.009405	0.02391	0.025852
0.019206	0.004865	0.004736	0.005564	0.005192	0.022469	0.024179
0.033906	0.020924	0.020557	0.02088	0.019867	0.013731	0.016028
0.025851	0.011208	0.011337	0.012329	0.012012	0.023037	0.025112
0.029684	0.015103	0.015162	0.016065	0.015604	0.022296	0.024506
0.034572	0.019938	0.020049	0.020992	0.020562	0.024488	0.026775
0.031731	0.020831	0.020224	0.020121	0.018888	0.007467	0.009738
0.023641	0.013475	0.012751	0.012415	0.011123	0.012262	0.013856
0.025693	0.015502	0.014801	0.014509	0.013225	0.010353	0.012085
0.031202	0.018401	0.017994	0.018262	0.01722	0.013198	0.015469
0.029829	0.017789	0.017278	0.017369	0.016227	0.011252	0.013466
0.029506	0.016336	0.015976	0.016329	0.01535	0.014785	0.017004
0.027367	0.013648	0.013382	0.013891	0.013044	0.01726	0.019395
0.008318	0.006463	0.006233	0.005348	0.006127	0.027948	0.028978
0	0.014663	0.014525	0.013661	0.014343	0.034011	0.034636
0.014663	0	0.000895	0.002125	0.003105	0.025712	0.027173
0.014525	0.000895	0	0.001332	0.002211	0.024962	0.026391
0.013661	0.002125	0.001332	0	0.001321	0.024513	0.025853
0.014343	0.003105	0.002211	0.001321	0	0.023198	0.024533
0.034011	0.025712	0.024962	0.024513	0.023198	0	0.002298
0.034636	0.027173	0.026391	0.025853	0.024533	0.002298	0
0.017084	0.012967	0.012073	0.010964	0.009864	0.016971	0.017556
0.027962	0.027299	0.026405	0.025298	0.024194	0.015891	0.014501
0.027272	0.028281	0.027396	0.026212	0.025203	0.019029	0.017663

0.023648	0.021418	0.020524	0.019454	0.018315	0.013763	0.0132
0.050892	0.039155	0.038685	0.038805	0.037657	0.019338	0.020325
0.029103	0.020961	0.020182	0.019666	0.018346	0.004968	0.006212
0.027576	0.018829	0.018066	0.017602	0.016286	0.006912	0.00839
0.028107	0.02076	0.019947	0.01933	0.018012	0.005945	0.006658
0.026078	0.01996	0.019106	0.018341	0.017044	0.008337	0.008583
0.028532	0.023496	0.022631	0.021806	0.020527	0.007978	0.007207
0.030861	0.027011	0.026134	0.025243	0.02399	0.009821	0.008217
0.034335	0.031356	0.030473	0.029547	0.028312	0.012674	0.0106
0.013644	0.002934	0.003693	0.00445	0.005714	0.02864	0.030083
0.011951	0.004118	0.003445	0.002151	0.002408	0.024568	0.025744
0.014118	0.008369	0.007489	0.006299	0.005317	0.020318	0.021265
0.025684	0.011135	0.011492	0.012673	0.012668	0.025998	0.028054
0.022958	0.00864	0.009134	0.010403	0.010634	0.026924	0.028862
0.030931	0.016375	0.016703	0.01785	0.01775	0.027375	0.029583
0.023569	0.023995	0.023112	0.021923	0.020921	0.017636	0.016735
0.03574	0.022223	0.022807	0.024106	0.024383	0.036092	0.038318
1.428287	0.942099	0.918552	0.912664	0.875358	0.888025	0.93752

ORA-641	ORA-690	ORA-691	ORA-692	ORA-704	ORA-710	ORA-711
0.004985	0.015835	0.017724	0.00998	0.030146	0.008429	0.006649
0.010812	0.024043	0.025715	0.018112	0.032211	0.014889	0.012663
0.032131	0.03471	0.037842	0.031974	0.006288	0.021499	0.021721
0.014594	0.0156	0.018636	0.012496	0.020811	0.00246	0.004193
0.017763	0.011534	0.014658	0.011688	0.023422	0.008395	0.010607
0.014453	0.006188	0.009348	0.006903	0.028604	0.009361	0.011054
0.008775	0.012305	0.014912	0.007578	0.026674	0.003545	0.003377
0.021839	0.034418	0.036381	0.028633	0.032381	0.022761	0.020652
0.018395	0.012675	0.015802	0.012651	0.022288	0.008377	0.010614
0.018231	0.013268	0.016414	0.01287	0.021588	0.007774	0.010011
0.017263	0.031509	0.032666	0.025569	0.039666	0.023743	0.021524
0.01914	0.022846	0.02585	0.019286	0.015922	0.008766	0.008684
0.020977	0.024526	0.027561	0.021107	0.014266	0.010573	0.010554
0.016966	0.030236	0.031953	0.024325	0.033583	0.019986	0.017762
0.013014	0.026777	0.028271	0.020816	0.034582	0.018043	0.015815
0.020056	0.027119	0.029905	0.022619	0.018554	0.012874	0.01174
0.018467	0.030979	0.032935	0.025187	0.031147	0.019571	0.017419
0.020814	0.032196	0.034425	0.026642	0.028018	0.019562	0.017593
0.025453	0.03601	0.038425	0.030692	0.026495	0.022589	0.020859
0.015909	0.020717	0.023602	0.016645	0.019165	0.006399	0.005751
0.008653	0.018445	0.020663	0.012887	0.027252	0.00769	0.005469
0.010173	0.018271	0.020722	0.013064	0.025208	0.00608	0.003857
0.017465	0.02536	0.028029	0.020557	0.020837	0.011398	0.009921
0.015334	0.02285	0.025514	0.018056	0.021437	0.008977	0.007418
0.016648	0.025791	0.028308	0.020664	0.023032	0.01233	0.010557
0.016065	0.026759	0.029052	0.021283	0.026052	0.014172	0.01215
0.012115	0.025688	0.025958	0.020287	0.043507	0.022985	0.021139
0.017084	0.027962	0.027272	0.023648	0.050892	0.029103	0.027576
0.012967	0.027299	0.028281	0.021418	0.039155	0.020961	0.018829
0.012073	0.026405	0.027396	0.020524	0.038685	0.020182	0.018066
0.010964	0.025298	0.026212	0.019454	0.038805	0.019666	0.017602
0.009864	0.024194	0.025203	0.018315	0.037657	0.018346	0.016286
0.016971	0.015891	0.019029	0.013763	0.019338	0.004968	0.006912
0.017556	0.014501	0.017663	0.0132	0.020325	0.006212	0.00839
0	0.014336	0.015412	0.008509	0.03478	0.012136	0.010881
0.014336	0	0.003163	0.005965	0.034791	0.014318	0.015445
0.015412	0.003163	0	0.007786	0.037952	0.01722	0.018172

0.008509	0.005965	0.007786	0	0.033085	0.010536	0.010953
0.03478	0.034791	0.037952	0.033085	0	0.023138	0.023938
0.012136	0.014318	0.01722	0.010536	0.023138	0	0.002239
0.010881	0.015445	0.018172	0.010953	0.023938	0.002239	0
0.011041	0.012743	0.015601	0.008862	0.024656	0.001676	0.002968
0.009026	0.010762	0.013424	0.0063	0.027295	0.004295	0.004756
0.011834	0.008314	0.011333	0.006001	0.027292	0.006095	0.007577
0.014813	0.00636	0.009512	0.007266	0.028446	0.009497	0.011237
0.018921	0.0072	0.009749	0.010789	0.029745	0.013534	0.015445
0.01534	0.029646	0.030431	0.023847	0.041901	0.023873	0.021751
0.009809	0.024027	0.02474	0.018301	0.039706	0.019637	0.017688
0.004749	0.019035	0.019916	0.013254	0.036789	0.01535	0.013621
0.020322	0.033374	0.035186	0.027504	0.033777	0.022432	0.020254
0.019214	0.032848	0.034431	0.026903	0.036106	0.022975	0.020747
0.024596	0.036795	0.038874	0.031097	0.031909	0.024559	0.02254
0.011165	0.004444	0.004291	0.004401	0.03695	0.01484	0.015351
0.0325	0.045313	0.047254	0.039518	0.038634	0.033335	0.031305
0.843349	1.147084	1.256772	0.943772	1.558883	0.76435	0.730283

ORA-712	ORA-713	ORA-714	ORA-715	ORA-716	ORA-725	ORA-726
0.007872	0.006928	0.01053	0.014186	0.018607	0.015869	0.011257
0.015039	0.0149	0.018572	0.022327	0.026763	0.009817	0.008106
0.02315	0.025794	0.026636	0.028578	0.030747	0.037287	0.035731
0.003848	0.006485	0.007304	0.010089	0.01365	0.025903	0.021876
0.008052	0.008924	0.006059	0.005215	0.006771	0.031554	0.026776
0.008091	0.007183	0.003567	0.000368	0.004733	0.029352	0.024105
0.002266	0.001571	0.005108	0.008918	0.013328	0.021734	0.017043
0.02355	0.024307	0.02785	0.031653	0.036	0.014578	0.016961
0.008262	0.009442	0.006873	0.006346	0.007772	0.031882	0.027222
0.007814	0.00922	0.006964	0.00691	0.008632	0.031449	0.026883
0.023813	0.023405	0.027041	0.030695	0.035103	0.004355	0.008745
0.010442	0.012998	0.014534	0.017298	0.020556	0.026583	0.02389
0.012249	0.01483	0.016229	0.018842	0.021914	0.027912	0.025451
0.020453	0.02072	0.024375	0.028175	0.0326	0.009887	0.011631
0.018187	0.017972	0.021639	0.025367	0.029799	0.007357	0.007521
0.014385	0.016496	0.018968	0.022249	0.025949	0.023549	0.022124
0.020276	0.020931	0.024503	0.028311	0.032682	0.012939	0.014338
0.020555	0.021687	0.025059	0.028803	0.033037	0.016929	0.017986
0.023806	0.025301	0.028436	0.032055	0.036104	0.021577	0.022937
0.008002	0.010362	0.01247	0.01566	0.019362	0.023725	0.020766
0.007909	0.008219	0.011828	0.015639	0.020044	0.016408	0.012802
0.00666	0.007619	0.011006	0.014784	0.019104	0.018436	0.014926
0.012759	0.014618	0.01741	0.020893	0.024826	0.02109	0.019452
0.010285	0.012103	0.014939	0.01847	0.022474	0.020605	0.018325
0.013507	0.015044	0.018134	0.021765	0.025864	0.018967	0.017645
0.015103	0.016208	0.019583	0.023335	0.027593	0.016151	0.015418
0.022321	0.020797	0.023894	0.026921	0.030959	0.006241	0.003835
0.028107	0.026078	0.028532	0.030861	0.034335	0.013644	0.011951
0.02076	0.01996	0.023496	0.027011	0.031356	0.002934	0.004118
0.019947	0.019106	0.022631	0.026134	0.030473	0.003693	0.003445
0.01933	0.018341	0.021806	0.025243	0.029547	0.00445	0.002151
0.018012	0.017044	0.020527	0.02399	0.028312	0.005714	0.002408
0.005945	0.008337	0.007978	0.009821	0.012674	0.02864	0.024568
0.006658	0.008583	0.007207	0.008217	0.0106	0.030083	0.025744
0.011041	0.009026	0.011834	0.014813	0.018921	0.01534	0.009809
0.012743	0.010762	0.008314	0.00636	0.0072	0.029646	0.024027
0.015601	0.013424	0.011333	0.009512	0.009749	0.030431	0.02474

0.008862	0.0063	0.006001	0.007266	0.010789	0.023847	0.018301
0.024656	0.027295	0.027292	0.028446	0.029745	0.041901	0.039706
0.001676	0.004295	0.006095	0.009497	0.013534	0.023873	0.019637
0.002968	0.004756	0.007577	0.011237	0.015445	0.021751	0.017688
0	0.002661	0.004653	0.00827	0.01249	0.023637	0.019123
0.002661	0	0.003673	0.007456	0.011887	0.02275	0.017859
0.004653	0.003673	0	0.003811	0.008225	0.026241	0.021177
0.00827	0.007456	0.003811	0	0.004436	0.029692	0.024455
0.01249	0.011887	0.008225	0.004436	0	0.033996	0.028669
0.023637	0.02275	0.026241	0.029692	0.033996	0	0.0057
0.019123	0.017859	0.021177	0.024455	0.028669	0.0057	0
0.014608	0.013066	0.016243	0.019432	0.023616	0.010612	0.005064
0.023067	0.023576	0.02719	0.031001	0.035399	0.012224	0.014801
0.023406	0.023578	0.027244	0.031032	0.035465	0.00938	0.012553
0.025488	0.026466	0.029922	0.033696	0.037978	0.017426	0.019957
0.013164	0.010666	0.009661	0.009381	0.011424	0.026142	0.020452
0.034245	0.035144	0.038642	0.042429	0.046732	0.022238	0.026249
0.769777	0.786154	0.876813	1.007353	1.197969	1.058123	0.938105

ORA-727	ORA-825	ORA-826	ORA-827	ORA-866	ORA-956
0.006973	0.01754	0.017108	0.02117	0.013849	0.029539522
0.008107	0.009535	0.008823	0.013861	0.021632	0.021704437
0.033422	0.028251	0.030752	0.025972	0.036154	0.032420681
0.017717	0.023523	0.024332	0.025178	0.016662	0.033938804
0.021981	0.030819	0.03135	0.032753	0.014487	0.041524291
0.019078	0.030746	0.030752	0.03348	0.009087	0.042205596
0.012423	0.022083	0.022163	0.024909	0.011978	0.033597416
0.018877	0.002358	0.005316	0.002997	0.032434	0.010894715
0.0225	0.030704	0.031342	0.032462	0.015573	0.041220331
0.022228	0.029996	0.030691	0.031673	0.015984	0.040422831
0.012844	0.00809	0.005145	0.013197	0.028397	0.017956579
0.020872	0.020774	0.022405	0.02097	0.023606	0.029409417
0.022591	0.021407	0.02323	0.021149	0.025407	0.029383322
0.013658	0.003399	0.003014	0.008344	0.02787	0.015550117
0.009406	0.007674	0.0062	0.012616	0.024098	0.019713399
0.020354	0.015582	0.017672	0.015009	0.027018	0.023276537
0.01572	0.002991	0.00497	0.006137	0.028994	0.01433612
0.018724	0.005891	0.008621	0.005079	0.030707	0.01382661
0.023619	0.009688	0.012665	0.005729	0.034893	0.012525077
0.017623	0.019019	0.020318	0.01998	0.021026	0.028659826
0.009554	0.015363	0.015517	0.01837	0.017043	0.026979045
0.011581	0.01642	0.016895	0.018917	0.017383	0.027644811
0.01764	0.014063	0.015845	0.014377	0.024933	0.022983852
0.015973	0.015081	0.016472	0.016124	0.022438	0.024852404
0.016269	0.011873	0.013584	0.012592	0.02497	0.021314309
0.01482	0.008903	0.010475	0.010393	0.025429	0.019165019
0.007739	0.017594	0.01502	0.022837	0.021749	0.028350718
0.014118	0.025684	0.022958	0.030931	0.023569	0.035739657
0.008369	0.011135	0.00864	0.016375	0.023995	0.022222932
0.007489	0.011492	0.009134	0.016703	0.023112	0.022806711
0.006299	0.012673	0.010403	0.01785	0.021923	0.024105722
0.005317	0.012668	0.010634	0.01775	0.020921	0.024382816
0.020318	0.025998	0.026924	0.027375	0.017636	0.036092402
0.021265	0.028054	0.028862	0.029583	0.016735	0.038318088
0.004749	0.020322	0.019214	0.024596	0.011165	0.032499721
0.019035	0.033374	0.032848	0.036795	0.004444	0.045313011
0.019916	0.035186	0.034431	0.038874	0.004291	0.047253692

0.013254	0.027504	0.026903	0.031097	0.004401	0.039518328
0.036789	0.033777	0.036106	0.031909	0.03695	0.03863438
0.01535	0.022432	0.022975	0.024559	0.01484	0.033335035
0.013621	0.020254	0.020747	0.02254	0.015351	0.031304848
0.014608	0.023067	0.023406	0.025488	0.013164	0.03424517
0.013066	0.023576	0.023578	0.026466	0.010666	0.035143525
0.016243	0.02719	0.027244	0.029922	0.009661	0.038642295
0.019432	0.031001	0.031032	0.033696	0.009381	0.042429017
0.023616	0.035399	0.035465	0.037978	0.011424	0.04673244
0.010612	0.012224	0.00938	0.017426	0.026142	0.022238241
0.005064	0.014801	0.012553	0.019957	0.020452	0.026249416
0	0.017054	0.015471	0.021796	0.015628	0.029114577
0.017054	0	0.002986	0.005249	0.031146	0.012177763
0.015471	0.002986	0	0.00806	0.030279	0.013749321
0.021796	0.005249	0.00806	0	0.035007	0.00877748
0.015628	0.031146	0.030279	0.035007	0	0.043268373
0.029115	0.012178	0.013749	0.008777	0.043268	0
0.859885	0.995792	1.004654	1.123035	1.109353	1.52769075

Grand Total	Mean Distance
0.735214005	0.002947207
0.774915479	0.002947207
1.403492984	0.002947207
0.808138895	0.002947207
1.01138165	0.002947207
0.998270241	0.002947207
0.755140386	0.002947207
1.026062391	0.002947207
1.015472849	0.002947207
0.993779967	0.002947207
1.034580409	0.002947207
0.87870989	0.002947207
0.938567758	0.002947207
0.901217273	0.002947207
0.841875869	0.002947207
0.887951258	0.002947207
0.905743983	0.002947207
0.949317689	0.002947207
1.116774087	0.002947207
0.787824642	0.002947207
0.70420111	0.002947207
0.704781567	0.002947207
0.810355799	0.002947207
0.762347523	0.002947207
0.794924709	0.002947207
0.797945347	0.002947207
1.086815202	0.002947207
1.428286543	0.002947207
0.942099247	0.002947207
0.918551755	0.002947207
0.912663876	0.002947207
0.87535846	0.002947207
0.888025251	0.002947207
0.937520001	0.002947207
0.843349192	0.002947207
1.147083945	0.002947207
1.256772349	0.002947207

0.943771568	0.002947207
1.558882617	0.002947207
0.764349592	0.002947207
0.730282734	0.002947207
0.769776583	0.002947207
0.786154247	0.002947207
0.876813442	0.002947207
1.007352674	0.002947207
1.197969383	0.002947207
1.058122994	0.002947207
0.938104888	0.002947207
0.859884726	0.002947207
0.995791763	0.002947207
1.004654418	0.002947207
1.123035255	0.002947207
1.109353176	0.002947207
1.52769075	0.002947207
51.82750439	0.002947207

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